RAILWAY MASTER MECHANIC

CHICAGO AND NEW YORK

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RAILWAY MASTER MECHANIC

A MONTHLY RAILWAY JOURNAL devoted to the interest of railway motive power, car equipment shops, machinery and supplies. SUBSCRIPTION PRICE $2.00 A YEAR ESTABLISHED 1878	PUBLISHED BY THE CRANDALL PUBLISHING COMPANY 510 SECURITY BUILDING CHICAGO TELEPHONE MAIN 3185	BRUCE V. CRANDALL, President WARREN EDWARDS, Vice President C. C. ZIMMERMAN, Secretary NORMAN F. REHM, Editor

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New Fuel Association

THE International Railway Fuel Association was recently organized for the purpose of improving methods of handling fuel as well as purchasing, inspecting, weighing and distributing it. The active membership is made up of purchasing and fuel agents, together with other railroad officials directly interested in such fuel problems, while the associate membership includes producers and manufacturers concerned in the production of fuel and the manufacture of handling and distributing devices.

The work of this association should be of great value to the railroad companies and the railroad officials, who are charter members, are very enthusiastic. Mr. Eugene McAuliffe, general fuel agent, Rock Island-Frisco Lines, is the first president of the association, and to him the credit is given for successfully organizing the association.

The Past Year

THE records of the year, 1908, indicate that betterment work was reduced to a small amount in all departments. By this statement it should not be inferred that any of the railroads have allowed their equipment to depreciate in a way to hamper the transportation facilities, but that new shops and their equipment, cars, locomotives, etc., have not been built except in cases of need.

The number of cars, built in 1908, was about 78,000, while in 1907 there were about 290,000. This shows a reduction of almost 75 per cent. In consideration of the number of surplus cars, which varied approximately between 450,000 and 110,000 for the year, there was not a pressing need for many new cars.

During the past year the steel box car question was discussed in several organizations, many mechanical officials being in favor of steel for the superstructure as well as for the underframing. Mr. W. R. McKeen, Jr., stated that the Union Pacific all-steel box cars developed no defects. At the Master Mechanics' and Master Car Builders' conventions last June the Bettendorf all-steel box car, built by the Bettendorf Axle Co., Davenport, Iowa, was exhibited.

In 1908 there was also a reduction in the number of locomotives built. There were approximately 7,300 built in 1907 and 2,300 in 1908, which means almost a 70 per cent reduction. Among the more important questions concerning locomotives that were considered last year are the mechanical stoker and the superheater. The committee report of the Master Mechanics' Association on mechanical stokers was to the effect that mechanical stoking is successful and it included descriptions of the more important mechanical stokers, but in the case of superheaters no definite recommendations were made in the report which covered the present data on the subject. The development of the Mallet compound continued as an important question in locomotive design.

Railroad extension in 1908 was chiefly in the west among the roads that were building Pacific coast connections. There was a decrease in new mileage from 5,200 to 3,200, about 40 per cent.

In reviewing the work of the past year, it is not surprising to find that betterment work was materially curtailed. It was a natural consequence of the market conditions because traffic was radically reduced, the railroad companies being affected to a greater degree than other industrial concerns. The gradual resumption in all lines is being felt, however, and this early revival is due to the resources of the country, which in agriculture could hardly have been more gratifying.

It is not logical to have an immediate return of normal conditions, so we must look forward to a steady renewal of activity. This means that the betterment work in all departments will be systematically taken up, which in the past year offered the best means of reducing expenses in view of the smaller gross earnings.

Railway Clubs

THERE are few members of railway clubs who do not appreciate the advantages of membership. In a recent address to the St. Louis Railway Club by Mr. J. J. Baulch, president of the club, he explained clearly what the railway club means and its value to railroad men.

One of the most important points is the free exchange of ideas between men in all branches of railroad work, as well as in all positions. Thought is stimulated along new lines and a broader conception of the progress in railroad construction, operation and maintenance is given. This alone should be sufficient to make any railroad man join a railway club.

These remarks are made at this time for the benefit of those who have not taken advantage of the opportunity, which the railway club offers, to become more thoroughly informed. It is usually the case that serious consideration of this matter results in an application for membership.

Mallet Articulated Compound Locomotives

THE advantages of the Mallet articulated compound locomotive in meeting the demand for greater power were brought out in a paper by Mr. C. J. Mellin at a recent meeting of the American Society of Mechanical Engineers. The use of this type of locomotive in freight service has already demonstrated its good points, which also favor its application to passenger service, especially in districts where there are heavy grades and sharp curves. The chief advantages are given briefly, as follows:

"The Mallet articulated arrangement presents the advantages of enormous tractive power concentrated in the combination of the two sets of engines with practically no increase in the individual weights of the moving and wearing parts over those of engines of the ordinary types; double expansion of the steam; simplicity and ease in operation; and a short rigid wheel base, with the weight distributed over a long total wheel base, resulting in the greatest flexibility and ease on track and bridges. It was also found possible at the very first to provide an engine under the control and operation of a single crew, having double the power of the largest engines of the ordinary type."

It is noted that over a hundred locomotives of this type have been built and that these range in weight on drivers from 106,000 lbs. to 410,000 lbs. and from 20,000 lbs. to 125,000 lbs. in tractive power. Tabulated data are given on the heaviest designs of different types, which show that the tractive power of the Mallet engine is double that of the other types. With engines of the same tractive power the weights of moving and wearing parts are much less for the Mallet type. This type of locomotive entails a logical development and with varied details of design the same principle may be used in meeting the future demands in passenger service. Relative to slipping the following comparison is given:

"With the ordinary engine, slipping at such times is a serious matter, as the train is losing speed and may stall on that account after a few repetitions. In the case of the articulated engines, the loss in power by the slipping of one engine is practically gained by the other, in the increase of unbalanced pressure that thereby results. This difference in the unbalanced pressure has the opposite effect on the slipping engine, usually causing it to stop slipping after a few revolutions, without the necessity of closing the throttle. This is explained by the fact that, when the low pressure engine slips, the receiver pressure naturally falls and reduces the back pressure on the high pressure piston, as well as the forward pressure on the low pressure piston; causing the latter engine to stop slipping on account of the friction against the rail under the reduced receiver pressure, which reduction also increases the average unbalanced pressure on the high pressure piston a corresponding amount."

In the past several years, descriptions of Mallet engines and discussions of important features have appeared in the RAILWAY MASTER MECHANIC. Among these was an article in the August, 1907, issue by Mr. T. F. Crawford, Great Northern Railway, on the tractive force of Mallet compound locomotives. The Mallet compound for the Erie Railroad, which is the heaviest and most powerful locomotive in the world, was described in the September, 1907, issue. The latter engine has a total weight in working order of 410,000 lbs., which is also the weight on drivers, and a tractive power of 94,800 lbs. or 120,000 lbs. when working simple.

Railroad Legislation

IN order to promote railroad activity, commercial organizations are advocating conservative legislation which shall restore confidence in railroad investments. The spirit of co-operation, which is the controlling factor in commercial growth, had much to do with the progress in railroad construction in this country, and the present agitation of the commercial organizations is more for the purpose of bringing back a full realization of this point than to decry recent legislation.

The Illinois Manufacturers' Association passed the following resolution:

Resolved, That the Illinois Manufacturers' Association respectfully requests all Senators and Representatives of Illinois in the National and State Legislatures to discourage all measures having a tendency to continue or aggravate the agitation against corporate interests, and to support all legislation which, without injury to their constituents, will tend to allay the hostility toward business conducted under corporate form, including manufacturing, commercial and transportation companies, while the new laws on the statute books are being tried out.

The above resolution indicates the feeling that exists among the members of a large independent organization, which has endeavored to promote shippers' interest in the past. The Southern Commercial Congress also passed a resolution, which follows, to express its attitude regarding the railroad problem.

"Railroad construction has been extensive, but the rapid commercial growth of the South requires an enormous increase in its railroad facilities to transport to market its many and varied products. The construction of such adequate facilities can be accomplished only by assuring the holders of capital that such enterprises will be safeguarded by conservative and constructive legislation, and we urge upon our Southern legislators the wisdom of such policy and condemn any agitation leading to the contrary. We favor a spirit of co-operation between the people and railroads and other corporate interests, to the end that the required confidence of investors may be established in the securities of the corporations of the South."

It is necessary that these facts be brought to the attention of our legislative representatives because a more speedy return to activity will result from a thorough appreciation of the feeling on the part of the large commercial organizations.

Four-Wheel 80,000-lb Capacity Steel Passenger Truck

THE length and weight of passenger car equipment used on American roads has been steadily increasing for the past number of years, and trains have been operated at a greater average speed. These conditions have placed greater strains on the running gear of all such equipment, and the truck illustrated by the accompanying photograph was designed to meet this demand.

This truck is of the four-wheel all-metal type having M. C. B. standard axles of 80,000-lbs. capacity, and 36-in. steel tired wheels. The wheel base is 8 ft., and length over side frames is 11 ft. 10 ins. The weight of trucks complete equipped with high speed brake rigging is 14,100 lbs. each.

In designing this truck, wrought metal has been used on all parts subject to strains in order to reduce to a minimum the chances of failure in service and to overcome the objection to the use of castings, which, on account of the liability of flaws in the initial castings, and crystalization due to shocks are more subject to breakage than wrought metal properly distributed.

The general construction of this truck, built by the Barney & Smith Car Company, Dayton, Ohio, is as follows:

The side frames are constructed of open hearth steel web plates, reinforced at the edges with angles. The pedestals are an integral part of the truck sides, the web plates being cut and reinforced with heavy malleable castings, which also act as guides to the journal boxes. The side frames are also cut out to receive equalizer and bolster springs, the opening for bolster springs being reinforced as shown.

The equalizers are made of best hammered iron and are of the double type, one being placed on each side of the frame and maintained in position by the equalizer spring seat castings which rest on the equalizers with an extension projecting downward, thereby forming a combined spreader and spring seat.

The cross transoms are formed of steel plate pressed in an inverted "U" shape and have flanges at the ends. These flanges are securely riveted to side frames.

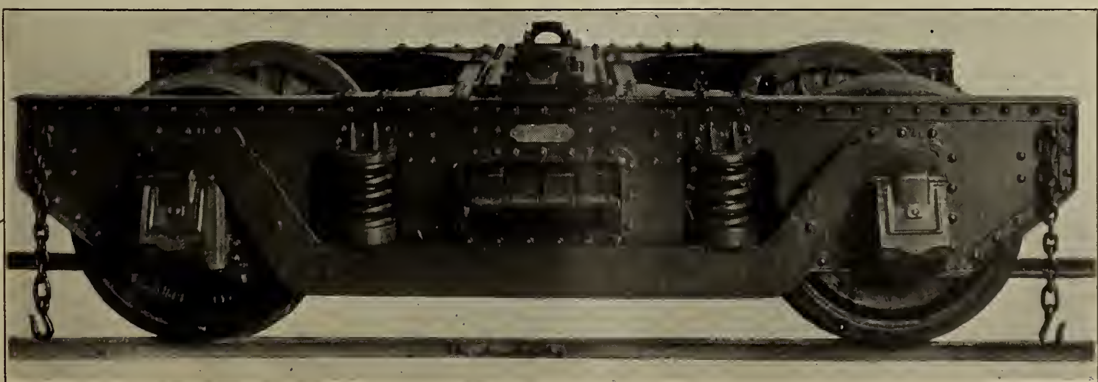
The end sills are composed of rolled channels secured to the side frames by means of malleable iron corner plates, the manner in which the cross transoms and end sills are secured to the sides being such that truck frames are kept square and true in service. The safety beams of standard I-beam section are provided and secured to end sills and cross transoms; axle safety guards being riveted to the bottom of these I-beams.

The brake beams are supported from a rolled T-section placed crosswise of and secured to the side frames and safety beams. To this T-section are also secured brake release springs, brake safety irons and lever guides.

The bolsters are composed of rolled I-beams reinforced at top and bottom with cover plates of proper dimensions, and provided with end and center filler castings, center plates, side bearings, bolster spring seats and chafing castings of malleable iron. All parts securely riveted together.

The spring plank is composed of two rolled steel angles and two elliptic spring seat castings which rest on the swing motion axles. Swing motion hangers, which support the spring planks, are of rehammered iron and extend upward and between flanges of the U-shape cross transoms, to which they are secured by turned steel pins.

All rivet holes are reamed and rivets power driven with the exception of a few connections which are driven



EIGHTY-THOUSAND POUND CAPACITY STEEL TRUCK.

by pneumatic hammer, and as all parts containing rivets are spring suspended there is no liability of rivets becoming loose in service. A large number of these trucks have been constructed and are in service under 70-ft. vestibule coaches, parlor and private cars.

Shop Building, C. R. I. & P. Ry.

THE Chicago, Rock Island & Pacific shop buildings and layout at El Dorado, Ark., are on a small scale, but contain some interesting details of construction. The section and plan of roundhouse, which is used in the extreme south, is shown in Fig. 1. This roundhouse has a depth of 90 ft. and is of frame construction on concrete foundation. The length of pit is 65 ft. and pit is 14 ft. 1 in. from the outer wall and 10 ft. 8-11/16 ins. from the inner wall. The walls of the pit are built of concrete and the floor of paving brick on edge grouted.

The walls and 10x10 in. posts have a concrete footing. The roof girders are 10x14 ins. and carry 4x14-in. joists on which are laid 2x8-in. matched and dressed roof boards covered by a composition roofing. The pitch of roof is 1 in 12 ins.

The design of smoke ventilator is shown in Fig. 2 and its location with respect to pit is shown in Fig. 1. The length of ventilator is 12 ft. and width 4 ft. The inside surfaces including both sides of lower slats are painted with two coats of oil paint and two coats of fire-proof paint.

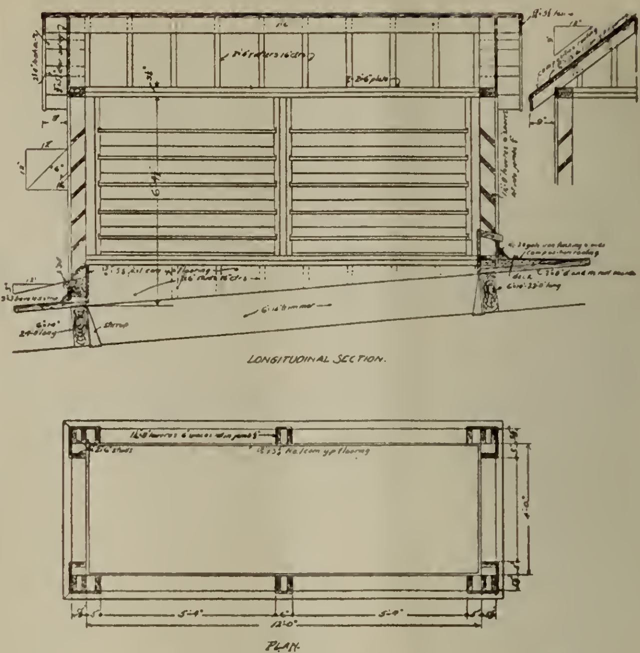


FIG. 2—SMOKE VENTILATOR, C. R. I. & P. RY.

In Fig. 3 is given a plan of the combination pit for drivers and trucks and in Fig. 4 is given a section through the pit. The walls of the pit are built of con-

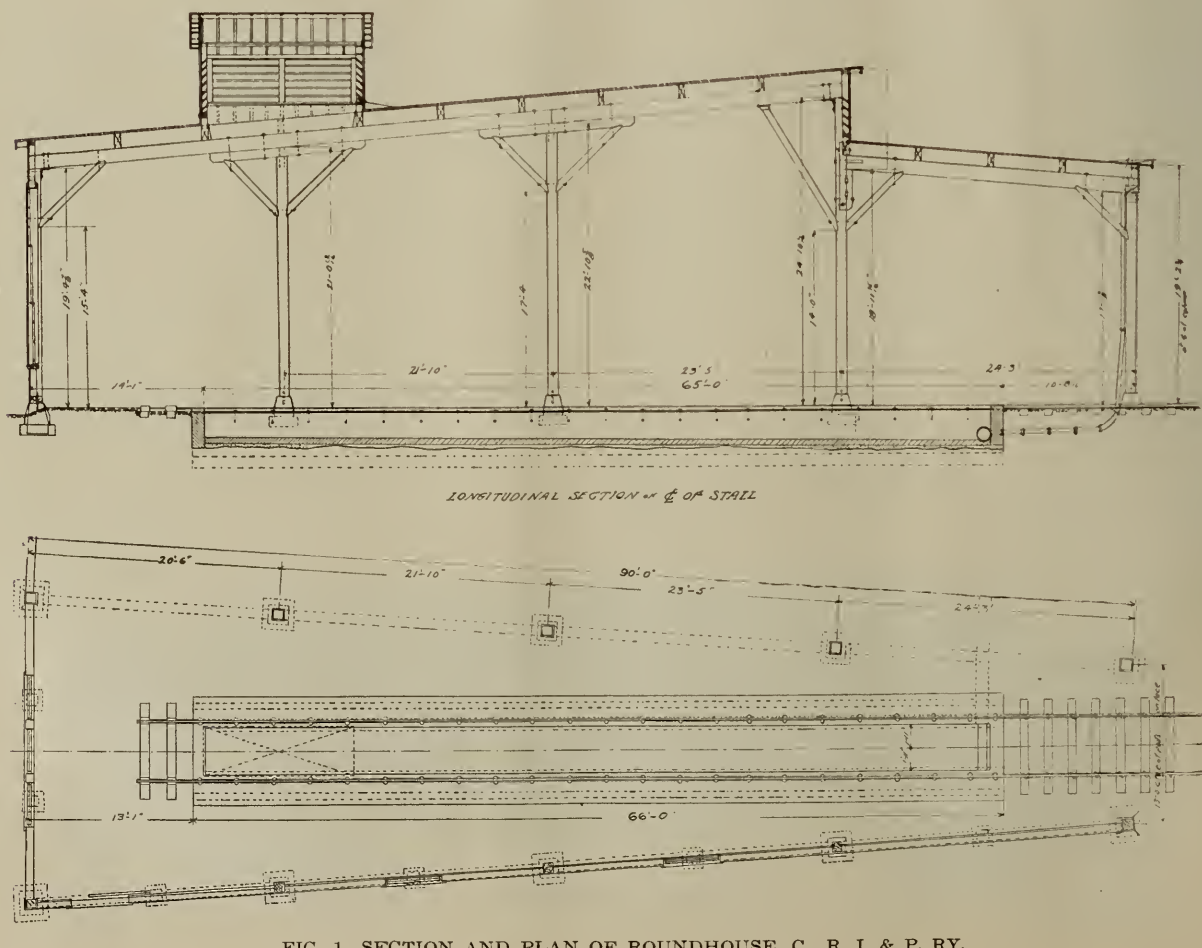


FIG. 1—SECTION AND PLAN OF ROUNDHOUSE, C., R. I. & P. RY.

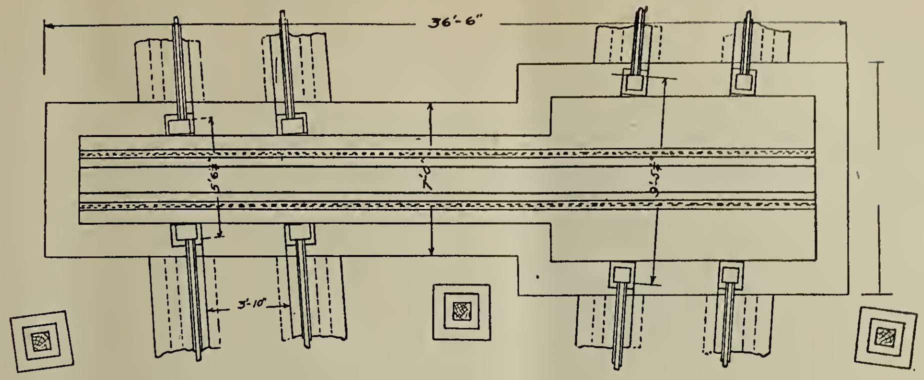


FIG. 3—PLAN OF COMBINATION PIT FOR DRIVERS AND TRU CKS, C. R. I. & P. RY.

crete. Allith track for No. 300 Reliable Merchandise carrier is to be bolted to bottom flange of I-beam. One Reliable Merchandise carrier is to be provided with a Yale and Towne 5-ton triplex block and the hand chain for operation of this block is to be 32 ft. long. The lift is to have a capacity of 5 tons.

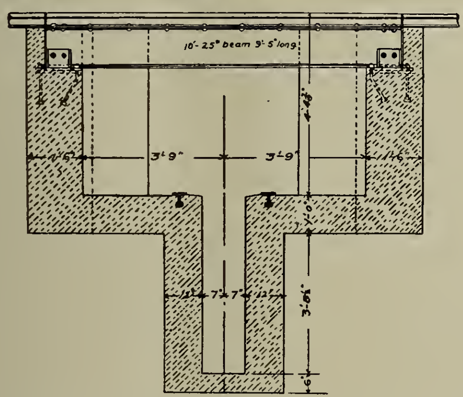


FIG. 4—SECTION THROUGH COMBINATION PIT, C. R. I. & P. RY.

A section through cinder pit is shown in Fig. 5. The floor of pit is of hard clinker-burned brick. There is a 5 per cent ascending grade to the cinder pit track and a 5 per cent descending grade to the depressed track.

Caring for Locomotives

AT 5 o'clock in the afternoon the Isthmian Canal Commissin engineer takes his train to the nearest siding, uncouples his locomotive from the string of loaded or empty cars, and runs the engine to the hostling yard. His dinner over, he goes to his quarters, and the following morning at 6:30 o'clock he is in the cab again. From the time the engineer leaves his locomotive at night until he takes the throttle again in the morning, the engine also is resting and preparing for the next day's work. Its food is two or three tons of coal, several barrels of water; and a few bushels of sand; and once in two weeks it is given a bath in the form of a "washout." The engineer calls his dinner and rest "recreation," and the recreation of his locomotive "hostling." Hostling is as essential to the engine as recreation is to the engineer.

Between fifty and sixty locomotives are hostled every night at Pedro Miguel. During the day screws have begun to show wear, a drawhead has weakened, a grate given out, lubricators and injectors, rod brasses, air brake equipment or trucks need repairing, the guides on the piston crosshead must be closed, or some other little weaknesses have developed in several of the engines; and those so affected are run into the shed, over the repair pit if necessary, and the machinist begins the repairs at once. The other engines are turned over to the six "gold" men known as "hostlers." These men have served as engineers and are now hostling, waiting a chance to take a regular run.

Each hostler takes four locomotives in one train and runs them to the coal chute, then to the sand chute, and then to the water pipe. This order may be changed as convenience dictates, but the process remains the same, and when the hostler leaves the engines they have a full store of coal, a tank full of water, and sand enough in the sand box to meet the next day's demands. Firemen then separate the cinders from the coal, dump them, and bank the fire. The oil cups are filled, the light repairs finished, and the locomotives cleaned, usually by midnight. After that the hostler's work is merely to visit each engine two or three times until 5 o'clock, and see that all is going well. Between 5 and 6 o'clock the fires are raked again, and when the engineer takes his locomotive at 6:30 o'clock the fire is bright, and the gauge registers from 120 to 150 pounds of steam.

Four engines are "washed out" every night, and an order is preserved so that each has a thorough cleaning once in fifteen days. Like the locomotives that need repairing, those to be washed out are separated from the rest early in the evening and hostled at once. They are then run over the cinder pit where the fires are dumped, and taken into the house where the steam and water are allowed to escape, while cold water is forced into the

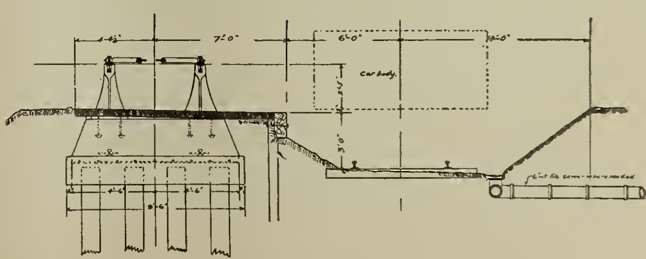


FIG. 5—SECTION THROUGH CINDER PIT, C. R. I. & P. RY.

boilers and running out carries with it the loose matter that has collected during two weeks. All this takes from 5:30 o'clock in the evening until 2 o'clock the next morning, when the fires are started again, and at 6:30 the engines are ready for their work.

To one not accustomed to such work the hostlers and their helpers moving in and out among the great engines, with the shadows deepened by an occasional headlight, the gleam from the cinder pit, or rays from the workmen's lanterns, make an eerie sight. Fifty locomotives maneuver in files of four on only six tracks, and so close to one another that the trains almost touch, while half a hundred men hurry about among them. It looks like a mix-up and sounds like discord; but the engines start only on double signals, there are no collisions, accidents are few, the work moves swiftly.

At daybreak the result of it all is seen in the locomotives standing ready, like horses at the barrier. On the morning of October 29, at 6:30 o'clock 52 locomotives left the yard in nine minutes, and often the clearance is made in seven minutes. Between 6:30 and 6:41 o'clock two locomotives had left the yard, coupled to a train of sixteen 20-yard cars which had been left on the siding the night before, had stretched the unloader cable, and started to the La Boca dumps.—The Canal Record.

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*Abuse of the M. C. B. Repair Cara**

AT its annual convention of 1896, the Master Car Builders' Association incorporated into the Master Car Builders' Rules of Interchange effective September 1, 1896, the following:

Sec. 16, Rule 4.

"When repairs of any kind are made to foreign cars, a repair card shall be securely attached to outside face of intermediate sill between cross-tie timbers. This card shall specify fully the repairs made, reasons for same, date and place where made and name of road making repairs," etc., etc.

This requirement has remained in the Rules of Interchange every year since 1896, and is still required under rule 76 of the present code. In revising the Master Car Builders' Rule of Interchange September 1, 1897, and since that time down to the present day (excluding the exceptions noted in last line of rule 4), intermediate or delivering lines were relieved from responsibility of wrong repairs not made by them. (See 1908 code, 2nd paragraph, page 2; rule 4, page 4; rule 47, page 19; and last sentence of rule 86, page 38.) The 1897 amendment referred to, rendered the use of the Master Car Builders' repair card all the more necessary, as, in relieving the intermediate or delivering roads from responsibility of wrong repairs not made by them, it "boiled down" so to speak, the matter of adjustment to the two parties only, viz.: the car owner and the road who actually made the wrong repairs. If, as required by the Master Car Builders' rules, the road who did the incorrect work applied a Master Car Builders' repair card covering the items objected to, its identity would of course be immediately known, and the adjustment of the account would then be a very easy matter. The application of the repair card in all cases of repairs to foreign car equipment as required by the Master Car Builders' rules, is not, I am very sorry to state, being done, and the fact that these repair cards are not being applied, brings to us a very difficult problem for solution. The road with which I am connected, has cases coming up every day where our cars are offered home to us with wrong repairs to sills, trucks, draft gear, and other very expensive parts of our equipment, and the expense of correcting same is enormous, and we cannot afford to bear it. The repair card is invariably missing, and we are then forced to the only other method of ascertaining by whom the repairs were made, and this leads us to that same old story of tracing with its attendant voluminous correspondence, loss of time, and expense, to say nothing of the burden placed upon the office forces of our Motive Power and Car Accounting departments. This difficulty has been growing worse from year to year, until now its presents to us a very serious condition with no apparent relief in sight. It is to be deplored that this particular rule is so flagrantly violated. Here we are an association of Master Car Builders, organized for the purpose of concerted action in various lines, the most important of which is the successful interchange of freight cars. To thoroughly understand each other in the workings of this particular branch of the business, we have agreed upon a code of rules, the carrying out of which necessarily means that railroads must be honest, otherwise the plan would be a complete failure. In the regular course of business our cars drift hundreds of miles from home and we have to depend upon the honesty of the foreign lines in the matter of repairs and the rendition of bills. There are instances without number, where foreign roads have noted upon their repair cards that wheels were renewed account of sliding axles renewed account cut journals, air hose renewed account missing, and numerous other parts repaired or renewed, for which the possessing road assumes the expense of such repairs account of the manner in which the defects were brought about. If the foreign lines were dishonest they could have reported such defects as the result of ordinary wear and tear and rendered bills for the work. It would not, therefore, be consistent for us to assign dishonesty as the cause of non-application of the repair card when repairs are made to foreign cars. My personal opinion is that it is due to indifference on the part of our repairmen. I have heard it said that the application of the repair card is not really necessary in view of the fact that the stub of such card reaches the car owner with the repair bill, or when sent through the mails in case no bill is rendered. This we all know is a grave mistake, as it is necessary to know immediately when car reaches home, where the incorrect repairs were

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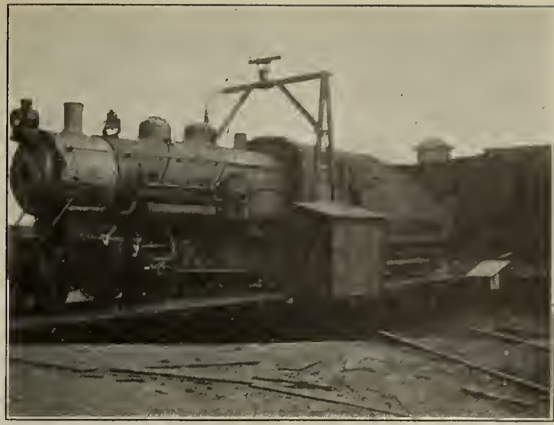
*Paper presented by Mr. J. J. Hennessey, M. C. B., C., M. & St. P. Ry., before the Western Railway Club.

made in order to avoid the objectionable tracing. It has also been stated that insufficient time is given to execute and apply repair cards when making up trains or when trains stop for only a brief period at repair points. I have looked into this and found that by having repair cards dated and signed, that it requires only a trifle more additional time to fill in the other necessary data and apply the card, as it means only minor repairs such as air hose, journal bearings, brake shoes and the like. I am therefore satisfied that this objection can be overcome if only an effort is made. The road with which I am engaged has what we term a traveling inspector, who is continually traveling over our system. It has been made part of his duties to look over foreign cars taken off our various repair tracks; also such foreign cars as receive minor repairs in the yards. If he finds any repairs made to such cars and no repair card attached covering the items, he makes report to headquarters and also to the foreman in charge at the local point, and the party at fault is easily located and disciplined. Headquarters also censure the foreman for allowing such violation, so that there is considerable incentive for the foremen to be vigilant in this regard. We have found this to be productive of very good results, and we have also found that the mere issuance of an order to apply repair cards in all cases of foreign car repairs, does not bring about the desired result; there must be something done to show that you mean to have the order obeyed. If our practice in this matter can be improved upon (and I believe there is always room for improvement), I sincerely hope the discussion here will bring it to light and give us all the benefit of whatever profitable ideas will be advanced. I also believe that the universal suffering among railroads and private lines due to the non-application of repair cards, makes the subject one that should be taken up by all the railway clubs in the country and thoroughly discussed, which will undoubtedly result in advancing some proposition that will bring about the desired condition.

Operation of Turntables

A STRIKING example of the economy and convenience which results from the use of electric power for the operation of turntables and transfer tables is shown by the installation of a motor on a turntable on one of the railroads in New York state. This turntable was formerly operated by hand, requiring the time of a number of men at intervals, which averaged the continuous service of two men for 24 hours a day. The donkey was equipped with a standard Westinghouse induction motor, known as type "F" high torque, rated at 20 hp., 200 volts, two-phase, 60 cycles. This reduced the labor required to one man per day of 24 hours.

Inasmuch as the men were paid 15 cents an hour in each case this motor produced a saving of $3.60 a day, or $1,314.00 per year of 365 days. At the cost of power for the motor has averaged but $8.00 a month, or a total



METHOD OF SUPPLYING POWER TO TURNTABLE.

of $96.00 a year, the net saving is $1,218.00 a year. The total cost of the electrical equipment, including the cost of installing the outfit, was approximately $1,500.00, which is but slightly greater than the actual saving in one year. As a result of this installation four other turntables have been supplied with electrical equipment by the same railroad, and plans are on foot for similarly equipping several more.

The economy is not the most important point in the advantages of the electrical equipment, although it makes a very good showing. The work of a turntable is intermittent and is usually rushing for a short time and then at a standstill, especially at terminals, where many locomotives often come in at the same time. The length of time required to turn a locomotive by hand depends largely upon the number of men available to do the turning, but even with the handles full, which condition requires from four to eight men, it is impossible to do the work as rapidly as with a motor. Hence, the saving in time at such periods is of great importance as the congestion at the turntables is relieved and the movement of traffic is expedited.

The method of supplying power to the table has some interesting details. A bridge is used with overhead wires, which run to a standard Westinghouse overhead collecting switch. This switch is constructed with brushes and collector rings so that contact is made at all times and in all positions of the turntable. This switch is so constructed that there is no strain on the line wire, as the cross arm to which they run does not move with the tables, but is stationary while the table revolves.

In this installation the cab is mounted on the center of the turntable, so that the wires run directly from the bridge of the cab and to the motor. In many instances the cab is mounted at one end, but instead of being directly on the table, it is mounted on the donkey directly directly over the motor, to overcome the jolting which the cabman would get when the locomotives run on and off.

In many cases, especially in a new installation, the feed wires are run underground in conduit and brought up through the king pin in the center of the table. The same type of switch mentioned above is placed between the tracks and the connections made from this point in the usual manner.

Several Truck Designs

THE standard C-80 high-speed "Trunk Line" double truck, built by the Standard Motor Truck Company, Pittsburg, Pa., is designed specially for high speed trunk line railroad service and has a carrying capacity of 80,000 lbs. at king pins. The journals are 5x9 ins. and the wheels are 33-in. forged steel wheels made by the Forged Steel Wheel Company, Pittsburg, Pa. The truck has pressed channel steel side frames and transoms. The pedestals are of cast steel machine fitted and are then pressed and riveted to the pressed steel side frames. The journal boxes are of cast steel and have Standard Motor Truck Company's standard lid in addition to a hinge at the top. The brakes have no brake beam and are carried practically on the equalizer bars and are adjustable in position to allow for varying diameter of wheels. All the holes in the brake rigging are steel thimbled and all wearing bolts are case-hardened. Coil springs are used on bolts to prevent chatter and wear.

The bolster is cast steel and the sides of the bolster are protected from wear by plates of high carbon steel. The bolster is guided between wear plates of low carbon steel which are bolted to the transoms and the bolster hangers have hardened tool steel saddles at their upper ends, which rock on hardened tool steel pins which are pressed into the transoms. The bolster springs are elliptic, 37 ins. long, and have six leaves. These are divided into sets of three leaves to reduce the damping effect, thus insuring easy riding.

This company also manufactures and is now building a truck of this same type having a carrying capacity of 120,000 lbs., with 6x10-in. journals and 38-in. forged steel wheels, and it will operate at a speed of 70 miles per hour.

INTERBOROUGH TRUCKS.

The standard C-60 high speed "Interborough" double trucks are designed to carry a combined car body and passenger load of 60,000 to 75,000 lbs., and are especially constructed to meet the severe conditions of heavy high speed interborough service, which service, owing to sharp curves and imperfect track, is probably more severe on truck equipment than trunk line service would be. To insure safety and low cost of maintenance, the frames and brake rods are solid forged without welds, and bolsters and brake rigging are protected by safety straps. The side frames are solid bars, the transoms rolled angles and the end frames pressed channel shape sections, and all are forged and machined and connected by the best possible system of riveting.

All parts are so protected that bolster hangers cannot wear down and no wear or chafing will take place on bolsters, transoms, side frames or journal boxes and owing to the use of compression springs on all wearing bolts the wear on the bolts and brake rigging is subjected to the least possible wear. All holes in the brake rigging are steel thimbled and bolts are case hardened by a new process which insures sufficient depth of hardened material.

The journal box lids are held on tight by a cam, are easy to open and cannot rattle off if properly put on. In order to reduce the consumption of power, the journal boxes are rigidly connected to the equalizer bars. To make the brake rigging the most efficient possible, the brakes are carried directly on the equalizer bars. To give the easiest riding effect the Standard Motor Truck Company's patent bolster spring is used. A double elliptic spring of this type has the easy riding qualities of a quadruple elliptic spring of the old design. The side swing of the bolster is checked by a friction device which is controlled exclusively by this company. To eliminate noise, all moving parts are held in contact by compression springs. The brakes do not rattle or chatter. They have no connection to the truck frame and thus the application of them produces no vibration in the car body.

Saskatoon Shops, Canadian Pacific Ry.

THE arrangement of the Canadian Pacific shops at Saskatoon is shown in Fig. 1. The coal pockets are located between the in-bound and out-bound tracks, which lead directly to the turntable. The sand and water supply is near the coal chute, while the depressed cinder pit is along the in-bound track midway between coal chute and roundhouse.

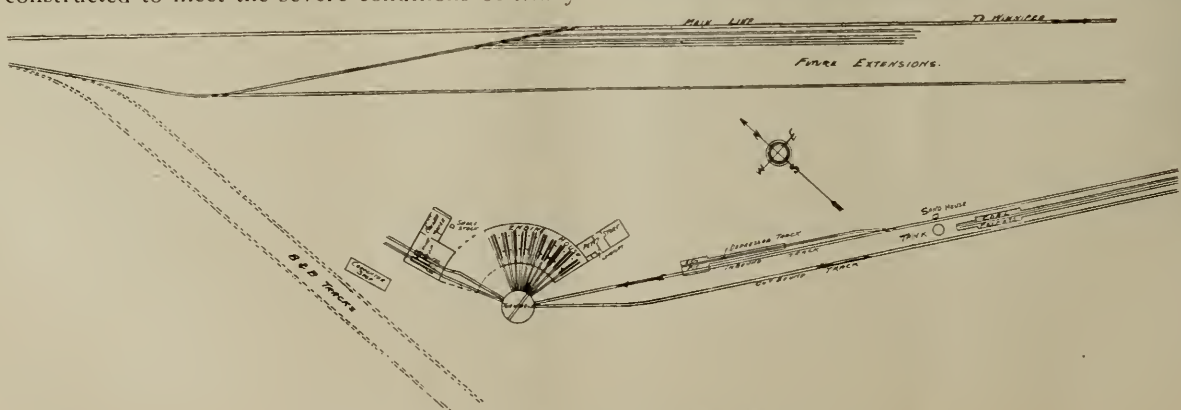


FIG. 1—CANADIAN PACIFIC SHOPS AT SASKATOON.

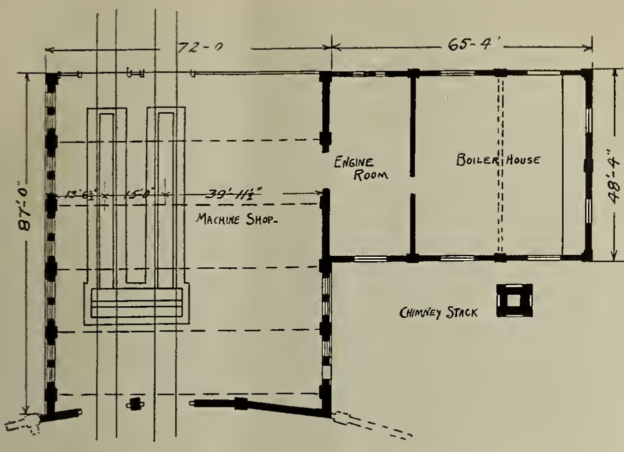


FIG. 2—MACHINE SHOP AND BOILER HOUSE.

In this layout it will be noted that the turntable supplies both the roundhouse and machine shop directly. The tracks lead from the turntable to the two erecting pits, as shown in the accompanying plans.

The boiler house and engine room are connected to the machine shop as in Fig. 2. The machine tools are located between the erecting pits and the engine room. The inner wall of machine shop is about 185 ft. from the center of turntable pit.

The arrangement of machine tools is shown in Fig. 3. The main shaft for driving these tools extends the length of the shop and is run at a speed of 130 r. p. m. The speed of countershaft for the driving wheel lathe at the left is 133 r. p. m.; the speed of countershaft of the McCabe lathe is 130 r. p. m.; the speed of countershaft of the McGregor Courlay lathe is 280 r. p. m.; the speed of countershaft of the McGregor Courlay shaper is 200 r. p. m.; and the speed of countershaft for the Bertram drill is 365 r. p. m.

The main shaft is driven from the Wheelock engine in the engine room, which also contains a 300 h. p. Webster heater, a Northern duplex washout pump, a vacuum pump and a boiler feed pump.

New Consolidation Locomotives, Pennsylvania Railroad

IN order to be prepared to handle promptly whatever increased traffic may be offered during the coming year, the Pennsylvania Railroad has just begun the construction of fifteen locomotives of the most powerful type which has yet been designed for use on this railroad. This locomotive is known as "H-8-b" and is to be built at the Juniata shops at Altoona, Pa.

Some idea of the character of this type of engine may be had from the fact that when the tender is fully loaded with coal and water and the locomotive is ready for service on the road, its total weight will be 384,000 pounds, nearly 200 tons. The weight of the engine proper, in working order, is approximately 241,000 pounds or about 120 tons. The tender is equipped to carry 7,000 gallons of water and 13½ tons of coal.

This locomotive is a Consolidation type, having one pair of truck wheels and four pair of drivers. The truck wheels are 33 ins. in diameter, and the driving wheels are 62 ins. in diameter. In general design this locomotive is quite similar to the type "H-6-b," which has been in general use for quite a number of years, but, on account of increased weight and large drivers, it is capable of hauling a heavy train at somewhat greater speed than the former types of freight locomotives. According to the latest improved practice Walschaert valve motion with 14-in. piston valves is used to control the steam distribution in the cylinders.

The boiler is of the standard Belpaire type, having a minimum inside diameter of 76¾ ins. It contains 465 2-in. tubes, 180 ins. long. The total fire grate area is 55.13 sq. ft., and the total heating surface is 3,839 sq. ft. The boiler is designed to safely withstand a pressure of 205 pounds per sq. in. The total tractive power is 42,661.

Briquetting of Coal

In a recent Consular Report, the advantages of briquetting by the use of sulphite pitch are explained by Consul George E. Eager, of Barmen. The following extracts are given:

This long-sought-for binding agent has been found in the "sulphite pitch." The material is obtained in the process of manufacturing sulphite cellulose. The wood is put through a washing process in lye by which the fiber is cleared of all resinous ingredients, it being pressed out from the wood pulp. Thus far this material has been entirely useless. Through a cooking process it is reduced to a highly glutinous substance called "sulphite pitch."

The sulphite pitch possess many qualities which shows its excellent advantages as a binding agent. It is intensely glutinous and possesses a high binding power. In the ordinary briquet of bituminous coal from 7 to 10 per cent of coal tar is used to give it the proper hardness, and with the use of sulphite pitch the same results can be obtained by the use of 5 per cent. There are qualities of coal and ore that can easily be

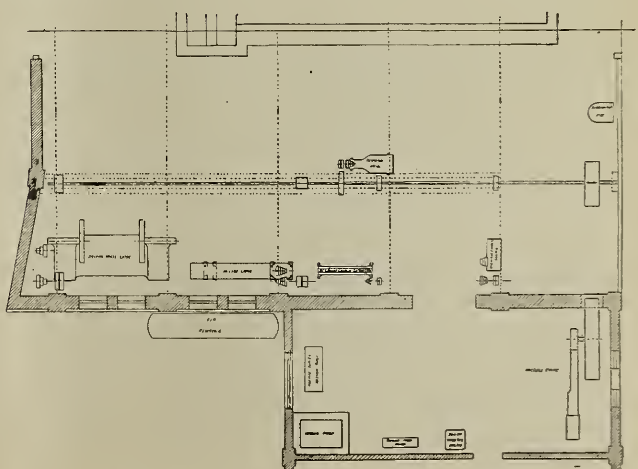


FIG. 3—ARRANGEMENTS OF MACHINES.

briquetted with from 2 to 3 per cent of the sulphite pitch.

Sulphite pitch burns without smoke or odor and is an ideal fuel for the household as well as for industrial purposes. In cities where the smoke nuisance has heretofore prevailed the use of briquets made with this sulphite pitch will form a solution of the smoke question. Trials have already been made with coke briquets made with this new process in blast furnaces and on torpedo boats wtih the most sanguine results.

In general, sulphite pitch consists of the following substances: Coke, 25 to 35 per cent; volatile matter, 50 to 60 per cent; ashes, 8 to 12 per cent; and water, 10 to 15 per cent.

The latest chemical tests have proved that the percentage of ashes can be materially reduced. Through the origin of sulphite pitch its ashes contain sulphur up to 20 per cent, or 2.5 per cent of the sulphite pitch. The sulphur, however, is tied up to iron and lime, which latter substances are always present in abundance, so that the sulphur remains in the ashes and cannot do any damage. It is true that sulphite pitch can be dissolved in water, and that briquets made from it are not waterproof; but this is of no great importance, as in most cases a waterproof briquet is not needed. The sulphite-pitch briquet is, however, more waterproof than the lignite briquet, the making of which has become a flourishing industry. The sulphite briquet is not hygroscopic, and can be made absolutely waterproof, if it is necessary, by a simple special treatment.

Cast Steel Truck Frames

THE first step in the manufacture of cast steel truck frames is to obtain a metal of the required composition. Basic open hearth cast steel is used in the side frame, illustrated herewith, and is of a composition which affords a high elastic limit. In a derailment the frames may be bent out of shape, but they do not break, and in most cases they may be straightened and put back into service.

ONE-PIECE FRAME.

The Bettendorf truck frame, which is taken as an example, is a one-piece casting with arch bars, columns, spring seat and journal boxes cast integral with the frame. In the first place the construction gives a simple design which eliminates bolts and rivets. This latter feature will be recognized as a very important point in truck frame construction when the fact is called to mind that the force in the repair yard is constantly replacing column and oil box bolts and nuts. Still, large number of truck bolts and nuts are missing in almost every line of cars, due to the fact that many cars seldom reach the yards where it is possible to handle these minor repairs. Nevertheless such minor defects may result in derailments as the truck frames are gradually weakened.

Besides, this simplicity in design means a reduced cost of maintenance. Where two or more men may devote all of their time to these minor truck repairs with the

FIG. 1—PRESS IN OPERATION OF STRAIGHTENING THE SPRING SEAT.

ordinary arch bar truck, none are required with the one-piece truck frame. When repairs are needed to a car they are of a more serious nature.

Another point which should not be overlooked is the reduction in weight which the one-piece frame affords. To illustrate approximately these frames gave a reduction in weight of about 1,000 lbs. per car.

DESIGN.

The distribution of metal is such as to effectually resist all stresses, allowing moreover a high factor of safety to which reference will be made under the description of tests. Metal is not wasted, however, in the frame so that the frame will still carry a greater number of load pounds per pound of truck frame, than the ordinary arch bar frame. This feature is not due entirely to careful designing but is made possible by the construction of frames.

The truck frame is built so as to be interchangeable with any standard truck frame. Any width of wheel base, design of journal box, height of bolster opening, etc., are possible without in any way interfering with the general features of the design.

With these frames a distance of at least 4 inches is obtained between lower arch bar and the top of rail. In this connection it may be said that the frame will skid along the roadbed in case of derailment, and will not tear

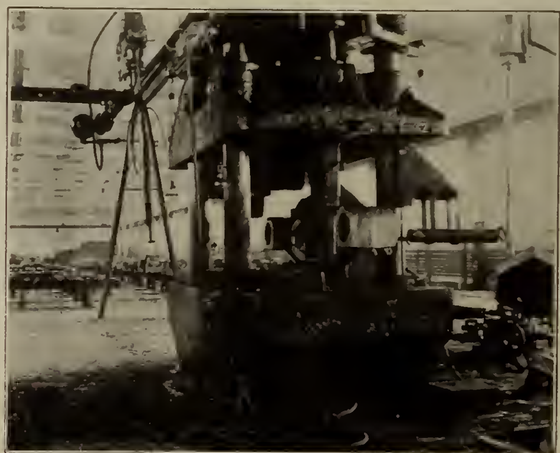


FIG. 2—TRUCK FRAME SUSPENDED ON SPRING SEAT.

up the track which fact is due to the absence of loose bolts, nuts, and parts of frame.

JOURNAL BOXES.

Regarding the journal boxes, which are cast integral with the frame, they are made of any standard design. The strength of the connection between arch bars and journal boxes is ample, and in the test of the frame the connection receives a load equal to the weight of the car. There is a lug on the bottom of journal box which may be used for jacking up when the truck is under a car.

In view of the fact that the journal boxes are cast integral with the frame, thus securing the advantages above mentioned, there is a guarantee to replace the entire frame if the journal boxes should fail in normal service or derailment. In most cases where journal boxes are damaged in wreck or derailment, they can be restraightened in the railroad shops.

BOLSTER OPENINGS.

The bolster openings are of the shape illustrated for the rigid bolster. The designs for Barber roller con-

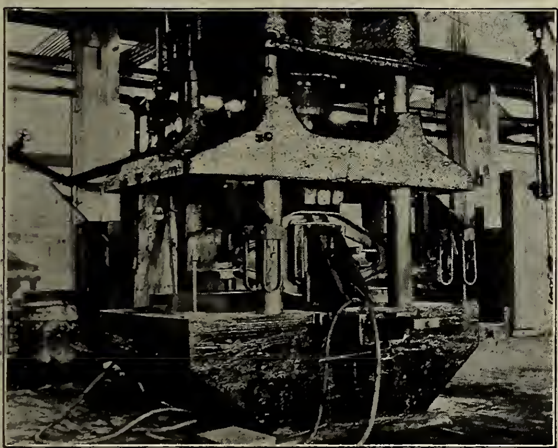


FIG. 3—SQUARING AND TESTING TRUCK FRAME TO CAPACITY OF CAR.

struction and swing motion bolster provide straight column guides. There is a hole cast in the bottom arch bar, in which a projection on the spring plank is secured. In this way rigidity is overcome to the extent that the truck is adjustable to track irregularities, and at the same time flange wear on wheels and end wear on brasses are reduced to a minimum.

TESTING AND SQUARING TRUCK FRAMES.

The machine for squaring and testing side frames, shown in the accompanying illustrations, is a press of 975-ton capacity. The first operation is straightening the spring seat and in Fig. 1 the press is shown with the dies on the platen pressing down upon the spring seat. After the spring seat is straightened the frame is suspended on the spring seat as in Fig. 2, ready to have the false journals slid in position in the journal boxes. Fig. 3 shows the press in the act of squaring and testing the truck frame. The upper portion of journal box, where wedge bears against top wall of journal box. must be in line with the spring seat. Fig. 4 shows the top platen of press returned, the false journals slipped out

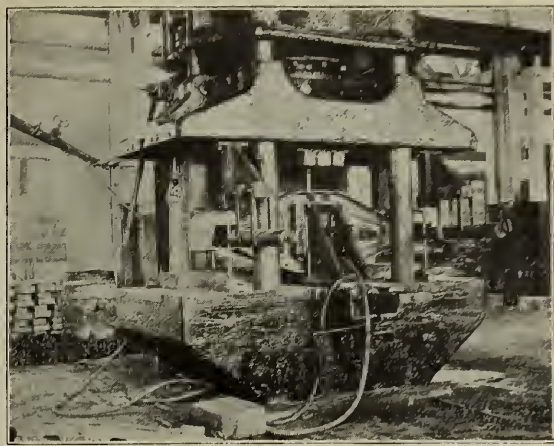


FIG. 4—GAUGES IN JOURNAL BOXES AFTER SQUARING.

of journal boxes and gauges in journal boxes to ascertain if the top walls of journal boxes are square with the spring seat.

The load, applied to the axles, as in Fig. 3, is equal to the capacity of car with which the frame is to be used and is, therefore, four times the load which the frame is to carry in service. As an example a 30-ton truck frame is tested with a load of 30 tons and a 40-ton frame with a load of 40 tons.

The truck frame is then turned upon its side, as shown in Fig. 5, and is straightened transversely so that the lugs for brasses on inside of journal box and the face of colum guide are thep roper distances from each other. The gauge is applied as in Fig. 6 to ascertain if the truck frame is straightened transversely.

INSPECTION AND FINISHING DEPARTMENT.

From the testing department the frames are removed by a 3-ton Pawling and Harnischfeger traveling crane to the finishing and inspecting department, shown in Fig. 7. The inspector gauges the wheel base and again tests the frames to see that thye are square. In this department pneumatic tools are used to chip, to gauge the column guides and dust guard openings and to chip up the journal box openings so as to produce a good fit between box and cover. After the frames are finished they are painted and then taken to the assembling department by the traveling crane.

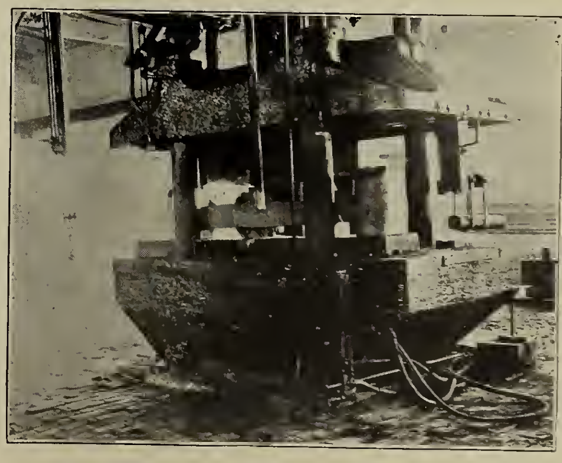


FIG. 5—STRAIGHTENING TRUCK FRAME TRANSVERSELY.

FIG. 6—GAUGING TO FIND IF TRUCK IS STRAIGHTENED TRANSVERSELY.

ASSEMBLING.

The number of operations required to assemble a Bettendorf truck is a minimum because of the small number of parts which are not riveted or bolted together. A view of the assembling department is shown in Fig. 8. All parts of the truck, including side frames, bolsters, brake beams, etc., are placed within access of the assemblers, so as to be handled by a 1,000-lb. traveling hoist. A pair of mounted wheels are run up on the elevated track and one side frame is placed in position. The wedges and brasses are then inserted in the journal boxes and the truck bolster set in position after which the second side frame, together with brasses and wedges, is added. Next, the bolster is raised up against the top arch bar and the spring plank and springs are slipped into position. Then after the brake beam is hung and brake rigging attached, the truck is completely assembled and ready to be placed under a car. It requires about 8 minutes to assemble this truck and about 9 minutes to dismantle it after the truck has been placed under a car.

When it is necessary to replace a pair of wheels, there are no journal box bolts to be removed as in the common arch bar truck. It takes less time to dismantle the truck, illustrated herewith, for the purpose of changing wheels than it does to remove journal box bolts which are in many cases either rusted or bent.

Oil Supply for Panama Railroad Locomotives

An order has been placed by the Panama Railroad Company for a 50,000-gallon steel tank and a 30-foot tower to be erected at Cristobal. The tank will be used in supplying oil to the oil-burning locomotives, 12 of which have been ordered and are expected on the Isthmus in February. The oil will be piped from the Union Oil Company's storage tanks at Mount Hope into the supply tank. This will be the only tank used by the Panama Railroad Company, as each locomotive will take enough oil at Cristobal for a round trip.—The Canal Record.

Ventilation of Cars

THE construction and operation of the Garland car ventilator was described in the February, 1908, issue of the Railway Master Mechanic in connection with its application to the passenger coach and refrigerator car. A new arrangement of Garland exhaust ventilators for ventilating the kitchen end of dining cars and private cars has been tested out and proved efficient and satisfactory by the General Railway Supply Company, Chicago.

The latter arrangement of ventilators is given by the above-mentioned company as follows:

The dining room is equipped with six or eight ventilators applied to deck windows in the usual manner in which they are applied to sleeping and passenger cars. The amount of air taken out by each ventilator at a speed of 45 miles per hour is 400 cu. ft. per minute. Six ventilators will therefore draw out 2,400 cu. ft. of air per minute. As the air capacity of the dining room is about 2,000 cu. ft., it will be seen that the air is changed in the dining room once every minute. The ventilation of the car increases proportionate to the speed of the train; the higher the speed, the stronger the ventilation.

The kitchen is equipped with four ventilators (two on each side) applied to the deck windows in the usual manner. Two of the side ventilators are connected with the hood over the range and carry off the heat and smoke. One of the other side ventilators is made double, the upper part draws from the kitchen while the lower part is connected with the refrigerator in the kitchen and keeps a current of fresh air passing through the refrigerator, carrying off the odors from the stock of supplies on hand. In addition to the four ventilators placed at the deck windows, two pairs of ventilators are placed over hatches in the center of the deck of the kitchen. Registers are placed on the under side of the hatch openings to regulate the ventilation. These extra ventilators increase the exhaust from the kitchen and produce a movement of air from the dining room towards the kitchen instead of from the kitchen toward the dining room. The total exhaust of air from the

FIG. 7—VIEW OF INSPECTING AND FINISHING DEPARTMENT.

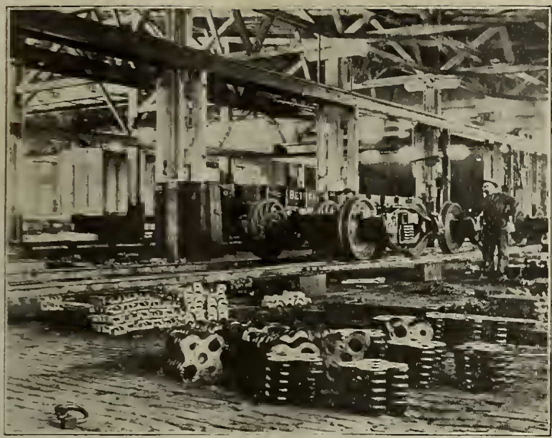


FIG. 8—VIEW IN TRUCK ASSEMBLING DEPARTMENT.

kitchen at speed of 45 miles per hour is 2,600 cu. ft. per minute. The air space in the kitchen being about 600 cu. ft., it follows that the air is changed in the kitchen four times every minute.

Ventilators can be easily applied to dining cars in the yards without withdrawing them from service. The side ventilators are applied to deck sash openings, the screens being removed. The ventilators on top of the deck over the kitchen cover the hatch openings usually fitted with lid and screen. The height of the ventilators on the deck is seven inches, which is less than the height of the smoke jacks from the range or the open hatch lids. They are therefore fully within the clearance limit.

Locomotive Coaling Station

RECENT reports from the Norfolk & Western's new locomotive coal and sand station at Concord, Va., show that the average time required to coal the big through-service passenger engines is only 35 seconds, counting from the instant the train comes to a standstill until it moves away.

This station, designed and installed by the Link-Belt Company, is of steel-reinforced concrete throughout. It is of the through-service type and includes overhead storage facilities for 260 tons of coal and 10 tons of dry sand, ground-floor storage for 100 tons of wet sand, engine and boiler-rooms, and shed over track hopper, as shown in Fig. 2.

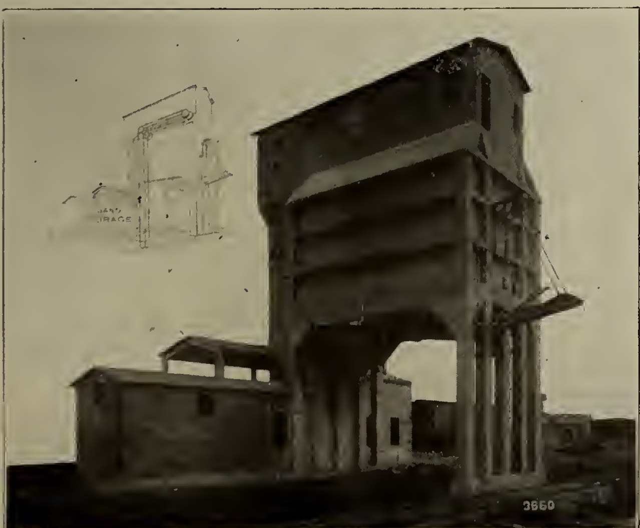


FIG. 1—LOCOMOTIVE COALING STATION, SHOWING LOCATION OF TRACKS.

The arrangement makes it possible to supply both coal and sand to engines on three tracks—the two main-line tracks, which it spans, and one outside track shown on the right in Fig. 1. The outside track in the rear is used for dumping coal into the track hopper and shoveling sand into the wet storage bins.

Each of the three service tracks is supplied with coal through a Link-Belt coaling chute, the flow being controlled by a gear-operated undercut gate. Sand is delivered through special swivelled telescopic spouts that can be adjusted to suit the position of the locomotive; one of these spouts serves the two inside tracks, and another the outside. All chutes and spouts are counterbalanced and, when not in use, swing up and out of the way automatically.

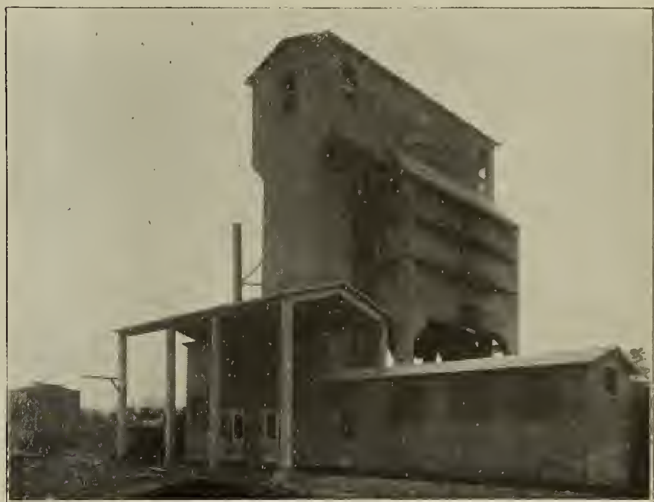


FIG. 2—LOCOMOTIVE COALING STATION, CONCORD, VA.

The track hopper for receiving coal from the cars is 10 ft. wide by 12 ft. long and fitted with a patented reciprocating plate, Fig. 4, which feeds the coal, in a steady, even supply, to an elevator of the gravity discharge type. This elevator, being called upon for hard, continuous service, is of particularly rugged construction. It consists of V-shaped steel buckets, 36 ins. long by 22 ins. wide by 10 ins. deep, attached every 3 ft. between two strands of steel chain fitted with rollers chambered to admit lubrication. It has a vertical travel of 60 ft. from the hopper to the top of pocket, and then a horizontal run, shown in Fig. 3, of 33 ft. over bin into which it discharges through two two-way chutes. Its speed is 50 ft. per minute; capacity, 50 tons per hour.

The sand storage bin, sand-dryer, engine and boiler rooms are in the building at the base of the pocket. Two openings in the upper part of the side wall of the sand bin are fitted with gates hinged at the bottom in such a manner that when let down they rest on the side of the car, forming a bottom that prevents spilling of sand in shoveling. The sand is transferred from wet storage to the dryer as needed and by this is fed to a small belt-

FIG. 3—LOCOMOTIVE COALING STATION, SHOWING V-SHAPED STEEL BUCKETS.

bucket elevator, shown to left in Fig. 3, which elevates it to the top of pocket and discharges it at the rate of 10 tons an hour through a spout into the 10-ton dry sand bin.

The power equipment is a 14 h. p. steam engine and a 20 h. p. vertical boiler. A manila rope-drive, 58 ft. centers, is used to transmit power from the engine to the head shaft of the coal elevator in the lantern of building; an Ewart link-belt drive, 7-ft. centers, from coal elevator head shaft operates the sand elevator.

Special Drill Socket

THE advent of the expenive high speed drills has brought before all drill users more strongly than ever before the problem of the loss occasioned by twisted tangs and broken shanks. With the ordinary carbon steel drills, notwithstanding the fact that the loss was considerable from this source, it was generally neglected, and considered as an unavoidable evil. However, when the tang was twisted off, or the shank broken on a high speed drill of approximately four times the value of an ordinary drill, and this expensive tool thereby rendered useless, the men in charge of such matters began to give the subject some serious thought.

FIG. 4—LOCOMOTIVE COALING STATION, SHOWING TRACK HOPPER WITH RECIPROCATING PLATE.

About that time the American Specialty Company, Chicago, came forward with the "Use-Em-Up" drill socket. This socket is similar to the stand taper socket with two exceptions; one that it has a flat on its inside surface, and the other that the drift slot is somewhat longer than on the ordinary socket to facilitate the driving out of tangless drills.

With the socket described it is only necessary to grind a flat on the remaining portion of the shank after same has been broken off, or the tang twisted off, in order to put the drill into immediate use, or if a flat is ground on a new drill the liability of trouble from this source is entirely eliminated.

Several of the standard drill makers are now furnishing their drills flatted to fit this socket at the same price as the ordinary drill. It will be noted that flattening the drill shank to fit this socket does not in any way interfere with its use in the standard taper socket.

Locomotive Guide Bar and Face Grinder

THE new guide bar and general face grinder, shown herewith, is especially designed for grinding locomotive guide bars and has recently been placed on the market by the Diamond Machine Company, Providence, R. I. The machine also operates efficiently upon grinder columns, water meter cases, water pipe flanges, lathe legs and floor plates. The wheel grinds cast iron with great speed.

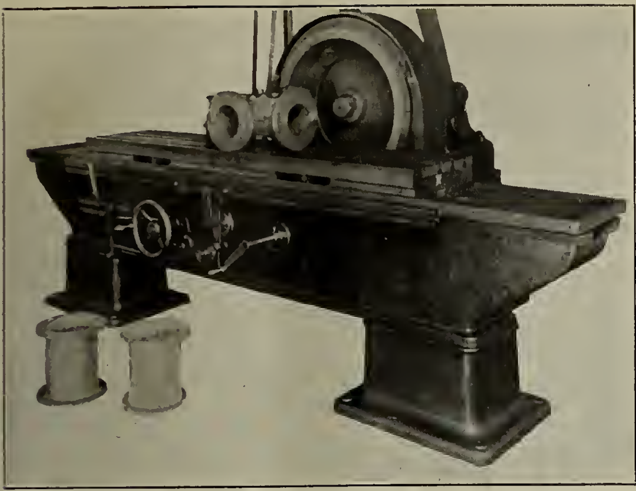
Among the advantages of the machine, these may be mentioned. Its operation is not hindered by hard iron or material of any kind. The work need not be so rigidly fastened as on a planer or milling machine. The mechanism movements are rapid compared with those of other machines doing this class of work. The emery ring is held in a steel-bound adjustable chuck, as on machines of this nature the wheel should not run unsupported.

The bearings are ample, made with the best Babbitt, ring oiling, and well protected from dust. The end thrust is taken by a ball thrust-bearing. Longitudinal table feed is obtained by open and cross belts which are connected to heavy gearing and a rack, with automatic reversing mechanism for any length of stroke, shifted by adjustable dogs. When hand feed is desired a clutch is thrown in mesh with a hand wheel. The cross feed is either automatic or by hand, as desired, and is capable of fine adjustment. An automatic pump with attachments is furnished for wet grinding on all machines.

These machines have been built in 84-in. and 114-in. lengths, for belt or motor drive. Longer machines can be made if desired.

The following data apply to the 84-in. machine:

The length of bed is 134 ins.; the length of table is 130 ins. and the width is 19½ ins.; the length of platen



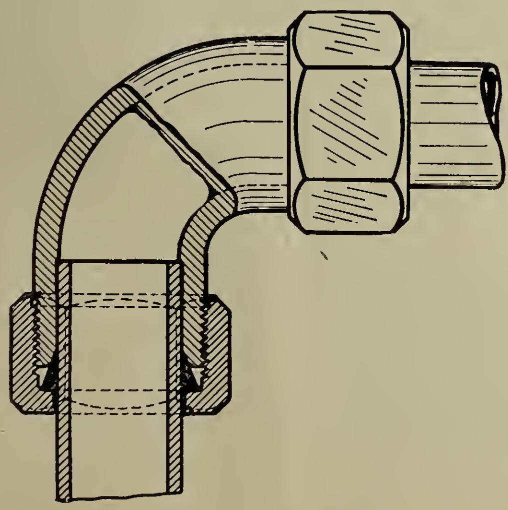
LOCOMOTIVE GUIDE BAR AND FACE GRINDER.

(4 slots, 13/16 ins. wide) is 84 ins. and the width of platen is 17½ ins.; the table travel per minute is 20 lineal ft.; the total length, including table travel, is 18 ft. 4 ins.; the total floor space required for operation is 18 ft. 4 ins. by 7 ft.; the wheel is of 30-in. diameter, in adjustable holder, and the number of revolutions per minute, depending on work, are from 350 to 700; the wheel spindle is 3½ ins. and wheel spindle bearing is 3½x10 ins.; the weight, all complete with countershaft, is about 8,000 lbs. and with motor drive about 10,000 lbs.

New Union-Cinch Pipe Fitting

THE new Union-Cinch pipe fittings were designed because of the difficulty of producing a satisfactory mechanical job of small piping with the ordinary threaded pipe and tapped fittings and due to the fact that it is more practical to do the work of threading in the shop than in the field.

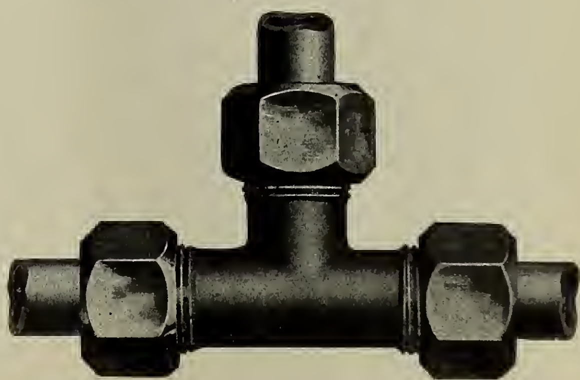
In the first place, it seems probable that the work of threading pipe and getting a good fit for the threads could be accomplished at a factory or in the shop much better than it is often done by means of a set of dies in the hands of more or less inexperienced workers, who are often obliged to thread a piece by holding it with a Stillson wrench while they try to run the die on by hand. After all the care possible has been exercised in making up a job where the pressures are rather severe, it is unusual not to find a number of leaks; and it has been noticed that these leaks usually occur where it is least convenient to get at them, to give the pipe another turn to take them up.



UNION-CINCH PIPE FITTING.

These new fittings are made in sizes corresponding to standard iron pipe up to one inch, and are especially designed for use in connection with the oil pumps and oilers manufactured by the Sight Feed Oil Pump Company, Milwaukee, Wis., who are manufacturers of these new Union Cinch fittings.

It is possible to use ordinary rough pipe with these fittings, if care is exercised in filing the ends of the pipe round and smooth; but the builders of the fittings are prepared to furnish smooth drawn steel tubing corresponding to the iron pipe sizes on the outside diameter. This tubing has No. 16 gauge wall in the ¾-in. and 1-in. size, and No. 18 gauge wall in smaller sizes, and has, therefore, a larger carrying capacity than ordinary pipe. In fact, the ⅛-in. pipe size is claimed to carry almost as much as the ordinary ¼-in. iron pipe. This steel tubing is said to be very cheap, thoroughly annealed and readily bent, and when it comes to paying the bill for labor and putting up a job of pipe work, the Union-Cinch system brings to light a number of strong arguments in its favor.



UNION-CINCH TEES.

In the first place, a hack saw and monkey wrench are all the tools that are required, except where some very fancy work has to be done, in which case a bending rig of some sort is very convenient. Each fitting is a union, and the piping may be taken down at any point where a fitting is inserted. The joint is made by screwing down the outside nut, which presses a thin, tapered shell into the annular cavity around the pipe, between it and the fitting, as shown on sectional cut. These nuts may be pulled up good and hard and the soft cone shell will make an absolutely tight joint around the tubing, which is good for 1,000 lbs. pressure per square inch; or, in fact, is absolutely tight under any pressure that the tubing will stand.

Where it is desirable to have a nice looking job, brass pipe may be used; although in cases where nickel-plating is done, the steel tubing will nickel-plate just as nicely as brass pipe and is much cheaper.

This type of joint may be taken down and made up again any number of times without any trouble. The Union-Clinch system is especially valuable in the troublesome work of piping up oil pumps, gravity oiling devices, gauges, drop pipes, etc., and especially in such work around ammonia handling machinery, because of the readiness with which they may be made up perfectly tight against the escape of ammonia gas.

PLANT OF THE AMERICAN CAR & FOUNDRY COMPANY.

Extension of a Car Repair Plant

THE American Car & Equipment Company, of Chicago, started about two years ago as brokers and sales agents in rebuilt and repaired railroad equipment and developed a business which resulted in the construction of their own plant for the rebuilding and repairing of freight cars that they handled. Their business is received from many of the representative railroads among which are the Rock Island system and the Illinois Central. This company will undertake the rebuilding and repairing of steel freight cars.

The present capacity of the plant, shown in the accompanying illustration, is 25 cars per day. The plant is located at Chicago Heights on the Belt Line and, connecting with three important trunk lines, railroad equipment is handled on the best possible basis to and from the shops from all the roads of the middle west.

The plant covers ten acres at present but five more will be added. The repair and erecting shop has a capacity of 30 cars under roof and the plant now has trackage for 300 cars.

A blacksmith and forge shop has just been finished and a new mill building is about to be erected. When the new mill building is erected the present large erecting shop will be used exclusively for repair work.

A specialty is made of heavy repairs in the overhauling of bad order equipment and the character of the work has formed the company's good reputation. The new plant will enable the company to build new equipment, but the policy is that of rebuilding and repair work.

The new plant is modern in all respects. The machinery is electrically operated. Pneumatic power is used for small tools, air hammers and drills and the testing of air brakes. The facilities are such that the work is handled in the most expeditious manner. Equipment has been furnished to railroad companies and private car owners in all sections of this country and Canada.

The business of the company is in charge of competent officials who have had long experience in the railroad business and who hold the confidence of railroad officials. Mr. H. H. Sessions, president, was for a number of years associated with the Pullman company and was general manager of the shops; Mr. I. J. Kusel, vice-president and general manager, has had experience in mechanical work for a number of years; Mr. C. R. Powell, general superintendent of the shops, was formerly connected with the Illinois Central and has broad experience in car repair work; Mr. W. H. Horne, secretary and treasurer, was formerly National Bank Examiner, and Mr. B. B. Barry, sales manager and purchasing agent, was formerly associated with the C. G. W. and C. & A. railroads. The sales office of the company is located in the Monadnock block, Chicago.

New Heavy Pattern Lathe

A NEW 36-in. heavy pattern lathe with triple-geared head and turret on shears is now built by the American Tool Works Company, Cincinnati, Ohio. In the following description, the back gear construction, the turret on shears, the turret feeds and the taper attachment are particularly emphasized:

The back gears are automatically disengaged when slipping pinion into internal gear, and vice versa. Longitudinal feed of carriage is controlled by a friction, and the cross feed by a saw-tooth clutch, operated from "star" handle on the apron, which is "cam actuated." The rack pinion in apron can be withdrawn while thread cutting. The feed-box, on front of the machine beneath the head stock, supplies three instantaneous changes for feeding and screw cutting, for every change of gears on quadrant at head end of lathe. The gears are covered wherever possible, and all loose running gears are bronze bushed.

The compound rest is fitted with a "four stud" tool holder, with tool resting on a separate steel base. The tool is clamped by the four nuts and two straps, which straps may be sent in the opposite direction. The compound rest may also be fitted with double T-slotted top-slids and equipped with regular tool posts set in tandem, which prevents slippage of the cutting tool, under heavy strains, and subsequent spoiling of the work.

The turret on shears is of new design throughout, possessing many new and valuable features. It is equipped with a new "indexing mechanism" which is self compensating for wear. This mechanism is located at the front of turret top-slide, which brings the locking pin very near to the tool. This is superior to turrets of other makes, which locate it at the back, in which position any slight wear is multiplied many times by the increase distance of the cutting tool.

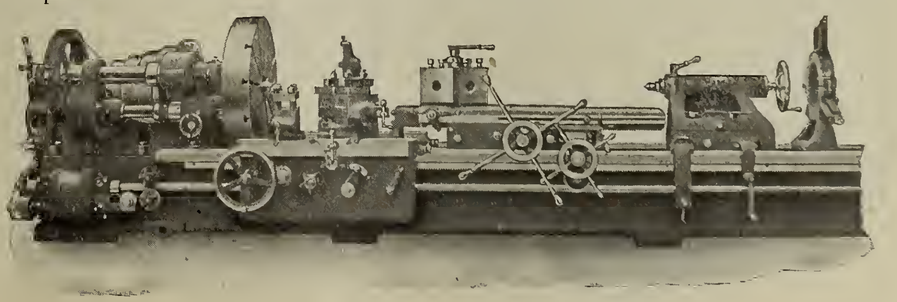
The turret can be tripped or revolved automatically or by hand, which is an original feature. Also, the mechanism can be set so as to be inoperative, when wishing to run the slide back to extreme limit, without withdrawing the locking-pin or revolving the turret. This is accomplished by the small lever shown near the large pilot wheel. The turret top-slide is supported on its outer end by a gibbed bracket attached to the front of the slide which travels along the V's of the bed and through its support eliminates all tendency to spring under a long reach. This feature is original with us. The bracket can be removed, should the work require that the turret slide pass over the carriage of the lathe.

The bottom-slide of the turret is moved along the bed by the pilot wheel shown at the rear end. It is clamped to the bed by two eccentrics, one at the front end and the other at the rear end. It is further secured from slipping, due to severe end-thrust, by a pawl, which, dropping from the turret, engages a ratchet toothed rack cast in the center of the lathe bed.

The eight well-selected feeds are supplied to the turret, ranging from .005 in. to .162 in. which are entirely independent of the regular carriage and apron feeds. Turret feeds are controlled by the two "star" knobs, carrying index dials, which are shown one directly above the other on the front of the bed near the feed box. The dials and pointers, thereon, indicate at once the feed in inches as set, and all changes can be made while the lathe is running. The "star" knobs operate through shafts, extending through the bed to the quick change turret-feed-box at the rear of head-stock, which is provided with a neat and substantial cover.

Provision is made on the compound rest slide to quickly attach the turret top-slide to same. This is very valuable when wishing to impart to the turret the feeds of the carriage, such as in large tapping operations. In such a case the taps get a "positive lead," since the screw cutting mechanism can be engaged in the apron and the proper lead thereby transmitted to the turret slide, carrying the tap. This valuable feature relieves the tap of all "dragging at the start" and the "positive lead" prevents the reaming tendency of the tap on the hole at the start, which would spoil valuable work, if not provided for in this way. This feature is also of value in ordinary jobs of chasing internal threads with a turret tool.

Feeds of turret can be reversed, which is a valuable feature when wishing to "back face" or "counter-bore." Reversal of feeds is controlled by the lever, conveniently



NEW 36 IN. HEAVY PATTERN LATHE.

ELECTRIC GANTRY CRANE.

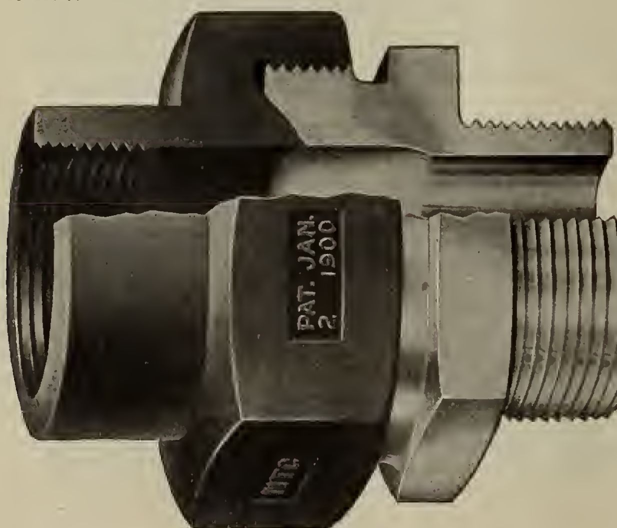
located on driving sprocket of quick-change turret-feed-box.

The taper attachment is of very heavy and substantial construction and is so designed as to eliminate all binding tendencies of the part, thereby, insuring smooth and uniform action. It is given a support on the bed and is supplied with a vernier attachment to facilitate very fine adjustment. It is graduated and the entire attachment is bolted to and travels with the carriage. It may be quickly engaged or disengaged at will, without disturbing the taper as set.

Electric Gantry Crane

THE accompanying illustration shows one of the six electric gantry cranes furnished the Great Northern Railway by the Whiting Foundry Equipment Co., Harvey, Ill. This, one-motor type of 100 tons capacity, is operated by hand and electric power.

The trucks are of structural steel sections provided with bearings for the main axles to which double-flanged cast iron wheels are fitted. The hoisting gearing is supported on bridge girders by means of structural framing. The drums are designed to give equal distribution of load upon girders. The factor of safety is five.



AIR PUMP UNION.

The hoisting motor is comparatively small as only low speed is required. The motor is fitted with an improved automatic electric brake, which is operated by an electric solenoid in circuit with the hoisting motor and is so arranged that it will come automatically into action when the electric current is off the hoisting motor circuit.

The principal dimensions are as follows: The span, center to center of runway rails, is 14 ft. 6 ins.; the clearance, inside of legs, is 13 ft.; the height from top of rail to underside of girder is 20 ft.; the distance from center to center of hook is 11 ft.; the lift, travel of hook, is 14 ft. 6 ins.

Air Pump Union

FOR use in connection with air pumps on locomotives, the "Kewanee" air pump union has been designed, being similar in construction to the well-known "Kewanee" union. These unions are manufactured by the National Tube Company, Pittsburg, Pa.

With this new union there is a brass to iron thread connection at the ring, which means that the union can be disconnected and reconnected indefinitely, in view of the fact that brass to iron does not corrode. There is also a brass to iron ball joint seat, whereby the gasket is eliminated with its attendant annoyances.

The unions are tested with 100 lbs. compressed air under water, and the slightest leak is detected. In the case of compressed air, it is difficult to locate a leak in service, and for this reason it is necessary to use the best joints in such work.

*Flat Spots on Car Wheels**

THE damaging effect of flat wheels upon rails has long been acknowledged and measures have been taken to reduce the evil. Thirty years ago the M. C. B. Association called attention to this matter and adopted a rule limiting the allowable length of flat spots to 2½ ins. The recent agitation in regard to the failures of steel rails in service has led to renewed interest in this subject on the part of railway officials. A proposition to reduce the allowable length of spot to 1¾ ins. was the subject of a report made by the committee on iron and steel structures of the A. R. E. and M. W. Association at their last annual meeting. (See report of Mr. A. J. Himes, p. 297 of the proceedings.) The matter is now in the hands of a joint committee of the M. C. B. and M. of W. Associations.

I wish to acknowledge here my indebtedness to Mr. Himes' report for some of the facts presented in this paper.

When the rule for the length of flat spots was adopted in 1878, the maximum freight car capacity was 40,000 lbs. and the weight of car 22,000 lbs., making a total weight on the wheels of 62,000 lbs. Today the 100,000-lb. car when loaded to its maximum capacity will weigh

*By Prof. Chas. H. Benjamin before the Western Railway Club.

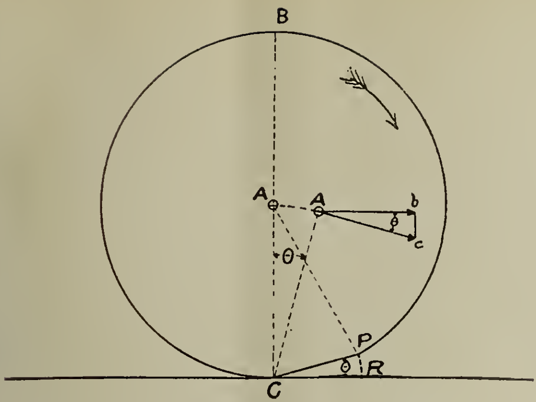


FIG. 1—FLAT SPOTS ON CAR WHEELS.

nearly if not quite 150,000 lbs. The speed has even more influence than the weight since the energy of impact will vary directly as the weight and as the square of the velocity. Probably the average speed of freight trains has doubled in the last thirty years. It is, of course, true that the weight of rails has greatly increased in the same time. Although the new rail may be twice as strong as the old to resist bending between the ties, it does not follow that its capacity for resisting blows is increased in the same ratio. The damage done by the hammer blow of the flat wheel is liable to be of a local nature and may not be averted by the great depth and weight of rail. The violence of the blow is also increased by rigidity of the rail and its supporting ties and ballast. This is particularly true at high speeds.

Professor E. L. Hancock, of Purdue University, in a paper read before the Indiana Engineering Society at their meeting in January, 1908, developed a mathematical formula for the energy of impact of a flat wheel and reference is here made to that paper for an analysis of the problem. It is sufficient for my purpose to call attention to the following facts:

Let A in Fig. 1 be the center of a car wheel D inches in diameter, revolving as shown by the arrow, and C P be a flat spot L inches long just beginning its contact with the rail. The whole wheel is turning about the point C and will so turn until P reaches R and the blow is struck on the rail. At this latter instant A will have reached A' and will be moving downward with a velocity represented by the line b c. (The angle b A′ c=A C A′ =P C R=θ.) If the velocity of A′, which is practically the same as that of the train, is assumed as v feet per second, then,

$$bc = v \sin \theta = v \frac{CP}{CB} = v \frac{L}{D}$$

If we regard the mass of the wheel and its load as concentrated at A and call the total weight W pounds, the kinetic energy of the mass just before the rail is struck will be:

$$E = \frac{Wv^2}{2g} \cdot \frac{L^2}{D^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Four facts are shown by this formula. The energy of impact will vary directly as:

1. The weight of wheel and its load.
2. The square of the velocity.
3. The square of the length of flat,

and inversely as:

4. The square of wheel diameter.

It is impossible to determine the force of the blow as this depends so largely upon the amount that the rail springs and gives under the impact. All we can do is to compare the energy of impact with that of the standard drop test for rails.

According to the specifications approved Sept. 1, 1907, by the American Society for Testing Materials, the standard drop test for steel rails shall be made with a weight of 2,000 lbs. falling the distances indicated in the following table. The distance between the rail supports is to be three feet:

Weight of rail in pounds per yard.	Height of drop in feet.	Kinetic energy in foot—pounds.
45 to 55	15	30,000
55 to 65	16	32,000
65 to 75	17	34,000
75 to 85	18	36,000
85 to 100	19	38,000

If we assume:

$D=33$ inches

and

$L= 2.5$ inches,

$g=32.2$ inches,

and substitute these values in Equation (1), we have,

$$E = \frac{Wv^2}{11200} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

If

S=speed of train in miles per hour

$$= \frac{15v}{22}$$

then

$$E = \frac{WS^2}{5220} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The following are some of the values of E for different weights and speeds:

ENERGY OF IMPACT IN FOOT-POUNDS OF A 2.5-IN. FLAT SPOT ON A 33-IN. WHEEL.

Wgt. on wheel, lbs.	Speed of train in miles per hour. 30	40	50	60
10000	1725	3060	4790	6900
15000	2587	4590	7185	10350
20000	3450	6120	9580	13800

If we compare these figures with those given under rail specifications, we find a factor of safety on a 100-lb. rail varying from 22 at the smallest weight and speed to 2.75 for the largest. If a 50-lb. rail is considered, the factor varies from 17.4 to 2.17. Since the impact varies as the square of the length of spot, reducing this length

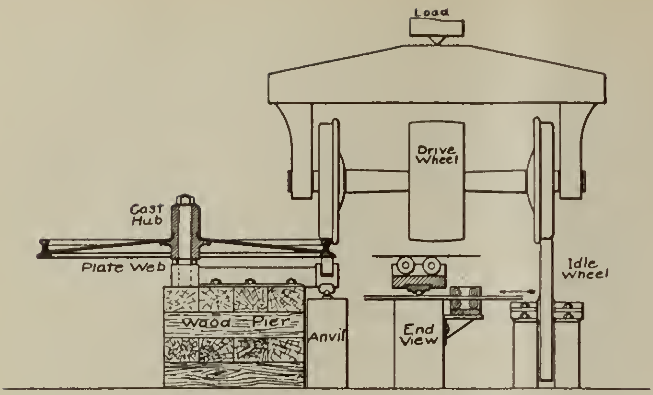


FIG. 2—FLAT SPOTS ON CAR WHEELS.

from 2.5 to 1.75 ins. would diminish the impact about one-half and double the above factors of safety.

In the foregoing brief mathematical treatment, some factors have been neglected such as the impact due to the falling of the center of the wheel before the contact of the flat spot with the rail, the fact that the wheel is a compound pendulum and that the mass can not be regarded as concentrated at its center of gravity, and the possible bounding of the wheel from one corner of the flat to the other without touching the rail at high speeds. It is not probable that any of these will have much effect on the values just given. It is, however, true that the flat spot on a wheel is usually not straight, but is convex or perhaps slightly rounded at the ends. For these reasons it is extremely desirable from both a scientific and business point of view to determine experimentally the exact effect of the blow delivered by a flat wheel on the rail. It is hardly practicable to do this with a car on a straight track because of the influence of the driving wheels of the engine and the number of wheels which would pass over a given point. To be satisfactory, experiments should be confined to one wheel whose condition is determined beforehand.

The apparatus shown in Fig. 2 will permit of continuous operation of one wheel upon one section of rail indefinitely and permit at the same time of measurement of the effects of the blows. The truck is so supported that one wheel turns freely upon an idle pulley while the other wheel on the same axle rests on a section of steel rail and in turning drives the latter by friction. The section of rail is bent to a circle lying in a horizontal plane and is firmly riveted or bolted to a supporting web, which in turn is fastened to a central hub of cast iron or steel. This hub turns freely on a vertical mandrel and is supported by a thrust bearing underneath. The rail and its attachments thus turn in a horizontal plane under the rotating car wheel. The portion of the rail immediately under the wheel is supported by friction rollers, which turn freely in a steel box or yoke. This latter forms a portion of the main casting supporting the hub of the rail and this casting is bolted to a wooden pier so as to have a certain amount of elasticity. On the lower side of this casting and directly beneath the point of contact between wheel and rail is a hardened steel hammer or ball resting on a strip of soft metal. The soft metal is supported on a heavy anvil of cast iron and is fed slowly underneath the hammer by friction rollers. The truck being loaded with the desired amount of pig iron or other material, the wheels and their axles are rotated by means of a variable speed motor, and the energy of the blow delivered by a flat spot on the wheel is measured by the indentation of the strip of soft metal underneath the hammer. The amount of energy due to any given indentation can be readily measured by producing a similar indentation under a drop press. The curving of the rail in a horizontal direction is not sufficient to interfere with the action of the wheel and the energy of the blow is transmitted directly to the soft metal.

It may be noted that it is possible with this machine to drive the wheels at any desired speed corresponding to any desired number of miles per hour and that any length or shape of flat spot can be readily tested. It is also possible to change the load as desired.

The same apparatus can be used for determining the impact due to flat spots on locomotive drivers or the effect of the various types of counterbalancing on the rail.

Such an apparatus can be arranged in a pit so as to bring the rail tested at grade and make it possible to run any truck or engine into position for testing without disturbing the mechanism of the truck itself, except as it may be necessary to attach a driving wheel. The results derived from the experiments can be combined with the mathematical reasoning in such a way as to make a working formula for practical use.

A simple modification of this apparatus would make it possible to test a span of rail between two supports the same distance apart as are the ties, and to measure the deflection produced by impact. It would also be possible to run a rail for any desired length of time under severe conditions and determine its wear and depreciation under these circumstances.

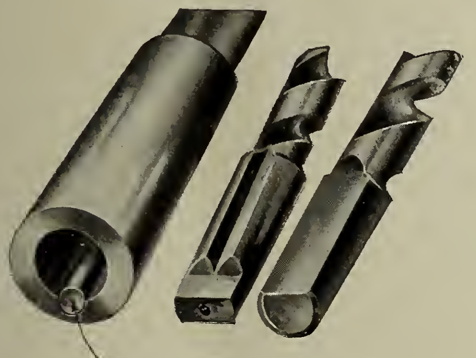
In view of the fact that there is at the present time some discrepancy between the rules for flat wheels and the speed and weight of trains, and to the further fact that no one seems to know exactly how much damage is done by flat wheels, it would seem very desirable to make an accurate experimental determination of the forces involved. The figures obtained from such experiments would also have a bearing upon the design of steel structures for railway use. The prominent part already taken by railway men in the experimental determination of the strength of railway machinery and structures would lead one to believe that this important investigation will not be much longer delayed.

Automatic Train Stop

The block signal and train control board of the Interstate Commerce Commission has given approval for the purpose of test of a cab signal and automatic train stopping device which is to be established on a branch line of the Philadelphia & Reading in the vicinity of Pottstown, Pa.

Lang Drill Socket

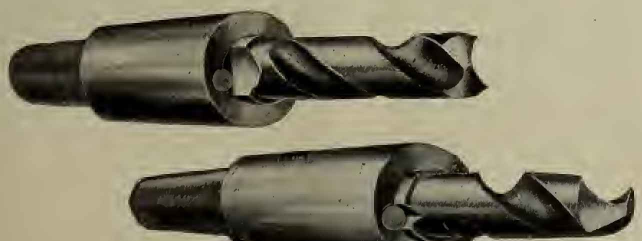
THE main advantage claimed for the new drill socket, shown herewith, is that the drill is held in the socket without the necessity of a tang, but by the use of a jig which is furnished. The drill press spindle may also be fitted up with a round steel key. It is claimed that with this method all the old drills with broken tangs may be used up and the good drills will not have their tangs broken, and more important still the sockets will not fall out of the drill press spindle. It is comparatively easy to replace worn out drill sockets and drills, but a worn out drill press spindle is a continual annoyance and source of trouble.



LANG DRILL SOCKET.

The shells of these sockets are made from 1/16 in to ⅛ in thicker than the standard drill socket, so that the insertion of the hardened steel key does not weaken them. These keys are made from tempered drill rod varying in diameter from ⅛ to ⅜ ins. These project one-third of their diameter into the opening. These keys are all pressed in socket absolutely parallel with the angle of the bore and central with the tang slot. The shank end of socket has a standard 90-degree V-groove (not shown in cut) milled its entire length, central with the tang (not shown in cut). As these keys and grooves are all made standard by accurate jigs, they are all interchangeable with each other, allowing any combination of sockets.

As shown in the illustration it is only necessary to grind a flat on the old worn out drills and the drift hole in socket is made extra long so that they can be easily knocked out. New drills can be ordered with the V-groove in shank from all makers at no additional cost. Drills in stock can be fixed up in a few minutes in a milling machine. This method insures a good true bearing the whole length of the keyboard.



LANG DRILL SOCKET.

This interesting development of the drill socket is the invention of Mr. George R. Lang and is manufactured by the G. R. Lang Company, of Meadville, Pa.

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*Metal Cutting Tools Without Clearance**

By Jas. Hartness

THIS paper sets forth a turning tool that is intended to cut without clearance. It consists of a cutter and a holder so constructed as to allow the cutter a slight oscillatory freedom in the holder. The center line on which the cutter oscillates is substantially coincident with the cutting edge. The oscillation of the cutter about the center line does not affect the position of the edge, but it does allow the face of the cutter to swing around to conform to the face of the metal from which the chip is being severed.

The objects of this construction are to make possible the use of more acute cutting edges in order to reduce the cutting stresses; to equalize wholly or partly the unbalanced side pressure on the cutting edge; and to obtain a rubbing contact to prevent lateral quivering.

In order to bring out these objects it is necessary to analyze briefly some of the conditions under which metal is worked in a lathe, dealing particularly with cutting angles, clearance of cutting edges, and the importance of minimizing the tendency of the work and tool to separate under cutting stresses.

No attempt is made to discuss the forms of cutting edges for withstanding the heat of high speed service. High speed tool forms have been ably and perhaps conclusively treated in the paper by Mr. Fred W. Taylor and its discussion, and in the papers of Dr. Nicholson before this society and before the Manchester Association of Engineers.

The generally accepted cutting angle of greatest endurance under high speed is about 75 deg., and the angle of least resistance, according to some of Dr. Nicolson's tests, is about 60 deg., with an increase below as well as above that angle.

The cutting angles of the tool described in the present paper may be varied from the present orthodox angles down to 30 deg. or less, according to the nature of the work.

The results obtained by Dr. Nicolson, which showed an increase in cutting stress for tools more acute than 60 deg., may have been due to the cuts having been run without cutting oil or suitable cutting lubricant. Furthermore, the comparative lack of durability of the more acute edge below 70 deg. may have been due either to heat or lateral quivering or both. The heat would have been greatly reduced by a liquid cooling

*From a paper presented at the New York Meeting (December 1908) of the American Society of Mechanical Engineers.

medium, especially one having some suitable lubricating qualities, and the lateral quivering may now be eliminated by means explained in this paper. The thin edge of an acute tool is obviously the least suited to carry off heat or to withstand the quivering incident to cutting.

Having mentioned the great work of Mr. Taylor and co-workers and of Dr. Nicolson, it is necessary at once to disclaim any pretension at contributing valuable data, such as are found in the papers of these truly scientific researchers. Nothing of the kind is possible at this time. All that is attempted is to suggest a scheme for widening the field of investigation.

Instead of approaching the subject as a scientist bent on getting exact data regarding performance of certain existing forms of tools and machines, the writer's line of approach has been from the standpoint of a designer and manufacturer of lathes, and particularly lathes of the character of the flat turret lathe.

THE CLASS OF WORK HERE CONSIDERED.

The means for cutting, set forth, should be considered from the standpoint of one who sees nothing but lathe work under 20 ins. in diameter, and of the kind usually found in any machinery building plant, whether it is a navy yard, railroad shop, or automobile building plant; not that the means are of no value in larger work, but being out of the writer's range of experience, such work was not considered in designing the tools described.

A more exact description of the range of work for which this tool is intended would be: Lathe and turret work under 20 ins. and over 4 or 5 ins. in diameter, and less than 8 or 10 ins. in length; also work up to 2 and 3 ft. in length, of diameters under 3 to 3½ ins. and generally over ¾ or 1 in.

It includes three classes of work: a, chuck work, having diameter generally exceeding length, and held wholly by a chuck or face plate; b, bar work, which is held in a chuck and steadied by back rests; and c, work having dimensions similar to bar work, but which must be turned on center points, with or without following and fixed steady rests.

It will be noticed that this excludes all of that kind of larger and heavier lathe work in which the principal duty of the lathe is the rapid removal of the stock. In the particular branch of work under consideration the rapid removal of stock is important, but not paramount.

Although the field of work includes all kinds of steel and cast iron, this paper will deal only with the standard open hearth machinery steel of about 20 points carbon.

In work supported on centers and in chucking work, the connection between the work and tool includes a number of joints, both for sliding the tool in relation to the work, and for the rotation of the work. Each of these joints has more or less slackness, and each of the slides and other members is more or less frail in structure. With a mounting of this kind the cutting edge of the tool does not pass through the metal without swerving and flinching.

TYPE OF TOOLS USED.

In the class of work under consideration each piece has several diameters, with shoulders which should be accurately spaced and formed. Nearly all the shoulders required in this class of lathe work are the so-called square shoulders.

In engine lathe practice these shoulders are "squared up" by a side tool after the other turning has been done by a round nose or diamond point tool, but in the turret lathe for bar work these shoulders are produced by the same tool that takes the stock removing cut.

The tool used in turners for bar work cuts on the same principle as the engine lathe side tool; that is, its rake or top slope is almost wholly side slope, and its cutting edge stands at an angle of 90 deg. to the axis of the work.

In the engine lathe a tool of this character has generally been unsatisfactory for rapid turning, yet in the turret lathe this very tool seems to be universally used for all bar work. The difference in performance seems to be due to the difference in mounting. It works well where there is no chance of vibration, but trouble begins when it is used in a machine like the engine lathe or turret-chucking lathe in which the work is supported by one part of the machine and the tool by another, and the true path of the cutting tool through the metal is dependent on the entire structure of the machine, there being nothing to prevent quivering.

The no-clearance tool to be described is a side tool, without clearance. Its under face bears flatly against the work, thereby preventing the lateral quivering which has previously made this type of tool inefficient.

MEANS FOR IMPROVING EFFICIENCY.

A machine's efficiency is proportional to its strength to resist its working stress. There are two ways to increase this efficiency; a, by strengthening the machine; and b, by reducing the stresses for a given result.

In the writer's previous work the strengthening of the machine has been accomplished by the elimination of unnecessary features, and placing the necessary joints for obtaining the various motions in the least objectionable positions. But since this has been so fully outlined in a semi-commercial treatise, entitled, "The Evolution of the Machine Shop," it is unnecessary to make further reference to the special forms of design therein set forth, except to say that a single-slide scheme of lathe design was adopted to eliminate the complicated and frail construction of the multi-slide tool carriage which is now in almost universal use in all standard machine tools.

The next step was to devise a means for minimizing the stress at the cutting edge, and the object of the present paper is to explain how this result has been obtained.

This reduction of stress may not be important in roughing work in which a flinching of the work or machine may be disregarded so long as the machine continues to crush off the metal, but for the kind of work mentioned in this paper it has been considered of first importance.

CUTTING STRESS.

DIRECT CUTTING STRESS.

For the purpose of analysis the cutting stress may be divided into three elements: The direct cutting stress, the separating stress, and the tendency to quiver, which we will consider in turn.

By direct cutting stress we mean that part of the stress that is directly downward in a lathe. With all other conditions unchanged, we should expect to find that an acute-edged tool would offer the least resistance, and that the difference in direct cutting stresses for tools of varying cutting angles would show a marked reduction in favor of the more acute tools.

Dr. Nicolson's experiments below 60 deg., already mentioned showed, an increase in cutting stresses and a marked loss in endurance, but these tests were on dry cutting without the benefit of a lubricant or a cooling solution. The thin edge tool is undoubtedly benefited more than the blunt edge tool by lubricant or cutting medium. Just what cutting angle would be the best under conditions of most efficient cooling medium may not yet be fully known.

That there is no marked difference in the blunter tool of varying cutting angles really does not affect the situation when we try the real cutting or sliding angles, which may be roughly stated to be efficient in proportion to their acuteness.

It is obvious that the least direct cutting stress for a given depth and feed would be obtained by a straight-edge tool, and one that would take a chip in which there is the least molecular change.

Crushing and partially or wholly shearing the chip into chunks which are three or four times the thickness of the fed undoubtedly increase the working stresses and heat.

The cuts accompanying Dr. Nicolson's discussion, p. 333, vol. 28 of Transactions, clearly illustrate the great distortion that takes place even in cutting with an acute tool of 60 deg. and a straight edge. This tool does not have even the disturbing element of shearing action at the edge of the chip, but the experiment shows the distortion of nearly every part of the chip. A tool having a round nose or a blunt edge would doubtless show still greater distortion.

A flat top slope should have a straight cutting edge. The more the edge is rounded the greater the conflict of the metal crowding to the edge. The flow of metal on the top slope of the round nose does not move in one direction wholly, but tends to travel towards the center of the curve. The conflict of currents of metal which approach the center from various parts of the curved cutting edge increases the direct cutting stress.

The crushing process of the present scheme of turning is due both to the bluntness of the cutting angle and the shape of the edge. A curved edge should have a curved top slope in order to remove the chip with the least distortion of the metal. The curved top slope for this purpose would make the shape of the cutting edge similar to the cutting edge of a carpenter's round-nosed chisel. This form of tool is not offered as a practical form, but is mentioned to emphasize the unnatural flow of the chip that must take place on the flat top slope of a round nose tool.

SEPARATING STRESS.

By separating stress we mean that stress which, in turning a shaft, forces the tool outward radially. Increasing this stress causes the work and tool to move apart, and results in variation in diameter, also in irregular and generally inaccurate product, particularly when the rough stock runs eccentric or irregular. Although this separating stress may be lessened by giving the tool more back slope, this is possible only in tools taking light depth cuts. A lathe tool, however, which takes a cut like a side tool, gives little or no tendency to separate radially.

With the side tool set at an angle of 90 deg. to the travel of the feed, the feeding stress does not tend to force the work and tool apart; in fact, this tool may be set so as to produce a slightly beveled shoulder either side of the 90 deg. so as either to draw the work and tool together when making an overhanging shoulder or to force the work and tool apart when producing an external bevel.

QUIVERING STRESS.

The quivering stress due to the nature of the chip is affected by the cutting angle of the tool. The chunks which make up the parts of a chip are less firmly united in a chip taken by a tool of 70 deg. cutting angle than by a tool of 50 deg., and of course the more firmly united chunks give a more continuous chip with the least vibration of stresses.

In turret lathe practice, especially in bar work, the tool and work are held together by a back rest which follows on the surface produced by the cutter, and in some kinds of turret-chucking work the tools for interior work are mounted on boring bars which take bearing either in the work or in the chuck which holds the work. When tools get this steady support directly on or in the work, they are freed from the chattering due to the machine mounting, but not free from that due to their own fraility or to the intermittent flow of the chip as it is taken off in chunks.

RELATIVE DESTRUCTION EFFECTS OF HEAT AND LATERAL QUIVERING.

The writer is not unmindful of the effect of heat in the destruction of the cutting edge, and fully realizes that no perfection of mounting of the work and tools will prevent destruction of the cutting edge of the tool by heat, but wishes to bring out the importance of the destructive effect of chattering which is ever present in standard types of machine tools. Heat is undoubtedly most destriuctive when roughing at high speeds, but the quivering plays a very important, if not the greatest part in edge destruction when finishing at the usual speeds.

OTHER CONSIDERATIONS.

The failure of the keen edge under normal cutting conditions, and its surprising endurance under some abnormal conditions, seem to indicate great possibilities open to any scheme that would maintain the best conditions. For instance, at one time, we have seen the edge of a diamond point broken off by an ordinarily heavy chip and at another time we have seen a similar tool deeply imbedded into the metal without breakage, the tool having taken a plunge and lifted or plowed up a chip of enormous proportions without breaking the tool. Every lathe hand has seen this performance. Usually it ends with breaking the tool or the center of the lathe, or both, but occasionally the lathe is stopped without breakage; then the lathe hand by great care may seperate the work and tool without breaking the edge. The immense chip plowed up by a frail tool demonstrates what a cutting tool can do under some conditions.

We are also aware that under some conditions a cutting tool will actually sharpen itself in the process of cutting, yet neither of these results is regularly maintained. They sugest, however, the possibility of supplying a means by which they can be maintained in regular work.

CLEARANCE.

Since the birth of the slide rest lathe, in which the tool was first guided by mechanism, turning tools have been given clearance and it has been assumed that they would not cut without clearance. Of course it is well known that the orthodox lathe tool goes out of commission after losing its clearance, but that does not demonstrate that a tool cannot cut without clearance. It only proves that the present tools require clearance as they are now formed and mounted.

A tool which has been ground for clearance, and set in such a position that its under face is at an angle to the shoulder produced, presents but a small area to the shoulder of work when the clearance of the extreme edge has given way. The area is so small, compared with the stress of the abrading metal passing it, that it rapidly scores and wears into a rough surface standing at a "negative" clearance angle. A tool with a negative clearance and rough surface, quickly goes from bad to worse.

The tool which has by chance been set in an angle lathe so that a comparative large area of the under face rides on the wall of metal does not wear away, because its surface is not subjected to as great abrading pressure per unit of area. Its area is sufficient to withstand abrasion.

It was assumed by the writer that increasing the contact of the under face of the tool against the face of the work would make it possible to cut without clearance. The advantage of a no-clearance tool is that its face rides on a good area and supports the under edge against the pressure which must be borne by a tool having clearance. This one-sided pressure may be wholly or only partly relieved.

Of course, in all of the former types of tools the cutting edge must withstand the stress, which is wholly one-sided, excepting for the occasional condition stated, in which a cutting tool obtained by chance a bearing on its clearance face.

THE NO-CLEARANCE TOOL.

In order to enable the tool to ride flatly against the wall of metal from which the chip is being removed, we have mounted it to allow a comparatively free swiveling action on a center line that is substantially coincident with the cutting edge of the tool. When the tool is so mounted the pressure of the chip on the top slope tends to throw the so-called clearance face against the shoulder, for the mounting allows the tool to swing around to the angle that may be necessary to fit any work form, from a straight surface in planer work and the nearly straight surface in work of large diameter down to the angle of a helix obtained by the coarse feed on work of relatively small diameter.

(To be continued.)

Universal Tool Holder

IT has long been recognized that tool holders are a success, and their advantages over the older method of using solid forgings is undisputed. The tool holders that are in general use today, however, are not all that could be desired. They are all more or less clumsy and wasteful of tool steel and what is probably the greatest objection to their use is the fact that a separate holder is required for each different tool, making it necessary for the machinist to change his holder every time he wishes to make a different kind of cut. The Van Doren Manufacturing Company of Chicago are placing on the market a holder which they claim overcomes these features. This holder was first designed for use in their own shops and proved such a success that they are now placing it on the market with the expectation that it will soon take the place of the old-style article.

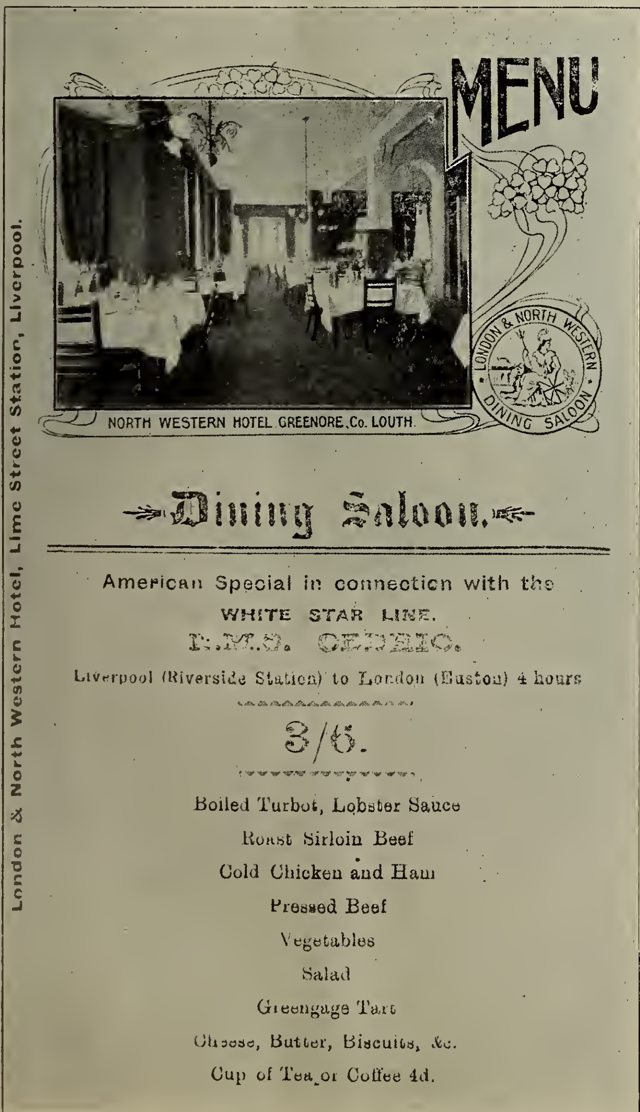
The Tait "Universal" tool holder, as it is called, is made of tool steel and, as will be seen from the illus-

UNIVERSAL TOOL HOLDER.

tration, is a perfect vise capable of holding a round, square or flat tool when compressed by screwing down on the tool post. With this holder the steel can be cut off the bar in any length. This permits the use of a very long tool for boring and other purposes and reduces the waste of tool steel in all cases to a minimum. With this holder there are no set screws with special threads to get out of order, and when it is necessary to sharpen the blade the holder can be withdrawn without turning the tool post around, obviating the necessity of bringing the tool rest away from the work. This holder is adaptable for use in screw machines, lathes, planers, slotters, sharpers and cut-off machines; in fact, anywhere where forged tools can be used. It is particularly useful in repair shops.

An English Menu Card

AS Americans, when we think of a hotel or restaurant, in our hunger and excitement we ordinarily conjure up before our mind's eye a placard about as long, though not quite so wide, as this page, bearing the legend at the top "Table d' Hote," or, as the case may be, "A la Carte," and below this a list of the edibles, the real significance and composition of which we only wildly surmise and yearn to know, and never try to pronounce—this for the reason that it is fondly (or otherwise) believed that the Frenchman discovered cooking and has ever since maintained a complete and absolute monopoly of the art, despite what "mother used to make."



BY COURTESY OF MR. TOM WYLES.

However, a lesson may be learned and a moral gleaned from the accompanying illustration of how they do it in Merry Old England. Here they spurn to honor the more frivolous French, plain old English being good enough for them, and they write it just roast beef, without the "a la" frills, etc.

We may draw our own conclusions as to the generousness of the portions served and the quality of the food and whether we would relish the meal as well as one of the famously good dollar dinners served by any of the numerous railroads in America. This is English, you know, so must be par excellence, with the Englishman's pardon.

This picture is printed through the courtesy of Mr. Tom Wyles; if you don't know him, you ought to. He has not expressed himself as to the comparative value of the dining service of English and American railroads. In addition to the meal he ate at a cost of 3/6 he got this card, and he didn't say whether he took it as a souvenir or—but that may be another story. The editors vouch only for the illustration being a correct and truthful copy of the original, that's all.

Concerning Some of Our Railway Supply Friends

In our July issue of nineteen hundred and one we first introduced the Protectus Company to our readers. A picture of Mr. W. C. De Armond and Mr. F. L. De Armond, with their exhibit at Saratoga, appeared among the "Snap Shot" photographs of that convention. They now need no introduction, but it

MR. F. L. DE ARMOND.

is a pleasure to refer to the recent addition to the personnel of the Company and publish in this connection the three pictures shown herewith.

Mr. Chas. H. Spotts appeared last June as president of the Spotts Formulae Paint Company of New York City. Mr. Spotts is well and favorably known because of his connection for the past ten years as manager of the paint department of the Joseph Dixon Crucible Company, manufacturers of Dixon's silica graphite paint. He had severed his connection with that company with a view of establishing a paint company in the vicinity of New York that would make a specialty of paints for structural and ornamental work. Mr. Spotts has made a specialty for a number of years of architectural and engineering specifications, and has had charge of the painting of such structures as the hotels St. Regis, Astor, Knickerbocker and Belmont; Altman's new department store, the new McAdoo Terminal Buildings, the City Investment Building, Broad Exchange Building, as also a number of other important structures in New York and other cities. The recent legislative work done by Mr. Spotts, as chairman of the legislative committee of the Eastern Paint Manufacturers' Association, has attracted considerable attention. Associated with Mr. Spotts was Mr. Walter F. Swearer.

Mr. Spotts has recently associated himself with the Proctectus' company, Philadelphia, as its secretary and Mr. Swearer becomes the New York manager, with headquarters at the Hudson Terminal.

Personal Mention

Mr. Edward C. Cole has been appointed traveling engineer of the Iowa Central, with office at Des Moines, Iowa, succeeding Mr. W. B. Ferris.

MR. WALTER F. SWEARER.

MR. CHAS. H. SPOTTS.

Mr. J. B. Cozart, master mechanic of the Mexican Railway at Apizaco, Pueblo, Mex., has resigned to go to the Pan-American.

Mr. T. N. Ely, chief of motive power of the Pennsylvania, has been granted a protracted leave of absence to visit Italy, France and Egypt.

Mr. Harry J. Hair has been appointed foreman of the Baltimore & Ohio Southwestern at Seymour, Ind. He graduated in mechanical engineering from Purdue University with the class of 1906 and has been connected with this road since that time.

Mr. B. H. Lent has been reappointed road foreman of engines of the Arizona division of the Atchinson, Topeka & Santa Fe, with office at Needles, Cal.

M. J. Powers has been appointed master mechanic of the Denver & Rio Grande, at Pueblo, Colo., succeeding Mr. W. A. Randow, transferred.

Mr. W. A. George has been appointed superintendent of shops of the Atchison, Topeka & Santa Fe, with offices at Albuquerque, N. Mex.

Mr. E. J. Shoffner, foreman of the Frog and Rail mill of the Norfolk & Western at the Roanoke shops, has been appointed general foreman at Cleveland, Ohio, succeeding Mr. H. F. Staley, who was appointed master mechanic of the Carolina, Clinchfield & Ohio.

Mr. Frederick Regan, formerly with the Chicago & Alton in the motive power department, has been appointed master mechanic of the southern division of the Kansas City Southern, with headquarters at Shreveport, La.

Mr. A. W. Horsey has been appointed master mechanic of the Chalk River section of District 4 of the Canadian Pacific, with headquarters at Smith's Falls, Ont., succeeeding Mr. G. T. Fulton.

Mr. A. West has been appointed master mechanic of District 1 of the Canadian Pacific, with office at Kenora, Ont., succeeding Mr. A. H. Eager.

Mr. Calvin Schreck has been appointed head foreman of engines of the Cleveland, Cincinnati, Chicago & St. Louis at Bellefontaine, Ohio.

Mr. George K. Anderson has been appointed road foreman of engines of the Albuquerque division of the Atchison, Topeka & Santa Fe, with office at Winslow, N. Mex.

Mr. Manual Parra has been appointed master mechanic of the Mexican Railway at Apizaco, Tlax, Mex., to succeed Mr. J. B. Cozart.

Mr. Frank Hopper, road foreman of equipment of the Chicago, Rock Island & Pacific at Dalhart, Tex., has been appointed road foreman of equipment of the Dakota division and part of the Minnesota division, with office at Estherville, Iowa.

Mr. H. Carrick has been appointed assistant division master mechanic of the Oregon Short Line, with headquarters at Pocatello, Idaho.

Mr. John Reed of the mechanical department of the Oregon Short Line at Salt Lake City, Utah, has been appointed general superintendent of the Salt Lake & Ogden Railway at Salt Lake City, in place of Mr. A. D. Pierrson, resigned. Mr. Reed is succeeded by Mr. George Wilson, chief clerk of the master mechanic at Pocatello, Idaho.

Mr. W. L. Hudson has been appointed road foreman of engines of the Pittsburg division of the Pennsylvania railroad, with offices in the Union station, Pittsburg, Pa., succeeding Mr. J. K. Russell, who was placed on the retired list December 1, after 51 years of service with that company.

Mr. John Boden, master mechanic of the Ohio River division of the Baltimore & Ohio, has been transferred to Garret, Ind. Mr. H. D. Van Valen, general foreman at Parkersburg, W. Va., succeeds Mr. Boden.

Obituary

The death of Mr. John Wohrle, Chief Car Inspector at Columbus, O., occurred at 6:30 a. m. on December 6, 1908, at his late residence, 267 East Eleventh avenue, Columbus, O., at the age of 62 years and 9 months. Mr. Wohrle was born in Columbus on February 27, 1846, and received his education in the Columbus public schools; his parents, Mathias and Helena Wohrle were born in Baden, Germany, and Mr. Wohrle was brought up in the German-Lutherian faith.

On February 2, 1865, he enlisted with Company G, 185th Ohio Volunteers, and received honorable discharge from the army September 26, 1865. He was married at Columbus, O., in December, 1870, to Miss Anna Rheinhart, of Columbus; this union was blessed with five children, three of whom with the widow survive; Mr. Edward Wohrle, of New York, Mrs. Seabert and Miss Nettie Wohrle, both of Columbus.

In 1867 Mr. Wohrle began active business in his native city as builder and contractor. He commenced his railroad career in 1870 with the H. V. Ry. in their car department and remained with that road until 1881, when he went to the N. & W. Ry., S. V. Div., at Portsmouth, O. In 1894 he resigned his position with that road and took service with the C. S. & H. Ry. at Columbus in the capacity of general foreman of the car department and retained that position until May 15, 1901, at which time he was elected by the railroad companies at Columbus as chief joint car inspector, which position he held up to the time of his death.

Mr. Wohrle stool very high in the estimation of railroad officers and his death is recognized by them as a distinct loss to the mechanical and car departments of the railroads at Columbus. His sudden death was a shock to his friends as he was apparently in perfect health up to the very hour of his death, his demise being caused by heart failure. His funeral took place on December 9 and was very largely attended, many railroad officials from out of town being present. Interment was at Greenlawn Cemetery, Columbus, O.

Trade Notes

The General Railway Supply Company, Chicago, have moved from 922-923 Marquette building into large quarters, rooms 531-532 of the same building.

Mr. Herbert E. Stone has just become connected with the Dearborn Drug & Chemical Works, as manager of sales in the Eastern department, with headquarters in New York City. Mr. Stone was formerly president of the N. A. S. E., and recently manager of the Pittsburg office of the Chapman Valve Company. Mr. Stone will have associated with him a corps of able assistants. The Dearborn company is to be congratulated upon the splendid addition to their selling force.

Two years ago, the American Blower Company distributed a large sum of money by giving each one of their employes one dollar and one additional dollar for each year of continuous employment. The largest single sum paid was $25.00, that being the entire life of the company at that time. Amounts ran from that to one dollar; no one received less than the latter amount. Last year, owing to the business depression, nothing of this nature was done, but this year the plan above outlined was again adopted.

Mr. Willis C. Squire, 209 Western Union Building, Chicago, Ill., has accepted the agency of the Falls Hollow Staybolt Company for the railway trade in the Chicago territory, and Mr. Alex. S. Mitchell, 45 Broadway, New York, for the railway and boiler trade in the New York teritory.

A new motor-driven Portable Mold Dryer is described in a circular recently sent out by the Hanna Engineering Works, Chicago. This dryer is made of heavy grey iron castings and lined with ordinary split fire brick. The air from the fan is regulated by dampers so that it may be forced either over or through the coke fire into the distributer and then through the pipes into any desired part of the mold, insuring an even pressure throughout and reaching into all pockets and angles.

The Pilloid Company has sent out interesting data on the new Baker-Pilloid locomotive valve gear, which has been applied to a Chicago & Alton engine.

Walch & Wyeth, Chicago, has issued on interesting circular on Manganesite paste, which is a non-poisonous metallic composition and unites two pieces of metal as one.

The 1909 edition of the Westinghouse Diary includes information on the following subjects: High pressure steam turbine, Seblanc condenser, low pressure steam turbine, mechanical stoker, mercury vapor lamps, meter testing, storage battery, single-phase railway systems Tungsten lamps, turbo-pumps and blowers and Westinghouse-Nernst lamps. It is a valuable asset for the mechanical engineer.

We are indebted to the Independent Pneumatic Tool Company, Chicago, for this interesting item concerning pneumatic tools on the stage: "That the importance of pneumatic tools is now more generally recognized by the public at large than ever before, is shown by the use of Thor hammers in Frederick Thompson's latest production "via Wireless" running at the Liberty theater, New York. The plot of the play revolves about the over-tempering of a huge experimental gun so that it will explode under test, and throw a large government contract for another into the hands of the steel works holding the patents on the second gun. The second act of the play discloses an exact reproduction of the forge room of one of the largest steel plants in the country. Each side of the stage shows a row of furnaces from which large billets of white hot steel are carried on over-head trolleys to the immense steam hammers in the center of the stage and forged into shape. During the action of the scene, the heavy thud and vibration of the steam hammers and the rapid blows of the Thor pneumatic hammers, show that the shop forces work on utterly unconscious of the vailiany of the higher officials. Just before the curtain falls, the much overheated gun forging is swung across the stage and dropped wtih a hiss and a cloud of vapor into the tempering bath. Mr. Thompson has carefully gone into all details of this scene and made it one of the most realistic productions on the stage."

The steady increase in business for the Northern Railway Supply Company, Chamber of Commerce building, Chicago, has resulted in its incorporation as a stock company. The manufacture and sale of such specialties as the Rogers dust-proof journal box and the Neudeck steel grain door will be continued on a larger scale at its several plants. The malleable iron plant at Benton Harbor, Mich., has been materially enlarged. The officers of the company are as follows: Mr. John F. O'Malley, president; Mr. A. W. Neudeck, vice-president, and Mr. H. W. Drew, secretary and treasurer.

The New York Central Lines recently placed an order eleven all-steel postal cars. The exterior of these cars will be covered with steel sheathing. This is an interlocking form of steel sheathing furnished by the General Railway Supply Company, of Chicago.

The Industrial Instrument Company was organized by men who have long been engaged in the manufacture of measuring instruments, the leaders being Messrs. B. B. Bristol, E. H. Bristol, and W. E. Goodyear, all of Waterbury, Connecticut, who were for many years, active in the development of The Bristol Company, and in the direction of its affairs during the time of its great development and success. This company now owns the entire capital stock of the Standard Gauge Manufacturing Company, until recently, of Syracuse, N. Y., and of the Standard Electric Time Company, of Waterbury, Conn. The home office will be located at Foxboro, Mass., with sales offices at 50 Church street, Nudson Terminal, New York, and 752 Monadnock building, Chicago, Ill.

The Westinghouse Electric & Manufacturing Company has again become the propert of the stockholders, after having been in the hand of receivers since the 23rd of October, 1907. The petition for the discharge of the receivers was made on December 5 in Pittsburg, Pa., before Judge Young of the United States District Court of the Western Circuit of Pennsylvania, and was immediately signed by him. Mr. Cravath in addressing the court on behalf of the Stockholders' Committee, stated that in the annals of receiverships, this one stood without a parallel as the most successful.

Mr. Allen Gray, president of the Gray Tile & Timber Co., Evansville, Ind., has been elected president of the St. Louis Car Wheel Company, St. Louis, Mo., succeeding the late Mr. John W. Nute. Mr. J. J. Morse, secretary-treasurer, has been made also general manager.

The Carborundum Company, Niagara Falls, N. Y., opened an office at 365 Frick annex, Pittsburg, Pa., January 1. Mr. W. W. Sanderson has been appointed manager of the Pittsburg district. He has been with the company many years.

The F. H. Niles Car Company, Chicago, has been incorporated to manufacture, sell and rebuild freight cars. The incorporators are Messrs. E. Terwilliger, E. D. Pray and A. Hendrickson. The capital stock is $50,000.

Mr. L. J. Viersen, secretary of the Kellogg Car & Equipment Company, Kankakee, Ill., has been elected president, succeeding Mr. Edwin M. Kellogg. Mr. H. Schwartzenburg has been elected treasurer, succeeding Mr. F. W. Kellogg, and Mr. E. H. Ward has been elected general manager. The company has planned to increase the capacity of its plant by the installation of additional machinery and tracks, as it has considerable work booked which guarantees such improvements.

The Latrobe Steel & Coupler Company, Philadelphia, Pa., is erecting two large additions to its plant at Melrose Park, Ill., which will increase its capacity 50 per cent. The structures will have dimensions of 50 ft. by 275 ft. and 40 ft. by 200 ft., and will be of steel construction. The Riter-Conley Manufacturing Company, Pittsburg, has the contract.

The Folger Locomotive Company, Tacoma, Wash., has been incorporated, with a capital stock of $1,000,000, by Messrs. W. B. Jones, T. B. Egan, J. A. Van Osel, W. F. Schaffer J. Loomis and L. W. Pratt.

The Interlocking Journal Bearing Company, New York, has been incorporated to make equipment, supplies and devices for railways, cars and locomotives. The capital stock is $100,000. The incorporators are: Messrs. John J. Donovan, Thomas Hill Lowe and Noah A. Stancliffe.

The A. B. C. Bearing Corporation now has its principal offices in the Railway Exchange building, Chicago. Mr. F. A. Lester, who is in charge of all sales and purchases, states that the corporation is prepared to handle promptly its rapidly increasing business.

Technical Publications

MECHANICAL DRAWING AND ELEMENTARY MACHINE DESIGN, by John S. Reid and David Reid. Published by John Wiley & Sons, New York. Cloth binding, 433 pages, 6x9 ins., illustrated. Price, $3.00.

This volume is prepared to help the student apply the principles of mechanical drawing to the solution of problems in the construction of machines and their parts. Rules, formulae and tables are supplied and the mechanical drawing is thus supplemented by data which give a thorough understanding of the subject. This book is an excellent treatise for technical students and is written so as to render the best possible assistance.

HANDBOOK OF SMALL TOOLS, by Erik Oberg. Published by John Wiley & Sons, New York. Cloth binding, 506 pages, 5x8 ins., illustrated. Price, $3.00.

This volume is a treatise on the design and construction of small cutting tools, and is prepared for the tool-maker, tool-draftsman, foreman, superintendent, etc. It provides specific information on the following subjects: Screw-thread systems; methods and principles of thread-cutting, measuring threads; threading tools, definitions of taps; hand taps; tapper taps and machine taps, screw machine taps, hobs and die taps; taper taps, miscellaneous taps; threading dies; plain and side milling cutters; miscellaneous milling cutters; reamers; drills, counterbores, hollow mills and lathe arbors.

RAILWAY MASTER MECHANIC

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CONTENTS.

Storekeepers' Association

The sixth annual meeting of the Railway Storekeepers' Association, will be held at the Auditorium Hotel, Chicago, on May 17, 18, and 19, 1909. Mr. J. P. Murphy, Collinwood, Ohio, is secretary of the association. Questions on organization, tools and supplies, requisitions, stock, etc., will be discussed.

A. S. M. E. Year Book

The Year Book for 1909 of the American Society of Mechanical Engineers was issued recently. Among the contents is the constitution, by-laws and rules of the association and a complete list of the membership. On Nov. 27, 1908, there were 15 honorary members, 2,322 members, 357 associates and 761 juniors, giving a total membership of 3,455.

Western Canada

Professor J. Austin Bancroft, lecturer in geology, McGill University, presented before the Canadian Railway Club a paper on Western Canada, illustrated by stereopticon views. The concluding paragraph is as follows: "In addition to recalling to your minds some of the more important resources, and of presenting a general description of the broad topographic features of 'the West,' this lecture has aimed to portray some of the causes which have produced the relief of the land of today. It is truly 'a fair land' which has been dealt with, and each Canadian should strive for its wholesome development. When a more careful, scientific study is made of topography, it becomes evident that when one is given a few facts concerning the underlying rock structures, and of the history of the action of the denuding forces which have been at work moulding the surface, that person should know what topographic forms to expect in a given region. Such a study and such knowledge should be of great value to those who have anything to do with the location of railways."

Pooling Cars

Mr. Arthur Hale, chairman of the car efficiency committee of the American Railway Association, states that slow progress is being made in getting the railroads to pool cars. He says, however, that a car pool is bound to come, as that is the only economical way to handle and regulate freight car equipment, and that from $300,000,000 to $500,000,00 is now tied up in idle equipment. Referring to the recent increase in surplus equipment, Mr. Hale said: "I do not like to knock prosperity gospel, but 200,000 idle cars do not spell prosperity."

Car Demurrage

The American Association of Demurrage officers report that for the quarter ended June 30, 1908, the number of cars handled under their auspices were 5,584,265, compared with 7,063,503 cars in the like quarter of 1907. Twenty-two different bureaus give the following comparison of cars reported and average detention of railroads and consignees:

	Quarter to June 30, '08.	June 30, '07.
Cars, number	3,726,588	4,594,416
Detention by railroads, days	0.34	0.42
Detention by con'g'ns, days	1.35	1.51
Total detention, days	1.69	1.93

Oil Burning Locomotives

Mr. George C. Henderson, formerly of the motive power department of the Atchison, Topeka & Santa Fe Ry., but now a consulting mechanical engineer, testified before the New York up-state public service commission on the question of the prevention of forest fires in the Adirondacks that the portion of the New York Central road running through the region could be equipped with oil-burning apparatus in locomotives for $55,986 and operated at annual cost over coal of $139,324. The Delaware & Hudson could be changed for $33,200 and operated at a yearly increase in cost of $41,470. The New York Central's representatives submitted a plan for changes in coal-burning locomotives to prevent the escape of live coals and cinders and for the establishment of fire patrols in the woods with apparatus, etc., to cost the company $70,000 for the first year and $25,000 for operation yearly thereafter. Edward B. Katte, engineer of the electric portion of the New York Central lines, showed that electric operation of trains through the Adirondacks would cost a prohibitive figure, $9,163,000 for installation of electricity and $1,079,000 for annual operation.

New Plant for Locomotive Company

The American Locomotive Company has purchased a plot of 130 acres of land at Gary, Indiana, from the Gary Land Company, a subsidiary company of the United States Steel Corporation, and plans are being drawn for a new plant which officers of the Locomotive company say will be the most complete and best equipped lomomotive works in the world. The land purchased is twice the extent of that occupied by the largest of its present plants and when fully occupied will give employment to from 12,000 to 15,000 workmen.

The land adjoins that of the new plant of the United States Steel Corporation. This site was selected at Gary, 24 miles from Chicago, to provide for the territory where the largest number of railroads converge to a single commercial center. The Chicago district is a great railroad center and that district is rapidly developing in manufacturing importance, which renders it favorable as a locatoin for securing material for building locomotives. This company now operates plants in Schenectady and Dunkirk, New York; Pittsburg and Scranton, Pennsylvania; Richmond, Virginia; Paterson, New Jersey; Manchester, New Hampshire, and Montreal, Canada. At present there is no large locomotive plant west of Pittsburg, and the selection of a location in the Chicago district provides additional locomotive building capacity where it is most needed for prompt and direct delivery to a large number of railroads. The size of the new plant will be sufficient to provide liberally for the growing needs of the railroads for years to come.

New Standard Type Underframe and Bogie for the Five-foot Six-inch Guage Lines of the Indian State Railways

To the general designs and requirements of Messrs. Rendel and Robertson, new standard underframes have recently been constructed by the Leeds Forge Company (Limited), and also the Metropolitan Amalgamated Railway Carriage & Wagon Company (Limited). The last mentioned firm already supplied to the Oudh and Rohilkhand Railway fifty-three of their underframes, fitted with 106 bogies, which latter, however, were constructed by the Leeds Forge Company (Limited). The underframes are built up of channel bars with the solebars and longitudes each strengthened by a strong truss rod of the queen post type. The bolster cross-bars to which the Baltimore ball centre and side bearings are bolted are made of channel bars in pairs over each bogie centre and run across the underframe from sole to sole. The The bottom portion of centre pivot is bolted to the bogie bolster. Both top and bottom sections are fitted with hardened steel balls, taking a bearing between the two races. The side frictions are made in three pieces, the top bolted to bolster crossbars, between this and the middle part work the 1¼ in. diameter hard steel balls fitted between the races. The centre section bears on the bottom portion which is bolted to bogie bolster; the bolsters can move endways slightly, and are mounted on rests of helical springs. These ball bearings allow bogie to take curves easily and no lubricant is necessary or allowed; with ordinary centre pivots and side friction plates, oil is used to reduce the friction, but this causes dust and sand to adhere to them. The bogies are provived with side laminated bearing springs. The leading dimensions are: Length over buffers, 72 ft. 2 ins.; length over headstock, 68 ft.; centres of bogies, 48 ft.; wheelbase, 11 ft.; length over corner pillars, 69 ft.; width over side pillars, 9 ft. 6 ins.; approximate tare (of carriage complete) 36 tons.—Indian Engineering.

Stresses in Staybolts

Interest in the question of life of firebox staybolts and the effect of the vibratory action of the firebox sheets on the endurance of staybolts, is and probably always will be keen, as long as the present design of staying locomotive boilers obtains.

All kinds of hypotheses were advanced as to the actual movement of the sheets under the expansive action of heat, but when all sophistries were exhausted the only recourse was to acknowledge, to paraphrase Brother Jasper's famous proposition of the sun, that the sheets "do move."

The degree of movement of firebox sheets under various pressures and temperatures, was accurately ascertained by the committee on flexible staybolts appointed by the American Railway Master Mechanics' Association and the results obtained by that committee as reported at the 1906 convention let in considerable light on a subject that had hitherto been approached only by simplest conjecture.

It is well known that staybolts never fail by tensile stress alone, the transverse stress due to the expansive action of the firebox sheets being the deciding factor that produces rupture of the staybolt, but the total stress to be provided for is a combination of tensile and transverse stresses, which are of such intensity in actual service as to demand not only the best material in staybolts, but extreme care as to the kind or type of staybolt used.

To determine the ability of staybolt iron to perform its functions satisfactorily before application to the firebox, various devices have been resorted to. Among these is a machine which holds the iron to be tested rigidly at one end and loaded so as to produce a tensile stress equal to that under which the staybolt is stressed in the firebox. While under this tensile stress the opposite end is rotated in a circular path at right angles to the axis of the staybolt under test.

The radius of the curve described by the vibrating end of the test piece represents the deflection of the staybolt in service and is supposed to give a fairly accurate line on the life of the staybolt in the boiler. The conditions, it is seen, are made as nearly identical with those of actual service as possible, excepting the temperature, and such test is no doubt as fair as can be made aside from the exception noted. This kind of a test is, of course, of value only to determine the endurance of staybolts of the so-called rigid types. Such staybolts have endured as many as 3,300 reversals of stress before rupture occurred, in the vibrating machine.

Of course flexible staybolts are not supposed to resist anything but a tensile stress and are not, therefore, considered in this connection. The accompanying tabulated values represent calculated stresses on various sizes of staybolts under both tensile and transverse stresses for various loads, from which it will be seen that staybolts have an important function in resisting the forces at work to destroy them.

Diameter of Bolt Inches.	Diameter of Bolt at Bottom of Thread inches.	Tension in Pounds per square inch due to load in pounds of 2000	2500	3000	3500	Fiber Stress in Pounds per square inch due to Deflection of 1/16-in.	3/32-in.	1/8-in.
7/8	0.767	4329	5411	6493	7575	57848	86773	115698
15/16	0.829	3706	4632	5558	6483	62531	93796	125062
1	0.892	3200	4000	4800	5600	67364	101046	134729
1 1/16	0.954	2798	3497	4197	4896	72047	108070	144093
1 1/8	1.017	2462	3077	3692	4308	76727	115093	153458

Length of staybolts between sheets—6 inches.
Boiler pressure—200 lbs.
Threads—12 per inch.
Pitch of bolts between centers—4 inches.

New Six-Wheel Coupled Tank Locomotive

For working suburban services, the East Indian Railway Company have just lately received delivery of ten heavy six-wheeled coupled bogie tank locomotives, built by the Vulcan Foundry (Limited), of Newton-le-Willows, Lancashire. These engines have the 0-4-6 wheel arrangement, with the crank axle of the middle coupled wheels driven by a pair of inside cylinders to which steam is distributed by balanced slide valves, worked by Stephenson link motion with a rocking shaft. The cylinders are 18 ins. diameter by 26 ins. stroke; the coupled wheels are 4 ft. 6 ins. and the bogie wheels 3 ft. 1 in. in diameter, the rigid wheelbase being 16 ft. and the total engine wheelbase 27 ft. 6 ins. The boiler barrel is 10 ft. 1 in. in length and has a diameter, inside, of 4 ft. 6 13-16 ins. The firebox is of copper and has a length (inside at top) of 4 ft. 9⅜ ins. and a width (inside at top) of 3 ft. 11⅞ ins., the depth (at front) being 6 ft. 5⅛ ins., and the depth (at the back) 5 ft. 11⅛ ins. The total heating surface amounts to 1,256.7 sq. ft. to which the firebox contributes 125 sq. ft. and the tubes (236 in number and 1¾ ins. in diameter) contribute 1,131.7 sq. ft. The grate area is 21.25 sq. ft. The fittings include Gresham and Craven's injectors, and steam sanding apparatus; the U. K. Metallic Packing, and Hulburd's Sight Feed Lubricators. There is steam and hand brake for the engine and a vacuum brake for working the train. The tank capacity is 2,000 gals., and there is fuel space for 3 tons of coal. The engine has a weight of 68 tons 15 cwts., of which 46 tons 5 cwts. is on the coupled wheels.—Indian Engineering.

Smoke Consumer

THE smoke consumer, which is shown diagrammatically in the accompanying drawing, is constructed after the patent of Karl Schleyder. The device has been applied and is claimed to operate satisfactorily. The following description is an abstract from the patent sheet.

By means of the invention the products of combustion which escape into the smokebox without being thoroughly utilized are sucked into the fire-box again for recombustion in such manner that the development of flame in the fire-box is not only not arrested, but, on the contrary, is actively assisted and the generation of steam accelerated and increased, while coal is economized and smoke avoided.

The improvement consists in the products of combustion which are conducted from the smoke-box into the fire-box through the well-known suction-pipe being mixed with a suitable quantity of air by special means and in the intensity of the suction of these products of combustion and of the air being controlled and regulated corresponding to the chimney-draft.

The suction-pipe R, which connects the smoke-box with the ash-pan, is secured at one end to an air-inlet casing A, located below the smoke-box, and at the other end to a smoke and air ejector B, located in the ash-pan.

The ejector consists of a vertical cast-iron casing, having flanges below and above and having also a lateral flange to connect the pipe R. Within the casing there is located an annular perforated pipe, to which the steam injector supply pipe is attached. The steam passes upward through the perforations and assists the suction action of the ejector. The casing is widened below, and in this enlarged part a flat cone is provided, the height of which can be adjusted, whereby the entrance of air into the ejector can be regulated.

At the top of the casing there is connected a pipe which projects through the grate into the fire-box. This pipe is surrounded by a stack of rings, D, which present ribs on the inside, so that passages are formed between the pipe and the rings. Through these passages fresh air flows into the fire-box and the rings, D, and the pipe are cooled, whereby they are better able to resist the action of the flames.

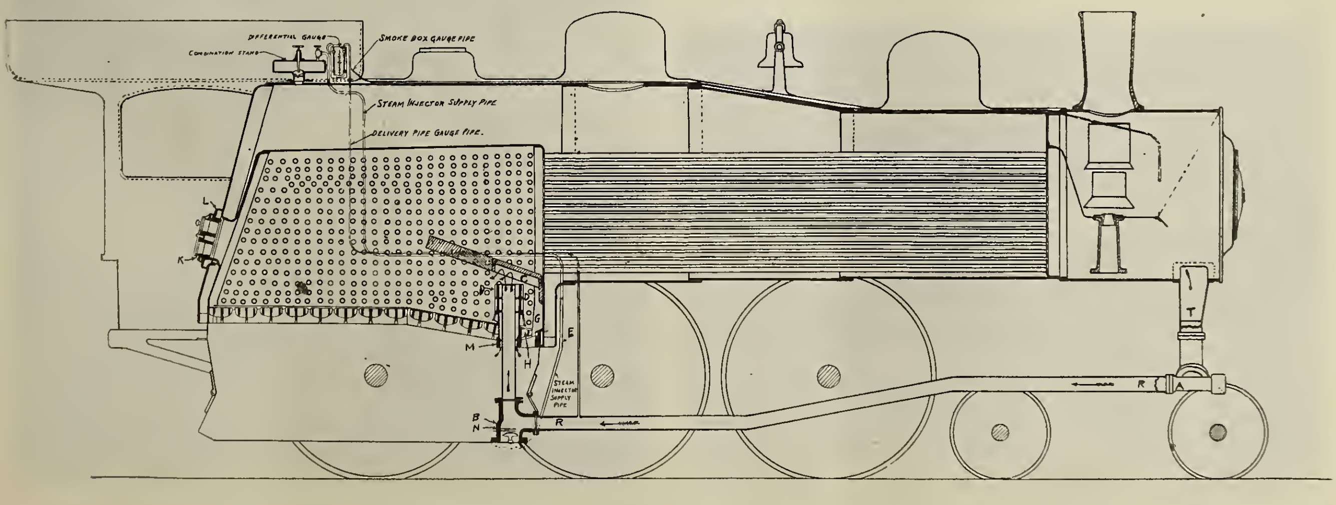
Above the pipe there is located a combustion baffle, C, secured in inverted position, that is, with the open side downward.

At the place where the hopper, T, of the smoke-box is connected with the pipe, R, the air-inlet casing, A, is provided. This casing is shaped similarly to the casing of the ejector, but is horizontally located and is connected, by means of flanges, with the funnel, T, and with the pipe, R.

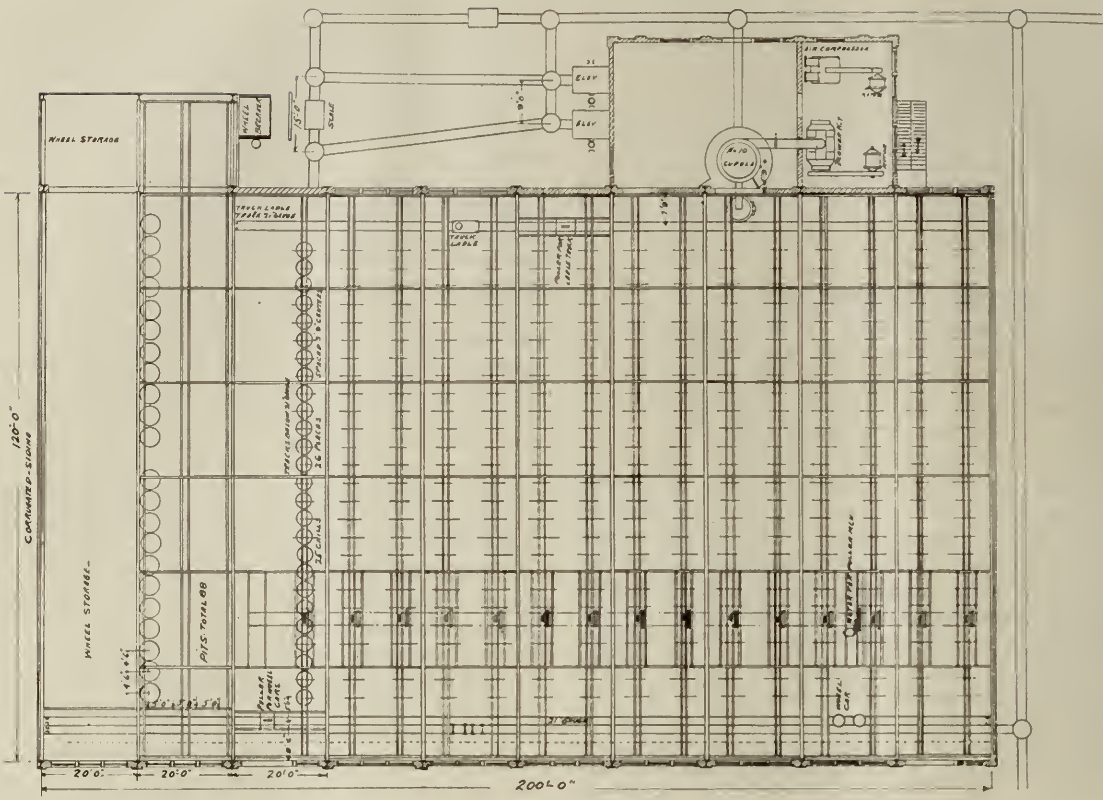
By the exit of steam from the annular pipe, the ejector and thus the entire smoke-consuming apparatus is set in operation, for owing to the action of the annular pipe in the ejector the pipe, R, casing, A, and funnel, T, will cause a strong draft in the direction of the fire-box, stronger than in the chimney itself, so that the products of combustion which enter the smoke-box and which otherwise would escape through the chimney into the air are compelled to flow back through the funnel T, pipe R, and ejector into the fire-box again. In order, however, to cause combustion of these returned products in the fire-box not only without obstructing the ordinary combustion process in the latter, but so as to promote the same, it is necessary to mingle the returned products of combustion with an ample supply of fresh air and to maintain the draft in the pipe R in a definite relation to the draft in the chimney or in the upper part of the smoke-box. It is thus necessary always to know exactly the difference between the draft in the funnel T or pipe R and that in the top part of the smoke-box (above the top row of boiler-pipes) or in the chimney, since otherwise in the event of only slight suction there would be practically no return of the products of combustion, while in the case of an unduly strong draft there would be a serious waste of steam, and owing to the strong inrush into the fire-box the fire would be choked. For this purpose a differential draft-meter may be employed.

New Car Wheel Plant

THE Louisville Car Wheel and Railway Supply Company was organized in 1871 and was chartered by a special act of the Legislature March 22, 1872. It had the first car wheel plant south of the Ohio river, although some wheels had been made in ordinary soft iron foundries with the usual equipment of such foundries, annealing being done by keeping sand on the wheel, etc. The plant was quite small and was enlarged in 1882 to a capacity of 100 wheels a day which was stretched from time to time until the capacity reached 150 wheels per day



Locomotive with Smoke Consumer of Schleyder Design.

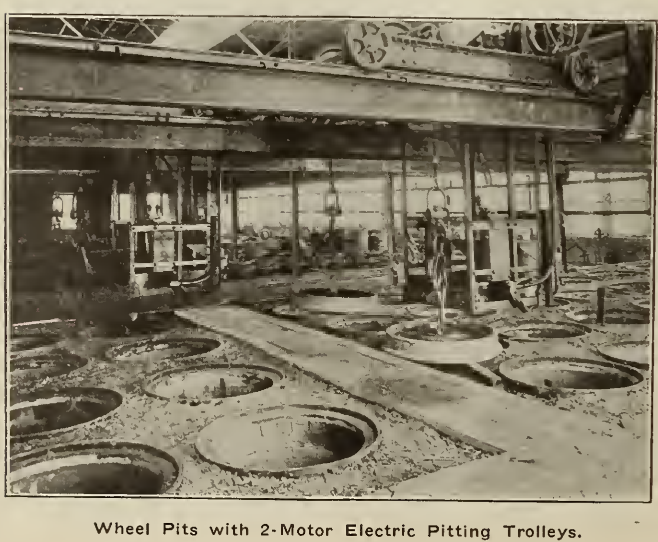


Layout of Wheel Foundry.

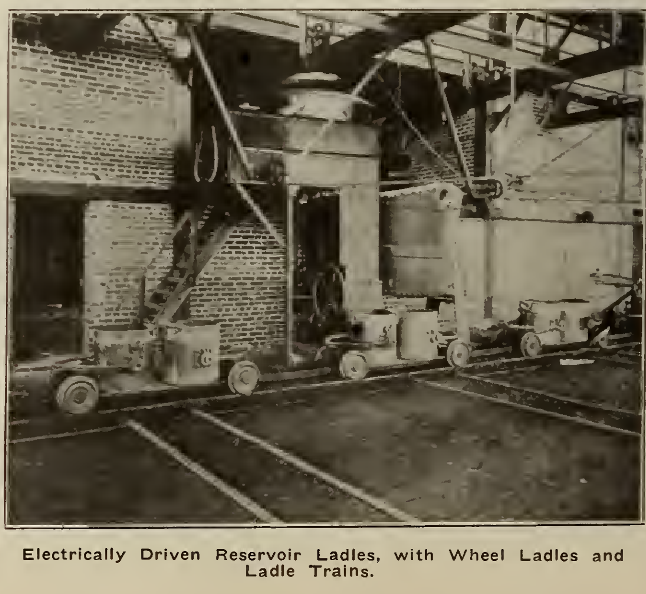
as it now stands. In 1907 they began the erection of a new plant located some three miles distant from the old plant and on the main line of the Louisville & Nashville Railroad. The officers of the company were: Pinckney F. Green, president; George White, superintendent, and D. H. Cheney, secretary and general manager. Mr. Cheney took a leading part in designing and supervising the erection of the plant, but died of pneumonia February 22, 1908, before the machinery was installed. He was widely known amongst the wheel men and was universally liked and respected. His death was a great set-back to the work on the new plant.

The new plant is provided with two switch tracks; one for shipping only, and the other principally for receiving raw material, but can be also used for shipping. The plant was designed and equipped by the Whiting Foundry Equipment Company with their straight line system; similar in detail to that supplied the Chicago, Milwaukee & St. Paul. The building is of brick and steel construction throughout, the main building being 200 ft. long and 120 ft. wide, with a side bay of 60 ft. by 30 ft., containing cupola and blower rooms. It is equipped with fifteen floors of twenty-five wheels per floor, making a total capacity of 375 per day.

The cupola room is equipped with a No. 10 Whiting cupola, 96 in. in diameter and 52 ft. 6 in. high. It is lined to a diameter of 78 in. inside. This cupola will melt at a rate of 24 tons per hour. Located at the sde of cupola is the blower or power room equipped with a No. 12 Sturtevant positive blower and a Chicago Pneumatic Tool Company's air compressor with a capacity of 250 ft. of air per minute; both being driven with a 50 h. p. alternating current motor. The charging floor, 30 ft. by 60 ft., is served by two 3-ton Whiting pneumatic elevators, fitted with 20-in. balanced air hoist. The floor is provided with four sets of tracks with a transfer car at each end; the idea



Wheel Pits with 2-Motor Electric Pitting Trolleys.



Electrically Driven Reservoir Ladles, with Wheel Ladles and Ladle Trains.

General View Across Wheel Floors.

being to provide for the storage of loaded cars before the heat, then to gradually work them off through the charging machine, and then down to the ground floor for fresh charges.

In front of the cupola is placed a Whiting pneumatic charging machine. This machine consists of a platform hinged at a level above the charging platform on the side toward the cupola, provided with a track for the charging car, in line with stationary tracks, as shown, guard, angles, and a hook for holding the car to the platform when being dumped. A dumping cylinder is properly supported by framing attached to the charging floor and pivoted to allow the alignment required. The piston rod is pivoted in a bracket attached to the under side of the platform. The platform is constructed of structural shapes and all joints are strongly riveted; the hinge pins are of ample size and arranged for easy removal and replacement. An apron plate is hinged to the platform and laps over an inclined chute in front of the cupola door. The controlling valve is located at any convenient point and is piped to the cylinder and connected with air supply.

In operating, the car is run on the platform and the hook engaged with an eye attached to the car frame. Then the valve is opened to admit air into the operating cylinder and the platform is raised to the dumping posiion. Iron charges are put on cars with ends about 12 ins. high, but open on both sides. Coke cars have their ends and sides enclosed, one side being fitted with a hinged door.

Through manipulation of the valve, the charge may be distributed as desired. The level of the charge must be maintained 3 to 4 ft. below the level of the door sill to get the best results.

The floor cranes are equipped with a balanced air hoist. This type of hoist, having air under pressure on both sides of piston, makes it especially suitable for molding floors, its action closely resembling that of a hydraulic hoist. The valves for these hoists are attached to the structural work independent of the hoist and are of special heavy construction to withstand the heavy usage necessary for this work.

The core room and ovens are located in a separate building, 30 ft. wide and 80 ft. long. This building is equipped with two core ovens with space for a third. One core oven is 9 ft. wide and 16 ft. long, without side racks, and the other is 13 ft. wide by 16 ft. long, with side racks, both being 8 ft. high. They are fitted with counter balanced sliding doors. Both are fired from a pit in the back. The heat from fire box is distributed by special arrangement of flues which insures an equal distribution of the heat, the steam and gas escaping in stack from an opening located at the floor line. For firing up they are provided with a damper located at top of oven which opens to allow the escape of smoke and closes as soon as they obtain a clear fire. Each oven is provided with two lines of tracks and can accommodate six cars each. These cars are constructed of channels, angles and plates, and are 4 ft. by 4 ft. 6 in. with perforated plate shelves. This type of shelf makes it especially convenient for this class of work as it is easy for sliding on and off cores. In order to facilitate the handling of these cars a transfer car is provided in front of the ovens. The annealing pits are served by two standard Whiting pitting trolleys with built up structural frames, each trolley handling two wheels at once and thereby serving two rows of pits. They are each fitted with two 5 h. p. alternating current motors. They are also fitted with the Whiting semi-automatic pitting tongs.

The operator's platform, reservoir, ladle, the train distributing iron, the hot wheel train delivering wheels to annealing pits, are practically duplicates of equipment furnished the Chicago, Milwaukee & St. Paul. The motors were supplied by the General Electric Company and are three-phase alternating current. As far as possible they were made in duplicate. The motors are distributed as follows: Reservoir ladle, 5 h. p.; ladle trains, 5 h. p.; hot wheel train, 5 h. p.; pitting trolleys, two 5 h. p.; floor cranes, 15 h. p.; blower and compressor, 50 h. p.

Universal Boring, Drilling and Milling Machine

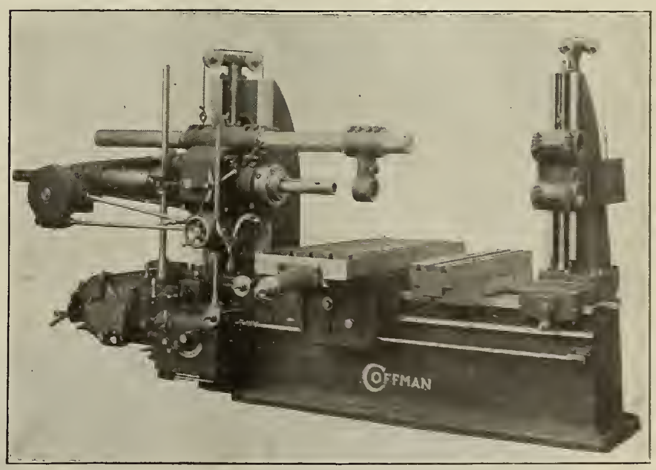
THE universal horizontal boring, drilling and milling machine, shown in the accompanying cut, has been designed upon the unit system so as to make possible the construction practically from the same pattern of the universal boring, drilling and milling machine, the plain boring, drilling and milling machine, and the plan milling machine.

These machines are built with the constant speed drive, motor drive or cone drive. When motor drive is applied to the constant speed box, constant speed motors are used and the speed variations are all made in the box.

Attention is called to the constant speed drive which is fitted with long shafts, long bearings all of which are bronze bushed and run in oil and are non-clogging. The gears are all steel and also run in oil. The speed changes in this box are 12 in number and reverse for running the spindle in either direction.

The heavy back gear drive is applied close up to the front main bearing of the spindle. This box gives two changes of speeds which are suitable for boring and facing with flat cutters which are the most common and frequent operations. Starting and stopping the spindle is also done by this one lever which is handy to the operator.

A friction clutch is not used for starting the machine or stopping it, but the transmitter gear is thrown out, leaving all parts at rest except the constant speed shaft which simply spins around in oil.



Universal Boring, Driling and Milling Machine, Built by J. P. Coffman, Franklin, Pa.

The feed box is fitted with steel gears which gives feeds fine enough for the most delicate tools. It also has strength and power to drive cuts milling or boring up to ½-in. feeds to one turn of the spindle.

The over arm has long been considered indispensable in milling. As applied in boring on this machine it makes it possible in long spans, where a number of holes are to be bored in line, to support the bar in the center. This permits of the use of several cutters at one time, and overcomes the disagreeable feature of chatter which is more or less attendant with the use of long bars. It will also supply the place of many special fixtures and in use is readily appreciated.

The universal machine is fitted with compensating driving head which not only takes up the looseness which will come in the bar, but also by the use of collet clamps the bar rigid for end milling. This feature is always valuable in accurate boring.

A threaded steel spindle nose plate with slotted face is also a part of the driver head, which takes a design of face mill that is screwed on with spanner wrench and driven with key, permitting the running of mills and fixtures in either direction.

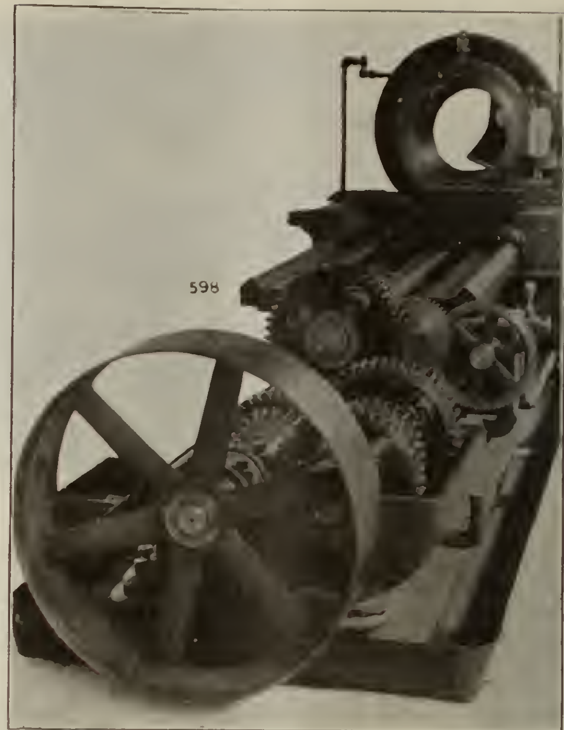
Mill arbors are centered by taper hole in spindle and driven by key and collar from nose plate, which gives a very powerful and rigid drive to slab, gang, and formed cutters.

This machine, used as a milling machine, is capable of producing at the minimum cost all kinds of milling operations that come within the range of a plain milling machine. All feed shafts are provided with safety pins and collars. Graduated dials of very large diameter to facilitate the accurate production of work are placed on all feed shafts. The screw for longitudinal travel of table is placed in the center of bed, insuring free movements and permanent alignment. All moving parts are provided with gibs for taking up wear.

Heavy Pattern Axle Lathe

THE accompanying illustrations show an extra heavy design in axle lathe construction, with an extremely powerful drive, rigid construction and every convenience that the character of axle turning would demand.

The bed is of very massive construction, cross girths being of box section. A longitudinal member of box section is cast in the center of the bed, extending its length parallel to the outer walls, and is for the purpose of further stiffening the cross girths. The walls of the bed are heavy and the metal dovetails on the upper and lower edges are as nearly equal as possible. The ends of the bed are cut away to facilitate the removal of tailstock, or permit of a reasonable overhang for emergency cases. In addition to the front and rear V's with the inner flat tracks, an additional 45-degree plain surface has been machined upon the bed in order to accommodate the bearing of carriage upon bed.

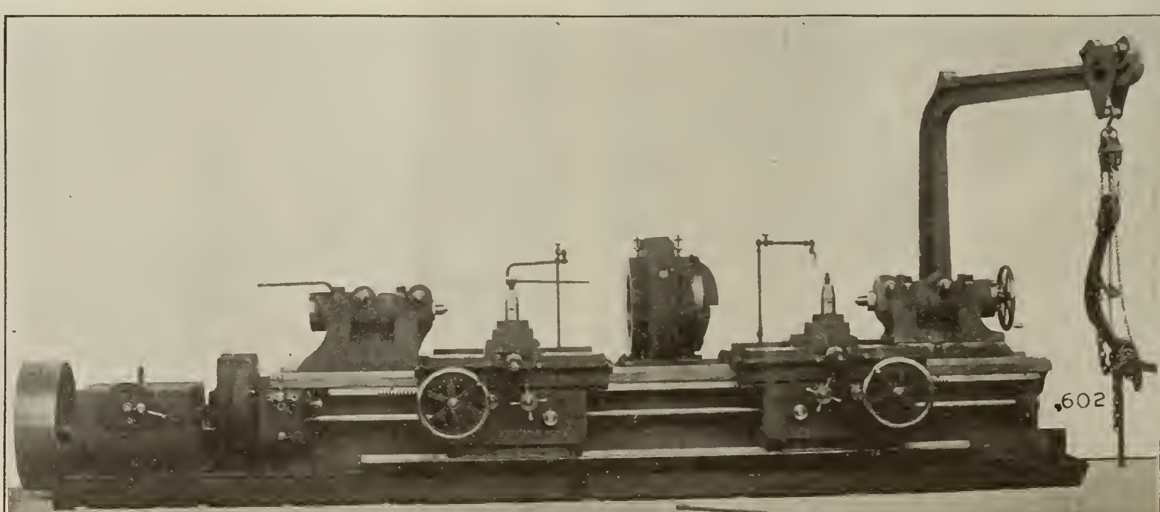


Driving Shaft with Carriage Bearing Upon Bed.

For simplicity in design and great possibilities for delivering power to the cut, the drive on this lathe is partcularly noteworthy. Power is applied to a constant speed pulley of large diameter, wide face, running at a high velocity. The variation in speed is obtained by sliding gears which run in a bath of oil. All shafts are carried in bushed positive ring oiled bearings. All gearing is of steel. The driving shaft is of large diameter and held in alignment by a number of journal blocks bolted to the bed. There is no overhang on the pinion of the main driving gear, since the shaft is supported on either side of it in long bearings. The large gear meshing with this pinion is placed in the center of the driving head, and as with the pinion has a double bearing. A powerful compensating driver is secured to the gear in the head, the dogs of which are faced with steel bolts.

All feed gears are of steel. The speed of the splined feed rod is effected by the gear train driving, from the main shaft through a change gear box, giving three feeds which may be changed while the lathe is in operation.

Particular attention is called to the compact box construction of the apron which is tougued and grooved into the car-



The Lodge and Shipley Axle Lathe.

riage, all gears being of steel. In addition to the clamping arrangement of apron to carriage, the apron is further supported by a third V cast in bed, and in such position as to be directly under the apron. The purpose of this construction is to support the apron at the bottom for both vertical and transverse stress. The spring of the apron due to the thrust from rack pinion is thus effectively overcome.

Considering now the carriage, we find that in addition to the bearing on the V's on the front and rear shear of the bed, it also has a flat bearing or track on the inside of the front shear. A further angular bearing of 45 degrees tends to secure a permanent alignment of carriage with bed. The carriage bearing upon bed is considered of importance in view of the extreme thrust from the burnisher as well as from heavy cutting. Water troughs are provided around the tool slide and wings of carriage. The tool post is arranged with hardened toothed plates interlocking with the tool and effectively preventing any possibility of the tool swiveling or slipping under the heaviest cuts. The tool slide is of steel.

The tailstocks are of massive construction and firmly bolted to bed. The clamps are brought to the top of spindle barrel. A pawl, engaging with rack, cast in bed, is attached to each tailstock, this design tending to relieve the strain on clamping bolts and overcome the thrust of heavy cutting, when blunt cutting tool angles are used. The tailstock at driving end has a stationary spindle with no transverse adjustment, the necessary adjustment being obtained from the spindle of the second tailstock, which is also provided with a transverse adjustment. The plug clamps for binding the tail spindles are of improved design, two instead of one for each tailstock, and placed at the top of the spindle barrel.

The flat bearing surfaces are carefully scraped to fit. Ample provision is made for delivering an adequate supply of water to the tools, all journals being copiously supplied with oil by means of positive automatic oil rings.

The Purchase of Railway Fuel Coal*

THE purchase of railway fuel coal is an important item, but after all a comparatively easy one; getting the right grade, at the right time with the right weight, and securing empty cars to load are, at times, more difficult problems.

There is plenty of coal, too much in fact; the mines do not work as regular as they should and as a result neither mines or miners can be depended on to work with mechanical smoothness. Habit is everything, and while the mines are idle waiting for men, care, orders, repairs, or some one of the thousand other things that shut mines down, the railroads go on burning coal. Of late you would think that a secret service department was a necessity in order to keep up with prospective shut-downs, the causes ranging from the size of the bit used in boring slot holes, up through the item of supplying a grade of powder that does not suit, the color of a new pit mule, etc. "Shut her down" is the sovereign remedy for the coal miners' ailments, and no other business on earth seems to suffer to the same extent from this uncertainty.

The officers of the Miners' Union, generally, appreciate this condition and they are struggling with it, but the polyglot races that go to make up the mine workers have at times conflicting views, and so they "stop her." For the man to whom it is up to, to get the stuff there are two remedies, eternal watchfulness or a large stock, and the last is an expensive luxury, tying up as it does capital and equipment, the consumer over the strike period. That, however, is not his rioration and theft, the railroad paying 5 per cent on the money tied up in the stock.

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*Paper presented before the Western Railway Club by Eugene McAuliffe, general fuel agent, Rock Island-Frisco lines.

Every two years it is the fashion for the miners to take a ten weeks' vacation; the next one is due March 31, 1910, and a couple of months before that we all get busy, the miner getting out double the usual quality of coal to tide the consumer over the strike period. That, however, is not his intention; he works for money to tide himself and family over, but the result is the same. The real loser is the consumer, the loss to railroads storing coal, including labor, depreciation of coal with consequent increase in operating expense, per diem, on cars and inconvenience to regular business easily equal to forty or fifty cents per ton. When the spring fishing season is over, the stock piles exhausted, it is "back to the mines" and forgetfulness.

Here I wish to ask you a question: Can we not avoid this bi-ennial shut down and prevent this waste of energy and material? If the two parties to the conflict, employer and employee, cannot get together without assistance, cannot such be rendered in the shape of a National Arbitration Committee with a conciliation law like that now in force in Canada, the miners to go on producing coal to meet the requirements in the mean time? This is a live question and one the railroads are interested in.

The money and labor spent by the railroads in getting ready for these shut downs, not including that used in cleaning up idle mines at the end of the shut down period, would pay for side tracks, shop extensions, track scales and other betterments required by the average railroad to properly serve its patrons.

Remember, these differences which of late have come at two year intervals do not reach the proportions of a strike; they are stoppages of production only, and they take place with automatic precision at 4 p. m. of March 31st, if that date does not fall on Sunday, in which case 4 p. m. of March 30th is the time.

The coal miner knows when he works with extra force in February and March that his labor is being piled up to defeat him, but that makes no difference; he cleans up his room the last day, sends up his tools and goes home to wait. In the meantime the Convention Hall at Indianapolis echoes to flights of oratory which is principally of the four-flushing variety; intellectual giants on both the miners' and the operators' sides thresh the air, while the railroad fuel departments are wearing the life out of the division forces to unload coal, to waste and deteriorate from handling and the elements. The orators mean to be honest, but it is time for the consumer to demand that a scale and condition that can be used for twenty-two months be continued in force until a new agreement is made; continuity of service pending the making of a new wage agreement is just as essential on the part of the coal miner as it is on the part of the locomotive engineer, when practically one hundred percent of the men employed act as they do in a concerted manner through the medium of their organization.

I opened this paper with a statement; most papers contain figures. I will make use of but one example. I said that the volume of railroad fuel used in the United States annually assumes large proportions. It equalled in 1907, 115,000,000 tons, or 2,875,000 car loads of 40-ton capacity, which set end to end counting 40 feet to the car, the "Cut" would be 21,780 miles long. The day's consumption equals 7876 cars, or a string 60 miles long. The railroads burned about 24 per cent of the total coal mined in the United States in 1907. These are the only figures I will make use of.

Buying coal is a business; so is buying anything else. The man who studies his dress and looks carefully into his purchases usually appears best. If he is a smoker and he buys his own cigars, he smokes a better grade than he would if he left the matter to his wife to attend to. I mention these things with the view of suggesting that buying coal should be studied, and made somebody's business, and railroads should pay cash for their coal and not try to pay part cash and part cars, as it has been charged was the practice a few years ago on certain roads.

Fuel contracts should not be given as a reward for commercial tonnage. When you get the contractor's tonnage you are liable to lose that of his competitor; they both pay the same rates of freight. Quality and price coupled with reliability of delivery are the conditions that should govern.

Dividing contract tonnage on a percentage basis is not a good thing either. It eliminates all competition as to price and grade. No man should have a cinch on anything in this world except health and family; keep him hustling for the rest and you are helping him most. When you do make contracts keep in touch with your contractor; know him if he shirks, lose him when the time comes, tying to those who tie to you. If one of your contractors suffers bad luck and cannot meet his tonnage obligation, reduce the pressure and levy a little heavier on the others. When he in turn is riding the tidal wave you can even up. If your contractor is on your rails you will find at times that he has problems and you can well afford to help meet them if he is the kind of a man you want to do business with. This again suggests specialization. Somebody must make fuel purchasing his business. The empty car is always a live issue. Paradoxical as it may seem, coal car shortages on a railroad always go hand in hand with coal shortages; plenty of coal, plenty of cars, but this is not an argument for tying up cars. The man who is responsible for the coal supply should, at least, be on speaking terms with the man who distributes the cars; they should keep in close touch and thus together work out many problems that will tend to economy.

The buyer usually has a close acquaintance with both the coal and the railroad operating man. That makes it possible for him to act as a go-between, and he can, if he will, do much through a force of competent inspectors to secure a maximum loading of cars as well as the proper disposition of foreign equipment. The fuel man, if he handles the invoices, can do much to smooth the path of the freight claim agent in settling claims and finding a disposition for refused coal. These gentlemen should also nod when they meet in the elevator.

The Mechanical and the Fuel Departments should hold a close relation to each other. When an engine crew has lost time or set out tonnage, charging it to the coal suggests the line of least resistance, besides the coal does not talk back; it is not there to do so. That does not mean that we do not get bad coal; it frequently comes good to-day, and tomorrow things at a certain mine go to the bad. Some of the worst coal I ever saw went over the screens when an inspector, or perhaps the superintendent was watching it. Somehow coal miners expect you to kick and when you do not they think that they can relax, and gradually the standard lowers till the battle cry is sounded, when they take a fresh hold. The best inspection is that which can command on the part of the inspector the whole force of the producers' organization to the end that good coal will be produced.

I do not believe it is the proper thing for the purchaser to employ men to stand around coal mines all day looking at the coal that goes into the car. That means that the buyer is furnishing superintendance that the seller should provide and pay for. There is a disposition on the part of the producer to lean on the railroad fuel inspector. I have often been asked to put my complaint in writing "so we can show it to the men." This is a plain confession that the job is too big for the mine superintendent, and he should be braced up to the extent of being forced to run his own business or else he should be relieved. There should be but one head to a coal business and the fuel inspector should not be a necessity, at least as far as exacting contract grade of fuel is concerned. Personally I intend gradually withdrawing the inspectors in my department from the mines and instead put them on work that the railroad company should look after. The purchase side as well as the selling side of the coal business calls for the application of honest principles. There is no difference between the seller who shirks his contract obligation in order to gain temporarily a few cents a ton, and the buyer who takes advantage of a hard luck market to scalp ten cents a ton on a few car loads of coal. When a railroad fuel purchasing agent finds it necessary to relieve an industry that is out of coal, do so, by charging it the regular commercial freight rate as the law requires, turning the coal over to the coal company which produced it, exacting a credit memo for amount paid, letting the coal company invoice direct. If you have to take a few cars of outside coal off the hands of some shipper, pay him what your contract price will stand, grade and freight charges considered, collecting car service again as the law and the published tariffs demand. The livest item in the coal line to-day is the question of car lot weights, both empty and loaded. There is very little dishonesty practiced in the handling of weights of carlot coal, but there are many inaccuracies. One car has an overweight, the next one an underweight, the gentleman who gets good measure does not complain, he who suffers the shortage howls. Let us all, coal operators, selling agents and consumers, be frank and agree that the fifty-ton coal car loaded gross to as much as 156,000 pounds, calls for jam up track scales, well set, maintained, and handled. We should get together on this and handle the question in a businesslike way and quit talking about it.

The producing railroad should carry a correct tare weight on its cars, weigh the commodity and weigh it right. Weight is a factor equal in importance to that of the rate, when figuring the freight on a car of coal. Every railroad having a mileage warranting same should have a weighing bureau with a competent man in charge of same. When the railroad is properly equipped to weigh carlot freight it should do the work and then as a carrier stand behind its own figures. Due consideration should be given to what can be classed as legitimate shrinkage of coal weights, particularly that due to the evaporation of contained moisture.

It may not be improper to say here that with coal cars equipped with the vertical plane coupler, maintained to the standard height as required by law, weights can be accurately obtained without uncoupling at either end.

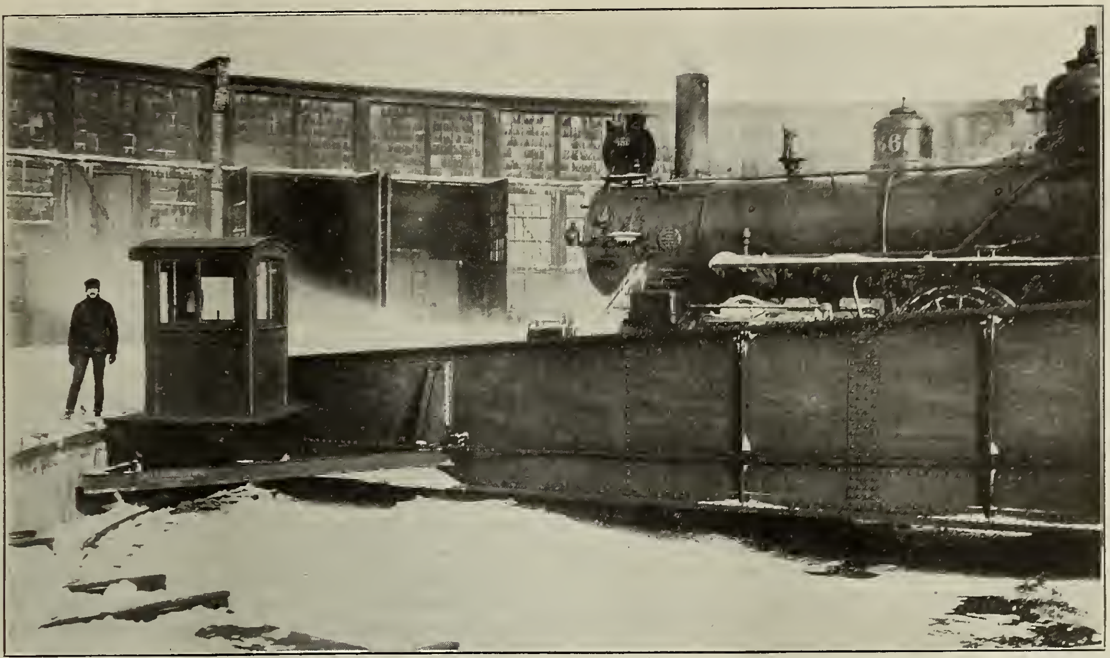
I have demonstrated this by a dozen separate tests including several hundred cars, and as a result of these investigations, personally made, I stand committed to the belief that cars when cut at one end can be weighed with accuracy providing they are stopped on the scale, this position, insuring correct weights, with the minimum expenditure of time and expense.

This is not a scholarly paper and it does not even attempt to exhaust the subject. If it provokes any discussion of the matter on the part of those more competent to handle same, I will have accomplished something.

Electric Turntable Tractors

NO where is it more evident that modern conditions demand the use of modern appliances than in the operation of locomotive turntables. The sight of from four to twelve men struggling to turn a locomotive is still a familiar one, but far less common than a few years ago. It is too expensive, not only in the cost of labor but also in reducing the capacity of the engine house. The electric tractor has proved one of the best solutions of the problem of turntable operation wherever power is available, owing to the simplicity of operation, reliability and low cost of maintenance.

The accompanying illustration shows a standard Nichols



Electric Turntable Tractor.

tractor attached to an 85-ft. heavy duty turntable. This was built by Geo. P. Nichols & Bro., Old Colony building, Chicago, who have made a special study of the application of electric power to turntables, and have equipped nearly 200 tables of practically every type and make, on nearly every important railroad system in the country.

The Nichols tractor consists essentially of a heavy triangular steel frame, attached to the table by means of hinges at two points widely separated, the weight being balanced almost exactly on the single traction wheel traveling on the circular rail in the pit. On this frame the entire mechanism is mounted, and above is the operator's cab, the platform and floor of which cover and protect the motor and machinery. A sheet metal housing encloses the machinery on the sides, and protects it from the weather. In the cab are located the steel switch box, controller, sand box lever, brake lever and, when desired, an and places the operator near the ends of the rails he is matching up. It also simplifies the connections to the sand box and brake.

Whether the installation is new or old it is extremely desirable to bring the current underground through conduits to the center of the table. In spite of the many varieties of turntable centers in use, in only three cases has it been necessary to resort to the overhead type of collector, one of these being on account of occasional high water. Suitable swivel collectors have been developed and standardized for every type of table. Either direct current of any voltage or alternating current of any phase, cycle or voltage, may be used. At many points where the railroad company has no power plant of its own, electric current may be bought at reasonable rates from outside companies.

So satisfactory have the Nichols tractors proved in service that most of the users have kept increasing their equipment, five or six systems having from twelve to sixteen each. Many of these tractors have been in continuous use for four or five years with no shut-downs or expense for repairs. One is serving an engine house that sends out an average of 400 locomotives every 24 hours. Several others serve even busier houses with no interruptions or delays. For such service hand power is out of the question, and other forms of power tractors, which are very desirable where electricity is not available, are not sufficiently reliable under all conditions of weather and care.

There are many engine houses where but few locomotives are turned and where it is necessary to call a lot of men away from their regular work every time an engine must be turned, which is expensive and causes confusion. With an electric tractor at such points an operator need not be kept on the table all the time, and it is simply necessary to call out one man who has familiarized himself with the operation of the tractor, to turn the table.

Forty-Ton Flat Cars

The specifications for the 80,000-lb. capacity flat cars, which were recently ordered by the Escanaba & Lake Superior Railroad Company, are as follows:

GENERAL DIMENSIONS

Length over end sills	41 ft.
Width over side sills	9 ft.
Height, top of rail to top of floor	4 ft. 2 in.
Height, top of rail to center of drawbar	2 ft. 10½ in.
Distance between truck centers	30 ft.
Distance from face of end sill to center of truck	5 ft. 6 in.
Truck wheel base	5 ft. 5 in.

SPECIFICATIONS

Side Sills—
(Two) Of long leaf yellow pine; size 5x12 in. x 41 ft.

Center Sills—
(Four) Of long leaf yellow pine; size 5x9 in. x 40 ft.

Intermediate Sills—
(Two) Of long leaf yellow pine; size 5x9 in. x 40 ft.

End Sills—
(Two) Of white oak; size 8x9 in. x 9 ft. 4 in.

Draft Timbers—
(Four) Of white oak; size 5x7¾ in. x 5 ft. 8½ in.

Deadwoods—
(Two) Of oak; size 6x8 in. x 3 ft.

Subsills—
(Four) Of oak, between bolsters and needle beams; size 4x5 in. x 9 ft. 10 in.

Subsills—
(Two) Of oak, 4x5 in. x 8 ft.

Flooring—
Of yellow pine, shiplapped, 1¾ in. thick x 4 in. wide.

Needle Beams—
(Two) Oak, 4½x8½x9 ft.

Body Bolsters—
Bettendorf make, for 80,000 lb. capacity cars, including malleable iron center plates and side bearings.
Draft Gear—
Miner, with tandem springs.
Drawbar Springs—
(Four per car) Each having capacity of 22,000 lbs.
Couplers—
Climax Automatic, with 5x5 shanks, made by the National Malleable Castings Company.
Air Brakes—
Westinghouse Air Brake Company, Schedule, H. 1., for freight cars.
Follower Plates—
of soft steel, 1½x6x8 in.
Drawbar Yokes—
Of soft steel, 1x4x2 ft., 5½ in. long.
King Bolts—
1¾ in. diameter x 22 in. in length.
Brake Shafts—
1½ in. diameter x 3 ft. 6 in. long.
Truss Rods—
(Eight per car) 1¼ in. diameter with ends upset to 1½ in. and properly secured by turnbuckles.
Brake Levers and Connections—
All in accordance with M. C. B. standards.
Stake Pockets—
Ten on each side of car, each pocket secured by two ¾ in. U Bolts.
Grab Irons and Steps—
All M. C. B. standard dimensions.
Queen Posts—
11 in. deep, of malleable iron.

TRUCKS

Channel Irons—
37 lbs. per foot. Regular 13 in. Carnegie section for freight cars.
Wheels—
650 lbs. each, made by the Griffin Car Wheel Company, under M. C. B. specifications and tests.
Axles—
Of M. C. B. dimensions; for 80,000 lbs. capacity cars, made by Willard Sons and Bell, under M. C. B. specifications and tests.
Journal Boxes—
Malleable iron, National Malleable Castings Company make, of M. C. B. dimensions, for 80,000 lb. capacity cars.
Journal Bearings—
M. C. B. standard for 80,000 lb. capacity cars.
Journal Bearing Keys—
M. C. B. standard for 80,000 lb. capacity cars.
Arch Bars—
Of steel; M. C. B. dimensions; top bar 1½ in. x 4½ in. in section; botton bar 1⅜ in. x 4½ in. section.
Tie Bar—
⅝x4½ in. in section.
Bolster Springs—
Of M. C. B. standard dimensions, for 80,000 lb. capacity cars.
Bolsters—
Bettendorf make, for 80,000 lb. capacity cars, or an approved design.
Brake Beams—
"Diamond Special" or Monarch type, made by the Chicago Railway Equipment Company.
Bolts—
Column and journal box bolts, of M. C. B. standard dimensions.
Painting—
Cars to be painted and lettered with a good grade of paint, consisting of two coats, well brushed in.

Elimination of Smoke

AT the request of the American Civic Federation, which is interested in the so-called "smoke nuisance," Mr. A. W. Gibbs, general superintendent of motive power of the Pennsylvania Railroad, prepared a paper which in part is as follows:

METHODS OF SOLVING PROBLEM.

The means which the railroad has at its command for the elimination of smoke are:

First—The use of comparatively smokeless fuel;

Second—The use of devices of various kinds which may allow the use of otherwise smoky fuels; and

Third—The education of the men operating locomotives and supervising their work.

FUEL AVAILABLE.

It is evident that the railroads must produce power with the fuel of the county through which they run, and a glance at a geological map of this country, will convince anyone that bituminous coal is that with which this question must be settled. Anthracite is confined to practically a few counties in the Eastern part of Pennsylvania. The amount of anthracite mined is a trifle more than 70,000,000 tons each year. It is the ideal fuel for domestic purposes and for use in plants where its cost is not prohibitive. The total amount is so limited, however, that were the demand to be on this fuel alone, the supply would be inadequate, in illustration of which we submit the following statement of the consumption for the fiscal year ending June 30, 1907, on twenty railroads, which, from their geographical location, would naturally have the first claims on this fuel, for the reason that they are nearest the anthracite field, viz:

	Anthracite (Tons).	Bituminous Coal (Tons).
Pennsylvania Railroad Company	61,297.25	7,159,627.55
Pennsylvania Company	....	2,128,994.00
Northern Central Railway............	22,364.00	604,856.00
Phila., Baltimore & Washington R. R...	....	637,765.45
Long Island Railroad................	156,494.84	155,618.52
Pgh., Cincinnati, Chicago & St. L. Ry..	....	1,758,501.00
Baltimore & Ohio Railroad...........	20,451.05	4,782,434.25
N. Y. Central & Hudson River R. R....	216,624.00	4,242,476.00
Michigan Central Railroad............	....	1,245,628.00
Lake Shore & Michigan Southern Ry .	....	1,998,902.00
Lake Erie & Western R. R............	....	300,613.00
New York, Chicago & St. Louis R. R...	....	539,614.00
Central Railroad of New Jersey.......	607,617.00	318,348.50
Delaware & Hudson Company.........	902,769.00	196,183.00
N. Y., New Haven & Hartford R. R..	34,268.00	1,830,701.00
Boston & Maine Railroad............	....	1,440,454.00
Erie Railroad	263,158.00	2,216,058.00
Philadelphia & Reading Railway.......	1,145,134.70	903,565.10
Lehigh Valley Railroad................	835,398.51	99,065.36
Delaware, Lackawanna & Western R. R.	1,312,907.00	342,142.00

MIXED COALS, NOT SMOKELESS.

These roads consume annually some 39 3-10 million tons, 5½ million tons of which is anthracite. It will be observed that some of the anthracite roads use considerable amounts of bituminous coal. In many cases this bituminous coal is used as an admixture in order to make it possible to burn under locomotive conditions, the very small sizes of anthracite otherwise not available. This mixture of two coals is not smokeless. Assuming that the entire consumption of these roads were anthracite, it will be seen that this small group alone would consume more than one-half of the total amount of anthracite mined. While such action would doubtless stimulate the production, it would but hasten the disappearance of this most valuable fuel, to say nothing of the enhancement in price which would most assuredly follow and directly affect every householder now dependent on this fuel. Granting that the anthracite thus absorbed by the railroads were replaced by bituminous coal for domestic purposes, the smoke situation would be far worse than at present because the numerous small domestic fires, with the usually imperfect combustion, produce more total smoke than would the same amount of bituminous coal burned in locomotive furnaces. The item of cost to the railroads would be such a tremendous increase in their expenses as to make it absolutely prohibitive. A recent study of this subject showed that on nineteen of the principal roads, the fuel bill exceeded 11.4 per cent of the total operating expense, or nearly 8 per cent of the gross earnings.

COKE.

The total production of coke is about 36 million tons annually, which is almost entirely used in metallurgical work, for which there is no substitute. While it may be admitted that the production of coke could be largely increased, it should be remembered that in the production of coke from bituminous coal, there is an initial waste of about one-third of the heating value of the fuel, with further losses from breakage in handling, it is evident that this attempted solution would be an unpardonable waste of our natural resources.

However, in the endeavor to obviate smoke, a great many attempts have been made to use coke, and the records of the tests show that the results have been very unsatisfactory, owing to the difficulty with which the fuel is handled, at times the heat being entirely too intense and at others the fire being almost stopped up by the ashes produced. It must not be forgotten that in the process of burning coal to coke, the ash originally in the coal remains in the coke, so that in burning a ton of coke, much more ash results than from the consumption of a ton of the coal from which it was made. The coke, when used, is satisfactory in but one particular, namely, its freedom from smoke.

The reason that anthracite and coke are smokeless is because of the large percentage of fixed carbon and the small percentage of volatile or flame-and-smoke producing material, for instance, the fixed carbon may run as high as 90 per cent, volatile matter not over 4 per cent; the remainder being ash and sulphur.

BITUMINOUS COAL.

Of bituminous coal, somewhat over 400,000,000 tons are mined annually, and the total consumption of this fuel by the railroads of this country is estimated to closely approximate 100,000,000 tons. This railroad consumption, it will be noticed, is almost sufficient to exhaust the present total production of both anthracite and coke, so that we may as well admit that this being a bituminous coal country, it is this fuel alone that we must consider in solving this smoke problem, although possibly in certain restricted localities we may be justified in entirely dsregarding all questions of expense and using only smokeless fuel; this for the sole purpose of controlling the smoke.

CHEMISTRY OF BITUMINOUS COALS.

The composition of our various bituminous coals differs widely. Some of them are relatively smokeless. Chemically, these are characterized by the great amount of fixed carbon and the small amount of volatile or flame-and-smoke producing constituents. Approximately, these may range from 70 to 80 per cent fixed carbon, from 15 to 22 per cent volatile matter, the remainder being moisture, ash and sulphur. On the other hand, some of the highly bituminous coals will contain less than 50 per cent fixed carbon, and over 40 per cent volatile material, and it is with such wide variations in composition that the question must be settled.

It is customary to group under the head of "volatile material" all the substances which will distill from the coal when heated in a closed tube, but on examination it is found that the composition of this material is quite complex, and it does not follow at all that the volatile material of one coal differs only in amount from that of another grade. While much has yet to be learned of the ultimate composition of this material, it is safe to say that some coals contain more of the smoke or soot producing constituents than others. In other words, some bituminous coals while containing approximately the same percentage of volatile material, are more difficult to burn without the emission of smoke.

The low-volatile bituminous coals have, unfortunately, the peculiarity that they are extremely friable and even though mined in lumpy form, will very speedily break up into small size, and although this does not interfere with their usefulness where burned slowly, it is a very serious hindrance to their use in locomotive boilers when worked to the fullest capacity, for the reason that the powerful draft throws out of the chimney a very large part of the fuel put into the firebox, and while at low rates of combustion this is the most efficient of our bituminous coals, this condition does not hold true when the demands on the locomotive are increased. For locomotive purposes, the physical structure of the coal is actually more important than the chemical composition. The important requirements are that the coal shall be fairly lumpy; that it shall be fairly uniform in size; that it shall not readily break up in the atmosphere; and that it shall retain its form in the firebox. When these conditions are met, such fuel can be burned with comparatively little smoke, owing to the possibility of maintaining a thin bright fire.

BRIQUETTES.

A possibility of the future, not yet fully developed, is the use of smokeless or low-volatile coals made into briquettes by the addition of suitable binding material, after which the fuel is pressed into large blocks. This practice, long known and utilized abroad, is now being developed in this country, very intelligent work being done by the United States Geological Survey, and while at present the cost of fuel so produced is so high as to be prohibitive, it is hoped that this method of preparing fuel may ultimately prove a factor in relieving the smoke nuisance. The conservation of our natural resources makes it imperative that we should be able to utilize all sizes and kinds of coal, so that instead of selecting the best of the coal and leaving the inferior grades in the mine, the vein which is being mined should have all the fuel removed, as otherwise, the settling of the ground causes the total loss of all the unmined fuel. To the extent that briquetting helps to attain this result, its extension is desirable.

OIL FUEL.

Oil fuel is largely used in some parts of the Southwest, where there are great deposits of oil, otherwise of little value. Owing to the distance and the difficulties of transportation, it is not likely that this fuel can be considered as one available for railroads other than those in the territory where such oil abounds, and may be dismissed from our consideration.

To recapitulate: Anthracite, coke and low-volatile bituminous coal are all being used, to a greater or lesser extent, at various points where the smoke condition is most pronounced, in order to minimize the annoyance, but, as has been pointed out, the extension of the use of such fuels is distinctly limited, and the great question remains: By what appliances or methods, without annoyance to the community, shall we successfully burn the bituminous coal which must be our reliance?

REQUIREMENTS FOR SMOKELESS COMBUSTION.

There is probably no railroad of importance which has not from time to time introduced appliances for this purpose. The basis on which such devices are planned, is as follows:

First—To distill the volatile gases at as uniform a rate as possible.

Second—To present to the burning gases an adequate supply of air to effect complete combustion.

Third—To thoroughly mix this air with the gases.

Fourth—To effect this mixture while the gases are still at a very high temperature.

Fifth—To allow sufficient time for this mixture and combustion of the air and gases to take place before the heat is absorbed and the temperature reduced below the combustion point.

With these five conditions complied with, the whole difficulty is overcome, and just insofar as the devices meet these five conditions are they successful.

DEVICES.

A bare mention of all these devices would be tedious, but it may not be amiss to indicate some of the methods by which this has been attempted.

The first condition is the manual one of introducing the coal steadily and in small quantities, preferably allowing it to coke near the door.

The brick arch placed across the lower forward end of the firebox and inclined upward and towards the rear, to act as a baffle to increase the distance that the burning gases must flow before the cooling of the flame is effected. In this process, the arch becomes intensely hot, thus maintaining the high temperature while the firedoor is momentarily opened. This device partly meets conditions 4 and 5 and when supplemented by judicious air admission above the fire, partly meets the last four conditions. This, one of the oldest devices, is probably the best and was once the general standard for locomotives of the Pennsylvania and other railroads. The reason why it was not maintained is that its presence in the firebox is a very serious obstacle to the proper and frequent inspection of the interior, on the perfection of which examination safety hinges. The arch remains incandescent for a long period, thus making proper inspection impracticable. The other reason for its disuse is that the locomotive is a power plant of such concentrated character and so highly forced that the arch alone without very intelligent firing, will not prevent smoke. To illustrate, it is perfectly practicable to operate at moderate power with such an absence of smoke that for periods of more than one-half hour not a particle of smoke will be visible, but let the conditions change, now shutting off, now working to the utmost limit of capacity, and smoke at once appears because the device will not adapt itself to these extreme conditions.

Other devices embody one or more of the following: Air pipes through the sides of the firebox to admit air to meet conditions 2 and 3; this is only partially effective. Again, air pipes more or less exposed to the heat of the fire so as to preheat the air, are tried, thus attempting to meet conditions 2, 3 and 4. The difficulty with this type is that the heat of the fire usually destroys the device. Still others employ steam jets, sometimes superheated, to thoroughly mix the gases and comply with conditions 2 and 3. Then there is the constantly recurring attempt to bring back to the firebox some of the smokebox gases, as well as the partly burned cinders there collected. This has never been devoleped to an extent to afford any promise.

AUTOMATIC STOKERS.

In this connection, while considering devices, we cannot omit all reference to the question of automatic stokers. The general progress demands transferring the burden of great manual exertion from the man to a machine, the latter doing the hard work and the man supervising the action of the machine. With this end in view, a great deal has been and is being done in the direction of developing automatic stokers which will do the firing with a certain amount of manual supervision. Of these devices, quite a number have been devised and put into use on locomotives. So far, they have not proven satisfactory and, from their imperfections, have not improved the smoke conditions, but the demand for them is so urgently recognized by the railroads, not only from the mere smoke question, but also on account of the saving in money and relief to labor that there is ground for hope that in the comparatively near future a satisfactory automatic stoker will be developed. The problem is a most difficult one, and at present some of the brightest and most practical minds are at work on a solution, and although it is difficult to predict how soon success may be attained, it is certain that decided progress is being effected.

The automatic stoker, when perfected, promises to be one of the most effective appliances to aid in the suppression of smoke, for the reason that it does not become tired from the hard work and, consequently, should do as well after hours of service as in the beginning; the contrary is the case with the man. For this reason the stoker, when perfected, will come to stay.

The gist of the matter is that devices alone, unless supplemented by intelligent and unremitting attention, never long survive. They start with a flare of trumpets; they show a decided improvement over previous conditions; then less is heard of them; and, finally, when inquiry is made, it is found that they have been removed as inefficient. The real reason is, that while new they received a degree of attention that makes them more or less successful, and the credit is ascribed largely to the device when it is actually due to the care.

Evidently, the real line of progress is to stimulate and maintain the intelligent care, and it is in the latter direction that the most progress is being made, and where there is the greatest hope for the future.

SUPERVISION.

Let us now consider what we believe to be the ultimate solution of the problem, without which the best fuel, and the districts containing a certain number of locomotives and men. In some cases it is the practice for these assistants to have subordinates to instruct in firing, although the tendency is to put in this position, men taken from the ranks of the enginemen, so that their rank will carry authority to instruct both enginemen and firemen. In addition, smoke inspectors, whose entire duty is to report locomotives emitting black smoke, are stationed at various points along the division.

PRINTED INSTRUCTIONS.

The management has prepared definite and uniform instructions, in printed form, which have been placed in the hands of all men responsible for operating, firing and attending to locomotives on the road and at terminals. From these instructions we quote the following which pertain particularly to the elimination of smoke, namely:

"Enginemen and firemen must work together so as to save coal and reduce smoke.

"The burning of bituminous coal in a locomotive requires air, which must be admitted through the grates and through the fire-door."

"Smoke means waste of coal and must be avoided."

"Large quantities of coal placed in the firebox at one time cool down the fire, cause smoke and waste coal; small quanbest appliances, will not be effective in reducing smoke, namely, the education and supervision of the men running and firing locomotives.

It must be remembered that on a large railroad system, there are thousands of men firing and handling locomotives: First, we have the engineman, who runs the machine and upon whose careful and judicious handling the ease of proper firing largely depends; secondly, we have the fireman, whose skill and interest in properly firing the locomotive must never flag for an instant; third, we have engine-preparers and ashpitmen at engine houses, who must understand how to clean old fires and build new ones with a minimum amount of smoke.

With the rapid growth of business and consequent increase in the number of employes, it must be realized that supervision in this sense requires a large force of men, for the reason that owing to the extent of the territory over which any group of locomotives and men run, following up any particular set of men is a very different proposition from that of supervising a very much greater number of men grouped in some one place, as, for instance, in a large power house.

The supervision to be effective involves, first, accurate instruction, and, secondly, repeated personal visitation to see whether this is followed, and, third, discipline if the instruction is persistently disregarded, either from inability or indifference, and the correction of abuses, such as the improper preparation of the locomotive for the run.

To show how this supervision is being effected, it must be understood that the organization of the railroad is practically a military one. On each division the man in charge of the enginemen and firemen, under the superintendent, is the road foreman of engines, who has assistants, each in charge of tities at regular intervals will keep the fire bright, prevent smoke and take less coal to keep up steam pressure."

"Lumps of coal should be broken in pieces not larger than 3 ins.

"A bright and level fire over the whole grate must be carried wherever possible. When a sloping fire is used, no more coal should be banked at the door than is necessary."

"To prevent smoke and to save coal, the fire-door must be placed on or against the latch after firing coal or using the scraper, slash-bar or hook, and when on siding, in yards, at terminals, or before starting."

"Before the throttle is closed, the blower must be used and the door placed on the latch. Firemen must stop firing long enough before steam is shut off to prevent smoke and waste of coal."

Under present day conditions, more supervision is required than formerly, on account of the rapid increase in railway business, necessitating the employment and promotion of men who have not been through the long course of probation formerly the rule. Furthermore, the importance of educating and developing intelligent supervising officers in order to reach the men, is of late being recognized. At Altoona, there has been installed a testing plant consisting of a locomotive whose driving wheels rest on suitable supporting wheel placed underneath and taking the place of the usual track, the whole locomotive being firmly connected to a dynamometer that maintains it in position while recording the work performed by the locomotive, so that it is operated in the usual way and produces the usual pull. It is otherwise stationary, subject to careful inspection and test entirely impracticable with the same locomotive running free on the road. By means of this plant, which is entirely devoted to the purpose of securing information, this road is educating its officers interested in the fuel question to its possibilities, so that they may thoroughly understand how to instruct the men to carry out the definite printed instructions.

Furthermore, this road is recognizing the necessity for greater supervision by the appointment of a greater number of supervising officers so that the number of men under the jurisdiction of each will be small enough to admit of constant personal contact.

It must not be forgotten in this connection, that the cost of the supervision mentioned in the foregoing, is a very serious burden on the cost of operation, and while the railroads would not provide such supervision but for the belief that it will yield adequate return, or from realization of the duties which the railroads owe the public, there must be a limit to the amount of money which they can so expend.

As stated before, the cost of fuel is from 8 to 11 per cent of the total operating cost of a railroad, and, therefore, economy in the consumption of fuel is one of the most obvious ways of reducing operating expenses. Fortunately, the methods described in the foregoing for the elimination of smoke from locomotives, are also those which must be followed in order to obtain the maximum economy in locomotive fuel consumption; in other words, the crew making the least smoke is also apt to save the most coal. It follows, therefore, that the railroads have a direct financial interest in the elimination of smoke to the lowest possible limit.

It should be clearly understood that there is no one remedy which can be generally applied. Each situation must be treated as a separate problem, giving attention to such points as the character of the road as to grades, the loading and speed of the trains, the distance which must be run through thickly populated districts, and whether we are considering a terminal or a through station. For instance, the remedy which has so improved the Washington situation will not apply to Baltimore, because the latter is a through station having adverse grades on each side. The Chicago situation, with Illinois coal, is still another problem. In brief, an intelligent study of the local conditions must be made in each case.

It will be noted that so far, nothing has been said of the possible solution by electrification.

This company, as you know, is now engaged in the development of terminals in the neighborhood of New York city, where electric traction is the only thing to be considered, owing to the use of deep sub-aqueous tunnels. This company is also operating, in the State of New Jersey, a fairly long line on which multiple-unit electric trains are operated. While avoiding technicalities, we will briefly state that the multiple-unit system of electric traction consists of nothing more than an electric road on which either single cars or sections of two or more cars—each car having its separate motor and control apparatus—are formed in trains, all the motors being operated by one motorman. This form of transit is doubtless familiar to all of you and is feasible on the road in question, insofar as passenger movement is concerned, because it is, in a measure, an isolated road and does not have to face many of the problems of long-distance transportation, but the freight business has to be handled by steam locomotives.

In the New York installation, we are confronted by the problem of both multiple-unit electric trains and of through trains hauled by electric locomotives. It is but fair to say that while the multiple-unit train seems to be fairly well worked out, the problem of the electric locomotive is far from a satisfactory solution, and although unremitting attention has been given to the subject for years past, it still remains in the experimental stage.

In the same locality—namely on the New York Central and the New York, New Haven & Hartford Railroads—are two other systems of electric traction. In the former, electric current is transmitted to the train by means of contact of a sliding shoe with a third-rail placed at the side of the running track, while on the New York, New Haven & Hartford Railroad, the transmission is from a suitably supported trolley wire placed above the tracks. Both methods have serious objections, but the question of an electric locomotive of adequate power and of thoroughly good stability for running, has yet to be developed.

The cost of everything electric is tremendous. The electric locomotives, such as they are, cost more than double the steam locomotives that they replace, and with this but a small part of the story has been told, as we must add the cost of track preparation, of the power plants, and all that goes to make the electric system as a whole.

The demand has frequently been made that if not the entire cross country line, the cities or terminals should be electrified. In some cases the same demand has been made where cities are not terminals for any but a small proportion of the trains running into them. Such a demand would involve two locomotive terminals, one on each side of the city, electrification of the space within the city limits, a supply of special electric locomotives and the delay of a double stop, to say nothing of the difficulties due to the interruption of such functions as the steam heating of trains. To offset the cost of this, there is no saving whatever in operation; on the contrary, the operating cost is largely increased. If the railroads could stand the burden of cost, it is certain that the public itself would not tolerate unnecessary delays of this kind. Naturally, the roads hesitate to undertake new electrifications, not only on account of the expense, but also because it is wise to learn the lesson of the mistakes of one installation and thus avoid their repetition at another.

While anything of the kind is possible from an unlimited expenditure of money, we do not hesitate to say that the time has not yet come when the enormous outlay of capital for the purpose of electrification of the railroads would be justified by the returns, and, further, we assert that the capital thus diverted would be far more useful in other directions.

The M. M. and M. C. B. Conventions

The first official circular of the Railway Supply Manufacturers' Association was issued by the secretary, Earl G. F. Smith, on Jan. 8th. It is given in part as follows:

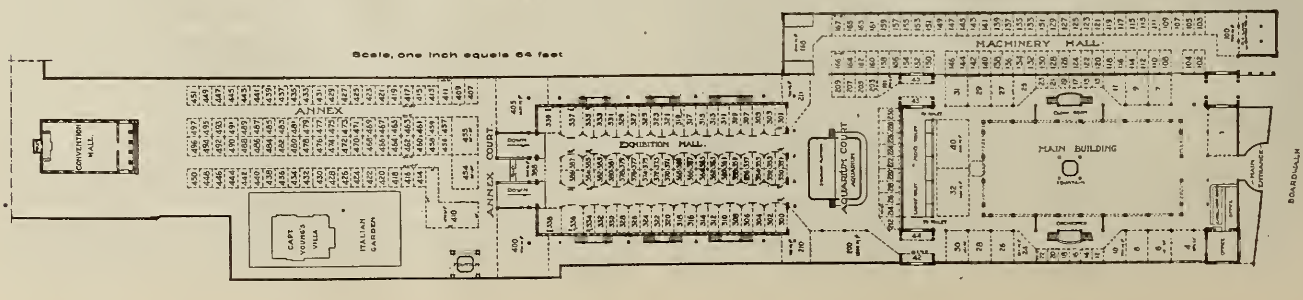
Location and Dates.—The next annual convention of the American Railway Master Mechanics' Association will be held in Atlantic City, N. J., June 16, 17, and 18, 1909; and that of the Master Car Builders' Association will be held in the same place June 21, 22 and 23, 1909. The railway men will meet in Convention on Young's Million Dollar Pier, where they met in the conventions of 1908. The exhibits and the offices of The Railway Supply Manufacturers' Association will again be located on the said pier with the exception of the track exhibits, which will be placed as they were in 1908 on the tracks of the Philadelphia & Reading Railway on Mississippi avenue immediately adjoining the Boardwalk and about 200 yards from the convention pier.

Membership Dues and Badges.—Membership dues in The Railway Supply Manufacturers' Association are $25.00 per year and carry with them one badge. Additional badges may be obtained by members for their representatives and ladies in actual attendance at the conventions for the sum of $5.00 per badge. Children under fifteen years of age accompanied by parents or guardians will be admitted without badges. Lost badges cannot be replaced and any found should be returned to the Enrollment Committee. Members are urged to pay their membership dues at once.

Exhibit Arrangements.—Contract has been let for the erection of exhibit structures, partly of a new design, which are expected to exceed in beauty and attractive effect anything we have had hitherto. The contract provides for 59,000 square feet of exhibit space, exclusive of aisles, and the arrangements are such that forty cents per square foot will cover the cost of erecting structures and providing the various facilities mentioned in this paragraph. The color scheme will be green and white. All roofs will be water tight and all booths not in permanent buildings will be protected from the weather with canvas curtains. The floors of all aisles that are under roof and of all booths, except those in Machinery Hall which are to be stained, will be covered with Crex matting. A telephone will be provided between every two exhibitors with free local service from Monday, June 14, to Thursday, June 24. A reasonable amount of power for operating exhibits will be furnished without extra charge from 8:30 a. m. to 6.00 p. m. as follows: Electricity, direct current at 110 volts, 220 volts or 550 volts; steam at 100 lbs. pressure; compressed air and illuminating gas. Fresh water will also be furnished. Terminals from which a supply of any of these items may be drawn will be brought to the exhibitor's booth, provided the requirements are stated in the application for space. Empty crates and boxes will be removed from booth, stored, and returned to booth without extra charge. Rubbish will be removed and the aisles kept clean. One standard, or name, sign about nine inches high and approximately the width of the booth in length will be furnished and lettered in paint as directed by the exhibitor. A sign board, corresponding to that of the name sign and to be hung immediately beneath the name sign, will be furnished without charge but the exhibitor is expected to bear the expense of lettering it. P. E. Lane, contractor, who can be found opposite the pier, offers to do this lettering at twenty cents per lineal foot. Referring to the enclosed diagram: The main convention entrance will open from the Boardwalk into the center of main building and the enrollment and other offices of our association will be located just inside this entrance. The center of this building will be a lobby, outlined with ferns, plants and flowers, and furnished with rugs and chairs. The exhibit structure in this building will consist of pedestals, supporting pots of ferns or flowers, and joined by chains. Signs will be hung from the ceiling. These spaces are restricted to light and clean exhibits or reception rooms, and it is desired that the exhibitors occupying these booths make the interiors as attractive as possible for the reason that they will look out upon the ball-room floor. Exhibitors accepting this space do so with the understanding that their booths may be used on the nights of the balls for the convenience of our members and guests. Machinery Hall, which in intended for heavy machinery, will have exhibit spaces marked off by a low open construction. Signs will hang from the ceiling. In place of matting in this building a stained pine floor will be laid over the floor used in 1908, and where it is made necessary by very heavy exhibits a two inch planking will be laid and stained. The aisles will be covered with matting. Aquarium Court will have the column construction of previous years. There will be an arbor effect around the aquarium. The upper floor of Exhibition Building, known last year as Marine Hall, will not be used, and the lower floor, formerly known as Amusement Room, will have ceiling and walls plastered with curved cornice, all calcimined white. The cornices will be formed along girders and sidewalls, making ten lines extending the full length of the building. Eight candle-power electric lamps will be placed two feet apart along each cornice and will be lighted throughout the day. This means that each aisle will have two rows of these lights and each booth a row at the front and a row at the back. The booths will be outlined with a panel effect and burlap, as last year, except that they will

SUMMARY OF SPACE

Annex Court and Annex			Exhibition Hall			Aquarium Court			Machinery Hall			Main Building		
Space Numbers	Frontage by Depth in feet	Area of each space in square feet	Space Numbers	Frontage by Depth in feet	Area of each space in square feet	Space Numbers	Frontage by Depth in feet	Area of each space in square feet	Space Numbers	Frontage by Depth in feet	Area of each space in square feet	Space Numbers	Frontage by Depth in feet	Area of each space in square feet
400	Irregular	1950	300-335 (odd and even)	Irregular	192	201	Irregular	208	100	Irregular	792	1	38 x 23	875
405	"	1490	336-337	"	342	203-209 (odd)	9 x 18	162	102-197 (odd and even)	9 x 16	162	4	27 x 25	678
407-411 (odd)	10 x 20	200	338-339	18 x 20	360	200	Irregular	1500	198	Irregular	900	6-9 (odd and even)	18 x 25	450
410	Irregular	1070	350-385 (odd and even)	Irregular	102	210-211	"	700				10-11	Irregular	320
413-481 (odd and even)	10 x 14.2	142	386-387	"	182	212	"	120				12-23 (odd and even)	9 x 10	90
454	27 x 20	540	388	18 x 27	480	214-230	10 x 15	150				24-25	Irregular	320
455	30 x 20	600										26-31	18 x 25	450
456-497 (odd and even)	10 x 16	150										32-40	40 x 25	1000
												42-45 (odd and even)	34 x 7	192



have bay fronts. The entrances to this building from Aquarium Court will be heightened as high as the ceiling will permit. A second exit will be provided at the seaward end of the east aisle, corresponding to the inclined plane used last year at the end of the west aisle, except that the grade of both inclines will be lessened by extending them. Annex Court contains large spaces which may be built largely to suit occupants. The Annex will have the column and panel construction substantially as in 1908. Very heavy exhibits cannot be placed in the Annex. Nearby and next to the ocean will be placed a fountain with ferns and plants and surrounded with benches. A summary of the space available will be found on the diagram.

Application for Space.—If it is your intention to exhibit at the 1909 conventions, application should be made on the enclosed forms and mailed in duplicate to the Secretary, 345 Old Colony Building, Chicago, Ill., so as to reach that office not later than February 13, 1909. No application will be considered unless accompanied by St. Louis draft, payable to R. H. Weatherly, treasurer, fully covering membership dues ($25.00) and the erection and use of exhibit structures on the space applied for at the rate of forty (40c) per square foot. There is on the pier some space for which we furnish no structures or facilities, and such space can be had without charge.

Assignment of Space.—On February 15, 1909, in Chicago, space will be assigned to all exhibitors who have made application prior to that date. The procedure will be substantially the same as in 1908. The exhibitors, if any, whose requirements, in the judgment of the Exhibit Committee, make it imperative that they be speedily taken care of, will be assigned space first. Lots will then be drawn to determine the order in which exhibitors may chose space. If a representative of the exhibitor is present, he may choose in his turn; if there is no representative present, the application will be used as a guide in assigning the best space possible. Kindly indicate on the application blank the location of space you prefer in the order of your preference.

Railway Business Association

By G. M. Basford

FOR sixty days out of the one hundred and twenty days of the life of the Railway Business Association it has been the good fortune of the writer to be associated with this unique movement, and it is with regret that pressure of his own work makes it necessary for him to turn over to other hands the official duties of the position of secretary. A pleasant obligation will be fulfilled if some additional light may be thrown upon the accomplishments and possibilities of the work of the association from the inside.

It is doubtful if any association has ever before in such a brief period received such co-operation and recognition. Never before have the commercial interests dealing directly with the railroads been organized in such a way as this.

For very well understood reasons the railroads have not yet begun to share in the return of prosperity and while many commercial interests are busier than they were, those concerned in supplying railroads with material and equipment have been unable to secure orders sufficient to put their men back on full time. This serious situation brought together our members in an effort to effect a change in public opinion which would lead to an improvement of the general railroad situation and aid in restoring normal conditions.

This movement was not only necessary but timely. The pendulum of popular sentiment had swung adversely to the railroads and swung too far, as indicated by a large amount of legislation, which affected the transportation interests by increasing the cost of railroad operation, while curtailing revenues.

At a recent dinner in New York the statement was made that during the years 1906 and 1907 the British Parliament enacted 114 laws for the government of Great Britain and Colonies, whereas during the same time Congress and the State Legislatures of the United States enacted 25,000 laws. It is reasonable to doubt that 12,000 wise laws per year, can be enacted in any country. The thinking people who constitute the safeguard of the nation had begun to recognize that the railroad interests could not be adversely affected by restrictive legislation without affecting all other human interests. There has been no general sentiment in favor of weakening restriction of railroads, but there is a growing conviction that restriction must be intelligent.

The way in which the members of the Association rallied to the call is scarcely more impressive than the ready support of the commercial public. By a combination of very important manufacturing concerns into a good-natured association, public opinion has crystallized to a gratifying extent and legislators, both State and National, have heard from the people in a voice devoid of quavering.

Some of the largest commercial associations have been ready and willing, at the suggestion of this Association, to make pacific utterances. Responses from the largest cities and from National Associations covering the entire country have been surprising. The voice asking for legislative quiet and for true statesmanship with respect to railroad enactments has come from many directions and from many interests, some of them being entirely separated from railroad affairs. Those, for instance, who make and sell shoes have co-operated through their National organizations to indicate appreciation of the fact that the welfare of those concerned in transportation is involved with their own welfare to such an extent as to justify a long step from their beaten paths to correct the unfortunate situation in which our members find themselves.

One reason for this co-operation lies in the recognition of the fact that the personnel of the Association is remarkable in including men known for the most successful engineering, manufacturing and commercial achievements. Some of our constituent concerns are as large commercially as a fairly large railroad. Our Association has conflicting competitive interests, all united in the bond of good fellowship to carry out the plan which makes for the common good. This plan is conducted absolutely independently of the railroads. It has been shown for the first time to be possible for influences outside of the railroads to band together to promote by organized action a realization of the inter-dependence between the public and the transportation interests.

Our activities are by this time very well known. In four months the fact has been demonstrated that the people are ready not only to acknowledge what the railroads have done for the country, but to give transportation questions the consideration which they deserve. To turn the light on obscure questions affecting the relations between the people and the railroads, tending to prevent extremes in legislation, constitutes a permanent work for this organization.

Not all the work already accomplished has been easy. The railroads as well as the public have their part to do and the work of the Association will include efforts to bring about a permanent friendly relationship. This cannot be done in a short time.

One of the most effective elements of the success of this Association is the generous good fellowship of its members. The organization already extends into sixteen States and often competitive interests in the same city are United in local achievement. No discordant notes are heard in the conduct of its affairs and it is inconceivable that any will be heard under the leadership of such a personality as that of the President of the Association, sustained by, and, enjoying the constant counsel of the able, energetic and potential men who compose its general executive committee. These two months in the executive office have been so crowded with important development that they have seemed exceedingly short.

At the outset reasonable doubt of the possibilities of the movement may have been justified. Some may have felt that it was too intangible and experimental to win their instant support. Now there is no room for doubt. It is no longer experimental. The writer regrets that because of compelling business obligations, he cannot continue in direct co-operation with a work so inspiring. This brief time has convinced him that the need for the organization was great, the field for its efforts wide, the plan of its work effective.

It is equally clear that so much remains to be done as to justify the question: How can any concern engaged in supplying the railroads with their requirements, delay enrollment in the Railway Business Association?

High Steam Pressures in Locomotive Service*

FOR many years past there has been a gradual but nevertheless a steady increase in the pressure of steam employed in American locomotive service. Between 1860 and 1870 a pressure of 100 lbs. per sq. in. was common. Before 1890 practice had carried the limit beyond 150 lbs. At the present time 200 lbs. is most common, but an occasional resort to pressures above this limit suggests a disposition to exceed it.

High steam-pressure does not necessarily imply high power. It is but one of the factors upon which power depends. The forces which are set up by the action of the engine are as much dependent upon cylinder volume as upon boiler-pressure, and when the pressure is once determined the cylinders may be designed for any power. The limit in any case is to be found when the boiler can no longer generate sufficient steam to supply them. The relation between pressure and power is therefore only an indirect one. But anything which makes the boiler of a locomotive more efficient in the generation of steam, or the engines more economical in their use of steam, will permit an extension in the limit of power. If, for example, it can be shown that higher steam-pressure promotes economy in the use of steam, higher steam-pressure at once becomes an indirect means for increasing power. The fact to be emphasized is that an argument in favor of higher steam-pressures must concern itself with the effects produced upon the economic performance of the boiler or engine.

Preparations for an Experimental Study.—In view of the facts stated, and with the hope of ascertaining a logical basis from which to determine what the pressure should be for a simple locomotive, using saturated steam, it was long ago determined to undertake an experimental study of the problem upon the testing plant of Purdue University. A few experiments involving the use of different steam-pressures in locomotive service were made at Purdue as early as 1895, but as the boiler of the locomotive then upon the testing-plant was not capable of withstanding pressures greater than 150 lbs., these early tests were limited in their scope. The matter was, however, regarded as of such importance that in designing a new locomotive for use upon the plant, a pressure of 250 lbs. was specified—a limit which then was and still is considerably in advance of practice. Thus equipped, an elaborate investigation was outlined, involving a series of tests under six different pressures, representing a sufficient number of different speeds and cut-offs to define the performance of the locomotive under a great range of conditions. But the expense of operating the locomotive under very high steam-pressures proved to be so great that the limited funds which could be devoted to the operations of the laboratory, in combination with the demands of students, which could be most easily satisfied by work under lower pressures, made it impracticable for a time to proceed with the work. A grant from the

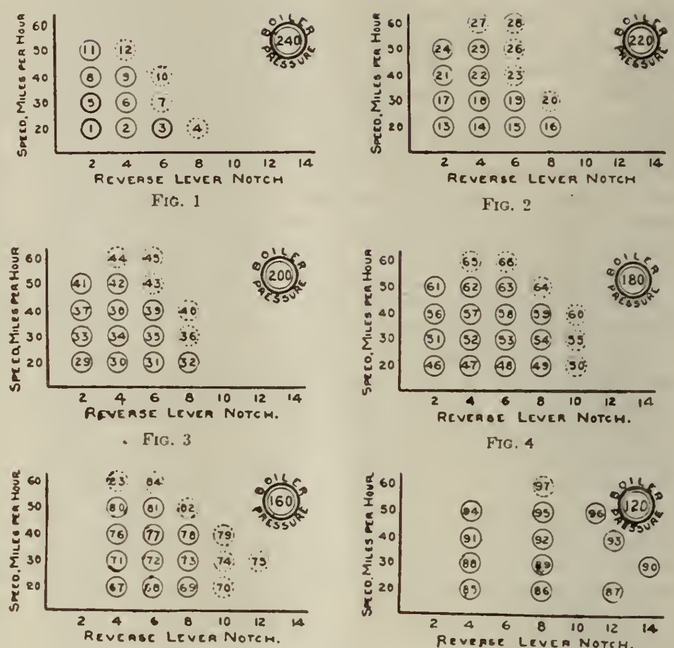


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6

Figs. 1 to 6—High Steam Pressures.

Carnegie Institution of Washington was announced late in the fall of 1903. The first test in the Carnegie series was run February 15, 1904, and the last August 7, 1905. A registering counter attached to the locomotive shows that between these dates the locomotive drivers made 3,113,333 revolutions, which is equivalent to 14,072 miles.

The Tests.—The tests outlined included a series of runs for which the average pressure was to be, respectively, 240, 220, 200 180, 160, and 120 lbs., a range which extends far below and well above pressures which are common in present practice. It was planned to have the tests of each series sufficiently numerous to define completely the performance of the engine when operated under a number of different speeds and when using steam in the cylinders under several degrees of expansion. As far as practicable, each test was to be of sufficient duration to permit the efficiency of the engine and boiler to be accurately determined, but where this could not be done cards were to be taken. A precise statement of the conditions under which, in the development of this plan, the tests were actually run, is set forth diagrammatically in Figs. 1 to 6 accompanying, in which vertical distances represent speed, and horizontal distances the point of cut-off as determined by the notch occupied by the latch of the reverse lever, counting from the center forward. Each complete circle in these diagrams represents an efficiency test, and each dotted circle, a shorter test under conditions involving the development of power in excess of that which could be constantly sustained. The numerals within the circles refer to the laboratory numbers by which the several tests are identified.

The locomotive upon which the tests were made is that regularly employed in the laboratory of Purdue University, where it is known as Schnectady No. 2. It was ordered of the Schenectady Locomotive Works in 1897. In selecting a second locomotive which should serve the purposes of the Purdue testing-plant it was decided to have the boiler of substantially the same

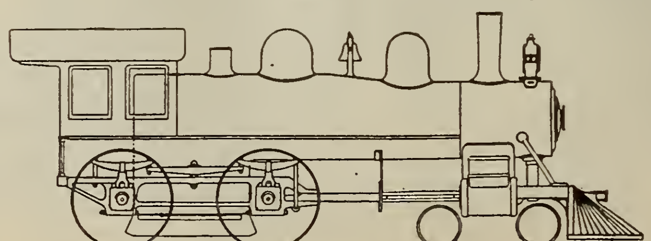


Fig. 7—Outline Elevation of Locomotive.

*Abstract of report by W. F. M. Goss to Carnegie Institution of Washington, from University of Illinois Bulletin.

Increase of Weight per cent	Boiler-pressures Selected as Bases pounds	Weight of Those Parts of a Locomotive Which Are Affected by Changes in Boiler-pressure pounds	Weight of Affected Parts Increased by per cent Given in Column 1 pounds	New Boiler-pressure Obtainable by Utilizing the Increase of Weight in Making a Stronger Boiler, pounds	Steam per Indicated Horse-power per Hour at the Pressures Given in Column 2, pounds	Steam per Indicated Horse-power per Hour at the New Pressures Given in Column 5, pounds	Direct Saving in Steam Consumption Resulting from an Increased Weight Equal to per cent Shown in Column 1, per cent	Indirect Saving Due to Reduced Rate of Evaporation, per cent	Total Saving per cent
1	2	3	4	5	6	7	8	9	10
5	120	55560	58340	150	29.1	27.1	6.87	1.67	8.54
	140	57390	60260	171	27.7	26.3	5.05	1.23	6.28
	160	59220	62180	192	26.6	25.7	3.39	.82	4.21
	180	61050	64100	213	26.0	25.2	3.08	.75	3.83
	200	62880	66020	234	25.5	24.8	2.75	.67	3.42
	220	64710	67940	255	25.1	24.5	2.39	.58	2.97
10	120	55560	61120	181	29.1	26.0	10.65	2.59	13.24
	140	57390	63130	203	27.7	25.4	8.31	2.02	10.33
	160	59220	65140	225	26.6	25.0	6.02	1.46	7.48
	180	61050	67150	247	26.0	24.6	5.38	1.31	6.69
15	120	55560	63890	211	29.1	25.3	13.06	3.17	16.23
	140	57390	66000	234	27.7	24.8	10.46	2.51	13.00
	160	59220	68100	257	26.6	24.5	7.90	1.92	9.82
20	120	55560	66670	241	29.1	24.7	15.12	3.67	18.79

Table 1—Total Saving When a Possible Increase in Weight is Utilized as a Means of Increasing Boiler Pressure.

capacity as that of the locomotive previously employed in the laboratory and which in later years has been known as Schenectady No. 1. In some other respects the new locomotive differed from its predecessor. Its boiler was designed to operate under pressures as high as 250 lbs., a limit which was then 25 per cent higher than the maximum employed in practice. Horizontal seams are butt-jointed with welt strips inside and out, and are sextuple-riveted. The design of its cylinders and saddle is such as readily to permit the conversion of the simple engine into a two-cylinder compound. The driving-wheels of the new locomotive are of larger diameter than those of Schenectady No. 1.

The principal characteristics of the locomotive are as follows:

Type		4-4-0
Total weight	pounds	109 000
Weight on four drivers	pounds	61 000
Valves; type, Richardson balanced		
Maximum travel	inches	6
Outside lap	inches	1⅛
Inside lap	inches	0
Ports:		
Length	inches	12.0
Width of steam port	inches	1.5
Width of exhaust port	inches	3.0
Total wheel base	feet	23
Rigid wheel base	feet	8.5
Cylinders:		
Diameter	inches	16
Stroke	inches	24
Drivers, diameter front tire	inches	69.25
Boilers, (style, extended wagon-top:)		
Diameter of front end	inches	52
Number of tubes		200
Gage of tube		12
Diameter of tube	inches	2
Length of tube	feet	11.5
Length of fire-box	inches	72.06
Width of firebox	inches	34.25
Depth of fire-box	inches	79.00
Heating-surface in fire-box	square feet	126.0
Heating-surface in tubes, water side	square feet	1196.00
Heating-surface in tubes, fire side	square feet	1086.00
Total heating-surface including water side of tubes	square feet	1322.00
Total heating-surface, including fire side of tubes	square feet	1212.00
Total heating-surface, value accepted for use in all calculations	square feet	1322.00
Ratio of total heating-surface based on water side of tubes to that based on fire side of tubes		1.091
Grate area	square feet	17.00
Thickness of crown-sheet	inches	$\frac{7}{16}$
Thickness of tube sheet	inches	$\frac{9}{16}$
Thickness of side and back sheets	inches	⅜
Diameter of stay-bolts	inches	1
Diameter of radial stays	inches	1⅛
Driving-axle journals:		
Diameter	inches	7½
Length	inches	8½

A SUMMARY OF CONCLUSIONS.

The results of the study concerning the value of high steam-pressures in locomotive service may be summarized as follows:

1.—The results apply only to practice involving single-expansion locomotives using saturated steam. Pressures specified are to be accepted as running pressures. They are not necessarily those at which safety valves open.

2.—Tests have been made to determine the performance of a typical locomotive when operating under a variety of conditions with reference to speed, power, and steam-pressure. The results of one hundred such tests have been recorded.

3.—The steam consumption under normal conditions of running has been established as follows:

Boiler pressure 120 lb., steam per indicated h.-p. hour 29.1 lb.
Boiler pressure 140 lb., steam per indicated h.-p. hour 27.7 lb.
Boiler pressure 160 lb., steam per indicated h.-p. hour 26.6 lb.
Boiler pressure 180 lb., steam per indicated h.-p. hour 26.0 lb.
Boiler pressure 200 lb., steam per indicated h.-p. hour 25.5 lb.
Boiler pressure 220 lb., steam per indicated h.-p. hour 25.1 lb.
Boiler pressure 240 lb., steam per indicated h.-p. hour 24.7 lb.

4.—The results show that the higher the pressure, the smaller the possible gain resulting from a given increment of pressure. An increase of pressure from 160 to 200 lbs. results in a saving of 1.1 lb. of steam per horse-power hour, while a similar change from 200 lbs. to 240 lbs. improves the performance only to the extent of 0.8 per horsepower hour.

5.—The coal consumption under normal conditions of running has been established as follows:

Boiler pressure 120 lb., coal per indicated h.-p. hour 4.00 lb.
Boiler pressure 140 lb., coal per indicated h.-p. hour 3.77 lb.
Boiler pressure 160 lb., coal per indicated h.-p. hour 3.59 lb.
Boiler pressure 180 lb., coal per indicated h.-p. hour 3.50 lb.
Boiler pressure 200 lb., coal per indicated h.-p. hour 3.43 lb.
Boiler pressure 220 lb., coal per indicated h.-p. hour 3.37 lb.
Boiler pressure 240 lb., coal per indicated h.-p. hour 3.31 lb.

6.—An increase of pressure from 160 to 200 lbs. results in a saving of 0.16 lb. of coal per horse-power hour, while a similar change from 200 to 240 lbs. results in a saving of but 0.12 lb.

7.—Under service conditions, the improvement in performance with increase of pressure will depend upon the degree of perfection attending the maintenance of the locomotive. The values quoted in the preceding paragraphs assume a high order of maintenance. If this is lacking, it may easily happen that the saving which is anticipated through the adoption of higher pressures will entirely disappear.

8.—The difficulties to be met in the maintenance both of boiler and cylinders increase with increase of pressure.

9.—The results supply an accurate measure by which to determine the advantage of increasing the capacity of a boiler. For

Increase of Weight per cent	Boiler-pressures Selected as Bases pounds	Weight of Parts of a Typical Locomotive (Boiler, Cylinders, Valves, Pistons, and Water) pounds	Allowable Increase of Weight pounds	Heating-surface of Typical Locomotives Whose Weights Are Given in Column 3 sq. ft.	Increase of Heating-surface Obtainable by Utilizing Increase of Weight in Making a Larger Boiler sq. ft.	Increase of Heating-Surface per cent	Saving in Evaporative Performance Due to Reduced Rate per cent
1	2	3	4	5	6	7	8
5	120	55560	2778	2000	234.7	11.73	2.85
	140	57390	2869	2000	242.5	12.12	2.95
	160	59220	2961	2000	250.1	12.50	3.04
	180	61050	3052	2000	257.7	12.88	3.13
	200	62880	3144	2000	265.3	13.26	3.22
	220	64710	3235	2000	272.9	13.64	3.31
10	120	55560	5556	2000	469.4	23.47	5.70
	140	57390	5739	2000	484.9	24.24	5.89
	160	59220	5922	2000	500.4	25.02	6.08
	180	61050	6105	2000	515.9	25.79	6.27
15	120	55560	8334	2000	704.2	35.21	8.55
	140	57390	8608	2000	727.3	36.36	8.84
	160	59220	8883	2000	750.6	37.53	9.12
20	120	55560	11112	2000	939.0	46.95	11.41

Table 2—Saving When a Possible Increase in Weight is Utilized as a Means of Increasing Heating Surface.

the development of a given power, any increase in boiler capacity brings its return in improved performance without adding to the cost of maintenance or opening any new avenues for incidental losses. As a means to improvement, it is more certain than that which is offered by increase of pressure.

10.—As the scale of pressure is ascended, an opportunity to further increase the weight of a locomotive should in many cases find expression in the design of a boiler of increased capacity rather than in one for higher pressures.

11.—Assuming 180 lbs. pressure to have been accepted as standard, and assuming the maintenance to be of the highest order, it will be found good practice to utilize any allowable increase in weight by providing a larger boiler rather than by providing a stronger boiler to permit higher pressures.

12.—Wherever the maintenance is not of the highest order, the standard running pressure should be below 180 lbs.

13.—Wherever the water which must be used in boilers contains foaming or scale-making admixtures, best results are likely to be secured by fixing the running pressure below the limit of 180 lbs.

14.—A simple locomotive using saturated steam will render good and efficient service when the running pressure is as low as 160 lbs.; under most favorable conditions, no argument is to be

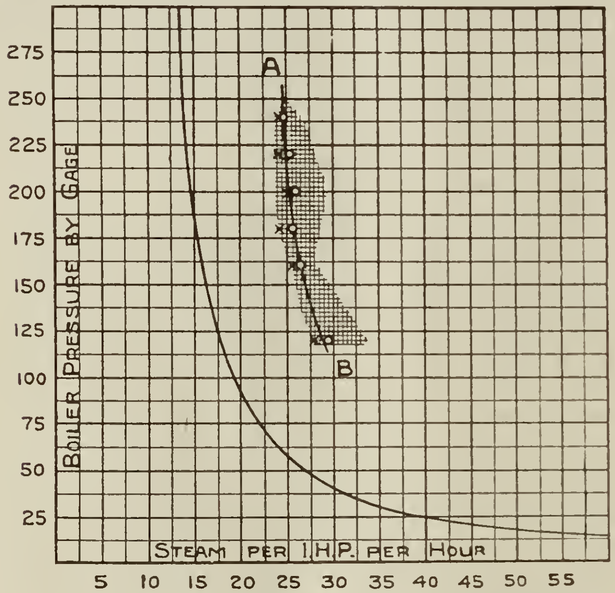


Fig. 8—Steam Consumption Under Different Pressures.

found in the economic performance of the engine which can justify the use of pressures greater than 200 lbs..

CONCLUSIONS CONCERNING BOILER-PRESSURE *vs.* BOILER CAPACITY AS A MEANS OF INCREASING THE EFFICIENCY OF A SINGLE-EXPANSION LOCOMOTIVE.

In the data on these tests an analysis was given showing the saving which may result in locomotive service, first, by increasing the pressure, the boiler capacity remaining unchanged, and second, by increasing the heating-surface, the pressure remaining unchanged. A summary of the conclusions is presented in Figs. 9 to 14 in which the full line represents the gain through increase of boiler-pressure and the dotted line the corresponding gain through increase of boiler capacity. The values for these diagrams are taken directly from Tables 1 and 2. It will be seen that starting with pressures which are comparatively low, the most pronounced results are those to be derived from increments of pressure. With each rise in pressure, however, the chance for gain through further increase diminishes. With a starting-point as high as 180 lbs., the saving through increased pressure is but slightly greater than that which may result through increased boiler capacity.

The fact should be emphasized that the conclusions above described are based upon data which lead back to the question of

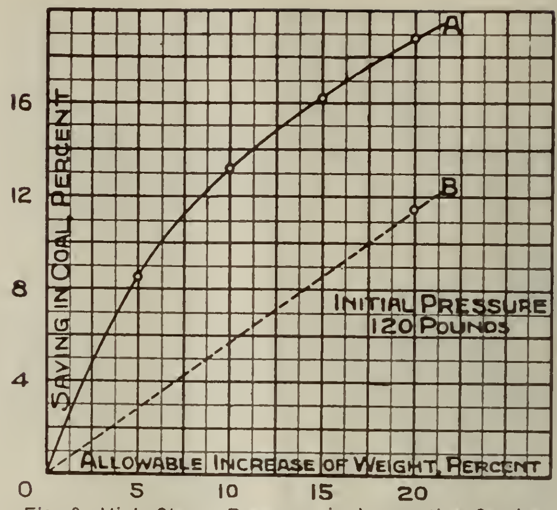


Fig. 9—High Steam Pressures in Locomotive Service.

coal consumption. The gains which are referred to are measured in terms of coal which may be saved in the development of a given amount of power. It will be remembered that conditions which permit a saving in coal will, by the sacrifice of such saving, open the way for the development of greater power, but the question as defined is one concerning economy in the use of fuel. It is this question only with which the diagrams (Figs. 9 to 14) deal.

There are other measures which may be applied to the performance of a locomotive which, if employed in the present case, would show some difference in the real values of the two curves (Fig. 9 to 14). The indefinite character of these measures prevents their being directly applied as corrections to the results already deduced, but their effect may be pointed out. Thus, the extent to which an increase of pressure will improve performance has been defined, but the definition assumes freedom from leakage. If, therefore, leakage is allowed to exist, the result defined is not secured. Moreover, an increase of pressure increases the chance of loss through leakage, so that to secure the advantage which has been defined, there must be some increase in the amount of attention bestowed, and this, in whatever form it may appear, means expense, the effect of which is to reduce the net gain which it is possible to derive through increase of pressure. Again, in parts of the country where the water-supply is bad, any increase of pressure will involve increased expense in the more careful and more extensive treatment of feed-water, or in the increased cost of boiler repairs, or in detentions arising from failure of injector, or from all of these sources combined. The effect of such expense is to reduce the net gain which it is possible to derive through increase of pressure. These

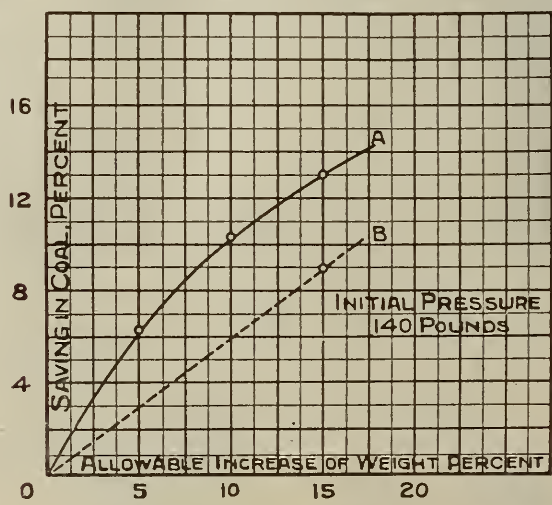


Fig. 10—High Steam Pressures in Locomotive Service.

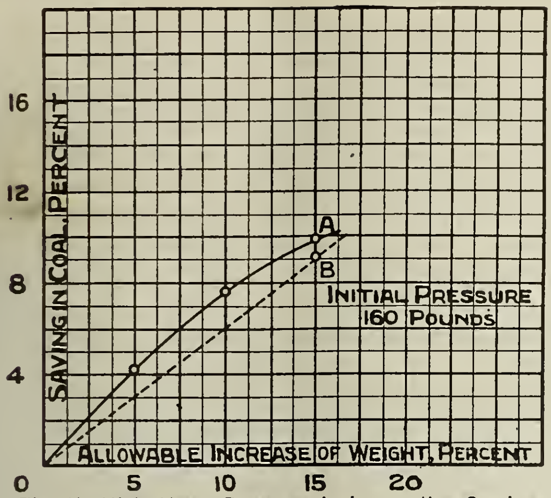


Fig. 11—High Steam Pressures in Locomotive Service.

statements call attention to the fact that the gains which have been defined as resulting from increase of pressure (Figs. 9 to 14) are to be regarded as the maximum gross; as maximum because they are based upon results derived from a locomotive which was at all times maintained in the highest possible condition, and as gross because on the road, conditions are likely to be introduced which will necessitate deductions therefrom.

The relation which has been established showing the gain to be derived through increased boiler capacity is subject to but few qualifying conditions. It rests upon the fact that for the development of a given power a large boiler will work at a lower rate of evaporation per unit area of heating-surface than a smaller one. The saving which results from diminishing the rate of evaporation is sure; whether the boiler is clean or foul, tight or leaky, or whether the feed-water is good or bad, the reduced rate of evaporation will bring its sure return in the form of increased efficiency. An increase in the size of a boiler will involve some increase in the cost of maintenance, but such increase is slight and of a sort which has not ben regarded in the discussion involving boilers designed for higher pressures.

Keeping in mind the fact that as applied to conditions of service the line *A* is likely to be less stable in it's position than *B*, facts set forth by Figs. 9 to 14 may be briefly reviewed.

Basing comparisons upon an initial pressure of 120 lbs., (Fig. 9), a 5 per cent increase in weight, when utilized in securing a stronger boiler, will improve the efficiency 8.5 per cent, while if utilized in securing a larger boiler, the improvement will be a trifle less than 3 per cent. Arguing from this base, the advantage to be derived from an increase of pressure is great. If, however the increase in weight exceeds 10 per cent, the curve *A* ceases to diverge from *B* and if both curves are sufficiently extended, they will meet, all of which is proof of the fact that the rate of gain is greatest for relatively small increments of weight.

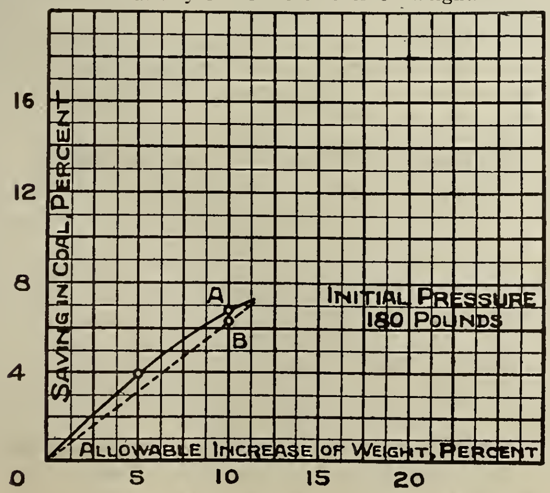


Fig. 12—High Steam Pressures in Locomotive Service.

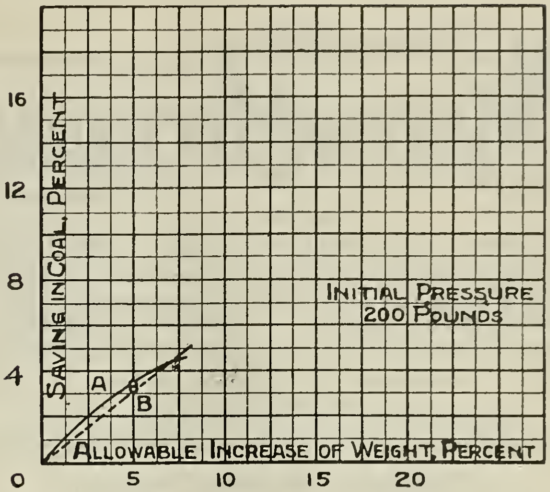


Fig. 13—High Steam Pressures in Locomotive Service.

Basing comparisons upon an initial pressure of 140 lbs. (Fig. 10), the relative advantage of increasing the pressure diminishes, though on the basis of a 5 per cent increase in weight it is still double that to be obtained by increasing the capacity.

Basing comparisons upon an initial pressure of 160 lbs. (Fig. 11), the advantage to be gained by increasing the pressure over that which may be had by increasing the capacity is very small so small in fact that slight droop in the curve of increased presure (*A*) would cause it to disappear. As the curve *B* may be regarded as fixed, while *A*, through imperfect maintenance of boiler or engine, may fall, the argument is not strong in favor of increasing pressure beyond the limit of 160 lbs.

Basing comparisons upon an initial pressure of 180 lbs., (Fig. 12), the advantage under ideal conditions of increasing the pressure, as compared with that resulting from increasing the capacity, has a maximum value of approximately one-half of 1 per cent. In view of the incidental losses upon the road the practical value of the advantage is nil. The curves *A* and *B* (Fig. 8), constitute therefore no argument in favor of increasing pressure beyond the limit of 180 lbs.

Basing comparisons upon an initial pressure of 200 lbs., (Fig. 13). it appears that under ideal conditions either the pressure or the capacity may be increased with equal advantage, this being in effect a strong argument in favor of increased capacity rather than of higher pressure.

Basing comparisons upon a pressure of 220 lbs., (Fig. 14), it appears that even under ideal conditions of maintenance the gain in efficiency resulting from an increase of pressure is less than that resulting from an increase of capacity. In view of this fact, no possible excuse can be found for increasing pressure above the limit of 220 lbs.

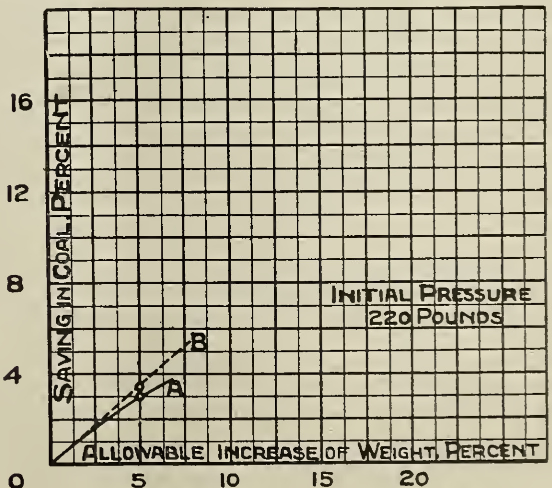


Fig. 14—High Steam Pressures in Locomotive Service.

RAILWAY MASTER MECHANIC

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Announcement

WITH this issue the Railway Master Mechanic becomes the property of The Railway List Company, publishers of The Monthly Official Railway List, and will be issued henceforth as a companion publication of the "Red List."

Bruce V. Crandall, President of the Crandall Publishing Company, from whom the paper has been purchased, has disposed of the property in order to devote more time to special advertising work, in which field he has been engaged somewhat extensively of late.

The Railway Master Mechanic needs no introduction to the great body of mechanical officials. It was established in 1878, and numbers among its readers many officials who have gained the summit of their calling since it first appeared to the world.

The Railway Master Mechanic carries its purpose and mission in the meaning of its name. It was founded with the idea of publishing and disseminating the news of the mechanical department of the railways of America. Since that time the office of superintendent of motive power has been created, in addition to the office of master mechanic, but the name of the journal has never been changed. The Railway Master Mechanic has had its fat and lean periods, but through all these years and the changes since its foundation it has made and maintained hosts of friends and patrons who will continue to watch its growth with interest and devotion.

The mechanical department of the railways of America, spending hundreds of millions of dollars for supplies and equipments annually and employing thousands of skilled men, is the field to which the Railway Master Mechanic is devoted. There is not a manufacturer of a tool or machine used in the railway shops or in the operation of trains, but who is interested in its pages; there is not a railway official from the round house foreman to the president of the road himself, who would not be benefitted by a careful perusal of its columns every month. The fact that many of the highest officials of this country hold the Railway Master Mechanic in the highest esteem, is proof of its value to all.

There are many railway shops where the Railway Master Mechanic is used continually as a reference. The best asset of any journal is its good will and the number of Railway Master Mechanics found in railway shops attest the high favor in which it stands among the officials who want to learn and succeed. To these men it appeals so strongly because it has always been the object of its editors to fill its pages with new ideas in shop practice, machine design and the latest and best news in all branches of mechanical engineering pertaining to shops, cars and motive power.

The life and value of any publication depends upon its circulation, quality and quantity of course considered. The contents of the paper must be of such a nature as to gain and hold the subscriber in order that the announcement of the advertiser may be profitable to him. These ideas will be carried out along broader and more progressive lines than has been possible heretofore. The publishers want more readers and will proceed at once to get them by making a better journal each month than the one preceding, and by interesting more railway officials, personally and individually, in the Railway Master Mechanic.

There will be some changes in the Railway Master Mechanic with the object of improving it and raising it to the highest standard possible. The announcement of these plans will be made from time to time as the features to be inaugurated are to appear.

The Railway Master Mechanic has been and will continue to be a favorite advertising medium for the supply manufacturer who has anything to sell to the mechanical department of the railroads, because of its editorial policy, and on account of its circulation among mechanical officials.

This issue being the first under the new ownership, effort has been made to make it as attractive and interesting as the short time would permit. Moving into new quarters, organizing and arranging necessary details, has made it impossible to bring it out as early as desirable.

The new management of the Railway Master Mechanic will strive at all times to give the maximum of service at the minimum of cost, feeling confident of the verdict.

Briquetted Coal for Locomotives

THE use of briquetted coal on locomotives has been the subject of much investigation in recent years and data on this subject is presented in a bulletin of the U. S. Geological Survey, by Prof. W. F. M. Goss. Comparative series of tests were made at the Altoona testing plant of the Pennsylvania Railroad on natural coals and briquets made from same. These tests indicated that there was very little deterioration of the briquets from handling, that the evaporative efficiency of the boiler was increased and that the smoke density was somewhat less. Regarding locomotive service particularly it was shown that the briquets gave a marked increase in efficiency, an increase in boiler capacity, and a decrease in the production of smoke.

The briquet industry in Germany has been so developed that in the year 1906, the output of the Rheinisch-Westfalisches Kohlen-Syndiket of coal, coke and briquets was in short tons about seventy-six million, thirteen million, and two million eight hundred thousand respectively. The briquets are only made to dispose of the fine coals, as it is not profitable to crush coal to supply material for same as the briquetting process is an expensive one, costing from $1.20 to $1.50 per ton. In the district in which this Syndiket operates coke is produced in large quantities and the breeze from the coke ovens is used as a binder for the briquets.

Regarding the use of briquets on German locomotives it is the opinion of German motive power officials that the best briquets are not as satisfactory as the best coal, and while they object to the practice of using briquets solely they believe that a fuel of half briquets and half coal is satisfactory. In fast passenger service one-fourth of the total fuel is frequently of briquets and this is placed on the top in the tender so as to be fired when starting the engine. It is believed, however, that the briquets can be stored with greater facility and handled with less loss than ordinary fuels.

The locomotive road tests which were made on the Missouri Pacific, the Lake Shore & Michigan Central, the Chicago, Burlington & Quincy, and the Chicago & Eastern Illinois railroads, to the number of 100, indicated that coal in form of briquets gives a higher evaporative efficiency and that there is a decrease in smoke density, together with an elimination of objectionable clinkers. On sixteen comparative tests over the Atlantic Coast Line Railroad, there were 5,397 tons of coal consumed per trip and 5,062 tons of briquets consumed. These tests showed from a practical standpoint that the briquets were satisfactory.

On the Chesapeake & Ohio Railway a series of comparative tests were also made and these tests proved that the briquets ignited freely, made an intensely hot fire and were in most respects entirely satisfactory.

On several European roads specifications have been drawn up covering the production of briquetted fuel. In these specifications the quality of a coal is defined, the nature of the pitch and the quantity to be used is stated and the tests for the briquets are given.

In consideration of the data which is given in the bulletin referred to above and of which brief mention has been made here, it may be assumed that the use of briquets will become more general, but that the manufacture today is not such as to give a fuel of material advantage over the natural coal. For this reason the briquet at the present time must be made from the slack or fine coal which cannot be readily transported or used.

Railroad Accidents

In previous issues of the Railway Master Mechanic, the large decrease in railroad accidents since October, 1907, has been noted. In the Accident Bulletin for the quarter, July, August and September 1908, it is shown that the number of casualties is again increasing.

Among the reasons for the low records in three previous quarters was the heavy reduction in traffic as well as in number of employees. In July, 1908, there was a decided increase in this direction, and it is to this that we may credit the increase in casualties to passengers and employees.

In the quarter ending September, 1908, the number of employees killed increased 17 per cent over the previous quarter; the number of employees killed in train accidents increased 39 per cent; the number of passengers killed from causes other than train accidents increased 30 per cent, and the number of passengers killed in train accidents increased about 300 per cent. The latter figure shows how important it is to continue a systematic investigation of the signaling systems now in use. It is found, however, that eight of the more serious accidents occurred on the lines where the block system was not in use. Regarding the collisions and derailments in the quarter mentioned above, there was a total of 2,567 or 1,170 collisions and 1,397 derailments.

The number of employees killed in coupling increased from thirty to thirty-nine for the quarter ending September, 1908. The accidents in coupling and uncoupling cars were due to reasons given in previous statements, and included such as the adjustment of coupler with foot, the coupling of damaged cars, uncoupling without using lever, riding car to uncouple and unexpected movement of cars. Now we may expect a greater increase in railroad accidents as traffic increases, but it is to be hoped that the earnest attempts to prevent the same may be felt in the coming year.

The All-Steel Car

A very interesting debate was held a short time ago at a meeting of the Car Foremen's Association of Chicago, in which question of wood versus steel cars was the subject. In this discussion the cost of all-steel cars was one of the important factors, and it was shown that the steel car exceeded the wood car in cost by about 50 per cent. While this cost may be materially reduced, there is no doubt that the all-steel car will not reach in cost the lower figure for the wooden car or composite car.

The cost, however, is not the only important factor in determining the value to the railroads of one car as against the other. The cost of repairs as viewed in several ways is very important. It is contended that the wood car can be repaired more easily than the steel car as the material for repairs is always on hand, thus keeping the cars in service. On the other hand the steel car is said to require few repairs, that is the minor repairs do not put it out of service. It is very difficult to determine a fair comparative percentage of each type car that is out of service for defects in consideration of the life of steel and wood cars that are now in use. Some figures were given, however, on this point and were amplified by comparison of figures both for loss of service and cost of switching. It was estimated that there would be a saving of $10,000 per year by a road using 50,000 steel cars exclusive of saving that might arise through the difference in the cost of repairs.

An objection was made to the all-steel box car, in that it is not adapted for general use, in view of the fact that these cars would become very hot, when closed and sealed in hot weather, and also on account of rust and sweating of the car.

The discussions do not relate to the composite car which is generally considered the best car that can be built for certain purposes, at least at the present time. The builders of all-steel cars, particularly all steel box cars, are improving their designs and it may be in the very near future that the more important objections or at least the valid ones will be eliminated. In the above notes on the discussion all points that were brought out are not included, as it was intended merely to give a general idea of opinions that may be held by railroad men. The statements are not credited to the speakers because they were elected to take one side or the other of the question, and therefore offered all possible evidence to win the debate for their side.

Concerning Side Sheets on Wide Fire Boxes

In regard to the life of side sheets in the wide fire boxes of modern locomotives a general discussion of the question was given at a recent meeting of the Western Railway Club. Mr. C. A. Seley advanced several theories, one in particular regarding the slope of the fire box and its relation to the circulation of the water. He suggested that the side sheets should be sloped or curved outward from above the fire line in order to produce a more rapid circulation and a wiping effect that would carry off the steam bubbles from the side sheets. This idea was advanced in view of the fact that water transmits the heat more readily than steam and thereby prevents overheating of the side sheets.

In the discussion of this question Mr. M. H. Wickhorst stated that his observations led him to believe that the overheating of the side sheets was due mainly to the formation of scale or the deposit of mud. When this condition arises the fire box sheets become corrugated, which renders them practically useless.

In connection with this discussion the question arose as to where the failures of side sheets occurred, that is, whether they occurred on the road or in the shop. The data given by Mr. Wickhorst showed that nearly all failures occurred in the shop, either in washing or after the boilers had become cold. These results indicate that a method of washing boilers should be used, which will keep the boiler continuously warm or at least above 150 degrees Fahr.

In Mr. J. P. De Voy's discussion of this question he referred to the Prairie and Atlantic type locomotives which were built by the Chicago, Milwaukee & St. Paul, after designs which he recommended. The fire box on these locomotives is 60 ins. wide and is what may be termed medium wide. There is a 4-in. water space and in reference to this Mr. De Voy believes that it may be increased to 8 ins. advantageously.

In closing the discussion Mr. Seley stated that in presenting the paper it was his idea to find some reason why the side sheets on modern fire boxes were lasting only about one-third as long as those in the old-style boxes. The reason for this decrease of life is very difficult to determine, as there are no exact methods of arriving at the conditions that exist inside a locomotive boiler. One gentleman in discussing the question stated that a test had been made which proved that there was a film of steam about three-eighths of an inch from the side sheet. If this condition really exists there is no doubt that it destroys the ready transmission of heat from the side sheet to the water, and thereby has a very great effect in bringing about the destruction of the fire box.

A suggestion was made that the old records of the railroad companies should be investigated and the fire boxes of different widths and forms should be classified with a view to obtaining a systematic record of failures and their dependence on the construction of the fire box.

Brighter Industrial and Commercial Outlook

RECOVERY from the industrial inaction, which dates from about November, 1907, is progressing in spiral form, not steadily forward, so that any one may see and feel assured of the gradually regained ground. There was quite a little spurt towards a restored activity immediately after the late presidential election. It lasted well into December, and the newspapers loudly proclaimed the joyous tidings, but the undoubted gain then made in shop activities did not last. The trend of things again pointed downward. Now there are evidences that another change has come.

Manufacturers of cars and of various supplies for railroad use report that orders are again coming in. It is possible that this renewed burst of activity like its predecessor, may be more or less temporary in character, but chances are that it will carry the industrial activities a little closer to perfection and that the recurring inaction, if it follows, will be less noticeable. In brief the tendencies of manufacture are distinctively upward.

It is to be remembered also that the railway supply branch of manufacture was far more seriously crippled by the financial tempest of some sixteen months ago than most other departments of manufacture. The manufacturer of agricultural machinery scarcely felt the restricting influences, for the farmers in all parts of the country, and even abroad, have been generally blessed with abundant crops and with good prices for the same, so that their economic status was not affected detrimentally. The present outlook for the maker of goods that go for consumption or ultimate use chiefly to the farmer is brightness itself. Railway traffic in the purely agricultural states has suffered far less than in centers of high-keyed manufacture, like Pittsburg, for example. The assured prosperity of the agriculturist is bound to spread gradually until it involves the other important branches of industry.

The production of pig iron in the United States was in round figures last year sixteen million tons, as compared with twenty-six million, in 1907, which was the record of all the years. Of that shrinkage the greatest loss came from the railroads. The carriers are by far the largest consumers of iron and steel products in the land and, since the market for iron and steel is generally regarded as one of the most accurate barometers of general trade, that is accessible to general observation, the importance of the railroad policies as to purchases and extensions becomes apparent. This activity of the railroads comes well along towards the end of the procession, for purchases are not made by the presidents and general managers, as a rule, until traffic so improves as to warrant the expenditure. The traffic represents the aggregate state of manufacture and commerce throughout the country. The revival of industry must precede, in the ordinary course of events, the brisk buying of supplies by the railroads. Having this in mind, the railroad earnings compared with a year ago, are cause for congratulation, for freight rates are about on a parity with those of a year ago and increased earnings, therefore, mean increased tonnage.

No doubt, the present partial drag upon industry is in large measure due to the pending tariff legislation, for if there is "genuine" revision, it means reduced duties and consequently lower prices for foreign material used by American manufacturers. Every sales agent knows how keen the average business man is to take advantage of possible reductions in the costs of his material and how he will dally with time when that possibility presents itself. It is to be hoped that this tariff revision will be pushed to conclusion in the early months of the incoming administration, and there is no reason to doubt that it will be, for the political powers of the land are well aware of this repressive influence of prospective tariff change upon general trade and commerce and will see to it that all possible haste in legislation will be made. There are heard many predictions that by midsummer the tariff revision will have been accomplished, and in the meantime there is no reason to doubt steady progress towards prosperity. The mere necessities of buyers and users will force a certain amount of immediate and early buying.

Old Shop Tools Rejuvenated

THIS caption covers a multitude of undesirable relics that would have found repose in the junk pile, but for the fact they represented a certain value in the annual inventory. Such tools are found in some of the best equipped shops and remain in service because they can be made to do some classes of rough work at a rate not too expensive when character of labor and wage is considered.

Old tools with their narrow belts and weak gear systems are not heavy dividend earners, but if they must be retained in service, the logical procedure is to get the most work out of them possible and that proposition is not a difficult one to meet when the problem is correctly approached.

A machine that was properly designed, that is, had the metal distributed in its make-up on mechanical lines, may always be put in shape to do good work and produce results never dreamed of by its builder, on the plain belt basis, and also when run with back-gear, provided the latter have teeth strong enough to stand up under the stresses of increased power input, and many of them are so well designed in this particular as to meet all requirements.

It will be understood that the life of a machine tool as measured by years of service does not mean that such tool is unfit for the strenuous push of modern shop practice, for it can be given another lease of useful life if the narrow belts are discarded and an electric motor is installed as a direct drive.

This scheme has been worked out to the betterment of output in many instances where it was impossible to replace an old tool by a modern one owing to the inability to get an appropriation covering the cost, and in many cases of this kind where tools have not only been unproductive, but an actual loss to the management, they have been put in condition to make a showing in economy of output by the simple application of a motor to the machine.

Cinder Pits

Editor, Railway Master Mechanic:

The method of taking care of cinders at our shop is very primitive. We have an ordinary cinder pit, 90 ft. long with a depressed track running alongside on which cars are stored and the cinders shoveled out of the pit into cars.

It requires the service of two men per day to keep the cinder pit clean. I have had no experience with either the locomotive or gantry cranes. I have read in different mechanical papers as to their usefulness.

It cost us on an average of $2.00 per day to keep the cinder pit clean.

Yours truly,

Georgia. M. M.

Editor, Railway Master Mechanic:

We have a depressed cinder track and all cinders are shoveled from the cinder pits into the cars by hand. There is no doubt, whatever, that cinder pits with water in which the cinders fall when removed from the ash pans and from which the cinders are afterward loaded in cars by a locomotive crane, is the best arrangement that I have ever seen and reduces the cost to a minimum.

I believe that by using one of these cranes that a car of cinders can be loaded for about 12 or 15 cents, while by using depressed track it will cost in the neighborhood of $2.50 or $3.00 per car.

The locomotive crane may also be used for loading of wheels and other material around the repair yards and shops, and is an ideal arrangement.

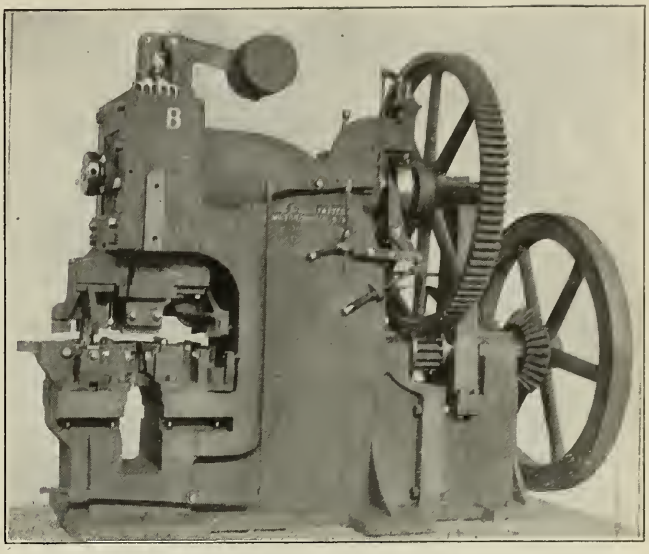
Yours truly,

Illinois. M. M.

Coping and Notching Machine

The machine, illustrated herewith, was recently furnished the Elgin, Joliet & Eastern Railway by the Long and Allstatter Company, Hamilton, Ohio. It is a combined machine for coping and notching, and the tools shown are for coping and notching, and, when these tools are removed, the slide is so constructed, that punching tools, six or eight in number, adjustable between centers, arranged with gags so as to make them operative or inoperative, at the will of the user, and suitable for punching the web or flanges of I-beams, channels. etc., can be attached.

The slot in the lower jaw is intended for the I-beam to pass through, and the flanges rest on the upper part (dies) in proper position for being punched, and when the beam is turned half way over, it is then in position for punching the web. The punching tools, running from front to rear in a straight line, can be used for this work and also for punching connections, etc.



Coping and Notching Machine.

The front tool is for notching; the center tool cuts the flange, and the tool nearest the throat of the machine trims the web; another tool near the front on one side does notching of various kinds and cuts away the web, when desired.

This machine may also be used with special tools, for cutting off I-beams, and of course it can be used as a single punching machine. Two angles can be bolted together and both punched at the same time. Two channels can be mounted in the same way, both flanges resting on the dies, same as I-beams.

The slide is arranged with "T" slots running from front to rear for holding the tools. This machine is arranged for side or angle drive, by belt, through miter gears as shown. It has automatic stop that brings slide to rest at the completion of each stroke, and this can be set so it will stop the machine at any part of the stroke.

Metal Cutting Tools Without Clearance

(Continued from January issue)

A tool so mounted either swings automatically to adapt itself to angularity of feed, or may be swung by hand as soon as the cut is started. Its natural tendency holds it snugly against the metal, but the force may be varied from one that equalizes the stress on each side of the cutting edge down to a very slight stress which only holds the tool in no-clearance position. An important feature is that the tool is free to swing around to offset the unequal wear on the "clearance" face.

In the early experiments the cutters used were clamped rigidly in a holder, which in turn was pivotally mounted on a fixed holder. The cutting edge of the tool was so located as to stand exactly on the center line of the swiveling holder.

In the later experiments the scheme has been simplified by loosely mounting the cutter itself, providing it with a round bottom struck from a center line which is near the cutting corner of the tool. The cutting edge is usually standing at an angle to its center line of swivel, giving the tool a front slope. The scheme of inclining the cutting edge to the line of the swivel was adopted for the purpose of using a bar-shaped tool in which its shape could be maintained by grinding, for with this shape grinding back the end provides for the wearing down of the top edge. This gives the tool a front slope when the swiveling center is kept horizontal. In some cases it may be well to tilt the holder to an angle that brings the cutting edge horizontal.

This departure from the ideal center position of the line of swivel is not sufficient to cause any trouble. In fact, the pivotal line need not be exactly parallel to the cutting edge, neither is it necessary to have it very near the center line of swivel. It is probable that under some conditions the cutting edge may advantageously be located either above or below or on either side of the cutting edge. The exact location of the cutting edge relative to the center of oscillation partly determines the pressure with which the chip is taken.

The extreme top edge of the tool, in some instances, has been slightly flattened on the acuter angles, the flat measuring from about 1-64 in. to 1-32 in., and standing either 90 deg. from the so-called clearance face or sloping in either direction. Very god results were obtained by giving it a negative side slope standing at a maximum angle of from 10 deg. to 15 deg. from the horizontal. This top flat seems to make a good resting place for the false edge, and it may be that its successful operation is dependent on the false edge.

One interesting phase of those experiments has been the comparative willingness on the part of the tool to relieve the carriage of the duty of feeding. This first became apparent when "thrown out." This self-feeding feature, of course, cannot apply the carriage continued to advance after the feed, had been to the action of planers, boring mills, or work of large diameter. It is mentioned here only to indicate the absence of resistance to the feeding motion under some conditions.

The ultimate outcome of the use of acute angle tools may be to allow each tool to take a heavy cut on small diameters to determine its own feed. In the turret lathe this would be a distinct advantage.

CHIP LIFTER AND CONTROL

The chip produced by the acute angle tools is a continuous chip possessing great lateral strength. The continuous chip is preferred by any operator who has had experience with hot chips thrown off by tools of blunter angles, but while this particular feature enables him to observe the action of the tool closely without risk, the continuous chip in itself becomes troublesome, if allowed to run too long without breaking. In some of the first experiments with this tool chips having a depth of about 3/8 in and produced by a feed of six to the inch, were found exceedingly troublesome, especially when allowed to run out to lengths of 5 to 15 ft.

The lateral stiffness of the chip of the more acute tool made it possible to increase the tearing open or splitting effect which occurs in cutting metals. To increase the tearing action it is necessary to allow the chip, after it has passed from the edge of the tool, to pass over a lifter in the form of a wedge, either formed integrally with the tool or placed in the path of the chip near the tool, having an angle that not only assists in tearing the metal ahead of the tool, but also relieves the slope of the tool near the edge from an important part of the labor.

In other words, a chip possessing lateral strength made it possible to carry an important part of the cutting or splitting tion farther away from the extreme edge. The heat generated by this part of the work, because of its position, of course in no way reduces the life of the extreme cutting edge. Experiments with the chip-lifting scheme seem to indicate that under ideal conditions the duty of the extreme edge of the tool may be simply to cut through metal which may be under more or less of a tearing or spliting stress.

Although this chip lifting effect may be produced by a top slope having a curved surface, it has seemed best for the convenience of grinding the tool on an ordinary wheel to keep the top slope of the cutter a flat surface, and to introduce this chip-lifter as a separate member, either as a part of the tool holder or in conjunction with the chip-breaker to be described.

Although it is, as was stated, a satisfaction to be able to stand near the cutting tool and to have some assurance of the direction in which the chip will travel, and to know that it is integral and not shooting out in hot chunks at all angles from the tool point, a continuous chip is nevertheless troublesome. Even with blunt tools, the curling chips which are sometimes used to illustrate ideal working conditions of a machine require the constant attention of the operator, and either a very large receptacle which doubles the floor space required for the machine or the almost constant attendance of an extra man for removing the chips from the room.

The use of the more acute angles increases the chip trouble, and may in some instances make it advisable to retain the blunt cutting angles, or at least, tools which produce tolerable chips.

For turning bar work in the turret lathe it has seemed best to adopt a chip-breaker which produces a fracture by placing an obstruction in the path of the chip at such an angle that the chip is bent, either by lifting or depressing, or both, shortly after it has left the tool, to an extent beyond its breaking point. In order to employ the chip-lifter most efficiently for the purpose of relieving the top slope of the cutting tool, the writer has preferred to use a chip-breaker which depended on depressing the chip after it passed over the chip-lifting incline. A breaker of this kind breaks the chip in lengths varying from 1/2 to 3 ins.

CONCLUSIONS

The no-clearance cutter relieves the edge from the one-sided pressure.

It prolongs the life of the cutter by allowing abrasion on its face without producing negative clearance.

It prevents lateral quivering.

It converts the lip angle into cutting angle, which for a tool of given form constitutes a gain of from 5 to 10 deg. in cutting angle.

It has extended the working range of the side tool which gives the minimum separating stress.

It has made possible the use of acute-angled tools which reduce the cutting stress, thereby increasing the output of machines which have been limited by lack of pulling power.

The reduction of the cutting and separating stresses has increased the accuracy (or output, which is generally interconvertible with accuracy) on nearly all lathe work.

This reduction also increases the output which has been limited mostly by the frailness or the slenderness of the work.

Single Speed Pulley Gear Driven Lathe

THE new 18-in. single-speed pulley, gear-driven lathe, shown herewith, is built by the Whitcomb-Blaisdell Machine Tool Company, Worcester, Mass. The new form of clutch used in making the speed changes is the principal feature of the design and this construction involves a principle upon which a basic patent has been received.

The geared headstock is shown in Figs. 1, 2 and 3. Referring to Fig. 3, power is received at driving pulley *A*, which is keyed to shaft *B*. The shaft *B* revolves in fixed bearings in the head-stock and carries pinions C_1 C_2 and C_3 keyed to it, and has pinion teeth cut on it at C_4. These four pinions mesh with corresponding gears D_1, D_2, D_3, D_4, which normally revolve loosely on friction shaft *E*. Either one of clutch bodies F_1, F_2 and F_3, and gear H, may, however, be engaged with the corresponding gear *D*, etc., by means of clutches G_1, etc., whose construction

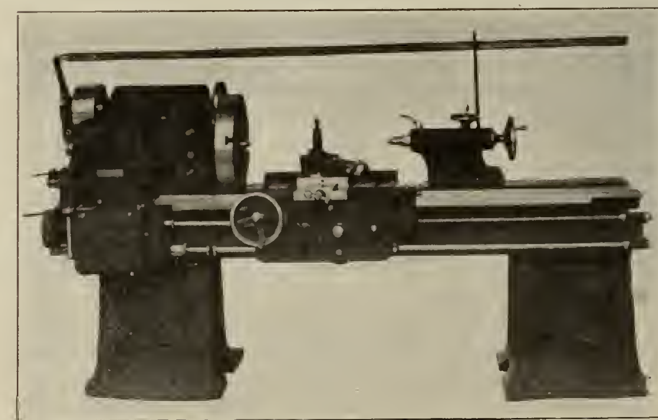


Fig. 1—Single-Speed Pulley, Gear Driven Lathe.

is described later. Four rates of speed may be given to shaft E when pulley A is running at constant speed.

Shaft E carries gear H keyed to it, and has pinion teeth cut in it at J. H and J mesh with gears K and L; K is keyed to clutch member M. L and M may be connected by clutches N_1 and N_2 respectively, with clutch bodies O_1 and O_2, which are keyed to the spindle P. The four speeds, which may be given shaft E are thus doubled, giving eight speeds for the spindle.

The construction of clutches G and N is seen in the detailed views at the right of Fig. 3. This form of clutch is a positive friction clutch, its engagement taking a measurable amount of time and allowing some slipping of the engagement surfaces, which obviates the severe shock met with at high speeds in positive clutches. On the other hand, the uncertain driving power and excessive slippage met with in friction clutches is avoided.

The expansion ring Q_1 in the upper clutch is hung on a pin R_1, which is fast to the revolving gear D_1. This ring is thus always rotating when the driving pulley is in motion. The open end of ring has pivoted to it a lever S_1, which through the medium of strut T_1 may be made to spread the ring open, engaging the inner diameter of F_1, and thus connecting D_1 and E. The movement of the lever for thus operating the clutch is effected by the sliding spline V, which has keyed to it series of cams U_4, U_2, etc. When this spline is shifted axially on shaft E to bring cam U_1 in the path of the revolving letter S_1 (the direction of revolution being immaterial), the latter, as soon as it strikes U_1, is forced outward, spreading ring Q_1 and engaging the clutch. If clutch ring Q_1 and lever S_1 are revolving in the direction of the arrow and shaft E is being started from a state of rest, the rotation of the ring and lever will cause the latter to ride up on the cam until the clutch is fully engaged, when, since E is rotating at the same rate as Q_1, the relative movement of S_1 and U_1 will cease so that the clutch will not be tightened more than is necessary to carry the load. If slippage occurs at any time, this will simply cause lever S_1 to ride still further over the cam, tightening the clutch still further. Any slippage thus tightens the clutch the exact amount required to carry the extra strain.

An interesting point in the design of this clutch is the means

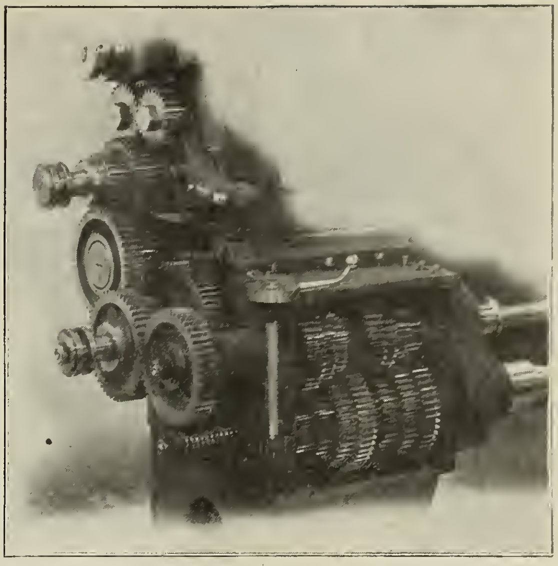


Fig. 2—Arrangement of Gearing.

of relieving the face of the clutch ring for the oil, where the driving surfaces come together. Clutch surfaces which run in oil must be grooved so as to allow the parts to come quickly to a bearing. In the case of this clutch, it was found necessary to groove the periphery of rings Q_1, to such an extent that the bearing area was divided into about ¼-in. squares, separated by oil channels. This permits the lubricant to be squeezed out almost instantly. With larger undrained areas, the squeezing out of the oil would take time, and as long as it remained, the full driving force would come from the engagement of lever S_1 and cam U_1; these parts, with the acute contact surface between them, could not have been made strong enough to stand the strain of the full driving power, so this complete grooving is necessary for the operation of the clutch.

The clutch adjusting itself, each time it is used, to the amount required by the load. The amount of slippage that takes place

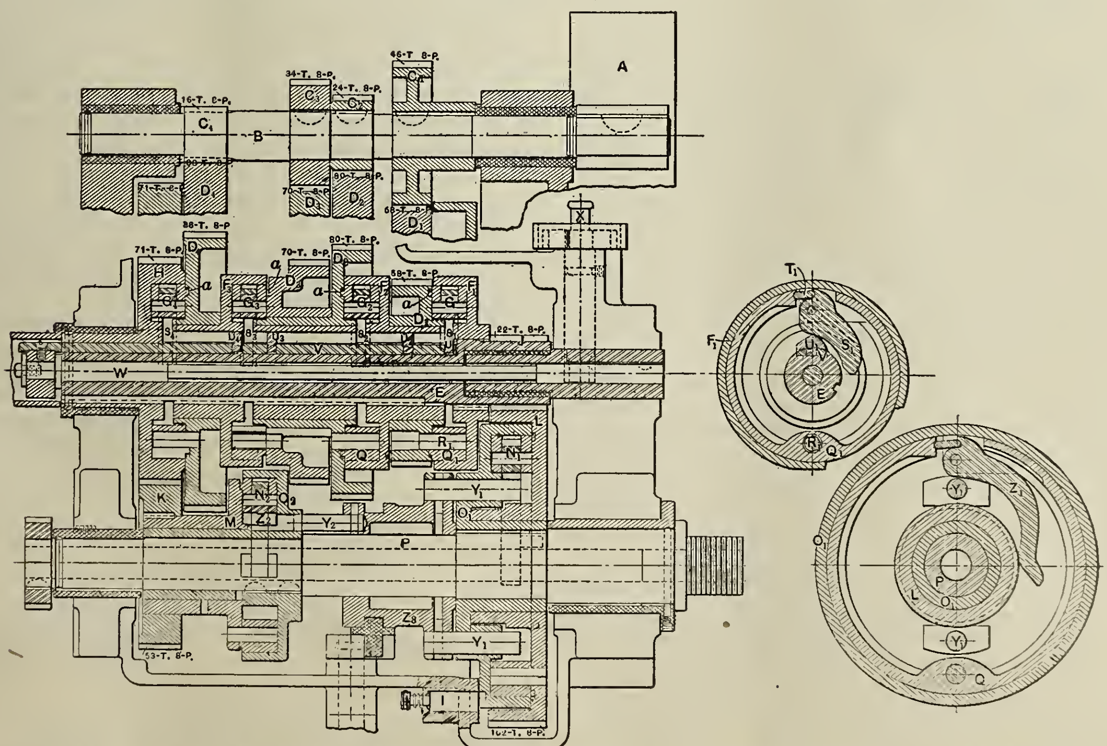


Fig. 3—Head Stock Spindle, Showing Gearing, and Positive Action Friction Clutches Which Control Speed Changes.

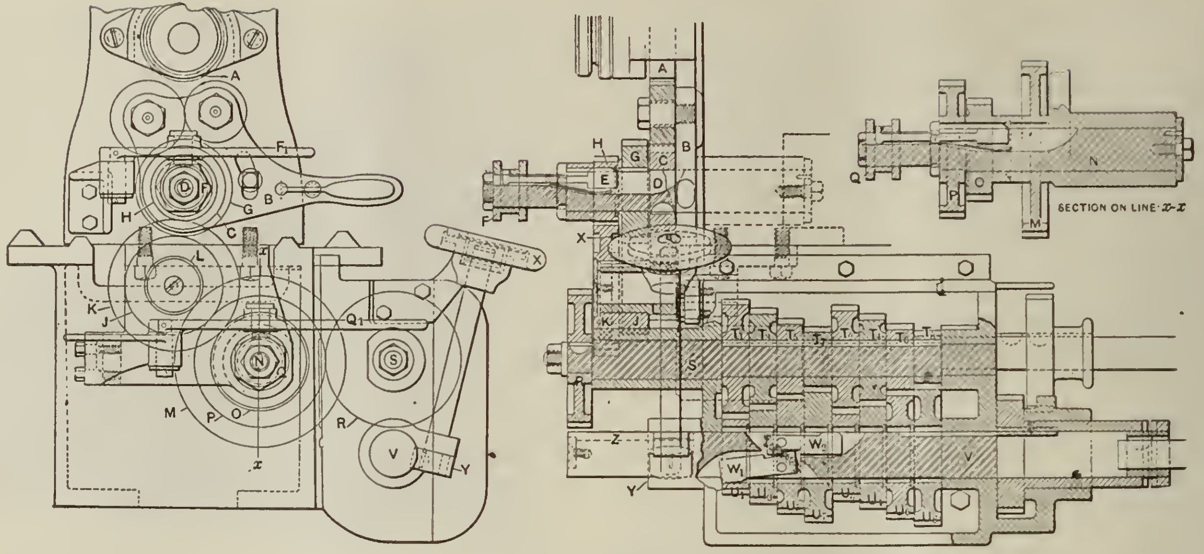


Fig. 4—Feed Change Mechanism; Double Sliding Key for Gear Box.

before the clutch is engaged is predetermined by the shape of the acting surfaces of the lever and cam, as there is no possibility of the parts ever slipping for more than the merest fraction of a revolution. This durability of the wearing surfaces is enhanced by the method of mounting rings Q_1, etc., which are provided with circular tongues at *a*, entering corresponding grooves in members D_1, etc. In their open positions, these tongues fit closely the small diameter of the grooves, thus centering the rings in members F_1, etc., and holding them entirely free from these members, so that there is no rubbing of parts not in action. When the rings are spread open to engage their respective members, the free fit on the outside diameter of tongue *a* permits them to engage freely and without restraint.

Spline *V* carries four cams U_1, U_2, etc., which engage corresponding arms S_1, etc. In the position shown, a movement of spline *V* to the left will bring U_1 out from under lever S_1, allowing it to drop and thus, releasing the clutch. Continued movement brings cam U_3 under lever S_3, thus engaging this clutch. A further movement to the left carries U_3 beyond S_3 and engages U_2 with S_2. The position farthest toward the left brings U_4 and S_4 in engagement. In the reversed motion, the same sequence is gone through in reverse order. This movement of spline *V* is effected by its connection at the left-hand end with sliding rod *W*, which passes through shaft *E*. This rod has pinion teeth cut on its extreme right end, engaging a pinion on stud *X*, which is in turn connected by gearing with the crank shown at the front of the main bearing of the headstock in Fig. 1. The four positions of the spline and the four corresponding speeds are indicated by the dial pointer shown Clutches N_1 and N_2 are identical in principle with clutches G_1, G_2, etc., though they differ slightly in construction, as shown in the lower face view at the right of Fig. 3. In these clutches cams U_1, etc., are replaced by pins Y_1 and Y_2, which engage levers Z_4 and Z_2. These pins are fast in the sliding collar Z_3 which is shifted by means of the vertical lever shown at the front of the head-stock in Fig. 1. Owing to the comparatively slow motion of gear *L*, two pins, Y_1 are provided, while but one pin Y_2 is used. This insures rapid action in the clutch even at slow speeds.

A detail in the construction of the head may be noticed at *I*; this is a spring plunger which may be pressed into engagement with corresponding notches in the face of member O_1 which is keyed to the spindle. It is thus possible to lock the spindle for unscrewing chucks, faceplates, etc., from the nose.

Provision is made in this lathe for thirty-two changes of feed for turning or threading, without removing or changing the gearing. Figs. 2 and 4 show how this is effected. The feed driving gear *A* on the spindle is connected through the usual reversing tumbler gearing on sector *B*. Gear *C* is keyed to shaft *D*; this shaft is slotted for sliding key *E*, operated through collar *F* by horizontal lever F_1. Key *E* may be set to drive either of gears *G* and *H*; these are separated by the hardened internal collar shown, which withdraws the key from one before it engages with the other. Gears *G* and *H* mesh with the corresponding gears *J* and *K* keyed to the hub of pinion *L*, which thus may be given either of two rates of speed. *L* and *K* engage gears *M* and *O* on shaft *N* (seen best in detail at the upper right-hand of Fig. 4) through a sliding key arrangement exactly similar to that in the shaft *D*. Either of gears *O* and *M* may be engaged to *N* by the shifting of collar *Q*, and the horizontal handle Q_1 attached to it. Shaft *N* thus has four rates of speed, which are transmitted through gears *P* and *R* to shaft *S*, in the feed box proper.

This feed box is of the sliding key variety, but differs radically from the usual type in the details of its construction. The reason for this will be apparent in the line drawing, Fig. 4. Gears T_1, T_2 T_3, etc., are keyed to shaft *S*, which, as explained, can be connected with the spindle in four different ratios. These gears mesh with mating gears U_1, U_2, U_3, etc., on sliding shaft *V*. These gears are engaged with *V*, in turn, by keys W_1 and W_2, which are pivoted to *V*, and are connected with each other by the spring and interlocking surface shown, so that when one moves into engagement the other drops out, and vice versa. This alternate movement in and out of engagement is effected by the hardened washers placed between each of the gears. As *V* in Fig. 4 is shifted to the right, the washer between U_2 and U_1 throws key W_1 out of engagement and puts a tension on the spring connecting W_1 and W_2, so that the latter is thrown into engagement with the spline in gear U_2, as soon as it comes into position to do so. A further movement of *V* disengages W_2 and throws W_1 into engagement with U_3. The order of engagement as *V* is shifted to the right is thus, U_1, U_2, U_3, U_4, etc.

V is shifted by means of a sleeve Z attached to its outer end, which has rack teeth cut in it meshing with pinion *Y*, at the lower end of the vertical rock shaft shown in Figs. 2 and 4. This shaft has a handle or knob *X*, and carries a dial with figures corresponding with the pair of gears engaged. Referring to the feed and thread plate at the front of the head-stock, the operator may find the number of threads per inch given by each of these eight positions, in combination with the four changes effected by the horizontal levers. The feeds are five times as fine as the threads.

The advantages of this form of gear box lie in the short axial movement required for the sliding keys, and the correspondingly compact arrangement of the controlling mechanism for the eight changes. Owing to the fact that when one of the

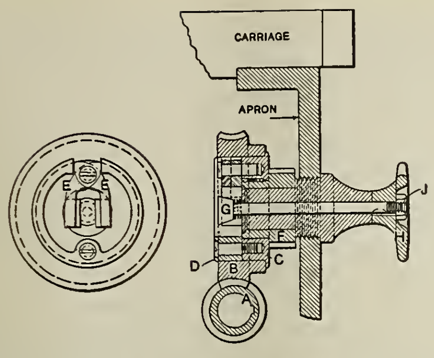


Fig. 5—Adjustable Friction Drive for Apron Feeds.

keys is in engagement the other is withdrawn, there is little wear on the hardened washers separating the gears. A much better selection of threads has been provided in this box than usual owing to the fact that the gears have not been limited to even pitches. Where it was necessary in the gear box, in obtaining a desired ratio, to employ fractional pitches, this has been done without hesitation, so that the pitches of different gears vary, though they are most of them about nine diametral. Each of gears U_1 and U_2 has six splines in its bore, so that they engage quickly. Provision is made for disconnecting either the feed rod or the lead-screw from the feeding mechanism, by means of the sliding gear and sliding clutch shown at the right of Fig. 4.

The details of the carriage construction follow the standard practice of the builders in most particulars. There are, however, two point of improvement which are worth mentioning. One of them relates to the friction drive for the feed. This is shown in section and plan in Fig. 5. The worm *A*, keyed to the feed rod, engages a worm wheel B, which normally revolves loosely on clutch body *C*. Split friction ring *D*, pinned to *C*, may be spread apart by the double levers *E*, so that the worm wheel drives *C* and the pinion *F*, to which, in turn, *C* is pinned. Levers *E* are spread apart by turning bolt *G* so that the circular portion of its head, instead of the flat portion, is brought around between the ends of the levers. Bolt *G* is turned by knob *H* on the outside of the carriage. The improvement in its construction lies particularly in the method of adjusting the clutch from the outside. This is done by nut *J*, which draws in bolt *G* against the pressure of the spring under its head. Owing to the conical shape of the round portion of the head of *G*, the axial movement operates to spread the levers further part, and thus adjustment is made for wear.

Another improvement in the construction of the carriage relates to a threading device which has been provided. This is shown in Fig. 6. The principle of the arrangement is the same as that employed on other makes of lathes for indicating the points at which to throw in the half-nut to "catch the thread" when running the carriage back by hand for a new cut in threading. Wormwheel *K* meshes with the lead-screw and is always in engagement with it. This is connected by gearing in the ratio of 2 to 1 with the vertical shaft *L*, which carries at its upper end a revolving dial having graduations indicated by a stationary pointer. The improvement consists in providing three concentric circles for these graduations, one for even pitches, one for odd pitches, and a third for half pitches. This provision makes it possible to catch the thread much quicker on even pitches than would otherwise be the case, while the cutting of half pitches is provided for. This is not usually done. The pointer is moved toward or away from the center to agree with the circle of graduations it is desired to read. It is evident from the dial that the wormwheel *K* has a pitch circumference of 4 inches.

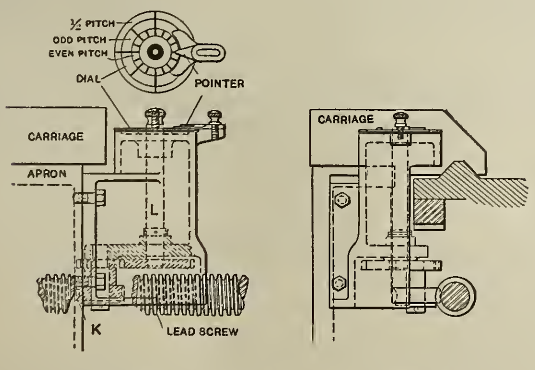


Fig. 6—Screw Cutting Dial for Throwing in Split Nut.

The tail-stock clamping arrangement, shown in Fig. 7, is original with this lathe. The tail-stock is clamped to the bed at the four corners by means of hand-wheel *N*. This is keyed to the threaded stud *O*, which may thus be screwed down against the hardened plate bearing in lever *P*. This latter is fulcrumed at *a* against the under side of the tailstock, and has a spherical boss at b, which bears against a hardened plate on clamping lever *Q*. This latter is hung from spherically seated nuts on studs *R*, which form a fulcrum for it. The outside ends at *c* bear on the under side of the ways of the bed, clamping the tail-stock at the front end. Pressure is also transmitted from lever *P* through lever *Q* to the outer end of lever *S*, which in a similar way through similar bearing points *d*, clamps the rear end of the tail-stock. Springs near bearing points *c* and *d* throw the clamping surfaces out of engagement when hand-wheel *N* is screwed back to relieve the pressure. The advantages of this arrangement lie in the very firm clamping which can be obtained, and in the handiness of the operation, it being necessary to make but one movement to clamp the tail-stock. Ordinarily there are at least two, and sometimes four nuts to be tightened. The workman is often careless about this, tightening only one. With this arrangement, the clamping action is simultaneous at the four corners with but one movement. Of course in adjusting the tail-stock, it is necessary to so set the nuts or studs *R* that the clamping action is evenly distributed.

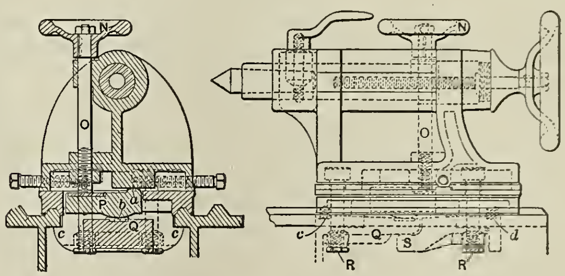


Fig. 7—Tail Stock, Method of Clamping.

Among the advantages of this lathe is that common to all lathes of the single pulley constant speed type, namely, that of delivering the same horse-power through all the changes of spindle speeds. In addition, this lathe never has to be slowed down to make any change in speeds or feeds, all of which may be effected by an unskilled operator, at full speed, or under the heaviest cuts. All the gearing in the head runs in oil, and it has been found to require no attention after many months of continuous operation, and then the only requirement was that of refilling with oil. The construction will thus be seen to possess marked advantages from the standpoints of both operation and maintenance. We are indebted to the Whitcomb-Blaisdell Machine Tool Company for a copy of the data given in Machinery and the photographs of the machine.

Kokomo, Marion & Western Traction Company

AS an illustration of what may be accomplished in building up an existing electric railway, lighting and power distributing system, and at the same time strengthening the industrial position of an entire community, the management of the Kokomo, Marion & Western Traction Company furnishes one of the most striking and instructive examples to be met with anywhere in the country. At the time ownership of the system was assumed by the interests now in control, less than four years ago, there was a small street railway and electric lighting plant, having no greater output than 500 kw., a few miles of trackage wholly within the city of Kokomo, and circuits containing several hundred arc and incandescent lamps. Today 22,000 incandescent and 395 arc lamps in and about Kokomo are supplied with electric current and more than one-half of the company's customers have various electric household devices; factories in the vicinity take upwards of 1,000 hp. daily in current for operating motors; the street railway system has been extended to a trackage of ten miles, and a finely equipped interurban line of 28 miles in length extends from Kokomo, a city of about 18,000 inhabitants, to Marion, having a population of 26,000, through several large towns situated in a rich, closely tilled agricultural country. Further extensions are projected to Terre Haute and Lafayette on the west, distant respectively 130 and 79 miles from the eastern terminus of the road. Among the principal places on the line now in operation are Greentown and Swayzee, each of about 2,000 people; Sycamore, Sims, Herbst and Roseberg.

NEW STEAM TURBINE POWER PLANT

Among outward signs of progress, however, the most prominent is the development of the new power station, which has recently been equipped with two Allis-Chalmers steam turbines and generators having an aggregate normal capacity of 2,000 kw. and delivering two-phase, 60-cycle current at a terminal pressure of 2,300 volts. The first of these machines, put in operation February 21, 1907, was found so satisfactory that a second unit of identical construction was ordered, the latter being placed on the line December 7th of the same year. The units will be described at some length farther along in this article, but, in order to obtain a comprehensive view of the entire equipment and operation of the road we will begin with the unloading of fuel from which the electric energy is primarily derived and follow the course taken by this power from the time it is first transformed in the furnaces until it has reached the end of its period of service.

COAL HANDLING SYSTEM

Coal, consisting of a comparatively low grade of Indiana screenings, is brought in on a spur from the Lake Erie & Western Railway and unloaded through a trestle extending the entire length of the firing room, so that it is heaped up in front of iron doors opening upon the several furnaces. From these piles it is shoveled directly into the furnaces, which are so arranged as to obtain a relatively high heat value from the fuel—with the exercise of good management. Removal of ashes is accomplished by an inexpensive device. Instead of the customary ash-pit with track and cars, there has been installed a tunnel and screw conveyor through which the ashes are constantly transferred to a pit outside the building. There, by means of a bucket elevator and inclined conveyor, the material is discharged to storage bins at one side of the building and unloaded into cars, which take it to points along the line where it can be used as ballast.

BOILER AND STACKS

The boiler equipment, set on concrete foundations reaching to bed rock, consists of three batteries, two of which include four Stirling boilers, each having a capacity of 235 h.p., and the third comprising one Atlas water-tube boiler with a capacity of 400 h.p. Two of the Stirling boilers discharge into one stack 6 ft. x 80 ft., constructed entirely of steel, and the remaining two, with the Atlas boiler, into a stack 6 ft. x 125 ft., also of steel. The shorter of these stacks is equipped with an engine driven blower, made by the Sturtevant Company, by means of which enough draft can be induced to give large temporary overload capacity to the two boilers with which it is connected. The boiler room has ventilators at the top and is very commodious, with room for considerable additional capacity.

STEAM HEADER AND PIPING

A main steam header 12 ins. in diameter, located above the pump compartment in the steam turbine room, is in the form of a loop, from which each turbine unit it fed by a 7-in. pipe. Gate valves are placed between each battery of boilers and between each turbine inlet, these valves being of the Crane type with rising stems. There is also a 4½-in. auxiliaray header. A proper arrangement of valves enables any part of the plant to be supplied from any boiler at will. All of the piping is made as short and direct as possible and heat insulation is provided in the shape of heavy covering of the pattern furnished by the Johns-Manville Company. Long bends to provide for expansion, have, of course, been used wherever necessary, and the system includes Cochrane steam separators.

FEED WATER HEATER AND PUMPS

The condensers and all of the other auxiliaries exhaust into a Cochrane heater (with Sorge water purifier) where a temperature of from 200° to 212° F.—never less than 200°—is constantly maintained. Water may be drawn from either the condenser suction or discharge pipes, from a deep well or from the city mains, and discharged into an elevated tank which feeds by gravity into the heater and from there by gravity into the boiler feed pumps; or the water may be by-passed directly to the boiler.

Two Worthington pumps are used for supplying the tank over the heater and two Dean pumps for boiler feed. Either one of any of these two is, however, of sufficient capacity to take care of the water system of the entire plant. The former are now being displaced by a centrifugal pump with 2½-in. discharge, driven by an induction motor supplied with current directly from the main generator busses through a step-down transformer; but the steam pumps will be held in reserve.

WATER SUPPLY

Water for condensation and boiler feed is taken from a creek, about 350 ft. distant, through a 16-in. cast iron pipe, and discharged back to the stream through 20-in. tile. The water is drawn from a concrete basin in the creek, 7 ft. square inside and extending 6 ft. below low water mark, with walls extending to high water mark and a gate on the down stream side where the water enters. This gate can readily be closed down tight, when desired, and the water exhausted by pumps in the power plant, so as to facilitate cleaning the basin of sand and mud.

STEAM TURBINES

The turbine operating floor is 5½ ft. above the boiler and pump room floor, 11 ft. above the basement floor and 30 ft. below the roof trusses, the foundation of each generating unit being kept entirely separate from the steel frame of the concrete flooring. Overhead is a 10-ton crane, hand operated.

In this room are placed two horizontal steam turbines and generators, of 1,000 kw. capacity each, a 330 kw. engine driven alternator operated in parallel with them, the exciters for these units, and sub-station apparatus, transformers, switchboard, etc., as later described.

Incorporated in these turbines are the various patented features controlled by their builders, Allis-Chalmers, among which may be mentioned channel-shaped shrouds protecting the ends of the blading from injury; machine cut slots in the foundation rings insuring accurate spacing of the blades; a method of fastening the latter which effectually prevents them from working loose, and improved balance pistons. Other details of special interest will be mentioned briefly under the subjects to which they belong.

The turbines operate at 1,800 revolutions per minute, with a steam pressure of 140 lbs. at the throttle, dry saturated, and a vacuum of 28" of mercury referred to 30" barometer at the exhaust nozzle. Large temporary overload capacity has been provided for in the design of these machines; high efficiency is maintained, and close regulation secured, even under the most unfavorable operating conditions, as a result both of good design and efficient station management. They are frequently run six weeks at a time without taking the load off and then only to make inspection.

BEDPLATE

The bedplate is divided into two parts, one carrying the low-pressure end of the turbines and the bearings of the generator, and the other the high-pressure end of the turbine. The turbine is secured to the former, while the latter is provided with guides which permit the turbine to slide back and forth with differences of expansion caused by varying temperature, at the same time maintaining the alignment. This arrangement permits of the utilization of the entire space between the foundation piers and below the turbine, for the condensing appartus. A grating is provided in the engine room floor directly over the condenser pumps and engines, so that operators above and below can watch each other's movements and signals, and the auxiliary engines can be watched from above.

CONDENSERS

The condensers for the steam turbines are of the jet type built by Allis-Chalmers Company, each capable of giving the best possible service when its unit is operating at full rated load. Cyclodial air pumps, direct-connected to enclosed, self-oiling, high-speed engines, and duplex, double-acting circulating pumps are installed with this apparatus, as is also a third condenser to take the exhaust from the re mainder of the plant.

GOVERNING MECHANISM

The speed of each turbine is regulated within close limits by a governor driven from the shaft through cut gears working in oil bath. This governor, by means of a relay, operates a balanced throttle valve. The entire mechanism is so proportioned as to respond at once to variation of load, but its sensitiveness is kept within such bounds as to secure the best results in the parallel operation of the two turbo-generators in this station. The governors can be adjusted for speed while the turbines are running, thereby facilitating the synchronizing of the alternators and dividing the load as may be desired. In order to provide for any possible accidental derangement of the main governing mechanism, there is an entirely separate safety or over-speed governor. This governor is driven directly by the turbine shaft without the intervention of gearing, and is so arranged and adjusted that if the turbine should reach a predetermined speed above that for which the main governor is set, the safety governor will come into action and trip a valve, shutting off the steam and stopping the turbine.

BEARINGS

The bearings are of the self-adjusting, ball and socket pattern, especially designed for high speed. Shims are provided for proper alignment. The lubrication of the four bearings, two for the turbine and two for the generator, is effected by supplying an abundance of oil to the middle of each bearing by means of a small cycloidal pump driven from the turbine shaft, and allowing it to flow out at the ends. The oil is passed through a tubular cooler with water circulation, and pumped back to the bearings.

It is not necessary to supply the bearings with oil under pressure, but only at a head sufficient to enable it to run to and through the bearings, this head never exceeding a few feet. The oil cooling system is taken care of by two induction motor driven centrifugal pumps, supplied by Thomas & Smith, of Chicago, and the American Well Works, and the gland water for the turbines is also supplied by two centrifugal pumps purchased from the former company, propelled by direct current motors taking their power from the exciter circuits. No oil of any kind is used in the interior of the Allis-Chalmers steam turbines, nor in the glands through which their shafts pass. Low oil alarms have been provided for the turbines.

The hot parts of each turbine, up to the exhaust chamber, are covered with an ample thickness of non-conducting material and lagged with planished steel, so applied that it may be easily removed. The nonconducting covering is also removable at the cylinder joint to facilitate the opening of the turbine for examination.

Between the turbine and its generator a special type of flexible coupling is used to provide for any slight inequality in the wear of the bearings, to permit axial adjustment of the turbine spindle, and to allow for differences in expansion. This coupling is so made that it can be readily disconnected for the removal of the turbine spindle or of the revolving field of the generator. Provision is made for ample lubrication of the adjoining faces of the coupling.

TURBO-GENERATORS

The revolving field alternators driven by these turbines are of Allis-Chalmers Company's standard type, designed for high efficiency and safe operation at high peripheral speeds. Some of the principal advantages embodied in their construction are summarized as follows:

The field core is built up of steel discs, each in one piece, giving high magnetic permeability and great strength. Coils are placed in radial slots, thereby avoiding side pressure on slot insulation and the complex stresses resulting from centrifugal force, which, in these rotors, acts normal to the flat surface of the strip windings. Bronze wedges hold the coils firmly in the slots, making the surface of the rotor a smooth cylinder, reducing windage losses and insuring quiet operation; and the end connections are securely held by chrome-nickel steel rings.

The stator is completely inclosed, eliminating noise of operation. Coils were completely wound and insulated before being placed on the core, thus obviating the coils readily removable. End conections are firmly braced, preventing deformation of coils in case of short-circuit.

For the purpose of obtaining adequate ventilation and for muffling the noise produced by the circulation of the air, the turbo-generators are enclosed in such a manner that the air is taken in at the sides through fans mounted on the rotor shaft which discharge it over the end connections of the armature coils into the bottom of the machine, whence it passes through the ventilating ducts of the core to an opening at the top. This system of ventilation is most efficient.

EXCITERS

Excitation of the two turbo-generators is accomplished by means of exciters of 35 kw. and 30 kw., the former being driven by an Allis-Chalmers induction motor and the latter by an Erie Ball engine. The engine-driven unit has a 5 kw. belted exciter, turbo-generator excitation at full load is at 120 volts, 160 amperes. The exciters do not take care of the station lighting. Current for this is derived directly from the main bus-bars, or from a storage battery.

STATION LOAD

As above intimated, the character of the load put upon this station is railway, lighting and power combined. At present there is a normal consumption of current somewhat under the rated capacity of the turbines, so that one can be held constantly in reserve, and this drops to a minimum, during the early morning hours, of about 300 kw.

A feature to be particularly commended is the thorough keeping of station records and the frequent checking of efficiencies of different parts of the plant. On the company's log sheet the daily load curve is plotted, thereby enabling it to be easily comprehended, for the 24 hours, at a glance. All costs and station performances are also recorded on the daily log. In addition to this records are kept in the office of the outside distributing circuits, and two Wright demand meters are constantly used to check the loads on lighting and power transformers over the town.

Alternating current is generated at two-phase, 2,300 volts, and transformed to three-phase, 11,000 volts for transmission over the line of the interurban railway. In the main station there are used for this purpose three 150 kw. oil-filled, self-cooled transformers, Scott connected, and in the sub-station (17 miles distant) there are three 150 kw. step-down transformers delta connected. These transformers have 1½-in. outlet pipes run directly through the floor, so that in case of fire oil can be emptied into barrels in the basement where the oil supplied is stored.

Direct-current for the city railway system and ten miles of the interurban line, is supplied through motor generator sets in the main station, delivering power at an operating pressure of 600 volts; and the sub-station at Swayzee, 18 miles east of Kokomo, contains three rotary converters for the purpose of transforming the alternating to direct current. One of these, having a capacity of 200 kw., is equipped with an induction starting motor, and two of 75 kw., each are started through a storage battery from the D. C. end.

DISTRIBUTION OF CURRENT

Current from the main generator bus-bars passes to the out-going lines through double-throw switches, ammeters, wattmeters and fuses, all such circuits being also put through integrating wattmeters. 300,000 circular mil cable is used, with high-voltage rubber insulation. The wiring from the generators to the switchboard is open work, fastened to the under side of the engine-room floor. The bus-bar system is in duplicate. Any machine or any feeder can be operated off of any set of busses. The switchboard rests on insulated stringers.

SWITCHBOARD

Each of the panels for the turbo-generators has instruments mounted upon it as follows:

Two Westinghouse ammeters,
One Westinghouse power factor indicator,
One Westinghouse volt-meter,
One Westinghouse indicating wattmeter.
One Westinghouse polyphase integrating wattmeter,
Two 4-pole single throw oil switches for main generator current,
One Cutler-Hammer rheostat located beneath the floor and driven by chain and sprocket,
One field knife switch with discharge rheostat synchronizing plug and receptacle and volt-meter plug and receptacle.

There is also a Westinghouse synchroncope on a swinging bracket at the end of the switchboard.

The exciter switch panel for the turbines has
Two direct-current Weston ammeters,
One direct-current Weston voltmeter,
Two Cutler-Hammer rheostats,
Two single-pole knife switches,
Four 4-pole double-throw Westinghouse oil switches.

The exciter panel for engine-driven unit consists of the following apparatus:
Two Stanley ammeters,
One Stanley voltmeter so arranged as to switch it on to pressure tap showing voltage at center of distribution uptown,
Two double-pole knife switches,
Wirt rheostat.

One panel for the engine-driven unit is equipped with Stanley instruments and double-throw switches.

One panel with Stanley instruments and switches controls four feeder circuits.

One panel controls one feeder circuit with room for an additional circuit. This has Westinghouse four-pole double-throw oil switches and G. E. wattmeters.

One panel controls four street arc light circuits on the Western Electric system.

The railway board consists of two panels, each controlling a 216 h.p. motor, and two panels each controlling the railway generators driven by these motors in the power plant sub-station. One panel contains the starting devices and a rheostat for these machines. There are also two feeder panels, one feeding the interurban line and the other on the city line. This railway board is equipped with Westinghouse apparatus except for a few General Electric wattmeters and two Stanley phase indicators.

Two panels control a storage battery and differential booster.

In the sub-station, at Swayzee there is a switchboard consisting of nine panels, viz., three alternating current and three direct-current for controlling the rotaries, one feeder panel and two storage battery panels.

STORAGE BATTERIES

In a separate building, located about 60 ft. from the main generating station, is a battery installation supplied by the Electric Storage Battery Company, which has a capacity of 480 ampere-hours and consists of 288 chloride accumulator cells. A smaller storage battery, consisting of the same number of cells, but having a capacity of 320 ampere hours, is installed in the sub-station at Swayzee. The latter has glass cells and the former are of wood with lead lining. The function of these batteries is to eliminate load fluctuations on the rotaries so that their output will be constant. Regulating boosters are installed in conjunction with each battery, of such design as to automatically regulate the charge and discharge of the battery, causing it to discharge when the load is in excess of the average and charge at times when the load is less than the average.

LINES

Alternating current passes from the switchboard bus-bars through the transformers, as above mentioned, the Stick breakers are provided between tthe high tension sides of the transformers and the outgoing lines, which are led through high-voltage bushings protected by round glass plates set in tile.

The lines are equipped with Westinghouse low equivalent arresters and Westinghouse choke coils, to which ready access is had from the gallery. The lighting feeders have G. E. lightning arresters and choke coils manufactured at the station. On the direct-current railway system Garton lightning arresters are used, there being four of these to every mile. Wirt lightning arresters are provided at each transformer on the lighting circuit.

EQUIPMENT OF RAILWAY SYSTEM

The line of the interurban road is built with easy curves and a maximum grade of no more than two degrees, most of the track being laid on the level. The right-of-way is 40 ft. wide and owned entirely by the company. Seventy-lb. A. S. C. E. rail is used, joined by a six-bolt standard splice bars.

The bonds are of the Ohio Brass Company's manufacture and consist of 0000 compressed bonds and soldered bonds on the interurban line and 00 compressed bonds on the city tracks. Rails are cross-bonded every half mile with 0000 copper wire.

The road is ballasted with crushed stone and gravel six inches deep, underneath the ties, 1,000 cubic yards of stone and 300 cubic yards of gravel being used to the mile. The ties are of white oak. Side arm construction has been used for the entire course of the line, cedar poles being placed along ten miles of the interurban system, chestnut poles on the remaining eighteen eighteen miles and cedar and iron poles in the city. The brackets are 9 ft. with 1½-in. tubing by the Ohio Brass Company. The lightning arresters, four to a mile, are grounded by means of No. 4 copper wire and ¾-in. iron rods driven into the ground by the side of the pole and also connected to the rail. The wires consist of two 000 trolleys suspended by the Ohio Brass Company's type "D" hangers. The feeder wires are 300,000 and 500,000 circular mil copper line feeding on to the interurban wires ten miles from the power station. The feeder from the sub-station is stranded aluminum equivalent to 300,000 C. M. copper. Spans are 100 feet in length.

One bridge crosses the Wildcat Creek near Greentown and there are two overhead railway crossings and several small steel culverts. The high tension wires cross the bridges on timber projections at the sides of the bridge, the trolley wires being supported from stands fastened to the overhead steel work. At Marion the crossings which span the Pennsylvania and C. C. & L. Railways, are of the girder type.

The interurban cars operated on the road, at an average speed of 25 miles per hour, are of the Jewett Car Company's build, equipped with four 50 h.p. 93A motors, K-28 controller and straight air-brake apparatus. There are six passenger cars of this type, with one freight car and one work car. Cars are run on one-hour headway, only three being ordinarily in service at the same time. Inside they are fitted with every modern convenience including overhead bundle racks, Peter Smith hot water heaters, toilet rooms and lights of high candle-power. About two-fifths of the interurban car is devoted to a smoking compartment, having comfortable arm-chairs arranged along the sides, and the remainder has aisle seats nicely upholstered. Direct telephone connection can be opened at any time between the cars and the train dispatcher's office by a pole and hook connection operated in accordance with a Stromberg-Carlson system. The city cars, built by the Cincinnati Car Company, are twenty-two in number, each having two 40 h.p., 92A motors and K-10 controller. Some of them are equipped with air-brakes.

CAR BARN AND REPAIR SHOPS

In the city of Kokomo there is a car barn 150 ft. x 50 ft., with four tracks, and a pit underneath the entire length of one. The repair shop adjacent to this is 45x70 ft. and contains two tracks, one having a pit 60 ft. long beneath it and the other having a pit of sufficient size to be used in taking out a truck. This shop is equipped with a full line of machine tools and other apparatus used in repair work.

POWER STATION BUILDING

Everything connected with the physical equipment of the system has been very carefully looked after and one of the best evidences of this is the power house itself, which is a well-planned, well-built, fire-proof structure. The exterior walls are faced with standard pressed brick laid in ¾ English bond with headers in each fourth course, affording a thorough bond into the wall. All of the interior surfaces in the engine room which have not been enameled are faced with Kokomo pressed sand brick of buff color and the remaining brick work is of the ordinary kiln-run quality. Tile roofing covers the building.

The foundations above grade, are of the best Indiana cut building limestone and below grade of concrete resting on bedrock.

The floors are of concrete with smooth surface, the engine room floor being supported on steel beams and under each of the turbine units there is an independent concrete foundation to a depth of 13 ft. 6 ins., foundations for the exciters, condensers and other auxiliaries being correspondingly strong. All machinery foundations rest on bed rock.

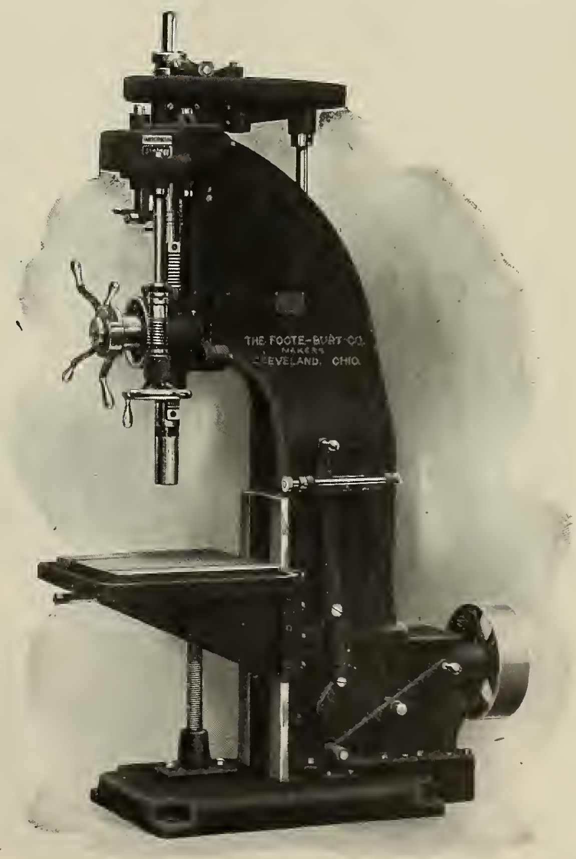
The steel trestle from which the coal cars are unloaded is 280 ft. long, 140 ft. of which is on the company's property. The steel work is built upon a concrete foundation and the frame is most substantially constructed.

High Duty Drill

THE high duty drill of 24-in. swing, shown herewith, has a capacity for high speed drills from ½ to 1¾ ins. in solid steel to their full cutting edge capacity. This machine is built by the Foote-Burt Company, Cleveland, Ohio. The machine is single belt driven with no shifting of belts required. All speed and feed changes are through quick change gear device. Levers for stopping and starting machine, and for changing feeds and speeds are all conveniently located, and within easy reach of the operator at all times. Spur gears are used throughout, except one pair of slow running two to one bevel gears at the driving end and one worm and worm gear for the feed.

The spindle is of forged high carbon steel, fitted with ball bearing thrust which is guaranteed not to crush under the most severe duty. Three changes of geared feed are provided; any one of which is instantly available by simply shifting a lever, conveniently located at front of machine. All feed changes can be made without the necessity of stopping the machine. Power feed is provided with adjustable automatic stop and hand stop. Hand feed is through worm and worm gearing, and quick traverse of spindle in either direction is accomplished through the spider hand wheel, located at front of machine, which, with either the in or out movement of any or all the handles, engages or disengages the same.

The table is of the bracket knee type, having a large square



High Duty Drill.

lock bearing surface on the upright, to which it is securely gibbed. It is further supported and elevated by a square thread jack screw, located underneath, slightly back of the center of spindle, to permit boring bars or other tools passing through the table. It is also provided with liberal oil groove and two T-slots.

The drive is a self-contained unit, neatly located in base of machine. The nine spindle speeds are through a double train of gearing, which is always in mesh and runs in a bath of oil. This device consists of a lock bolt engaging any one of three gears in each of the two trains, giving the nine speeds, any one of which is instantly available by shifting the levers, located at side of machine, to the different locations for different speeds as indicated by index furnished. One pair of two to one bevel gears are securely housed at the end of speed box, inside of column, which make the connection to the vertical driving shaft, and the distance between the vertical driving shaft gear and the spindle gear, being spanned by an idler spur gear, overcoming the necessity of but one pair of bevels in the construction of the entire machine.

A tapping attachment can be furnished when so desired, which consists of a positive steel clutch located on the idler gear at top of machine, obviating the necessity of driving and leading the spindle through the keyed member of the clutch. This attachment reverses at a ratio of two to one. The compound table is an extra attachment, consisting of an entirely new knee for this purpose. It has a longitudinal adjustment of 14 ins. and a cross adjustment of 8 ins. Top platten is fitted with two T-slots, running lengthwise; also with liberal oil groove, and has a working surface of 16½x30 ins. When compound table is furnished, the maximum distance from nose of spindle to top of table is decreased 5¾ ins.

New Air Compressors

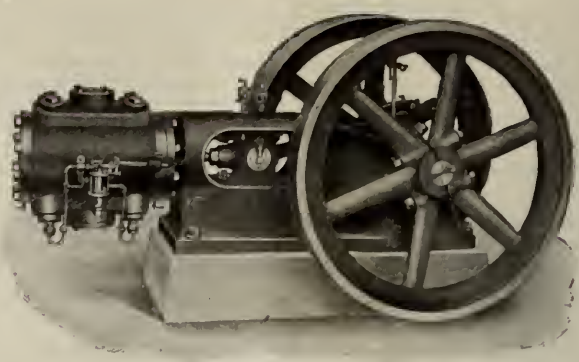
A LINE of air compressors, built by the Thos. H. Dallett Co., of Philadelphia, Pa., brings out new features in compressor design. These compressors are claimed to incorporate the essential features of having all parts requiring adjustment or renewals readily accessible, employing the best material and workmanship throughout, and using a liberal amount of metal, scientifically placed, to insure rigidity in operation.

The frame is of the open fork center crank type and is of an especially massive and rigid design to obtain on each size compressor a greater range of capacity by substituting, when desired, a cylinder of the next larger size than the standard to operate at 100 lbs. pressure. By way of example: on an 8-in. stroke compressor the regular cylinder for 100 lbs. pressure is 8 ins. in diameter, but a 10-in. diameter cylinder can be substituted and still operate at the above pressure, whereby a greater volume of air is obtained with but a slight increase in cost of machine.

The cross head guides are cylindrical and are bored at the same setting as the boring and facing of the end which receives the cylinder, insuring absolute alignment, this being flanged for bolting the cylinder to the frame, and the convenience in tightening the cylinder stud nuts, which are on the outside, will be appreciated by the users.

The main bearings are lined with a high grade babbitt metal, which is poured into dovetailed recesses and is piened in to obviate shrinkage, and then bored and scraped to fit the crank shaft. Lubrication is effected by means of sight feed devices, or by gravity or force feed system, as desired, and drains are provided for draining off all drippings from guides, stuffing boxes and crank pit.

The duplex belt, duplex steam and single steam machines are supported on a rigid and deep sub-base, thus making the entire machine self-contained, obviating any possibility of getting out of line, and insuring satisfactory operation on either a rough



Single Belt-Driven Compressor.

temporary foundation of timbers, or a permanent one of concrete or brick. An oil gutter is provided entirely around the lower base flange on all sub-bases. This is an excellent feature, as it insures a clean foundation and floor free from unsightly oil puddles and stains.

The steam cylinder and valve gear of the steam driven machines are examples of up-to-date steam engine practice, and are suited to the operation of compressors, giving high efficiency with slight attention. All steam ports are short and direct and of the proper area. The clearance has been reduced to a minimum, giving an appreciable saving in steam consumption. A plain D balanced slide valve is used on the small and medium sized machines, the Meyer balanced adjustable cut-off valve being employed on the larger machines. To provide efficient heat insulation, all steam cylinders are lagged with mineral wool and neatly jacketed with planished sheet steel.

The rocker arms on all valve gears are provided with means for adjustment, doing away with all wobbly movement and unnecessary lost motion.

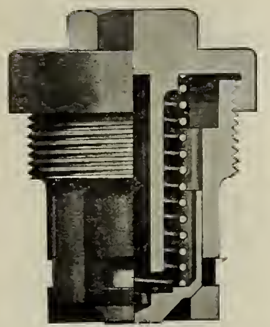
On every steam driven machine the governor is equipped with a safety stop device, which immediately stops the machine in case the governor belt should break.

The governor pulley is situated on the end of the shaft outside of the fly wheel on the single machine, thus bringing the fly wheel as close to the bearing as possible and also eliminating all possibility of oil or grease from the eccentric getting on the governor belt.

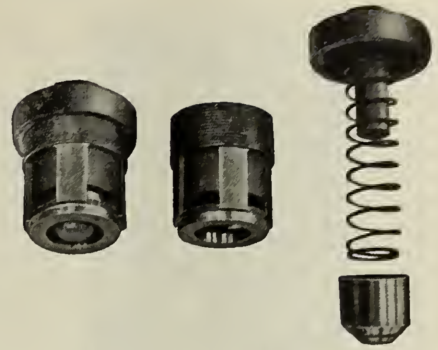
In the case of duplex compressors with compound steam cylinders, if the machine stops with the high pressure side on the dead center, which occurs frequently, it will not start automatically, this being due to the fact that but one side (the high pressure) takes steam from the line. This trouble has been overcome by using a reducing valve of standard make, which reduces the live steam pressure for use in the low pressure cylinder; thus if the high pressure side stops on the dead center, live steam is fed to the low pressure cylinder through the reducing valve, starting the compressor. It is obvious that steam from the boiler is taken into the low pressure side only when starting, otherwise the operation is identical with any compound machine.

The air and steam cylinders are tied together and held in position by means of an internally flanged tie or distance piece. On the smaller sizes this piece supports the air cylinder, but on the larger sizes the air cylinder is supported on a pedestal, while the tie piece is of circular design without the foot piece. Ample openings are provided on each side of the tie piece to allow adjustment of the stuffing boxes and tghtening the cylinder stud bolts.

The air cylinders are of a special hard close grained iron, and allowance is made for reboring if necessary. Suitable and efficient means are provided to obviate any chance of the air valves being drawn into the cylinder in case of breakage. Each cylinder is thoroughly tested before assembling under hydraulic pressure of 200 lbs., and all defective castings are eliminated.



Air Discharge Valve.



Parts of Air Discharge Valve.

The clearance space is reduced to a minimum, and all heads and cylinder walls are thoroughly water jacketed, thus obtaining the highest efficiency possible. Means are provided for draining the cylinder and cylinder head jackets of water, this being essential in cold weather. The lubricant is fed directly into the intake passage, allowing the suction to carry the oil into the cylinder in the form of a fine spray. This mode of lubrication has been thoroughly tried out and found to give efficient and equal lubrication of all working parts.

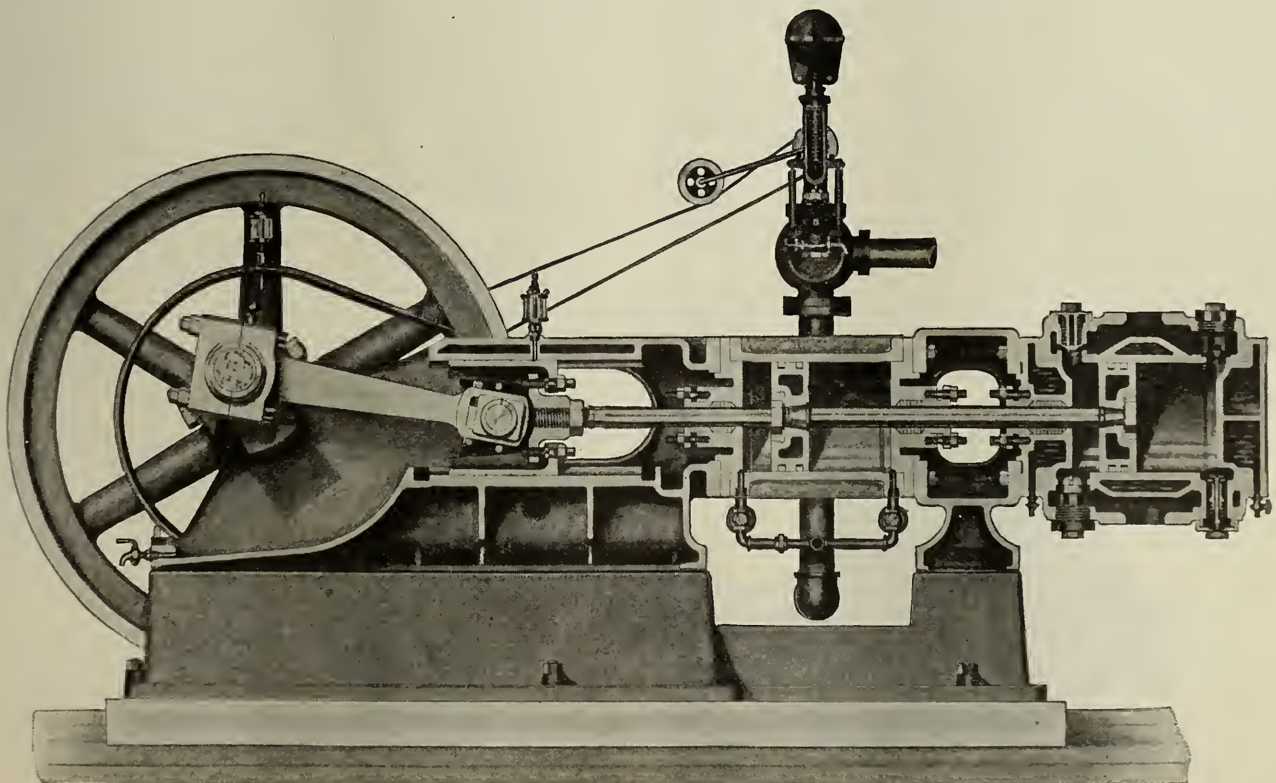
Mechanically operated inlet valves are supplied on any size compressor if desired. These valves are of high grade of work manship, ground no gauge and the valve holes lapped to size. Any of the "Dallett" standard low pressure compressors are suitable for vacuum service, and are furnished with mechanically cperated inlet valves for a high vacuum.

The piston rod on both belt and steam machines is designed to allow for re-turning in case of wear. In re-turning a rod, allowance has been made in size to leave the threads untouched, only necessitating the turning of the straight diameter of the rod.

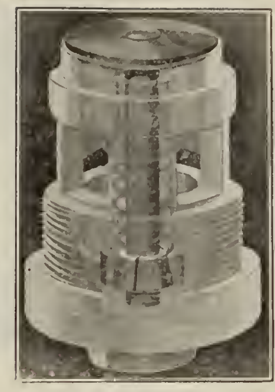
The cross head is a new type box pattern, made of semi-steel. Its shoes are adjustable and of large bearing surface. The upper shoe is lubricated by means of a sight feed lubricator, and the lower shoe runs continually in a bath of oil. One of the features of this design is the side openings, which allow easy access to the cross head shoe binder bolts. The cross head pin is tool steel, hardened and ground. It is fitted to tapered seats in the cross head, drawn tight on the tapers by means of a nut held in position by a pin. Means are provided for turning one-quarter revolution in case it wears flat on the two bearing sides, thus doubling the wearing capacity.

The air intake and discharge valves are special features of these compressors. The intake valve is of the automatic poppet type, contained in a malleable iron cage. The cage is one piece and combines both seat for the valve and guide for the valve stem. The cage is threaded and screws into the wall of the air intake chamber only, and is simply seated in a recess on the main bearing wall, using thin corrugated copper gaskets to secure a tight joint. A hexagonal recess has been cast in all cages to accommodate a special cast steel wrench for use in removing and replacing valve cages.

The valve cage cap acts as a lock nut for holding the cage in place after it has been screwed down on its seat in the cylinder. It is provided with a hexagonal projection and the same



Sectional Elevation of Single Steam Machine.



Air Inlet Valve.

wrench can be used here as on the valve cages. In the case of a compound machine, corrugated copper gaskets are placed under the valve caps on the high pressure cylinder to insure against any leakage, as the discharge pressure from the low pressure cylinder is constantly at these joints.

The valve proper is a special alloy hardened steel, with seat and stem ground to gauge. The valve spring is of phosphor-bronze and of the right proportion to give the valve an easy opening and a quick closure.

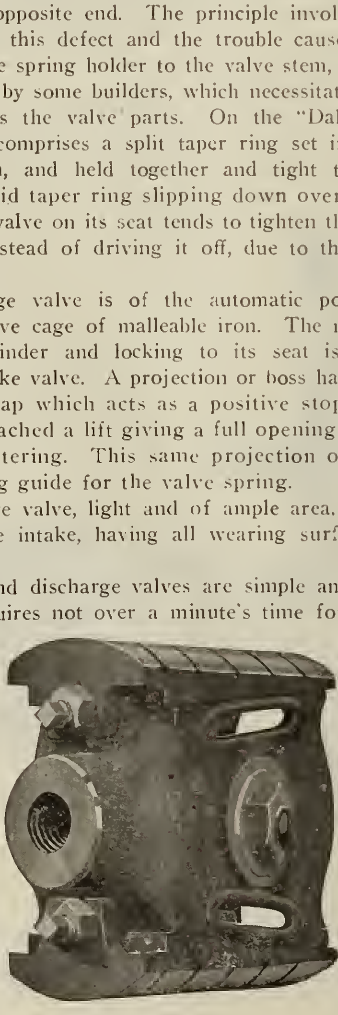
Much annoyance and trouble has been caused on certain makes of intake valves due to the spring holders shearing off or working loose. The cause of this trouble is due to the sudden stopping of the valve on its seat, which tends to drive the spring holder off the valve stem. This effect may be likened to driving a hammer on its handle by means of hitting the handle on its opposite end. The principle involved is identical.

To eliminate this defect and the trouble caused by threading and pinning the spring holder to the valve stem, solid ends have been employed by some builders, which necessitates a split guide and complicates the valve parts. On the "Dallett" valve, the spring holder comprises a split taper ring set into a recess on the valve stem, and held together and tight to the stem by means of a solid taper ring slipping down over it. The hammering of the valve on its seat tends to tighten the spring holder on the stem instead of driving it off, due to the action of the taper.

The discharge valve is of the automatic poppet type contained in a valve cage of malleable iron. The method of seating in the cylinder and locking to its seat is identical with that of the intake valve. A projection or boss has been provided on the valve cap which acts as a positive stop for the valve when it has reached a lift giving a full opening area, and does away with fluttering. This same projection on the cap also acts as a spring guide for the valve spring.

The discharge valve, light and of ample area, is of the same material as the intake, having all wearing surfaces ground to gauge.

Both inlet and discharge valves are simple and compact, and each valve requires not over a minute's time for removal com-



Cross Head.

Parts of Air Inlet Valve.

plete. This feature will be appreciated in case of repairs or overhauling.

The connecting rod is of the marine type and is to be depended upon for the most severe duty. It is made of crucible steel, and both crank pin and cross head boxes are made of phosphor bronze bearing metal. Adjustment is obtained at the cross head end by means of a wedge and split box. The crank pin end is adjusted by removable tin liners, and both bearing surfaces are of extremely liberal proportion, lubricated by wick wipers.

The crank shaft on both single and duplex machines is exceptionally massive, forged out of a solid billet of mild open hearth steel, carefully turned and polished. In the case of a duplex shaft, the portion in the center is enlarged to accommodate the heavy fly wheel.

The wheels on all machines are heavy and of large diameter, insuring smooth operation, and in the case of belt machines, the face is very wide. The fly wheels on the larger machines have square cored holes in the rim to facilitate turning over by hand.

The inter-cooler plays a very important part in economical operation of a two stage machine. The "Dallett" inter-cooler is of large cooling area, employing the return flow type of water circulation, using baffle plates to deflect the flow of air and aid in its effectual contact with the cooling tubes. This method is very efficient in reducing the temperature of air between stages to approximately the original temperature, thus tending to reduce the final or discharge temperature and also the horse power required for a given capacity. The nest of cooling tubes may be removed intact from the inter-cooler box without disturbing any of the piping, as unions are supplied to obviate this feature. The inter-cooler is supplied with pop safety valve, pressure gauge and drain valve.

In a compressed air plant the demand for air is often of such an intermittent character that automatic regulation of the supply of air in accordance with the demand becomes a necessity.

The belt driven machines are provided with an unloading device which automatically unloads the air cylinder. When a certain determined pressure is reached in the air receiver, one or more inlet valves at both ends of the air cylinder are held open, and the load is taken off the compressor, allowing it to run light until the pressure drops in the receiver, upon which the valves are released and air compression is resumed.

On the steam machines, a combined speed and pressure governor is used. This governor unloads the air cylinder exactly the same as on a belt driven machine, and at the same time it controls the speed, allowing a single steam machine to just turn over when unloaded, and bringing a duplex or compound machine to a dead stop. By this means a great saving in steam is effected and the wear and tear on the working parts, as in the case of continuous running machines is reduced.

A complete unloading equipment is furnished with all machines. The compressors described are built in sizes from 8-in. stroke up to and including 16-in. stroke, and give a range of capacity from 79 cu. ft. of free air per minute to 1,200 cu. ft. Special machines for any capacity, pressure or service, or any standard machine direct connected to motor, water wheel or gas engine, are built in addition to the standard line.

Armbrust Brake Shoe

The Love Brake Shoe Company, Fisher building, Chicago, manufactures the Armbrust brake shoe for locomotives, tenders, passenger and freight cars. These brake shoes involve certain principles, among which should be noted the following: First, scoring at the shoe's center causes any accidental breakage to occur at that immaterial point; second, spacing lugs cast on the back of the shoe to space the shoebody away from the brake head, enabling it to wear entirely out without danger of it wearing into the head, even should the shoe wear unevenly; third, a steel connector cast in the spacing lugs on the back of the shoe (not in the body of the shoe, which would weaken it). The latter feature is for the purpose of holding broken parts, should accidental breakage occur at any points other than at the center, firmly in place until worn out. The scoring of the shoe at the center, causing any breakage to occur at that immaterial point, permits the shoe to adjust itself to the tread of the wheel thereby giving better service on the tires and adding to the life of the shoe. This also enables the shoe to fit the brake head at the four points of contact, taking the strain off the shoe and throwing it onto the brake head where it properly belongs.

The body of the Armburst shoe, either car or driver, can be worn down to the steel connector. The scrap that remains amounts to about 3 lbs. in the car shoe and about 10 lbs. in the driver shoe. Aside from the above features in the driver shoe, it is pinned to the brake head the same as the car shoe, although where roads desire it can be constructed so as to bolt and hook on the brake head. On account of the former construction it is not necessary to have rights and lefts and, therefore, the road does not need to carry so much stock; also, as there are no rights and lefts to the shoe; when worn more on one end than on the other it can be turned as is the practice in car shoes.

Lang Tool Holder

THE tool holder, shown herewith, is a 2-in. by 3-in. by 16-in. inserted toolholder designed especially to turn locomotive tires. It is constructed to obtain the rigidity, backing and radiating surface of a solid tool. It is not a competitor of other holders on "all-around" work, but is in a class by itself for removing metal on plain work in the lathe, vertical mill or planer. It will take a cut on a pair of 72-in. worn locomotive drivers of 1/4-in. feed by 5/8-in. depth cut at a speed of from 10 to 15 ft. per minute. This is the cut that snaps 1½-in. by 3-in. solid tools off like pipe stems.

The method of holding these cutters is well adapted for forming-tools and these are furnished machined to any shape. The regular cutters furnished are drop-forged, of high speed steel; the points are air-hardened and ground ready for use. The cutters are 7 ins. long and 2 ins. across flat and are set in the holder at 10 degrees front and side clearance. This allows grinding on face as well as top, as 7 degrees is the proper clearance. The face of cutter need only be ground a short distance down from top. If the cutter were set in at the proper angle it would necessitate grinding entirely off the top, which would use up the cutter about twice as fast. Cutters can be used up to less than 3 inches in length. There is no loss through repeated forging. Two cutters will do as much actual turning before being used up as a solid tool 1½ ins. by 3 ins. by 24 ins., weighing 30 lbs. In addition to the saving in steel and forging, they save time in grinding. To remove cutter for grinding or to adjust it up another notch, it is not necessary to remove the bolt from the holder. Simply loosen the nut and turn the bolt head one-fourth revolution and cutter can be slipped up or out or put back with the same operations.

The holder is made of steel of over 100,000 pounds tensile strength and oil hardened and is made right and left hand (right hand feeds towards head-stock of lathe). This holder is made by the G. R. Lang Company, Meadville, Pa.

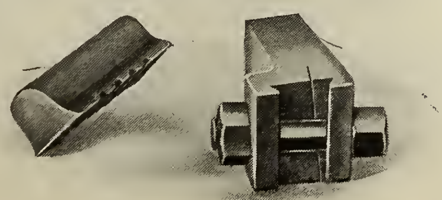
The points can be made in the shops, if desired, and it is therefore possible to use up old short pieces of high speed steel. These points are very easily forged under the steam hammer, using a form which is easily made or secured from the company.

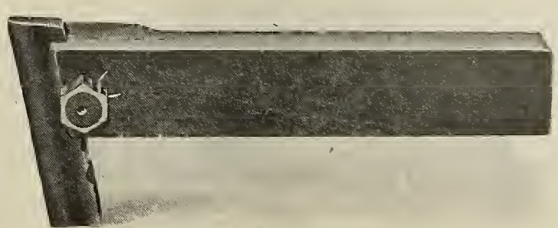
The forming cutters mentioned above are especially useful in forming both sides to the flange. Annealed cutter points, which can be planed up to the standard gauge, are obtainable. By grinding them entirely on the top, the true radius can be maintained until the point is entirely worn away. In roughing the tread the turning point can be fed right up into the flange as the point projects far enough out from the holder to allow the latter to clear flange on the deepest cuts.

The Safety-Appliance Law

This law is directed, as its name implies, to the equipment with and maintenance of certain mechanical appurtenances to rolling stock employed in the transportation of interstate commerce. These appliances are couplers coupling automatically by impact and capable of being uncoupled without the necessity of men going between the ends of the cars; secure grab-irons or hand-holds; and power air-brake systems by which the speed of trains can be regulated from the cab of the locomotive. The object of the act, primarily, is the protection of life and limb of railroad employes, but their safety is so intimately associated with the welfare of the traveling public that Congress indirectly had in mind the safeguarding of passengers no less than that of railroad operatives. The duties of such employes necessarily involve them in constant peril. The personnel of the American railroad employes, both numerically and from the viewpoint of individual character, constitutes a magnificent portion of American citizenship. It would seem, therefore, that their well-being is a subject no less worthy of judicial consideration and conservation than the property rights of their employers.

The railroads, however, are inclined to lay much stress upon the sanctity of property interests. They contend that the safety-appliance act is penal in its nature and that it should, for that reason, be strictly construed. They seek to justify their violations of the law by pleading ignorance as to the condition of their equipment or want of intention on their part to disobey the statute. It is, on the other hand, the understanding of the Commission that the law should be so liberally, or at any rate so reasonably, construed as to carry out the objects for which it was enacted. And it is their belief that these objects can be effected only by hold-





Lang Tool Holders.

Metallic Sheathing.

ing the carriers subject to the act to a strict accountability for their violations of its provisions. Such a requirement is entirely in keeping with the dictates of justice. It is far better that a penalty, even though it may seem harsh, should be assessed against a carrier than that countenance should be given to a construction of the act in accordance with which the railroads may become careless in respect to the safety of their employes and of the traveling public.

As stated in previous reports of the Commission, considerable difficulty was encountered in executing the safety-appliance law as originally enacted. This was due in part to the fact that the law was applicable, apparently, only to cars or equipment loaded with or hauling interstate commerce. In order to prove that a car in a particular instance was loaded with or engaged in interstate commerce, it was necessary to produce the railroad waybills and memoranda covering the shipment in question. Without these documents it was frequently impossible to determine whether or not there had been a violation of the law. This situation was materially improved by the amendment to the original act, by which it is made applicable to every railroad failing to equip and maintain in accordance with and carrying interstate commerce, but also such of its equipment as may be engaged in the movement of intrastate traffic, provided such equipment is being used in connection with cars engaged in interstate commerce. In other words, the law as amended comprehends: (1) All cars and equipment actually used in the transportation of interstate commerce. (2) All cars and equipment used in connection with cars or equipment engaged in the transportation of interstate commerce. (3) All cars and equipment hauled by a carrier engaged in interstate commerce.—From annual report of the Interstate Commerce Commission.

Metallic Sheathing

THE accompanying illustration shows metallic sheathing on a Santa Fe observation car. This sheathing, which is a specialty of the General Railway Supply Company, can be used advantageously with either an all-steel or wood framing. It is possible to secure a construction embodying the good features and eliminating those which may be considered objectionable and expensive in the building of an all-steel car.

The formation of metallic sheathing produces air chambers between the inner and outer walls, and provides an insulation against heat and cold, keeping a car cool in summer and warm in winter. The expansion and contraction of the metal is also taken care of in a manner to prevent spreading of the seams.

The sheathing is made up in panels which are fastened in place with screws, and the intermediate or alternate slats are then dipped in a mixture of oil and color and driven into position, completely hiding the screw heads, so that the method of fastening the sheathing is in no way discernible on the exposed surface.

Tests to determine strength have proven that the formation of steel used in this sheathing is stronger, by far, considering its weight, than any solid metal; consequently rigidity is added to the framing without materially increasing the weight. That metallic sheathing has many advantages over wood is undisputed, chiefly on account of its being absolutely fireproof and the large saving effected in the cost of maintenance, which, within one year, is claimed to offset the small difference in the original cost of application.

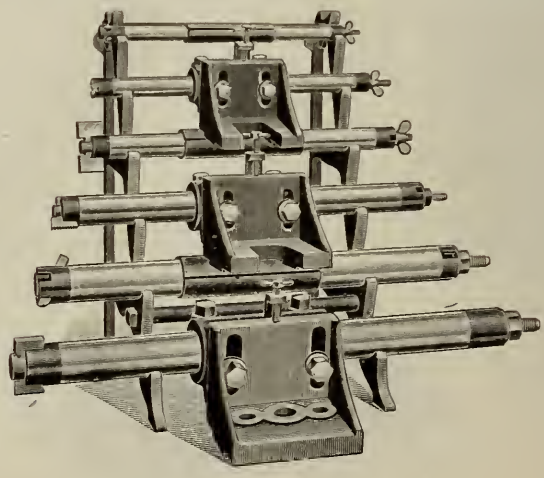
The sheathing is also furnished, if desired, with two priming coats of paint, baked on, which increases the life of the paint, makes it vastly more durable, and requires burning off less frequently than if applied by brush in the ordinary manner. This treatment is equivalent to enameling, and the sheathing is immediately ready when applied to a car, to receive the body color and varnish, which is a saving of time heretofore consumed in priming and surfacing and increases the shop output from 20 to 25 per cent.

Some Tool Room Specialties

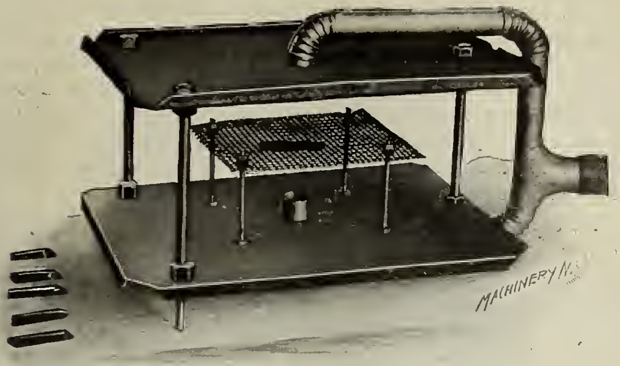
IN the accompanying illustrations are shown a tool room set for engine lathes, combination hollow bars for engine lathes, and a cold air tempering fixture.

The tool room set comprises six boring bars, three holder brackets, three bushings and one cast iron rack. The hollow boring bar is designed to hold different kinds of tools in various positions and is made so that there are no set screws to upset or break and no wedges to lose. The holder brackets are adjustable and made in two parts, the knee base and the sleeve. The bushings are made of cast iron to fit into the sleeve of the adjustable brackets.

The facilities for using thread chasers in the combination



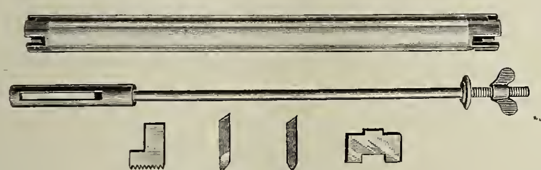
Tool Room Set for Engine Lathes.



Cold Air Tempering Fixture.

hollow bars for engine lathes, shown herewith, for inside and outside threading and especially for all kinds of heavy flange work, will be noted. The use of self-centering double end cutters for duplicate work makes for economy in the shop.

The Krieger cold blast high speed hardening stand for tool and machine shop work is also shown. In hardening high speed steel in cold air blast, it is necessary that the air circulate freely upon all sides of the tools treated and form no eddies. This new cold air tempering fixture has these important points combined. The two air outlets are directly over each other with a horizontal wire screen in center of same, for placing heated tools or cutters on it to cool evenly



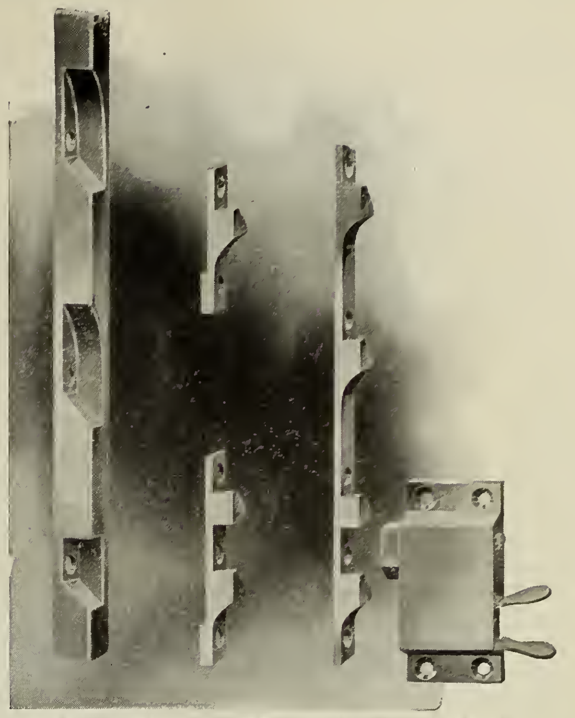
Combination Hollow Bars.

and quickly. The operator can direct all his attention to heat properly the next tool or cutter. This is an essential point in cold air blast hardening, this way being cheaper and safer than oil bath process, as it requires no stirring and will waste no oil. It will temper up to ⅝ in. square lathe tools and cutters up to ½ x 3-in. diameter with a common air blast and larger with a pressure blast. It can be attached to a blacksmith forge or gas furnace blast with a rubber hose. By placing it to the right side of fire will make it very convenient for operating. These devices are manufactured by the Krieger Tool & Manufacturing Company, 83 Randolph street, Chicago.

Car Window Fixtures

An interesting combination of inventions in side weather stripping, dust deflectors, sash balance and sash locking means for car windows is manufactured by the Grip Nut Company, Old Colony building, Chicago. From the illustrations and description it will be seen that one of the essential features is the ingenious arrangement of flexible weather strips applied at the two sides of the window on the sash. In this construction the inside window stops and finish is placed away from the sash, and the sash is fitted loosely, allowing clearance edgewise to prevent binding.

The necessary opening around the loosely fitted sash is positively sealed, air tight and dust proof by the weather strip forming a flexible joint, also cushioning the sash broad side against the outside stops and at the same time centralizing the sash between the two window jambs, which not only reduces the friction to a minimum, providing easy operating sash, but eliminates all rattle. This is a novel departure from all previous practice and is claimed to eliminate

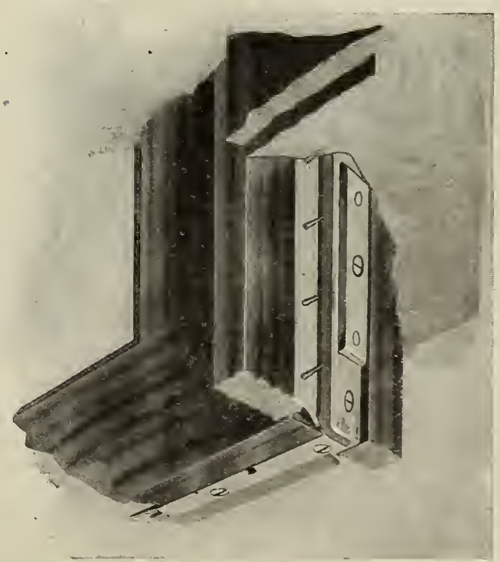


Gravity Wedging Sash Lock, Flush Stamped Wedge Rack, Continuous Cast Wedge Rack and Individual Bottom and Upper Wedge Racks.

the defects which have heretofore been accepted as necessary defects, impossible to correct.

A clever device to prevent rattle and the sash from falling is the gravity wedging lock. The lock bolt is beveled 45 degrees and settles into a corresponding downward and outward beveled rack. A gradual wedging of the sash against the stops in its downward movement effects a gradual stop, preventing the usual sudden jar, which loosens the screws and fixtures, breaking glass, etc. The sash is securely locked against the outside stop in a peculiar manner, preventing all rattle and accidents by falling.

Various designs of these racks are made, some of which are shown in these cuts. The pressed rack appears especially neat, as it sets flush with the stop. The designs cost no more than the ordinary continuous rack. The individual stops also show the anti-rattle wedging feature and are re-



Side Compression Weather Strip and 3-inch Bearing at Top Corners of Sash in Operative Position, with Parts Cut Away to Admit of Unobstructed View.

Car Window Fixture.

inforced by extra thickness at the bottom, doubling the usual support in the wood to prevent splitting and pulling out screws. These improved individual stops used on windows with balanced sash are equally as effective as continuous stops and cost less.

Other improved methods may be used, such as channel holding top and bottom weather strips, but the side air tight weather strips and gravity wedging sash lock are the principal features of this device. The line is exceptionally complete, consisting of over forty combination designs suitable for any desired construction of window in either wood or steel cars. Full-size working models are used for inspection and demonstration to prove that they are mechanically correct. The devices have been in service more than a year and are said to be entirely satisfactory.

Personal Mention

Mr. Frank Rusch has been appointed master mechanic of the Chicago, Milwaukee & St. Paul lines west of Butte at Seattle, Wash.

Mr. E. F. Jones, acting master mechanic of the Chicago & Western Indiana, has been appointed master mechanic, with office at Chicago.

Mr. J. H. Milton, general car foreman of the Chicago & Alton at Bloomington, Ill., has resigned to become general car foreman of the Chicago, Rock Island & Pacific at Shawnee, Okla.

Mr. T. L. Burton has been appointed general inspector in charge of airbrake, steam heating and car lighting equipment of the Philadelphia & Reading.

Mr. J. A. Mellon, mechanical engineer of the Delaware, Lackawanna & Western at Scranton, Pa., has resigned.

Mr. F. F. Small, mechanical engineer of the Pacific Electric Ry Co., has been appointed superintendent of the mechanical department, and Mr. J. Strang, general foreman of shops of the same company has been appointed master mechanic.

Mr. O. D. Greenwalt has been appointed master mechanic of the Williamsville, Greenville & St. Louis.

Mr. James McBrian has been appointed district car inspector. Choctaw district, of the Chicago, Rock Island & Pacific, with office at Argenta, Ark.

Mr. W. A. Bennett is now road foreman of engines of the Chicago, Burlington & Quincy at Edgemont, S. Dak., with jurisdiction over the line from Alliance, S. Dak., to Deadwood, and over all branches in the Black Hills.

Mr. J. F. Bowden, master mechanic of the Baltimore & Ohio, at Parkersburg, W. Va., has been appointed master mechanic of the Chicago division, with office at Garrett, Ind., succeeding Mr. D. Gallaudet, resigned to take service with another road.

Mr. H. P. Flory, mechanical engineer of the Central of New Jersey, has been appointed superintendent of motive power of the New York, Ontario & Western, succeeding Mr. G. W. West, deceased. Mr. G. W. Rink, chief draftsman of the Central of New Jersey, succeeds Mr. Flory.

Mr. Edward Williams Pratt, whose appointment as assistant superintendent of motive power and machinery of the Chicago & Northwestern Railway was recently announced, was born at Fort Atkinson, Wis., June 2, 1869. His father, George A. Pratt, was at the time of his death the oldest in point of service of any agent on the Chicago & North-Western, and it was for his uncle, the late Dr. Edward H. Williams of the Baldwin Locomotive Works, that he was named.

At the age of thirteen he learned telegraphy in his father's office; graduated from high school at his home town, and completed the course in Mechanical Engineering at Lehigh University, where he was prominent in field and track athletics. During his several vacations he took up field work in Civil Engineering on the Chicago & North-Western, and Elgin, Joliet & Eastern Railways, the latter during construction. After graduating from Lehigh, and feeling that with Civil and Mechanical Engineering he still lacked knowledge in Electrical Engineering, he entered the employ of the Western Electric Co., a short time later resigning to accept the superintendency of the Chicago Hardware Mfg. Co.

In 1892 Mr. Pratt again entered the employ of the Chicago & North-Western Railway. At first he was in the air brake repair room, and later in the same year he was appointed general air brake inspector. During the seven or more years in this position he was a very active member of the Air Brake and the Traveling Engineers' Associations and was recognized by the technical journals as one of the best authorities in the country on the air brake; he was one of the first to instruct on the double brake applications for passenger trains, and was also instrumental in developing the system of progressive examinations for firemen and engineers.

On Jan. 1, 1900, he gave up the air brake work and became roundhouse foreman, Chicago, in order to place himself in line for promotion in the mechanical department, and was rewarded by rapid promotions as follows: General foreman, Ashland Division, Ashland, Wis., June 1, 1900, to November, 1901; master mechanic of Iowa & Minnesota division, Mason City, Iowa, November, 1901, to Dec. 31, 1902. On Jan. 1, 1903, he accepted the position as master mechanic of the Fremont, Elkhorn & Missouri Valley Railroad, which a short time later was taken over by the parent company, and has since been known as the Chicago & North-Western "Lines West of Missouri River." As master mechanic of the "Lines West," Mr. Pratt has also had charge of the locomotive and car departments of the Wyoming & North-Western Railway, a subsidiary line in Wyoming.

Edward W. Pratt

George P. Jones

Mr. George P. Jones, president of the Jones Car Door Company up to the time of his retirement from business two years ago, died at his home in Chicago on February 10. Mr. Jones had been a resident of Chicago since 1877 and for many years had been the head of the Jones Car Door Company, but he had been extensively engaged in other lines previously to his embarking in the railway supply field. He was a gentleman of the old school, a good friend and an honorable man. He will be missed by a wide circle of friends and acquaintances. His birthplace was in London, Ohio.

Trade Notes

"Bettendorf Bears" is the title of a clever booklet being sent out by the Bettendorf Axle Co., presenting a new idea in advertising railway supplies in that it appeals to the children. The subject matter in rhyme is composed of thirteen stanzas, four lines each, illustrated with photographs and three color drawings, depicting lucidly the troubles of the S. M. P., who didn't use Bettendorf Trucks and his conversion to and belief in their superiority after a visit to the shops of the "Animal Line." The booklet is a splendid example of the fine art of printing, the three color work by which the drawings are reproduced being especially attractive. As an example of the subject matter the last stanza of the Bear Book is as follows:

But the one black bear that bossed the rest,
Told him the truth—he might have guessed,
The animal line makes no repairs:
Its trucks are built by the Bettendorf Bears.

The author of this work is Bruce V. Crandall, for many years publisher of the Railway Master Mechanic, now engaged in special advertising work of which this booklet is an example.

Mr. Fred Matthews, well known in the railway supply business, is the head of the recently organized railway supply company, Mathews and Company, 1502 Fisher building, Chicago. Mr. Mathews was formerly with the Schoen Steel Wheel Company and several years ago Chicago representative for the Standard Railway Equipment Company of St. Louis. His company now has the western agency for Mulconroy's flexible metallic hose and also the Northwestern Locomotive Sander.

Mr. R. A. Van Sickler has been appointed Chicago representative of the Regal Paint and Oil Company of Detroit. Mr. Benson Brown, formerly of the Acme Paint Company of Detroit, and also with James J. Sipe & Co., of Pittsburg, is president of the Regal Paint & Oil Company, and is one of the best known paint men in the railway world. Mr. Van Sickler is also well known in this field, having been with James J. Sipe for a number of years.

The McConway and Torley Company, Pittsburg, Pa., issued a supplement to Car Interchange Mannual, showing the latest decisions of the Arbitration Committee of the M. C. B. Association. This, together with the Car Interchange Manual, contains a complete epitome of all the arbitration cases to date. They should like to place a copy of the Manual and the supplement in the hands of every person who would find them useful.

At the annual meeting of the stockholders of Independent Pneumatic Tool Company, held at Jersey City, N. J., the following directors were elected: Messrs. James B. Brady, New York City; W. O. Pacquette, New York City; John P. Hopkins, Chicago; M. S. Rosenwald, Chicago; James J. McCarthy, Chicago; S. Florsheim, Chicago; John M. Glenn, Chicago; John D. Hurley, Chicago; John R. Turner, Jersey City, N. J. At the annual meeting of the directors just held in Chicago, the following officers were elected: James B. Brady, president, New York City; W. O. Jacquette, 1st vice-president, New York City; John D. Hurley, 2nd vice-president, Chicago; A. B. Holmes, secretary and treasurer, Chicago. The annual report shows that the company is in excellent financial condition, and that during the quarter ending December 31st, 1908, 40 per cent more business was transacted than during the corresponding period of 1907.

Little short of consternation has reigned amongst the manufacturers of fans and blowers and much interest evidenced by the leading architect-engineers, consulting engineers, heating, ventilating and power plant engineers and contractors since the introduction and sale in the country of the famous "Sirocco" blowers. The fact that the American Blower Company, the leading interest in that line of manufacture in this country, has now consolidated with the Sirocco Engineering Company of New York, constitutes an announcement in engineering and commercial circles of exceptional note.

The Chicago Car Heating Company, Railway Exchange building, Chicago, announces that Mr. W. H. Hooper, formerly general agent for the Safety Car Heating and Lighting Company, has been appointed assistant to the president of this company, with headquarters in Chicago.

A treatise on shop heating has been prepared by the vice-president and chief engineer of the American Blower Company, Mr. F. R. Still, whose experience makes him an authority on this now too little understood but important subject of factory heating and ventilation.

The interference, relating to electric heaters having junction boxes, between an application of James F. McElroy and the patent to Edward E. Gold, No. 850,924, and dated April 23, 1907, has been decided by the patent office in favor of Edward E. Gold, by reason of an abandonment by McElroy of his claim of priority.

Schuchardt & Schutte, New York, have moved their offices and warerooms from 136 Liberty street to the West Street building.

Mr. William C. Ennis, formerly superintendent of motive power and master mechanic of various railways, of late connected with the American Locomotive Co., and now located at 543 Broadway, Paterson, N. J., has been appointed by the Falls Hollow Staybolt Company as eastern traveling representative.

Mr. Edward C. Brown, manager of the Hawaiian office of the Dearborn Drug & Chemical Works, at 42 Queen street, Honolulu, is making an extensive oriental trip of three or four months during which he will visit Japan, the important sea coast cities of China, Australia, the Philippines, Java, and other important islands in the Pacific Ocean. Mr. Brown has most successfully handled the Dearborn company's business in the Hawaiian Islands since that department was opened, some ten years ago.

Mr. Charles R. Herron, of Chattanooga, Tenn., late southern sales manager of the American Brake Shoe & Foundry Company, died at his home in Chattanooga December 6, 1908. Mr. Herron was a highly respected citizen and a noted business man of Chattanooga, with a wide acquaintance throughout the South; his friends were legion in all walks of life. Born in Ireland in 1844, he came to America with his parents in 1848 and located in St. Louis. At the age of fifteen he became a foundry apprentice, and after serving his apprenticeship, became a journeyman moulder, traveling through the United States and Canada. In 1873 he started a stove factory in Indianapolis. He then became connected with the Eureka Foundry Company of Cincinnati, and served a term as a member of the Board of Public Works of Cincinnati. His connection with the brake shoe business began in 1889, when he took charge of the Ross Meehan foundry at Chattanooga in the manufacture of brake shoes and malleable iron castings. He became connected with the American Brake Shoe Company, and in 1902 with the American Brake Shoe & Foundry Company, where he continued as Southern sales manager to the time of his death. He was also largely interested in the Herron Pump & Foundry Company of Chattanooga. "Charley" Herron was a good man, honest, straightforward and energetic, yet modest and kind-hearted, a friend of everybody, and his death is a loss to all his friends North and South.

The Gold Car Heating & Lighting Company, 17 Battery place, New York, recently issued a supplement to catalog 1905, which deals with Gold's combination pressure and vapor car heating system. The operation of the system is explained diagrammatically, including also the operation of parts.

The Falls Hollow Staybolt Company, Cuyahoga Falls, Ohio, has recently sent out some handsome celluloid blotters, which they will furnish to any railroad official upon request.

The Rockwell Furnace Company has been awarded the contract covering the complete furnace equipment for the new locomotive shops of the D. L. & W. R. R. at Scranton, Pa. The furnace equipment consists of thirty-five of the latest type furnaces operated with 300 B. T. U. water gas, which is made in Loomis Pettibone producers.

The Youngstown Car Manufacturing Company, Youngstown, Ohio, has opened a Chicago office at 1508 Fisher building, in charge of Charles B. Owens.

The Kankakee Car Company, Kankakee, Ill., has been incorporated in Illinois, with $130,000 capital stock, for building and repairing cars and rolling stock of all kinds. The incorporators are: Messrs. Leroy J. Vierson, W. J. Wesloh and Adolph Stankowitz. The Kankakee Car Company will be the new name for the Kellogg Car & Equipment Company, the president of which is Mr. Leroy J. Vierson.

The National Machinery Company, Tiffin, Ohio, published a new catalog on their extensive line of bolt, nut and rivet machinery, upsetting and forging machines and wire nail machinery. The various designs are illustrated and thoroughly de cribed in this catalog of 197 pages.

The Gisholt Machine Company, Madison, Wis., are building a new 88-in. vertical boring mill, described in circular recently sent out.

At a meeting of the board of directors of the Galena-Signal Oil Company, held in New York, on Wednesday, January 27, Mr. S. A. Megeath was elected first vice-president and general manager of the Galena-Signal Oil Company, effective as of date of election, with headquarters at Franklin, Pa.

The Dearborn Drug & Chemical Works report that the general business of the company for the last six months of 1908 was larger than for any other six months in their history, indicating the quick returns of prosperous business conditions. The percentage of increase the past few months, and especially for January, in the eastern department of the company is particularly gratifying. Mr. Grant W. Spear, vice-president and eastern manager, at the general offices, 299 Broadway, New York, who has been for years vice-president of the Dearborn company at Chicago, ably assisted by Mr. Herbert E. Stone, as general sales manager; Mr. P. H. Hogan, manager of the Boston office, and Mr. Paul T. Payne, manager of the Philadelphia office, with Mr. P. G. Jones as special representative in the Philadelphia district, together with such popular and able representatives out of the New York office as Messrs. McConnaughy, Mitchell, etc., constitute a most effective organization which is an assurance of the high grade manner in which the affairs of the Dearborn company will be handled in the Atlantic Coast states.

Extensive orders for "Allen" portable pneumatic riveting machines have been reported recently by the manufacturer of these tools, John F. Allen, 370-372 Herard avenue, New York city. Two riveters each have been sold to the Kelly Manufacturing Company, Waterloo, Ia.; Memphis Steel Construction Company, Memphis, Tenn., and Harlan & Hollingsworth Company, Wilmington, Del. The order from the Harlan & Hollingsworth Company is the second "Allen" riveter sold them within a period of three weeks.

A very handsome booklet, about 5x8 ins., has recently been gotten out by the Joseph Dixon Crucible Company, Jersey City, N. J. It is entitled "Lubricating the Motor," and as its name indicates, deals with the subject of lubrication of automobiles, motor boats and motor cycles. The booklet is divided into chapters which deal with the individual part of motor mechanism: cylinders, transmissions, bearings, etc. There is a chapter on tires which includes some valuable hints on this rather sensitive part of the vehicle. There are also special chapters entitled, "Overhauling the Car" and "Motor Boat and Cycle," which are self-descriptive. The booklet opens with a brief treatment of flake graphite lubrication. A good point is developed concerning the peculiar advantage of flake graphite when combined with oil or grease, due to the lack of sensitiveness of flake graphite as compared with oil or grease.

The D'Olier Engineering Company, Philadelphia, Pa., issued circulars, descriptive of there steam turbines for direct-connected and belted service and of their horizontal centrifugal pumps.

A pamphlet on Manganese Steel Castings has been issued by the American Brake Shoe & Foundry Company, Western Union building, Chicago.

The National Tube Company, Pittsburg, Pa., has recently issued an instructive booklet on Shelby steel tubes and their making.

RAILWAY MASTER MECHANIC

ESTABLISHED 1878.

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CONTENTS.

General Foremen's Convention

The executive committee of the International Railway General Foremen's Association has selected Chicago as the place of holding the convention in 1909, June 1, 2, 3, 4 and 5. The Lexington Hotel has been chosen as the official headquarters, at which the following rates have been granted, European plan: $1 to $2 per day, single, without bath; $2 to $3 per day, double, without bath; pleasant outside rooms with bath, $2 to $3 per day single; $3 to $4 per day double. A club breakfast can be secured from twenty cents up, and a table d'hote luncheon at 50 cents.

Arrangements have been made for exhibits by the supply firms, particulars of which can be secured from the secretary of Supply Men's Association, Mr. J. Will Johnson, 1427 Monadnock building, Chicago. Applications for membership can be secured from any of the officers of the organization, or from the secretary-treasurer, Mr. E. C. Cook, Royal Insurance building, Chicago.

Oil Burning Locomotives

Six of the twelve new locomotives recently purchased by the Panama Railroad Company have arrived on the Isthmus, and the other six will come in two consignments, on ships due to arrive this month. These are the locomotives that are to use oil as fuel, and to this end they have been equipped with combination oil and water tanks, the oil capacity being 2,300 gallons and the water 5,000 gallons. The oil tanks can be taken from the tenders and the space they occupy can be used as coal bins in case it is ever desirable or necessary to use the locomotives as coal burners. The coal capacity is ten tons. The oil burners are of the Booth pattern, and they can be removed readily and replaced by grates at any time it becomes necessary to use coal. The locomotives are of the simple Mogul type, cylinders 20 by 26 inches, tractive power, 26,000 pounds; steam pressure in boilers, 200 pounds to the square inch; drivers, 63 inches in diameter. They have the latest Westinghouse air brake equipment automatic couplers, and Cardwell draft gear. The first of them will leave the Cristobal shops this week, and all six of those now, under erection will be in service within a month. When the twelve are put in service the twelve 100-class engines now in use will be retired to yard use, or will be equipped as oil burners. A 50,000-gallon tank will be erected at Cristobal to supply oil to the locomotives.—The Canal Record.

Railroad Activity

A statement by Mr. B. F. Yoakum, chairman of the executive committee of the Rock Island-Frisco System, is given in American Industries, as follows:

I am proceeding with a feeling of confidence in the future that Judge Taft will prevent uncertainties in the business of the country.

We need a period of agricultural, commercial, and manufacturing activity, free from disturbance. If a petition asking for this simple remedy for the good of all classes were circulated among the people, it would receive more signers than the combined vote of both Mr. Taft and Mr. Bryan. The million and a half railroad employes would sign it. The million farm owners of this country would sign it; it would give them a broader and steadier market for their farm products, their cattle, and their hogs. The merchants, the manufacturers and their employes would sign it. They all want stability of government to enable them to plan their work ahead, assuring permanent and lucrative employment.

Mine Explosion and Rescue Station

The United States Geological Survey, acting in co-operation with the Illinois State Geological Survey and the University of Illinois, has established a Mine Explosion and Mine Rescue Station at Urbana, Ill. The purpose of the Station is to interest mine operators and inspectors in the economic value of such modern appliances as the oxygen helmets and resuscitation apparatus as adjuncts to the normal equipment of mines. The Station also will concern itself with the training of mine bosses and others in the use of such apparatus. Its service is to be rendered gratuitously, and so far as possible to all in Illinois, Indiana, Michigan, West Kentucky, Iowa and Missouri, who may desire the benefits thereof.

Wood Preservatives

An increase from three and one-half million gallons of the oil of coal tar or creosote, as it is popularly known, imported into the city of New York in 1904, to an amount estimated to be almost twenty-five million gallons last year, is one of the indications pointing to the progress of the wide national movement for the conservation of forest resources.

It is creosote which the government and scores of corporations and private wood users have found to be one of the most satisfactory preservatives of railroad ties, mine props, telephone and telegraph poles, fence posts, and for timbers used for other commercial purposes. Lengthening the life of timber in use means the lessening of the drain on the country's forests, and what is more important to the average business man, it means the saving of thousands of dollars annually spent for the labor of the frequent renewals made necessary when untreated timber is used.

Scheduled Time

Figures that have been compiled by the Pennsylvania Railroad show that out of a total of 369,315 trains of which a special rec-

Train No. 28—Pennsylvania Special—Arriving at Jersey City Jan 1st to Dec 31st, 1908, Inclusive.

Days on Time	Days Not More than 5 Min Late	Days Not More than 10 Min Late	Days Not More than 20 Min Late	Days Not More than 30 Min Late	Days Over 30 Min Late	Total Days	Total Mins Late	Percentage On Time	Percentage Late	
314	3	8	14	8	19	366	1838	85 78	14.22	—1908
278	10	12	16	12	38	365	4046	75.95	24.05	—1907

Train No. 29—Pennsylvania Special—Arriving at Chicago Jan. 1st to Dec. 31st, 1908, Inclusive.

Days on Time	Days Not More than 5 Min. Late	Days Not More than 10 Min. Late	Days Not More than 20 Min Late	Days Not More than 30 Min Late	Days Over 30 Min. Late	Total Days	Total Mins Late	Percentage On Time	Percentage Late	
315	3	7	8	8	25	366	2423	86 06	13 94	—1908
280	4	6	19	15	42	365	4131	76 50	23 50	—1907

Note.—Figures for 1907 are from June, 1907, to June, 1908.

ord was kept during the year 1908, 324,739 trains, or 88 per cent. of the total, made scheduled time or better.

Of through trains records kept of 81,369 trains on the five principal divisions, show that an average of 87 per cent. of the trains made scheduled time, while 23 per cent. of this average number made better than scheduled time. The latter trains "made up" time on the road.

During the year 1908, the Pennsylvania Special, the 18-hour train running between New York and Chicago, a distance of 912 miles, arrived at Chicago on time 315 out of 366 days, and at New York on time 314 days in the year. Of the 51 days on which the train was late at New York, upon only 19 was the delay greater than thirty minutes.

Recent Lectures

Dr. Frederick W. Taylor, past-president of the American Society of Mechanical Engineers, gave an address before the College of Engineering of the University of Illinois on Thursday, February 18. His talk was along general engineering lines, supplemented by anecdotes from the early part of the careers of successful engineers.

Mr. W. H. Finley, assistant chief engineer of the Chicago & North-Western Railway Company, gave a lecture before the College of Engineering of the University of Illinois on Friday, February 19, on "The Quebec Bridge Failure."

Cleveland Industrial Exposition

Cleveland's Industrial Exposition, which will be held June 7 to 19, promises to be unique in the history of home-product expositions in the diversity of manufactures shown. It is estimated that 125,000 different articles come out of the city's 3,500 shops. The percentage of these displayed will give unusual variety and range to the exhibits and will add greatly to the spectacular as well as to the educational value of the exposition. Cleveland leads all other American cities in the production of steel ships, heavy machinery, hardware, twist drills and small tools, wire and wire nails, bolts and nuts, vapor stoves, electric carbons, malleable castings, telescopes, gasoline, steam and electric automobiles, and takes high rank in the manufacture of paints and oils, women's clothing, chewing gum and various other products.

New Passenger Coaches

The following item concerning the new passenger coaches on the railways of British India is taken from a report of Consul-General William H. Michael, of Calcutta:

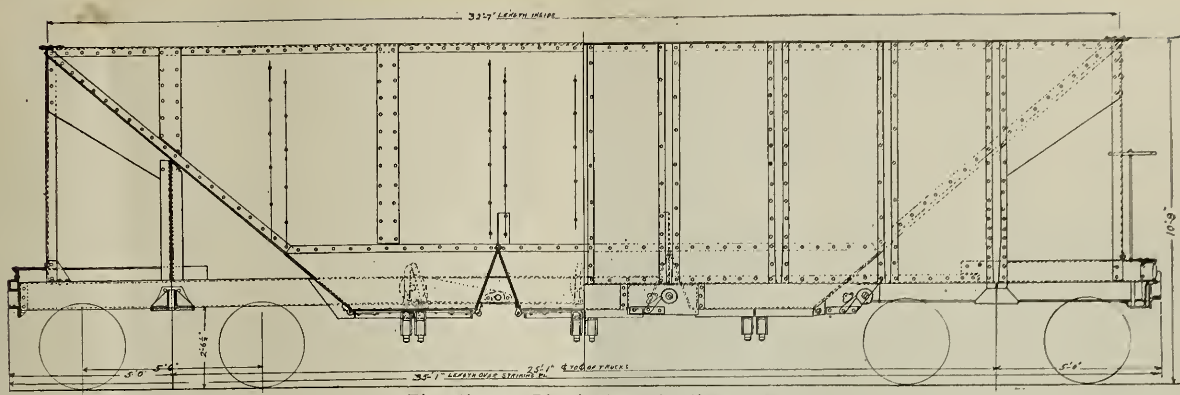
The new car is built on the corridor plan, and will be substituted as fast as possible on the broad-gauge road running from Bombay northward. It is stated that this coach has the approval of the railway board, and is intended to be the standard type for new rolling stock in India. The coach is of the ordinary bogie type, but is mounted on six-wheeled bogies, which give extraordinary smoothness in running. It is built with a corridor running from end to end of the coach, and from this corridor opens out a series of two-berth compartments, the upper berth being of a most ingenious design, so compactly constructed that at first sight it is difficult to see how it is lowered. In this compartment there is abundant space for two, with all the luggage any two reasonable persons need take into the carriage with them. There is a neat ledge running along the side of the compartment for small articles, and a capacious hatrack. Every compartment has a powerful electric fan, entirely under the control of the passenger, and three electric lamps, one small light being separately switched, so that it may be kept burning all night, if desired, without inconvenience. If the passenger so wills, he can fasten his door, bolt all the venetians or windows, and be absolutely secure against intrusion. If the party extend beyond the accommodation of a single compartment the sliding door connecting it with the adjoining compartment can be left open and the two compartments thrown into one. There is an electric bell, enabling the attendant to be summoned at any hour of the day or night. At either end of the coach there is a commodious bathroom. This is a roomy cabin, with a good bath half sunk in the floor, an abundant equipment of mirrors, and all toilet and sanitary conveniences. One bathroom is reserved for women and the other for men. There is a compartment for servants, so that they are within call at all hours. In time it is the purpose to add a room where the heavier luggage may be stored and opened when occasion demands. American tourists who hape used these new cars speak in the highest praise of them.

New Birmingham Southern Car

The new Birmingham Southern car, which is shown in the accompanying illustrations, is 35 ft. 1 in. over striking plate, 32 ft. 7 ins. in length inside and 25 ft. 1 in. from center to center of trucks. The height of car from rail is 10 ft. 3 ins.

The specialties of the car are as follows: Arch bar trucks; 5½x10-in. journals; Schoen steel wheels, 33 ins. diameter; pressed steel truck bolsters; Westinghouse draft gear; climax draw head; capacity, 1905 cu. ft.; end floor arrangement, 450, and 10-in. brake with K-1 triple.

New Birmingham Southern Car.



Elevation of Birmingham Southern Car.

The purpose in making the end floor arrangement 450 is, of course, to provide for a long-time want of self-clearing car. It is found that plants using cars of this description generally unload about twice the amount of coal in a given time than with the old style equipment, and therefore the railroad has the cars in their possession that much longer; thus it requires a reduced number of cars to properly handle the traffic.

Cars of this type to the number of 160 are now being built by the Pressed Steel Car Company for the Birmingham Southern Railroad.

Cinder Pits

Editor, Railway Master Mechanic:

Handling ashes at the round house—the plan we follow here is to shovel the ashes from the pit to the car. The pit is open on one side and the top of the car is about two feet higher than the bottom of the clinker pit. Our men are allowed so much per engine for handling these ashes and we find it amounts to about 6 cents per cubic yard. The force doing this work consists of 5 men days and 5 men nights. Their earnings will run from 17½ to 18½ cents per hour.

Yours truly,

Illinois. M. M.

Editor, Railway Master Mechanic:

Cinders on this division are handled with a plain depressed track cinder pit. We just use the ordinary depressed track pit, raking the ashes from the ash-pans into the cinder pit, cooling them off, then shoveling them from the pit to the cinder cars on the track which is depressed below the floor of the cinder pit so that the cinder pit men will not have to lift the cinders too high.

The pit is just a common depressed cinder pit. I have never had any experience with cinders handled with a locomotive crane or any other kind of hoist.

The cost is a variable quantity with us, not depending on the number of engines handled in the 24 hours. We use two men in the cinder pit to rake the ashes from the ash-pans. This is necessary because most of the engines have the divided pans. It would not work well to try to clean an ash-pan with one man, as it would make it necessary for him to go from one end of the engine to the other, as the cinders were dumped; therefore the labor remains the same whether we hape a few or many engines.

Yours truly,

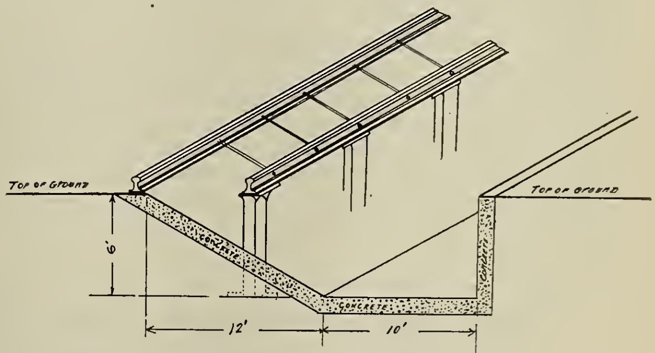
Michigan. M. M.

Editor, Railway Master Mechanic:

The accompanying sketch shows the general plan of cinder pit used at this point. We handle approximately 500 engines over this pit each month and use two men, one working days and one working nights, to clean the ash-pans and shovel the cinders over into the open part of the pit where the locomotive crane can get them when loading. The salaries of these two men are, of course, the bulk of the expense of handling the cinders, and most of their time is employed in cleaning ash-pans, which will be eliminated when all locomotives are equipped with self-dumping ash-pans. These two men are each paid at the rate of $50 per month, making a total of $100 per month for labor. The cost of loading one month's accumulation of cinders by locomotive crane will not exceed $4.50, being made up as follows:

Salary of crane engineer	$2.00
Cost of fuel	1.00
Cost of lubrication	.50
Cost of maintenance of crane	1.00
	$4.50

In regard to the locomotive crane I wish to advise that this is used almost exclusively in handling fuel for locomotives, only a small part of its time being taken up by the loading of cinders. The crane we have is a No. 1 crane with 1½-yd. bucket and built by the Browning Engineering Company.



Pit 60' Long 6' Deep. 11 Pedestals Set 5' apart for rails to rest on.

In connection with this crane we use one engineer and a helper who attends to the placing of the bucket when coaling engines out of cars. No coal whatever is handled by hand and the average cost of coal handled for the year 1908 was 7 cents per ton, while if it were handled by hand it would have cost on an average of between 20 and 22 cents per ton.

Yours truly,

Indiana M. M.

Locomotive Cranes

There are economical and expensive ways in doing yard work. To eliminate this expense there has been developed in this and foreign countries a machine that is a wonderful economizer, the locomotive crane. The rapidity with which it does its work and the vast amount of various kinds it is capable of doing makes it a necessity.

Fig. 1—Locomotive Crane, Car Repair Work.

These machines have become exceedingly popular, especially among the various railroads of the United States, Canada and Mexico. They are used for doing such work as coaling engines, handling cinders, sand, gravel, scrap, lumber, ties, wheels, rails, trucks, do light wrecking and are of great value on the rip track, besides numerous other places in the yards. They are of inestimable value on construction work, for the building of temporary as well as permanent piers, and they are used to handle bridge members. This kind of a machine is by far the most modern appliance for hoisting and conveying all kinds of yard material. It is propelled by either steam or electricity. When electricity is used as power a trolley, third rail or cable is needed, but in most cases steam is used, and it is generated upon the crane.

Fig. 1 shows a view of a Browning locomotive crane used in the yard of the Street's Western Stable Car Line to help in the repair of cars. It is also used for loading and unloading various kinds of material.

Fig 2 shows the Browning locomotive crane used by the Nickel Plate Railroad at Conneaut, Ohio. At that point a crane is used to coal the engines while they are being cleaned over the cinder pit, and then is used to transfer the ashes from the pit to the car. This system is used in numerous places throughout the country and is found to be a most saving device.

The following figures taken from the cost of operating a chute during one month of 1907 and also the cost of operating a Browning locomotive crane for the same work besides handling the ashes in one month of 1908:

No. of tons handled, chute, 8412; crane 8322. Gross cost handling coal: chute, $802.05; crane, $467.97. Cost of handling cinders: without crane, $620.55; with crane, $428.05.

The above shows a saving of almost 40 per cent. This machine more than paid for itself in one year's time. Some places where all conditions are favorable the saving has surpassed this and has gone over 50 per cent. This is only one of the numerous instances where saving has been accomplished by using a locomotive crane.

There are various accessories to the locomotive crane. The last crane mentioned above uses a Browning clam shell automatic grab bucket. For handling iron and steel in any form,

Fig. 2—Locomotive Crane, Nickel Plate Railroad.

castings, pigs, sheet or scrap iron, a Browning electro lift magnet is often used, which is a most valuable labor saving device. The crane may also be equipped with a scraper bucket or a steam shovel attachment, thus enabling the locomotive crane to be used as an excavator or railroad ditcher of no mean ability. Each day the operators and owners of these machines find something new for them to do and they always do their part. The time will soon be here when a great demand will be made for locomotive cranes, as their ability is an unknown quantity.

Locomotive and Car Shops at Spirit Lake, Idaho

Idaho & Washington Northern Railroad

So much consideration has been devoted in the past to the very large locomotive shops, that the subject of arrangement and equipment of terminal facilities in smaller units has been rather neglected. A good example of the latter type of shop is found at Spirit Lake, Idaho, on the Idaho & Washington R. R. Here, the modern practice of compact arrangement, with room for extension, crane serpice for erecting and machine shops, facilities for stripping and erecting the heaviest locomotives and convenience in handling material have been carried out with such modifications as are demanded by the reduced size of the plant.

These shops are planned to handle all repairs to the equipment of the railroad not only as at present constructed but also for the extensions now being made.

In the general arrangement of buildings the round house and the facilities for turning engines naturally took precedence; and, as the shops are placed between the main line of the railroad and a hillside, the location of the main buildings on one side of a straight lead to the round house was decided to be the most advantageous.

The round house has a clear depth of 90 ft. inside of the walls. It has, at present, 9 stalls, and is located so as to allow extension to the full circle of 44. The outer wall is of brick resting on a concrete foundation, and the roof is of wooden construction resting on posts. The windows are set at the rather unusual height of 5ft. above the floor and are carried up to the roof, making the outer wall in effect, a series of brick pilasters with a glass filling. By the installation of an additional 100 sq. ft. of glass per stall, over the doors along the inner wall of the round house, the natural lighting over the whole house is made exceptionally uniform; and affords a pleasing contrast to the condition, so often occurring in round houses, where torch light at midday is a necessity for any work back of the cylinders of the locomotives.

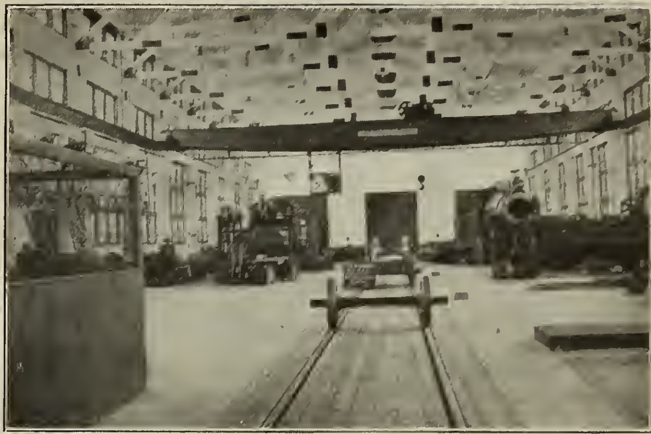
A concrete floor, slightly sloped to drain into concrete engine pits, permits the house to be kept clean with a minimum of expense, and obviates the enormous amount of labor often expended in trucking heavy pieces to and from engines over a cinder or dirt floor. Work benches containing lockers are provided between the stalls at the outer row of posts, giving a clear passage way around the house along the outer wall. The usual drop pits for drivers and truck wheels are provided, and are fitted respectively with hydraulic and pneumatic drop pit jacks.

The round house is equipped with a most complete system of protection against the consequences of runaway or carelessly handled engines. At the end of each round house track, near the outer roundhouse wall, is a depressed stop to prevent engines from over-running the track and knocking out part of the house. By keeping the stop at rail level, injury to the pilot is avoided when a locomotive over-runs the rail. At a distance of 20 ft. from the turn table end of each round house track is a derail, automatically operated by the turn table lock. Unless the lock, which is thrown by a lever at the side of the turn table, is in place, and the turn table is in line with the track, the derail prevents a locomotive from coming within 20 ft. of the turn table pit. On the lead tracks from the main line to the turn table this distance is increased to 50 ft. Any one who has had the experience of getting a large engine out of a turn table pit can appreciate the value of this device.

Provision for handling heavy pieces and driving wheels direct from the round house to the machine shop is made by extending one of the round house tracks through the outer wall and connecting it to the track which runs through the machine shop. This is, unfortunately, a feature which is often omitted in shop arrangements. The fan and radiators for the indirect heating system are located in a small building adjoining the outer walls of the round house, and the hot air is delivered through underground ducts into the engine pits.

On the approach tracks to the round house is a coal trestle with 10 5-ton pockets, filled, by gravity, from a storage space above them. It is equipped with a motor driven hoist for pulling loaded cars up the 19 per cent. incline and has a total capacity of about 175 tons of coal. At one end of the coal trestle is the sand-house and green sand bin. The sand is dried in a sand stove and then raised by compressed air into an elevated dry-sand bin having a capacity for 10 cu. yds. of dry sand. The dry sand is delivered to the locomotives by gravity.

Between the coal trestle and the round house are located the 10-in. water crane, the cinder pit and the depressed track for loading cinders. The depressed track is constructed with concrete retaining walls, of which one is widened out into a shelf between the cinder pit and the depressed track, at the level of the cinder pit bottom. This furnishes a walk 4 ft. 3 ins. wide, for the men engaged in loading cinders or cleaning ash-pans,



Interior View of Machine and Electing Shop, I. & W. N. R. R.

and obviates the necessity for a deep cinder pit or for men going underneath the engines. For a cinder pit where the loading is done by hand, this materially facilitates loading. The rail between the walk and the cinder pit is carried on I-beams, supported at intervals of 7 ft. 5 ins. by concrete piers.

MACHINE AND ERECTING SHOP.

West of the round house approach tracks is the erecting and machine shop. This is a brick building 210x70 ft. with concrete foundations, wooden roof trusses, and concrete floor. The entire area of the building is served by a 10-ton, 3-motor, traveling electric crane, arranged so that it can be operated either from the cage, or by pendant cords extending to the floor.

The erecting shop, in the south end of the building, has three longitudinal erecting pits, all served by one transverse drop pit with a 30-ton hydro-pneumatic transfer jack. When a locomotive enters the shop for overhauling, the engine truck springs are blocked and the front pair of drivers are dropped, moved out between the pits, and taken away by the traveling crane. The engine is then moved forward so that each pair of drivers may be removed in succession, the last pair being removed after the rear end of the engine has been securely blocked. The engine truck may be removed by jacking up and blocking the front end; or, dropping it as it passes over the drop pit, and supporting the front end of the engine on a special truck under the cylinders. This method of de-wheeling an engine takes little time and labor, and does away with the dangerous and laborious jacking necessitated in wheeling and de-wheeling heavy modern locomotives where drop pits or tables are not used. It also does away with the necessity for the moving about of partially stripped engines incident to the use of a gallows frame or drop table in combination with a transfer table, and permits all the stripping to be

Birdseye View, Idaho & Washington Northern Railroad Shops.

Interior of Roundhouse, I. & W. N. R. R.

done over the same pit on which the engine is erected. As the shop was designed to serve an equipment of approximately 50 engines, the first cost of traveling electric cranes with capacity for the heaviest modern locomotives, or the combination of a drop table and transfer table, would have been prohibitive.

The machine tools are located in the north end of this building and are arranged so that the small tools, driven by countershafts, are grouped along the east wall. The motor driven tools are a 48-in. planer, 36-in. engine lathe, 51-in. boring mill, 60 in. half universal radial drill press, 79-in. driving wheel lathe with double wheel quartering attachments, and 400-ton hydraulic driving wheel press. The latter is set in a covered pit of such a depth that the ram stands above the floor at a height suitable for pressing on and off of car and truck wheels. By removing the pit cover, driving wheels may be handled in the press. The boring mill, which has a chuck on the table and is used for boring car wheels as well as for general work, is equipped with a jib crane and air hoist for handling work from the floor to the table.

The small tools, which are driven from a line shaft hung from the east wall of the building, consist of an 18-in. lathe, 24-in. shaper with concave attachment for slotting driving boxes and with index centers, 2-in. bolt cutter with lead screw for cutting staybolts, water tool grinder, double dry grinder, twist drill grinder, power hack saw, ¾-in. high speed drill press and 4-in. pipe machine. The countershafts for these machines are supported by timbers carried on brackets on the east wall and are located so as to minimize the obstruction of light from the windows. A band saw and a single spindle wood borer have also been installed and are both driven by a single motor set on the floor.

In the north-east corner of the machine shop is located the tool room enclosure. In part of this space, separated from the tool room proper by a railing, is installed a motor-driven, two-stage air conpressors, of 500 cu. ft. capacity; and also the switchboard and a motor-generator set which supplies direct current for the variable speed motors driving machine tools and for the crane motors. The power for the shops is supplied by 3 phase, 440-volt, electric current, from an outside source; and to this fact is due the rather unusual location of the machinery. Since the operation of the air compressor is made automatic by means of an unloading device, and the motor generator set requires practically no attention, the services of an engineer are dispensed with, and the machinery is watched and cared for from the tool room.

In the opposite corner of the north end of the building are located the radiators and the fan for the indirect heating system; and over these, on an enclosed platform 10 ft. above the floor, are the toilets and lavatories, and the metal lockers for the shop employes.

BLACKSMITH SHOP.

The blacksmith shop occupies 65 ft. of the south end of a brick building parallel to and 38 ft. west of the machine shop. The building is 97 ft. long by 40 ft. wide and has brick walls on concrete footings and a trussed wooden roof. The blacksmith shop equipment consists of one 1100-lb. steam hammer, a single-ended motor-driven punch or shear, and three forges, one of them extra large. Space for additional forges and anvils is provided. A three-ton jib crane serves the hammer, the punch, and the large forge. Blast is furnished by a motor-driven pressure blower set in a covered pit and discharging into underground tile ducts. One corner of the building is used as a flue shop. It is equipped with a motor-driven flue cutter, an oil flue welding furnace, and a penumatic flue welder. Space outside of the building has been provided for a flue rattler.

BOILER PLANT.

Since electric power for the shops is furnished from an outside source, and electric drives are installed throughout, there is no necessity for a power house. However, a steam boiler plant is installed for supplying steam for heating the various buildings and the coaches in the coach yard, for operating the steam hammer, and for blowing fires in the round house. The boiler room occupies 32 ft. of the north end of the same building as the blacksmith shop and is separated from the latter by a brick wall. This location places the boilers approximately in the center of the group of shop buildings. The boiler plant consists of two 125-h. p. horizontal return tubular boilers which burn either coal or refuse slab wood. The firing floor is covered with brick; and a coal bin with a capacity for one carload of coal is placed inside of the west wall of the roon opposite the boilers, and is filled direct from cars standing on a track alongside of the building. All condensation from the heating systems, and the cooling water from the air compressor jacket, is drained into a concrete pump pit in the boiler room and returned to the boilers by an automatic feed pump and receiver which may also be supplied with city water. An injector has been installed for feeding the boilers in case of an emergency.

STOREHOUSE AND OFFICE BUILDING.

The storehouse is a brick building 124x30 ft. with a wooden floor resting on concrete foundations, and a wooden roof. In the south end of the building are the offices of the mechanical department, and, at the north end, is a fire-proof oil cellar. The metal oil tanks in this cellar are filled from the level of the storeroom floor, and the oil is distributed from a delivery counter, to the level of which the various kinds of oil are lifted by self-measuring pumps.

The storehouse platform extends all around the building at the same level as the storehouse floor; or at the height of the average car door. At the north end of the building the platforn is extended out 100 ft. from the building wall with the full width of 42 ft.

Interior of Paint Shop, I. & W. N. R. R.

Cinder Pit, I. & W. N. R. R.

PAINT AND COACH SHOP.

This building is intended for general use in repairing, cleaning and painting passenger cars. It is 108 ft. long and 45 ft. wide with two longitudinal tracks extending nearly the whole length of the building. The walls are of brick, resting on concrete foundations, and the roof is of wood and has longitudinal skylights extending along the center line to give ample light between the tracks. The floor is of concrete and is sloped in accordance with an underground system of drains in order to permit washing of coach bodies and trucks. Along the walls at the north end are sinks for washing the removable parts and the drying racks for sashes, doors, ventilators and seat arms. Trussed planks resting on ladder horses are provided for painting or repairing coach sides.

COACH AND FREIGHT CAR YARD.

Owing to the ordinarily mild climate at Spirit Lake, the freight car repairs are made outside on tracks west of the blacksmith shop. A car repairman's house, 40 ft. by 12 ft., is located alongside of the repair tracks, for housing tools and clothes. A line of piping for compressed air is run along the tracks with hose connections for compressed air drills and hammers. The coach yard has two tracks between which are service boxes at intervals of 50 ft., containing steam, water and air connections. Standard gauge industrial tracks are provided, for handling mounted wheels and transporting heavy material between the machine shop and repair tracks and the blacksmith shop.

HEATING AND LIGHTING.

The machine shop and round house are heated by indirect heating systems. One 120-in. fan in the machine shop and one 130-in. fan in the round house, deliver hot air through underground concrete and tile pipe ducts. The fans are motor driven. The storehouse and office building, the car repairman's house, and the coach and paint shop, are heated by direct radiation from steam coils. As the amount of exhaust steam from the shops is negligible, live steam is taken from the high pressure steam mains, through reducing valves, for use in the heating coils.

The shop yards are lighted by a number of arc lamps, supported either on the buildings or on lighting poles distributed about the yard. The machine shop and the blacksmith shop are lighted by arc lights. The natural lighting of the former shop was made a matter of special attention and the result due to the arrangement of windows and the absence of overhead obstructions is an endorsement of the design. The other buildings, including the round house, are lighted by incandescent lights; and, in all buildings, a number of outlet boxes for extension lamp cords are provided in addition to the stationary lights.

WATER SERVICE AND SEWERS.

The high cost of cast iron pipe in this locality made the use of iron water mains undesirable; and, as the soil at the shops is a dry gravel, wooden water pipe was installed throughout the shop yards. Fire hydrants are arranged about the yard; and, in addition, two hose houses, each containing a hose reel on a truck and a supply of fire hose have been provided. In the interior of each building hose valves and reels of fire hose have been provided so that fires originating inside of the buildings may be properly attacked.

Owing to the fact that seepage through the soil is very rapid, the round house, turn table and cinder pit drain into a dump pit. The sanitary sewers from the machine shop and storehouse are connected through a manhole to a city sewer running near the shops.

CONSTRUCTION.

The preliminary work for the plans of the shops was taken up in May, 1908, and construction was begun the latter part of June. All buildings and equipment were turned over to the Railroad Company, ready for operation, early in November 1908.

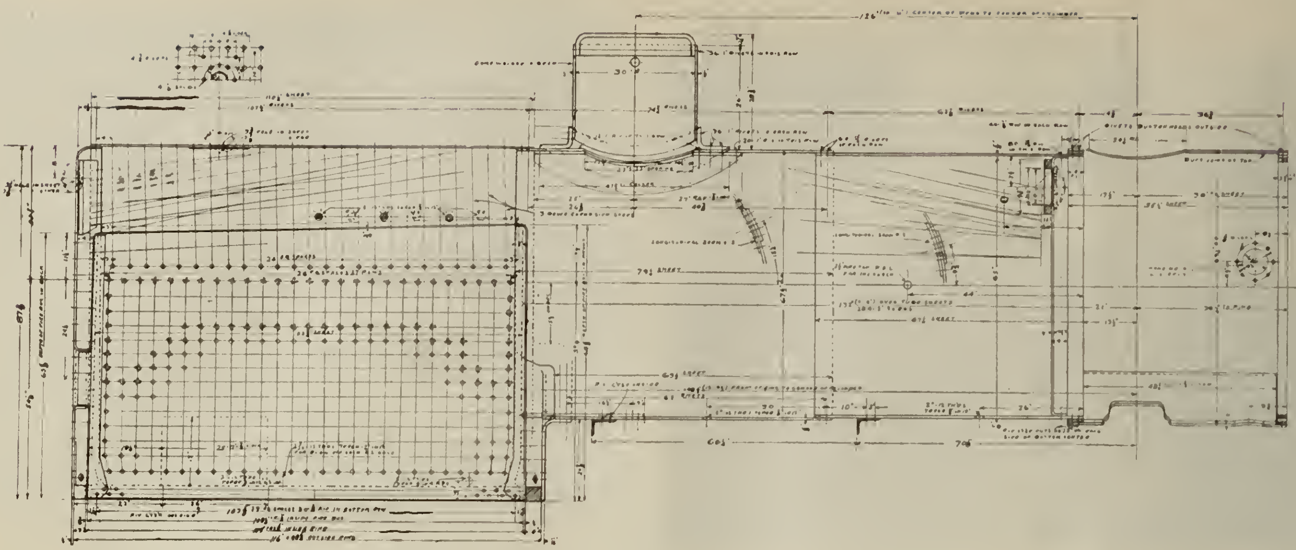
The shops were designed and built, and all the equipment was furnished and installed, including even all hand tools necessary to make the shops complete and ready for operation by Westinghouse, Church, Kerr & Co., engineers under the supervision of Mr. R. F. Blackwell, vice-president and general manager, and Mr. W. C. Smith chief engineer of the Idaho & Washington Northern Railroad.

Six-Wheel Switcher

C., H. & D. Ry.

The six-wheel switcher, shown herewith, was built by the American Locomotive Company for the Cincinnati, Hamilton & Dayton Railway. It has a tractive power of 28,160 lbs. and a total weight as well as weight on drivers of 135,500

Six-Wheel Switcher, Cincinnati, Hamilton & Dayton Railway.



Elevation of Boiler, Six-Wheel Switcher, C., H. & D. Ry.

lbs. The weight of engine and tender in working order is 236,000 lbs.

The engine is built for standard 4 ft. 8½ in. guage, and has a wheel base of 11 ft. 6 ins., the total wheel base of engine and tender being 42 ft. 11¾ ins. The diameter of driving wheels outside tire is 51 ins. and on wheel centers is 44 ins. The cylinders are 19x26 ins. and spaced 88 ins. between centers. The type of valve is the Richardson, balanced with 5½-in. travel and ¾-in. steam lap. The setting is 1/16-in. lead in full gear F. & B. The piston rod diameter is 3¼ ins. and piston packing is Jerome metallic.

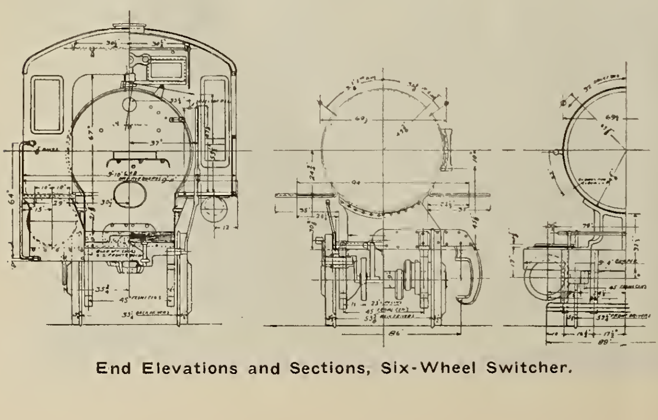
The axles of driving journals are 9x10 ins., and of tender are 5x9 ins. Journal boxes are of cast steel. The brake, driver, is Comb. West. Am.; tender, Westinghouse; pump, 9½ ins. L. H., one reservoir, 26½x72 ins.

The boiler is of the straight top type with outside diameter, first ring, of 66¼ ins. Bituminous coal is used, and the working pressure is 180 lbs. The distance from center of dome to center of cylinder is 126 ins.

The fire-box is of the narrow type, the width being 41⅞ ins., and the length 108⅛ ins. The water space is 4 ins. front, 3 ins. sides, and 3 ins. back. The thickness of sheets is ⅜ in. crown, ½ in. tube, ⅜ in. sides and ⅜ in. back. The crown staying is radial. The staybolt marked with broken circle are 1-in. Tate flexible. All short staybolts are of ⅞-in. diameter, except outside vertical row front and back, which are of 1-in. diameter. All short staybolts have 3/16-in. holes drilled 1¼ in. deep in outside ends.

The tubes are made of charcoal iron, the length being 11 ft., and diameter 2 ins. Guage is No. 11 B. W. G. There are 280 tubes.

The heating surface of tubes is 1600.5 sq. ft. and of fire-box is 160.5 sq. ft., giving a total heating surface of 1,761 sq. ft. The grate area is 31.5 sq. ft., and style of grate is the rocking.



End Elevations and Sections, Six-Wheel Switcher.

The tender frame is the American Locomotive Company standard. The style of tank is the U-shape slipping back. Capacity of tank is 5,000 gallons, and fuel capacity is 8 tons.

Steel in Passenger Car Construction*

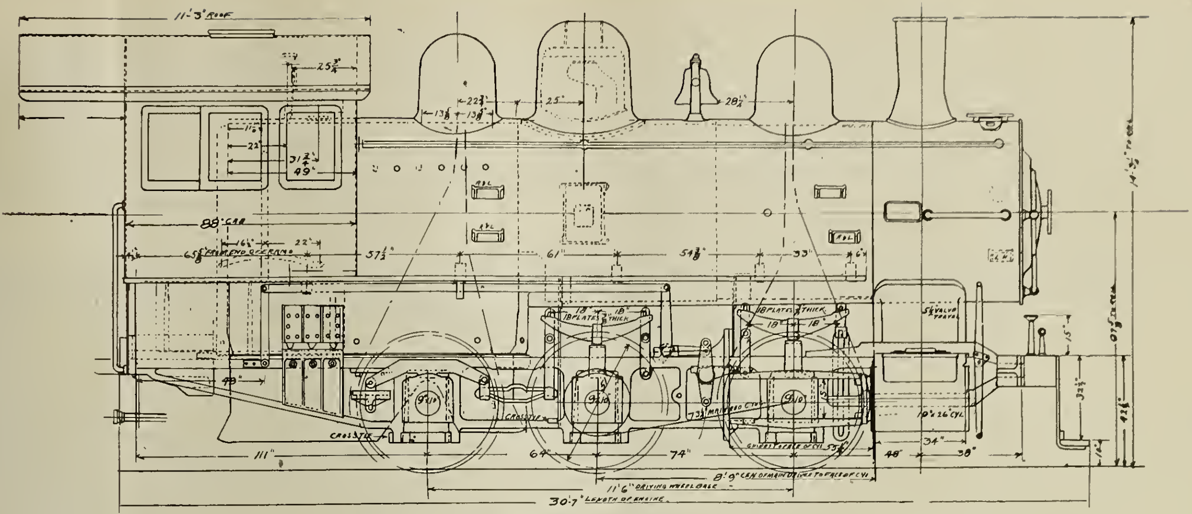
By John McE. Ames

The primary cause of the introduction of steel in passenger construction, I take to be the idea of safeguarding the passenger against fire and accidental injury from telescoping and other causes. Nearly every wreck of wooden coaches carries with it a harrowing tale of suffering from fire, and many legislators have agitated the question of compelling the railroads by law to provide the traveler with non-combustible conveyances. The advent of electricity as motive power increased materially the danger from fire and in order to avoid conditions such as existed in the Paris underground accident, the question of non-combustible coaches was brought forcibly before those railroads intending to enter New York by sub-river tunnels. Here the danger from smoke would be nearly as great as from fire itself.

Before the death of that far-sighted executive of the Pennsylvania system, the late Mr. Cassatt, he decided that with the completion of the tunnel system into New York, none but steel coaches should be used in tunnel service and preparation according to his policy is being rapidly brought to completion. These sub-river tunnels have, therefore, been factors in the introduction of steel in coach construction, but the primary idea is nevertheless the safeguarding of the passenger. The growing scarcity of long timber for sills and the reduction in cost of maintenance of steel over wooden cars may both be considered as minor causes in the introduction of steel.

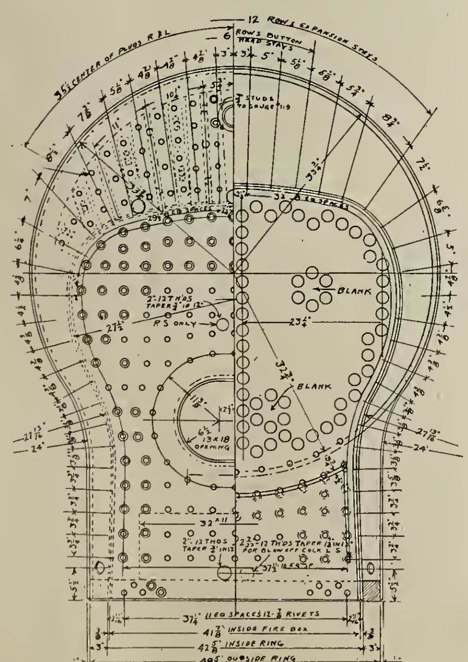
We know then why steel should be used but the question occurs to many as to where steel should be employed and where it is unnecessary. Opinions differ regarding interior finish, roof, doors, headlining, floors windows etc. To attain the safeguarding of passengers there is no question but that steel should be used for underframe posts, carlines, etc., or that steel or metal exterior should be used in order to avoid fire from outside causes. But is it necessary to make the interior of similar material even if it can be and is being done? The statement is often heard among railroad men, "If we are going to build of steel, let us build a coach entirely of steel without even a splinter of wood." This expresses the sentiment prevalent today, but I do

*From paper presented before the Central Railway Club.

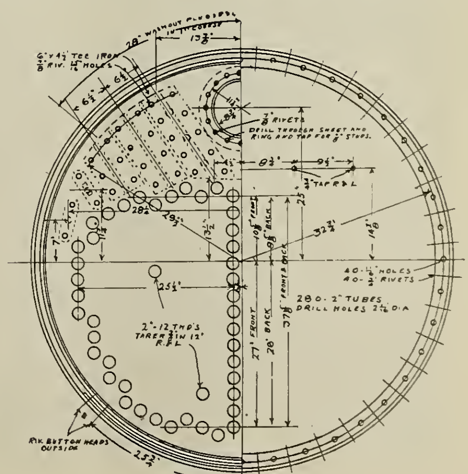


Elevation of Six-Wheel Switcher, C., H. & D. Ry.

not believe the result obtained by the elimination of *all* wood, compensates for the increased cost and loss of insulating qualities, nor is it necessary for the safeguarding of the passenger. In order to apply steel both inside the coach and out, every piece of metal must be either bolted or riveted in place, requiring much ingenuity to so design that rivets may be driven. The alternative is to rivet the outside plates to the frame and then attach the interior plates by means of machine screws tapped into posts and carlines. This generally proves an easy but sad solution, for vibration and unequal expansion soon loosen the tap screws and out they come like tacks driven into plaster. A few wooden furrings bolted to posts, belt rails or carlines, entirely covered on the outside by the steel construction, on the inside by the finish and head lining, which may be well fastened thereto by wood screws, offers a much cheaper, neater and unobjectionable method of construction except for the sentimentalist who wishes to eliminate the last splinter of wood. Aluminum or a slow burning artificial board certainly should be permitted to replace steel for headlining, partitions and interior pier covers. I would not advocate the use of steel for window sills or arm rests on seat ends. These parts soon loose their paint due to constant elbowing, thus presenting an untidy appearance and should be made of wood. The use of steel for roofs adds to the weight of the coach as at least ⅛-in. material is required when roofs are to be walked on while icing and filling tanks. The greatest care must be taken with joints of the roof sheets to avoid leakage. Good results are obtained by lap joints, both edges of which are welded to the adjacent plate by oxy-hydrogen or other process. This is all expensive work and there is doubt whether the result is enough better than canvas covered artificial board to warrant the additional expense. If, however, we are to safeguard the passenger, steel must be used for roofing in order to protect him from external fire in cases where a coach is overturned. Steel should not be used for roofs where power is taken from overhead wires, as it would prove too dangerous to employes. If steel is used in a case of this kind, it should be provided with a substantial insulating covering which will, of course, again add weight to the car. Floors are another difficult proposition in a steel coach. Passengers should not be asked to walk on a slippery steel plate, even if carpet covered and, therefore, some other surface must be provided. Magnesium cement has been largely used but could be substituted by interlocking rubber or cork tiles, both of which are insulating and slow burning. Steel alone should not be used for floors, but should be used on the lower surface especially with electrically driven trucks. The use of steel or brass for window frames seems like a waste of metal in view of the fact that heat from without, if severe enough, may break the glass and even though the wood should ignite, there is not enough of this material in the frame to pro-



Elevation and Section of Boiler, Six-Wheel Switcher.



Elevation and Section Through Boiler, Six-Wheel Switcher.

duce any serious result. The same may be said of doors if fitted with glass, otherwise steel should be used for doors as a protection against fire in adjoining coaches. From the builders' standpoint, the chief reason why wooden window frames should be used is that each farme may be fitted to place and a tight joint obtained in spite of unequal window openings due to camber, uneven metal work, etc. Steel for mouldings is today the accepted practice and a good product is obtainable in cold drawn metal, but here again must be provided wood furrings to which the mouldings may be attached by wood screws or else the undesirable tap screw, or similar device is required. Steel is good but not essential for partitions and seat frames. I believe the evolution of the steel coach will produce a more composite interior than required by present demands.

The subject of paint on steel naturally comes to mind. After building a coach entirely of steel at great expense so as to safeguard the passenger against fire, the builder is often required to paint and varnish the exterior and grain the interior to resemble wood, using highly inflammable material. This is, of course, an inheritance from the wooden coach, a habit which is hard to change. Steel can be given an excellent dull paint finish which could be easily kept clean and we await some Lochinvar to lead us away from the highly polished and inflammable finish now in vogue. Incidentally the subject of noise due to the use of steel was a mooted question before any coaches were built but anyone who has ridden in a steel coach will concede that, except for a slight drumming sound over the trucks, there is, if anything, less noise in a steel than in a wooden coach.

Having discussed why steel should be used in passenger car construction and where it should be or need not be used for safeguarding the passenger we come to a collateral subject which must be considered along with the use of steel, namely: its insulation against heat and cold. What have we gained if, while endeavoring to safeguard our passenger from fire and wreck, we freeze him in winter and roast him in summer? I am free to confess that there is very little data obtainable on this subject of insulation. We know that steel absorbs a large amount of heat from the sun's rays, but believe that with open windows and electric fans, steel coaches will be as agreeable as the present wooden coach in summer. Winter, however, presents a different problem. A steel coach in our Northern countries could be subject to an exterior temperature of 40 deg. to 50 deg. below zero and an interior temperature of 90 deg. (providing someone does not interfere with the porter) or in all a difference of 140 deg. The outside steel is tending to contract, the inside steel to expand, and both to equalize the temperature without and within the coach. This is the condition which ruins tap screw fastenings, tends to loosen rivets and destroy connections, thus warranting the use of wooden furrings, artificial board or other lining material not subject to expansion and contraction. In winter steel feels colder and in summer hotter than wood, and this is another reason why window sills and arm rests should not be made of steel. Air-tight joints are difficult to make with steel against steel and although an air space may be provided between the sheathing and lining, it is in no sense a dead air space such as is required for good insulation. Double floors should keep out the cold from below and there is little trouble with roof insulation, but the side and end framing, cut up by window and door openings, is a problem still somewhat unsolved. An attempt at insulation has been made by backing the steel lining with asbestos cloth, but joints cannot be covered as in a wooden coach and air gets through the smallest opening, thus reducing the efficiency of the asbestos packing. I do not wish to convey the idea that steel coaches cannot be heated satisfactorily, for slightly increased radiating surface over that required in wooden coaches produces the desired result, but still it is evident that the better the insulation, the less the required amount of heat, and it is along these lines that the problem should be taken up.

In guarding against leakage from rain or snow, joints must necessarily be made as tight as possible. This is done in the roof by welding or soldering the overlapping joints and in the outside of the frame by so constructing that plates and pier covers overlap so as to provide against leakage. The least opening which permits water to run down back of a plate produces a streak of rust and ruins the painters' best efforts. This can be and is overcome by proper design and workmanship and is not to be compared to the difficulty of insulating against cold.

When a railroad official makes up his mind that the safety of his passengers warrants the use of steel in his coaches, he usually asks the car building company, these two leading questions:

"How much more will a steel coach cost than my standard wooden coach?"

"How much more will it weigh?"

The answers to these questions depend upon many conditions and to some extent the price is governed by the weight. The only fair way to approach these questions is to compare the weight and cost per passenger according to seating capacity. All available information in regard to steel coach weights is tabulated on page 322 of M. C. B. Proceedings, Vol. 42, and to this the official is respectfully referred. It happens that the length of many standard wooden coaches is 60 ft. or under, the exact length having been largely governed by the longest stick available in one piece for sills. Now to substitute steel for wood in a 50 or 60 ft. coach, whose weight has been minimized by years of development, does not produce the result desired. To illustrate, reference to the table mentioned gives the weight of a 53 ft. 5¾ in. Penna. steel coach, seating 64 passengers, as 95,400 lbs. or 1,490 lbs. per passenger. Table No. 2 on page 319 of the same volumn gipes weight of Penna. wooden 53 ft. 9 in. coacn, seating 62 passengers, as 85,000 lbs., or 1,375 lbs. each a difference of 117 lbs. per passenger in favor of the wooden coach. On the other hand the same table gives the weight of the Pennsylvania 70-ft. steel coach, seating 88 passengers as 116,100 or 1,319 lbs. each and the weight of Penna. 70-ft. wooden coach, seating 80 passengers, as 106,000 lbs. or 1,325 lbs. each. Both the steel weights given include storage batteries not included in the wooden car weights. These figures illustrate the fact that when changing from wood to steel, in order to obtain true economy, the length best adapted to steel construction should be considered and a comparison then made on a basis of weight per seating capacity. An important factor which governs the cost, is the number of coaches in a given order. Designs, die work, formers, patterns, jigs, templates—all absolutely essential for steel work where wood could be cut and tried—cost as much for one coach as for 50, and unless duplicates of some standard coach already built, an order for a few steel coaches is necessarily a costly proposition. As the number in a given order increases, to some extent, the price per coach decreases, since overhead charges may then be distributed proportionately, but at best, the cost of steel is greater than wood in coaches unless a comparison is made per passenger carried. However, the steel coach should last longer and cost of maintenance should be largely reduced.

Having determined that the use of steel will safeguard the passenger and that the price of steel compares favorably with wood, if considered on a basis of cost per passenger carried, let us not forget that the stockholder is also interested in new rolling-stock. What effect has the use of steel in passenger construction upon the railroad stock-holder and his dividends? We can safely say that he benefits by the use of steel, due to decrease in cost of maintenance, and longer life of coach at small increased initial expense. But how about cost of repairs in case of wreck? A wrecked steel coach presents a bad condition and repairs of this kind are much more costly than for wooden coaches. If badly wrecked, the wood coach may also burn and leave no salvage other than the metal parts. If, on the other hand, a steel coach, by not burning or telescoping, has saved the life of one or more passengers, it has served the purpose for which it was constructed and the stockholder benefits by fewer damage judgments. The railroad company may well afford to scrap such a coach, obtain the salvage and purchase a new one with money saved from litigation.

To conclude, the use of steel in passenger construction is not an experiment but a matter of daily use. It lends itself readily to the skill of the artisan and reduces risk of serious accident to the passengers. It is more available than wood, produces a plainer effect, is easy to clean and weighs no more than a wooden coach if economically designed. The initial cost per passenger carried is about the same as for wooden coaches, its maintenance considerably less. The life of a coach is greatly increased by the use of steel, and damage suits as well as suffering in case of accident greatly reduced. The use of steel in coach construction is increasing daily and is here to stay.

Locomotive Repair Shops at Battle Creek, Mich.

Grand Trunk Railway

These shops were occupied October 1, 1908, and are centrally located on the Western Division, and take care of the repair work for 259 locomotives, covering over 1,000 miles of track. The general layout provides for a future extension of 100 per cent. to each building in such a manner that the area for extension is not between the structures, in which case it would be necessary to carry material from different departments over this additional area. Provision has also been made on the top site of the car department, which is to be located east of the present buildings.

The power house is located at the east side of the shops so as to be central when the car shops are erected. The 75-ft. 10-ton yard crane serves all shops and storehouse, covering an area of 100,000 sq. ft., which is used for the storage of heavy material, castings, etc. A foundry, and carpenter and pattern shops, are to be located on the north side of the yard crane run-way opposite the locomotive shops, and the frog shop just east of the present forge shop, on the south side of the yard crane run-way.

All buildings are parallel to the main line, and all yard tracks to buildings connect with the main line to give free movements of material to and from the shops.

POWER HOUSE.

The power house is a handsome substantial building, the concrete foundation of which rises to a height of 5 ft. above the ground, and supports the steel structure with its colonial shale brick walls and flat composite roof of aasphaltum. The floors throughout the building are of concrete, thus minimizing the danger of fire. The two parts into which the building is divided forms suitable boiler and engine rooms.

The boiler equipment consists of four vertical Wickes boilers, each of 340-hp., a water heater 54 ins. in diameter and 23 ft. high, and an outside packed union boiler feed pump. The boilers, which are arranged in batteries of two, each battery occupying 596 sq. ft., are hand fired, with a heating surface of 3,402 sq. ft., and are supplied with rocking grates 52 sq. ft. in area. Coal is dumped into the bunker directly from the cars and fed into the coal chutes, which are conveniently arranged before each firebox, the labor of stoking being thus reduced to a minimum. More than sufficient draft is obtained from a circular concrete chimney which rises to a height of 175 ft., and is so constructed as to permit the extension of the boiler plant if an increase of

Interior View of Erecting Shop, Battle Creek, Mich.

power is desired. High pressure steam is supplied to the engine room for power; to the forge shop to operate the steam hammers; to the locomotive shops to drive the heating fans and for boiler testing purposes; and to the office and storehouse where it is reduced in pressure and used for heating purposes. Low pressure exhaust steam and, when this is insufficient, steam reduced from high pressure is used to heat the locomotive and forgs shops. The steam piping leading to the different buildings is suspended in an underground concrete tunnel, covered with movable concrete slabs which, being slightly above the level of the surface of the yard, form a convenient walk down the midway.

In connection with the water system there is a water storage tank of 100,000 gallons capacity, supported on a steel structure 120 ft. high. This tank is supplied from the shop mains. The water pipes pass through the power house and the piping and valves are so arranged that the shops can be supplied either from this tank, or from the city mains, and that water can be pumped by a fire pump into the tank, or from either tank or city mains into the shop water system. This pump is a Worthington fire pump with a capacity of 1,000 gallons a minute and capable of maintaining a pressure of 75 lbs. There is also a vacuum pump connected in the return from the heating system which reduces the pressure in the return pipes to the equivalent of 10 ins. of vacuum. These two pumps and an oil filter are placed in the engine room on the floor below the level of the main room, which is 5 ft. above the ground.

In regard to electric power, after careful consideration, it was decided that it could be purchased more economically than generated. Power is therefore obtained from a hydro-electric plant which delivers it over a 3-phase, 60-cycle, 5,000-volt alternating current transmission line provided on entering the power-house, with the necessary protection against lightening. In the shops direct current of 220 volts, and alternating current at 440 volts are called for. To meet the requirements there are two banks of transformers in the power house, one composed of three single-phase, 250-k.w. transformers by means of which the voltage is stepped down from 5,000 to the 440 volts necessary; the other consists of three single-phase 75-k.w. transformers, the secondary voltage being 152, the necessary voltage a 250-k.w. rotary converter providing the desired 220-volt direct current. A small induction motor is used to bring this converter up to synchronous speed. In addition a 200-k.w., 440-volt, 60-cycle, 3-phase generator, driven by a 300-h.p. simple noncondensing Corliss engine, running 150 revolutions per minute, installed, as well as a generator exciter driven by a small vertical steam engine. This generator can be used to avoid complete shut-down in case of trouble with the transmission line or generating plant. Also, as more exhaust steam than can be obtained from the fan engines and steam hammers is required for heating purposes in cold weather, it is clear profit to first utilize the live steam in driving the generator and exhaust from the engines for heating. The electrical apparatus in the powerhouse was manufactured by the Westinghouse Electrical Manufacturing Company.

The high tension apparatus, which can be operated from the switchboard by means of remote central switches, is located on two balconies, one above the other, beneath which the transformers are situated. In front of these, and facing the balconies is the switchboard, before which are located the generator, exciter and converter. Connected with the switch-board are two sets of alternating current, bus cars carrying 440 volts, one for the generator, the other for the purchased power, and also the buses for the 250-volt direct current circuit. The switch board comprises the necessary panels for the control of the convertor, and of the direct current, alternating current, generator, and purchased power lines, as well as six alternating current and two direct current feeders, the alternating current feeders are so connected

Tank Shop, Battle Creek, Mich.

Air Brake Department, Battle Creek, Mich.

that they can be thrown on either the generator or the purchased power buses.

A tunnel, built of concrete, lies beneath the floor behind the switch-board and passing through this the feeders are carried in lead covered cables through clay conduits from the power house to the fuse panels in the shops. Branches to motors and lighting circuits are connected to the feeders in service boxes.

ERECTING AND MACHINE SHOP.

The erecting and machine shop is a spacious building, under one roof, and constructed of steel, concrete and brick, being of self-supporting type, having floor dimensions of 170 x612 ft.

The concrete portion of the walls rises to the level of the window sills, for which point to the roof, brick is employed, colonial shale being used on the outside face. The roof covering the composition of felt and tar spread over with gravel, light being obtained through skylights and surrounding windows of the clere story of the erecting shop, while the roof lighting of the machine shop is furnished through windows of saw-tooth type.

By the medium of four pipes, placed at 24 ft. intervals connected to drain pipes inside the building, water from roof is conducted to the sewer.

Particular attention has been devoted to obtain full benefit of natural light. Instead of the ordinary window glass, the corrugated style was adopted, which latter though not clear enough to distinguish objects through, nevertheless the produced effect, giving a better diffusion of light and almost entirely eliminating shadows. Besides this the interior of the building, being painted white, produces an excellent reflecting surface.

Due consideration regarding the comfort of the employees is quite apparent in these shops. Situated on the balcony which extends along the machine shop side of the wall, a length of 588 ft. x 40 ft. in width, are to be found three heating fans by means of which air is drawn over an aggregate of 43,500 lineal feet of 1-in. steam pipe coils. The heated air passing through down ducts, enters concrete tunnels, leading to the diffusers along the walls, slightly above floor level from whence it enters the shop. It can be readily imagined that by this method, besides imparting warmth, a perfect circulation of air is steadily maintained.

A 60 h. p. engine drives each of these fans, the exhaust steam passing through the coils, which steam, along with that from the steam hammers, pumps and main engine, is ample to cope with an outside temperature considerably below zero point.

There are also located on the balcony, toilet rooms, and lavatories of approved sanitary design, a copious supply of hot and cold water being on hand at all times. Individual lockers of the hospital type are placed along the walls of the lavatories and in one of these each employee hangs his hat and coat during working hours.

Five feet metal urinals, which are also sanitary in design, are located on the ground floor at the column, on the dividing line between erecting and machine bays.

Hemlock sleepers placed four feet apart in well tamped sand constitute the foundation for the ground floor which is of 3x6 in. yellow pine.

In the erecting bay which is 70 ft. wide by 612 ft. long are twenty-five engine pits, each 43 ft. in length, having a space allowance of 24 ft. between their respective centers.

Extending along the sides of each pit are recesses, in which are hung air piping and wiring conduits. The former have connections to admit of the use of extension incandescent lamps. Water and steam pipe valves are placed at the back end of each pit to be used in connection with the customary boiler test. Between each two pits is located work bench attached to which are two extension lamps similar to those in pits. Each of the benches is also equipped with two heavy vises. To all the supporting columns adjacent to the back end of the pit, there are also attached air pipe connections, and plug receptacles.

Norton Draw Cut Planer, Battle Creek.

The erecting bay possesses the advantage of two electric cranes, one of 120-ton and the other of 10-ton capacity. These are supported by separate runways, which are attached to the steel frames of the building. The larger crane being above the smaller one has ample head-room to carry a locomotive the entire length of the shops over the others, while the smaller crane expedites the work of stripping and erecting various parts of the engines.

Motor driven double emery wheels are placed along the walls immediately in front of the locomotives to save time on various portions of the work.

There are two tracks which enter the machine shop opposite the sixth pit from each of the erecting shops to facilitate the transporting of engines to and from that shop.

At one end of the erecting bay five pits are temporarily covered over, that portion being allotted to the pipe department and also to the welding and cutting of flues. It might be stated that due to the fact of an approved method of repairing flues and also the relative location of each machine and furnace, the process of accomplishing the work is of an expeditious character. A motor driven pressure blower delivers a 14 oz. blast to both of these last named departments.

Running parallel with the erecting bay is located the heavy machine tool section of the machine shop. This section is 60 ft. in width and 612 ft. long. It is not at present used entirely in the interest of the machine shop, about 120 ft. being used as carpenter shop. The entire length, however, is served with a 10-ton crane. The machines in this section are driven by an individual motor. With the exception of a portion of the wheel and truck department and the major portion of the general machine department, all the other departments embraced within the machine shop on the ground floor are arranged under the balcony in the following order, commencing 24 ft. from the west end: Wheel and truck, piston and crosshead, motion, tool, bolt and rod. The tin, paint, air brake, brass finishing, machine repair, belt, and electrical departments are located on the balcony floor which is of re-inforced concrete.

In order that each one of the above named departments might be self-sustained a sufficient number of machines of varied types have been allotted it, thus obviating the frequent handling of the work.

A concrete caustic soda vat having inside dimensions of 10x10x10 ft. deep is located in the main bay of the machine shop. By means of this the work of cleaning wheels, engine trucks, etc., is quickly accomplished. Through the medium of a small motor driven exhaust fan the fumes from this vat are conducted outside the building.

BOILER AND TANK SHOP.

These shops are located at one end of the machine and erecfing shops at right angle thereto, being constructed on similar lines to that of the erecting shop, having floor dimensions of 180x205 ft. A brick curtain separates this shop from the erecting and machine shops. An opening, however, admits of the conveying of boilers to and from the erecting shop, the boilers being passed through by means of a truck with a revolving top.

The main boiler bay is 60x180 ft. and has ample capacity to accomodate nine boilers at one time and is covered by a 30-ton double trolley crane. In the machinery bay which has dimensions of 50x180 ft., an accumulator capable of exerting water pressure of 1500 lbs per sq. inch has been installed. This is supplied by two motor driven pumps adjacent to it. The hydraulic tools consist of a large four-post flanger and a horizontal punch having a 60-in. throat. In addition to these there is in the forge shop two heavy shears, a large punch and a bulldozer, which receive power from this plant. The riveting tower has not yet been equipped with its relative machinery.

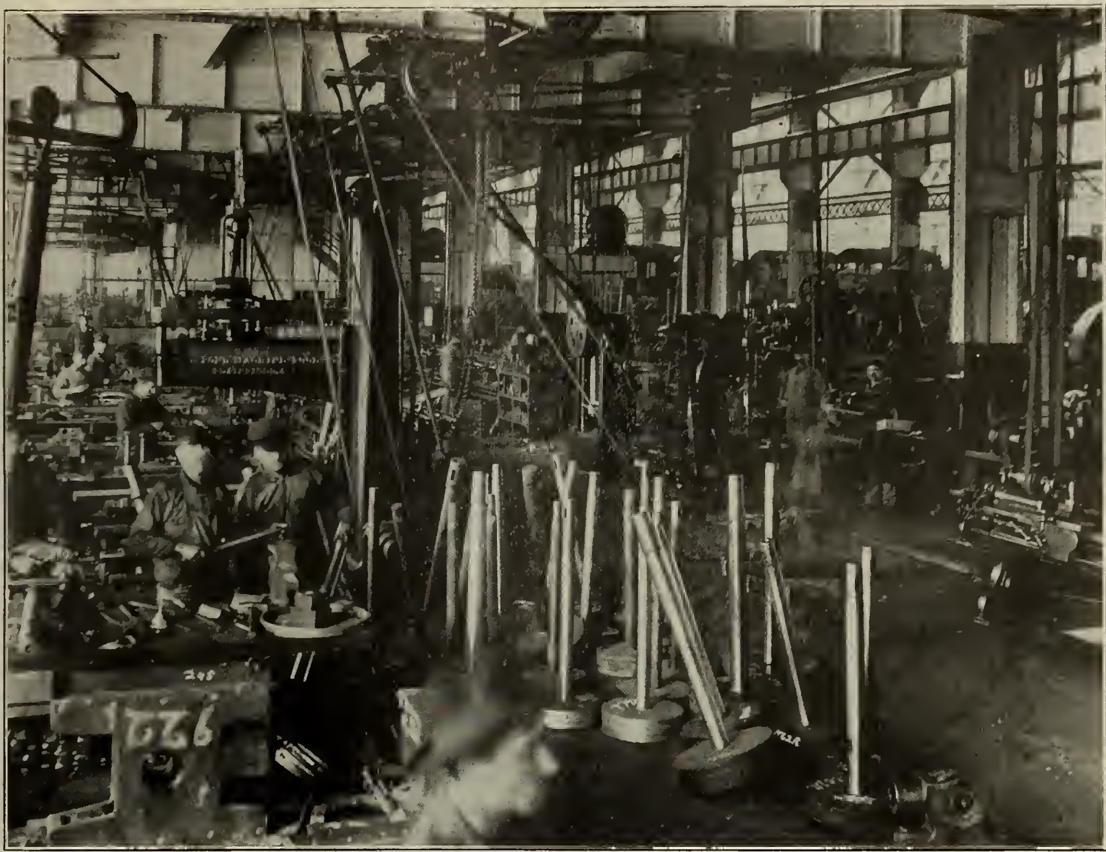
A large annealing furnace forms a part of the equipment in this department, also a motor driven splitting shears and punch besides other miscellaneous tools. The brass foundry is also temporarily located in this bay. A 10-ton overhead travelling crane and several jib cranes facilitate the handling of the work in this bay.

The tank shop is divided into two bays running parallel with each other; one on which truck wheels and axles are dealt with and the other dealing with repairs to frames and tanks, the tank bay having a floor space of 65x205 ft., which gives ample room to place a tank and a frame on a single stall. A 20 ton double trolley crane is employed in this bay.

Alluding again to the machine bay which has a floor space of 30x205 ft., half of this bay is traversed by a five-tone single trolley crane, the remaining portion having been provided with a balcony on which are located toilet rooms and lavatories, containing individual lockers. In addition to this there is a blower of which the heating coils contain 15.50 lineal feet of 1 in. pipe. Thus the building is kept at a comfortable temperature even in the coldest weather.

On each column in this building there are air drops and lighting receptacles similar to those described in the machine and erecting shops. In the locomotive, boiler, and tank shops, offices for the foreman have been provided. These are equipped with telephones and are elevated above the ground floor, thus commanding an unobstructed view of the entire shop.

Boiler Shop, Battle Creek.



Light Machine Bay, Battle Creek, Mich.

Throughout each building and attached to their supporting columns are to be found fire hose supports, on which are hung the necessary fire hose, which are also connected to their respective water valves. By means of this arrangement there exists excellent fire protection.

FORGE SHOP.

The forge shop is 66 ft. east of machine and erecting shop with the north end on yard crane runway. The building is a self supported steel frame with brick curtain walls, composition roofs and cinder floor. The inside dimensions are 100x200 ft. and 24 ft. 8 ins. from floor line to bottom of roof trusses.

The building is divided into ten 20-ft. bays. The windows are 15 ft. 8 ins. wide, and extend from concrete water table to bottom of roof trusses. The center of roof has a monitor 10 ft. high by 20 ft. wide with a pivoted sash, mechanically operated for ventilation and light, and this with wall windows give excellent lighting.

Ribbed glass is used, which diffuses the direct rays of the sun, so that men working close to the windows are not inconvenienced when the sun shines directly on sides of building. The toilet and locker rooms are located on the outside on the west, a side of building.

All steam piping is carried in an underground tunnel in centre of building to and from steam hammers. The oil and water piping is carried underground in pipes laid in concrete and high pressure air in roof trusses with outlets on columns. The wiring is brought in at north end of building and carried overhead for lights and motors.

All material in this shop is handled by jib cranes and cars on a 24-in industrial track and serves all parts of the building. The coal and coke sheds are located just south of shops, and industrial track runs into it, so that coal can be taken to all forges on a small coal car.

The draft for all furnaces and forges is furnished by the American Blower Co.'s blower, directly connected to a 100-h.p. induction motor. The air piping is galvanized and is carried overhead for forges and furnaces, except where the down spout would interfere with jib cranes, in which case it brought down the wall, and underground to furnace or forge.

There are 10 McGaslin double forges on the west side of building. All light work is done on side next wall, while on the side next the steam hammers, which range from 350 lbs. to 3,300 lbs., the heavy work is taken care of. Near the north end of the forges in the centre of the building is placed a special fire, which is raised and lowered by air. This is used for welding frames and is close to the 3300-lb. single frame hammer, both of which are covered by a jib crane and are close to yard crane for handling engine frames.

The hydraulic bulldozer, the hydraulic bar sheer, 3½ in. forging machine, 1½ in. bolt forging machine, with their oil furnaces, are located in northeast corner of shop, and take care of all machine forging for the plant.

Just south of this on east side of building is the axle department, with axle furnace, 5,000-lb. hammer and double cut-off and centering machine. This machine and the two forging machines are run by a 30 h. p. motor group drive. The 3,500-lb. hammer and furnace are located just south of this, and take care of the heavy forge work.

The spring department is located in the south end of the shop, and contains the nibber and trimmer, and tapering rolls, with individual motors, also a hydraulic punch and hydraulic spring bender, with suitable furnaces conveniently located. There is a vertical hydraulic shear near the center of the shop for general purposes.

All furnaces are of oil burning type, supplied from tanks located in a concrete oil house about 300 ft. south of forge shop under a pressure of 20 lbs. All forges are fitted with 22-ft. stacks extending through the roof, thus removing the smoke and gasses by means of natural draft.

STORE, OFFICE BUILDING AND OIL HOUSE.

The store and office building is a two story structure, built

Store House, Battle Creek.

of re-inforced concrete and brick. It is 60 ft. wide by 200 ft. On the east and west sides there is a concrete platform 12 ft. wide. This platform is on a level with the first floor. which is occupied by the store department and the unloading tracks which run on either side of the building are located at a level convenient for unloading freight from the cars to the platform. These platforms extend to the centre of the midway where heavy material may be easily handled with the yard crane. The platform along the east side extends to and around the oil house, which is located about 150 ft. from the store and office building.

The main entrance to the building is located in the south end. At this point there is a spacious hallway: to the right is the clerk's office of the store department to the left the storekeepers private office, while directly in front is a stairway leading to the motive power department offices which occupy the second floor. Back of the stairway on the first floor is located the vault, filing and toilet rooms and then comes the general store room which is fitted up with necessary shelving counters, scales, etc., and is very complete in detail.

The second story is occupied by the master mechanic and his staff, it is divided into two sections by a hallway running from the top of the stairway to the assembly rooms at the north end. The master mechanic's private office which is located at the southwest corner in a commodious room 20 ft square finished in quartered oak. maple floor in a commodious room 20 ft. square finished in quartered oak, maple floor and tinted walls. Next to this in the south end is the stenographer's office, 14x20 ft. and on the west side the clerks' room 32x50 ft., adjacent to the clerks' room is the filing room and vaults. Continuing along the west side the drawing class room is next and this room is 32x40 ft. It is fitted with tables, drawing boards, blackboards, etc., and across one end is a row of clothes lockers to accommodate the clothing of those who attend the evening classes. Two evenings a week are devoted to the instructing of apprentices in mechanical drawing, practical mechanics and electricity. Across the hallway from the drawing class room is a reading room, 20x40 ft. This room is provided with the latest periodicals pertaining to the mechanical, scientific and literary world. Leading from this room and also the drawing class room are vertical rolling doors, which may be opened into the assembly room, which is 60x80 ft. and will accommodate about 400 persons easily, making an ideal place for social functions, lectures, etc. Continuing along the east side and opening from the reading room is the library with the book cases which are stocked with the latest works of friction. The toilet room comes next. followed by the draughting room in the south east corner.

The building is lighted throughout by incandescent electric lamps of 16 candle power. Clusters are artistically arranged on chandeliers hung from the ceiling, each lamp being inclosed in frosted glass globes. In the office where desk work is being carried on, plug connections are arranged at convenient palces in the walls so that desk lamps may be used Steam heat is used throughout the building, the steam being supplied from the power house at low pressure.

The part of the building devoted to the office work is finished in quartered oak, maple floor over concrete, and tinted walls. Class partitions are located on either side of the wall, on upper story. Each room is provided with necessary lockers and toilet.

The oil house is a single story building 30x40 ft. and it is built of re-inforced concrete and brick. The floor of the building is about ten feet above the ground level, which happens to be low at this point and makes convenient place for the air storage tanks, ten in number, with a capacity of 2,000 gallons each. The oil house is divided into two rooms of equal size, one is used as a pump room for pumping the air from the tank below, the other for the storing of oil in barrels. The oil pumps are six in number three of which are power pumps and the others are operated by hand. There are of the Bowser self measuring type. The power pumps are operated by a two-horse power Western Electric motor belted to line shaft.

SEWERAGE.

It was necessary to install two sewer systems as it is against the rules of the City Board of Health to dump raw sanitary sewerage into the creek at this point because it would become a nuisance in the summer when water is low as the creek flows through the center of the city for two miles.

It was either a case of putting in a purification plant or pump 1,000 ft. against a head of 25 ft. into the city sewer. There is such a small difference in elevation between end of sewer and creek which is close by that filtration beds would be overflowed several times every year by the high water in the creek, therefore it was decided to install the pumping plant. The pump pit is house is located south of buildings and all sanitary sewerage is brought to this point by gravity.

The pumping apparatus consists of two separate units so that one is always ready in case anything goes wrong with the other. Each one has centrifugal pump directly connected to a vertical motor which is controlled by a switch and when water reaches the required height in pit, one pump then starts up and pumps it out and if this pump does not work, the

Oil House, Battle Creek.

Yard Crane Runway, Battle Creek.

other pump will start when it gets a few inches higher, and pump it out.

All rain water and water used for washing out engines, cooling compressors, etc, is carried by the storm sewer into the creek by gravity. The sewers are built of extra heavy double strength sewer tile with self cleaning grades outside of building, and inside of buildings. All sewers are of cast iron soil pipe to a point 4 ft. outside of building. All closets, lavoratories and urinals are of white heavy enameled iron with a hardwood finish.

TELEPHONE SYSTEM.

A local telephone system, connecting all foreman's offices, petit stores, powerhouses and other departments, has been installed. The switchboard is located in the general office of the master mechanic. At present 14 telephones are used and provision has been made on switchboard for a total of 25 telephones, which will be installed when foundry, frog shop, carpenter shop and car department are added to the present plant.

WATCHMAN'S SYSTEM.

A watchman is kept on duty at plant both day and night. There are fourteen stations located around the plant at different places. Newman clock is used and the night watchman having to visit each station once every hour from 6 p. m. to 6. a. m. and register the stations on clock which shows on its record sheet the exact time each station was visited during the night.

THE REGISTRATION.

Each workman is required to punch a time clock on entering the shop in the morning, when leaving and returning at noon, and when leaving in the evening. Eight-day time registering clocks are used for this purpose. They are distributed in such a manner that they are convenient for workman to punch without extra walking from his entrance to building.

MOTORS.

The alternating circuit motor is used in all cases, except where speed variations cannot be mechanically accomplished, in which case direct current motors are employed. All motors from 5 h. p. and over are equipped with suitable starting devices, fuses and circuit breakers with low voltage release.

LIGHTING.

The general shop lighting is obtained by Copper Hewitt mercury lamps, which give a very steady and efficient light. They use a set of balanced coils, star connected to the 440-volt shop feeders. This gives a voltage between the neutral wire and any phase of 256 volts, which operates them. They are self-starting and light up as soon as switch is turned without tilting the tubes. They are connected two in multiple for each switch.

The installation here is interesting because this is about the first large shop in the country to install the alternating current type of Cooper-Hewitt lamp. The incandescent lights for drop lights in engine pits and erecting bay, also foreman's offices, are tapped directly off the 250-volt direct-current feeders. The lights for offices and store house are incandescent, and use transformers to step down from 440 volt to 110 volts. The yard lighting is done with series arc lights. A special panel and constant current transformer is located in power house for these, as the switchboard attendant turns them off and on.

WATER SYSTEM.

Water is pumped from the river at Nichols roundhouse, and forced through a 6-in. main to the repair shops. There is also a connection on the ground to the 2-in. high pressure main of the city water department that can be used in case of emergency. The water from the power house is carried through a loop of 2-in. mains around the shops to fire hydrants and different points along the buildings, from which points it is conveyed through the buildings in underground cast-iron pipes.

Drinking water is supplied from a deep well at power house, and is pumped through galvanized pipe to the different drinking fountains in shop by a small pump in power house.

COMPRESSED AIR.

The compressed air system is rather a novel departure from the usual practice, as a number of units distributed over the shops are used instead of a centrally located one. There are three 100 h. p. Ingersoll Rand air compressors, directly connected to 106 h. p. Western Electric induction motors, having Cutler Hammer magnetic starters, that automatically maintain an air pressure of 100 lbs. One is located in the north end of the machine shop, one in the center and the other in the boiler shop, two of them can supply the maximum demand, one being available in case of emergency. These receive air from the outside.

The air piping is carried overhead on the roof trusses and pipes to drops are carried down the column, piping for pits being hung in heating tunnel, which extends along the end of the pits.

SCRAP BINS.

These are located within easy reach of each stop, being planned to conform with the latest classification as compiled by the General Storekeepers' Association.

Lavatories, Battle Creek.

The Telephone for Train Dispatching

Although the telephone has been in use for years in connection with the transaction of business between the various departments of railroads and has become a universal means of transacting commercial business, it has not, until recently, been considered on an extensive scale as a substitute for the telegraph in the dispatching of trains on steam railroads.

During the past year, however, considerable thought has been devoted to the use of the telephone in place of the telegraph for the directing of train movements and the dispatching of trains.

There are several reasons for this. The first and probably most important one being the enactment of state and federal laws limiting the working day of railroad employes transmitting or receiving orders, pertaining to the movement of trains, to nine hours.

Another reason, which was brought about by the legislation mentioned, was the shortage of good telegraph operators. It was estimated that 15,000 additional operators would be required if the train order telegraph offices in service in 1907 were to be kept open after the new laws were in effect.

The increased expense occasioned by the employment of the additional operators, based on the prevailing rates, was estimated at approximately $10,000,000 per year.

Still another reason for the introduction of the telephone is the decreased efficiency of the average commercial and railway telegraph operator.

Whether this is brought about by the attitude of the telegraphers toward the student operator or the fact that there are so many opportunities in other branches of the electrical business that appeal more strongly to the young men interested in electrical work has not been determined, but no doubt both have a bearing on this point.

Notwithstanding the fact that the telephone is being used daily by the public for the transaction of important business even between points at great distances from each other, and further that the railroads themselves have for years used it in connection with the handling of the traffic in their terminals and in emergency for the directing of trains on the main lines, many railroad employes and officials questioned the advisability of using it, in place of the telegraph, for the issuing and receiving of train orders.

This is not surprising when it is remembered that the telegraph has been almost universally used for this service since 1850, and where properly installed, operated and maintained has rendered excellent service.

Further, the employes now engaged in telegraph service are naturally adverse to apparatus or methods of operation with which they are not familiar and which they fear may affect their positions. Many of the officials in the operating department of the railroads obtained their early training in the telegraph department and naturally have a preference for this service and have hesitated to recommend the use of a system which to them is comparatively new and untried.

The installation and successful operation of telephone train dispatching circuits by a number of prominent railroads throughout the country during the past year has demonstrated beyond a doubt that this service can be rendered by telephone with equal safety, reliability, and accuracy, and further, with greater speed and also at a decreased expense than when rendered by telegraph as heretofore.

Owing to the differences which exist in the construction and operation of the railroads throughout the country, the geographical and climatic conditions to be met and the volume and character of the traffic which must be handled, it was believed by some that, while the telephone could be used on some roads it could not be successfully used on others.

*Paper by Mr. W. E. Harkness, Western Electric Company, before the St. Louis Railway Club.

While it is true that the differences noted are important factors in the problem and that that which will be satisfactory in meeting the conditions existing on one road may not meet those existing on another, it is equally true that with a knowledge of the conditions to be met and a thorough knowledge of the telephone art, a system can be designed to meet the new conditions and render equal and, in the majority of cases, superior service to that obtained with the telegraph.

This has been confirmed by the experience of those roads who have recently installed the telephone for dispatching service, as well as those who have for years been using the telephone exclusively for this service or as an adjunct to their telegraph system.

The first questions that are asked when the use of the telephone for train dispatching is suggested are:

How does it differ from our present practice of dispatching trains by telegraph? and what advantages does it possess over present methods?

In answer to the questions the following differences and advantages are found to exist:

The orders are issued verbally by the dispatcher to the operator or operators over a metallic circuit telephone line in place of being sent by telegraph. The orders are issued word by word, in some cases names and figures are spelled letter by letter to insure accuracy, and the dispatcher writes the order in his book as he dictates it to the operators, thus regulating the speed to such a rate as to enable it to be readily copied by the operators.

The same form of orders is used as heretofore; no changes have been made in their wording and the operators, receiving the orders, repeat them to the dispatcher as before, except that this is done by telephone in place of by telegraph.

The manner of calling the stations desired differs from that now employed, in that each station is called individually or any group of stations may be called without signaling the other stations, on the line. This is accomplished by means of selective apparatus at the stations controlled by the dispatcher, who, by pressing a button, corresponding to the station desired, can, within a few seconds, start a bell ringing at that station.

When the operators at the stations wish to communicate with the dispatcher it is not necessary for them to operate a key or other calling device, as the dispatcher's telephone is always connected to the line and all that is necessary for the operator to do is to place his telephone receiver to his ear, listen to see if the line is in use, and if not, talk into the transmitter.

The operating differences can be summed up in a few words by saying that "the orders are transmitted by speech in place of by telegraph and the stations are called selectively and distinctly in place of by telegraph code."

The physical differences are the use of two wires in place of one, the use of copper wire in place of iron and telephone and selective calling apparatus in place of telegraphic apparatus.

The advantages possessed by the telephone over the telegraph for dispatching purposes are many, as has been demonstrated by those roads who are now using it.

At present the dispatcher handling his work by telegraph is under both a mental and physical strain, due to his efforts to keep things moving and prevent delays to traffic and the almost incessant operation of the telegraph key.

The mental strain is not only occasioned by keeping track of the location of each train on the division and planning for their movements and meeting points, but also by the translation and transmission of his orders, letter by letter and word by word, by means of the telegraph key operated by hand and checked by ear. In other words, an unnatural method of communication is being used to transmit his thoughts which requires not only manual skill, but also mental effort.

A mental strain is also experienced when receiving by telegraph as the sounds received from the telegraph sounder must be translated mentally into letters and words before the meaning is clear.

It will be contended by many that the telegraph operator does all of this translating unconsciously and is therefore not subject to a mental strain. This, however, does not seem to be borne out by the experience of the dispatchers and operators who have been using the telephone for dispatching work, for in nearly every case the reduced strain has been noticed and spoken of. The fact that they do the same amount of work by telephone in one-half of the time formerly required by telegraph is sufficient to indicate that they experience considerable relief.

Some of this relief is necessarily physical and no doubt assists in reducing the mental strain. The abandonment of the telegraph key for calling the stations has been a great physical relief to the dispatchers and in place of calling stations continuously for minutes and not being certain of the operator receiving the call, they are now with a single motion able to give a distinctive and insistent signal and are assured that the signal is received at the station and also a prompt reply from the operator.

Several stations can now be called in much less time than it was usual to call one by telegraph, and the operators have been relieved of all calling of the dispatcher.

It has been found that the stations answer the signal given by the selector bell much more promptly than they do the sounder. This is partially due to the volume of sound given by the bell and also the fact that it will ring until they answer the call.

The fact that the noise of the telegraph instruments is removed will also have an effect upon the work of the dispatchers and operators.

The calling of stations by the dispatcher while conversation is being carried on with other stations enables a saving in time to be effected.

The greatest saving in time, however, is in the issuing and repeating of orders and the prompt replies received when inquiring as to conditions affecting the movement of trains. This is realized when it is remembered that the highest speed attained by an expert telegraph operator is around 50 words per minute, while with the telephone a speed of 100 words a minute may be attained without the skill required by the average telegraph operator. The average telegraph operator will average considerably less than 50 words a minute and in many cases the quality of the sending will be far from good, so that in addition to the speed there will be a difference in quality of service to be considered. The advantage of the increased speed of sending orders by telephone is very apparent when the operators at a number of stations repeat the order issued, for the dispatcher's O. K., notwithstanding the fact that many of the words are spelled letter by letter.

As to the accuracy of the telephone as compared with the telegraph it seems hardly necessary to answer the questions which have been raised in regard to the point when it is remembered that the dispatching and reporting of trains on a large number of roads has been handled for a year or more by telephone without mistakes having occurred, and, as we are all aware, the telegraph is not free from errors in transmitting or receiving.

Greater accuracy in transmitting orders by telephone is insured by the fact that the dispatcher writes down each word as it is spoken instead of sending it from memory by telegraph as is now customary and the same check is made on the station copies as at present, by having each of the operators repeat the order word for word as written by them, the other operators and the dispatcher all checking each repeat.

While on this subject, which is one of the first objections raised to the use of the telephone by those not familiar with its use and advantages, it may be well to state that as early as 1883, long before the telephone had reached its present high state of development, it was used for operating trains on the New Orleans & Northeastern Railroad. In this case the service was rendered over a single iron wire for a distance of about 100 miles and orders issued to four regular trains and numerous work trains. This method of operation was followed for over a year and during this period no accident occurred which could be attributed to the use of the telephone.

The Lake Erie, Alliance & Wheeling has been operating a line of single track road for a distance of about 100 miles by telephone exclusively for a number of years with equipment not to be compared with that now available for this service. Thirty trains in each direction per day are handled on this line.

The low grade division of the Pennsylvania Railroad between Columbia and Parkersburg, Pa., a distance of 38 miles, has been operated by telephone supplemented by block signals since August, 1906. The average number of trains passing over this division per day is 95 and the number of cars 4,800, transporting a total of 280,000 tons.

Many of the western railroads have for years been using the composite telephone to assist in the movement of trains. These telephones are connected to existing telegraph lines and while the service rendered is not as good as that which is being rendered by a modern dispatching circuit, it has been of immense benefit in clearing up congestions of traffic or enabling the dispatcher to be notified promptly of breakdowns or delays.

In addition to the foregoing there are numerous cases where the telephone is being used and has been used for years to handle the traffic of large terminals, and, if I am not mistaken, the terminal in your own city has been handled in this way for twelve or more years; in fact, the telephone service is absolutely necessary for its successful operation.

The improved line construction and telephone apparatus available today for this service is far superior to that used even five years ago and this, together with the safeguards already used in the issuing of train orders, is ample to reduce the chance of error to a minimum. It must be remembered, however, that any method of transmitting intelligence involving the co-operation of human agencies is necessarily subject to error and the telephone is not an exception to the rule. It must also be remembered that no mechanical device is free from troubles, but all that can be done is to make it as nearly free from trouble as possible, and I believe that the telephone apparatus of today is superior to the telegraph apparatus in this respect, and further possesses the advantage that it can be used by any one who can talk and hear.

In criticising the telephone for railroad service, particularly train dispatching, it has been stated that all voices are not transmitted equally well by telephone. This is true, but trouble from this cause is seldom experienced and it will be possible to obtain employes with suitable voices easier than it is to get employes who can send good Morse. It is also possible that a man's voice may be affected sufficiently by a cold to interfere with transmitting by telephone; this, however, is usually temporary, and with the telephone some one else in the office can readily take his place, which is not always true, when, on account of sickness, a telegrapher cannot work.

(Continued on page 93.)

RAILWAY MASTER MECHANIC

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Cutting Steel

At a recent meeting of the Central Railroad Club a paper by Mr. Cecil Lightfoot on the subject of cutting steel was presented. As the writer of the paper was absent, Dr. J. B. Waterhouse, of the Lackawanna Steel Company, explained more in detail the application of oxygen to cutting steel. In a few words this method is explained as follows:

The metal, either iron or steel, is heated to a temperature of about 1200 deg. Cent. by employing an oxy-hydrogen, oxy-acetylene or other flame. Now the form of blow-pipe provides two concentric jets of which the pre-heating flame is the outside annular one, and the interior is the jet of oxygen.

After the metal is heated to the required temperature the annular flame is shut off and the jet of oxygen is directed against the heated surface and causes rapid oxidation of the metal. It is possible to continue cutting across a rail, plate, or girder as the bright spot, where oxidation occurs, travels with the jet of oxygen, which should be moved very slowly across the metal. It might be said here that Mr. Lightfoot explained that it has not been possible as yet to use this method for cutting cast iron, due mainly to the graphitic condition of the carbon which prevents the direct union of iron and oxygen.

Railroad Purchases

A very forceful editorial appeared recently in the New York Times, on the subject of Steelmakers and Railroads. It brought attention to the fact that the betterment budget has been cut down from $16,000,000 in 1907, to $1,000,000 on the Burlington road. This curtailment of expenses was cited as an example that indicates the effect of adverse railroad legislation. It is said that in eleven states through which the Burlington passes, there are 272 laws pending, and 800 laws have been passed within the last two years. The complaint does not seem to be against legislation, but against the illogical rulings put into effect by men who understand railroad conditions superficially.

This same editorial mentions the fact that large appropriations are being made for railways, both in Canada and Mexico. The last sentence, which concludes this statement, is as follows: "The very men we denounce as malefactors are regarded as benefactors north and south of us."

In the past months since the organization of the Railway Business Association, we have called attention to its work many times. It is understood by every one that this association has for its membership the manufacturers who sell nearly all of the engineering railroad equipment, and this fact is openly admitted, but it should not in any way unfavorably influence the opinions of American people, inasmuch as in the plants of these manufacturers and in the railroad shops several millions of men are employed. It is thus plainly seen that the attack on the transportation companies strikes directly into our industrial enterprises.

The Railway Business Association has compiled a list of resolutions that were passed by prominent business organizations in this country since Nov. 24, 1908. It is surprising to note the interest that is taken in the work of the Railway Business Association and the demand for conservative legislation which all the business organizations throughout the country feel is necessary.

Single Phase Railways

The progress which has been made in electrification of steam roads in the past six years keeps the possible change in motive power constantly before the railway world. A paper on The Single-Phase Railway System which was presented before the New England Railroad Club by Mr. N. W. Storer, engineer, Railway Division of the Engineering Department, The Westinghouse Electric & Manufacturing Company, brought out some very interesting points on which a few remarks are here made.

The results of electrification of the New York Central, New Haven and other important roads are being watched very carefully. It may be said that the decision in favor of electrifying the Chicago terminal of the Illinois Central Railroad was due mainly to the success which has already been noted on roads in New York and vicinity.

If the change in motive power concerned only the locomotive itself, electric locomotives would undoubtedly be substituted for steam in all kinds of service throughout the country, because it is found that limitations as to the weight of trains rests with the draw-bars and the speed of trains with the construction of the roadbed. The electric locomotive is always ready for service; there are no fire-boxes, water tanks or coal bunkers; power is not consumed while the locomotive is idle, and finally there is no trouble from smoke or cinders.

The distribution of power, however, was a serious problem until 1902, when the single-phase motor was developed to operate satisfactorily. An impression should not be obtained that the question of power distribution has been solved for all purposes, it is only that progress has been made to such an extent that electrification is practical and makes for efficiency and economy in operation.

Before it was practical to use alternating current on the electric locomotives, it was necessary to provide sub-stations equipped with rotary converters at frequent intervals. The expense of such work is considerable and constant attention is required. On the alternating current systems transmission lines carry very high voltages with 11,000 volts on the trolley. Under these conditions step-down transformers alone are required at distances from 10 to 20 miles, and, as there are no moving parts, very little attention need be given to these transformer stations.

Three-phase motors have been used to some extent, but do not meet the conditions in railroad service. This is mainly on account of the over-head construction resulting in a complication of two over-head wires, and due to the fact that the three-phase motor is really a constant speed machine. On account of the numerous crossings it is not probable that the three-phase motor will be used other than in tunnels and for special service on continuous runs.

The single-phase motor, which is in service, is in a way a special type of direct-current machine and is said to operate better on direct than on alternating current. The armature is wound similarly, but in some cases resistance leads are inserted between the armature windings and the commutator. In the pole faces of the motor, there is also a set of coils, termed "compensating winding," which is used to neutralize armature reaction and improve the power factor. The motors for the New York, New Haven & Hartford road are designed to be used on the direct-current third-rail system of the New York Central and on the over-head single-phase system of the New Haven.

In concluding his remarks on the possibilities of the single-phase system, Mr. Storer called attention to the following points, which he explained in the paper:

"First, the necessity and advantage of high voltage for distributing current for railway purposes.

"Second, the fact that the single-phase system possesses this advantage, and has demonstrated its advantages, in cars and locomotives operating successfully at the present time in all classes of service. There are all sizes of trolley cars with equipments of from two to 50-h. p. motors each, up to 60-ton interurban cars, equipped with a total of 500 h. p. per car. There are locomotives doing all classes of work, from hauling heavy freight trains through the St. Clair tunnel, and the freight service in the long hauls on the Spokane & Inland Railway, down to the magnificent machines which are operating the trains of the New York, New Haven & Hartford Railroad between Stamford and New York."

In discussing the paper Mr. M. V. Ayers said that he realized some years ago that the most important phase of the electrical business would be the branch connected with electric railway work, and he looks forward to see the next step to be the electrification of the road between Boston and New York. Many other important points were brought out in the discussion. The above review will indicate the interest that there is in electrification work to-day.

Responsibility for Railroad Accidents

In placing responsibility for railroad accidents it must always be remembered that both railroad men and railroad equipment are given the most exacting inspection, the men in their knowledge of the work they are to handle and the equipment in the operation it is to perform.

Engineers, firemen, train-dispatchers, etc., are only promoted to the positions they hold or to higher positions, after they have served an apprenticeship and have given evidence of satisfaction both mentally and physically. Roadmasters and other track officials also serve a long apprenticeship, if service may be rightly interpreted as apprenticeship, and each road gives definite instructions as to the best methods of maintenance. The above officials were mentioned merely to illustrate this point, but in all branches of railroading the requisites are fully as stringent.

In so far as equipment is concerned, it is a well-known fact that new designs are thoroughly tested out before they are adopted. Railroad managers are very skeptical, because they realize the responsibility in the way of accidents particularly, for which they are held accountable when a change in equipment is made.

Mr. W. S. Park, general superintendent of the Union Pacific Railway, presented a paper before the Western Railway Club on the subject, Publicity for Railroad Accidents, in which he discussed the relationship between employers or officers, employes and the public. Then, after mentioning national legislation in connection with a deluge of laws, impracticable and impossible of observance, he made the following statement:

"The control of this tendency is in the conservatism of business, as, with the commercial classes our interests are mutual. Manufacturing and transportation are, perhaps, the two greatest human vocations, unless it may be that of 'production.' We should take into our councils those who more fully appreciate that railroading, as well as merchandising, cannot be managed or restricted by those who have little knowledge of its utmost requirements. If we are to be thus associated we must railroad on business principles. Throw open to the public that which they have a right to know. When they buy of us transportation for themselves or their loved ones, let it be with the assurance that if we are unable to deliver them safely, we will, as true business men, go to bottom of our inadequacy and disclose the reason and correct it."

In urging publicity for railroad accidents, he cited experiences of the Union Pacific, which indicate that open investigation even becomes an aid to the legal department of the railroad company, because it leaves no mysteries for legal "shysters" to point to insinuatingly.

M. C. B. Rules

The standing committee on rules of the Central Railway Club reported to the officers and members of the Central Railway Club on the revision of Master Car Builders' Rules of Interchange, as follows:

Rule 3. Defect cards shall be 3½x8 ins., and of the form shown below. They shall be printed in red ink on both sides, and shall be filled in on both sides with ink or indelible pencil. The cards must plainly specify in full each item for which charges are authorized, indicating on which end the defects exist.

The end of the car upon which the brake staff is located, shall be known as the "B" end, and the opposite end shall be known as the "A" end. The end of car towards which the cylinder push rod travels shall be known as the "B" end and the opposite end as the "A" end.

Rule 19. Flat sliding: If the spot caused by sliding is 2½ ins. or over in length, on cars of 60,000 capacity or under, or if the spot caused by sliding is 2 ins. or over in length on cars in excess of 60,000 capacity.

Rule 33. This rule should be changed to conform with the present practice, inasmuch as all hose are M. C. B. standard at present, and the rule should read accordingly.

Rule 41. This rule should be changed to conform with the recent decision of the American Railway Association as to size of advertisement matter permitted on freight equipment.

Rule 44. Cars intended to be equipped with metal brake beams and so stenciled, if found with wooden brake beams, any metal brake beam of proper dimensions and fitting to the car that does not require the change of hangers or other parts, will be considered proper repairs.

Rule 45. Cars equipped with M. C. B. couplers having pocket rear end attachments and so stenciled, if found with stem or spindle attachments instead of pocket, or any car having tandem attachments found with pocket for single spring.

Rule 49 to 55 inclusive. It is recommended that the combination of damage be eliminated, and that a new rule be incorporated making the combination to read one ned sill and three longitudinal sills on wooden underframe cars. Anything less than this combination would be considered owners' defects.

Rule 56. Change this rule to eleminate the combination on the end of car, and make it read: damage to end of car or any portion of the same broken outwardly, will be considered owners' defects.

Rule 76. Change the reading of this rule to conform with the recommendation in Rule No. 3.

Rule 85. Change the reading of this rule to conform with the recommendation in Rule No. 3.

Rule 94. Change the price for side door for stock or box car, to $4.00 in place of $3.65; also change the price of half of end door on furniture or carriage cars, to $3.50 instead of $3.00.

Rule 113. Your committee respectfully request that proper consideration should be given the portion of this rule referring to the application of metal center sills, inasmuch as they do not consider the increase of $40.00 on the value of bodies sufficient, and that the same should be increased in value.

Passenger Rules.

Your commitee respectfully recommend that paragraph "C" of Rule 3, also Rule 4 entire, on page 90 be eliminated, inasmuch as this is taken care of by special agreements.

Your commitee respectfully recommends that some definite action be taken to outline the wear of flange on steel and steel tired wheels in freight car service, with a view of condemning the same.

Your commitee respectfully recommend that some definite advice be given as to the clause in Rule 22 on the handling of pitted journals, as to whether the same can be charged on the basis of truing up the journals or not.

It is the opinion of your committee that some consideration should be given the subject to include in the rules a price for adjusting brakes.

Your committee would respectfully call attention to the fact that a large number of cases are coming up from time to time of metal parts of cars supplemented with wooden parts, and it is recommended that some rule should be framed to protect the owners on these parts.

Your committee would most urgently recommend that the name be stamped on each knuckle, the same as is now being done with the coupler, as we believe this would greatly benefit the interchange all around.

Your committee have carefully considered the question of M. C. B. Association repair cards, and it is felt that it would improve the service greatly, if the following recommendations was incorporated in the Rule covering the use of repair cards: M. C. B. Association repair cards shall not be required for ordinary running repairs covered in the train yards.

The committee was composed of Messrs. T. J. O'Donnell, B. H. Hawkins, R. . Miller, I. S. Downing, M. Meehan, Wm. Shone, J. S. Lentz, C. Montgomery, W. H. Williams, W. H. Sitterly, and C. E. Spoor.

Locomotive Repair Shops at Stratford, Ont.

Grand Trunk Railway

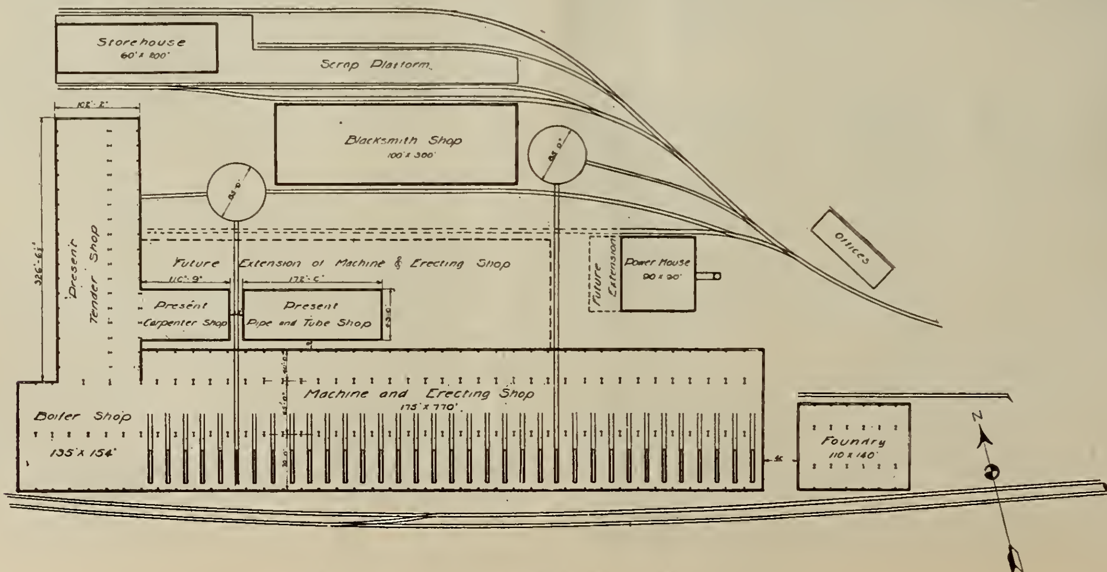
The new locomotive shops of the Grand Trunk Railway System in Stratford, which include part of the shops built in 1888 and also a new tender shop built in 1904, are among the largest on the continent. They were designed by the Arnold Company of Chicago. The Forest City Paving Company of London had the contract for the cement work, and the Canadian Bridge Company of Walkerville for the steel. The portion recently completed was commenced in August, 1907, so that the construction has taken about a year and a half. The modern machinery with which the shops are equipped, was installed under the supervision of Mr. Robert Patterson, master mechanic. A description of the shops, particularly the main portion and power house, follows:

The shops of the Grand Trunk Railway System now completed in Stratford are the general locomotive shops of the middle and southern divisions, including lines west to St. Clair and Detroit rivers and extending east to Toronto, Niagara Falls, Fort Erie, and all branch lines in the province of Ontario. This division includes about 1,491 miles of road and 400 locomotives.

The new shop plant consists of a machine and erecting shop, 616x175 ft., a boiler shop, 135x154 ft., and a power house, 90x108 ft. The power house and the machine and erecting shop are connected by a pipe tunnel made of reinforced concrete. In addition to these buildings there is contemplated in the future the erection of a foundry, 110x140 ft., and a pattern shop 50x120 ft. It is also proposed to run a yard crane from the foundry to the machine and erecting shop. All these various buildings, etc., are shown on the cut herewith published, which also shows the older buildings, consisting of the tender shop completed in 1904, the offices, the storehouse, blacksmith shop, carpenter shop, brass foundry, plate shed, tube and pipe shop, etc.

THE NEW LOCOMOTIVE SHOP.

This building includes both the machine and erecting shop and the boiler shop. The building is a self-supported, steel structure,



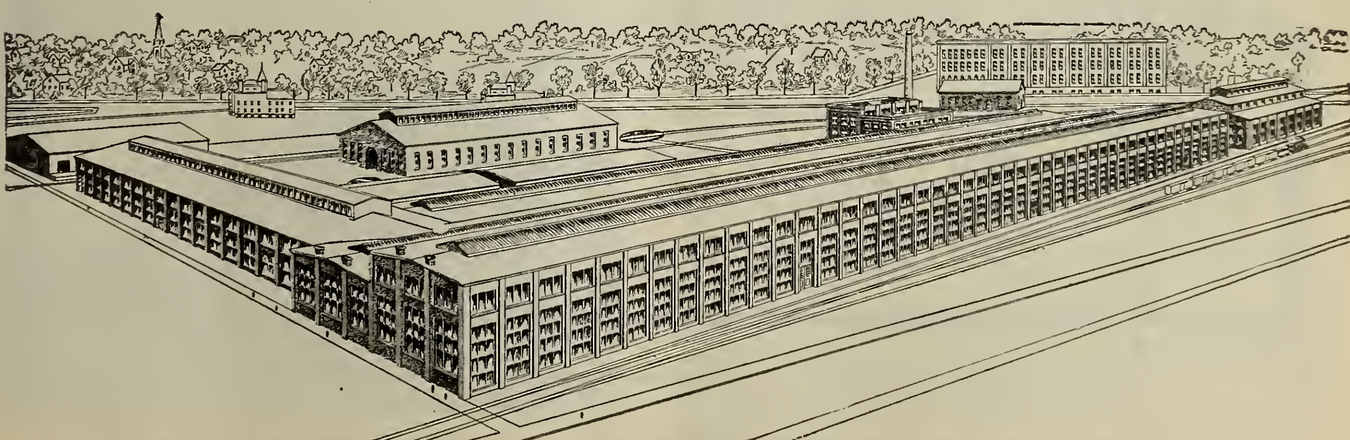
Layout of Locomotive Repair Shops, Stratford, Ont.

View of Locomotive Repair Shops, Stratford, Ont.

with concrete walls. The total length is 770 ft. and the total width is 175 ft. There is no division between the machine and erecting shop and the boiler shop, the same runways being carried through both shops. The erecting and machine shop is 616 ft. in length and contains 28 engine pits, 22-ft. centers. The locomotives enter the building on the north side from an 85-ft. turntable to engine pits. The engine pits are provided with air, water, and electrical connections for lighting and running small machines, such as cylinder-boring machines, etc. Jib cranes are mounted on south columns and occur midway between engine pits. These are to be used for the lighter parts of the locomotives during dismantling and erection. There are small jib cranes on center columns in machine shop and the columns on the north side of the machine bay to assist in handling material in connection with machine work independent of overhead electric cranes. The erecting shop is served with a 120-ton crane capable of lifting the heaviest locomotives to a height sufficient to clear the other locomotives on the floor, carrying same to any part of the shop desired. The interior view of the erecting shop illustrates the method of handling locomotives. Directly below the 120-ton crane is a messenger crane of 10-ton capacity for handling the various parts of the locomotives, such as drivers, trucks, engine frames, etc., which are not heavy enough to warrant using the 120-ton crane.

THE MACHINE SHOP.

Paralleling the erecting shop is the machine shop, in two aisles, one with crane service for large machine and one without crane service, containing small belt driven tools. Above the latter is a gallery used for heating fans, air brake department, brass work, bolts work, and other light machine work. All heavy machines in the center bay of machine shop are driven with individual motors, but machines under and above the balcony are divided into nine groups. Each one can be run separately or a number can be coupled up and driven together. As the work



Perspective of Locomotive Repair Shops, Stratford, Ont.

Erecting Shop, Stratford, Ont.

of this shop is all specialized, each group contains its own particular machines for its special work, also the necessary fitting equipment.

Alternate columns of the heavy machine bay are provided with compressed air and electrical connections. Air is also provided along north wall of building and under balcony. On each fourth column of the two middle rows of columns, water service connections are provided on the main floor and balcony.

THE BOILER SHOP.

The boiler shop is located on the west end of the machine and erecting shop, and is provided with stalls located on 22-ft. centers. The shop is composed of two bays, one 70 ft. wide and the other 65 ft. wide. The 70-ft. bay is served with a 30-ton crane, which crane runs upon a continuation of the 120-ton crane runway of the erecting shop. This is also served with a 10-ton messenger crane running below the 30-ton crane. The 65-ft. bay is provided with a 10-ton crane. No riveting tower has been provided in the present designs and if same is required in the future, an extra half bay will be built on the west end of the boiler shop, to the necessary height. This will be supplied with a 20-ton crane for lifting boilers, also with a hydraulic riveting stake. The boiler shop is further provided with flange and plate furnaces, which furnaces connect with flues in the west wall of the boiler shop. These flues are built inside pilasters of the building, being in cross-sectional area, 18x24 ins., with walls 8 ins. thick extending a short distance above the roof line. Four such chimneys are provided in the west end of the boiler shop. The boiler shop is also provided with two test pits, 24 ft. long and 4 ft. wide, for testing boilers. These are located in the southwest corner of the building, adjacent to the flange furnaces.

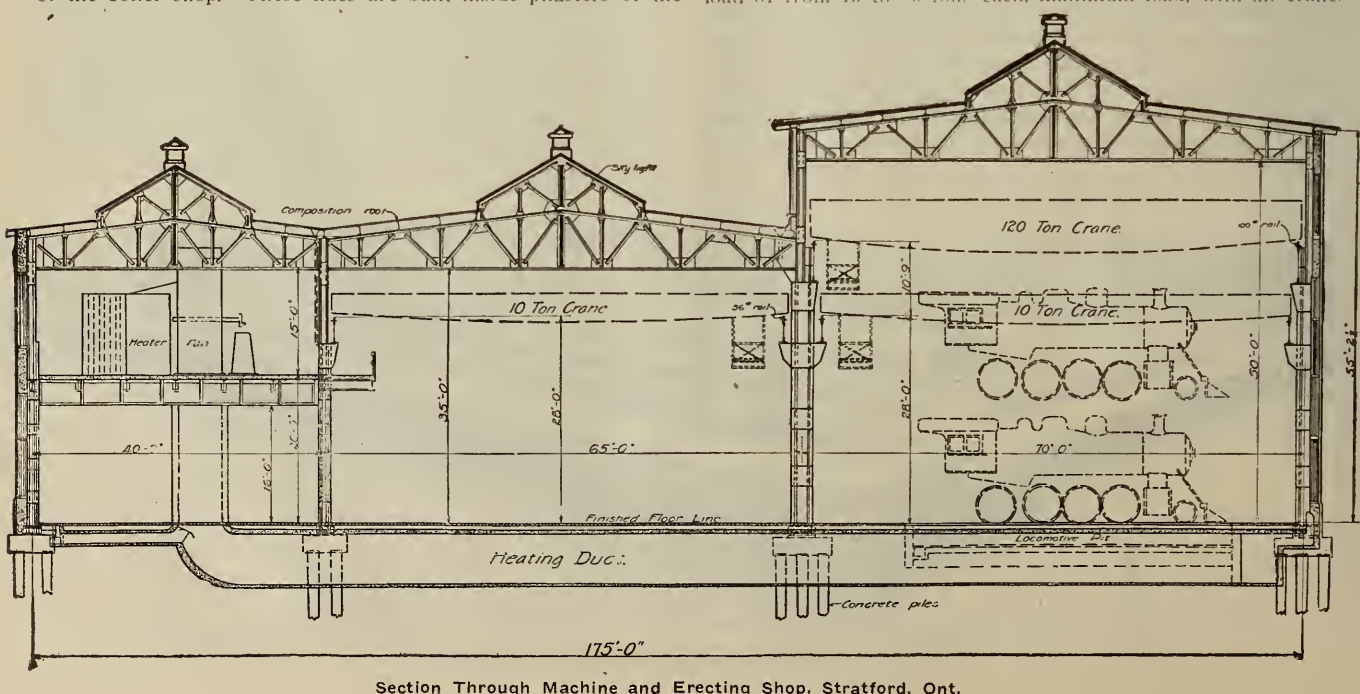
HEATING.

The entire building is heated by indirect radiation, utilizing exhaust steam from the power house in heaters. It may be necessary at times to assist the supply of exhaust steam by turning live steam to the heaters through a reducing valve. Fans are operated by small horizontal engines, the exhaust steam from which passes into the heating coils as an additional assistance to that supplied from power house. The experience up to the present time is that this system will provide ample heating requirements for the cold weather. The circulation of air throughout the shop is very good, keeping at the same temperature for the most part. The air is taken in from the outside by means of fans, driven by small horizontal engines, exhaust steam of which passes into heat coils. Fans, heaters and engines are located on the balcony, the hot air being distributed through a system of underground concrete ducts with openings in walls and in the ends of locomotive pits on the south side of building. A small heating duct is also provided under the balcony and underground on the north side of the building, having vertical outlets through the floor.

All wiring is concealed in ducts underneath the floor. Particularly good lighting is obtained by means of large windows and from skylights which are placed in all three bays of the building.

FOUNDATIONS.

The question of foundations required some study. The present shop plant is built upon to fill, varying in depth from 10 to 15 ft., below final floor level. After some consideration and comparison of various designs, it was decided to use concrete piles for the seven bents of the boiler shop and the west eight bents of the machine and erecting shop. These piles are driven in groups of from three to six each under the building columns. They were finished off about four feet below the floor level at which point a reinforced concrete cap was built up to an elevation 2 ft. below floor line, which elevation was adopted for the base of steel columns. The wall foundations were carried between these concrete pile footings and were reinforced so as to act as concrete beams. The concrete piles ordinarily carry a load of from 15 to 20 tons each, maximum load, with all cranes



Section Through Machine and Erecting Shop, Stratford, Ont.

fully loaded and full snow load on roof, between 35 and 40 tons on each pile. A test was made of one of these foundations and the same was found to be satisfactory under the above loads. The longest pile driven in was 20 ft., others varied in length down to 12 ft. The remainder of the foundations were designed with spread footings on basis of a soil pressure of 5,000 lbs. per sq. ft. These footings are carried down to the natural ground level and the wall footings are carried between them as concrete beams as previously mentioned. In the first eight bents of the machine and erecting shop, the engine pits are also supported on concrete piles, eight concrete piles being driven under each engine pit, each figured to carry a maximum load of 35 tons.

STRUCTURAL STEEL WORK.

The structural steel work consists of plate, angle and channel columns supporting roof trusses of the Warren type and plate crane girders. The steel columns are designed to carry the maximum roof, wall and crane loads with a fibre stress of 16,000 lbs. per sq. in. less the ordinary deductions for designing long columns. When crane thrusts and wind stresses are considered in addition, the total stresses are allowed to run up to 20,000 lbs. per sq. in. In designing crane runway girders, careful consideration was given to the effect of the horizontal and vertical shear on the top flange rivets, due to heavy wheel concentration. The balcony in the light machine bay is designed to carry a live load of 350 lbs. per sq. ft. The building is provided with a copper skylight supplied with ¼-in. ribbed wire glass. A sufficient number of lockers are provided for each workman in the shop, designed on the basis of 18 workmen per engine pit. One wash basin is provided for every four men. These lockers and wash basins are located in lavatory rooms directly under the heating fans. These rooms consist of two floors, 10-ft. ceilings. This arrangement makes the lavatories and lockers easily accessible from both the main floor and the balcony, stairs being provided immediately adjacent to these rooms, extending from the main floor to the balcony.

WATER SUPPLY.

The water supply for this department is taken from a lake adjacent to the city of Stratford. In case of this supply being insufficient to meet requirements, provision is made for using the city supply. The drinking water is taken from artesian wells located on the shop site. The water service lines loop all buildings where possible, to provide a proper circulation in all parts of the system. The fire hydrants are located in different parts of the shop. Addition fire protection is already provided by the city fire hydrants which are located close to the shops.

SEWER SYSTEM.

The shop plant is at present served by a sanitary sewer, which handles the drainage from water closets, wash basins, engine pits, etc. This system connects with the city septic tanks and contact beds, which are located about three miles from the shop site, near to the southwest of the city. The new shop is also provided with a storm water system, which will collect the yard drainage and roof drainage. This outside sewer is of vitrified tile to a point 4 ft. outside the building line, where it is joined by cast iron soil pipe inside the buildings. The storm water system discharges into a small creek to the west of the shop plant.

Machine and Erecting Shop, Stratford, Ont.

Machine Shop, Stratford, Ont.

POWER HOUSE.

This building is a self-supported steel structure reinforced with concrete walls, 90x108 ft. All walls and foundations below the ground have been water-proofed. The water room is equipped with four vertical water tube boilers, traveling link grate stokers and coal and ash handling plant. The engine room is equipped with two 400 kw. generators, direct connected to a horizontal tandem compound and two small 35 kw. generators direct connected to simple engines; the latter being for lighting purposes. One cross-compound horizontal Corliss air compressor with a capacity of 1,150 cu, ft. of free air per minute is also installed. In the pump room, there are two horizontal outside plunger feed pumps, two vacuum pumps and one fire and service pump and feed-water heater.

BLACKSMITH SHOP.

The original blacksmith shop has been retained, additions having been put to it in 1904, and it is an up-to-date shop.

TENDER SHOP.

The tender shop was also built in 1904 and is a self-supported steel structure, reinforced with concrete walls and has a capacity for holding 18 tenders at one time for repairs. This is served by an electric crane of 25 tons' capacity.

The electric power for shops is direct current, 220 volts. The shops throughout are lighted with Cooper Herwitt mercury vapor lamps. In addition to the shops, all the buildings on the company's property are lighted from the power house, including the Y. M. C. A., station, freight shed and roundhouse.

The Telephone For Train Dispatching.

(Continued from page 87.)

It should also be rembered that the telegraph operator is subject to paralysis of the arm due to the continued use of certain muscles in the wrist when sending. There is no such effect or any other physical trouble caused by the continued use of the telephone, and further, its introduction and use enables many telegraph operators already affected with paralysis, but otherwise efficient employes, to continue to carry on their work in a satisfactory manner. This should also appeal to other operators now using the key.

A very marked effect upon the relations existing between the dispatcher and the operators has resulted from the use of the telephone. It has been found that these employes have become better acquainted since using the telephone and that this has resulted in closer co-operation in the performance of their work. It is usual to find the men calling each other by their given names and the fact that they are talking with each other seems to have liminated the caustic remarks and comments so frequently sent by telegraph. The remark of a dispatcher after using the telephone for several months to the effect that he "had not been mad once since using the telephone" is well worth repeating as it indicates an improved condition. Another illustration of this is the reason given by an operator when asked why he liked the telephone. His answer after some thought was this: "If you and I were working together in an office and you had something to say to me you would not write me a message telling me what you wanted done and then send it to me by telegraph, you would turn around and talk to me. That's why I like the telephone." This statement seems to have reached the root of the matter, namely, direct personal communication.

The fact that the telephone can be used by train crews enables the dispatcher to get in direct communication with the conductor or engineer and in case of emergency obtain at first hand the conditions. By equipping the trains with portable telephone sets the dispatcher may be reached from any point between stations in case of break down.

The location of telephones located at sidings which may be connected to the dispatcher's line and thus enable train crews to keep the dispatcher posted as to their movements will be of considerable value.

The Union Pacific are using siding telephones together with signals which are under the control of the dispatcher. These signals are to be used to assist in the movements of trains when changes in schedule can be effected to advantage.

The first of the present type of telephone dispatching circuits was installed by the New York Central & Hudson River Railroad in October, 1907, between Albany and Fonda, New York, a distance of 40 miles. This section of the road is on the main line and has four tracks controlled by block signals.

The Chicago, Burlington & Quincy Railroad was the next road to install train dispatching circuits. In December, 1907, a portion of the main line from Aurora to Mendota, Illinois, a distance of 46 miles, with eleven offices, was equipped. This was followed by a section between Aurora and Galesburg, Illinois, a distance of 125 miles, with sixteen offices. A third section between Aurora and Clyde, the end of the Chicago terminals, a distance of 28 miles, with fifteen offices, was equipped. All of these circuits covered a double track road on which reverse movements are made.

The above installations were followed by an equipment on their single track line between Aurora and Savannah, Illinois, a distance of 106 miles, with twenty-three offices. This later equipment resulted in convincing many who were skeptical as to the use of the telephone on single track roads, as it was found that not only was the telephone service more satisfactory but safer than on double tracks when reverse movements were made.

These installations were followed by others until at the present moment there are over twenty telephone dispatching circuits in use on the C. B. & Q. R. R., covering 125 miles of double track, 28 miles of multi track, and 1,381 miles of single track and connecting with 286 stations.

Other railroads have equipped portions of their lines with telephone dispatching circuits and, except where due consideration of the various factors entering into their individual problems have been overlooked, have been successful in demonstrating the superiority of the telephone over the telegraph.

Among these are the following:

Lake Shore & Michigan Southern, Chicago & Northwestern, Michigan Central, Chicago, Milwaukee & St. Paul, Northern Pacific, Delaware, Lackawanna & Western, Great Northern, Chicago, Rock Island & Pacific, Union Pacific, Illinois Central, Canadian Pacific, Atchison, Topeka & Santa Fe, Erie Railroad, Virginia Railway, West Jersey & Seashore.

Numerous other roads have ordered equipment for this service or are contemplating doing so.

When it is remembered that this development has occurred in a little more than a year and has been effected without the occurrence of a single accident which can be traced to the use of the telephone, it must be conceded by even the most skeptical that the telephone is at least equal to, if not superior, to the telegraph for this service.

An outline of the factors entering into the problem of rendering telephone service for train dispatching will, it is believed, enable those not conversant with the details of the service to realize what must be considered when preparing for this service and also what has been accomplished by the manufacturer of telephone and selective apparatus during the short time in which the demand for such service and apparatus has existed.

The construction of the line for this service is one of the most important matters. In view of the fact that interference to the service affects the earning capacity of the road, great care should be taken to see that the best material possible be used in the construction of the line and that every means be taken to prevent interruptions to the service brought about by mechanical or electrical disturbances on the line.

Hard drawn copper wire of sufficient size to withstand wind and sleet should be used and the line should be a metallic circuit, i. e., two wires shuld be used. The wires forming the circuit should be properly transposed and so located in relation to other circuits as to prevent inductive disturbance from other wires or mechanical injury.

The introduction of considerable amounts of cable in the circuits, particularly rubber insulated telegraph cable, should be avoided as it reduces the volume and affects articulation. When cable must be used, lead covered paper insulated telephone cable having the wires twisted in pairs to prevent inductive disturbances should be used, not only on account of it affecting the transmission less than the rubber insulated cable but also on account of its lower first cost. Cable of this type can be furnished to withstand the potentials used on telegraph circuits and on account of its low capacity, as compared with rubber insulation, will improve the operation of telegraph service as well as that of the telephone circuits.

When adjacent telegraph or telephone circuits are to be used in cases of emergency as patch circuits for the dispatching circuits, care should be taken to see that they are in first-class condition before being used for this service. In some cases it has been found that such wires, owing to temporary repairs, are of various sizes and kinds of material and contain poor joints which, until discovered and removed, have occasioned poor service and increased the maintenance expense.

When constructing new lines it is well to bear in mind the future extension of the circuits or their use for patching other long circuits in cases of emergency, as considerable saving can often be effected by the proper selection of the kind and size of wire to render the desired service. It may often be more economical to provide wire of a larger size than is necessary at the start to provide for service which will be required in the future.

The lines recently constructed for dispatching service have in general been well built, and with but few exceptions have been free from inductive disturbances or mechanical defects.

Copper wire weighing 210 lbs. per mile has been used. This is of sufficient size to render a very high grade of telephone transmission over lines in excess of those now required for dispatching service. With the usual pole line construction of from 35 to 50 poles per mile a circuit of this kind will, with few exceptions, withstand severe wind and sleet storms.

The usual practice is to transpose these circuits every quarter or half mile, depending upon the number and kind of circuits on the same pole line. This has been found sufficient except under abnormal conditions when special transposition must be provided.

In view of the fact that the present pole lines are available for these circuits the expense of building a telephone circuit is not excessive, particularly when the advantages gained by this service are considered.

Such a circuit as those which are now being used will cost approximately $85.00 per mile or an average dispatcher's circuit covering a division 150 miles in length would cost about $13,000.

These figures do not include the telephone and selective apparatus, the prices of which vary according to the type used.

The depreciation of a circuit of this kind is very low as the average life of the copper wire is considered to be fifty years. The average life of an iron circuit is from 6 to 20 years.

The patching circuit which should be provided for emergency use may consist of two adjacent telegraph or telephone wires. These two wires should be transposed to prevent inductive disturbances when they are used in the dispatching circuit.

These wires may be used for telegraph or telephone service under normal conditions.

By applying suitable apparatus to two such wires two duplex telegraph circuits and one metallic telephone circuit may be obtained which will permit of four telegraph messages and one telephone message beng transmitted simultaneously.

Such a circuit as this has been in use on the Union Pacific R. R. between Omaha, Nebraska, and Cheyenne, Wyoming, since last June, and has been rendering excellent service. When the telephone circuit is not being used for official conversations between division headquarters, it is used for the transmission of messages which otherwise would be sent by telegraph.

The following figures will give some idea of the traffic handled over this circuit in a month:

Messages handled by telegraph......	59,020
Messages handled by telephone......	30,703
Conversations by telephone, 2,539; time consumed by conversations, 126 hours, which is equivalent in messages to	3,780
Total.........................	93,503

A comparison of the telegraph and telephone traffic on this line is interesting, particularly when it is understood that the telephone messages are handled at a less expense than by telegraph.

Further, the telephone operators handle as high as 450 messages per day, and it is believed that this could be increased to a larger amount if the line were not used so much for conversations.

The telephone apparatus used for train dispatching service should be such as to render the voices of the dispatcher and operators both distinctly and with sufficient volume to prevent mistakes.

To accomplish this in a satisfactory manner due consideration must be given to the conditions which must be met, and in this connection it should be remembered that the conditions on a dispatching circuit differ in many ways from those prevalent in either local or long distance service.

The length of the line, the kind and size of wire, the number of stations connected to the line, the kind of telephone, transmitter, receiver, induction coil and circuit, together with the kind and amount of current supplied, all have a bearing on the service and changes in any one of these factors will affect the service.

With but few exceptions the lines constructed for telephone dispatching have been of such character that there should be no difficulty experienced due to the length of the line or the kind and size of the wire.

The number of stations connected to the line vary from ten to forty-four, and this with the various methods of operation has necessitated special attention being given to the point.

In regular commercial telephone service there are usually but two people talking or listening on the line at a time, while in dispatching service it is customary to have from three to five operators in addition to the dispatcher all connected to the line at the same time and in addition an unknown number of other stations listening to their conversation. The limit in numbers being fixed by the total stations having access to the line. These two conditions demand entirely different telephone apparatus and circuits, as in the first case the telephonic currents are divided between the receivers at the two stations, while in the second case the telephonic currents must be divided among the receivers of three, five or even twenty or more stations, depending upon the number of operators listening in on the circuit.

Various methods of rendering efficient service under these severe conditions have been proposed and tried. Some have attempted to equalize the telephonic current passing through the receivers at the various stations, others have increased the volume of transmission, and still others by a combination of the two have attempted to secure more satisfactory results.

In some cases increased volume of transmission has been accomplished at an increase in battery consumption and a decrease in the clearness of articulation.

In others the volume of transmission has been decreased to obtain clearer articulation.

The great difficulty in settling a matter of this kind is the fact that there is no standard which can be readily used and with which the actual service rendered on a line can be compared. No two users of a telephone will agree as to the relative volume or articulation obtained on two different circuits as it is largely a matter of opinion. Even with skilled observers differences in volume of transmission are often taken for differences in quality or articulation and vice versa, or the amount of difference when judged in per cent. will vary within a wide range.

With the ordinary user of the telephone these errors are greatly magnified and therefore anything but correct.

A comparison of a laboratory standard and a working line is a physical impossibility if the tests are to be made by the same parties and under the same conditions.

In comparing the relative merits of telephonic apparatus it should be remembered that the conditions should be the same throughout, and comparisons made by observing the service on the same or a different line cannot be considered as far, as it is impossible for the mind to accurately retain the impressions imparted by the ear for any length of time. Further, in making tests on actual lines it is impossible to control changes in atmospheric or physical conditions and changes may occur in an instant which will seriously affect the results of a comparison.

It may be of interest for you to hear how accurate comparisons in transmission are made and the standards which are used.

The limit of commercial transmission is taken as that obtained over a 1,000 mile circuit of No. 8 BWG copper using standard telephone sets and circuits. It is of course impossible to make tests over an actual line of this kind so the characteristics of such an effect on telephone transmission being known, artificial lines have been constructed which possess all of the electrical properties of the actual line, and comparisons are made with these as a basis. To reduce the chances of error still further these artificial lines have been compared with standard No. 19 gauge paper insulated telephone cable and reduced to terms of miles of No. 19 gauge cable. This establishes a unit of comparison, and all comparisons are expressed in these units. In this way, it has been determined that transmission over 1,000 miles of No. 8 BWG copper circuit is equivalent to that obtained through 30 miles of standard No. 19 gauge paper insulated cable.

In the same way comparisons have been made with circuits of various gauge wires both of copper and iron and the results of tests can thus be expressed in terms of any character of line or cable if so desired or conditions set up equivalent to any length or kind of circuit. The development and construction of such standards requires a large amount of time and money which prohibits their general use.

With a standard artificial line such as has been described, a comparison of different telephone apparatus can be made and the differences in the service rendered determined without danger of the results being affected by unknown troubles on the line, and further, the differences can be expressed in definite terms.

With this arrangement differences in transmission can be determined which to the ordinary user would not be distinguished.

By an arrangement of switches, transmitters or receivers of various types can be compared or connected in circuit with various induction coils, thus determining the relative merits of various parts of the equipment. By another switch the battery supply may be varied and the effect of different amounts of current through the transmitter determined.

Numerous attempts have been made to measure the relative transmission obtained from telephone instruments of various types or to apply well known mathematical formula to determine their relative merits, but up to the present nothing has been found to be as accurate as the method previously mentioned, owing to the fact that no instrument has yet been devised which will distinguish between good and bad articulation as accurately as the human ear.

For a number of months work has been carried on with the idea of developing apparatus which will enable transmission to be rendered having sufficient volume and clear articulation and at a minimum consumption of battery as to satisfy the most critical. It is expected that this work will be completed and the apparatus be available for use within a short time.

Various types of telephone sets are being used at the stations, each of which has certain advantages and disadvantages and the selection is largely a matter of opinion based on operating merits or cost.

The New York Central and the Canadian Pacific are using a special transmitter arm so arranged that the transmitter and receiver are fixed on the arm, and the operator upon placing his ear to the receiver has his mouth in line with the transmitter. This arrangement permits an operator to have the use of both hands and the operator is required to assume a proper position as regards the transmitter.

The arm is arranged with an adjustable mouthpiece on the transmitter and an adjustable earpiece on the receiver to allow for different sizes and shapes of faces. A switch connecting the set to the line is operated when the arm is moved to the position in which it is used by the operator. A foot switch is used to close the transmitter battery in place of a key operated by hand. This is used to prevent a waste of battery and the introduction of noise on the line when an operator is listening in on the circuit.

The operators using these sets also operate the interlocking switches, and for this reason it was not thought advisable to use a set which would necessitate their wearing a head telephone which might interfere at times with their rapid movement.

The Burlington and a number of other roads have been using a simple form of transmitter with which a head telephone is used thus giving the operator considerable freedom of movement.

The telephone equipment is connected to the circuit by removing the head telephone from a switch hook upon which it is hung when not in use.

A key operated by hand is provided to close the transmitter battery during conversation. This key is arranged to open the transmitter circuit when released by the operator thus permitting him to listen on the circuit without a waste of battery or causing a noise on the circuit. A foot switch could be used with this equipment if desired. The use of the transmitter key has not been found objectionable as it is not necessary to hold the key when receiving, thus leaving both hands free for writing, and when talking the operator is not required to write so that there is no necessity for him to have both hands free.

The only objection that can be raised to this arm is that the operator is not compelled to speak directly into the transmitter by the association of the transmitter and receiver. This apparently has not caused any serious trouble. In fact, the dispatcher can readily determine if the operator fails to use the apparatus correctly as the difference between speaking directly into the transmitter or at some distance from it is very apparent.

The desk stand arrangement for a head telephone has also been used principally on account of its low price. The D., L. & W. were the first to use this type of apparatus and it is now practically their standard. It is open to the same objections as the arm previously described and in addition to this is liable to injury by being knocked off the desk. It has the advantage, however, of being located so as to be convenient to several people.

The Santa Fe and Union Pacific have used a set between the transmitter arm and the desk stand or what is commonly called a "flexophone." This consists of a desk stand stem attached to an arm which can be raised or lowered so that it can be used while seated or standing and in addition can be rotated in a horizontal plane.

This set possesses the advantages of the other arms and is free from the troubles experienced with the desk stands. The fact that it can be used when standing is an advantage possessed by none of the other arms.

The dispatcher's equipment is practically the same on all of the railroads and consists of a chest transmitter, supported by a band passing around the dispatcher's neck, and a head telephone.

This apparatus is connected to the circuit by means of a flexible cord terminating in a plug which, when inserted in a jack attached to the desk, completes the line connection.

as well as the transmitter circuit. This arrangement permits the dispatcher to move about and to have the use of both hands.

A transmitter key is provided so that the dispatcher may listen in on the line without wasting the transmitter battery or bringing noise from the room on the line.

This key differs from those used at the way stations in that it is not necessary for him to hold it down when talking, it being arranged to lock when operated and remain so until released.

On account of this equipment being different from that with which they are familiar, the dispatchers in some cases have said that they did not like it. This feeling, however, is not lasting and after a short time disappears. The same feeling existed among the telephone operators in exchanges when similar apparatus was first introduced, but after using it for a short time they preferred it to that which they had been using.

It has been suggested that a loud speaking receiver be used by the dispatcher. This arrangement while available and capable of giving a large volume of sound is not satisfactory on account of the quality of the sound rendered being less distinct than that obtained from a regular receiver held close to the ear. This is largely due to the reflection of the sound waves in the horn which must be used to amplify the sound. Another objection to this device is that noise in the room of from outside will prevent the dispatcher hearing distinctly.

A device of this kind is to be tried on one of the eastern roads for use in block towers in connection with the reporting of trains from tower to tower. Another design is being prepared for one of the western roads for trial on a dispatching circuit.

The use of a double head telephone has been considered and should be of benefit where the dispatchers or operators are located in noisy locations.

The use of a transmitter which could be mounted on the dispatcher's desk which could be spoken to in place of having to speak directly into the mouthpiece as at present has also been suggested. This arrangement, while possible, would be found unsatisfactory for two reasons. First: It would render a poor quality of transmission, and second: it would necessarily have to be very sensitive to transmit the voice from a distance and it would therefore pick up other sounds in the room which, when transmitted on the circuit, would affect the service.

It is possible that under some conditions that such devices may render satisfactory service but it is believed that much better service can be obtained by following standard practices which have proven satisfactory.

The cost of the telephone apparatus depends largely upon the type used and will vary from $17.00 to $36.00 per station. An average of $25.00 per station may be used for rough estimates.

The selective apparatus in general use may be divided into two general classes based upon the method of operation:

1. Electromechanical.
2. Mechanical.

I shall not attempt at this time to give a technical description of the selective apparatus but leave you to examine the two types on exhibiton which illustrate the latest development of the two types mentioned.

The Gill selector representing the electromechanical type and the Wray-Cummings the mechanical type.

In general, the apparatus consists of a selector located at the station, the operation of which is controlled by the dispatcher. The selector when operated closes a bell circuit and causes the bell at the station to ring until stopped by the operator answering the call. The operation of the selector is effected by the dispatcher sending a combination of impulses of current out over the line. The time between the impulses or the combination of the impulses operating the selector at the particular station desired.

The sending of these impulses at the proper intervals or in the proper combinations is done automatically by the dispatcher operating the station and starting keys on his calling mechanism.

Various methods of operation have been suggested and tried. The first method, and one which is still used, is to call each station consecutively. This arrangement required eight seconds to call any one station or in case a number of stations were called it would require eight seconds times the number of station, to call all stations desired. For example, three stations would require a total of 24 seconds, or five stations a total of 40 seconds.

While the above time was much less than the time taken to call by telegraph, higher speed of calling wa sdemanded and arrangements were made to enable individual stations to be called in from two to thirty seconds, or all stations up to 28 could be called in 30 seconds. A still further improvement enables all of 50 stations to be called in a total of 50 seconds or individual stations of the fifty in from 2 to 20 seconds.

Some objection has been raised to the bell at the station ringing continuously until the call is answered by the operator, for in some cases a station might be called by mistake and the call not answered for hours owing to the absence of the operator. This would cause a waste of battery and increase the maintenance expense.

Several schemes have been proposed to accomplish the desired results and apparatus is now available for this purpose. One arrangement permits the dispatcher to stop the ringing of the bell at any time after it has started. Another arrangement permits the bell to ring for a certain length of time and then automatically causes it to cease.

It is believed that the continuous ringing bell will insure quicker answering of the calls than where the bell rings for a short interval and then ceases. This is based on the experience with the present continuous ringing systems and also upon a similar arrangement in telephone exchange practice in connection with the ringing of subscriber bells by machine until the call is answered.

One of the selective systems has one feature which is not supplied by any of the others, and that is what is known as an "Answer-back" signal. This consists of an audible signal received by the dispatcher when he has called a station and the bell has started to ring. This has several advantages.

First: The dispatcher is assured that he has called the station and the bell is actually ringing.

Second: The fact that the dispatcher is aware of this causes the operators to answer the call more promptly.

Third: It acts as a check on the operation of the station apparatus as the "answer-black" will always be received if the bell is operated.

The selective apparatus at the station consists of the selector, two relays, resistances and a few dry cells for the operation of the selector and bell.

A recent design of selector dispenses with the two relays as the selector itslf may be connected directly in the line in place of being operated by one of the relays. This reduces the amount of apparatus at the station which is desirable from a maintenance standpoint.

The selective apparatus is operated by relays connected to the telephone circuit.

Two methods of connecting these relays in circuit are employed:

1. By bridging them across the telephone line.

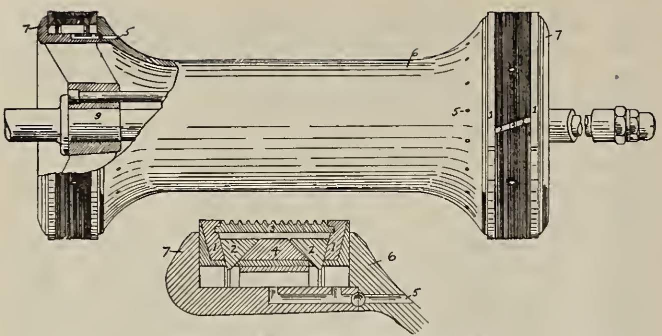


Fig. 1—Semi-Plug Piston Valve.

2. By connecting them in series with the telephone line.

There are advantages and disadvantages with both arrangements.

With bridged relays the impedance must be high enough to prevent excessive losses in transmission due to the large number of relays bridged across the line.

The resistance in the relay bridge must vary at each station to furnish each relay with the proper amount of current to insure its satisfactory operation.

When the relays are connected in series with the line they must be of low impedance to prevent excessive losses in telephonic transmission. This is usually accomplished by shunting the relays with a non-inductive resistance.

It is customary to connect one-half of the relays in series with one line wire and the other half in series with the other line wire, thus balancing the circuit.

It has been found, however, that an exact balance in the number of relays is not necessary.

The disadvantages experienced with the bridged circuit is that in case one side of the circuit opens it is impossible to call a staton beyond the break.

With the series circuits is possible to call every other station beyond the break.

It may be well to state that with one wire open conversation can be carried on by telephone beyond the break.

The transmission losses are less with the bridged circuit but the losses due to the use of series relays are comparatively slight and in no case have they affected the service to a noticeable extent.

Several schemes have been used to facilitate the patching of the despatcher's circuits.

On account of their cheapness small knife switches have been used in many cases, and special telephone test panels which are more expensive have also been designed.

With either of these arrangements patches can be affected very quickly even by inexperienced people.

The test panels offer more facilities for testing than the combination of switches and is less liable to trouble than the exposed switches.

The cost of the total station equipment, including telephones, selectors, test panels and installation will vary according to the apparatus used from $60.00 to $96.00 per station.

An average installation would approximate $80.00 per station.

Combining these figures with those covering the cost of the dispatcher's equipment and the line construction a dispatching circuit of 150 miles to which is connected 30 stations, will cost approximately $15,000.00, or at the rate of $100.00 per mile.

This figure is not excessive when the advantages which may be derived from such an equipment are considered and it will be found that the expense of construction and maintenance will be insignificant as compared with the amount saved by the prompt reporting of delays, the relieving of congestion of traffic and the reduction in the loss of time.

Semi-Plug Piston and Slide Valves

This valve is called semi-plug because, while it is without steam, it is a snap ring valve; that is, the packing rings are expansible and fit themselves to the valve chamber, but, when the throttle is opened, the steam is admitted to the chest to enter the space below the rings, and the action of this pressure is to lock the snap rings in a fixed diameter, making practically a plug of it during the time the pressure remains on. This is all important in a piston valve, for, to secure proper service, it is necessary to maintain true cages in order to maintain steam tight valves. Steam tight valves cannot be secured without proper design and construction of rings to begin with and the absolute regulation of their frictional contact against the cage to prevent wear of the cages while the valve is working at short cut-off. In addition to this it is absolutely necessary to prevent latteral wear. In order to accomplish all of these necessary features, this semi-plug valve was designed on the principle of leverage by wedges, the pressure acting upon the wedges. In the valve the wedges take the form of cones, or circular wedges.

The outside walls of the snap rings, numbered on the drawing, are straight and fit against the straight wall of the follower and spool (See Fig. 1). The inner walls of these snap rings are beveled, forming a cone. Next to the snap rings are wall rings, 2, the sides of which are beveled to fit the cones of the snap rings. These are called wall rings because they form the inner walls for the snap rings. These wall rings are uncut, non-expansible steel rings. Between these wall rings, in the center, is placed a double-coned expansible ring, called a wedge ring, 4, and which, with the wide ring, 3, interlocked into each snap ring forms the complete packing. The wide ring performs two important functions; first, it carries the snap rings across ports while drifting and, second, it keeps the snap rings parallel with each other.

Now, having the principle of the valve fixed clearly in mind, its operation will be noted. Wedge ring, 4, is put in under tension. Its tendency, therefore, is to crowd the two solid wall rings laterally against the cone sides of snap rings, 1. This prevents lateral wear of all rings. The degree of angle on the cones, it will be observed, is much greater on the double tapered wedge ring than on the snap rings. These angles are so calculated that, while the pressure is underneath all the rings, the leverage of the doubled tapered wedge ring, crowding the solid wall rings against the cones of the snap rings, is just sufficient to prevent the snap rings from further expansion, but not sufficient to reduce the snap rings in diameter. By a little consideration of the effect of changing the degrees of angles, it will be observed that the frictional contact of the snap rings against the valve chamber depends entirely upon these angles, and it can, therefore, be regulated to any desired degree.

Following the action of this valve when steam is admitted to the steam chest, it passes through the small holes around the spool, and finds an outlet, first, under the first snap ring, and, second, under the central wedge ring. There are from 14 to 18 holes in the end of the valve. The velocity of the steam from these holes against the first snap ring insures its fitting the valve chamber, and the action against the wedge ring is to place it in position of the pressure to lock up the rings. The packing consists of the combination of rings, which is free to move up and down on the spool, that the rings may fit the cages perfectly correct, regardless of any variation in that position of the spool. Because it is disastrous to the valve cage to allow the spool to ride on it, as it wears the cage out of true, and, therefore, destroys the perfection of valve service, no provisions are made for carrying the spool on the rings, and the spool must, therefore, be carried on the valve rod. This can be accomplished in any way desired, but is the one feature essential in using this valve.

By observing the locking effect of the doubled tapered wedge ring, when it is expanded by pressure underneath, thereby crowding the two solid wall rings laterally and holding them, as it were, with a predetermined force against the cone sides of the snap rings, it will be realized that, by putting sharper cones on the sides of the snap rings and making the solid wall rings to correspond, the force of the double tapered wedge rings, crowding the wall rings laterally on a sharper cone, would decrease the diameter of the snap ring, regardless of the pressure under it, under which conditions the leverage would be too great and would permit a blow over the outside of the snap ring. On the other hand, if the degree of angle on the snap ring was lessened, and the cone made flatter, with wall rings to correspond, then the wedging power of the central wedge ring would not be sufficient to hold the snap rings from expanding by the pressure underneath them, and this would result in excess friction against the valve chamber, caused by insufficient leverage to lock the rings. The same effect can be reached in either direction by changing the degree of angle on the double tapered wedge ring. With this action clearly in mind, it will be seen that the snap ring will remain in the diameter of the cage at which it is locked up, unless it is locked up in a large part of a worn cage, for instance, and the movement of the valve forces it down into a smaller part of the cage, under which conditions the snap ring would be forced shut to the diameter of the cage at the smallest part. Under these conditions the snap ring would remain the smallest diameter of the cage while the valve traveled back to the position of the original locking, and, in that position, there would be a blow over the outside diameter of the snap ring. It will be seen, therefore, that this valve will not wear a cage out of true and it will also be observed that it is very important that the valve is put into a true cage to begin with. It will, in time, true a cage up, but this is expensive, and would, therefore, be a foolish application.

The valves are made for internal or external admission and have been made for both; that is, reversible, in which case the valve is used as a reversing gear by changing the steam to internal admission. The rings of this valve are all machined in their working diameters. The packing rings are properly lapped with a solid steel joint plate, the side of which is beveled, bringing it to a sharp edge at the periphery of the ring, thereby avoiding any notches in the steam or exhaust lines of the valve. This American semi-plug piston valve is manufactured by the American Balance Valve Company.

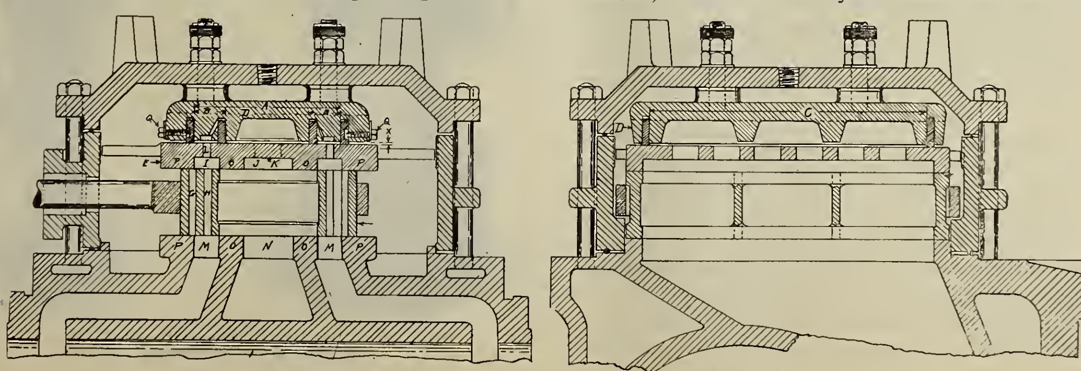
The piston valve, as illustrated, is already in use on about 18 roads, and is giving remarkable service, such as two years and over in freight service, with the greatest wear of cages 34/1000 in. The valve is maintained by duplication of rings from stock, the two snap rings and wide ring being the only parts of the valve that wear out, and these are renewed from stock without any hand-fitting or machine work on the valve or the rings. The valve is absolutely steam-tight during the life of a set of rings, which averages about 22 to 24 months in freight service and 12 to 15 months in passenger service. The road having the largest number of engines equipped at this time is the Pennsylvania, with over 600 locomotives equipped.

THE JACK WILSON HIGH-PRESSURE SLIDE VALVE.

The first consideration in examining into this improved high-pressure valve is to the balancing feature, and it is well to get one very important fact clear in the mind; that is, that the balanced area of the valve is changeable, that it has but one change in each stroke of the valve, and that this change in the area of balance corresponds with the changed condition of the valve on its seat at the different points of its travel. Therefore, in changing the balanced area to suit the requirements of the valve at the different positions on its seat, a perfectly balanced valve is secured in all positions. Demonstrating this we will refer to the sectional view of the valve in its central position on its seat, Fig. 2, this being its heaviest position; that is, if there were no balance on the valve, it would be subject to pressure on its back equal to the entire area of the valve face. The space, A x C, prevents the steam from exerting a pressure on the back of the valve according to the number of square inches contained in this space. This area is as large as it is possible to take off the valve, while in its central position, and not cause it to leave its seat. The valve is, therefore, balanced on its heaviest position all that it is possible to balance it and yet maintain the steam-tight joint at the faces of the valve.

With the valve in the position where it is admitting steam to the cylinder port, or just cutting off the steam for expansion, when the cylinder is full of steam, it exerts an upward pressure on the face of the valve equal to the area of the steam port. If this upward pressure on the face of the valve were not counter-acted it would, of course, lift the valve off its seat, since the valve, being fully balanced in its central position would not stand this increase of balance by the pressure in the port pressing upward on it and it would, therefore, be lifted off its seat. In other valves it has been necessary to leave them under-balanced in their central position to prevent their being lifted by port pressure. In this valve this pressure in the port is counter-acted by allowing the steam to get on the top of the valve through the ports in the valve, and the pressure is at all times equal on both faces of the valve. The port pressure, does not, therefore, affect the valve, but, since the valve plate lies loosely on the back of the valve, and the cylinder port pressure passes through the valve to the "pocket" port in the face of the valve plate, it would lift the valve plate from the valve unless it was permitted to pass to the other side of the valve plate to an equal area of the port pressure. Therefore, the smaller space, B x C, is enclosed at back of the valve plate and always open to port pressure. It will now be quite clear that, when the valve is unbalanced by pressure in the cylinder port, the valve plate is simultaneously unbalanced by the same pressure entering the space, B x C. There is one space, B x C, over each port. Each acts with its own port only.

When the valve in the extreme position of over-traveling the seat, with the ordinary balance valve the balance is fixed



Figs. 2 and 3—Jack Wilson High-Pressure Slide Valve.

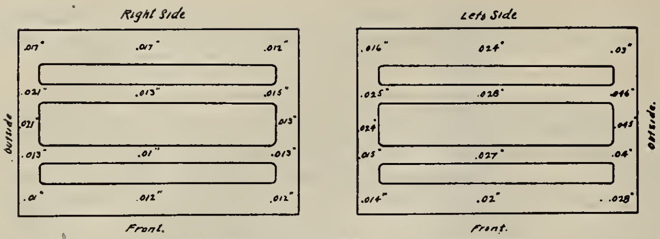


Fig. 4—Showing Wear of Valve Seats.

to and moves with the valve. Therefore, when in this position, the valve is subjected to an upward pressure on its face equal to the area of the face of the valve exposed by over-traveling the seat, and in the common balance valve this exposed area is just as important as that area of the valve face exposed to the port pressure and should be taken care of as well as that of the port.

In the Jack Wilson valve the over-travel is entirely neutralized by the valve traveling out from under the upper seat at the same time, and to the same extent, that it travels over the lower seat, and the over-travel, therefore, cuts no figure in the balancing of the valve. It should be remembered that the seat is so proportioned that the valve will travel to the edge of the seat at the lowest possible cut-off at which the engine can work. With this proportion of seat it is permissable to use as great a valve travel as is desirable, and at the same time to maintain a uniform frictional contact of the valve and seat, and, with the one change in the balanced area and the balancing of the valve at over-travel, absolutely meet the full requirements of valve at the different points of its travel. This practically explains the balancing feature of this valve, which consists of a large area that balances the valve all that is possible in its central position, and two, small areas in the interior of the other, and to which steam is admitted to counteract the pressure in each port.

In Figs. 2 and 3, parts of the valve are indicated as follows: Main balance (by outside strips), A x C; port balance (by inside strip), B x C; balance pressure plate, D; valve plate or second valve seat, E; main valve, both faces alike, F; double admission ports, G; double exhaust ports, H; pockets in valve plate corresponding in length and width with steam ports, I; pocket in valve plate to equal exhaust ports, J; relief holes in valve plate, K; ports to port balance area, L; steam ports, M; exhaust port, N; bridges in seat and valve plate, O; and outer edge of valve seats, P.

The sketch, Fig. 4, shows wear in one-thousandth parts of an inch of the valve seats on an engine of the Central Railroad of New Jersey, which made 168,324 miles with the valves.

The slide valve, as illustrated, is developed to a high degree, and is the result of six years of trials and tribulations to secure a perfectly-balanced and fully reliable double-acting slide valve. This valve has now been in service under the highest locomotive steam pressure, that of 235 to 240 lbs., since May, 1906, nearly three years, without any trouble with seats or any other troubles with valve. The engines are on the Reading Railroad, and in their fastest service. Its service has been equally well on many other roads, including the mileage of 168,000 with the greatest wear of valve seats 46/1000.

This valve contains many valuable features for a practical locomotive valve, double admission, with shortest steam passage; double exhaust, getting rid of the steam after it has done its work. The valve is balanced in all positions of the stroke, and travels over the seat at all cut-offs at which the engine can be worked. This insures with the minimum wear an even wear, and, therefore, a steam-tight valve during the longest period of service. The balancing feature is absolutely stationary, therefore, a permanent part of the locomotive, while the valve is the only moving part, and being of the grid-iron type, gives the lightest reciprocating weight.

The valve is now applied to old or new power, and can be put on and all adjustments made in any round-house without the use of machines, as washers are put on the outside of the studs on top of the cover, being of various thicknesses, allowing the balance pressure plate to be adjusted for height at any time by changing the washers from the outside to the inside, and lower the balance plate to any desired amount.

Forged Steel Hydraulic Jacks

The Duff Manufacturing Company, of Pittsburg, Pa., exclusive manufacturers of the Barret jack and Duff ball bearing screw jacks, has put on the market the Duff-Bethlehem forged steel hydraulic jacks, completing their large line of jacks of all types, and offers what is claimed to be the latest and highest development in the hydraulic jack industry. The Duff-Bethlehem hydraulic jacks are forged entirely out of steel and patents covering its special features and construction have been allowed the Bethlehem Steel Company, who have designed and perfectd this jack and who do the special forging necessary with their unequalled facilities in that line. The Duff Manufacturing Company have the entire and exclusive handling of the Duff-Bethlehem jack in conection with their large line of Barret and Duff jacks.

The Duff-Bethlehen hydraulic jack, being forged entirely out of steel, provides a wonderful construction for that type of jack. These new types of jacks have special features whereby the imperfections and troublesome conditions in the usual hydraulic jack construction are entirely avoided. The Duff-Bethlehem jacks weigh from 30 to 60 per cent. less than ordinary hydraulic jacks of equal lifting capacity, and stroke—made possible by its forged steel construction. It further provides greater strength, capacity and durability.

Both the cylinder and ram of the Duff-Bethlehem jacks have a solid bottom, thus requiring no packings and dispensing with joints at those points. The most troublesome packing in other designs of hydraulic jacks is at the bottom of the cylinder. As the cylinder of the Duff-Bethlehem jacks has its base, or bottom forged integrally therewith, it obviates entirely this troublesome feature of packing. Another packing that frequently causes trouble and expense is also entirely dispensed with, viz., insuring closure of the ram piston from the pump socket as the Duff-Bethlehem jack has a solid ram bottom forged integrally with the pump socket. There are practically only two small packings in the entire Duff-Bethlehem jack, and as joints are also eliminated there is no chance for leakage and no expense for renewal of packings, as in other designs of hydraulic jacks.

Forged Steel Hydraulic Jacks.

By the improved construction and location of valves, the Duff-Bethlehem jacks are capable of extending their full length in a vertical, horizontal or inclined position, without any adjustment whatever, and all sizes will operate at any angle. In the operating mechanism a minimum number of parts of simple and strong construction are employed and any parts may be easily replaced if necessary, without special tools. Also in this construction the valves may be attended to without removing the packing and the packing without removing the valves.

The valves in the Duff-Bethlehem jacks are absolutely positive and require no special adjustments or parts to insure their operating under all conditions. The load may be tripped or may be lowered as slowly as desired, or stop at any point when lowering if desired.

The Duff-Bethlehem jacks are constructed of open hearth fluid compressed forged steel and bronze and their inside working parts are drop forgings. They are made in all types and capacities adapted to railway and general lifting purposes. The Duff-Bethlehem (low) or telescope type is forged entirely out of steel, fitted with an improved duplex pump, automatically regulating the change of speed proportional to the load being lifted and made regularly with capacities ranging from 30 tons to 300 tons and higher capacities if required.

This line of hydraulic jacks is complete and together with the Duff Manufacturing Company's large line of Barrett jacks, Duff ball bearing screw jacks, etc., covers practically every type or kind of a lifting jack for every possible condition and lifting purpose.

Special Meeting of C. J. C. I. & C. F. Association

A special meeting of the executive committee of the Chief Joint Car Inspectors' and Car Foremen's Association was held at Cleveland, Ohio, on January 23rd. Besides the executive committee there were other members of the association present and among those in attendance were the following: H. Boutet, A. Berg, George Lynch, T. J. O'Donnell, S. Skidmore, G. M. Bunting, F. M. Brown, J. V. Berg, Bruce Crandall, Jos. Dyer, D. J. Durrell, F. W. Dewey, J. W. Eager, J. F. Farran, F. H. Hansen, P. J. McGreevey, J. D. McAlpine, E. C. Pearse

The secretary read the call of the meeting, which showed that it was called for the purpose of recommending to the M. C. B. Association changes in the M. C. B. rules.

President Boutet presented what in his opinion would be the proper changes.

"The preface of the rules to remain as they are."

"Next to this, the rules pertaining to defects, for which the delivering line is responsible, should be put together and same be made as few as possible."

"It is my idea that you make the delivering line responsible for slid flat wheels, rough journals, missing brake material, wooden brake beams, if applied in place of metal, combination of defects which denote unfair usage if occurring at the same time and on the same end of car, damaged end sill accompanied by damage to three longitudinal sills, damaged longitudinal sills if necessitating replacing or splicing of more than three sills, making the other defects on cars defects for which the owners are responsible."

"This, I believe, will facilitate the interchange and stop a great deal of argument and dissension coming up at interchange points."

"I would also change rules 125 and 126 in regard to the sending home of worn out and damaged cars, to provide for same being inspected by some disinterested person, for example, a joint car inspector at some point employed by four or more roads or some head of car department of a disinterested line, to examine the car and state whether or not the owners are responsible or if same was in such condition that it should be destroyed, if so, in the first place the road having the car in its possession to make repairs or in the latter case destroy the car sending the scrap material home."

"I think the same should be carried out in regard to private line cars, which would prevent the hauling of a great many disabled and dilapidated cars over the line."

After President Boutet had presented his suggestions as to desirable changes in rules, a general discussion of these questions followed. Mr. Skidmore, secretary, read the preface of the rules, and it was moved by Mr. O'Donnell and seconded by Mr. Berg that the preface of the rules stand as read. This motion was carried.

Mr. Lynch opened the discussion by saying that he wanted to know if he was to understand that the delivering line defects and the owners' defects were to be put under separate headings in the book of rules.

Mr. Dyer.—I think that the delivering line company's defects should be put in the front of the book of rules and the different headings as pieces, parts, etc., be put on additional pages in the book.

Mr. O'Donnell.—I suggest that simply to put under one heading the delivering line responsibility. On the first pages of the book of rules.

Mr. McAlpine.—I would like to ask if only the members of the executive committee were asked to speak at this meeting.

Mr. Boutet.—My intention was to get as many of the members as possible to come here and talk these matters over with us. We came to get whatever information we could out of the meeting and want all to say something, whether a member of the executive committee or not.

Mr. McAlpine.—I would put the delivering line and owner's defects grouped so that the inspector could familiarize himself with the delivering line defects, without having to refer to any other part of the book of rules, or in fact look through the whole book.

Mr. Crandall.—I am interested in seeing the book of rules so arranged that the inspector can see just what he is looking for without referring to the whole book. I think the rules should be grouped in such a manner that anything exceptional or important could be immediately referred to. This could be done by the use of italics or capital letters to attract attention. In this way important rules could be more easily referred to.

Mr. Durrell.—I believe the condensing of the rules would help greatly in determining just what rules our interchange inspectors and repair men are required to learn and would also be of assistance to us when reports come to our car foremen and before we are able to pass on certain cases and make our report to our superintendents, as it would enable us to get at it more quickly. I see great advantages in it and think it best to move that the executive committee recommend to the M. C. B. Association the condensing of the rules bearing on the above subjects, and the printing of same under different headings, viz., owners' responsibility and delivering line's responsibility, and eliminate everything else in the book pertaining to rules covering the subjects of responsibility. I think this would simplify matters a great deal.

Mr. McAlpine.—I think they should be separated, that they should be printed by themselves.

Mr. Boutet.—In that way it would not be necessary for an interchange inspector to know the whole book of rules: all that would be asked of him is to familiarize himself with the delivering line defects and what was safe to run.

Mr. Lynch.—As long as owners' defects and delivering line defects are under separate headings there would be no difficulty in knowing who was to pay for repairs, as the separate headings would be before them and as soon as a car needed repairs they would attach a card and make a note of it.

Mr. Durrell.—I move that for the purpose of making the M. C. B. Book of Rules, pertaining to owner's and delivering line's responsibility more readily understood and in more condensed form for the benefit of car inspectors and others having to do with the interchange of cars, that the executive committee recommend to the M. C. B. Association the condensing of the rules bearing on the above subject and the printing of same in the book of rules under two headings, viz., delivering line's responsibility and owners' responsibility, and eliminate from the other parts of the book of rules anything covering the subject of responsibility. Seconded by Mr. Hansen and carried.

Mr. Boutet.—What defects should we recommend making the delivering line responsible for?

Mr. Skidmore.—A car owner should be made responsible for all missing material on cars, except missing material pertaining to brakes. The fact of making the delivering line responsible for missing material in interchange has been ignored to a certain extent all over the country, that would show to the framers of the M. C. B. Rules that there is something radically wrong with that part of the rules. There is no benefit to anybody to make the delivering line responsible for owner's defects in interchange and I believe it would do away with a large amount of tracing, correspondence, etc., for defects cards if such was the case. The bill can be rendered against car owners for defects as well as against the delivering line.

Mr. Berg.—I think that missing brake material should also be included.

Mr. Skidmore.—I did not intend that brakes missing should be an owners' defect. I wish that everyone would state their objections as that is what we are here for.

Mr. O'Donnell.—Referring to Rule No. 42, it is my opinion that any missing material due to ordinary servce should be chargeable to the car owners, whether the car is offered in interchange or not. In my opinion the rules should be framed to cover it in this manner.

Mr. Boutet.—How about slide flat wheels? I think this is a defect for which the delivering line should be responsible.

Mr. O'Donnell.—I move that slide flat wheels and cut journals be made delivering line defects as at present. Seconded by Mr. Berg and carried.

Mr. Boutet.—How about missing brake material?

Mr. Skidmore.—That is a broad proposition since about all cars are equipped with metal brake beams and air brakes, it would not be well to make owners responsible for missing brake material in interchange.

Mr. Berg.—I would recommend that brake levers and connections missing be classed as owners' defects, train men remove broken connections in transit and at the next inspection point you treat it as missing material and only charge labor. Brake levers and connections are more frequently missing from being broken than from other causes, that is my reason for recommending making them chargeable to owners.

Mr. Boutet.—How about missing brake beams?

Mr. Berg.—I am not prepared to recommend considering missing brake beams as owners' defects.

Mr. Boutet.—We could hold owners responsible for part, for example, the P. & L. E. deliver to the Lake Shore at Erie an L. & N. car with one brake beam and mottom brake connection and brake lever missing they would give you a card for the brake beam, lever and bottom connection missing, it being understood that the beam would cover the head and shoe, but, if on the other hand, this same car only had the bottom connection and lever missing, you would not get anything for that, but would charge the owners.

Mr. Hansen.—I move that the delivering line be made responsible for missing brake material only when the beams are missing. Motion seconded by Mr. Durrell and carried.

Mr. Lynch.—I move that the rules pertaining to air brakes remain as they are because all cars must be equipped with air and the railroad companies desire air brakes kept in good condition. Seconded by Mr. Farran and carried.

Mr. Boutet.—Do you want to make the delivering line responsible for anything else?

Mr. Skidmore.—I move that the delivering line be made responsible for wooden brake beams, if applied in place of metal brake beams, when cars are so stenciled. Seconded by Mr. Bunting and carried.

Mr. O'Donnell.—I move that the delivering line be made responsible for combination of defects as follows: Three longitudinal sills, if accompanied by damage to the end sill on the same end and all occurring at the same time. That they should also be made responsible for more than three longitudinal sills if broken at the same time and on the same end to be considered as a combination on wooden framed cars. Steel underframed cars the combination to be one longitudinal sill and one end sill broken at the same time and at the same end or more than two longitudinal sills broken at one time and at the same end. All other combinations, as they now appear in the book of rules, to be made owners' defects. Motion seconded by Mr. McGreevey and carried.

Mr. O'Donnell.—I move that the following be added to Rule No. 44, beginning after the word "pocket": Any car having tandem attachments found with pocket for single spring. Seconded by Mr. Berg and carried.

RULES PERTAINING TO HOME ROUTE CARS.

Mr. Boutet.—I would suggest changing rules 125 and 126, regarding the sending home of worn out and damaged cars, provide that same be inspected by some disinterested person, as previously referred to by me. I believe, however, that the owners should decide whether the car should be destroyed or repaired.

Mr. Hansen.—I think the matter should be taken up with the owners as to whether the car should be sent home or whether it should be repaired or dismantled.

Mr. Skidmore.—I move that Rule 125 be changed to read as follows: All wooden framed cars that the person desiring redress may call in a disinterested person, such as the head of a car department of a disinterested line or his representative, or a chief joint car inspector, who is employed by four or more lines, who shall examine the car and, if he finds that the defects on the car are such that the owners are responsible for, he shall write to the owners of the car, sending a copy to the road calling him in, and the owners shall decide whether the car shall be repaired or dismantled. If the owner elects to have the car dismantled or destroyed, if the car is a 60,000 capacity car, the person destroying the car shall allow the owners second-hand price for wheels and axles, full price for air brakes, scrap material prices for all other metal. If the car is less than a 60,000 capacity car, the person destroying the car will allow the owner full price for air brakes, scrap material for all other portions of metal, except wheels, which will be allowed second hand price. Seconded by Mr. Berg and carried.

Mr. Skidmore.—I move that Rule 126 be changed to read as follows: That a metal car that is safe to run, which on account of wreck or accident or from defects due to ordinary wear and tear, shall be reported to its owner the same as in Rule 125 and the owners shall designate whether or not the car shall be sent home or destroyed. In case he elects to have the car sent home, the persons having the car in their possession shall make same safe for trainmen, as provided for by Intercar for all defects which they are responsible for. Seconded by Mr. McGreevy and carried.

Mr. Skidmore.—I have made these motions on Rules 125 and 126 on account of so many roads requesting home route cards for cars, in some cases where the repairs were not very extensive, on other cases where they have misrepresented the facts to the owners. I think it would be great deal cheaper to all railroads, especially on wooden framed cars, that the cars be repaired on the road on which they became disabled, for example, a road might get a car occasionally that they might have to rebuild, they would still have a great deal less work to do on their line than they have to do under the present rules, for it is almost impossible to get a great many of the cars that are sent home on route cards over a line without going in the shops two or three times to have repairs made to get the cars over their line. In a great many cases they are in such condition that they are extremely dangerous to haul and could not be made perfectly safe unless the cars were thoroughly overhauled.

Mr. O'Donnell.—I move that this association recommend to the M. C. B. Association that the coupler companies be required to stamp the name of each knuckle on same as is now done on the couplers. Seconded by Mr. Lynch and carried.

Mr. O'Donnell.—My idea on pitted journals is as follows: We find lots of journals of 60 M, 80 M and 100 M capacity with defects on the journals that could be termed no other than pitted and, while it is understood that all pitted journals are supposed to be scrap, it was thought possible that the journals mentioned above could be handled as pitted journals and trued up and charged to the car owners, which would make the rule clear, as they now have to be termed as cut journals, however, this is left to the judgment of the committee in making the final report.

In accordance with the foregoing it was decided that it should be recommended to the M. C. B. Association that the Book of Rules of Interchange be changed as follows:

That the preface of the Rules remain as it is.

That the delivering line is responsible for the following defects:

Wheels slid flat, if the spot caused by sliding is 2½ inches in length or over.

Cut journals, axles bent or axles rendered unsafe by unfair usage by derailment or accident.

Combination of defects as follows:

Three longitudinal sills, if accompanied by damage to end sill on the same end and all occurring at the same time, or more than three longitudinal sills if broken at the same time and on the same end.

Journal bearings and journal box bolts, which require removal by reason of a change of wheels or axles, for which the delivering line is responsible, regardless of the previous condition of the bearings or bolts.

Cars equipped with steel or steel tired wheels and so stencilled if found with cast iron wheels.

Missing air brake hose, missing air brake pipe or damaged fittings, angle cocks, cut-out cocks, cylinders, reservoirs, triple valves, pressure retaining valves, or any parts of these items.

Missing brake beams.

Cars equipped with metal brake beams and so stencilled, if found with wooden brake beams.

Cars found with one inch air hose on one and one-quarter inch train pipe.

Cars equipped with air signal steam pipe, hose and couplings, and so stencilled, if missing.

M. C. B. Couplers not equipped with steel or wrought iron knuckles.

Cars equipped with M. C. B. Couplers and having pocket rear end attachments and so stencilled, if found with stem or spindle attachments in place of pocket.

Cars equipped with tandem spring couplers, if found with single spring pockets.

Damage to any part of the car caused by unfair usage, derailment or accident, also temporary advertisements, tacked, glued, pasted or varnished on cars. Any card or poster exceeding 5x8 inches in dimensions, bearing the name of a manufacturer or shipper occupying more than two-fifths of the card.

Cards with letters exceeding one-half inch in dimensions being considered an advertisement.

The rest of the rules in the book to read "Owners' Defects," so far as covering the defects on the car and that the prices be eliminated from the other parts of the rules:

Change Rule 125 as follows:

All wooden framed cars that a road has in their possession in an unserviceable condition and they are desirous of procuring redress from the owners on same may call in a disinterested person, such as the car department head of a disinterested line, or his representative, or a chief joint car inspector, who is employed by four or more lines, who shall examine the car and, if he finds that the defects on the car are such that the owners are responsible for, he shall write to the owners of the car, stating all defects that exist on car, sending a copy to the road calling him in, the owners shall decide whether or not car shall be repaired or dismantled at their expense, if the owner elects to have the car dismantled or destroyed, if the car is a 60,000 capacity car or over, the person destroying the car shall allow the owner second hand price for wheels or axles, full price for air brakes, and scrap material prices for all other metal. If the car is less than a 60,000 capacity the person destroying the car will allow the owners full price for air brakes, second hand price for wheels, scrap price for all other metal.

Rule 126.—To be changed as follows:

That a metal car that is safe to run, which on account of accident or serious damage by wreck or otherwise or from defects due from ordinary wear or tear, shall be reported to its owner, same as provided for by Rule 125 and the owner shall state whether or not the car shall be sent home or destroyed. In case he elects to have the car sent home, the persons having the car in their possession shall make same safe for trainmen as provided for in Interstate Commerce Rules and shall place an M. C. B. Defect Card on car for all defects for which the delivering line is responsible.

S. Skidmore, Secretary.

H. Boutet, President.

RESOLUTION OF EXECUTIVE COMMITTEE.

We, Members of the Executive Committee of the C. J. C. I. & C. F. Association of America, believe that the foregoing changes in the M. C. B. Rules would be beneficial to the railroads throughout the country for the following reasons:

There is no benefit gained by making the delivering line responsible for defects, for which the owners are responsible, if car is in interchange.

We believe that the previous idea to make the delivering line responsible was for the purpose of maintaining the equipment. We do not believe this is accomplished, but it only makes a vast amount of work in tracing and giving cards for defects, which are purely chargeable to the owners.

We are firmly of the opinion that if defects are chargeable to owners under one condition same should be chargeable to them under all conditions. We are also of the opinion that owners' defects do not reach far enough and believe that a great number of cards are now issued against delivering lines, which should be chargeable to car owners. As same are being treated in this way at nearly every large interchange point in the country and if the rule is good at this point it should be good at other points throughout the country.

Our object in putting delivering line defects in the front of the book was so that the interchange inspectors would not be compelled to learn the whole book of rules by heart. All that would be necessary for them to know was what was safe to go to his line, according to the instructions of his superiors and for what the delivering line was responsible. We believe that this would save a great deal of time and a vast amount of disputes and delays to freight.

In regard to the combination which we saw fit to recommend, that they be reduced, it is our positive knowledge that the matter of combination of defects is abused in a great measure, for example, a car is run for one or two years on its own road with two broken sills and is offered to some connection and accepted for two broken sills as owners' defect. The line receiving the car will probably deliver same back with an additional sill broken, then they are made responsible for the whole combination. This is not only true of railroad cars, but private line cars, which are not repaired when they get home with one or two sills broken, but allowed to run until they get a combination; then the railroad is compelled to pay for same and we do not think this is the intent of the rule made.

In regard to the changes in Rules 125 and 126 we cannot but believe it would be of great saving for the railroads throughout the country not to send cars of this kind home. We do not believe it would make near as much work for any line to repair an occasional car at the expense of the owner as it is to do under the present rules and same could be done in one of their principal shops and it would not entail the amount of repairs that is being done at points where they are not prepared to do the work.

This would also prevent the hauling of worn out cars and dilapidated cars over the country, which is not only expensive but dangerous to the line hauling them.

It is very seldom that a line is able to get one of these cars without having to shop it several times at its different repair tracks along the line, whereas if this car had been rebuilt or thoroughly repaired before it became unserviceable it could have been immediately put into revenue service instead of having been hauled from one to three thousand miles over the country empty. The following home route card will show this is being done at the present time.

Intercolonial car No. 1854, which was at Cleveland, Ohio, left over the C. C. C. & St. L. to the Terminal R. R., St. Louis, to Vandalia R. R., to Penna Co., to the P. R. R., to D. H. Co. R. R., to Rutland R. R., to Q. M. & S. R. R., to the owners. This is only one of the many cases that actually come under our notice.

H. Boutet, President.

A. Berg, Vice-President.

S. Skidmore, Secretary and Treasurer.

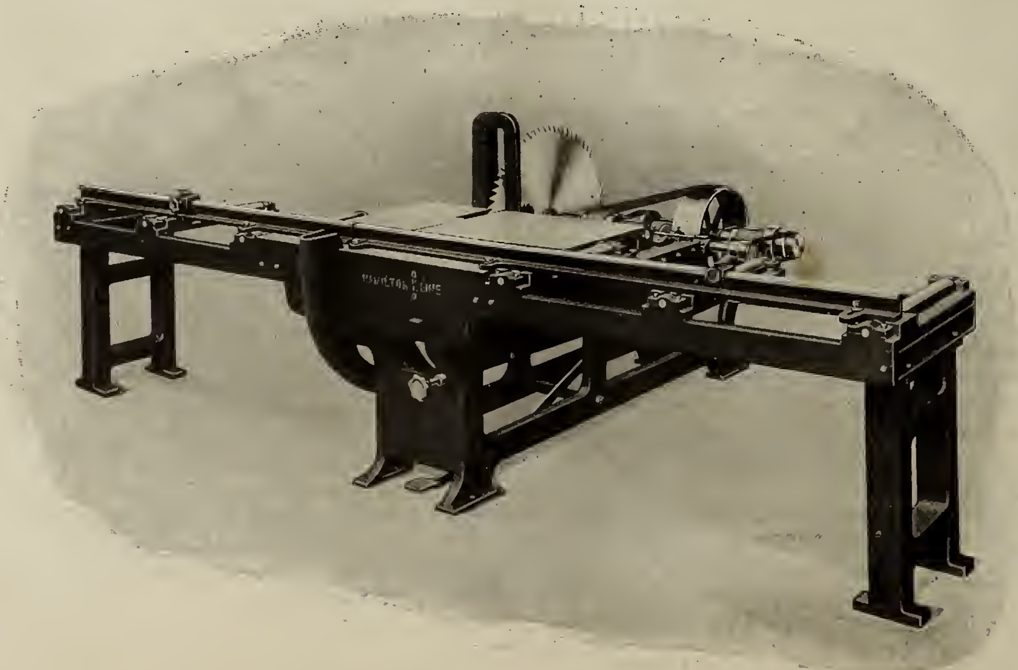
Executive Board:
C. Waughop,
F. R. Trapnell,
Geo. Lynch,
J. O'Donnell.

Hamilton Automatic Cut-Off Saw

This heavy automatic cut-off saw is constructed for medium and heavy work in car shops, ship yards, and for heavy building material. The frame is of heavy construction, well braced throughout and is 8 ft. 5 ins. long over all from front to back. The table is 13 ft. long, from end to end.

The saw is driven by an improved drive consisting of an endless belt which runs over the various pulleys and idlers in such manner as to maintain straight lines between pulleys, thus maintaining equal tension on the belt at all times and doing away with swinging frames or idlers.

The saw housing travels on top of the frame in heavy dove-tail slides and is provided with adjusting gibs for taking up wear and for lining up the saw. The feed of this housing is by means of a heavy lead screw driven by right and left friction gearing, which is controlled by a foot treadle at front of machine. There are three rates of forward feed and one return. The housing can be started or stopped at any point in its travel and can be returned to its starting point at will of the operator. A stop rod is furnished by which the backward travel of the saw can be regulated, as it is not necessary to return the saw for the full stroke for every cut made.



Hamilton Heavy Automatic Railway Cut-off Saw

The table is of extra large size, consisting of a central connected portion 5 ft. in length and having long wing roller extensions, giving a total length to the table of 13 ft. The roller table is 30 ins. wide and will admit material 27 ins. wide.

One 30-in. saw is furnished, but saws up to 36 ins. in diameter can be used, which latter will cut off material up to 27 ins. by 9 ins. or 17 ins. by 14 ins. The countershaft is attached to machine and has tight and loose pulleys 14 ins. diameter by 8¼ ins. face, which should make 250 revolutions per minute.

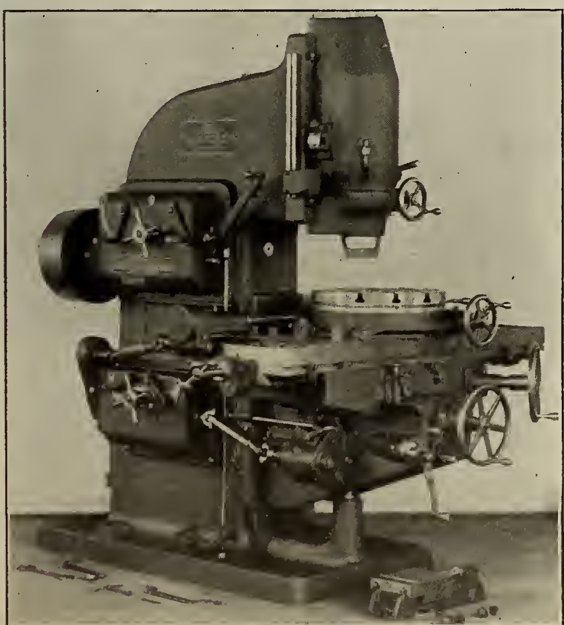
The Bentel & Margedant Company, Hamilton, Ohio, manufacture this saw as well as the well-known Hamilton (Ohio) line of car shop wood-working tools.

High Power Milling Machines

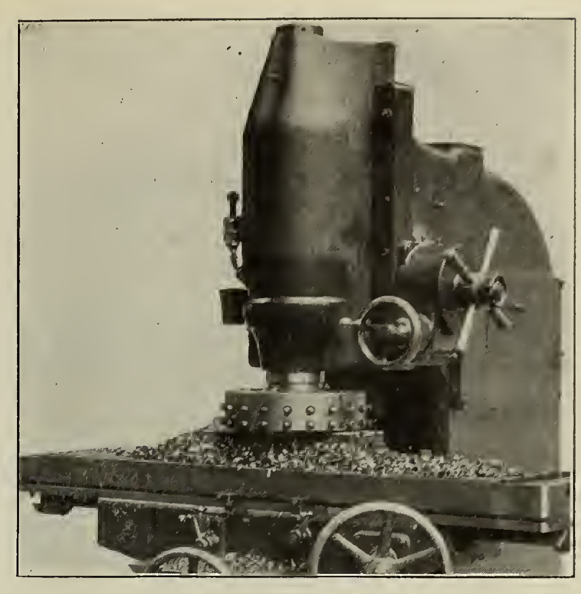
Two views of a high power vertical milling machine, built by the Cincinnati Milling Machine Company, are shown herewith. One of these illustrations shows the machine at work milling forged steel bars having 55,000 lbs. tensile strength, 50 per cent elongation. The bars are 5 ins. wide and the machine takes a cut ⅛ in. deep, feeding 16 ins. per minute. This amounts to 10 cu. ins. of steel removed per minute, and the work is done with a 10 horsepower motor working slightly overload, using 12 gross horsepower. This differs from the cutting this machine was doing at Atlantic City only in that at that time it was taking a cut ¼ in. deep, 8 ins. per minute in this same steel, which also amounted to removing 10 cu. ins. of steel per minute.

Two views of horizontal milling machines are also shown and one of these shows a machine milling four drop-forged steel pieces at one time, taking a cut in each piece 13/16 ins. wide, 1¼ ins. deep, at a table travel of 2 ins. per minute. This amounts to 8⅛ cu. ins. of steel removed per minute. The machine is using a 10 horsepower motor, and it must be conceded that this is remarkably heavy cutting when using cylindrical cutters on a horizontal arbor, or, in other words, is evidence of a machine of tremendously high efficiency.

These milling machines are the outgrowth of a conviction of the Cincinnati Milling Machine Company that the time has come for the entire re-design of milling machines for high power work, and of much study and experimental work undertaken in order to produce machines which, beginning with a given cut, should be harmoniously designed from the



Vertical Spindle Milling Machine, Constant Speed Drive and Circular Milling Attachment.



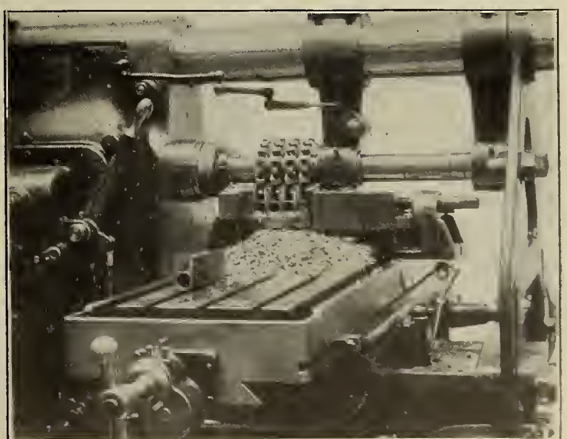
Vertical Milling Machine in Operation.

spindle back through the entire machine to the motor to produce that cut. This standard cut, which forms the starting point in the design of the machines is (taking the No. 4 plain horizontal as an example) ⅛ in. deep by 6 ins. wide, with such a rate of feed as will remove from 7 to 8 cu. ins. of metal per minute—this cut being taken in machinery steel of 55,000 lbs. tensile strength, with a standard spiral milling cutter having nickel teeth. The machine is designed to take this cut for continuous service and to safely take a maximum cut considerably larger than the standard cut used as a basis.

Back of these convictions is the principle, strongly advocated by this company, that modern machine tools should not be sold on the old basis of net weight and driving-pulley dimensions, but on the basis of the quantity and quality of work they can produce. While these machines are thus in line with the progress toward high-power milling, the company recognizes that all milling is not of that class and they have no intention of discontinuing the production of the older type of machine.

Next to this feature lay the determination to produce a line of machines to meet the possible wants of a customer as regards his system of driving and feeding, and capable of being changed by him at any time to suit any change in his transmission system;—and to offer these machines in the same variety of driving and feeding arrangements with both vertical and horizontal spindles.

This latter result is nothing less than a remarkable achievement in machine design. It is brought about by the



Horizontal Milling Machine in Operation.

unit system of construction, whereby the simple selection of appropriate units produces the machine desired. The basis of the complete design is the constant speed belt-driven machine with the driving shaft parallel with the spindle, the feed box being driven from the constant speed shaft, and fitted with an index plate giving the feed in inches per minute. By simply removing a bracket and supplying another, this is converted into a machine of the same style, but having the driving shaft at right angles with the spindle. Again, by removing the driving-gear box and substituting another simpler one, the machine becomes a cone-pulley machine in which the feeds are driven from the spindle, but with no change in the feed box itself. Substituting a different feed index plate, however, gives the feeds in thousandths per revolution. By the same exchange of brackets as before, this cone-pulley machine becomes one with the driving shaft parallel with, or at right angles to, the spindle, as desired. By substituting a sprocket wheel for the driving pulley and adding a bracket at the base, the constant speed belt machine becomes a constant speed motor-driven machine and by a similar substitution the cone pulley machine becomes a variable speed motor-driven machine, the feed being appropriate to the drive in all cases.

Even more noteworthy is the application of the same system to machines havng vertical spindles, for up to the frame head the horizontal and vertical spindle machines are identical, the vertical machine involving nothing not contained in the horizontal machine except the frame casting, the mechanism at its top, and a pair of bevel gears to change the motion of the horizontal shaft to the vertical shaft. In this way no less than 12 distinct machines are made by merely changing the frame and drive, the table mechanism and feed box being identical in all types, while there are but two speed boxes.

Plate Straightening Rolls

The accompanying illustration shows a set of plate straightening rolls, built by the Hilles & Jones Company, Wilmington, Del. This machine was recently installed in the Readville shops of the New York, New Haven & Hartford Railroad, the Reading shops of the Philadelphia & Reading Railway, the Mt. Clair shops of the Baltimore & Ohio Railroad; and the McKees Rocks shops of the Pittsburg & Lake Erie Railroad. It is made in various lengths between housings, the widest being 10 ft. 2 ins.

There are six rolls of forged steel, 12 ins. in diameter, and two of the upper rolls are placed alternately with the lower rolls giving the usual corrugating action on the plate. The third upper roll is placed directly over the outside lower rolls, this third roll having independent adjustment both vertically and laterally allowing a plate to be pinched at any desired point and stretched for removing buckles. This is especially desirable on long, narrow plates. This type of

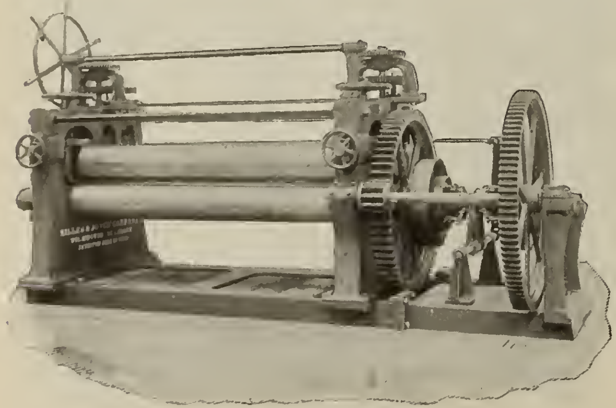
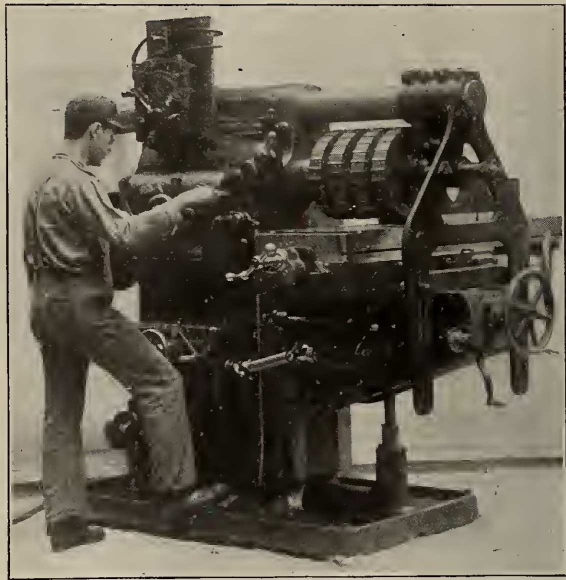


Plate Straightening Rolls

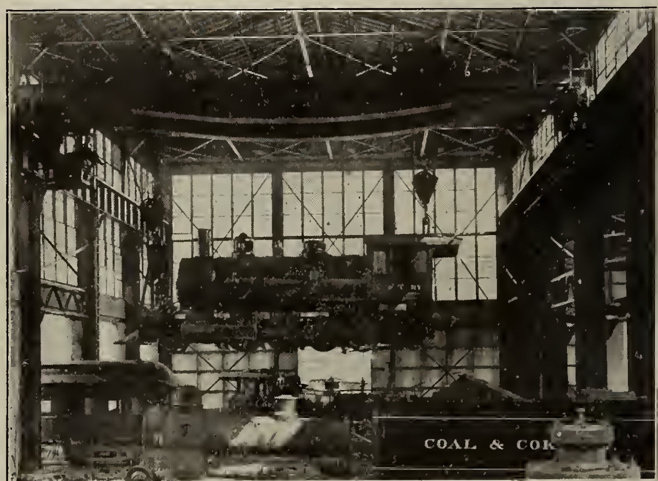


Horizontal Milling Machine, Operator's Position.

machine has become almost a necessity in the manufacture of tenders and the same general design of machine, in lighter sizes, is being used by the railroads for passenger car work on which the sheets have to be leveled. Driving may be either by duplex friction clutch pulleys, as shown, or by reversible motor directly connected.

Double Trolley Crane

The standard 120-ton Morgan cranes are built especially for railroad shops by the Morgan Engineering Company, Alliance, Ohio. The crane shown in the view was furnished to the Coke & Coal Railway Company, Elkins, W. Va., and is what is known as a double trolley crane, each trolley having a capacity of 60 tons. In addition to the 60-ton hoist on each trolley, there is a 5-ton auxiliary hoist for



Double Trolley Crane.

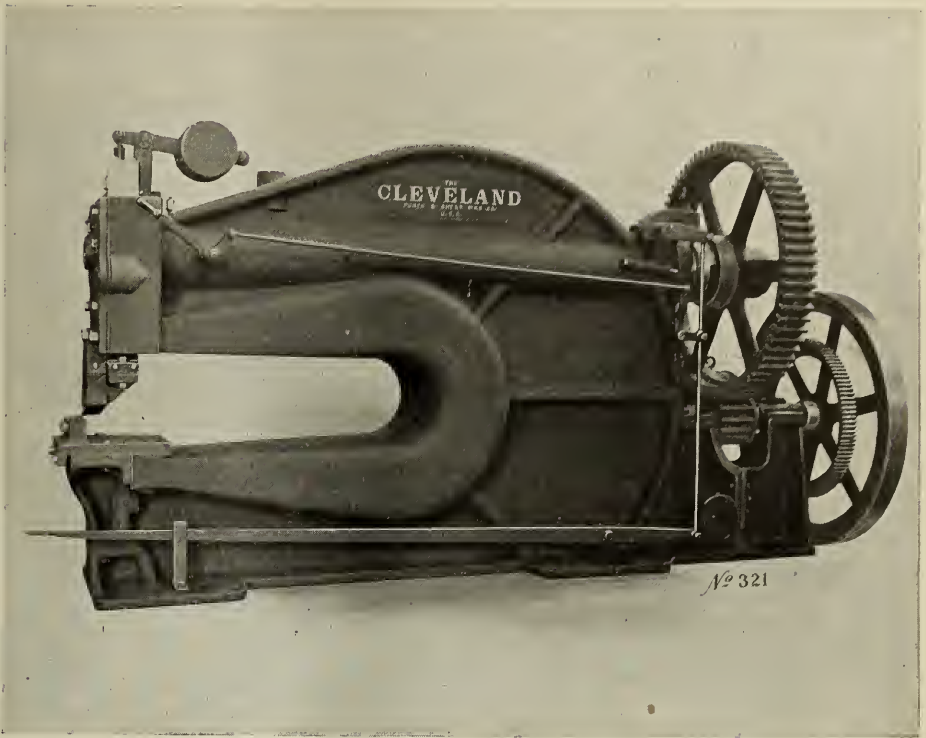
handling light loads at high speeds. The span of this crane is 65 ft. from center to center of bridge rails. A number of these cranes have recently been installed, several of them for the Grand Trunk Railway system at their Battle Creek and Stratford shops, described elsewhere in this issue.

Our Country and Our Railroads

An address on Our Country and Our Railroads, delivered by B. F. Yoakum, chairman of the executive committees of the Rock Island-Frisco Line, before the Chicago Association of Commerce, dealt in part with the control of the railroads through the Federal government. "Railroad pools should not be legalized; pools are secret understandings between the parties to them, but railroads should be permitted to enter into open traffic alliances, subject to the approval of the Interstate Commerce Commission, which would safeguard the interests of the public. The same Federal authority should authorize the issuance of railroad securities, thereby protecting the investor against over-capitalization."

Cleveland Shear

A flush front shear, installed in the West Albany shops of the New York Central Lines, is shown herewith. This machine, built by the Cleveland Punch & Shear Works Company, is used for shearing plate and has interchangeable attachments for punching angle, shearing, flue hole punching, bar shearing, etc. This machine is of solid frame type and is cast with only one core which is used for the main shaft. This machine is equipped with automatic stop and is especially adapted for railroad work.



Cleveland Flush Front Shear, New York Central Lines.

Personals

Mr. B. W. Benedict has been appointed bonus supervisor of the Atchison, Topeka & Santa Fe at Topeka, Kan., and will have territorial charge of bonus work on the Eastern Grand division and functional supervision over standardization of schedules.

Mr. S. S. Riegel has been appointed mechanical engineer of the Delaware, Lackawanna & Western, at Scranton, Pa., succeeding J. A. Mellon, resigned.

Mr. T. McHattie, master mechanic of the Grand Trunk at Montreal, Que., has been appointed superintendent of motive power of the Central of Vermont.

Mr. Charles L. Gasper, mechanical engineer of the Wisconsin Central, has been appointed superintendent of the mechanical department of the Canton & Hankow Ry., at Canton, China, to succeed T. S. Reilly, whose death was recently noted. Mr. Reilly, who died of an abscess of the liver, has been buried at Hongkong, a British colony. Mr. Gasper will leave for China at once.

Mr. R. G. Cullivan, general foreman of the locomotive department of the New York Central at West Albany, N. Y., has been appointed division superintendent of motive power, to succeed Mr. E. A. Walton, resigned. Mr. Cullivan will be succeeded by Mr. Marvin Howe, general foreman of the locomotive department at Oswego, N. Y.

Mr. J. C. Garden has been appointed master mechanic of the eastern division of the Grand Trunk, with headquarters at Montreal, in place of Mr. T. McHattie, who has resigned to take service with another company.

Mr. W. S. Kenyon has been appointed master mechanic of New Orleans & Northwestern, with office at Ferriday, La., vice Mr. B. J. Peasley, transferred to St. Louis, Iron Mountain & Southern shops at De Soto, Mo.

Mr. P. N. Jones, electrical and mechanical engineer of the Pittsburg Railways Co., has been appointed general superintendent of the company.

Mr. G. E. Johnson has been appointed master mechanic of with headquarters at Wymore, Neb., vice Mr. A. B. Pirie, assigned to other duties.
the Wymore division of the Chicago, Burlington & Quincy,

Mr. A. S. Work, road foreman of engines of the Chicago & Alton at Bloomington, Ill., has resigned, and Mr. James Butler has been appointed to succeed him.

Mr. C. B. Smyth, assistant mechanical engineer of the Union Pacific, has resigned to accept the position of superintendent of the McKeen Motor Car Co., with headquarters at Omaha, Neb.

Mr. F. C. Pickard, formerly master mechanic of the Mississippi Central, has been appointed master mechanic of the Cincinnati, Hamilton & Dayton at Moorfield, Ind., to succeed Mr. C. B. Cadman, resigned.

Mr. E. G. Osgood has been appointed master mechanic of the Williamsville, Greenville & St. Louis, succeeding Mr. O. D. Greenwalt, resigned.

The jurisdiction of Mr. J. P. Nolan, master mechanic of Morgan's Louisiana & Texas, has been confined to the Algiers shops and Mississippi terminals.

Mr. W. H. Edgecombe has been appointed bonus supervisor of the Western Grand division of the Atchison, Topeka & Santa Fe, with office at La Junta, Colo.

Trade Notes

Mr. Russel Dale, formerly sales manager of the Celfor Tool Company, is now the Chicago representative of the Carpenter Steel Company, of Reading, Pa., with offices in the Commercial National Bank building, Chicago. Mr. Dale is one of the well known and popular railway supply salesmen, having been sales manager for the Rich Manufacturing Company, which was later changed to the Celfor Tool Company, for the last few years. He introduced the Rich drill chuck and Celfor high-speed flat drills in many shops, both in this country and abroad. The Carpenter Steel Company is one of the largest manufacturers of high grade steels and wire in the country. Among their products are "Zenith," high-speed tool steel, T. K. alloy steel, Air Hardening steel, Fast Finishing steel, "Extra," "Standard" and "Comet" tool steels.

Mr. J. E. Simons, Fisher building, Chicago, formerly of the firm of Lawson & Simons, Chicago, has been appointed Western agent for the Damascus Bronze Company, Pittsburg, Pa., and the Composite Board Company, Niagara Falls, N. Y. The latter company makes an inflammable board for the interior lining of steel cars.

Announcement is made that the Rockwell Furnace Company, of 26 Cortlandt street, New York, have purchased the factory, drawings, patterns, etc., of the Rockwell Engineering Company, and the business will hereafter be transacted under the name of Rockwell Furnace Company, incorporated under the laws of the state of New York. All customers of the Rockwell Engineering Company are assured prompt fulfilment of all orders for repair parts, etc., and the new company will be pleased to submit prices on any new work in the furnace line.

The Plunger Plastic Packing Company, of St. Paul, Minn., in placing the D. & L. throttle rod equipment upon the market, have broken away from the old coil and ring packing and use a plastic packing that has many advantages over the old style; the chief among them is the fact that it is leak proof and stays so, and it can be renewed without killing the engine. Packing put up in the usual form cannot retain its elasticity and lubrication for any length of time, and when these elements disappear the throttle packing leaks as a natural consequence. The only remedy is to kill the engine and repack the throttle with some other of the "53" varieties upon the market, in the hope of better results next time.

The Light Feed Oil Pump Company, Milwaukee, Wis., submits a copy of Bulletin No. 209, which contains a description, illustrated by photographs and line drawings, of the Richardson automatic sight feed oil pump.

The American Wood Working Machinery Company, Rochester, New York, issued a circular on their four-column moulder, which is one of their late style machines.

After prolonged and earnestly contested litigation between the rival claimants for the patent for the "impositive lock" which forms part of the well-known Gold hose coupler, a decision has just been rendered by the Commissioner of Patents on appeal in favor of Mr. Edward E. Gold, president of Gold Car Heating & Lighting Company. The Gold coupler is provided with a lock which locks automatically and prevents accidental uncoupling, but yields when the cars pull apart and permits the couplers to uncouple automatically. The contest for the patent for this important invention has been a vigorous one for four years past, and much testimony has been taken, resulting in the recent decision of the Commissioner of Patents on appeal in favor of Mr. Edward E. Gold.

The Helwig pneumatic hammer, here illustrated, is designed to meet the demand for a pneumatic hammer of increased capacity, simple design, substantial construction, one convenient to handle, easy of operation, and low in cost of operation and maintenance. The valve mechanism is very simple. The valve is balanced, of piston type, and of large wearing surface. It is made of solid tool steel, hardened and ground, and as it operates in the same direction as piston, the wear on it is reduced to a minimum and the full power of air allowed to be utilized for effective work instead of being wasted in overcoming friction. It is made by the Helwig Manufacturing Company, St. Paul, Minn.

C. W. Leavitt & Company, New York, are now located in the Hudson Terminal, Cortlandt building, 30 Church street, New York.

Burton W. Mudge & Brother, Commercial National Bank building, Chicago, has been appointed western representatives for the McInnes Steel Company, of Corry, Pa., who handle a complete line of high-grade tool steel of all kinds. A complete stock will be carried at the warehouse, 52 West Washington street, Chicago.

"Aid to Shippers" is the title of a 72-page book containing a quantity of information of value to all engaged in the export or import trade. The book is issued by Oelrichs & Company, of New York, for more than 40 years the American representatives of the North German Lloyd Steamship Company, who by reason of long experience are qualified to advise. The table of foreign moneys with United States equivalents, together with weights, measurements, tariffs, customs requirements, etc., etc., will be found of great value. "Aids to Shippers" will be sent, postpaid, on request to Oelrichs & Company, Forwarding Department, 5 Greenwich street, New York.

Mr. Alexander B. Wetmore has accepted the position of sales manager of the Monarch Steel Castings Company, of Detroit, Mich., effective March 1. Mr. Wetmore leaves a long period of service with the Detroit Lubricator Company to take up the sales of the well-known "Monarch" couplers and "Monarch" graduated draft gear, made by the Monarch corporation.

"Peerless" high speed reamers are claimed to reduce the tool cost per reamed hole one-half, and with the same machines and operators, turn out twice as many reamed holes per day as carbon steel reamers. They are made by the Cleveland Twist Drill Company, Cleveland, Ohio.

The American Car & Equipment Company, Chicago, has moved its offices from the Monadnock block to 730 Colony building.

The newly organized Duntley Manufacturing Company, Chicago, has taken the whole of the fourth floor of the Plymouth building for its general offices.

The Northwestern Railway Supply Company, 8 South Canal street, Chicago, has changed its name to the Central Railway Supply Company, and has increased its capital stock from $500 to $25,000.

Mr. C. B. Smyth, assistant mechanical engineer of the Union Pacific, has been appointed superintendent of the McKeen Motor Car Company, Omaha, Neb., and will hereafter devote his entire time to the interests of that company.

The Indianapolis Railway Mail Equipment Company, Indianapolis, Ind., has been incorporated to manufacture and sell railway mail equipment, capital stock, $100,000. The incorporators are Messrs. William A. Zumpfe, Ernest L. Killen and George B. Mabin.

Mr. Charles W. Waughop, Jr., has been appointed sales agent of the Scullin-Gallagher Iron & Steel Company, St. Louis, Mo., with headquarters at St. Louis. Mr. Waughop will act as the coupler expert of the company.

Mr. T. Herbert Taylor, 419 Empire building, Atlanta, Ga., has about completed the organization of a railway and mill supply company, to be located in Atlanta, and would like to hear from concerns manufacturing articles handled by railway Sand mill supply houses.

The long series of producer gas tests on various grades of bituminous coal, conducted by the U. S. Geological Survey at the St. Louis Exposition, have been productive of such fruitful results that the testing work has been perpetuated and the government has secured for this purpose a 140-h. p. Westinghouse 3-cylinder vertical single-acting gas engine. This engine is of the same type as that installed at St. Louis, upon which all of the producer gas tests were made. An important schedule of experimental work has been laid out by the government engineers and tests will be run on all classes of bituminous coals, lignites, peat, etc.

RAILWAY MASTER MECHANIC

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Vol. XXXIII Chicago, April, 1909 No. 4

CONTENTS.

Non-Resident Lectures at the University of Minnesota

Mr. Edward P. Burch, consulting engineer, Minneapolis, is giving a course of ten lectures on "Electric Traction for Railway Trains" at the College of Engineering of the University of Minnesota. The lectures include the following subjects: History of Electric Traction, Advantages of Electric Traction, Characteristics of Steam Locomotives, Characteristics of Electric Locomotives, Motor Car Trains, Electric Railway Motors, Power Required for Trains, Steam, Gas, and Water Power Plants, The Transmission System, and Electrification of Railroads.

Presentation Ceremony, the John Fritz Medal

The John Fritz medal for 1909 has been awarded by the "Board of Award" specially selected for the purpose, and consisting of four members of each of the National Engineering Societies, to Mr. Charles T. Porter, Hon. Mem. Am. Soc. M. E., for his work in advancing the knowledge of steam engineering, and in improvements in engine construction. The public ceremony of the presentation of the medal to Mr. Porter took place in the auditorium of the Engineering Societies Building, New York, April 13, 1909. Besides the simple ritual of the presentation of the medal, in the presence of invited guests and distinguished representatives of engineering, there were addresses by representatives of the four groups of the profession most concerned. The program included the following speakers: Dean W. F. M. Goss, of the University of Illinois; Prof. F. R. Hutton, of Columbia University; Mr. Robert W. Hunt, of Chicago, and Mr. Frank J. Sprague, of New York.

Transportation Exhibit, Alaska-Yukon-Pacific Exposition

Actual demonstrations of every railway safety device, approved and unexploited, will be made daily in the transportation building and yards of the Alaska-Yukon-Pacific Exposition, which will open on June 1 in Seattle. The transportation building is now being hurried to completion and tracks, spurs, switches, and "Y's" are already laid for the most complete exemplification of general and special railway traffic ever aottempted on the grounds of an exposition.

So desirous were eastern locomotive builders of taking advantage of reaching the Oriental field through the medium of the Seattle fair, that they provided the major portion of the $75,000 which the construction of the transportation building has cost, in order that the structure should be of ample size for their most complicated illustrations. Locomotives of all makes and all periods will be exhibited. Everything, from the old "hay burners" of the cotton belt. to the big transcontinental mogul will be shown under full steam. and a modern passenger train, equipped with the last word in Pullman service, lights, brakes and wireless alarms will be a daily show.

Oil-Burning Locomotive

In the proceeding brought by the forest, fish and game commissioner before the New York state public service commission, second district, to require the railroads operating in the forest preserve of the Adirondacks to take measures to prevent railroad fires in that region, the commission has rendered a decision ordering oil to be burned through the months from April 15 to November 1 of each year. The complete installation of oil burning is to be effected by April 15, 1910, and at least two locomotives on the Mohawk & Malone R. R. and two on the Delaware & Hudson road are to be fitted with oil-burning apparatus and placed in service this summer in order to accustom the men to the use of oil and avoid any experimenting next year.

Panama Canal Works

The record for daily excavation in the Central Division on the Panama Canal was broken on February 27, 1909, for the fifth time during the month. On that date, 59 shovels excavated 77,064 cubic yards, an average of 1,306 cubic yards per shovel for the eight-hour day. The material excavated was loaded in 2,177 Lidgerwood flats, 352 large Western dump cars and 2,754 small Western and Oliver dump cars, a total of 5,283 car loads.

Work on the widening of Culebra Cut between Las Cascadas and Paraiso was begun the middle of November and already considerable progress has been made. Authority for the change from a 200-ft. to a 300-ft. channel at the bottom of the Cut, was given at an advantageous time from the construction point of view, as the steam shovels had not excavated to so low a level that they could not be taken to the higher levels with advantage. Most of the excavation for the widening is to be on the east side of the channel, although cuts are made on each side and in places 50 ft. will be taken from both sides. The width of the Cut at the top and at the lowest levels yet reached is not uniform, as it depends on the nature of the material in the upper slopes. The width is 1,000 ft. at Gold Hill and other points, and is only 500 ft. at the top at Paraiso.

At the angle at Gold Hill little or no additional excavating will be necessary at the present levels, as a 350-ft. turning basin is under construction at this tangent. At the point between Gold Hill and Cucaracha, where there was a small angle in the line of the 200-ft. channel, there will be none in the 300-ft. canal.

Slides have been taken advantage of in the plan for the 300-ft. channel. The slides on the west bank at Culebra had been removed to such an extent that steam shovel No. 205 made only one cut on the widening, and this completed the excavation necessary at about elevation 180. At Cucaracha, where the big slide is still creeping into the prism and where several hundred thousand yards of materal have already been taken out outside the slopes necessary for the original 200-ft. channel, the line has been turned so as to eliminate the angle mentioned above and and to include much of the excavation already done. On the east bank between Empire and Culebra shovel No. 257 is taking out material so unstable that it would have been necessary to remove it even if the width of the canal at the bottom had not been increased, and the widening does not make it necessary to remove any more material from this point than would have been removed for the 200-ft. canal. Shovels Nos. 205, 220, 225, and 232, working on the east slope of the Cut, and shovels Nos. 257, 206, and 211, working on the west slope, are all engaged on the widening.—Canal Record.

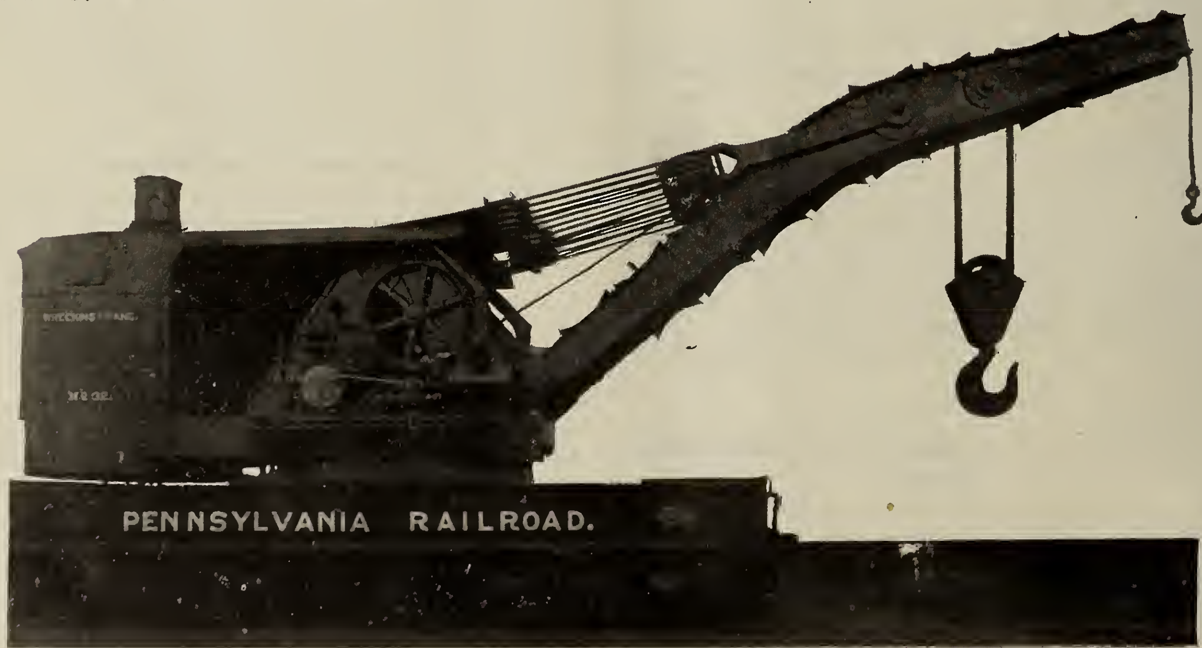
One thousand pounds of old French scrap have been forwarded to the director of the United States mint at Philadelphia by the Chief Quartermaster of the Isthmian Canal Commission to be used in making canal medals. Up to Jan. 1, 1909, about 2,400 medals have been earned, and it is estimated that the number of medals to be earned in the future will aggregate about 500 per annum. In the distribution of the metals the following method will probably be observed. Medals which have been earned by persons no longer connected with the Commission or Panama Railroad Co. will be distributed from the Washington office of the Commission; medals earned by employes who have died subsequently will be delivered to their heirs, and medals earned by present employes will be distributed from Culebra.

Locomotive Wrecking Crane, Pennsylvania R. R.

The Pennsylvania R. R. has recently added a locomotive crane to its wrecking equipment. This crane, which is of 100-ton capacity, is shown in the photographic reproduction herewith. The steel framework is 26 ft. long and 9 ft. wide, with the crane pivoted at the center, making it equally serviceable in any location of the jib. The longitudinal sills are made up of 24-in. I-beams of 100 lbs. to the foot, which are boxed with heavy plates, the connection with the side beams being made wtih angles double riveted. The end sills are 36 ins. deep and of ¾-in. stock. Two 10-in. brake cylinders, piped to a common reservoir, operate the brakes, and the equipment includes a vertical, submerged tube boiler, 62 ins. in diameter by 9 ft. in height, a 500-gallon water tank, and a double engine with 12x12-in. cylinders.

The maximum radius of the main hoisting block is 23 ft. 4 ins., and of the auxiliary hoist, 30 ft. with an ordinary working radius of 27 ft. The crane has a capacity of 100 tons at a radius of 16 ft., while at a radius of 20 ft. the capacity is diminished to 80 tons. When in working order, with coal, water and ballast, the weight is about 106 tons. The car is carried on two four-wheeled trucks with steel-tired wheels 33 ins. in diameter. Four nests of coiled springs are used to support each bolster, roller side bearings being also provided.

The main, auxiliary and jib hoisting motions are entirely independent of each other, being operated by independent trains of gearing, and are provided with independent brakes. Telescopic out-riggers are used to secure stability for the crane with its various loads. In none of three motions is any use make of ratchets or other devices for holding suspended loads. The drum for the main hoisting rope is of very large capacity, allowing for a total length of 200 ft. The auxiliary hoist also has a drum of large capacity and purchase arranged in gearing. The jib hoist motion is provided with a train of steel gearing, ending in the bronze worm and steel worm wheel operating, directly, the hoisting drum. In this way the danger of dropping the boom with or without loads is entirely obviated. The crane was manufactured by the Industrial Works, Bay City, Mich.



New Locomotive Crane, Pennsylvania R. R.

Balanced Compound Locomotive

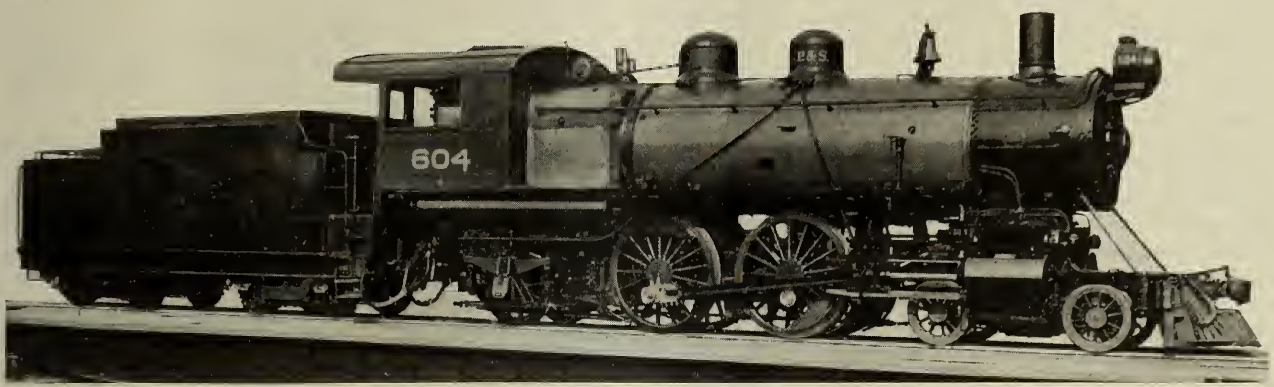
Spokane, Portland & Seattle Ry.

The Spokane, Portland and Seattle Ry. is under construction from Portland to Spokane, at which point it will connect with the Great Northern Ry., thus giving the latter a direct line to Portland. For passenger service on the new road, the Baldwin Locomotive Works have recently completed ten balanced compound locomotives of the Atlantic type. An equal number of similar engines were built at these works for the Great Northern Ry. in 1906, and have been giving satisfactory service. The new locomotives exert a tractive force of about 23,000 lbs. when working compound

In accordance with Great Northern practice, these locomotives are equipped with Belpaire boilers. The first and second rings in the barrel have "diamond" seams on the top center line, while the third ring, which carries the dome, has a welded seam on top with a liner inside,. The firebox is built with a straight back head and sloping throat, and is double riveted to the mud ring, which is of cast steel, 5 ins. wide all around. The throat sheet completely encircles the barrel; it is flanged out of a single piece, and formed to fit the top corners of the outside firebox shell. The back head is stayed with gusset-plates, which in turn are braced by longitudinal stay rods, anchored on the boiler barrel. The gusset plates are cut out to accommodate two rows of transverse tie rods, which support the flat surfaces of the outside sheets above the crown. The smoke box is slightly extended and is made in one piece. It is of the self-cleaning type, fitted with perforated plates and a single high exhaust nozzle.

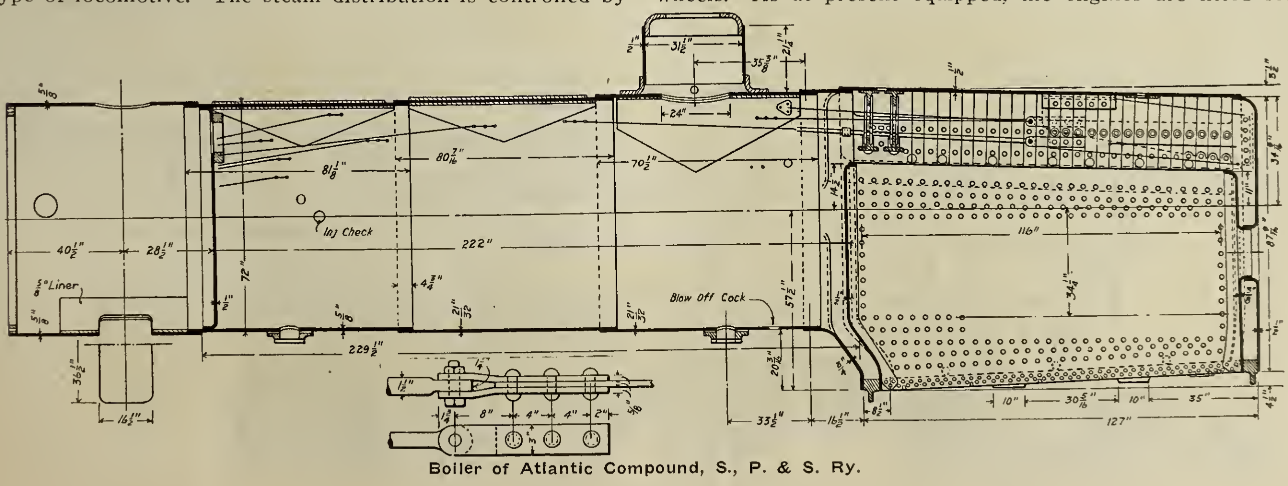
The cylinders are of the design usually applied to this type of locomotive. The steam distribution is controlled by two 15-in. piston valves, which are driven by Stephenson link motion. As the leading driving axle is cranked, the eccentrics are placed on the second axle, and the valves are driven by long rods which are provided with knuckle joints and intermediate bearings. The outside cylinders drive the second pair of wheels. The four guides are braced by cast steel bearers, which are bolted to a single yoke extending across the locomotive. The crank axle is built up with a cast steel central web.

The main frames are of cast steel, 5 ins. wide, spaced 43 ins. between centers. The rear frames are of the same material; they measure 4 ins. in width, and are spliced to the main frames back of the rear driving pedestals. A steel casting provides a transverse brace at this point, and also supports an expansion plate which carries the front end of the mud ring. The rigid trailing wheels frequently used in this type of engine are replaced in the present design by a radial swing truck with outside journals. The front and back truck wheels have cast steel spoke centers, and were supplied by the Standard Steel Works Co.



Balanced Compound Atlantic, S., P. & S. Ry.

The cab is of steel, with interior fittings conveniently arranged. The throttle lever is placed in a vertical position and is carried by a bracket mounted on the boiler shell, a short distance in front of the back head. The throttle rod runs outside the boiler, and the valve is operated by a shaft which passes through a stuffing box located in the side of the dome. The tender is equipped with a water bottom tank and steel channel frame. The trucks are of the equalized type, with semi-elliptic springs and "Standard" steel tired wheels. As at present equipped, the engines are fitted for

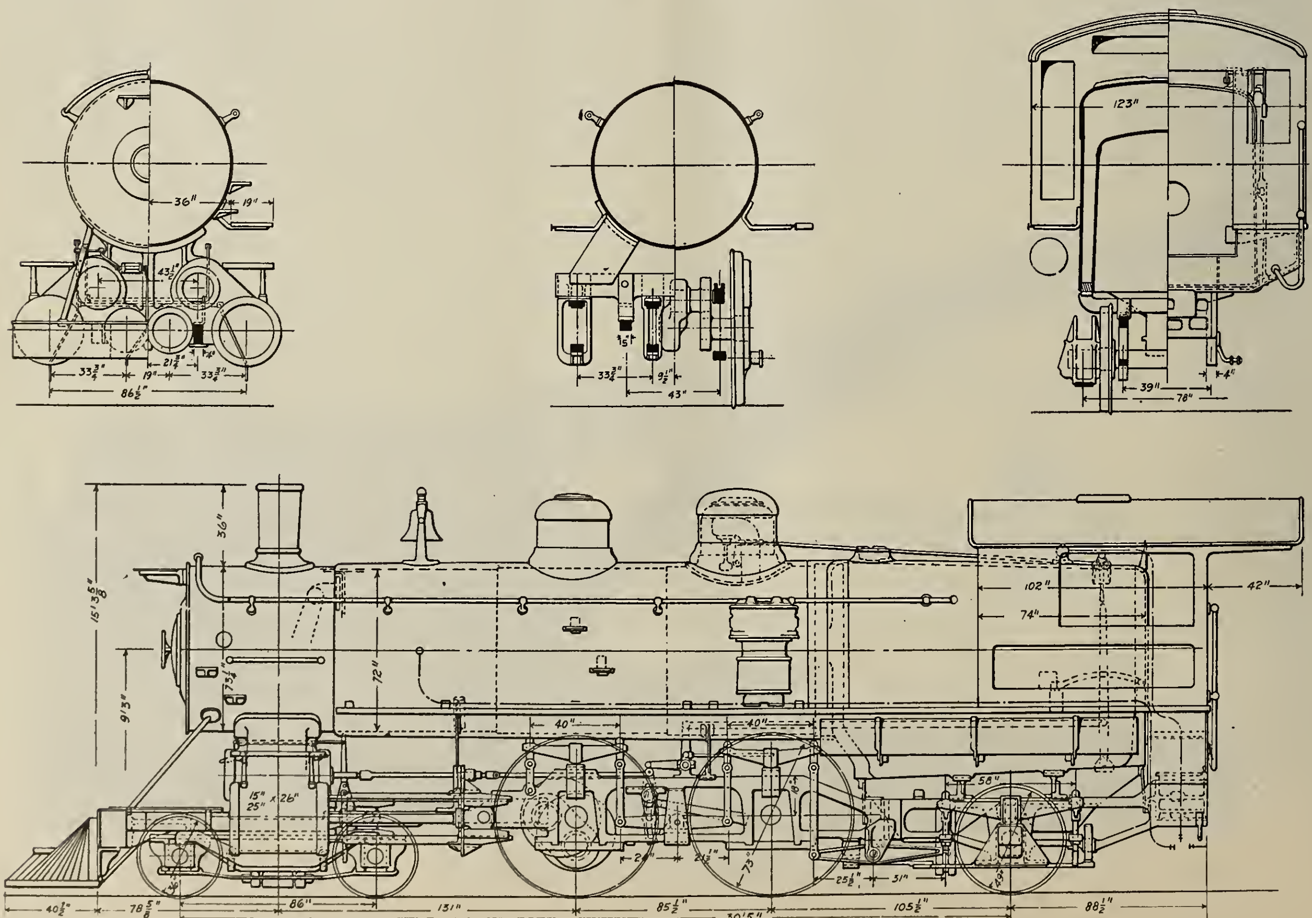


Boiler of Atlantic Compound, S., P. & S. Ry.

coal burning, but oil tanks are also furnished in case a change of fuel should prove desirable in the future.

This is an interesting example of a high powered Atlantic type locomotive, in which large boiler capacity is provided in conjunction with compound cylinders. The principal dimensions, given in the table, indicate that these engines are well adapted to heavy express service.

Gauge	4 ft. 8½ ins.
Cylinders	15 ins. and 25x26 ins.
Valves	Balanced Piston
Boiler—	
Type	Belpaire
Material	Steel
Diameter	72 ins.
Thickness of sheets	¾ in.
Working pressure	210 lbs.
Fuel	Soft coal
Staying	Vertical
Firebox—	
Material	Steel
Length	116⅛ ins.
Width	66¼ ins.
Depth, front	72 ins.
Depth, back	64 ins.
Thickness of sheets, sides	⅜ in.
Thickness of sheets, back	⅜ in.
Thickness of sheets, crown	⅜ in.
Thickness of sheets, tube	½ in.
Water Space—	
Front	5 in.
Sides	5 in.
Back	5 in.
Tubes—	
Material	Steel
Wire gauge	No. 11
Number	301
Diameter	2¼ ins.
Length	18 ft. 6 ins.
Heating Surface—	
Firebox	208 sq. ft.
Tubes	3,265 sq. ft.
Total	3,473 sq. ft.
Grate area	53.4 sq. ft.
Driving Wheels—	
Outside diameter	73 ins.
Inside diameter	66 ins.
Journals, front	10x10¾ ins.
Journals, back	9½x12 ins.
Engine Truck Wheels—	
Front diameter	36 ins.
Journals	6x12 ins.
Back diameter	49 ins.
Journals	8x14 ins.
Wheel Base—	
Driving	7 ft. 1½ ins.
Rigid	7 ft. 1½ ins.
Total, engine	30 ft. 5 ins.
Total, engine and tender	63 ft. 5¾ ins.
Weight—	
On driving wheels	115,000 lbs.
On truck, front	51,900 lbs.
On truck, back	52,300 lbs.
Total engine	219,200 lbs.
Total engine and tender, about	368,000 lbs.
Tender—	
Number of wheels	8
Wheels, diameter	36 ins.
Journals	5½x10 ins.
Tank capacity, water	8,000 gals.
Tank capacity, coal	13 tons
Service	Passenger

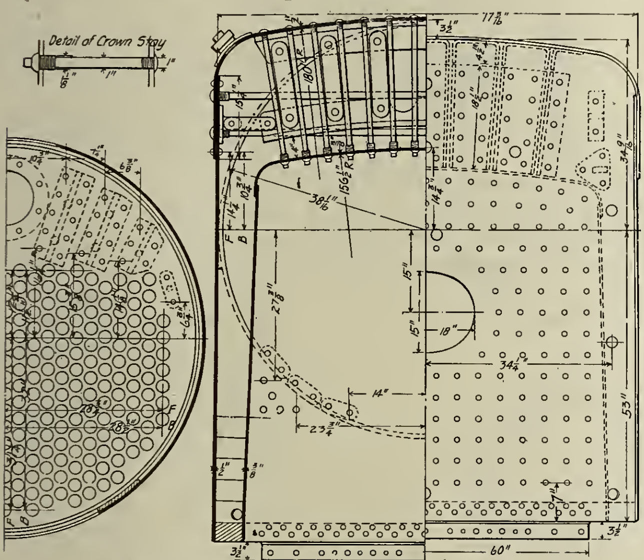


Elevation and Sections of Atlantic Type Compound, S., P. & S. Ry.

Abuse of the M. C. B. Repair Card*

Current M. C. B. rule 76 requires that when repairs of any kind are made to foreign cars, a repair card shall be securely attached to designate locations of the repairs, this card to specify fully the repairs made, reasons for same, date and place same were made and name of road making the repairs, etc. Obviously, the repair card was adopted for the purpose of establishing a close relationship between the car owner and the road making repairs and thus eliminate tracing upon the part of the car owner to determine the responsibility in the event of wrong repairs having been made, and at the same time relieve intermediate or delivering roads from any responsibility.

The object was most worthy, and if all roads actually making repairs to foreign cars fully complied with rule 76, identification by owners would be easy, and prompt adjustment in the event of wrong repairs possible. Unfortunately,



Firebox of Atlantic Compound, S., P. & S. Ry.

however, it is claimed that rule 76 is not being complied with by all railway companies who are parties to the M. C. B. rules, thus producing a very unsatisfactory condition and practically annulling the purpose for which the repair card was created. It has been discovered on some roads that the card is often attached to cars by attempting to force the tacks into the timber with the thumb, with unsatisfactory results. When the car finally reaches home, minus the card, and it is found that wrong repairs have been made, the owner must pay the cost of repairs or employ an additional force of clerks to trace and locate the malefactor. The length of time required for the car to reach home is often great, and the stubs that have accumulated with the bills from foreign roads reach such proportions that the function of selecting the particular stub to check against the card on a car requires time and patience not usually allotted to the busy railway man. If you are fortunate enough to finally locate the stub for the car in question, and upon examination of the car discover that the metal parts are so corroded or tarnished that you are unable to distinguish between alleged new work and the old, one is apt to give the billing road the benefit of the doubt and pass the bill for payment; also in cases where you are in receipt of a bill for repairs and the car itself bears no repair card or evidence of the work described, you still have left the choice of two evils, that of passing the bill without finally locating the work, or refusing payment.

When unquestionably rule 76 has been and is to-day being flagrantly violated, one would be without standing in court should he without positive proof allege dishonesty upon the part of any railway in the non-application of repair cards. It is possible that the fault may lie in the indifference of repair men. The fact remains that bills are being rendered for repairs to cars that bear no repair card, and in some instances no evidence of repairs having been made. In the light of experience, it would appear that the repair card in its present form is not what it should be, and even if rule 76 be fully and honestly complied with by all roads, the weakness still remains and is about equally divided between the possible loss when attached or failure to attach the repair card to the car, and the difficulty of determining by examination of the car whether specific repairs have or have not been made, especially when cars are long absent from home.

Assuming that all roads are, or intend to be, perfectly honest in complying with rule 76, what in the rule will prevent a road from removing a pair of wheels in perfectly good condition, that have been in service but a year under a foreign car, and placing this pair of wheels for further service under one of its own cars, and billing the foreign road for a pair of new wheels to replace those which it claims were shelled out, and attach a repair card to the car in evidence of work done? Again, what in rule 76 will prevent any road taking the initials and numbers of any and all foreign equipment which may be standing upon their sidings in perfectly good condition, attaching repair cards thereto without doing any work at all and rendering bills for alleged repairs? It is rumored that a certain railway established the practice of applying side doors to the majority of foreign cars passing one repair point, brake-shoes at another repair point, air-brake hose at another, etc. This scheme worked well until the side door specialist became over zealous and began to apply side doors to coal cars, which fact the car owners discovered when about to pass the bill. Whether this be true or not, the possibilities are certainly present.

It has been suggested that many so-called combination car users' defects, as described in M. C. B. rules 49 and 56, are somewhat dangerous for the car owner, in view of the fact that they can be speedily converted into the owners' defect by a slight error on the part of a repair man in omitting to repair the end sill, where both that and a longitudinal member are damaged and require replacement on the same end of a car. The loss of the repair card takes from the car owner the only means of identifying the actual repairs made. Should the owners, upon examination of the car, discover that a new end sill had been applied in conjunction with the longitudinal sill, they would doubtless refuse payment for the latter. These queries are simply submitted as food for thought and are in no wise intended to convey the idea that any railway in the country would adopt any other than fair and honest measures; but I am reminded that any rule which would make absolutely impossible nefarious practice would be an excellent one to adopt as a substitute for present rule 76.

It is human nature to criticise or pick flaws in any rules provided for the government of men or business, and I am only one of the great army that comes before you without a remedy which practice has proven faultless. The remedy will come in due time through the united effort, thought and action of the railway men of this country, to whom I bare my head in recognition of their unquestioned fairness and honesty of purpose. In the meantime, and still operating under the present rule 76, let us aim to obey it to the letter and if necessary establish an inspection that will leave no doubt in our minds that the provisions of the rule are being absolutely complied with on the road we are representing.

*From a paper read before the New York Railroad Club, March 19, 1909.

Safety Valve Capacity*

It is the purpose of this paper to show an apparatus and method employed to determine safety valve lifts, giving the results of tests made with this apparatus upon different valves; to analyze a few of the existing rules or statutes governing valve size; and to propose a rule giving the results of a series of direct capacity tests upon which it is based, its application to special requirements, and finally, to indicate its general bearing upon valve specifications.

Two factors in a safety valve geometrically determine the area of discharge, and hence the relieving capacity: the diameter of the inlet opening at the seat, and the valve lift.

The former is the nominal valve size, the latter is the amount the valve disc lifts vertically from the seat when in action. In calculating the size valves to be placed on boilers, rules, which do not include a term for this valve lift, or an equivalent, such as a term for the effective area of discharge, assume, in their derivation, a lift for each size valve. Nearly all existing rules and formulae are of this kind, which rate all valves of a given nominal size as of the same capacity.

To find what lifts standard make valves actually have in practice and thus test the truth or error of this assumption that they are approximately the same for the same size valves, an apparatus has been devised and tests upon different makes of valves conducted. With this apparatus not only can the valve lift be read at any moment to thousandths of an inch, but an exact permanent record is obtained somewhat similar to a steam engine indicator card in appearance, and of a quite similar use and value in analyzing the action of the valve.

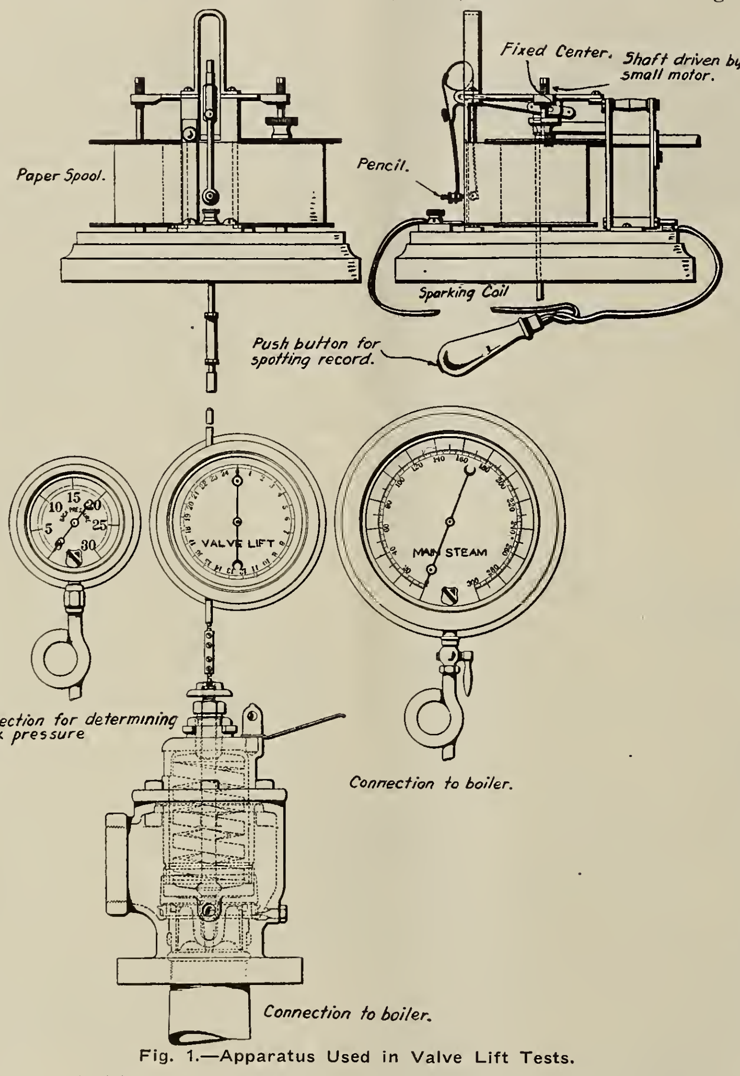


Fig. 1.—Apparatus Used in Valve Lift Tests.

As appears in Fig. 1, the valve under test is mounted upon the boiler in the regular manner, and a small rod is tapped into the top end of its spindle, which rod connects the lifting parts of the valve directly with a circular micrometer gauge, the reading hand of which indicates the lift upon a large circular scale or dial. The rod through this gauge case is solid, maintaining a direct connection to the pencil movement of the recording gauge above. This gauge is a modified Edson recording gauge, with a multiplication in the pencil movement of about 8 to 1, and with the chart drum driven by an electric motor of different speeds, giving a horizontal time element to the record. The steam pressures are noted and read from a large test gauge graduated in pounds per square inch, and an electric spark device makes it possible to spot the chart at any moment, which is done as the different pound pressures during the blowing of the valve are reached. The actual lift equivalents of the pencil heights upon the chart are carefully calibrated so the record may be accurately measured to thousandths of an inch.

In testing, the motor driving the paper drum is started and the pressure in the boiler raised. The valve being mounted directly upon the boiler, then pops, blows down, and closes under the exact conditions of service, the pencil recording on the chart the history of its action.

With this apparatus, investigations and tests were started upon seven different makes of 4-in. stationary safety valves, and these tests were followed with similar ones upon nine makes of muffler locomotive valves, six of which were 3½ ins., all of the valves being designed for and tested at 200 lbs. The stationary valve tests were made upon a 94-h. p. water tube boiler made by the Babcock & Wilcox Co. The locomotive valve tests were made upon locomotive No. 900 of the Illinois Central R. R., the valve being mounted directly upon the top of the main steam dome. This locomotive is a consolidation type, having 50 sq. ft. of grate area and 2,953 sq. ft. of heating surface. Although a great amount of additional experimenting has been done, only the results of the above will be quoted in this paper. These lift records show (with the exception of a small preliminary simmer, which some of the valves have) an abrupt opening to full lift and an almost equally abrupt closing when a certain lower lift is reached. Both the opening and closing lifts are significant of the action of the valves.

The results of the 4-in. iron body stationary valve tests summarized are as follows: of the seven valves, the average lift at opening was .079 ins. and at closing .044 ins., or, excluding the valve with the highest lifts, the averages were .07 ins. at opening and .037 ins. at closing. The valve with the lowest lifts had .031 ins. at opening and .017 ins. at closing, which that with the highest had .137 ins. and .088 ins. Expressing the effective steam discharge areas of the valves taken at the opening lifts as percentages of the largest obtained, the smallest had 31.4 per cent, the next larger 40.8 per cent, and the next 46.6 per cent. Of the six 3½-in. muffler locomotive valves the summarized lifts are as follows: average of the six valves .074 ins. at opening and .043 ins. at closing. Average, excluding the highest, .061 ins. at opening and .031 ins. at closing. The lowest lift valve had .04 ins. opening and .023 ins. closing; the highest, .140 ins. opening and .102 ins. closing. As percentages of the largest effective

*From a paper by Philip G. Darling before the American Society of Mechanical Engineers, Feb. 23, 1907.

steam discharge area the smallest was 36.4 per cent, the next larger 39.8 per cent, and the next 46.4 per cent. In both the stationary and locomotive tests the lowest lift valve was flat seated which is allowed for in the above discharge area percentages See Table).

The great variation—300 per cent—in the lifts of these standard valves of the same size is startling, and its real significance is apparent when it is realized that under existing official safety valve rules, these valves, some of them with less than one-third the lift and capacity of others, receive the same rating. Three of these rules are given as an illustration of their nature: The United States Supervising Inspectors' Rule, the Boiler Inspection Rule of Philadelphia and the rule of the Board of Boiler Rules of Massachusetts.

Rule of the U. S. Board of Supervising Inspectors.

$$A = .2074 \times \frac{W}{P}$$

A = area of safety valve in square inches per square foot of grate surface.

W = lbs. of water evaporation per square foot of grate surface per hour.

P = boiler pressure per square inch (absolute).

In 1875 a special committee was appointed by this board to conduct experiments upon safety valves at the Washington navy yard. Although the pressures used in these experiments (30 and 70 lbs. per sq. in.) were too low to make the results of much value today, one of the conclusions reported is significant.

"First: That the diameter of a safety valve is not an infallible test of its efficiency.

"Second: That the lift which can be obtained in a safety valve, other conditions being equal, is a test of its efficiency."

The present rule of the board, as given above, formulated by Mr. L. D. Lovekin, chief engineer of the New York Shipbuilding Co., was adopted in 1904. Its derivation assumes practically a 45-degree seat and a valve lift of 1-32 of the nominal valve diameter. The discharge area in this rule is obtained by multiplying the valve lift $\frac{D}{32}$ by the valve circumference (π x D), and taking but 75 per cent of the result to allow for the added restriction of a 45-degree over a flat seat. The 75 per cent equals approximately the sine of 45 degrees, or .707. This value for the discharge area i. e. ($.75 \times \pi \times \frac{D^2}{32}$) is substituted directly into Napier's formula for the flow of steam, $W = a \times \frac{P}{70}$. Thus in the valves to which this rule is applied the following lifts are assumed to exist.

1 in. valve, .03 in.;	3 in. valve, .09 in.;	5 in. valve, .16 in.
2 in. valve, .06 in.;	4 in. valve, .13 in.;	6 in. valve, .19 in.

Massachusetts Rule of 1909.

$$A = \frac{W \times 70}{P} \times 11$$

A = area of safety valve in sq. in. per sq. ft. of grate.

W = lbs. of water evaporation per sq ft. of grate surface per second.

P = boiler pressure (absolute).

One of the most recently issued rules is that contained in the pamphlet of the new Massachusetts Board of Boiler Rules, dated March 24, 1908. This rule is merely the United States rule given above, with a 3.2% larger constant, and hence requiring that amount larger valve. The evaporation term is expressed in lbs. per second instead of per hour, and two constants are given instead of one; but when reduced to the form of the United States rule it gives $A = .214 \times \frac{W}{P}$.

Figuring this back, as was done above with the United States rule, and taking the 75% of the flat seat area as there done, shows that this rule assumes a valve lift of 1-33 of the valve diameter instead of 1-32 of the United States rule. This changing of the assumed lift from 1-32 to 1-33 of the valve diameter being the only difference between the two rules; the inadequacy of the United States rule just referred to applies to this more recent rule of the Massachusetts Board.

Philadelphia Rule.

$$A = \frac{22.5\ G}{p \text{ plus } 8.62}$$

A = total area of safety valve or valves in sq. in.

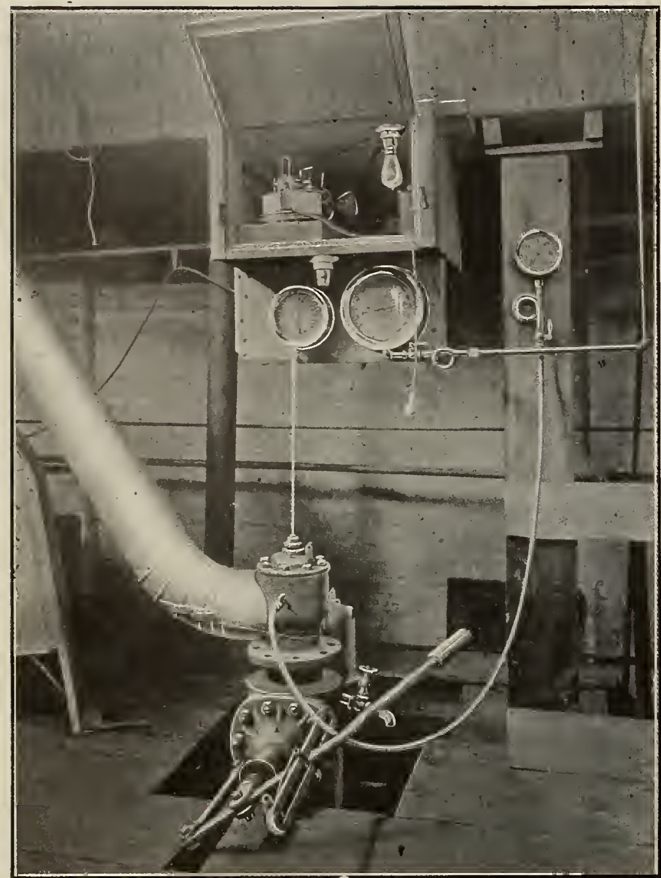
G = grate area in sq. ft.

p = boiler pressure (gauge).

The Philadelphia rule now in use came from France in 1868, being the official rule there at that time, and having been adopted and recommended to the City of Philadelphia by a specially appointed committee of the Franklin Institute, although this committee frankly acknowledged in its report that it "had not found the reasoning upon which the rule has been based." The area (A) of this rule is the effective valve opening, or, as stated in the Philadelphia ordinance of July 13, 1868, "the least sectional area for the discharge of steam." Hence, if this rule were to be applied as its derivation by the French requires, the lift of the valve must be known and considered whenever it is used. However, the example of its application given in the ordinance, as well as that given in the original report of the Franklin Institute Committee, which recommended it, shows the area (A) applied to the nominal valve opening. In the light of its derivation, this method of using it takes as the effective discharge area, the valve opening itself, the error of which is very great. Such use, as specially stated in the report of the committee above referred to, assumes a valve lift at least ¼ of the valve diameter, i. e., the practically impossible lift of 1-in. in a 4-in. valve.

The principal defect of these rules in the light of the preceding tests is that they assume that valves of the same nominal size have the same capacity, and they rate them the same without distinction, in spite of the fact that in actual practice some have but one-third of the capacity of others. There are other defects, as have been shown, such as varying the assumed lift as the valve diameter, while in reality with a given design the lifts are more nearly the same in the different sizes, not varying nearly as rapidly as the diameters. And further than this, the actual lifts assumed for the larger valves are nearly double the actual average obtained in practice.

The direct conclusion is this, that existing rules and statutes are not safe to follow. Some of these rules in use were formulated before, and have not been modified since, spring safety valves were invented. and at a time when 120 lbs. was considered high pressure. None of these rules takes



Lift Apparatus at the Plant of the Consolidated Safety Valve Co.

account of the different lifts which exist in the different makes of valves of the same nominal size, and they thus rate exactly alike valves which actually vary in lift and relieving capacity over 300 per cent. It would therefore seem the duty of all who are responsible for steam installation and operation to no longer leave the determination of safety valve size and selection to such statutes as may happen to exist in their territory, but to investigate for themselves.

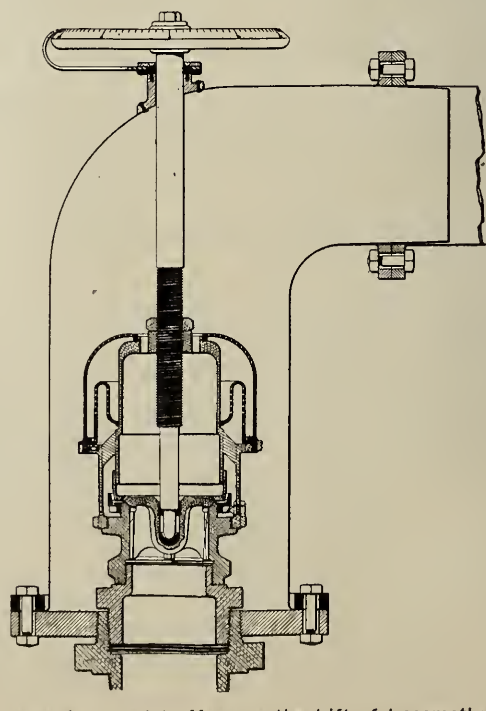
The uncertainity of the co-efficient of flow, that is, of the constant to be used in Napier's formula when applied to the irregular steam discharge passages of safety valves, has probably been largely responsible for the fact that this method of obtaining valve capacities has not been more generally used. To determine what this constant or coefficient of flow is, and how it is affected by variations in valve design and adjustment, an extended series of tests has recently been conducted by the writer at the Stirling department of the Babcock & Wilcox Co., at Barberton, O.

A 373-h. p. class K, No. 20 Stirling boiler, fired with a Stirling chain grate, with a total grate area of 101 sq. ft., was used. This boiler contained a U type of superheater designed for a superheat of 50 deg. F. The water feed to this boiler was measured in calibrated tanks and pumped (steam for the pump being furnished from another boiler) through a pipe line which had been blanked wherever it was impossible with stop valve and intermediate open drips to insure that there was no leakage. The entire steam discharge from the boiler was through the valve being tested, all other steam connections from the boiler being either blanked or closed with stop valves, beyond which were placed open drip connections to indicate any leakage. A constant watch was kept throughout the testing upon all points of the feed, and steam lines to insure that all water measured in the calibrated tanks was passing through the tested valves without intermediate loss.

The valves tested consisted of 3-in., 3½-in., and 4-in. iron stationary valves, and 1½-in., 3-in., and 3½-in. locomotive valves, the latter with and without mufflers. These six valves were all previously tested and adjusted on steam. Without changing the position of the valve disc and ring and springs of these valves were then removed and solid spindles threaded (with a 10-pitch thread) through the valve casing above inserted. Upon the top end of these spindles, wheels graduated with 100 divisions were placed. Figure 2 shows the arrangement used with the locomotive valves, the spindle and graduated wheel being similar to that used with the stationary valves. By this means the valve lift to thousandths of an inch was definitely set for each test and the necessity for constant valve lift readings with that source of error eliminated.

In conducting the tests, three hours' duration was selected as the minimum time for satisfactory results. Pressure and temperature readings were taken every three minutes, water readings every half hour. A man stationed at the water-glass regulated the feed to the boiler to maintain the same level in the boiler during the test; other men were stationed, one at the water tanks, one firing, and one taking the pressure and temperature readings. Pressure readings were taken from two test gauges connected about 4 ins. below the valve inlet, the gauges being calibrated both before and after the series of tests was run and corrections applied In all, 29 tests were run; 15 were 3 hours long, 4 2½ hours, 3 2 hours, and 7 of less duration.

Tests numbered 1 to 5 were preliminary runs of but one hour or less duration apiece, and the records of them are thus omitted in the appended table which gives the lifts, discharge areas, average pressure and superheat, and the steam discharge in lbs, per hour of each of the other tests. The discharge areas have been figured for 45 degree seats from the formula a =2.22 x d x L plus 1.11 x L2; where a equals the effective area in sq. in., d equals the valve diameter in



Apparatus as Arranged to Measure the Lift of Locomotive Valves.

inches, and L equals the valve lift in inches. In tests 8 and 23, where the width of valve seat was .225 in. and .185 in. respectively, and the valve was thus slightly above the depth of the valve seat, the area was figured for this condition.

As previously stated, the application of these results is in fixing a constant for the flow of Napier's formula as applied to safety valves. The formula is $w = A\frac{P}{70}$ in which w equals lbs. of steam discharged per second, P equals the absolute steam pressure behind the orifice or under the valve, and a equals the effective discharge opening in sq. in. This may be stated as E = C x a x P; in which E equals the lbs. steam discharged per hour, and C equals a constant. The values of E, a, and P being given for the above tests, C is directly obtainable.

Safety Valve Capacity Tests

Run at the Stirling Works of the Babcock & Wilcox Co., Barberton, Ohio, Nov. 30 to Dec. 23, 1908

Test Number	Duration of Test, hours	Size and Type of Valve	Adjustment Remarks	Valve Lift inches	Pressure, Lbs. per square inch.	Superheat, degrees F.	Discharge per hour, Lbs. of Steam	Discharge Area (Note 1) Sq. in.	Remarks
6	3	4-in. R. F. Iron Stationary	Regular Adjustment Exh. Piped	.0695	151.7	43.6	5120	.6226	No back pressure
7	3	"	"	.139	145.4	45.1	8600	1.255	Back pressure 2 lbs.
8	3	"	"	.180	135.7	49.2	11020	1.704	Back pres. 3 lbs., max. lift.
9	3	"	"	.1045	149.4	41.9	7290	.9400	Back pressure 1 lb.
10	2½	3½-in. Locomotive Type R	Regular Adjustment without Muffler	.140	146.7	39.0	8685	1.109	Tests 10 to 12, inclusive, with an open locomotive valve
11	3	"	"	.070	152.5	38.0	4670	.5493	
12	3	"	"	.105	150.3	41.2	6780	.8280	
13	3	" Type S	with Muffler	.1395	146.3	38.1	8400	1.106	Muf. valve in this and following loco. tests
14	2	"	"	.140	52.2	51.3	3620	1.109	Test at low steam pressure
15	2½	Same except with lipped feather	"	.140	146.4	39.0	8600	1.109	Different type of valve disc
16	3	4-in. R. F. Iron Stationary	Regular Adjustment Exh. Piped	.140	138.5	42.3	8770	1.265	No back pressure, repetition of test 7
17	3	"	Adj. Ring one turn 1/16-in. above reg. pos.	.140	142.0	50.1	8900	1.265	Back pres. 3 lbs. Adj. ring pos. changed.
18	2	1½-in. Locomotive Type S	Regular Adjustment with Muffler	.107	140.8	23.0	2515	.4272	Tests 18 to 21 inclusive unsatisfactory as the valve was too small for the boiler used.
19	1	"	"	.060	151.2	.0	1550	.2038	
20	2½	"	"	.075	146.3	.0	2025	.2560	
21	2½	"	"	.075	147.7	.0	1975	.2560	
22	1½	3½-in. R. F. Iron Stationary	Regular Adjustment Exh. Piped	.070	146.8	42.6	4320	.5493	No back pressure
23	3	"	"	.140	139.9	43.6	8360	1.136	No back pres.
24	3	"	"	.105	141.6	48.7	6300	.8280	Tests 24 to 27 incl. No back pressure
25	3	3-in. R. F. Iron Stationary	"	.130	140.1	48.4	6370	.8846	
26	3	"	"	.100	142.8	45.6	5160	.6770	
27	2	"	"	.070	142.4	29.5	3705	.4716	
28	3	3-in. Locomotive Type S	Regular Adjustment with Muffler	.130	138.4	48.7	7060	.8846	
29	3	"	"	.090	139.3	43.9	4950	.6034	

Note 1.
The valves all having 45° bevel seats, these areas are obtained from formula— $A = 2.22 \times D \times l + 1.11 \times l^2$, except where, as in tests Nos. 8, 23, the valve lift is greater than the depth of the valve seat where the following formula is used: $A = 2.22 \times D \times d + 1.11 \times d^2 + \pi \times D \times (l - d)$. a = Discharge area (sq. in.) D Valve diameter (in.) l = valve lift (in.) d = depth of valve seat (in).

Note 2.
The four wings of the valve feather or disc probably reduce the flow slightly, but as these are, cut away at the seat, a definite correction of the exit areas for them is impossible. Further the formula constants are desired for the valves as made.

Table Showing Results of Lift Tests.

Figuring and plotting the values of this constant indicates the following conclusions:

(1st) Increasing or altering the steam pressure from approximately 50 to 150 lbs. per sq. in. (tests 14 and 10) does not affect the constant, this merely checking the applicability of Napier's formula in that respect.

(2d) Radically changing the shape of the valve disc outside of the seat, at the huddling or throttling chamber, so-called, does not affect the constant or discharge. In test No. 15 the valve had a downward projecting lip, as in cut on page 7, deflecting the steam flow through nearly 90 degrees; yet the discharge was practically the same as in tests No. 10 and No. 14, where the lip was cut entirely away, as in cut on page 16, giving a comparatively unobstructed flow to the discharging steam.

(3d) Moving the valve adjusting ring through much more than its complete adjustment range does not affect the constant or discharge. (Tests No. 16 and No. 17.)

(4th) The addition of the muffler to a locomotive valve does not materially alter the constant or discharge. There is but 2% difference between tests No. 10 and No. 13.

(5th) Diregarding the rather unsatisfactory 1½ in. and 3 in. locomotive valve tests, the different sizes of valves tested show a variation in the constant when plotted to given lifts of about 4%.

(6th) There is a slight uniform decrease of the constant when increasing the valve lifts.

The variations indicated in the last two conditions are not large enough, however, to materially impair the value of a single constant obtained by averaging the constants of all the 24 tests given. The selection of such a constant is obviously in accord with the other four conditions mentioned. This average constant is 47.5, giving as the formula (E = 47.5 x a x P). Its theoretical value for the standard orifice of Napier's formula is 51.4, of which the above is 92½%.

To make this formula more generally serviceable, it should be expressed in terms of the valve diameter and lift,

Lift Apparatus Rigged for Locomotive Test at Burnside Shops, Ill. Cent. Ry.

and can be still further simplified in its application by expressing the term E (steam discharged or boiler evaporation per hour) in terms of the boiler heating surface or grate area. For the almost universal 45 degree seat the effective discharge area is, with a slight approximation (L x sine 45 x π x D), in which L equals the valve lift vertically in inches, and D the valve diameter in inches. Substituting this in the above formula gives E = 47.5 x L x sine 45 x π x D x P, or E = 195.5 x L x D x P.

The slight mathematical approximation referred to consists in multiplying the (L x sine 45) by (π D), instead of by the exact value (π x D plus ½ L). To find directly the effect of this approximation upon the above constant, the values for E, L, D, and P from the tests have been substituted into the above formula and the average constant redetermined, which is 108.1. The average lift of all the tests is .111 in. Plotting the constants obtained from the above formula in each test, as ordinates, to valve lifts, as absissae; obtaining thus the slight inclination referred to in condition 6, paragraph 23, and plotting a line with this inclination through the above obtained average constant 108.1, taken at the .111 in. average lift, gives a line which, at a maximum lift of, say, .14 in., shows a constant of just 105. At lower lifts this is slightly larger. Hence 105 would seem to be the conservative figure to adopt, as a constant in this formula for general use, giving

$$E = 105 \times L \times D \times P.$$

This transposed for D gives:

$$D = .0095 \times \frac{E}{L \times P}$$

Note that the nominal valve area does not enter into the use of this formula, and that if a value of 12, for instance, is obtained for D, it would call for 2-6 in. or ¾ in. valves. For flat seats these constants become 149. and .0067 respectively.

The fact that these tests were run with some superheat (an average of 37.2 degrees F.), while the majority of valves in use are used with saturated steam, would, if any material difference exists, place the above constants on the safe side. The capacities of the stationary and locomotive valves, the lift test results of which are summarized in paragraph 8, have been figured from this formula, taking the valve lifts at opening and in pounds of steam per hour, are as follows:

Of the seven 4-in. iron body stationary valves, the average capacity at 200 lbs. pressure is 7370 lbs. per hour, the smallest capacity valve (figured for a flat seat) has a capacity of 3960 lbs., the largest 12,400 lbs.; and of the six 3½-in. muffler locomotive valves at 200 lbs. pressure, the average capacity is 6060 lbs. per hour, the smallest 4020 lbs., the largest 11,050 lbs..

To make the use of the rule more direct where the evaporation of the boiler is only indirectly known, it may be expressed in terms of the boiler heating surface or grate area. This modification consists merely in substituting for the term E (lbs. of total evaporation) a term H (sq. ft. of total heating surface), multiplied by the lbs. of water per sq. ft. of heating surface which the boiler will evaporate. Evidently the value of these modified forms of the formula depends upon the proper selection of average boiler evaporation figures for different types of boilers, and also upon the possibility of so grouping these boiler types that average figures can be thus selected. This modified form of the formula is

$$D = C \times \frac{H}{L \times P}$$

in which H equals the total boiler heating surface in sq. ft. and C equals a constant.

In locomotive practice there are special conditions to be considered which separate it from regular stationary and marine work. In the first place, the maximum evaporation of a locomotive is only possible with the maximum draft obtained when the cylinders are exhausting up the stack, at which time the throttle is necessarily open. The throttle being open is drawing some of the steam, and therefore the safety valves on a locomotive can never receive the full maximum evaporation of the boiler. Just what per cent of this maximum evaporation the valve must be able to relieve under the most severe conditions can only be determined experimentally. Evidently the severest conditions obtain when an engineman, after a long, hard, uphill haul with a full glass of water and full pressure, reaching the top of the hill, suddenly shuts off his throttle and injectors. The work on the hill has gotten the engine steaming to its maximum, and the sudden closing of throttle and injectors forces all the steam through the safety valves. Of course, the minute the throttle is closed the steaming quickly falls off, and it is at just that moment that the severest test upon the valves comes.

A large number of service tests has been conducted to determine this constant. The size valves upon a locomotive has been increased or decreased until one valve would just handle the maximum steam generation, and, the locomotive heating surface being known, the formula was figured back to obtain the constant. Other special conditions were considered, such as the liability in locomotive practice to a not infrequent occurrence of the most severe conditions; the exceptionally severe service which locomotive safety valves receive; and the consequent advisability on locomotives to provide a substantial excess valve capacity.

As to the method of applying the proposed safety valve capacity rule in practice, manufactures could be asked to specify the capacity of their valves, stamping it upon them as the opening and closing pressures are now done. This would necessitate no extra work further than the time required in the stamping, because for valves of the same size and design, giving practically the same lift, this would have to be determined but once, which of itself is but a moment's work with a small portable lift gauge which is now manufactured. The specifying of safety valves by a designing engineer could then be as definite a problem as is that of other pieces of apparatus. Whatever views are held as to the advantages of high or low lifts, there can be no question, it would seem, as to the advantage of knowing what this lift actually is, as would be shown in this specifying by manufacturers of the capacity of their valves. Further, as to the feasibility of adopting such a rule (which incorporates the valve lift) in statutes governing valve sizes; this would involve the granting and obtaining by manufacturers of a legal rating for their valve designs based upon their demonstrated lifts.

This paper has dealt with but one phase of the subject of safety valves in order that its conclusions might be drawn more clearly. The apparatus and tests shown indicate that the lifts and capacities of different make valves of the same size and for the same conditions vary as much as 300%, and that there is, therefore, the liability of large error in specifying valves in accordance with existing rules and statutes, because these rules, as shown, rate all valves of one size as of the same capacity, irrespective of this variation. A simple rule, based upon an extended series of direct capacity tests, is given, which avoids this error by incorporating a term for the valve lift. Finally the method and advantage of applying this rule in practice has been briefly indicated.

Recapitulation of Capacity Formula.

For 45 degree Valve Seats.

1. $E = 105 \times l \times P \times D$

or transposed

2. $D = .0095 \frac{E}{l \times P}$

Modified Forms for Special Applications.

For Locomotives.

3. $D = .055 \frac{H}{l \times P}$

For cylindrical multitubular, vertical and water tube stationary boilers.

4. $D = .068 \frac{H}{l \times P}$

For Water Tube Marine and Scotch Marine Boilers.

5. $D = .095 \frac{H}{l \times P}$

E = Pounds of steam relieved per hour.

l = Verticle lift of valve in inches.

P = Steam Pressure (absolute) lbs. per sq. in.

D = Nominal diameter of valve (inlet) in inches.

H = Total boiler heating surface in sq. ft.

For flat seated valves the constants in these formulae are as follows: 1—149.; 2—.0067; 3—.052; 4—.065; 5—.090.

Cost of Motor Car and Locomotive Service, C. R. I. & P. Ry.

During the months of November and December, 1908, and January, 1909, the Chicago, Rock Island & Pacific used, on its Salina branch, a motor car which was built by the American Locomotive Co. The run from Herington, Kan., to Salina is 49 miles. The motor car was operated 47 days during these three months, making a total mileage of 4,975 miles. The average cost of operation per mile in November was 15 cents; in December 18.5 cents and in January 20.4 cents.

In January the motor car was in service five days and the service for the balance of the month, 26 days, was performed by a steam locomotive and train, making a total mileage of 2,548 miles, and the average cost per mile was 17.31 cents. The train was made up of one combination car and one coach, the two having a total weight of 60 tons. The locomotive was an 8-wheel engine with cylinders 18 ins. x 24 ins. and drivers 64 ins., weight on drivers 54,400 lbs., weight of engine 89,000 lbs., weight of engine and tender, 80 tons, and the weight of engine and train, 140 tons.

The total weight of the car is 100,000 lbs.; weight on drivers, 32,400 lbs., the cylinders are compound, 9¼ in. and 14½ in. x 12 in. stroke. The boiler is of the return tubular type with working pressure 250 lbs. Its total heating surface is 624 sq. ft. and it is furnished with a superheater. The maximum power of the engine is 250 h. p. The car is 55 ft. 9 ins. long. It has engine and baggage compartments and a seating capacity for 40 passengers. Much of the time the motor hauled a coach as a trailer and the total weight was then 130 tons, but the oil consumption was not materially increased over that of the motor car alone.

The table below gives in detail the items making up the cost per mile of the motor car performing 20 days' service in November, 1908, when it made a total mileage of 2,325 miles, compared with the locomotive and train which performed 26 days' service in January, 1909, and made a mileage of 2,548 miles.

	—Average cost per mile.—	
	Motor car.	Loco. and train.
	20 days.	26 days.
	Nov., 1908.	Jan., 1909.
	Cts.	Cts.
Fuel oil	3.35	5.64*
Wages, enginemen	3.15	6.80†
Wages, conductor	2.15	2.48
Running repairs	4.13	0.51
Cleaning	0.96	0.57
Roundhouse service	0.62	0.57
Miscellaneous supplies	0.56	4.56
Oil and waste	0.21	0.18
Total	15.13	17.31

*Coal.

†Fireman included.

It is now intended to further experiment with the motor car on a short stub run of 5 miles with frequent service between Atchison and Rushville.

Boulton Shops

Richmond, Fredericksburg & Potomac R. R.

In every railroad shop there are two points which must be constantly kept in mind, keeping the cost of repairs down and decreasing the length of time that the rolling stock is kept out of service while the work is being done. Every shop superintendent is ready to give a trial to any plan which, on investigation, offers good evidence of being capable of reducing these items. It has been urged in the past that the application of motors to the individual machines in railroad shops would effect many economies and the installations that have been made have, to a certain extent, justified these statements.

Flexibility in location is one important advantage which results from the use of motors, as the power is applied directly to the individual machines, and hence the location of each one in the shop, is independent of any line shaft or belting limitations. Only in the case of small machines, is use made of line shafting, and here a few machines are driven from a short shaft which is usually belted to a motor. Another important advantage is the gain which is made in the productive capacity of the machines; this shortens the time required for a given piece of work and hence decreases the labor cost. Not the least important items are the high degree of reliability and great convenience of this method of drive.

General View of Planing Mill, Boulton Shops.

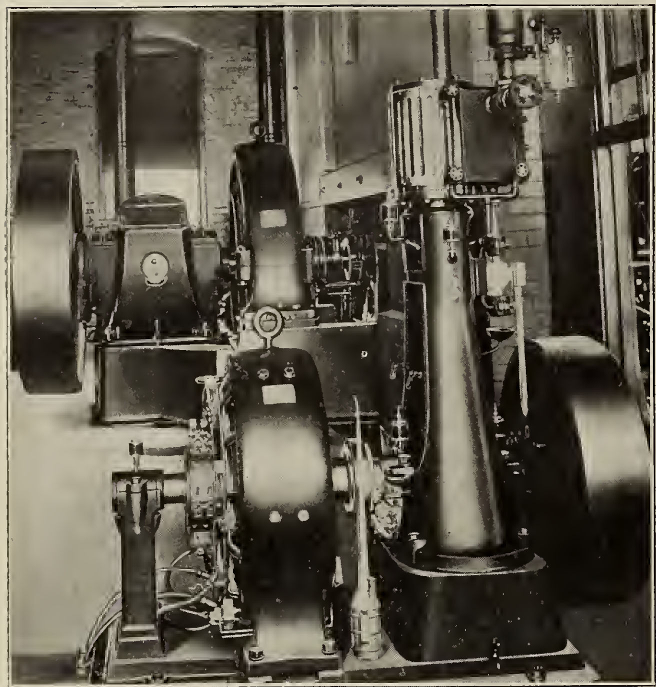


Fig. 1.—Generator and Exciter, Boulton Shops.

An excellent example of the change from steam to electric drive is furnished by the Boulton shops of the Richmond, Fredericksburg and Potomac R. R. at Richmond, Va., familiarly known as the "Washington-Richmond Line" as it runs from Washington, D. C., to Richmond, Va., and is one of the fastest lines of communication between the two cities. The maintenance of the rolling stock and the manufacture of both freight and passenger cars is carried on at these shops. A three-phase, 220 volt, 60-cycle, system of distribution is employed with constant speed induction motors.

The original electrification was begun about six years ago by the installation of a 75-kilowatt, belted generator which was used only for lighting purposes, and about one year later a 125-kilowatt Westinghouse generator was added to supply power for the machine shop. This is in use at present and is driven by a Ball engine of 225 horsepower capacity, direct connected to the generator. Upon the erection of the new planing mill it was necessary to replace the 75-kilowatt generator by one of 150 kilowatt capacity to drive the woodworking machines. This latter generator is direct connected to a Ball engine of 250 horsepower capacity. The generators are excited from a 17½-kilowatt, 125-volt, direct-current Westinghouse generator driven by a Troy upright engine. The larger generating unit and the exciter are shown in Fig. 1. Steam is supplied from two locomotive type boilers at 125 pounds pressure.

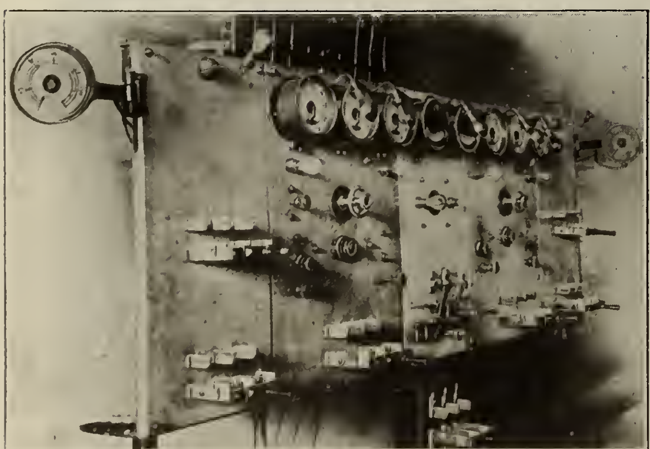


Fig. 2.—Switchboard, Boulton Shops.

The entire electrical equipment was installed by the local operating force of the company under the direct supervision of Mr. W. F. Kapp, superintendent shops and machinery. From the time of the original installation no interference whatever has been experienced by the failure of any of the power plant equipment or the motor, the only interruption of service which has occurred has been the occasional blowing of a fuse when some one of the motors was started improperly.

The switchboard, shown in Fig. 2, has two generating panels, one exciter panel and two feeder panels, all of blue Vermont marble. Ammeters are provided for all three legs of the circuits on each generator panel, with a voltmeter for each generator as well as a voltmeter and ammeter for the exciter. While the lighting and power circuits are kept separate the switchboard is so arranged that these circuits can be supplied for either or both of the generators as may be necessary.

The machine shop equipment is particularly well arranged, both with respect to the machines and the driving motors and the natural lighting facilities. Several of the individually driven machine tools are shown herewith, clearly indicating

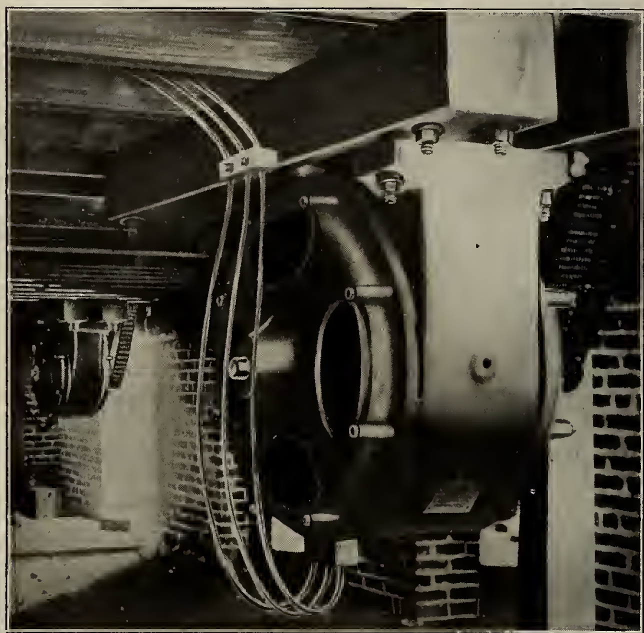


Fig. 3.—Motor Under Planing Mill Floor.

the convenience of the motor drive as well as the general cleanliness of the shop, as a result of the elimination of a large part of the belts. The accompanying table shows the different equipments used in the shops, including the woodworking department, the machine shop, the wheel mounting shop and the blacksmith shop. In addition to the equipment shown in the table should be mentioned a storehouse elevator, operated by a 10-horsepower induction motor, and a Sturtevant fan in the punch shop, for use in connection with the heating system, driven by a 10-horsepower motor. The heating of the paint shop is done by a 50-in. fan and heater coils which are located in the roof trusses, the fan being operated by a 7½-horsepower motor.

In connection with the installation of the 40-horsepower motor driving the two boring mills, the wheel press and the double head axle lathe in the wheel mounting shop, it

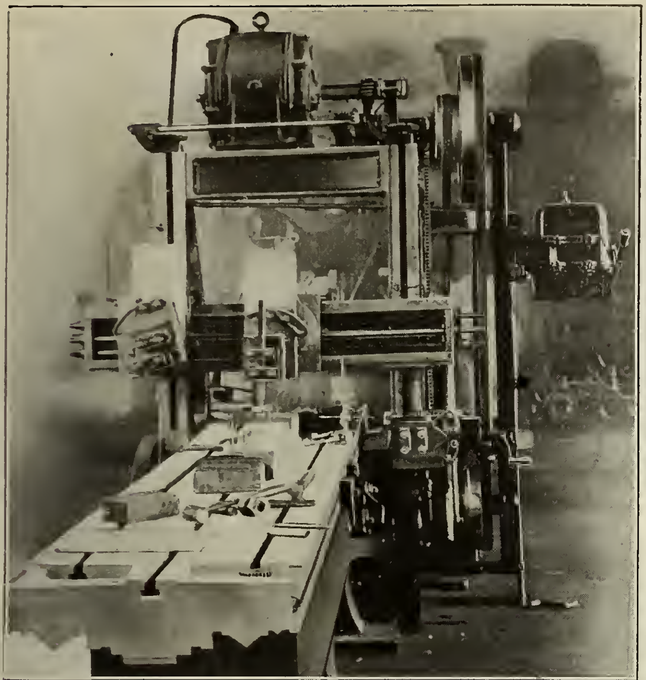


Fig. 4.—Planer with Individual Drive.

should be noted that the original intention was to drive the entire machine equipment from this one motor, but circumstances allowed a regrouping of the tools so that this motor became available for its present work. It has ample capacity to allow considerable expansion in this department when such proves to be necessary.

Main Shop Equipment.

	Machine Size.	Manufacturer.	H.P.	Drive.	Location.
Planer	36x11 in.	Niles, Bement, Pond	7½	Individ.	Mach. Shop
Driving wheel lathe	90 in.	"	20 & 3	"	"
Shaper	24 in.	"	7½	"	"
Boring mill......			5	"	"
Planer		"			
Wheel press...		"	10	Group	"
Drill press		"			
Boring mill.....	44 in	"			
Lathe	35 in.	"	15	"	"
Lathe	24 in.	"			
Guide grinder		"			
Lathe	43 in.	"			
Lathe	24 in.	"			
Drill press.....		"	10	"	"
Emery grinder.		"			
3 lathes.......	24 in.	"	5	"	"
Punch and shr.		Hilles &			
2 bolt threaders		Jones	7½	"	.Blksmth Shop
Grindstone		"			
Bolt header....	1½ in.	"			
Drill press.....	24 in.	"	10	"	"
Pipe threader..	4 in.	"			
2 tool grinders..		"	3	"	Tool Room
Fan	30 in.	Sturtevant	3	Individ.	Blacksmith Shop
2 boring mills..	44 in				
Dble Head Axle lathe					
Wheel press...	250 tons		40	Group	Wheel Mounting Shop
Tool grinder...	24 in.				
Flue tumbler...	200 flues		10	Individual	Outside
Band saw......	42 in.	Fay & Egan	7½	"	Pl. Mill
Car Sill Tenoner and gainer...	12 in.	"	7½	"	"
Cut off saw....	40 in.	Greenlee	15	"	"
4-side moulder.	10 in.	"	20	"	"
Double cabinet makers' saw.	24 in.	"	15	"	"
Universal plane	12 ft. x 30 in.	Woods	40	"	"
Jointer	24 in.				
Double head shaper					
Lathe	20 in		20		Group
Sash sticker....					
Jig saw.........					
3-tool grinders..					

In the machine shops the line shafts of the group drives present an unusual feature in the high speed at which they are run. Standard practice usually gives a maximum line shaft speed of approximately 200 revolutions per minute, but here one shaft runs at 400 r. p. m. and the other three at 300 r. p. m. No trouble whatever has resulted from these unusual speeds.

The planing mill, an interior view of which is shown, is especially interesting owing to the manner of mounting the motors. In the extension of the shop plant it became necessary to fill in to a considerable depth the ground on which the planing mill is situated in order to bring the floor level up to a grade. It was decided not to fill in the space immediately beneath the building but to leave this portion in the shape of a basement, utilizing the space to mount the motors and such shafting as is necessary to operate the various machines. The motors are suspended from the lower side of the floor beams and connected to the machines or shafting which they operate by means of a flexible chain; the method of support is clearly shown in one of the illustrations.

This solution of the motor drive question has resulted in a planing mill which is practically free of obstructions with the exception of the tools themselves and such material as may be in process of manufacture, the only motors above the floor being the one on the traversing bed planer as illustrated, which is driven by a 10-horsepower motor mounted directly on the machine, and the one above the floor line driving the fans which take care of the shavings. This latter is situated in the roof trusses. The blast and exhaust pipes drop from the trusses directly to the machines which they serve.

The refuse from the machines is collected by means of a 50-in. fan and driven to the boiler room where it is consumed by means of a second 50-in. fan. Both fans are driven by a 40-horsepower induction motor.

The length of time which the plant has been in service has given an opportunity to prove or disprove the claims made of the advantages of electric drive. The results of the equipment at Boulton have been a justification of the foresight of the men responsible for the installation at a time when the question of the suitability of electric power for railroad shops was much discussed. The entire electrical installation was made with Westinghouse Electric & Manufacturing Co. apparatus.

The large new works of the National Sanitary Mfg. Co., located at Salem, Ohio, are equipped throughout with the "Kirkwood" system of fuel oil burning as manufactured by the Tate, Jones & Co., of Pittsburg, Pa. Due to the peculiar topographical conditions, it is necessary to lift the oil to quite an elevation in order to reach the furnaces where it is used, yet so perfect is the system that but one side of their ordinary pumping system is required. Due to the uniform heat secured, the low cost of maintenance and the little care required, it is found to be most admirably adapted for this particular purpose. The Salem company manufactures high quality bath tubs and other sanitary articles.

Fig. 5.—Shaper with Individual Drive.

Passenger Cars in Zanzibar

The Island of Zanzibar is located about twenty miles off the coast of German East Africa. The population of the island is about 150,000 and about two-thirds of the population live in the town of Zanzibar. The Zanzibar R. R. has been in operation for over two years and a regular daily schedule is maintained. The track is laid with rails weighing 25 lbs. to the yard and varying in length from 18 to 24 ft. The road is single track for its entire length of seven miles. At each end of the road there is a water tank of approximately 1,000 gallons capacity and in addition to these the road is equipped with an engine shed and complete machine shop.

Zanzibar is under English rule, the present system being established in October, 1891, by the appointment of the First Minister to the Sultan, who is in effect the governor of the island. The Sultan who occupies the royal palace in the town of Zanzibar and enjoys the privileges of a monarch, is but the nominal ruler. His subjects for the most part include representatives of all the tribes of East Africa with an intermingling of Asiatic elements and are called Swahili. The actual population of the island is unknown, but it is estimated at about 200,000, of which 100,000 live in the town of Zanzibar. The European population is probably not more than 500 persons.

Scene on Zanzibar R. R.

The railroad has recently received a shipment of passenger cars from the J. G. Brill Co., one of which is shown in the accompanying illustrations. It is an ordinary 22-ft. flat car body mounted on Brill No. 420 freight car trucks and provided with wood slat longitudinal seats and a removable roof with striped duck side curtains. The roof is supported by five posts on each side which fit into iron post sockets of the same type as is used on American flat cars. The cars are built for 36-inch guage track and are five feet wide over the sills. Each car has a center oil lamp and two signal bells.

For the private use of the Sultan, two special cars were built, which resemble the horse cars in use in the United States twenty years ago. These cars are fitted "luxuriously" with carpets, rugs and rattan chairs.

We are indebted to Brill's Magazine for the photographic reproductions which illustrate different phases of the island's railroad traffic. The locomotive, which is shown hauling five cars in a passenger train, is a study in itself.

"Foster Interlocking Switch Stands" is the title of a catalog recently issued by Frank M. Foster, of Columbus, Ohio. The pamphlet describes the action of the switch stands bearing this name. The stand is so constructed as to perform all the operations of a interlocking switch with one movement of one lever. The action of the apparatus is clearly illustrated in the catalog.

Approaching Transfer of the Electrification Problem*

It has been very interesting to watch the assaults of the electrical engineer on the transportation problem, and his gradual approach to the final task—the supplanting of the steam locomotive. The street railway problem was solved years ago; then came the heavier elevated and subway applications; finally a certain amount of steam road electrification became necessary. Perhaps the opportunity would not have presented itself yet, had it not been for legislation in response to public clamor for relief from smoke and accidents in tunnels.

The electrical man approached this last important undertaking with supreme confidence, based on his past successes, so that under the stress of enthusiasm there was considerable prophecy of quick and extraordinary results. All difficulties were not foreseen, however, and in the working out temporary setbacks were recorded. Nevertheless, enthusiasm supportd by patience and energy prevailed to bring success. This success is not final—will not be for years—but the thing is done. Train service can be handled reliably and economically by electric power. Proof of this is close at hand in the magnificent success of the New York Central and the New Haven installations, both of which are now operating with most satisfactory reliability, and so far as we can learn, with pleasing economy.

As a result, the electrification problem is practically ready to be transferred to the field of the railway engineer. Hereafter the question will never be "Can I?" but must be "Shall I?"

Of course, it is not to be understood that the electrical engineer may drop all connection with the work. He will be just as necessary as a mechanical engineer is at present. But if he is an electrical engineer and nothing more, his sole function will be the perfection of details and methods. The real problem will be solved by the men who have both a thorough knowledge of railroading and or the possibilities of electric traction. Such men can be derived from the two heretofore distinct electric and railway fields, and the process is started. For some time numerous electrical engineers have been acquiring an accurate and profound knowledge of railroading and vice versa.

One can conceive of condition which, if they had prevailed, would have called for nothing more than an extension of modern subway and elevated practice. But these conditions did not obtain in the work to be done. Through trains, and other traffic, requiring interchange of motive power demanded the development of large electric locomotives. This

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*From a paper read before the New York Railroad Club March 19.

Car for Passenger Service, Zanzibar R. R.

feature marked the departure from all previous experience and was looked upon as the only uncertain element. As a consequence much attention and study was put on the locomotive with most satisfactory results. In one great terminal electrification it was the only part of the work which was not an enlargement or further development in details of what had been more or less standard for some time in subway and elevated work.

The system used for heavy transportation work up to the beginning of steam railway electrification had been the 600-volt, direct-current third-rail system. This system has been used so extensively that it has become standard in many of its details and could be made wholly so in all essential purposes, if proper means were used. But study of the electrification problem showed that there were some disadvantages in this system which would prevent it answering all requirements. Men began to look to other systems which perhaps would be more advantageous. As a result of this study and development, the railway engineer in taking up this problem is confronted with no less than five different systems, any one of which would probably do the work reliably, and with more or less economy and would be financially practicable. These systems are:

(1) The 600-volt direct-current third-rail system.

(2) The 1,200-volt (or higher) direct-current third-rail, or trolley system.

(3) The high voltage alternating current three-phase system.

(4) The high voltage alternating current three-phase system.

(5) Various gasoline electric cars, and gasoline car systems.

A careful study of all these systems from both the technical and the financial standpoints will show that each has its own advantages under certain particular conditions. Congestion of traffic, limitations of space, number and kinds of grade, physical characteristics of the country, danger to public, etc., all bring about this singularity of advantage. For this reason, it may be stated very positively that no electrical engineer who comes to the matter with an unbiased mind is willing to advocate any one system as the only system to be used. Even those men who have greatest faith in one system find themselves compelled to counsel the use of other systems when warranted by circumstances of a problem at hand. This difficulty of selection has been in evidence in every important decision that has been made. The last important decision of this sort was made after the elaborate installations of the New York Central and the New Haven roads were available for study in a practical way, but in addition a large number of special experiments were thought necessary, all of which proved that the decision was far from easy.

There are a number of engineers who suggest disposing of all difficulties by simply deciding each specific case, whether large or small, according to its own conditions. If it be a terminal, a tunnel, a heavy grade, or what not—simply put in the system which is best adapted at the time. This would seem to be a short-sighted policy, and only justified if other action is found impracticable. Electrification does start in spots, but it will not end with these, and the question of extension is likely to arise very quickly. We know now that electrification is not a luxury which will be used under favorable circumstances, but is a system of transportation which is gradually bound to do a large amount of work now done by steam.

The fact is, we are not electrifying terminals, tunnels, grades, etc., but must electrify whole systems, and this point should be kept in the mind in all decisions. Electrification means investment of millions, partly in direct outlay, partly by losses due to interruption during installation, and partly due to amortization of apparatus. It is of the utmost importance therefore to get started right, even if the work is only for a very small portion of the whole road. There is no problem before engineers in the railway world to-day which requires more broad-minded attention and consideration than steam railway electrification.

It is natural that the point of getting started right should appeal most strongly to the directors and other officials of

Zanzibar R. R. Passenger Train, Private Car of Sultan in Rear.

railways who must finally accept the responsibility for spending the large amount of money necessary. These men think of whole roads and even systems. They see clearly not only the disadvantages of getting started wrong, but also the great advantage of starting right. For example, the present standard gage in use to-day has as it chief advantage the fact that it is standard. All engineers wish that a view far enough into the future had been possible in the early days so as to show the great advantages of a wider gage. It is not sufficient therefore to show that various systems can be installed more or less satisfactorily. The whole matter will be counted as experimental by broad-minded men, and will not command real backing on its merits until there is a practical unanimity among technical men as to what simple or composite system is generally applicable to all work.

A composite system would be undesirable, but it may be necessary. At one time the combination of apparatus for both direct and alternating current on one locomotive seemed formidable, but only a few days ago the speaker made several trips on a New Haven locomotive where this is done, and the change from one power to the other was simplicity itself—a push of a button or two on the controller. Nevertheless, it is probable that it is a case of simplicity being a result of careful design and eternal vigilance in operation.

Assuming, therefore, that it is desirable to settle at the earliest possible date just what electrical system will be most suitable for steam railway electrification in general, it becomes necessary to determine what conditions such a system must satisfy in order to be acceptable, and then to attempt to find means by which the adoption of this system may be secured.

It is evident, first of all, that if trunk line electrification is ever to be accomplished it will be done by means of a high voltage system. By this we mean a voltage of ten thousand or more. Arguments on this point have been presented, so that it is useless to introduce them here. It may be stated, however, that this conclusion is based chiefly on cost. We are considering, of course, freight and passenger traffic, local and through service, branch and main lines; in other words, a whole system. It does not take a great deal of consideration to show how difficult it would be to handle the whole traffic of the Pennsylvania Railroad between New York and Pittsburgh with anything but a high voltage system.

The necessity for high voltage will be all the more obvious when it is recognized that a fundamental requirement for complete electrification will be the ability to transmit enormous amounts of power to shifting locations, depend upon accidental congestions of traffic. There may be times when a large part of the total generating capacity may be required at a place for a short time only. It is idle to lay out the transmission or contact system for any predetermined train service. The railway engineer can now mass his motive power to suit his convenience, and he will not be satisfied with less under electrification. It should be a fundamental maxim that no feature of electrification design should hamper or restrict railway operation proper.

Secondly, the system must be adaptable to all sorts of conditions. High voltage requires a certain amount of space, and perhaps would not be available in places where the space was insufficient, such as tunnels, subways, etc. Moreover, as years go on railway trains, particularly local ones, will undoubtedly run more into the streets of cities, above or below them, instead of stopping at terminal stations. It will probably be a long time before permission could be obtained or 11,000 volts could be used safely in the streets of a city. Therefore, if the same equipment is to be used, it will be necessary to have a lower voltage. This, of course, can be most easily and effectively done by means of alternating current, though the present working of the New Haven system in the Grand Central terminal shows that it is possible with direct current. The simplicity of the control apparatus, however, with the alternating system would make it more attractive than the use of both kinds of current. Moreover, in a long system there might be various tunnels, bridges and towns where the voltage would have to be lowered for a short distance and where the installation of direct current for that particular small portion of the road might be very expensive.

The simplicity of the alternating current system under these circumstances is obvious, when it is remembered how easily high tension taps could be placed on the auto transformer for varying trolley voltages. No changes would be necessary in low tension taps and group switches. The various sections of the line would be separated by section breaks of necessity. An automatic device could easily be arranged by which the transformer would always be set for the highest line voltage whenever a section break was struck, after which the motorman could throw in the proper tap which also could be easily protected from a mistake on his part.

An overhead trolley necessarily follows if a high voltage system is used, and, as noted above, a third rail or overhead trolley with direct or alternating current for low voltage where necessary.

We shall say nothing about cost here, because it is assumed that any system otherwise available will stand the financial test both in first cost and in operation.

The early standardization of details of electrification is almost equally important with the adoption of a general system. It must be acknowledged, however, that great care must be exercised in attempting anything along this line. If we standardize too soon we run the serious risk of adopting inferior methods and faulty design. We also may commit the greater error of stifling progress for a time and restricting the normal development of the art. On the other hand, we have too many examples of methods and arrangements adapted carelessly at the beginning of an art through inattention allowed to grow into standards. We suddenly find a much-to-be-desired change practically impossible.

To avoid this the whole matter should be placed in the hands of committees of the great national societies, just as all other matters requiring standardization. We have too many fine examples of proper action by these committees to need any discussion as to how conservative they should be. No one need fear that a committee from the American Institute of Electrical Engineers acting jointly with committees from the Master Mechanics' and Maintenance of Way associations would give hasty or insufficiently considered decisions.

It will now be well to note those parts of electrification which are most fundamental and therefore most in need of standardization. By fundamental we mean those features which would involve great interruption of service and enormous expense if they had to be changed later, and also all features which are involved in the interchange of equipment by different divisions or roads. Some of the features mentioned have become almost standard by usage.

(1) Location and type of third rail and shoe.

(2) Location of overhead contact conductor.

(3) Side and top clearances.

(4) Location of end couplings.

This includes sockets for lighting and heating bus, power bus and train line. Hose couplings have standard location now.

(5) Low voltage for direct and alternating current on third rail and overhead contact line.

(6) High voltage for overhead contact line.

(7) Frequency of alternating current.

An Engineer Who is Also a Doctor

One of the best engineers on the Boston & Albany Railroad leads a dual life, as after his daily run the engineer becomes a doctor. He is a graduate of Brown University and has a medical diploma. His name is H. F. Brackett, and he drives a locomotive because he loves the "iron steed." At certain times during the day he wends his way through the streets of Brighton with an air of dignified reserve and with medicine case in hand. His calls upon patients being over, his silk hat is placed in its bandbox, off comes his white necktie, fancy vest and other stylish clothing, and an hour later Dr. Brackett is speeding over the rails, eyes to front, and his hand firmly clutching the throttle. The clever physician has become the skilled engineer.

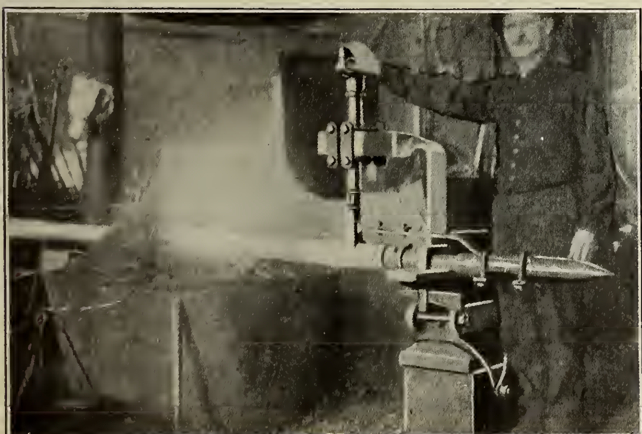
For twenty-seven years, and up to the present year, Dr. Brackett ran "No. 221," which pulled the New York express from Boston to Springfield. In his thirty-eight years of unbroken service as an engineer he has the rarely equaled record of never having been in a wreck. He has never killed a person nor destroyed a cent's worth of property through negligence or inefficiency. With "No. 221" he has broken records, has made a mile in 40 seconds, and has daily driven 100 miles in two hours.

As a physician, Dr. Brackett is a member of prominent medical societies. As an engineer, he is known to many railroad men in Boston. He is examining physician for the Brotherhood of Locomotive Engineers and for the New England Order of Protection. He is the physician of the men of the Boston & Albany, and when Dr. Brackett is about the yards of that road he is sought by the injured and the distressed. In his grimy overalls, his face blackened by smoke and ashes, he has dressed burns, performed surgical operations, bandaged bruises and cuts and questioned and advised.—By H. A. Packard, in Power and the Engineer.

Improvised Boiler Tube Welding Hammer.

The accompanying illustration, which is taken from the Compressed Air Magazine, shows how a pneumatic hammer may be rigged for welding boiler tubes with dispatch. As the stock of boiler tubes is thin, and therefore loses its heat quickly, success in welding depends greatly upon the rapidity of the hammer blows. In shops not equipped with machines which are factory built for this purpose, an arrangement something like that shown should result in considerable saving of time.

The apparatus here shown is, of course, home-made, except that a standard pneumatic riveter is used. As will be seen, the mandrel, upon which the tube to be welded slips easily, is clamped upon the anvil exactly in line with the tube as it lies in the fire. The swage is held by a flat spring, clamped to the rear of mandrel, just high enough to clear the tubes. The hammer is held in position by a standard which is clamped to the side of the anvil. When the tube is at the right welding heat it is shoved forward onto the mandrel, the operator manipulating the hammer valve to shower the blows upon the swage while a man at the other end keeps the tube turning.



Homemade Boiler Tube Welding Apparatus.

Railway Refrigerating Plant.

Experimental Railway Refrigerating Plant

An experimental refrigerating plant has been installed by the U. S. government, Department of Agriculture, in a specially constructed box car shown in the illustration herewith, which is taken from the Valve World.

The plant is intended for government experimental work in pre-cooling perishable goods, such as fruits, etc., and, if the original schedule is being carried out, the car now is somewhere in California, making tests with oranges intended for transcontinental shipment. One-half of the car contains the machinery, while the other half is an insulated coil-room containing about 5,200 ft. of 1¼-in. extra heavy continuous welded ammonia coils arranged in eight coils, each coil complete with separate ammonia expansion valves and separate ammonia stop valves. In the other half of the car the machinery is located. There is a 35 h. p. kerosene oil engine for the source of power; this engine by various belts and countershafts drives a 12-ton ice machine, a 2 kw. generator for lighting and power, a 42-in. blower for blowing the air to be cooled over the coils, a centrifugal brine pump, and a motor-driven triple pump.

This room also contains a 48-pipe double-pipe ammonia condenser, two large liquid ammonia receivers, an oil intercepter for the ammonia, water storage tanks, speed changing countershaft, and the complete piping and fittings for the kerosene, water, ammonia, and oil lines.

The plant is installed in a space practically 20 ft. long by 7 ft. wide and 6 ft. 6 ins. high, so it can be readily understood the difficulties to be encountered in undertaking to place such a large amount of apparatus in such a small space. In the final test a temperature of 15 degrees below zero was obtained on the air which was circulated.

The refrigerating car was designed, all the details worked out and its building and equipment supervised by Mr. S. J. Dennis, cold storage engineer of the Pomological Bureau, Department of Agriculture. It chief purpose is to secure refrigeration for the government experiments at such points in the South, and other fruit-growing districts, where adequate refrigeration cannot now be secured. The experiments already conducted by the department have demonstrated clearly that where a product needs refrigeration sufficient to make pre-cooling advisable, the question of promptness in pre-cooling is most important.

As a means of obtaining data on the refrigerator supply of the car plant a large calibrated ammonia reservoir has been fitted up in the car for measuring the ammonia circulated in the car. Provision also is made for weighing-tanks to weigh the ammonia in case tests of that sort are considered necessary.

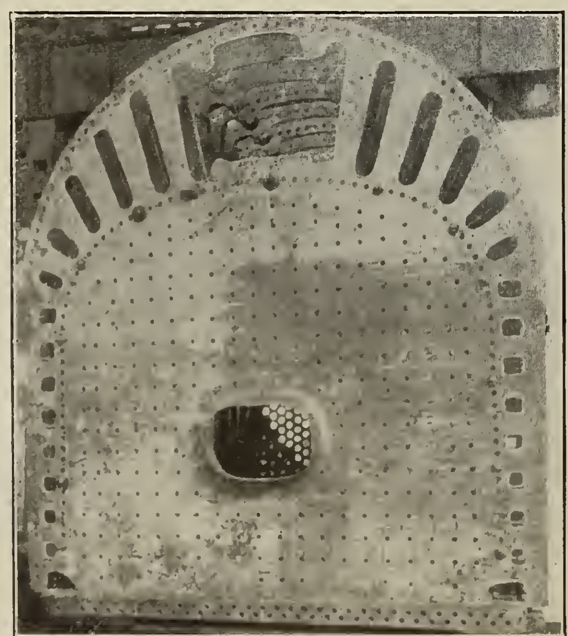
New Firebox for Locomotives

The accompanying illustrations show the aspect and construction of a locomotive firebox designed and patented by F. W. Schupert and Henry W. Jacobs. The latter is an assistant superintendent of motive power of the Atchison, Topeka & Santa Fe Ry. and the firebox is being fitted to several engines at the Topeka shops of this road.

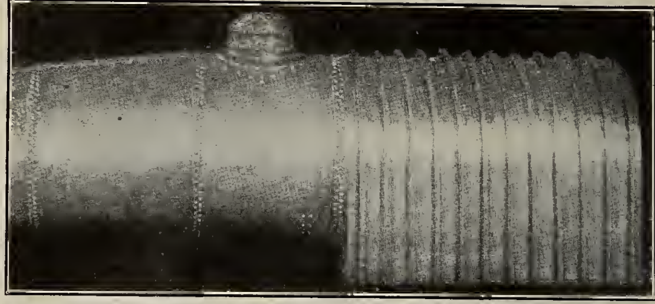
Heretofore attempts at firebox improvement have included a decided increase in size, a slight alteration of the general form, the occasional introduction of water tubes or the combustion chamber, and the widening of the water leg. The demand for greater tractive power has caused the enlargement of grate areas and the shape of firebox sheets and wrapper sheets has been modified. In the main, however, the principles long ago established have been adhered to until the present. Long experience and careful study of the prevailing design, however, has led to the decision that improvements can be made in the arrangement and construction along the following lines: A greater strength with a reduction in thickness and weight of material, an increase of circulation of the water inside, an increase in the circulation of the gases outside, an increase of transference of heat from the gases to the water per unit of surface, a reduction of weight in proportion to steaming power, a greater heating surface in proportion to weight, a reduction of fuel consumed per effective horsepower, a reduction of water delivered with the steam, and a reduction of heat delivered into the atmosphere.

This firebox is the result, and it is being applied to what is known as the "Santa Fe type" engine, which is the largest engine in the world of rigid wheel-base design. This same type of firebox is also to be applied to the new passenger Mallet type engines, which will be the largest locomotives in the world of any type.

In this firebox the usual arrangement of flat sheets supported by staybolts has been abandoned except in the front sheets and door sheets. Side sheets and wrapper sheet have been replaced by sets of channel-shaped sections riveted together with their flanges away from the fire. Staybolts have been replaced by stay sheets, one at each joint of the channels, which are interposed between the sections and secured by the same rivets that hold adjacent flanges. These sheets are partially cut away in the water leg, as shown below,



Rear View of Inner Firebox.



Boiler Equipped with New Firebox.

to permit horizontal circulation of water around the firebox and the edges of the sheets form calking strips for making tight joints between adjacent channel sections. All seams are submerged and no joints are exposed to the direct current of heat and gases. Due to the irregular outline thus formed for the firebox crown and sides, the available heating surface of the hottest section of the boiler is enlarged without increasing the size of the grate area. A mud-ring of either the ordinary type or a special design consisting of cast steel pockets may be used.

In the fabrication of this firebox all the work is done by means of templets, jig and formers, so that each one of the component parts is exactly like every other one, and all are interchangeable. This is achieved independently of the skill of the operators.

The American Blower Co., of Detroit, Mich., has recently issued a pamphlet describing and illustrating "Sirocco" fans. The book is of great assistance in determining sizes and capacities of ventilating and heating systems, as it includes tables of speeds, pressures, etc.

* * *

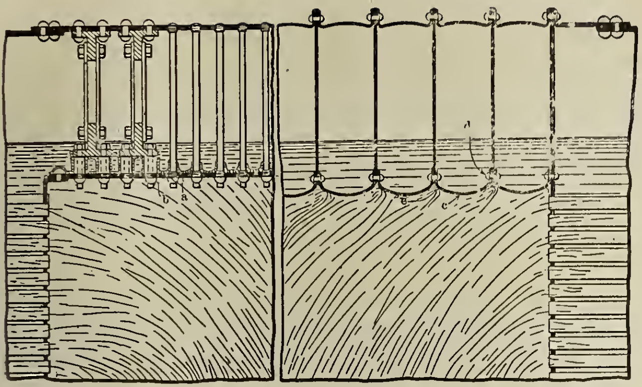
"Bement Hammers," a pamphlet recently issued by the Niles-Bement-Pond Co., New York, is a very comprehensive catalog of power hammers varying in capacity from 250 to 24,000 lbs. The value of the booklet is enhanced by the information as to erection, foundations, boiler capacities, etc., which it contains.

"The Products of Kennicott" is the title of a booklet which very fully describes the boilers and water treating plants manufactured by the Kennicott Water Softener Co., of Chicago Heights, Ill. Several interesting installations are very fully described, and the illustrations are clear and comprehensive.

Consolidation Locomotive, Western Maryland R. R.

The Baldwin Locomotive Works has recently built ten heavy consolidation type locomotives for the Western Maryland R. R. This line has curves of 12 degrees on the main line and the maximum grade is 156 ft. per mile for a distance of 10 miles. The new engines exert a tractive force of 43,300 lbs., and are examples of a type which is giving satisfactory results in heavy service. The total weight of the locomotive in working order, exclusive of the tender, is approximately 100 tons.

The cylinders are single expansion, and the steam distribution is controlled by balanced slide valves actuated by Walschaert's gear. The valves are driven through rockers, whose bearings are bolted to a cross tie located immediately back of the cylinders. This cross tie is supported on lugs which are cast in one piece with the front top rails. The link bearings are bolted to the guide yokes, and the links are built up, with cast steel side plates. The valves are set with a maximum travel of 6 ins. and a constant lead of $\frac{1}{4}$ in.



Illustrating Old and New Styles of Fireboxes.

The driving-wheel centers, driving boxes and main frames are of cast steel, and the engine truck wheels are of forged and rolled steel, manufacturd by the Standard Steel Works Co. The truck is equalized with the first and second pairs of driving wheels, and the frames are supported, at the rear end, on leaf springs. This arrangement should promote easy riding. Grease lubrication is provided on all driving and crank pin journals.

The boiler is straight topped, with a sloping back head and vertical throat. The side water legs of the firebox slope outward from the mud ring; an arrangement which, according to recently advanced theories, should tend to prolong the life of the sheets. The sides and crown of the inside box are in three pieces. The crown is radially stayed, and is supported, at the front end, by one T bar hung on expansion links. The barrel is built with three extra rings, and the longitudinal seams are welded at each end.

The tender trucks are of the arch bar type, with chilled cast iron wheels weighing 715 lbs. each. The frame is built of 12-in. steel channels, and the tank is of the water bottom type, having a capacity for 7,000 gallons of water and 12 tons of coal.

The design, while representative of modern practice, is conservative in that it embodies features which have been tried out in service. The photograph shows the general features, while the dimensions are given in the table following:

Gauge	4 ft. 8½ ins.
Cylinder	22x30 ins.
Valve	Balanced
Boiler—	
Type	Straight
Material	Steel
Diameter	80 ins.
Thickness of sheets	13/16 in.
Working pressure	200 lbs
Fuel	Soft coal
Staying	Radial
Firebox—	
Material	Steel
Length	108 ins.
Width	70 ins.
Depth, front	75 ins.
Depth, back	66 ins.
Thickness of sheets, side	5/16 in.
Thickness of sheets, back	5/16 in.
Thickness of sheets, crown	⅜ in.
Thickness of sheets, tube	½ in.
Water Space—	
Front	4 ins.
Sides	3½ ins.
Back	3½ ins.
Tubes—	
Material	Steel
Wire gauge	No. 11
Number	329
Diameter	2¼ ins.
Length	14 ft. 10 ins.
Heating Surface—	
Firebox	159 sq. ft.
Tubes	2,854 sq. ft.
Total	3,013 sq. ft.
Grate area	52.5 sq. ft.
Driving Wheels—	
Outside diameter	57 ins.
Inside diameter	50 ins.
Journals, main	10x12-ins.
Journals, other	9x12 ins.
Engine Truck Wheels—	
Front diameter	30 ins.
Journals	6x10 ins.
Wheel Base—	
Driving	15 ft. 4 ins.
Rigid	15 ft. 4 ins.
Total engine	24 ft. 0 ins.
Total engine and tender	57 ft. 9½ ins.
Weight—	
On driving wheels	182,000 lbs.
On trucks, front	18,000 lbs.
Total engine	200.000 lbs.
Total engine and tender, about	340.000 lbs.
Tender—	
Number of wheels	8
Wheels, diameter	33 ins.
Journals	5½x10 ins.
Tank capacity, water	7,000 gals.
Tank capacity, coal	12 tons
Service	Freight

Consolidation for Western Maryland R. R.

RAILWAY MASTER MECHANIC

Established 1878

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The motive power department of the Chicago & Northwestern Ry. is completing a series of tests of locomotive valves and gears, making special note of the results of service records made by locomotives equipped with Walschaert, Stephenson and Baker-Pilliod gears, and with the Young valve and gear. We hope to publish the results of these tests in a later issue.

It is encouraging to the inventors and manufacturers of motive power improvements to witness this expression of open mindedness on the part of the Northwestern officials. Whether or not one of the new gears finds favor in the eyes of the latter, the makers are given the satisfaction of a fair trial and figures to show the reason for acceptance or rejection. Motive power men will watch for results of the trials with interest and once the ice of a high degree of conservatism is broken, the way will be easier even for those who, for one reason or another, are not able to make a first-class showing in this competitive test.

Many authorities in the operating departments of American railroads object to the employment of firemen who have been machinists. They state that these men never can be trained to handle engines in such a way as to get trains over the road efficiently. Their stand is based upon experience, and their argument seems logical. A locomotive which has been in service for several years is rarely in perfect condition when brought out of the house for a trip. If the engineer has been trained as a machinist he inspects the running gear with a more critical eye than does the man whose training has been confined to road service. The consequence is he finds the minor defects in numbers and his mind dwells upon them throughout the trip. The fact that he is more competent to repair breakages does little good when, in these days, a delay of ten minutes or less constitutes an engine failure. Moreover, it is seldom defects of the class mentioned which result in engine failures and, therefore, the man who is only intent upon getting his train over the division regardless of the defects, so disconcerting to the machinist, is the one who is most useful to the operating department. We recognize the fact that there are differences in opinion among men dealing daily with this subject, and believe that there is an argument for the use of shop trained men as firemen and engineers. The subject seems an interesting one, and perhaps one which is worthy of discussion among mechanical officials.

A patent was granted April 6 to F. W. Schupert, of San Bernardino, Cal., and Henry W. Jacobs, of Topeka, Kans., for a radically new design of locomotive firebox. Mr. Jacobs is an assistant superintendent of motive power on the Atchison, Topeka & Santa Fe Ry., and the firebox will be tested out on this road at an early date. On another page of this issue we describe the principal points of interest in the new design, and it will be recognized as something original in the railroad field. Only a few weeks ago Mr. Vauclain was granted a patent on his flexible boiler with superheater, reheater and feed-water heater, for articulated locomotives. No attempted improvements in locomotive boilers within several years have presented such bright prospects as do these two inventions. It is an unfortunate fact that most of the inventions calculated to further railroad progress are the creation of impractical and untrained men. The reasons are hard to find, but the fact is none the less evident. It appears that the more thorough a man's training in the mechanical field, the more he realizes his own inefficiency as compared with some of those who, having gone before, have worked on the same problems. It is refreshing, therefore, to view the original brain work of trained mechanical men as evidenced in material and apparently radical improvement of the locomotive boiler, which for so many years has disconcerted all attempts at any improvement outside of adaptation to size alone.

The Locomotive's Left Side

It was discovered many years ago that the left sides of locomotives were giving more trouble than the right. The inference of a passing consideration was that the engineer more easily located noises and indications of trouble on his side than on that of the fireman. The matter has been given more thought in later years, however, and some experimenting has added its results. Pounding of the boxes and frame breakages undoubtedly occur more often on the left than the right side. The records prove this, but the cause seems to be still a matter of opinion. It would seem that a process of elimination applied to the differences between right and left sides would eventually bring about a satisfactory location of the cause or causes.

The matter has been up for consideration before the master mechanics' conventions several times, and it was considered by the General Foremen's Association, at its convention in May, 1908. At this convention an unidentified voice covered the subject in point as follows: "We had trouble with the left frame breaking more than the right. On right lead engines we changed crank pin lead for experiment and I understand that the broken frame is transferred to the right side, showing that the lead has all to do with the pound It seems to me it is conclusive that whichever side has the lead, the opposite will have the pound, because we always keep up against the shoe or wedge on leading side." This man is not the first to place the blame upon the fact that it is customary to arrange the cranks so that the right pin leads the left by a quarter revolution. Changing the setting so that the left crank leads would not seem to be of any benefit other than to transfer the pounding and resultant frame breakages to the right side. It is true, however, that the wedges will be set up more carefully and be more closely watched on the right than on the left side because of the fact that lost motion will be discovered by the engineer more quickly on his side than on that of the fireman. For this reason it would seem a better plan to allow the left side to lead. A better cure, however, would result from a design of box which would, partially, at least, offset the twisting effect at the time when the left crank passes the center on the forward motion. Whether or not this is possible, we are not in a position to say, but the occasion for improvement is not mythical.

The Atlantic City Conventions

The Atlantic City conventions are only two months distant. This will be the fourth time these important meetings have been held at this famous resort, and they promise to be much greater in point of attendance, interest and the number and variety of exhibits than last year. The list of exhibitors who have applied for space shows a considerable number of new names. The return of more prosperous times and the promising outlook for improvement in railroad conditions with the looked for orders for rolling stock and equipment, give much encouragement to manufacturers of all kinds of railway supplies and material. The last eighteen months have been trying ones in the supply business; supply men and railway officials look forward to the mechanical conventions as the end of the depression. With July and the early fall months will come the orders that have been held up so long for rolling stock and equipment. For this reason the attendance of the convention will be unusually large. There is a better feeling everywhere than has been evident for a long time. Actual business by manufacturers of supplies in March was a disappointment, it is true, but the undercurrent of opinion concerning summer and fall business is strongly optimistic. There are two good reasons for this. The first is the increasing earnings of the railroads and the excellent reports that are expected from most of them with the end of their fiscal year in June. The other is the promise of an early settlement of the tariff question with the Payne bill now in the hands of the Senate.

There is only one unknown factor of size in the prosperity equation, and that is the crops for 1909. The government report on the condition of wheat is below last year, but the probable high price and consequent continued prosperity of the farmer will tend to equalize conditions, as well as the fact that we may get a bumper corn crop and other large yields of the cereals sown this spring. Another good indication of improvement in railroads' conditions were the results of the convention of the American Railway Engineering and Maintenance of Way Association held in Chicago in March. The expression of many of the engineers in attendance confirmed the belief that the railroads will shortly resume the purchase of material on a generous scale. The attendance was unusually large, and the fact that the engineer is an official whose ear is close to the ground, catching the first rumble of approaching changes which mean improvement in construction and betterment or the reverse, is worthy of note. Every manufacturer, who exhibited at the convention, arrived doubtful of results and departed happy over the outcome even though the expense was far more than it has been any year before.

These conditions point with certainty to a successful convention at Atlantic City in June—the largest and most important gathering of railway officials in the world.

Gas Producer Tests

A series of gas producer tests is now being conducted in the mechanical engineering laboratory of the University of Illinois. The object of these tests is to provide impartial data on the efficiency and operation of small producer plants of the general class, using different grades of anthracite coal. A rather elaborate line of investigation has been planned and the producer plant has been equipped accordingly.

The plant, as installed by the Otto Gas Engine Works, consists of a 60-h. p. suction gas producer with one wet scrubber, gas receiver and a 22-h. p. gas engine. In order to facilitate testing, a Schutte-Koerting steam ejector of 12,000 cu. ft. capacity per hour has been placed beyond the first scrubber and is used to produce the suction in the producer. Gas is drawn from the producer through the first scrubber and is ejected into the second scrubber in which the steam used by the ejector is condensed. From the second scrubber the gas passes to a dryer and from the dryer to two Westinghouse gas meters connected in parallel. From these meters the gas passes to waste. The steam injector provides an excellent means of operating suction gas producers without the use of the gas engine, thus simplifying the tests and promoting uniformity and accuracy.

Means have been provided for obtaining the moisture in the gas and the temperature in the fuel bed. The amount of air used by the producer is determined from a calibrated orifice. and this quantity is later checked from the analysis of the gas and of the coal. The Junkers calorimeter is used for determining the heating value of the gas and for checking the analysis. The Hempel Gas Analysis Apparatus is used for the analysis of the gas. Samples for the analysis of the gas and for the Junkers calorimeter are taken continuously.

The work is proceeding under the general direction of Mr. C. M. Garland, instructor in the Mechanical Engineering Laboratory, in co-operation with Mr. A. P. Kratz, a graduate student, for whom the work is to constitute a thesis investigation.

Largest Locomotives in the World

Two large freight locomotives of the Mallet type (2-8-8-2), constructed for the Southern Pacific Company, were completed April 14. These are the largest and heaviest locomotives yet built, and they combine many new features of design.

One of these locomotives was placed on a track of the Philadelphia & Reading Railway, Philadelphia, from April 15th to April 17th, inclusive, where it was inspected by many railroad officials.

The principal dimensions are as follows:

Cylinders	26 in. and 40 in. x 30 in.
Boiler, diam.	84 in.
Steam Pressure	200 lbs.
Fire Box, length	126 in.
Fire Box, width	78¼ in.
Heating Surface, firebox	232 sq. ft.
Heating Surface, tubes	6161 sq. ft.
Heating Surface, total	6393 sq. ft.
Grate Area	68.4 sq. ft.
Driving Wheels, diameter	57 in.
Wheelbase, driving	39 ft., 4 in.
Wheelbase, total engine	56 ft., 7 in.
Wheelbase, total engine and tender,	83 ft., 6 in.
Weight, on driving wheels, est.	390,000 lbs.
Weight, total engine, est.	430,000 lbs.
Weight, total engine and tender, est.	600,000 lbs.
Tank Capacity, water,	9,000 gals.
Tank Capacity, oil	2,850 gals.

Cylinder Boring Machine

A new design of cylinder boring machine has been invented by W. J. Hagman, of Philadelphia, and the patent on same assigned to the Niles-Bement Pond Company. The description, as given in the patent sheets, follows:

This invention pertains to improvements in machines for boring steam engine cylinders, such as cylinders of locomotives having a cylindrical steam chest disposed parallel with the cylinder and having pipe connections presenting their ends at the ends of the cylinder and having their axes parallel with the axis of the cylinder these pipe connections not extending through from one to the other.

The improvements will be readily understood from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a front elevation of a cylinder boring machine exemplifying my invention, the driving mechanism being omitted, and the main boring bar being broken away to show the secondary bar in its rear: Fig. 2 an end elevation of the same, showing the end appearing at the right of Fig. 1: and Fig. 3 a similar end elevation with the right-hand housing omitted and the main and secondary boring bars appearing in vertical transverse section in the plane of line a of Fig. 1.

In the drawings:—I, indicates the bed-plate of the machine: 2, one of the housings projecting upwardly therefrom: 3, the other housing, shown as arranged for adjustment longitudinally on the bed-plate: 4, a bearing mounted for adjustment on each housing in a horizontal path at right angles to the axes of the boring bars: 5, screws in the housings for adjusting these bearings: 6, the main boring bar, journaled in the bearings 4, this bar to have the construction and provision usual in the boring bars of cylinder boring machines: 6(a), a projection from one end of this main boring bar for the reception of the usual driving gear: 7, the secondary boring bar having its ends journaled in the two housings parallel with the main boring bar, this secondary boring bar having a diameter less than that of the main boring bar so as to adapt it to deal with the cylindrical steam-chest of such a cylinder as has been referred to: 8, the projecting end of the secondary boring bar 7 for the reception of the usual driving gear for driving this bar: 9, a super-housing provided with a vertical face and mounted for sliding motion horizontally on the upper portion of housing 2: 10, a screw for adjusting the super-housing 9 in a direction to and from the axis of the main boring bar 6: 11, a bearing-bracket mounted for vertical sliding motion on the vertical face of super-housing 9: 12, a screw for vertically adjusting this bearing-bracket 11: 14, the projecting outer end of this tool bar for the reception of a driving gear: 15, a super-housing mounted for horizontal adjustment on the top of housing 3: 16, a screw for horizontally

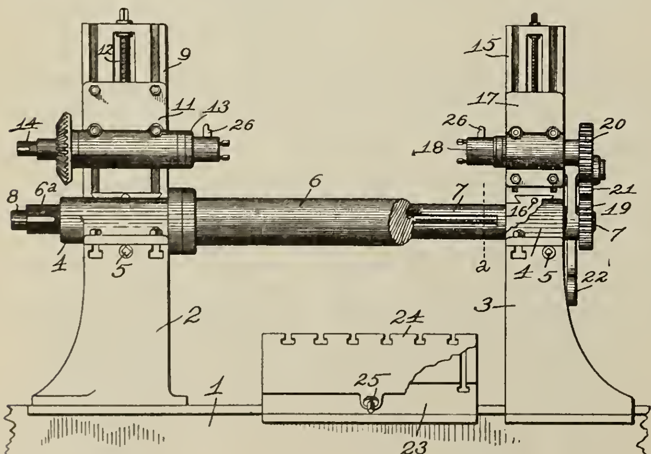


Fig. 1.

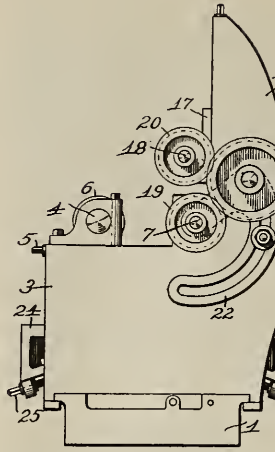


Fig. 2.

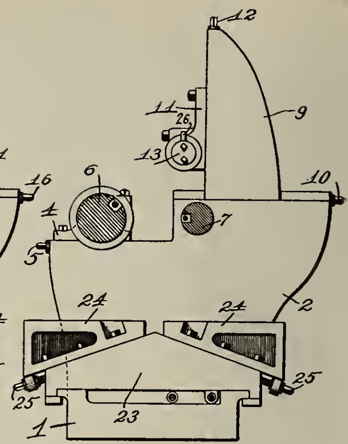


Fig. 3.

adjusting this super-housing: 17, a bearing-bracket mounted for vertical adjustment on the super-housing 15 by means of a screw after the manner of bearing bracket 11: 18, a tool-bar journaled in bearing-bracket 17: 19, a gear fast on an end of secondary boring bar 7 projecting outwardly beyond housing 3 in which that bar is journaled: 20, a gear fast on the outer end of tool-bar 18 and disposed in the vertical plane of gear 19: 21, an intermediate gear engaging gears 19 and 20: 22, an adjustable tumbler carrying gear 21 and serving in adjusting that gear for engagement with gear 20 in the varying vertical positions of the latter: 23, a table-base mounted for sliding motion longitudinally on the bed-plate between the two housings and having its upper surface sloping downwardly in opposite directions from the transverse center of the table-base: 24, super-tables having their bases resting on the sloping upper surfaces of the table-base, the upper surfaces of these two super-tables being horizontal, and the super-tables being mounted for adjustment up and down the sloping surfaces on which they rest: 25, screws for adjusting the super-tables up and down the slopes of the table-base: and 26, facing cutter secured at the inner ends of tool-bars 13 and 18.

The cylinder to be bored is secured to the upper surfaces of the super-tables, those two tables having their levels adjusted relative to the boring bars and relative to each other by being adjusted upon the slopes of the table-base, thus permitting the general work-holding table to adapt itself to the under side of a cylinder casting whose main body has one size and its steam-sheet a somewhat different size. Some of the adjustments of the cylinder-casting will be made by blocks or saddles upon the tables but the independent adjustment of the two tables provides for a nice adjustment of the axes of the cylinder and the steam-chest into coincidence with the horizontal plane of the two boring bars.

The casting is to be so adjusted transversely of the machine that the axis of the steam-chest will coincide with the axis of secondary boring bar 7, and the bearings of main boring bar 6 are to be adjusted to or from the secondary boring bar so as to bring the main boring bar concentric with the cylinder. Under these conditions the two boring bars may act upon the casting, the main boring bar boring and facing the cylinder while the secondary bar bores and faces the steam-chest, it being understood that these two boring bars will be provided with the usual boring and facing accessories.

The facing of the ends of the pipe-connections of the casting cannot be done by means of a single bar, owing to the fact that there is no passage extending axially from one of these pipe connections to the other. Housings 9 and 15 are to be adjusted transversely of the machine to bring tool-bars 13 and 18 into the vertical planes of the ends of the pipe-connections to be faced, and bearing-brackets 11 and 17 are to be adjusted vertically upon their housings to bring the tool-bars into the horizontal planes of the ends of the pipe connections which they are to face. The ends of the pipe-connections are then to be faced by means of the facing tools 26. The gearing arrangement causes motion to be transmitted from the secondary boring-bar to tool-bar 18, and the gears 19, 20 and 21 in connection with the tumbler provide for the varying position of the axis of tool-bar 18. The gearing arrangement illustrated for getting motion to tool bar 18 represents the best that has thus far come within my contemplation.

Bearing Metals*

Among the most important points to be considered in choosing an alloy for bearing purposes are the following: (1) Low coefficient of friction; (2) sufficient compressive strength; (3) durability; (4) ease in fixing and replacing; (5) minimum wear on journal; (6) low temperature of running—i. e., ability to quickly get rid of heat generated; (7) good behavior under irritating circumstances, chiefly with regard to safeguarding the shaft or axle from deterioration; and (8) cost.

When well fitted, the bronzes run cooler and with less friction than any other bearing metals. They will also stand a higher pressure than their rivals, though this is of little importance, as, beyond a certain pressure, which the best of the white metals and plastic bronzes will easily stand, the lubrication is interfered with. On the other hand, the rigid bronzes wear the most of all, and it is this fact which has caused them to be largely replaced by either a white metal-lined bearing or by the plastic bronzes.

The best alloys of this class are the true bronzes, and these are still regarded by some engineers as the best for heavy loads, though zinc is largely used as a cheapening diluent in practice. The hardness of the bronzes increases as the tin increases, and the rate of wear also increases. The practical limit for tin is about 20 per cent, as with a higher percentage the alloys are too brittle to be safe. The microstructure of the bronzes with over 6 per cent tin consists of a portion high in copper surrounded by a eutectic high in tin. As the tin increases, the proportion of the eutectic increases, and as this is a very hard constituent, the hardness of the alloy also increases. The constituent to solidify first is a solid solution of tin in copper; it is isomorphous with pure copper, and may be regarded as simply hardened copper. The eutectic shows a more or less granular structure—grains of the solid solution with a chemical compound of copper and tin with the composition CuSn. It is probable that this hard eutectic performs the principal bearing surface. When the eutectic assumes too large a proportion of the metal the alloy becomes too brittle for use.

Bronzes are notoriously difficult to cast, and it is a general practice to alloy 1 to 2 per cent of zinc in them for the purpose of getting better castings. It probably acts as a mild deoxidizer. Zinc is often added as a cheapening addition for common bearings. Anything from 0 to 14 per cent zinc and from 8 to 18 per cent tin is used, but those bearings high in zinc cannot be recommended for good work, as they wear very badly.

The introduction of phosphorus as a deoxidizer in making these bronzes was a decided improvement, and closer grained, harder, and more homogenous castings were obtained. Silicon is also used for the same purpose. The zinc, although mildly deoxidizing, does not produce the same drastic effects as the more powerful reducing agents. It is essential to have just enough phosphorus or silicon to deoxidize the metal and pass into the slag; all excess retained by the metal is to be avoided. Arsenic is also sometimes used as a deoxidizer, but it possesses no special advantages, and is a decidedly dangerous substance for foundry use. The great disadvantage of the rigid bronzes is their want of plasticity. They do not mould themselves round the shaft to make good any deficiency in the fitting.

The term "anti-friction" is often applied to the white bearing metals. This is somewhat a misnomer, as because they are less hard the anti-friction alloys have a higher co-efficient of friction than the bronzes. The name has been applied because of the decrease in the number of cases of excessive heating in bearings when they were introduced. In the case of railway axle bearings it was thought that the lining would not stand the rough usage that this type of bearing is subjected to, but after very exhaustive tests the lined bearings were proved to be incontestably superior. The wear was proved to be less than half as much. The properties which are sought in a white bearing metal are plasticity and hardness. The plasticity should be sufficient to enable the metal to mold itself round the shaft, but it must be tough enough to stand a reasonable pressure without deformation. It should also possess sufficient hardness to give as low a frictional resistance as possible. These apparently contradictory properties are given by alloys consisting of hard grains embedded in a plastic matrix. This, then, is the characteristic constitution of all the best anti-friction alloys. The hard grains in service are slightly in relief, and perform most of the bearing duty with a minimum of frictional resistance, while the plastic matrix allows of a certain amount of play under abnormal pressure. This peculiar relief is often very apparent on the surface of a bearing that has been in use, and is said to aid greatly in spreading the oil evenly over the bearing surface.

Lead-antimony alloys are the cheapest white-lining metals in use, and are considered by some to be quite good enough for rough purposes, as in the case of railway axle bearings. Their compressive strengths are the lowest of all, and the only point in which they may be said to excel is in their cheapness. Lead and antimony alloy in all proportions, the eutectic alloy containing 13 per cent antimony. With less than 13 per cent antimony the excess lead crystallizes out first in peculiar leaf-like crystallities, and these are surrounded by the eutectic. With more than 13 per cent antimony the excess antimony crystallizes out first in well-defined cubes. To produce an alloy of the required constitution it will be necessary to have the antimony in excess of 13 per cent. As the antimony increases, the alloys get harder till a limit of about 25 per cent antimony is reached, where the alloy becomes too brittle for safe use. The range of the useful alloys is then from 13 to 25 per cent antimony.

The alloys of tin and antimony are very similar in constitution to the previous class. Here the cubes consist probably of the compound SnSb, and are not nearly so brittle as the cubes of pure antimony, though slightly less hard. The compound also enters into the eutectic matrix, and gives an alloy of remarkably high compressive strength. These alloys are probably the most expensive of the white metals, and although their properties are distinctly good, they can be equalled, if not excelled, by a slightly cheaper group of ternary alloys, which are considered next. The binary alloys of tin and antimony are rarely used in practice.

Alloys of tin, antimony and copper include the original "Babbitt" metal—Sn 88 per cent, Sb 8 per cent, and Cu 4 per cent. They are the highest priced of the alloys in com-

*Abstract of paper by A. Hague, read before the Staffordshire Iron and Steel Institute.

mon use, on account of their high content of tin, and they may generally be relied upon to give the best results. They have the highest compressive strengths (if we except the zinc alloys, which have many inherent disadvantages), and they get rid of heat produced most rapidly—i. e., they run at the lowest temperature. These alloys may be considered to be built up of three constituents: (1) A copper-tin compound, approximating to composition CuSn; (2) an antimony-tin compound, before referred to in the tin-antimony alloys, probably being SbSn; and (3) tin containing a small proportion of above compounds. The copper-tin compound crystallizes in hexagonal needles, which have a characteristic tendency to group themselves into stars. It is the hardest constituent, but is also very brittle. The tin-antimony compound crystallizes in cubes as before mentioned, while the matrix consists mainly of tin toughened by about 3 to 5 per cent of Cu and Sb present at their compounds with tin. It is the cubes, and not the stars, which perform the major part of the bearing duty. With less than 4 per cent of antimony no large primary cubical crystals of SbSn are obtained; the antimony is then completely taken up by matrix, and also at least 2 per cent Sn is required to give any primary bronze needles. In practice the limiting range in composition of these alloys is probably very near the following: 2 to 10 per cent Cu, and 8 to 15 per cent Sb. With more than 10 per cent Cu, or 15 per cent Sb, the alloys get too brittle. It will be noticed that the copper is more active in producing brittleness than the antimony. Consumers have a big objection to having their high-priced tin alloys diluted with the comparatively cheap metal lead. According to one authority, however, this is a case where cheapening is actually beneficial, as he states that the lead both hardens and toughens the metal, besides making it more readily melted.

By the introduction of tin to lead-antimony alloys the brittleness of the hard antimony grains is modified by the presence in solid solution of a greater or less amount of the compound SbSn. This compound also enters into the antimony of the eutectic matrix, increasing its compressive strength. The wear of these alloys is said to be considerably less than that of the tin-copper-antimony alloys, probably due to the large percentage of lead in the alloys. Their heat-dissipating capacity, which is determined by the combined effects of (1) specific heat, (2) thermal conductivity, and (3) radiative capacity, is inferior to the tinny alloys, and they are not therefore to be recommended for high speeds. The compressive strength of the series is comparatively low, and they are therefore unsuitable for high pressures. They may be regarded as giving intermediate properties between those of the lead-antimony alloys and the genuine Babbitt metals. The character of the metal is improved as the proportion of tin increases, right up to the point where the lead is absent, and we have the binary alloy of tin and antimony; but as the high tin alloys are no cheaper, and do not give as good results as the genuine Babbitts, it follows that there is a financial limit to the increase of tin.

Although lead and copper do not alloy, by the introduction of antimony a homogeneous alloy free from segregation may be obtained, providing the copper does not exceed 10 per cent. With more than 10 per cent Cu, rich coppery portions tend to segregate out. The copper forms with the antimony the compound $SbCu_2$, which has a beautiful violet color, is probably identical with the well-known "Regulus of Venus." It crystallizes in needles, and is also a toughening constituent of the matrix. The cubes of antimony probably do the greater part of the bearing duty, and at least 15 per cent antimony is required to produce any cubes. The range of composition then is probably somewhere near the following: 15 to 25 per cent antimony, and 4 to 10 per cent copper.

The constituents of the alloys of zinc, tin and antimony are zinc, tin, and antimonide of zinc. Here the antimonide of zinc is the hard constituent which should crystallize out first in primary crystals to do the bearing service. Free zinc, crystallizing out as primary crystals, is to be avoided, as it is a very bad metal in bearings, owing to the ease with which it grips, or cuts, and results in what is known as galvanizing of the journal. The alloys which have the antimonide crystallizing out first are the important ones, and are roughly to be found within the following limits: 10 to 15 per cent Sb, and 10 to 15 per cent Sn. The remarkable point about these alloys is their high compressive strengths. They are comparatively cheap with regard to the price of constituent metals, but are difficult to cast, as the volatilization of zinc is aggravated in the presence of antimony.

According to one authority the casting temperature of white-metal bearings should be near the melting-point of zinc. It should not be higher, as it is apt to oxidize, and hard grains of oxide cause irritation in the bearing. By casting round a cold core the metal is chilled, and too great a proportion of the hardening constituents is held in the matrix; the hard grains are much fewer and smaller in size. Chill casting is not to be recommended, though it is often resorted to by manufacturers to give a fine-grained ingot. It brings the matrix, which, though stiffer, is still comparatively soft, too much into play as the actual bearing constituent. A common practice among engineers is to cast round a core heated to about 100° C., when a moderate rate of cooling is obtained, and moderate-sized cubes result. Metals which have been chilled in casting have been proved to be very troublesome in practice, as have also metals which have been allowed to cool too slowly, either from casting at too high a temperature or from the core being too warm. In this last case the cubes are abnormally big, and owing to the slow rate of cooling, a sort of segregation of the lighter cubes from the heavier matrix takes place.

The want of plasticity of the rigid bronzes was recognized as a decided disadvantage, and attempts were made, originally by Dr. Dudley, of the Pennsylvania Railway Co., to obtain a certain degree of plasticity by the introduction of lead. This was successfully accomplished up to the extent of 15 per cent of lead, and after exhaustive tests these alloys replaced the old rigid bronzes. The lead does not appear to alloy to any extent with the bronze, but to be mechanically held by it, and "forms trails of a plastic substance throughout the metal." These plastic bronze bearings are claimed to be superior to Babbitted bearings, because it is said that the wear on the journal is much less. The soft lining is supposed to embed the grit and steel particles worn from the journal, and consequently produce an abrading action. The harder bronzes allow this grit, etc., to work itself out. It is found necessary to have a certain proportion of tin in order to retain the lead without segregation, and also to give the alloy the required strength. The standard bronze is said to be of about the following composition: Copper, 78 per cent; tin, 7 per cent; lead, 15 per cent. To get more lead into the alloy it would be thought that the tin would have to be increased, but the exact opposite is the case. By reducing the tin to a minimum of 5 per cent, lead to the extent of 30 per cent could be included in an alloy without segregation. This is probably due to the amount of the tin eutectic present. At 5 per cent Sn the eutectic is practically absent, and the meals set completely soon after entering the mold, thus trapping the lead. When the eutectic is present in any proportion, and as it is liquid long after the main bulk has solidified, it gives the molten lead plenty of opportunity to segregate to the bottom of the casting, owing to its high specific gravity.

The American Railway Association's Bureau for the Safe Transportation of Explosives*

While a small business, and even a small country may be dominated by an individual, expansion and combination of units demand corresponding expansion in methods of government.

Our national legislature would long since have degenerated into a useless mob if means had not been devised to curtail the influence of individuals bent upon rowing their tiny crafts against the current of events. It is of no consequence to the nation, as a whole, that this is not a current toward progress for the individual: that his craft must go up stream or sink. The wise pilot will accept the inevitable, abandon the craft, and expend all available energy upon salvage rather than on useless opposition.

Whether we approve or not, as individuals, combinations of large interests into so-called Trusts, of the working classes into Labor Unions, of legislative agents into Commissioners, of railway interests into Associations and Bureaus, have come to stay. The existence of these organizations, far from being the result of individual action, is based upon the operation of natural laws as broad and deep as those that cause the evolution of species and the survival of the fittest.

Is the Bureau of Explosives one of the abortions in this great scheme of natural development, or does it represent the sprouting of a seed fallen upon fruitful soil? Time alone can furnish the answer. We are not called upon to furnish it, and, furthermore, our answer could not materially affect the final result; but an approval of the bureau, followed by active support of its work by the members of this and of other railway organizations, will materially hasten the availability to railway interests of any benefits promised by it. On the other hand, and if the organization and conduct of the bureau have been upon wrong lines, a verdict of disapproval from you will help to hasten a desirable and general appreciation of these facts.

I propose to sketch the origin of the bureau, the general nature of its work to date, and its possible lines of development.

Origin of Bureau.

In April, 1905, Mr. James McCrea, now president of the Pennsylvania Railroad Company, and then vice president of the lines west of Pittsburg, advocated before the American Railway Association the appointment of a committee to prepare a set of regulations to promote the safe transportation of explosives. For more than fifteen years the Pennsylvania Railroad, whose traffic in dangerous articles exceeded many times that of any other road, had struggled by individual effort to decrease the chances in favor of the occurrence of fires and explosions on its property. These efforts had not prevented serious disasters, including explosions at King's Mills, Forest, Crestline, Redstone Junction and Greenwood, the net results of which were 13 people killed 25 injured and a financial loss to the company that exceeded $300,000.00. The necessity for some concerted action by all roads was apparent. No amount of care can prevent the occasional destruction, always promised, by explosives not in proper condition for transportation. Of what avail, if a road by individual action secures at junction points shipments prepared and forwarded with a reckless disregard of precautions? It is also true that no matter how friendly their personal and official relations, the traffic representatives of railroads are, and should be, constantly influenced by healthy competition. Regulations to promote safety necessarily cause restrictions on the practice of a shipper, restrictions that are generally unwelcome to him and sufficient to bring his custom to the soliciting freight agent who is able and willing to cancel them. To secure the shipper's consent to restrictions, it is primarily necessary to convince him that they will apply with equal force to his competitor situated on another transportation line. The enforcement of proper regulations also means the expenditure of large aggregate amounts of money by carriers and shippers, a burden which cannot be placed readily where it belongs,—on the consumer.

We have here broad and sound reasons for a radical change in the old methods of individual railway administration in this particular. The interests of all roads require the safe transportation of dangerous articles and independent efforts have proved powerless to bring it about. Combined action in some form was as inevitable as is the ultimate escape by a running stream from obstructions to its flow.

The appointment of a Committee on Transportation of Explosives to prepare and present to the American Railway Association at its meeting in October, 1905, a set of Regulations for the Transportation of Explosives in order that after approval by the association, these regulations might be recommended to its members for individual adoption and enforcement, was approved. While the personnel of this committee was still under consideration, one of the most disastrous explosions in the history of transportation by rail in the United States occurred at Harrisburg, Pa., May 11, 1905. Its net results eclipsed the aggregates already mentioned since 20 lives were sacrificed and the financial loss exceeded $500,000.00. In the reverberating influences of such disasters we recognize the voice and the power of those natural forces that have driven railroads into combinations for mutual protection. As individuals, we yield to these forces, much as a flock seeks shelter from a storm. Only a supernatural wisdom could have directed us to the shortest route to the desired haven. To anticipate somewhat, we have drifted by intelligent experiment into the trial of a Bureau of Explosives in our search for further protection. We may keep and expand this bureau; and we may disorganize it to continue our search.

During the summer of 1905 the Committee on Transportation of Explosives, under the chairmanship of Mr. McCrea, worked diligently and effectively in the preparation of regulations. It had the use of the exceptional knowledge and experience of Dr. Chas. B. Dudley, chemist, Pennsylvania Railroad, member of the comittee, and now president of the bureau; it employed additional civilian experts on explosives and consulted experts from the Army and Navy Bureaus of Ordnance.

Immediately after the Harrisburg accident, the Pennsylvania Railroad put a competent man on duty as inspector to promote the education of railway employes and shippers in the requirements of the regulations of that line for the transportation of explosives and to check their violations of them. The official who decided to put this inspector on duty planted the seed of the Bureau of Explosives. The inspector's reports soon demonstrated the necessity for his services and emphasized the self-evident fact that regulations do not enforce themselves.

The regulations proposed by the committee were approved by the association in October, 1905, and adopted promptly thereafter by practically all of the members. This uniform adoption and publication of regulations, essential as it was, did not produce any marked change in the handling of shipments of explosives. This is illustrated by an extreme case in the experience of our inspectors some two years later. An agent who had received, in due course, a copy of the circular of his road prescribing the regulations, was subjected

*From paper by Col. B. W. Dunn before the New York Railroad Club.

to his first inspection. Did he have a copy of the regulations? The agent was not quite sure. It depended somewhat on whether this particular circular was printed on paper soft enough to use in cleaning lamp chimneys. If so, it had probably been expended for this purpose; and if not, it might be in a box where he kept a lot of circulars that he had never found time to read.

In October, 1906, a year after adoption and publication of the regulations by its members, the association decided that some common agent of all the roads was necessary for the uniform enforcement of these regulations; and it approved a constitution and by-laws for a Bureau for the Safe Transportation of Explosives and Other Dangerous Articles, the preparation of which had been authorized in April, 1906.

Membership in the bureau was optional and it was not until over seven months later that practical work was started by opening the office of the chief inspector in New York city. At this time the membership comprised 78 companies operating 130,026 miles of railroad, while the membership of the association comprised 274 companies operating 236,581 miles. There is reason to believe that some of the 78 companies had joined the bureau perfunctorily and without due appreciation of the obligations assumed; also that many of the remaining 196 members of the association had neglected to join through a failure to consider duly the general forces back of the movement.. It is known that some of the companies held aloof to await the outcome of the experiment. At the present time the bureau membership comprises 158 companies operating 202,186 miles. It is significant that this rapid growth of the bureau occurred during a period of marked financial depression which necessitated a strict scrutiny of every dollar spent for railway operation. Of the 155 members of the association not yet enrolled as voluntary members of the bureau, only 9 operate more than 1,000 miles of road, 4 of which are located in Canada and 2 in Mexico.

It is now believed that it would have been better for all concerned if some way had been found at the beginning to make membership in the bureau compulsory. Complete experiments, presenting all conditions needed to demonstrate conslusively success or failure, are the most satisfactory. If the failure of the bureau is to be the outcome, the sooner it is known the better, that we may try other experiments and thus arrive more promptly at a satisfactory solution of our difficulties.

Development of Bureau Work.

Initial Difficulties.

Due allowance will be made by a just critic for difficulties that retard progress. The committee had provided in the constitution and by-laws an excellent general scheme for dividing the work of the bureau among: (1) a force of traveling local inspectors; (2) a chemical laboratory with the necessary personnel and testing and analytic apparatus; and (3) the directing headquarters of the bureau, the office of the chief inspector.

It requires time to acquire momentum. A satisfactory local inspector possesses a combination of qualities that cannot be found in the open market; a special building had to be constructed and special apparatus devised for the laboratory; a complete system for administration had to be provided, including numerous blank forms to facilitate reports, instructions to govern the delicate relations of inspectors to railway officials in the exercise by the inspectors, in cases of emergency, of authority vested in them by the constitution and by-laws of the bureau, pamphlets for the information and instruction of shippers, inspectors and railway employes. These are samples only of the work that had to be performed in the office of the chief inspector. Each of these tasks, successfully accomplished, meant an addition to the momentum of the bureau. A chief inspector succeeding hereafter to the control of this work may not appreciate all the initial difficulties. Any one of you, now in control of a large department of railway work in good running order, will appreciate them if you imagine all your experience, and all the details of your system for operation, out of existence and the necessity present for starting anew.

In addition to other tasks requiring attention, the regulations for explosives needed revision and an entirely new set of regulations for inflammable ariclets and acids had to be prepared. An idea of the methods adopted and of the possibilities for expension of the usefulness of the bureau may be conveyed by brief discussions of representative tasks already accomplishel or in progress.

Co-operation of Manufacturers.

The manufacturers of explosives had not complied willingly with the regulations of individual roads and the principal cause for their opposition was a fear that their competitors on other lines might avoid the expense of a more careful preparation of their shipments and thus secure a trade advantage. A general conference, invited by the bureau in November, 1907, was attended by a majority of the manufacturers. The situation was thooughly and frankly discussed to indicate the reforms needed in the interests of safety. It was pointed out, among other things, that the cans used for shipping black powder were weak and the loose powder, the first step toward disaster, was being found too frequently on the floors of cars in transit; dynamite was being produced with unsatisfactory absorbents that allowed liquid nitroglycerin to escape from cartridges and packing cases; packages of explosives were not being properly loaded and stayed in cars. Among the reforms acknowledged as due from the railroads were: more careful and intelligent inspection of packages to detect their defects when offred for shipment; more careful loading and staying of less than carload shipments; better selection and preparation of cars for carrying dangerous explosives; more careful handling and more frequent inspection of these cars en route.

The co-operation promised by the manufacturers at this conference has been realized. At the suggestion of the chief inspector, they appointed a committee to consult with him from time to time on matters of mutual interest as they might arise. No obligation to follow the advice of this committee was assumed by the bureau; but it was promised by the chief inspector that no radical changes in regulations would be made without hearing and considering the opinions of manufacturers. One important by-product of this conference was the establishment of better relations between some of the competing manufacturers who united for the first time in striving for a common end.

A little consideration is necessary to appreciate fully the value of this co-operation to the work of the bureau. Without it, we should have to depend upon forcing, through our inspections and a resort to embargoes, a compliance with regulations at large shipping points; and we could not expect, without great additional expense, to inspect these points oftener than three or four times per annum. A co-operating manufacturer is more valuable to us than would be half a dozen additional inspectors. He not only keeps his factory employes in line, but he controls, or dominates, the work at many other large shipping points where distributing magazines and customers reship his products.

It is evident that the most direct way to avoid a difficulty is to remove the cause. The wording of new regulations must necessarily be more or less indefinite. For example, we may prescribe that a shipping package for explosives must be strong and tight and that it must stand certain drop tests. Many types are in use that stand the tests but there is reason to assume that great differences exist in the numbers of individually defective packages furnished by the different types.

It would not be wise to select arbitrarily what appears to be the best package and prescribe its exclusive use at once. In the spirit of true co-operation, the plan followed by the Bureau ers of serious violations. All railway employes should be made to understand that the regulations are issued to be enforced; that to invite, or condone violations, for traffic or other reasons, is unfair to a company's connections; and that proper efforts of the bureau will be supported by disciplinary action whenever necessary.

Perfection of Regulations.

Nothing will conduce more to ultimate success than a thorough appreciation of our partnership interest in this work. Frequent changes in rules are to be avoided for many reasons; but efforts to inject into them the wholesome lessons of experience must never be relaxed. They represent a compromise between naturally antagonistic influences, safety and convenience. Instead of condemning all rules for defects thought to exist in one or more, a critic should describe the defect and submit to the Bureau his suggestions for remedial changes. So little interest was taken a year ago, by the parties most interested, that a distribution by the chief inspector of galley proofs of the proposed rules, for criticism and suggestion, bore little fruit. "Nothing to suggest," "Rules satisfactory," "Rules too voluminous" are samples of some of the comments. It is known that this was due principally to the fact that railroad officials did not have the time required then to study the subject effectively. With the advance now made in education and interest in this matter, less time is necessary and our united experience will be more suggestive of ideas. Our next revision of these rules should show, therefore, a great advance toward perfection if each party in interest will, after mature consideration of both safety and convenience, submit his suggestions to the chief inspector. In several instances a railway official has referred to the rules in the presence of his subordinates as "nonsense" or "tommy rot," thus striking at the very root of all discipline, and all because one of the rules did not meet with his approval. These officials had not utilized their opportunity to criticize the rule before its promulgation and were, therefore, partly responsible for any defect in it; they may also have been unimformed as to the reasons for the rule. Their plain duty was to enforce the rule first and then to submit their criticisms and arguments against it. The bureau's availability to receive, collate, digest and utilize such suggestions is, alone, a sufficient reason for its existence.

It probably did not occur to the above mentioned critics that they had a proprietary interest in the Bureau and a share in its responsibilities; that the Bureau is not a representative of foreign and hostile authority, but a member of their family striving honestly to further their interests in every proper way.

That the bureau has apparently won the confidence and approval of the Interstate Commerce Commission, and thereby demonstrated its ability to represent all transportation interests in any discussions of proposed changes in federal laws, should be a source of gratification and pride to its proprietary members.

Legality of the Rules

The legality of the rules and the penalties that can be enforced for wilful violations of them should be understood by all concerned. The Federal Law of May 30, 1908, is unusual and it illustrates a modern tendency to delegate legislative authority to commissions. The promulgation by Congress in 1866 of a rule for the packing of explosives for transportation had proved a failure; and this act of 1908 transfers to the Interstate Commerce Commission legislative authority to prescribe details. This Commission confines its direct action to explosives, but finds it necessary to give general directions to the common carrier which require him to go still further and add rules of his own for handling both explosives and inflammables. The rules thus added, until pronounced inefficient, unreasonable or unnecessary, by a court of competent jurisdiction, are also the law of the land, and wilful violators of them are subject to the penalties prescribed in the Act. We thus find a graded exercise of legislative authority by Congress, the Commission and the Common Carrier, each having the power, under general limitations and subject to judicial approval, to change its own rules. An official who, for any improper purpose, such as diversion of traffic, directs his subordinates to violate, or permits the wilful violation of, any one of these properly promulgated rules, is an enemy of the public welfare and is subject to prosecution and punishment. Imagine the predicament of such an official if loss of life could be shown to result directly from his action. For much less reason a prominent official has had to answer at the bar of justice to a charge of homicide.

As an example, let us assume that one official considers it "nonsense" to label a package of whiskey and sees, incidentally, a chance to divert traffic from a competitor by ordering this rule disregarded. As a result the package is loaded into a car with dynamite and during transit on a hot summer day it is injured by coupling shocks; the whiskey escapes and its vapors mix with the air. In anyone of a dozen probable ways, a spark or a flame ignites this mixture, explodes the dynamite and kills a numbero f people, who have been deprived of the protection against this catastrophe afforded by the regulations. Who should be held morally and legally responsible for their deaths? Would any of you like to change places with our critic who has pronounced the regulations "nonsense"?

On the other hand, let us assume for the sake of argument, that by focusing its attention too accurately on safety, the bureau has overlooked, or been uniformed of, necessities; and has caused the labeling of so many packages that their separation from dynamite requires not only a special car for the latter, but empty cars on each side of it to separate it from cars placarded "inflammable." This condition, or anything approximating it, would be "practical nonsense" and should be corrected as soon as possible. Hasty action, on insufficient information, or information applying only to limited and special conditions, should not be taken; but the facts should be reported for thorough investigation and for such remedial action as will be subserve all interests affected.

Possible Development.

For years, railway employes and officials have been organizing with great benefit to their varied interests. I doubt whether any of you could prepare, without some research, a list of all of these associations. Unfortunately, some of them exercise independently very important functions, and their field of influence overlap, with resulting confusion, if not actual conflict of rules. Traffic officials find it necessary to prescribe rules for packing certain articles in fixing their freight classification; the Bureau of Explosives considers different rules necessary to secure safety and the shipper's confusion is excusable.

Absence of useful combinations means a waste of energy. Our railway lines are traversed by scores of inspectors whose general usefulness could be vastly increased by proper co-ordination of their education and duties. We have seen in the growing importance and usefulness of the Committee on Car Efficiency how to combination of interests can increase the efficiency of equipment; and it is predicted that a combination to increase the efficiency of our educational in inspection service will be effected eventually by the organization of what may be called a "Bureau of Enforcement" or a "General Inspection Bureau" whose agents will act as scouts for all operating officials to keep them informed of the actual conditions on their lines and to assist them in perfecting and enforcing all of their rules.

Conclusion.

A railway official is not overburdened with leisure and is naturally averse to giving much serious attention to the devising of remedies for the troubles of others. From this has arisen a tendency to let the bureau work out its own salvation. I shall feel more than repaid if this paper causes some of you to take a more kindly interest in the honest, if weak, efforts to serve you, of the infant member of your family, of railway organizations. When we are wrong, correct us; when we are right, defend us; until our failure is demonstrated, support us.

Systems of Governing Shop Laborers*

The modern bonus system is one of the latest developments of shop operation and consists in making time-studies of the various operations and determining accurately, or more properly inaccurately, in many instances, the length of time a man should take to perform certain work, and then giving him a bonus in proportion to the amount of saving in time or money he can make. It guarantees day's wages, and a man by unusual effort can make 20 per cent in addition to his wages. If he should make over this amount it is generally considered that the time allowance should be adjusted. This system is kept up by elaborate office records and a small army of clerks, and the foremen or assistant foremen have practically little to say about it in any way, and in many instances these men, who have been interested and satisfactory foremen, lose all interest in their work, and influence on those under them. The men themselves, as a rule, have little confidence in the system, and simply tolerate it until they can get something else to do, or if times get good and men scarce, labor trouble ensues. All sentiment and esprit de corps has been wiped out, the company or shop has a bad name among mechanics, and only those who cannot find employment elsewhere will work for it.

The piece-work system, with guaranteed day wages, with a careful study of prices, which the accounting officers or their subordinates work together with the foremen, and practical men who are especially skilled themselves, or have knowledge gained by years of experience, is in my opinion the simplest and most promising. I do not mean the old piece-work system such as I worked under 25 years ago, where prices were guessed at in a great measure, some very much too high; other equally too low, with the usual predetermined earnings which the man was going to be allowed to make and the cutting of prices every time he ran over the amount; better day work than any such system. As an example of such a system worked in regular practice, I once worked alongside of a very fair man who was running a brass lathe. This man had decided to leave the shop, and the month before leaving, speeded up to the highest limit for quantity (not quality), as we afterwards discovered. The result was that he made $147 for the month against his usual pay of from $65 to $70. He had about ruined his machine, and a large part of the work that he had turned out had afterward to be scrapped. The master mechanic, when he scrutinized the pay-roll, arbitrarily cut the price on this work about 70 per cent, simply saying, "We don't want these fellows to make over $75 or $80 per month." Those of us who were working in the shop soon "got wise" to the fact that the "old man" had set a limit and we were particular not to give him any cause to complain of our making too much. The shop afterwards was put on a day-work basis, with proper supervision and turned out more work at less cost than it had been doing piece work.

*From an address by H. A. Gillis before the Richmond Railroad Club, Dec. 14, 1908.

The Taylor system is another system which has its good points and bad ones. It is very elaborate, and practically consists of a "Planing Bureau" where every detail of operation is worked out from the ordering of materials to the shipping of the finished products. The speed and feeds of machines, the time of transporting materials from one machine to another, and the sequence of operation and assembling is all systematically worked over in advance. All this is good, but it has a tendency, if not watched, to be carried to extremes, and take away all initiative on the part of foremen and workmen. The principle seems to be that the brains are in the office or "Planning Bureau" and the muscle in the shop. As originally carried out by Mr. Taylor, there is no place for compromise or judgment to be used by foremen or men. The Bureau is absolute. The system has certainly improved the output of a number of manufacturing establishments, has much in it of merit, but also has the serious fault of killing sympathy and mutual confidence and respect between the shop proper and the office, the employer and the employes. No system which does not take in these fundamental factors can, in the long run, stand and be successful.

The trouble with nearly all these systems is that they widen the breach between employers and employes, instead of bringing them closer and closer together in a relationship of mutual confidence and respect; yes, and in my opinion, a still closer union of brotherly love and sympathy. This is ideal, I will admit, but it is only by striving after ideals that the permanent and really good things are accomplished. We often hear that there should be no sentiment in business, but this is not so; there is more or less sentiment in everything. If you want to lead a lot of men in a fight, you have got to have these men with you, you have got to hold them with sentiment.

Now to you men who may be employing other men, I want to give you a word of counsel. Knowing your men; get close to them; take an interest in them, and encourage them. Let every man and boy feel that he has some hope of a better job; let him see that you are interested in him, and if he is a clerk or office boy, let him feel that some day he will be chief clerk. An occasional kind word, or word of encouragement, will often make a man who is only a fair man, an excellent one. Every man likes encouragement, and needs it. I once worked for a man who for 18 months never spoke a kind word to me. I would have to tell him every once in a while how well I was doing, and finally he said to me one day, "You make me tired. You are all the time patting yourself on the back," and I said, "I do not know what I would do if I did not pat myself on the back. I have been here 18 months and you have never given me any encouragement or patted me on the back, and I need it, and therefore have to encourage myself."

Now, another thing: When you see a man going wrong or displeased with his work, don't let him continue a moment longer after you discover it, but stop him then and there, before he goes too far, and give him a chance to right himself. I don't believe there is a single man in this room who can honestly say that he ever did, day after day, a full day's work. I know that I can't say it. And even now, when I am practically working for myself, and have no one over me to find fault or to administer rebuke, I have a hard time treating myself right. My tendency is to get out doors and have a good time, and my inclination is frequently to cut my business and enjoy myself, and I do not think that I am very different from other men.

Now let me say once more, it does not matter what kind of a system you may have for your shops and offices, you must appreciate and realize that the old fundamental principle of sentiment and consideration between man and man, and as I have said before, even brotherly love and affection at times, cannot be ignored.

Shop Time Keeping and Labor Distribution*

By the latest report to hand of the Interstate Commerce Commission, it is shown that in the year 1906 railways paid out in wages the sum of nine hundred and fifty million dollars, and of this amount the shop pay rolls represented the magnificent sum of two hundred and twenty millions, or about twenty-three per cent. These figures will, no doubt, impress you with the necessity for extreme accuracy in the matter of shop timekeeping, whether the work be paid for by the hour, day, month, or piece. Any carelessness or inaccuracy in the method of compilation will, necessarily, result in injustice, either to the employee or to the company, and it might be noted, involves also something far beyond the amount a company may lose through particular errors or omissions.

It means dissatisfaction with the company if an employee loses the just return for his labor. It means the building up of an improper spirit if he gains something that does not belong to him, and the question of method by which the recording of time may be kept is of secondary importance to the knowledge that accuracy and truthfulness are enforced and a fair and just return is made to the employees for services performed, coupled with a correct distribution to the company for the money expended. There can be no chance hazards in this matter any more than in the matter of a company's traffic or the care of its moneys. It must be known that the men have worked as represented and that the rate paid is correct, also that the amount of money shown on the pay-roll is charged to the accounts upon which the labor has been expended.

These are the vital features of shop timekeeping, and whether a company shall have an efficient or an inefficient shop management, whether there shall be economy or extravagance, responsibility or irresponsibility, largely depends upon these features properly appreciated.

It can be stated as a general proposition that shop timekeeping should be taken care of under the direction of an officer acting independently of the person who hires or the official who directs. The officer to whom is assigned the charge of the timekeeping and labor accounts should, by performing his duty faithfully, protect the interests of the employer and employee by preventing the introduction or growth of irregular or improper practices, and by affording the management accurate information of the extent and purpose of expenditures for labor and the measure of economy that has characterized such expenditures, and by formulating such a system as will insure the payment to employees every cent earned.

In days gone by, when shops were small, men reported directly to their leader or boss, and there was neither roll-call nor checking in or out, but as time progressed and shops grew, and the number of employees outstripped the immediate supervision of the boss, the necessity of some system of checking the employees on and off duty became evident.

The systems devised varied considerably, each, no doubt, having its redeeming features, and one cannot overlook the fact that it is necessary to study the physical conditions of the immediate surroundings before the most suitable, efficient, and economical method can be decided upon.

My first experience was with the metal check system, a system which, to-day, boasts many advocates. Each employee is designated by a number upon the staff record of the time office, and upon passing in to work through the check office is given a metal check number to correspond with his number upon the staff record. This check he retains until passing out from work, when it is deposited with the check clerk, and so on.

*From a paper read before the Canadian Railway Club.

This method, however, proved to have its weak spots. For instance, it was virtually impossible to detect an employee depositing more than one check, thereby leaving a loophole by which he might assist a co-employee residing in the opposite direction to the check office or defraud the company by depositing the check of an employee who had decamped.

But the most serious objection arises from the fact that, in the case of a dispute regarding the allowance or disallowance of certain time, which disputes, as a rule, come up some little time after the occurrence, the evidence available, when boiled down, resolves itself into a deadlock of one man's word against another's.

As the shop buildings or repair yards became more dispersed and grew, the distance from the check office to the immediate location of the work also became greater, and, as a consequence, resulted in the loss of valuable time to both the employer and employee. Some measures were, therefore, necessary to overcome these weak spots. To establish a record of evidence by which to satisfactorily dispose of the question of disputes, and to overcome the lost time between check office and work, or, vice versa, by inaugurating some system of time registration right at the job. Hence the adoption of mechanical time registers or time clocks.

Form S. & M. A.

CANADIAN PACIFIC RAILWAY CO 190

Daily Time Certificate } Name.......................................

Clock ....No........ Rate..............

DAY WORK

CHARGE TO	Commenced Work	Foreman's Initials	Finished Work	Total Hours Day Work	VALUE

NOTE—When employee's full time is on Day Work. Foreman signs here ....

PIECE WORK

CHARGE TO	Commenced Work	Foreman's Initials	Finished Work	Total Hours Day Work	VALUE

Piece work hours checked in time office by.............................

Columns headed "Value" to be filled in by Timekeeper.

Fig. 1.

These registers or clocks are of various capacities, i. e., 50, 100, 150, 200, and 250 numbers, but for big shops and large staffs the most convenient register is one of 150 capacity. Each register is designated by a number, although in some plants the registration numbers of the clocks run in sequence from one up.

The system of registering, assembling, and accounting for the time recorded on the registers is as follows:

A successful applicant for work is given an order by the shop superintendent upon the timekeeper for a number upon the register. This order is made out giving the man's name in full, his occupation, and the name of the foreman under whose immediate jurisdiction he is to work. Upon presenting this order at the time office he is called upon to endorse it, so that there shall be no question as to the correct manner of spelling his name, and as a means of subsequent identification, if necessary. The order is taken up by the timekeeper and entered on the staff record and in the timebook of the register to which he is assigned. The timekeeper then gives the man a slip, carrying reference to the register number, and his number upon such register, and instructs him as to the correct methods of recording his time.

The registration or punching of the clock on and off duty by the men at the regular starting and quitting hours is supervised by a clock watcher, an employee who is selected for integrity and satisfactory service, and his ability to identify each and every man recording upon his particular register.

As each employee registers himself on duty at one of the regular starting hours, he is handed a day time card (Fig. 1) by the clock watcher upon which to record a statement of the various jobs upon which he is engaged. The clock watcher checks up the clock record, commonly known as a clock slip, with the list of employees assigned to his register immediately after starting time, morning and noon, and makes a list of the absentees or possible late arrivals for the foreman's information, thus enabling the foreman to lay out his work to meet such conditions.

Immediately before the men punch off duty finally at the regular shop closing hour, they deposit their day time cards, carrying a full distribution of their time, into locked metal boxes placed immediately adjacent to each register and in the commanding view of the clock watcher.

A late arrival wishing to start at an irregular hour, must first report to his foreman, at whose discretion he will be allowed to start or otherwise. If allowed to start he punches the clock and receives from his foreman a time-card, upon which the foreman has entered the starting hour.

Should an employee desire to quit work at an irregular hour, he must first obtain the permission of his foreman, who, in giving him permission, takes up the time-card and enters upon it the hour at which the man quits and instructs him to punch the clock, after which he gives him a pass-out order carrying reference to the permitted quitting hour, which order is delivered up to the gate watchman, who again records the time of delivery and turns the order into the time office.

By these methods the possibilities of an employee omitting to register himself on or off duty, at the regular shop hours or at an irregular hour, are practically eliminated. Should an omission occur, however, it is promptly detected in the time office, where the clock slips and the time-cards are compared, and any inconsistencies are immediately reported to the shop superintendent on a form specially provided for the purpose. The matter of the omission is then taken up by the shop superintendent with the foreman, and he in turn with the employee, for an explanation as to his violation of the regulations. If satisfactory, the foreman is then required to make a declaration, Fig. 2, that to his personal knowledge the said employee was on duty between stated hours. The allowance of the unrecorded time is allowed or disallowed at the discretion of the shop superintendent, based upon the facts of the case. Should, however, a man become a frequent offender, he is dismissed.

Every employee becomes his own timekeeper; you have his registration upon the clock borne out by his signed declaration on his time card, and the check of the clock watcher, which is verified by the timekeeper.

Labor Distribution.

As in the case of time registration, there are various methods in vogue of taking up and distributing shop labor to the accounts upon which it is expended. The first method that I experienced was that of time distribution clerks making the rounds of the shops with the time distribution books once per day and taking up the distribution of the time worked the previous day; a page was assigned to each man, the description of the work performed and number of hours, etc., recorded in the column headed up for the purpose. By this method a competent distribution clerk could take up the distribution of, on an average, 250 men. Barring clerical errors and lapses of memory on the part of employees, this method should give a correct distribution of the pay roll, but to draw off the distribution and assemble it to the individual jobs entailed a great deal of clerical work at the close of the month or at any time when it might be required to know the cost of any specific job to date. By a reversal in the headings of the time distribution book, that of assigning a page or pages to the job instead of the man, the distribution clerk's capacity was increased about 100 per cent, and the

Form S. & M. A. 7

CANADIAN PACIFIC RAILWAY COMPANY.

CERTIFICATE OF UNRECORDED SHOP TIME.

To

MASTER MECHANIC.
SUPT. LOCOMOTIVE SHOPS. STATION..................
SUPT. CAR SHOPS.
ASST. MASTER CAR BUILDER. DATE..........190
DIVISIONAL CAR FOREMAN.

I hereby certify that................ Clock No.... ..

Check No.........reported to have omitted to register himself at..................was to my own personal knowledge on duty from............to..............

....

Foreman............Shop

To........................

Dept. of the Aud. of Stores and Mech'l Acct's.

....

I recommend that time be allowed to the above employee from.............to.........:....on..............190... in compliance with the Dey Register Regulations now effective.

........................190

....

Head of Department.

NOTE.—This Certificate must in all cases be signed personally by Head of Department and Foreman, otherwise time will not be allowed.

Fig. 2.

assembling operation decreased 50 per cent, and the aforementioned difficulty regarding cost of any job to date was largely obviated. Still, these methods were not altogether satisfactory; whenever the question of apparent excessive shop costs came up, the opportunity to excuse the shop management at the expense of the distribution clerks was always open, and in some instances the excuse was probably well founded.

By the time card system the responsibility cannot be conscientiously shifted. The approval by the foreman of the distribution given by the men upon their time-cards must be considered binding, also the capacity of the distribution clerks is increased so that they can handle the distribution cards of from 1,200 to 1,500 men. I have explained the method of collecting the time cards from the boxes, how the hours and rates are checked, and how the verification as to the accuracy of the distribution is obtained. Upon the cards being returned to the time office, after receiving the signature of the foreman, they are handed over to the distribution clerks who compute the value of the distributed hours by the wage rate on the card, transferring the distribution in dollars and cents into distribution sheets to the various jobs. This method removes the necessity of drawing off and assembling the distribution; as a matter of fact, a weekly progress report, or, in other words, a daily or weekly distribution of the pay roll, can be reported inside of twenty-four hours after the completion of the period, providing, of course, that there are no delays in the handling of the cards to and from the shops. Further, by following out the system in all its details, an absolute distribution can be obtained barring the possible value of cards delayed under investigation or the changing of an employee's rate during a broken period, and of which change the time office has not received the necessary approval. Periodical checks are made upon the distribution clerk's work by tabulating the value of the cards against the sum total of the entries upon the distribution sheet for any given period.

At the large plants a check of the men at their work is taken care of by shop constables or watchmen, whilst at the smaller plants where the distribution clerk's time is not entirely occupied with the cards, he makes the rounds of the shops. It is argued that the system of the workman writing up his own card is more costly than that of the distribution clerk making the rounds of the shops.

That too much time is lost, still if time is never lost to a better advantage than in giving a company an accurate accounting for the wages paid, there might be grounds for the contention. From my own personal experience I question very much if any more time is taken up by the men in making up their cards than in giving their time verbally to a timekeeper, and the incidental delays therein. For instance, in the machine shop it very often necessitates the stopping of a machine; in the blacksmith shop the smith will let his heat cool or fire die down, whilst in the boiler shop it often happens that a whole gang has to be silenced before a timekeeper can get a hearing, and so on . This, coupled with the discussion of various matters of mutual interest, causes a loss of time over which the shop management has little or no control.

Contract Work.

I wish to state briefly that the method by which employees doing contract work record themselves on and off duty, and that of reporting the distribution of their time, is the same as if working day work with the additional check of the contract timekeeper. And, further, that whilst it is very undesirable that an employee should work both day and contract work, it cannot always be avoided, and to meet this contingency the foreman is required to initial the time card at the time the change is made from contract to day work, or vice versa. I will not dilate further upon the question of methods of taking care of contract time, checking the output, and the general merits of the various systems and schemes which afford sufficient material for a paper in themselves, and with which it is hoped a member of our club will some day favor us.

Evolution of the Brake Shoe*

As a chain is no stronger than its weakest part, so also is the air brake mechanism no stronger than its weakest integral part. At one time this point of failure was the brakeshoe, but, thanks to the intelligent efforts of progressive manufacturers, such is no longer the case. From the wooden shoes used in the early days of railroading to the present standard shoe of cast hard iron and expanded mild sheet steel is a long jump, bridged by successive betterments in the form and ingredients of this most useful article of train equipment.

No doubt a brief history of the brakeshoe will be interesting. Prior to 1850 wooden shoes were universally used, the low speed and slight tonnage of the trains permitting the satisfactory use of brake blocks of oak, hickory or any other hard, tough wood. But the steady development of the arteries of commerce necessitated changes in the brakeshoes as in other equipment. The heavier trains, greater speeds and steeper grades confronted as the railroads reached forth over the mountains to the fruitful valleys proved too much for the wooden shoes, which were constantly igniting from the friction of the harder applications.

So, from 1850 to 1860, most of the railroads, as the wooden shoes became worn out, replaced them with shoes partly of wood and partly of wrought or cast iron. It is also recorded that stone brake blocks were tried out on at least one railroad. For several years, on the principal roads in this country, wrought iron strips riveted to cast iron blocks were used as brake shoes. During this period the cast iron wheel was in universal use. These composite brake blocks, on account of the expense of maintaining them, were superseded by cast iron ones. The action of the wrought iron faces of the composite brake blocks on the wheel tread was very severe.

The first case iron shoe was patented by Stephen Morse in 1853 and shows a combined head and shoe of cast iron. One of the elementary requirements of brakeshoe practice is to keep the shoe as cool as possible, that it may stand up to the work required, because, after all, heat is the enemy of the brakeshoe as well as of the wheel, and it is of vital importance, for the success of both, that the temperature be maintained as nearly normal as possible. To this end Morse designed his shoe with a large, thin web at the back, having openings for air circulation and for cooling the broad surface at the back of the shoe by exposing it to the air.

About 1870 the question of power brakes began to be seriously considered, and this added impetus to the interest in braking mechanism, and the brakeshoe secured a due amount of consideration. But of the many patents taken out very few of the types have been adopted, the majority covering shoes which were impracticable or commercially impossible to manufacture.

Since the introduction of the all-metal shoe and head various improvements have followed in distinct lines:

First, in the development of the wearing portion of the brakeshoe to secure long life or durability.

Second, in the composition of the wearing face of the brakeshoe to secure retarding effect, without injury to the wheel.

Third, in the reinforcement of the body metal of the brakeshoe to secure the continuance of the shoe in service, by preventing the falling away of the parts of the shoe in case the body metal cracks.

Cast iron succeeded wrought iron in 1870. Experience with all kinds of material in brakeshoes ever since has only served to emphasize more and more strongly the good qualities of cast iron for the major portion of the brakeshoe. The first objection raised concerning the cast iron shoe was the short life or rapid wear, resulting in frequent renewals. To

*By Tom Hamilton in the Santa Fe Employees' Magazine.

secure greater durability inserts of wrought iron were disposed transversely at intervals along the wearing face. By this means the life of the brakeshoe was increased several times over that of the cast metal alone. But when steel tired wheels were put into service it was found that the action of the wrought iron inserts in scoring the softer steel tire was most severe, and these shoes were abandoned in favor of plain cast iron for use with such wheels.

In 1884, the rapid wear of the cast iron shoe having created dissatisfaction, another shoe was put into usage. This consisted of forming the brakeshoe of a hard iron cast against chill blocks, forming chilled areas at intervals in the wearing face. However, durability of the brakeshoe when obtained by chilled areas must necessarily be obtained at the sacrifice of some of the frictional qualities of the unchilled shoe, so, in 1896, what is known as the Corning shoe was put out, consisting of hard chilling cast iron with chilled ends, soft machinery iron being disposed in the wearing ends.

As another step forward in the development of the brakeshoe for the purpose of obtaining the maximum durability with the least sacrifice of frictional effect and strength to stand up in service, the Diamond "S" construction was brought out in 1897. This consists in casting hard iron about a bundle of expanded mild sheet steel. This produces a brakeshoe with composite wearing face of strong iron interlaced with strands of mild steel which interrupt the rapid grinding away of the cast iron, securing a high degree of durability with the least sacrifice of frictional effect. Also, by reason of the minute distribution of mild steel in the shoe face, there is no continued action of steel in any one part of the shoe and no injury whatever done to the steel tire.

As a brakeshoe having a body of hard iron chilled in places is structurally weak, the Streeter shoe was brought out in 1899 as an improvement on previous practice. The body is of soft nonchilling iron surrounding a continuous spiral insert of very hard white iron disposed in the wearing face. By this means a stronger shoe is obtained than where the hardness is integral with the body of the shoe.

An even better design, known as the "U" shoe, was introduced during the year 1900. It is an improvement on the other types of shoes using chilled areas for durability, in that those shoes having face chills are liable to crack across the face in a hard application of the brakes or when the shoe is struck a heavy blow, and, these hard sections being located along the face of the shoe, when a crack occurs the shoe is practically disabled, whereas in the "U" shoe the chill is applied on the inclined end from the back and the hardest part of the shoe does not come into direct contact with the wheel or receive the heat directly. Cracks are much less liable to occur in these chilled ends, and if they do occur, the shoe of the maximum durability as well as of high frictional qualities, owing to the large extent of unchilled metal in contact with the wheel.

The peculiar structure of cast iron, whereby granular particles are supplied to roll between the wheel and shoe and produce high friction, together with the non-flowing and even welding qualities of this metal by reason of which it will not injure the steel tire, and the fact that cast iron is plentiful and cheap, easily machined or cast into the desired shape, all combine to commend this metal for the brakeshoe. And, as before stated, the experience up to date and the efforts to provide better metal for the purpose than cast iron have not produced anything more satisfactory. The comparatively low durability of unchilled cast iron, its low tensile strength and weakness to resist shocks are the principal objections that can be raised against it for use in the brakeshoe.

The modern brakeshoe has a body of strong cast iron, a wearing face of cast iron—or a composite face of cast iron and harder or tougher metal in which the cast iron largely predominates—a back of tough, mild steel to which the body metal is firmly attached, and lugs or supporting points for the attachment of the brake head of tough steel and practically integral with the steel back. This construction provides a brakeshoe which retains all of the braking efficiency of the cast iron shoe, and the weakness of the cast metal and its liability to fracture under blows or rapid heating is corrected by the steel back, which holds the parts of the shoe together in the event of cracks occurring and permits the shoe to be worn to the limit before removal. To make the reinforcement complete and eliminate all possibility of failure either through the body of the shoe or at the connecting point or lug, the steel back and wrought lug were introduced in 1904. This completes the development of the cast iron brakeshoe to meet the demands of modern service. This type of brakeshoe is the logical result of the development of this particular part of the brake mechanism to meet the demands of modern railroad practice with its heavy loads and high speeds.

In addition to carrying a much heavier load than the car wheels, the driving wheels of the locomotive are forced along the rail by the steam pressure. The driving wheel must pull the train, and, to avoid slipping in starting, sand is spread on the rail, and this sand, in connection with the slippage on the rail, which is at times unavoidable, wears a groove into the steel tire which sooner or later must be turned true again in the lathe to be safe to run. The brakeshoe, rubbing along the wheel tread, must necessarily ruff off some of the wheel metal, and this fact has been recognized in the construction of the driver brakeshoe. Recognizing the fact that the shoe, which in the early days was of wrought metal, was assisting in the grooving of the wheel tread by the rail, the shoe was recessed over the limits of the rail wear and the bearing at the throat of the flange cut away. This permitted the shoe to move out of place on the wheel tread, and an improvement was patented by Ross in 1884 which recessed the shoe over the limits of rail wear on the wheel tread but left a lip on either side of the wheel flange as a guide to hold the shoe in place. This type of shoe came into general use, as it assisted in maintaining the proper profile of the tire.

The cast steel inner flange of the Ross shoe assisted the rail in wearing into the wheel flange at the throat, and as an improvement a skeleton shoe was designed in 1904, wherein the greater part of the flange throat wear by the shoe was avoided, the shoe metal being cut away and leaving only enough bearing to keep the shoe in position. This design permits a shoe of less weight and increased efficiency.

For locomotive driving wheels the shoe is of strong cast iron reinforced in its wearing face by cutting inserts of extremely hard steel, which are not annealed by the heat. These inserts are located so as to cover the tire beyond the limits of rail wear. The ends of the shoe are tapered and cast against a chill block in the mold, which leaves a hard, smooth surface to resist wear as well as to radiate the heat and prevent undue wear at the ends of the shoe. The back consists of a plate of mild steel, to which the body metal is firmly anchored. The attachments for the brake head are of mild steel made practically integral with the back, while the bolt holes are punched through the steel back. This construction provides a brakeshoe of high efficiency, durability and beneficial action on the wheel tread and one which can be safely worn to the steel back before removal is necessary.

For steel-tired wheels under engine trucks, tenders and coaches the best usage is a flange brakeshoe having a cast iron body with inserts for increasing the durability of the wearing face disposed along the outer tread and flange groove in the shoe face, supported by a steel back to which the body metal is securely anchored, and having wrought metal attaching lugs for the brake head. For cast iron wheels under freight equipment: An unflanged cast iron shoe supported by a steel back and having a wrought lug made practically integral with the back.

Many tests have been made, extending over several years, which have demonstrated the value of the steel back, as it practically doubles the life of the ordinary cast iron shoe and permits the brakeshoe to be made of hard cast iron with heavier inserts than it is possible to use in the unreinforced cast iron body. The shoe is not disabled by reason of cracks in the body metal and can be worn down to the steel back before the necessity of removal. It is a recognized standard on many of the trunk lines in this country on all equipment and is almost an absolute necessity where the high speed brake is used.

British Patent Revocation

The first revocation of a patent granted to a foreigner by Great Britain under the new patents act is announced. Consul Frank W. Mahin, of Nottingham, deeming the case of interest to Americans who hold or contemplate taking out British patents, as it points out a line of defense which is ineffective, reviews it as follows:

The case involved two patents granted to a German upon the same invention, a process of manufacturing thin imitation stone slabs or tiles. An exclusive license in this country was held by a Belgian company. It was admitted that the process had been carried on exclusively outside of the United Kingdom, but in defense it was stated that the company's factory in Belgium was sufficient to deal with the whole of its trade in this country and elsewhere, and that the articles could not be produced as cheaply in Great Britain as abroad, owing to the higher cost of labor and materials. It was also stated that the company had advertised in British trade journals that the owners were willing to dispose of the patents or to enter into a working arrangement with firms in Great Britain likely to be interested in the process, and had communicated with various British firms for the purpose of granting licenses under the patents or of selling the latter, but that no offer had been received in response. The decision of the comptroller-general is quoted, as follows:

The comptroller-general, in his decision, stated that in determining the question at issue regard must be had not only to the interests of the patentees, but also to those of the public, and that the mere fact that it would be more profitable or convenient to a patentee to manufacture abroad than in this country could not be regarded as a satisfactory reason for not taking the necessary steps for introducing the manufacture into this country. The patentees had taken advantage of their monopoly of sale, but had not availed themselves of their monopoly of manufacture, and, on the evidence, he could find no good ground for coming to the conclusion that there was any inherent reason why the patented process should not be carried on commercially in this country. It appeared that there was little, if any, difference in the prices at home and abroad of the materials used or in the facilities for obtaining them, and if the reason that wages were lower in other countries than in England was an insuperable bar to the introduction of the industry to this country it was difficult to understand how many industries which were carried on successfully in the United Kingdom continued to be carried on. As to the question of the advertisements and offers to sell the patent rights, he could not regard the fact that no answers were received as a satisfactory reason for not manufacturing in this country.

NO JUSTIFICATION FOR LENGTHENING TIME ALLOWANCE.

It seemed impossible to hold that a patentee could relieve himself of the duty of manufacturing in this country by the mere insertion at any time of a few advertisements and the sending round to manufacturers of a few circulars to which no replies were received. The advertisements and offers in this case were of the vaguest description, and gave no intimation of the terms on which the owners of the patents were prepared to treat beyond the statement that such terms would be reasonable. Dealing with a suggestion that patentees who had taken out their patents before the passing of the act should be treated with greater leniency than those who had since taken out patents, the comptroller-general pointed out that a year of grace had already been allowed under the act, and said that he could find nothing in the act which would justify him in lengthening it.

It had been contended by counsel for the patentees that the object of the section being merely to bring about the establishment of new industries in this country a patent might not be revoked under it unless it could be shown that the revocation would lead to the establishment of such new industries. In the present instance, if the patents were revoked it seemed to him impossible to say that a new industry would not be established in this country, where no royalities would be payable in respect of the carrying on of the process, but even if no such industry was started here their revocation would undoubtedly have one beneficial result, for it would free the trade in the patented article and enable French and German manufacturers to import it freely into this country, the effect of which might very possibly be to reduce its price and, whilst in no way preventing its importation from the Belgian factory, give purchasers an opportunity of selecting for themselves between the articles manufactured there and at other factories.

He had always regarded the object of the section as being to put a check on the practice, which was alleged to prevail very extensively, of taking out and maintaining patents in this country, not with any intention of working them here, but with the object of preventing the patented articles from being manufactured here and from being imported by any other parties than the patentees. If, on the evidence which had been submitted in this case, the two patents in question might not be revoked, he found it very difficult to imagine any case in which a patent could be revoked under the section. He could not see that any advantage would result from postponing the revocation for a further interval. If he were to allow any further opportunity to the patentees to comply with the requirements of the law, he would be establishing a precedent the practical result of which would be to encourage patentees to defer compliance with the requirements of the section until applications were made to revoke their patents.

Moreover, if it were true, as has been urged on behalf of the patentees, that they could not afford to work the patented process in this country, and that if they did they must raise the price to the consumer, it would be no real kindness either to them or to the public to delay the revocation of the patents. If the patents were revoked forthwith, as it appeared to him they should be, it was by no means improbable that some one else might undertake the working of the patented process in this country; but, whether or not such a person could be found, the trade would be freed and liberty given to import the patented article, not only from Belgium, but also from France and Germany and any other country in which it may be produced. He therefore ordered, subject to an appeal to the court, that both patents be revoked forthwith and that the patentees pay to the applicant in respect of the costs of his applications the sum or 45 guineas ($229.94).—Daily Consular and Trade Reports.

The Railroad Club—Its Worth*

The best answer as to the value of this association is given by your presence here at this minute, and a real wise man would stop his paper here and let you guess the rest to suit your individual inclinations. But there is a little something that can be said: Our association is made up, generally speaking, of practical railroad men from the operating, mechanical, engineering and roadway departments, and railroad supply men handling everything from steam derricks, steel ties, water columns, crossing gates and angle bars to locomotives, lanterns and ball-bearing jacks.

Now, these supply men are all good fellows, good mixers, but above all they are a mighty capable lot of men; each one thinks, or is paid to think, that his particular invention, or his particular car spring, window fastening, fusee, triple valve or monkey dung is the best and only real thing on the market, and where such men as Frank Barbey, Walter Leach and the worthy treasurer of the organization really settle down to selling goods, you can make up your minds they will change all your standards fourteen times in fourteen months. They will, for example, come to you with a first-class crossing-gate, which you can install for about $300, and as you have got only about 5,000 crossings it is a small matter, and you begin to put 'em in. After you have adopted this standard, some inventor who has the advantage of the previous man's experience improves on the improvement, and down comes the same Mr. Supplyman with such an innocent look on his face that you would think he never handled a crossing-gate before, and when he gets through with you another standard has been adopted, and so on to infinity. The persuasiveness on the part of the supply man is what enables him to join so many clubs and spend so much money in entertaining us; but, gentlemen, in this as in most everything else, the dear old public finally foots the bills. The supply man gets next to the road master, the bridge supervisor, the master mechanic and the superintendent, exploits his wonderful utility device, warranted to cut down your expenses 50 per cent, and if you buy two devices to cut out all expense, and gets the friendly interest of the lower officers, not forgetting the the section foreman if he is anywhere in reach; and when the time is ripe he approaches the railroad manager with a view to a sale. The "big boss" sends down through the routine channels an order to investigate and report, and he is so surprised at the unanimity of opinion that the road will have to stop running if the device is not put into use, that he immediately orders a supply and the trick is done. This illustrates the value of the association to a part of us.

There are advantages on the other hand: Some of the real railroad men know everything about the business, but most of us know but little about it; and when, through the necessities of the company or the grasping of some unexpected opportunity, we are placed in some supervisory position, the job carries with it such an unending mass of detail that we can only apply the knowledge gained in the past, and have little time to get beyond the business of the day. This is a word of progress, however, and the methods of business and the appliances for doing it will vary and improve from year to year until the end of time. Here is where the supply man comes in and proves himself a friend in need. It is his business to know what the best thing is for accomplishing a certain result. He is not tied down to the distribution of a pay-roll as between the elimination of grade crossings or the addition of a few ties to John Smith's side track, to the determining of whether a cross-head bolt should have a square head or a round one, nor is he obliged to explain to a fireman why he allowed him a day and five-tenths instead of a day and a half. He keeps in touch with all the best things in the market; and after we get so we know and trust him, he is really a great help to us; he keeps us posted as to what is going on, what the other fellow is doing, how he does it, what economies he makes in operation or maintenance, and thus enables us to get into the game and handle our business with greater efficiency and more economic results. The officials of one road rub elbows with the officials of another, they compare notes, they learn how one man does the same thing they are doing in a different way, and does with less actual labor or less wear and tear on their gray matter or reasoning powers, and the result to the employe is a capacity for greater responsibility, and to the company a more competent officer. This illustrates the value of the association to another part of us.

There is, however, something beyond and better than all of this, and that is the great humanitarian side of the question. Men are gregarious by nature, they are born with a desire for company, they want to be with some one they know and love and respect, with the mother who bore them, with the brothers, the sisters, the wife and their own children; in fact, men through all time and through all generations have sought and still seek the great heavenly chord of human sympathy. Men through all the ages have fought for great causes, for God, for religion, for national independence, for personal liberty, for life itself, and in it all has been woven the thread of sympathy of man for his fellow man. Health cannot be bought, riches do not bring happiness, power does not command love, and I tell you, gentlemen, that loyal friendship under the grace of God is the one thing that makes life worth living. Whenever good men come together, here or elsewhere, and are welcomed with a hearty grasp of the hand, a laugh, a kindly look, or a merry twinkle of the eye, it broadens their usefulness in the world, it heightens their stature of respectability, it increases their value as men of affairs, and it directly adds to the happiness of their homes, because whatever affects the men affects the steadfast affection of the mothers, the wives and children.

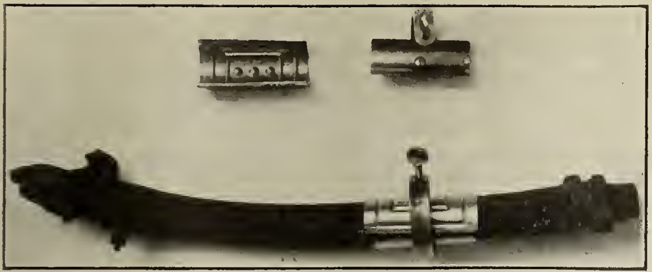
Therefore, I believe this association has done you good; if I have been able to raise even a smile from you or to give you a mite of food for thought, the time has been well spent. Everything that tends to the uplift of man's character tends to the uplift of the whole human race, and I am confident this thought illustrates the value of this association to all of us.

*A paper by A. W. Martin, Supt. N. Y., N. H. & H. R. R., read before the New England Railway Club, March 9, 1909.

An Ounce of Rust Prevention

Serious as is the problem of rust prevention in all branches of the iron and steel industries, and in all the ramifications of those which produce iron and steel commodities, comparatively little seems to be known about the subject, and less written about it. Most of those who have been confronted with the problem feel that whatever the process may be by which oxidation of iron or steel occurs it is a dangerous foe to the metal which it attacks. Many efforts have been made to evolve a means for checking its voracious consumption of our steel and iron structures and the machinery of iron and steel by which their production is made possible.

It is known that under the influence of atmospheric oxygen, carbonic acid and other agencies, iron and steel acquire a superficial coating which results from a combination of the metal with the agent in question. Rust or oxidation will inevitably appear on iron or steel, large or small, rough or smooth, unless the surface of the metal is protected by a suitable covering of some kind. Rust forms not only on iron exposed to the air and moisture, but on iron set in brick or concrete, or under water. Everything made of iron or steel is liable to oxidation, and therefore loss in appearance and strength.



Emergency Leak Stopper for Air Hose.

Wherever rust has once formed, its further occurrence is a natural sequence, and its prevention becomes impossible unless the affected parts are perfectly freed from all traces of oxide. The ultimate safety of a structure is not, as might be supposed, measured in the strength of large exposed members, but rather in the proper preservation of the smallest component parts, present in very large numbers in the larger members. An important function in all construction is discharged by the rivets, which unite plates, stays and girders. If rust is allowed to gain a foothold in the rivets and screws, the rigidity of the entire structure is imperilled.

While efforts at rust prevention have been centered in the problem of preserving structures built of steel, many other interesting phases of the same problem have been claiming attention as well. One of these demands for a rust preventive came with the necessity of protecting machinery and miscellaneous shipments of iron, as finished product, during transportation to different parts of the country and in storage afterward when awaiting use. It was necessary to give the steel such a coating of water shedding material as to form a rust preventing, impervious layer over the surface exposed. The substances used were those least susceptible to the influence of atmospheric oxygen, and consequently with the smallest tendency to form fatty acids, because these acids attack the metal and form with it a composition of a rusty brown color. Though tallow is a fat often used for greasing the surface of iron, it is one that very soon becomes converted into a rusty brown mass, and allows the iron to rust. Mineral oils give better results than either vegetable or animal fats A preparation which has been successfully used for years in this particular field is known commercially as Anti-Rust, prepared for the market by F. L. Melville, New York City. This product is semi-liquid in form, easily applied and not affected by changes of temperature. It is readily removed from the surface treated without resorting to the use of benzine or other cutting agents. Anti-Rust has given good results under all manner of severe tests, notably in the protection of iron from the corroding influence of salt water and in long continued open air tests .

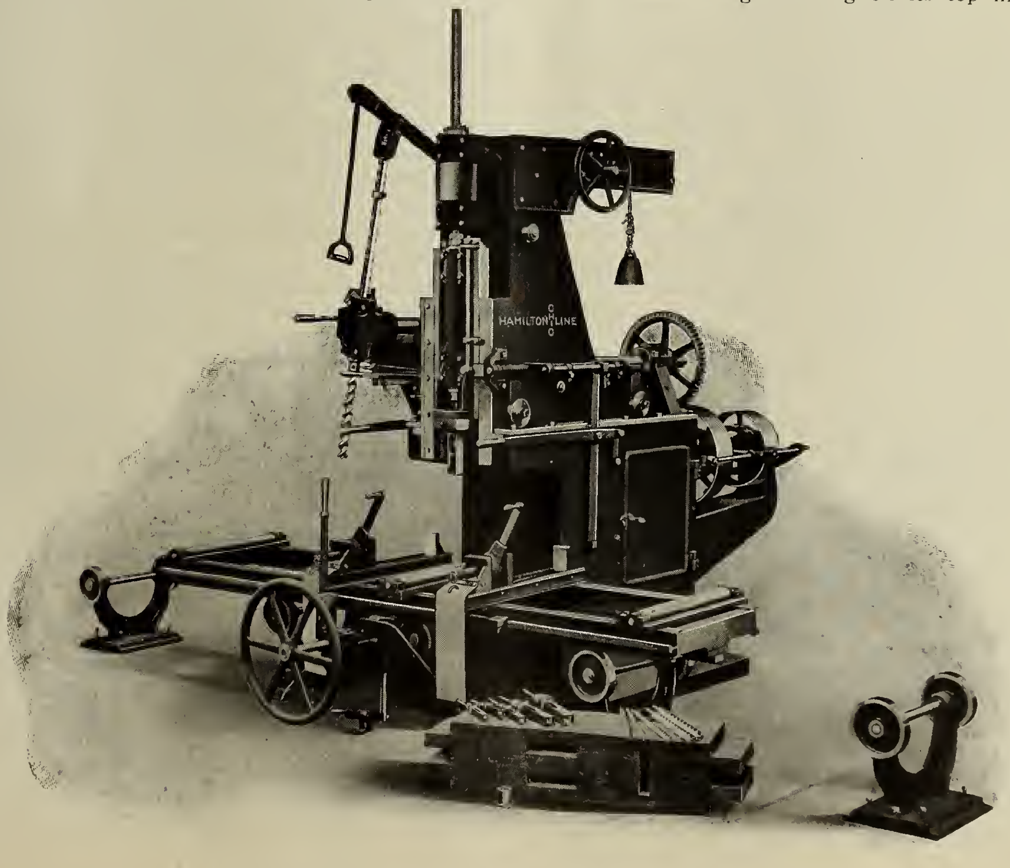
Emergency Leak Stopper for Air Hose

A leak in an air hose, occuring between terminals, is a state of affairs requiring prompt attention. It is not, however, always convenient to apply a new hose, and the appliance shown in the illustration is constructed to quickly stop the leakage of air from a burst hose with minimum delay to the train.

The device consists of a plate, five inches long, furnished with ridges which are embedded around the hole or leak, thus making an air-tight chamber, and a yoke and set-screw. The object is to use the leak stopper only until the train reaches the terminal, when the air brake apparatus inspector will apply a new hose. The leak stopper is then turned in to the storekeeper. The device is made of steel and can be easily carried in the pockets of the trainmen. The appliance is manufactured by the Kitzmiller Leak Stopper Co., of Harrisburg, Pa.

Car Mortising Machine for Heavy Work

A machine built for heavy mortising work in the railroad shop is shown in the illustration. The frame is a single cored casting with wide base and solid support for the table and carries the large housing on its top in square gibbed



Hamilton Vertical Automatic Hollow Chisel Car Mortiser No. 159

slides, supporting same by four rollers which roll on top surface of gib with easy movement by means of rack and pinion feed controlled by ratchet lever from operator's position. The housing requires no counterbalance, working quickly and easily in either direction.

The table consists of steel beam construction, very rigid, to carry the heaviest timbers, and mounted on large roller ways at every intervals. It will clamp material 20 ins. wide by 16 ins. thick, is provided with quick-acting eccentric clamps, and has both power and hand feed. Adjustable stops along the front, gauge accurately to length. The table is under full control of operator, through the power lever or hand wheel. It can be stopped or started instantly.

The chisel ram, 29 ins. long, mounted on front of housing in dovetail slides, is counterbalanced to take all weight from the working mechanism. The long closed cap box holds the boring spindle rigid for running at high speed without vibration, the driving pulley being carried between two boxes and sleeved in same full length. The spindle sliding in sleeve prevents wear of boxes and retains alignment against any heavy pull of belt which is controlled on pulley by two idlers, one being automatically adjustable to take up variation in belt length or position, owing to belt being crossed as it comes from the countershaft above. The chisel ram has a 17-in. vertical movement and 16-in. movement across carriage, mortising 6 ins. deep. The power is imparted by a train of gearing and reverse friction pulleys, all placed outside for ready inspection, adjustment, etc. Cutting speed of chisel is 13 ft. per minute with return double this speed.

The radial boring attachments can be used either on one side as shown, or on both sides, or may be omitted. They have 20-in. vertical adjustment, 16-in. transverse adjustment, and angular adjustment of 30 degs. either way. The machine is made by the Bentel-Margedant Co., Hamilton, O.

Trade Notes

Mr. Russel Dale, formerly sales manager of the Celfor Tool Company, is now the Chicago representative of the Carpenter Steel Company, of Reading, Pa., with offices in the Commercial National Bank building, Chicago. Mr. Dale is one of the well known and popular railway supply salesmen, having been sales manager for the Rich Manufacturing Company, which was later changed to the Celfor Tool Company, for the last few years. He introduced the Rich drill chuck and Celfor high-speed flat drills in many shops, both in this country and abroad. The Carpenter Steel Company is one of the largest manufacturers of high grade steels and wire in the country. Among their products are "Zenith," high-speed tool steel, T. K. alloy steel, Air Hardening steel, Fast Finishing steel, "Extra," "Standard" and "Comet" tool steels.

T. N. May, heretofore with the Brady Brass Co., New York, is now dealing in railway equipment and supplies, with office at 2 Rector street, New York.

The H. W. Johns-Manville Co., New York, has given the contract for 1,100 tons of structural steel for its new warehouse at Milwaukee, Wis., to the American Bridge Co.

The Automatic Car Coupler Co., Los Angeles, Cal., has been incorporated with $50,000 capital stock. The incorporators are F. R. Bonney, F. H. Norwood, W. H. Soale, K. Elliott and C. H. Wills.

The New York, Philadelphia & Norfolk has ordered a steel car float with a capacity of 30 cars, and also a seagoing steel hull tug boat. The present floating equipment of the N. Y., P. & N. consists of 11 car floats and 7 tugboats.

The Union Draft Gear Co., Chicago, has been incorporated to manufacture and deal in railway specialties, equipment and appliances; capital stock, $2,000,000. The incorporators are Matthew J. O'Brien, Daniel L. Madden and Francis O'Shaughnessy.

A. Munch, for the past eight years Sales Manager of the Northern Metallic Packing Co., St. Paul, Minn., has resigned. It is understood that Mr. Munch will take a vacation, after which he will become identified with a prominent supply concern.

The New York offices of the Baldwin Locomotive Works, Philadelphia, Pa., and the Standard Steel Works Co., Philadelphia, have been moved to 50 Church street. The New York representatives of both companies are Harry W. Sheldon and Frederick W. Weston.

Gustav Baurmann, President of the Phoenix Car Spring Co., Chicago, died at his home in Chicago on March 31 as a result of a stroke of apoplexy which he suffered nearly a year ago. He was born in 1857, at Louisville, Ky., and located in Chicago about thirty years ago.

A. R. Young, C. E., Western Agent of the Fort Pitt Bridge Works, Pittsburg, Pa., has resigned to become a member of the firm of W. R. Carter & Co., engineers and contractors, Lawrence, Kan. H. C. Breidert, C. E., of the Pittsburg office of the Fort Pitt company, succeeds Mr. Young, with office at Chicago.

The Rowe Perfection Sleeping Car Co., Seattle, Wash., has been incorporated with $20,000,000 capital to manufacture and sell a new type of sleeping car. It is intended to build a plant employing several thousand men. President, John Anthen; vice-president, Eugene E. Harold; secretary and manager, John L. Loughran, all of Seattle.

James MacMartin, Chief Engineer of the Delaware & Hudson, has resigned, effective about May 1, to become vice-president and general manager of the Elmore & Hamilton Contracting Co., Albany, N. Y. The contracting company has work under way on the Long Island Railroad, the Western Maryland and the New York city water supply system.

An organization in a city of Latin America engaged in the import and export trade would like to receive propositions and prices from contractors for furnishing the following materials: Locomotives, fuel, bridge material, rails, turn-tables, water tanks, telegraph and telephone supplies, trucks, concrete and cement block machines, wire and building materials of all kinds. (Inquiry No. 3250, Bureau of Manufactures, Washington, D. C.)

The General Railway Equipment Co., Chicago, has just been organized to do a general business in buying, selling and handling new and rebuilt railway and contractors' equipment, locomotives, cars, steam shovels, etc. I. J. Kusel, formerly president of the American Car & Equipment Co., Chicago, is president, and Thomas C. McCalla is secretary

The Cutler-Hammer Mfg. Co., of Milwaukee, makers of electric controlling devices, announce the opening of a district office in Cleveland, Ohio, 1108 Schofield building. The new office will be in charge of Mr. C. J. Kruse, who comes from the engineering department of the Cutler-Hammer company, and who is well qualified to advise regarding the proper device to use in any case involving the control of electric motors.

Captain Boggs, of the engineering department of the Isthmian Canal Commission, reports on the spreaders which have been in service two years as follows: "The ten spreaders furnished by the Mann-McCann Company surpass what was expected would be able to be obtained, as to strength and operating facilities, tending both to increase the volume of work accomplished with one movement of the spreader, and to obviate the delay by eliminating the breakages which occur more frequently in spreaders of lighter construction."

The United States Geological Survey in co-operation with the State Geological Survey, has established at the College of Engineering, University of Illinois, Urbana, Ill., a Mine Explosion and Mine Rescue Station. The purpose of the station is to interest mine operators and inspectors in the economic value of such modern appliances as the oxygen helmets and resuscitation apparatus as adjuncts to the normal equipment of mines. The station also will concern itself with the training of mine bosses and others in the use of such apparatus. Its service is to be rendered gratuitously, and so far as possible to all in Illinois, Indiana, Michigan, West Kentucky, Iowa and Missouri, who may desire the benefits thereof.

The annual meeting of the stockholders of The Union Switch & Signal Company took place March 9, in the office of the company, Westinghouse building. Owing to the absence of Mr. George Westinghouse in Europe, Col. H. G. Prout, vice president of the company, acted as chairman. The financial statement was read to the stockholders, and directors was elected as follows: George Westinghouse, Robert Pitcairn, William McConway, George C. Smith, Thomas Rodd, H. G. Prout, James J. Donnell. After the meeting, a representative of the company stated that they have at the present time on hand at Swissvale orders for unfilled business amounting to $1,357,000. New contracts for block signaling and other railroad safety devices are now coming in more freely than at any time during the last twelve months. Inquiries for quotations on new business are increasing right along and are spread pretty widely over the entire country.

The convenience of square holes and of square countersinks in certain classes of constructions has long since directed the attention of inventors to the problem of producing such holes in wood, metal, etc. at a single operation. We are now able to mention a device by means of which it is possible to bore such holes upon any ordinary lathe, milling machine, or drill press at a rate nearly equal to the speed at which ordinary round holes can be drilled with a flat or twist drill. A large number of these chucks have been sold in Germany to such firms as Freidrich Krupp, Siemens & Halske, etc., practically all of which are of the square hole type. The device is being introduced into this country by the Radical Angular Drill Company, who have fitted up a show room on the second floor of the Engineering building, 114 Liberty street, New York city, where they have the device arranged for demonstration on a milling machine of the ordinary type.

When a flood came and covered the floor of the machine shop of the Birmingham Iron Foundry, at Derby, Conn., those in charge were glad to note the practical working test that had been unwittingly given to a rust preventitive known as Anti-Rust, which had been used to protect the highly polished rolls of a 3-roll Calender, standing on the erecting floor. When the water, which had reached the height of the lower roll, had subsided, it was found on examination that the delicate surface protected by the Anti-rust was not harmed in any way.

The Railway Business Association, 2 Rector street, New York, issued a pamphlet on "The Story of Four Months' Accomplishment."

The February issue of "Graphite," published by the Joseph Dixon Crucible Company, Jersey City, N. J., contains many interesting notes.

Mr. B. J. Peasley, master mechanic of the St. Louis, Iron Mountain & Southern, at Ferriday, La., has been appointed master mechanic at De Soto, Mo., succeeding Mr. P. J. Conrath, resigned. Mr. W. S. Kenyon succeeds Mr. Peasley.

Mr. J. E. Irwin, master mechanic of the Marietta, Columbus & Cleveland, has resigned to become superintendent of equipment of the Indian Refining Co., Georgetown, Ky., and Lawrenceville, Ind., and the position of master mechanic has been abolished.

The Buckeye Steel Castings Co., Columbus, O., has opened an office in the offices formerly occupied by the Julian L. Yale & Co., in the Railway Exchange building, Chicago. Mr. C. B. Goodspeed will be in charge and Mr. F. J. Coolidge will be associated with him. They will handle the business formerly handled by the Julian L. Yale Co.

The American Car & Equipment Co., 1538 Monadnock block, Chicago, has announced the following changes: H. H. Sessions, president; C. R. Powell, vice-president; W. H. Horine, secretary and treasurer; B. B. Barry, general sales manager. Mr. I. J. Kusel has resigned as vice-president and disposed of his holdings in the company to Mr. H. L. Winslow, formerly of Julian L. Yale & Co.

Mr. Frank Miller, formerly engineer of the Julian L. Yale & Co., in charge of the sale and installation of steam heating appliances and the Miller locomotive hot water wash out and refilling system for roundhouses, has become associated with W. L. Miller Heating Co., Railway Exchange building, Chicago, as sales manager.

Mr. A. Munch, for the past eight years sales manager of the Northern Metallic Packing Co., of St. Paul, Minn., has resigned from that company, same taking effect April 1, 1909. It is understood that Mr. Munch will take a well-earned vacation, after which he will become identified with a prominent supply concern.

Horace L. Winslow, for a number of years connected with Julian L. Yale & Co. in general railway supply business, pipe engineering, etc., has opened an office at 730 Old Colony Bldg., Chicago, for a continuance of business along the same lines as heretofore handled. A corporation with $25,000 capital is being organized and Mr. Winslow will have some of the men formerly connected with Julian L. Yale & Co. associated with him. In addition to the old lines handled by Julian L. Yale, now deceased, Mr. Winslow will handle the Clark blow-off system for removing sludge from locomotive boilers and keeping them free from scale.

Mr. Willis C. Squire has recently been appointed district manager of the Central Inspection Bureau with offices in the Western Union Bldg., Chicago. This bureau is equipped to furnish competent engineers for all classes of railway, bridge and builders' equipment, and makes a specialty of designing cars, inspecting locomotives, passenger cars and freight cars. It has recently completed the inspection of some forty-four locomotives for the Argentine government and is now superintending the construction of a large amount of freight and passenger equipment for shipment to China.

The General Railway Equipment Co. has recently been established. This company will do a general business in the matter of buying, selling and handling new and rebuilt railroad and contractors' equipment: locomotives, coaches, cars, steam shovels, etc. Mr. I. J. Kusel, formerly president of the American Car & Equipment Co., has taken the position of president and general manager, and Mr. Thomas C. McCalla is secretary and treasurer of the company. Their general offices are located at 1535 Old Colony Bldg., Chicago, where they will be very pleased to meet their old friends and patrons.

Mr. W. P. Pressinger, who recently resigned as general manager of the compressor department of the Chicago Pneumatic Tool Co., has organized the W. P. Pressinger Co., to handle the vacuum cleaning machines, both portable and stationary, made by the Keller Manufacturing Co., of Philadelphia, Pa., and formerly sold by the Chicago Pneumatic Tool Co. The new company has opened offices and salesrooms at No. 1 West 34th street, New York City, and will establish local agencies at all distributing points throughout the eastern territory.

New Literature

"WHO MAKES WHAT"—Published by Daniel T. Mallett, 253 Broadway, New York. 300 pages, 7x10 ins. Price $1.00.

This book, as its title indicates, is a directory of manufacturers. And is divided into five parts as follows: Part 1—Directory of wholesale hardware houses and jobbers, United States and Canada, with the history of each establishment; Part II—Directory of more than 10,000 manufacturers, arranged alphabetically and geographically; Part III—Directory of products, arranged alphabetically, of more than 10,000 manufacturers; Part IV—Directory of important foreign merchants in all parts of the world; Part V—Directory of export commission houses and buyers in New York City.

* * *

PRACTICAL LESSONS IN ELECTRICITY, selected from the textbooks in the electrical engineering course of the American School of Correspondence at Armour Institute of Technology, cloth binding, 240 pages, 6x9 ins., illustrated. Published by the American School of Correspondence, Chicago.

Elements of electricity and the electric current are covered by L. K. Sager; electric wiring, by H. C. Cushing, Jr.; storage batteries, by F. B. Crocker

"This volume consists of four of the fifty-five regular textbooks in the electrical engineering course of the American School of Correspondence at Armour Institute of Technology, bound together in convenient form, but not in the order usually studied The purpose of the volume is to give the public an opportunity to judge of both the standard and the scope of the instruction offered, the elementary instruction being illustrated by the first half, and the advanced instruction by the last half, of the book. Although published primarily to demonstrate the character of the text-books of the school and representing only a fragmentary part of the complete electrical engineering course, yet it is confidently believed that this volume has in itself enough practical information to make it a valuable addition to the library of the expert electrician as well as to that of the amateur."

* * *

FORGING, by John Lord Bacon. Published by the American School of Correspondence, Chicago. Cloth binding, 106 pages, 6x9 ins., illustrated. Price, $1.00.

The book is a manual of practical instruction in the hammering, working, forming and tempering of wrought iron, machine steel and tool steel, including details of the modern process of electric welding.

The first part covers materials and tools, the second deals with typical forging operations and the third treats of miscellaneous forging processes.

* * *

The proceedings of the thirty-ninth annual convention of the Master Car and Locomotive Painters' Association were recently issued in book form and contain valuable papers and discussions on questions relative to car and locomotive painting. The secretary of the Association is A. P. Dane, B. & M. R. R.

* * *

The American Well Works, Aurora, Ill., has issued a folder illustrating samples of several types of machines which it manufacturers. Drilling machines and pumping engines are fully described and the pamphlet will be of interest to all concerned with deep well work.

* * *

The Jeffrey Mfg. Co., Columbus, O., has recently issued a pamphlet which describes and illustrates several of its new specialties, among them being the "Jeffrey Multi-Claw" bar and the "Lock-Jaw" wrench. The forge and foundries department of the Jeffrey company is a new department, organized to manufacture specialties of this kind, each of which has features of practical economy of general interest to the trade.

Instruction Pamphlet No. 5030, published by the Westinghouse Air Brake Co., Pittsburg, Pa., deals with the type "K" triple valve. As this type of valve is much ahead of the old style freight triple valves it will soon be adopted for freight equipments, and master mechanics and engineers will do well to secure the book and make themselves acquainted with the valve's action.

* * *

A book which is very interesting to all iron and steel workers has been recently issued by the Carpenter Steel Co., Reading, Pa. Color tables for tempering and hardening, with instructions, are an interesting feature. There is a large amount of general information and a price list of iron and steel shapes is included.

* * *

A recent publication issued by the McKeen Motor Car Co., of Omaha, Neb., presents some interesting particulars of the increasing popularity of gasoline motor cars with mechanical transmission, as made by that company. This type is now in use on the Union Pacific R. R., Central Pacific R. R., San Diego, Cuyamaca & Eastern Ry., Illinois Central R. R., Galveston, Houston & San Diego Ry., Erie R. R., Chicago & Northwestern Ry., Los Angeles & San Diego Beach Ry. and the Silver Peak (Nevada) Ry. McKeen cars have been in practical daily service for four years, during which time 36 have been built and are in operation. California heads the list with 151 cars, and another will shortly be sent to the Los Angeles & San Diego Beach Ry. of that state. Sixty cars are now under way at the shops of the company. Five of these new cars are 70 ft. long, have a seating capacity of 105 passengers, and each is being built to take the place of a steam locomotive and two or three cars. The regular 55-ft. car, which seats 75 passengers, will generally accommodate the traffic usually handled by a steam locomotive and one or two cars.

Personals

W. F. Ackerman has been appointed superintendent of the Haveleck shops of the Chicago, Burlington & Quincy.

W. E. Symons has been appointed superintendent of motive power of the Chicago Great Western, with office in St. Paul, Minn.

Geo. W. Robb has received the appointment of assistant master mechanic of the Grand Trunk Pacific.

Herman Rhoda, master mechanic of the Delaware, & Eastern, has resigned.

C. F. Buttress has been appointed master mechanic of the Hoton Interurban, the position being left vacant by the resignation of H. J. Kohlstedt.

James Blair has been appointed mechanical foreman of the Intercolonial.

H. L. Mackenzie has been promoted to the position of general locomotive foreman of the Intercolonial.

A. B. McDonald has been appointed general car foreman of the Intercolonial.

N. W. Maine has been appointed master mechanic of the Montana Railroad.

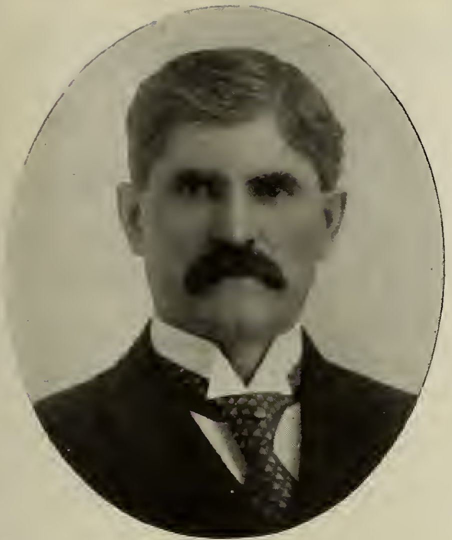
J. P. Gannon, master mechanic of the New York, New Haven & Hartford, has retired.

Samuel Smith has been appointed master mechanic of the Nevada Northern as successor to S. F. Deckelman, retired.

O. K. Cameron and E. M. Sweetman have been appointed master mechanics of the Northern Alabama.

A. Fortin has received the appointment of master mechanic of the Quebec Ry. Mr. Fortin succeeds Mr. W. Langford, who has resigned.

C. B. Smyth, assistant mechanical engineer of the Union Pacific, has resigned to accept the position of superintendent of the McKeen Motor Car Co., Omaha, Neb.



W. E. Symons.

W. F. Ackerman.

T. A. Lawes has been appointed master mechanic of the Southern Indiana with office at Bedford, Ind. He succeds G. A. Gallagher.

G. E. Johnson has been appointed master mechanic of the Wymore division of the Chicago, Burlington & Quincy with office at Wymore, Neb. He succeeds A. B. Pirie, assigned to other duties.

W. B. Embury has been appointed master mechanic of the Oklahoma & Pan Handle division of the Chicago, Rock Island & Pacific, succeeding W. J. Monroe, resigned.

A. B. Vaughan, mechanical foreman of the Lexington, Ky., shops of the Louisville & Nashville, has retired after 50 years of continuous service with the company. He is the second oldest employee connected with the system. Mr. W. B. Blue, engine inspector, will succeed Mr. Vaughan.

James Bleasdale, of Wilmerding, foreman of department D, of the Westinghouse Air Brake Co., has resigned to accept a position with the motive power department of the Baltimore & Ohio.

A. B. Pirie.

The office of Superintendent of Motive Power, Second division, of the Atlantic Coast Line, has been moved from Savannah, Ga., to Waycross. Mr. N. E. Sprowl, master mechanic at Savannah, has been appointed shop superintendent at Waycross, and Mr. W. J. Pamplin has been appointed master mechanic of the Savannah and Waycross districts, with office at Waycross, and jurisdiction over the forces at Savannah, Ga., Jesup, Brunswick Thomasville, Albany and Waycross, including enginemen and firemen assigned to these districts.

Mr. Edgar B. Thompson, assistant superintendent motive power and machinery of the Chicago & North Western, has been appointed superintendent of motive power and machinery of the Chicago, St. Paul, Minneapolis & Omaha, succeeding Mr. John J. Ellis, retired on account of having reached the age limit provided for in the pension system of the company. Mr. E. W. Pratt, master mechanic of the lines west of the Missouri river, at Missouri Valley, Iowa, succeeds Mr. Thompson. Mr. S. C. Graham, master mechanic of the Ashland division, at Kaukauna, Wis., succeeds Mr. Pratt. Mr. William Hutchinson, master mechanic of the Iowa and Minnesota division, at Mason City, Iowa, succeeds Mr. Graham and Mr. F. C. Fosdick, assistant division master mechanic, at Chicago, succeeds Mr. Hutchinson.

Mr. V. T Bartram of the Temiskaming & Northern Ontario Railway Commission, having resigned, position of purchasing agent is abolished. All matters pertaining to the purchasing department are now in charge of Mr. W. A. Graham, storekeeper.

Mr. D. Gallaudet, master mechanic of the Chicago division of the Baltimore & Ohio, has been appointed master mechanic of the Grand Junction Terminal of the Denver & Rio Grande, with jurisdiction over the Second district, Second division; also that portion of the Second district of the Third divison between Grand Junction, Somerset and Montrose, with office at Grand Junction, Colo.

Mr. E. A. Walton, division superintendent of motive power of the New York Central at Albany, has retired, and his duties have been assumed temporarily by Mr. Daniel R. MacBain, assistant superintendent of motive power at that place.

Mr. E. W. Pratt, master mechanic of the Chicago & Northwestern in charge of the lines west of the Missouri river, has been appointed assistant superintendent of motive power and machinery with headquarters at Chicago, to succeed Mr. E. B. Thompson, who has been appointed superintendent of the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at St. Paul, Minn.

Railway Mechanical Patents Issued During March

Lateral motion truck, 913,333—Edwin C. Washburn, Minneapolis, Minn.

Dump car, 913,357 and 913,358—Argyle Campbell, Chicago, Ill.

Railroad journal box, 913,360—Edward G. Caughey, Sewickley, Pa.

Car axle box lid, 913,371—Harry C. Gamage, New York, N. Y.

Locomotive pilot, 913,391—Walter E. Justis and Alexander V. Littrell, Roanoke, Va.

Car roof, 913,412—James Macker, Hammond, Ind.

Waste supporting attachment for journal boxes, 913,458—Robert A. Billingham, St. Marys, Pa.

Reinforced truck frame, 913,602—Leonard G. Woods, Pittsburg, Pa.

Locomotive tender truck, 913,609—William L. Austin, Philadelphia, Pa.

Car door hanger, 914,411—Joel E. Hill, Lexington, N. C.

Track sander, 914,425—Charles W. G. King, Philadelphia, Pa.

Engineer's alarm, 914,445—Edward McClintock, St. Paul, Minn.

Automatic coupling for air brakes, 914,512—George Ripma, Grand Rapids, Mich.

Train controlling mechanism, 914,521—John G. Schlee, Cincinnati, Ohio.

Lubricating device for journal boxes, 914,524—James G. Smith, Covington, Ky.

Brake beam, 914,530—Robert H. Thompson, Denver, Colo.

Draft gear for railway cars, 914,665—William R. Matthews, Pa.

Wall pocket for sleeping car berths, 914,701—Stewart W. Clark, Cincinnati, Ohio.

End construction for cars, 914,726 and 914,727—Bartholomew Julien and William Point, Omaha, Neb.

Convertible amusement and dining car, 914,748—Chismore H. Packard, New York, N. Y.

Passenger car, 914,751—Edward T. Robinson, St. Louis, Mo.

Drop door structure for cars, 914,786—Francis W. Bradley, McKees Rocks, Pa.

Velocipede, 914,845—Merrill L. Jenkins, Harvey, Ill.

Bogie for railway and the like vehicles, 914,889—Alexander Spencer, London, Eng.

Car coupling, 914,895—Samuel Sznutchko and Ellerslie W. Stevenson, Oakdale, Pa.

Car ventilator, 914,924—Samuel C. Carroll, Dallas, Texas.

Automatic car stop, 914,938—John J. Fleming, Carrick, Pa.

Fender, 914,985—John W. Sprint, Boyce, Va.

Draft gear for cars, 914,990—Nicholas H. Surdenik, Chicago, Ill.

Grain car door, 914,994—Daniel W. Thomas, New Holland, Ill.

Axle box for railway cars, 915,011—John B. Arrington, Grove Hill, N. C.

Means to prevent overturning of locomotive bells, 915,023—Clarence H. Foster, Pittsburg, Pa.

Braking device, 915,031—Van Buren Lamb, New Haven, Conn.

System of washing and filling locomotive boilers, 12,925—Spencer Otis and William White, Chicago, Ill. (Reissued.)

Mail carrier support, 915,102—Alvin A. Maurer, Dalton, Ohio.

Brake shoe, 915,119—Charles S. Shallenberger, St. Louis, Mo.

Air brake apparatus, 915,155—Henry F. Bickel, New York City.

Car dumping device, 915,179—Alfred E. Hoermann, New York City.

Outside car roof, 915,205—Peter H. Murphy, St. Louis, Mo.

Means for closing the entrances to and exits from passenger cars, 915,207—Joseph W. McMillan, Los Angeles, Cal.

Car lamp bracket, 915,216—John Rausch, Huntington, Ind.

Draft gear mechanism, 915,272—David F. Crawford, Pittsburg, Pa.

Car coupling device, 915,341—Richard D. Gallagher, Jr., New York City.

Outside car roof, 915,350 and 915,352—John J. Hoffman, St. Louis, Mo.

Running board saddle, 915,351—John J. Hoffman, St. Louis, Mo.

Turn table, 915,360—Fremont Kobler, Chihuahua, Mexico.

Draw bar and coupling, etc., 915,403—David A. York, Northgrove, Ind.

Brake shoe, 915,408—George M. Beard, Hanover, Pa.

Dump car, 915,419—Charles H. Doty and William L. Burner, Columbus, Ohio.

Mail bag delivering apparatus, 915,439—Frank H. Hougland, St. Louis, Mo.

Door for grain cars, 915,566—Lillie Dimick, South Whitley, Ind.

Mail bag catcher, 915,652—Oscar O. Ayres, Olathe, Kan.

Air brake system, 915,654—John S. Barner, Albany, N. Y.

Railway draw bar, 915,722—Harry L. Allen, Alliance, O.

Air brake triple valve, 915,723—Walter M. Austin, Swissvale, Pa.

Fluid pressure air brake, 915,724—Walter M. Austin, Swissvale, Pa.

Folding grain door, 915,739—Joseph E. Chantler, Lamar, Colo.

Dump car, 915,800—Frederick Seaberg, Chicago, Ill.

Car pipe line coupling, 915,894—Peter A. Senecal, Winnipeg, Manitoba, Canada.

Operating mechanism for train pipe valves, 915,907—Joseph M. Towne, East Orange, and Elmer E. Allbee, Arlington, N. J.

Train signal system, 916,038—Horace H. Sharpe and Willis R. Vanaman, Atlantic City, N. J.

Door for passenger cars, 916,045—Soren R. Skov and Terence Scullin, Cleveland, Ohio.

Locomotive ash pan, 916,150—Taylor W. Heintzelman, Sacramento, Cal.

Car coupling, 916,246—Daniel Alford, Cuba, Ill.

Nut and bolt lock, 916,285—Robert L. Elwood, Sr., and Robert L. Elwood, Jr., Monongahela, Pa.

Device for preventing accidents on railways, 916,342—Jacob M. Long, Los Angeles, Cal.

Passenger registering apparatus for cars, 916,359—James J. McDermott, Clifton Heights, Pa.

Car axle clutch, 916,377—Ernest C. Smith, Hinckley, Ill.

End gate for mine cars, 916,401—Frank C. Greene, Cleveland, O.

Railway car control apparatus, 916,405—John B. Atwood, Allegheny, Pa.

Brake hanger, 916,453—Charles H. Knobbs, Elizabeth, N. J.

Wick adjusting device for railroad lanterns, 916,534—Pontus H. Conradson, Franklin, Pa.

Location indicator for cars, 916,549—Emanuel Hagstrom and Gustaf Hagstrom, Lindsborg, Kans.

Locomotive engine track, 916,556—Clarence H. Howard, St. Louis, Mo.

Car underframe, 916,586—Harry M. Pflanger, St. Louis, Mo.

Dump car, 916,592—Herman Pries, Michigan City, Ind.

Brake for railway vehicles, 916,614—James E. Schumacher, York, England.

Railway crossing, 916,645—Powell O. Adams, Cameron, Tex.

RAILWAY MASTER MECHANIC

ESTABLISHED 1878.

Entered as Second-Class Matter June 18, 1895, at the Post Office at Chicago, Illinois, Under Act of March 3, 1879.

Vol. XXXIII Chicago, May, 1909 No. 5

CONTENTS.

Special Train for the Conventions

In accordance with its usual custom, the Pennsylvania Lines will furnish an electric-lighted train, to be known as the "M. M. Special," for accommodation of the members of the American Railway Master Mechanics' Association and the Master Car Builders' Association and their friends. The special will leave Chicago at 5:30 p. m., Monday, June 14th, and arrive at Atlantic City about 5:00 the following evening without change, and will be composed of modern Pullman sleepers, observation car, library smoker and two Pennsylvania dining cars. The fare for this occasion will be $26.00 for the round trip, tickets being on sale from June 1st with thirty-day return limit, which will permit of stop over at Philadelphia, Washington, Baltimore and Pittsburg, returning, but should there be a desire to take advantage of stopping at Washington or Baltimore, it will be necessary to so state at time of purchasing tickets.

Proposed Train for the President

A railway train, consisting of a baggage car and a private car for the exclusive use of the president, will be provided by the government if congress enacts into a law a bill introduced by Representative Dwight, of New York. The measure provides that the presidential train shall cost not to exceed $60,000, and in addition the sum of $25,000 is made available for the yearly traveling expenses of the president: "I believe this bill will be passed at the current session," said Mr. Dwight. "President Taft has planned to take extensive trips throughout the country during the next few years. He wants to see the people and the people want to see him. Under present circumstances the president is forced to pay his own traveling expenses. It is my belief that this expense should be borne by the government. The president should not only be provided with a train, but funds should be allowed with which to operate it."

The Idle Car Record

The car efficiency committee of the American Railway Association, in a bulletin giving a summary of surpluses and shortages from February 19 to April 14, states that the total number of idle cars on the date last named was 296,663, an increase of 63. There was an increase of 6,497 in box cars, and a decrease of 5,564 in coal and gondola cars. The decrease in flat cars is considerable, due to drafts on this class of equipment for construction purposes and in quarry trade. The results by groups differ from the grand total.

Raising Wrecks at Panama

The hull of a Belgian type ladder dredge, which was abandoned by the French in the Chagres River at San Pablo, Panama, has been cut into four parts, loaded upon cars, and will be hauled to La Boca. There the hull will be put together again and such repairs made as are necessary to put it in condition for service as the float of a marine derrick. A crane with machinery will be installed capable of lifting 25 tons. The chief use to which it is intended to put this floating crane is in removing old wrecks from the Canal prism between Miraflores and La Boca. These wrecks are old French dredges and other shipping sunk in the channel of the French canal near the crossing of the Rio Grande, or that had been laid up on the banks of the Rio Grande and had floated into the Canal at high water. Those that lie directly in the prism of the Canal will be blown up with dynamite and loaded upon barges to be towed out to the sea and sunk in deep water.—Canal Record.

General Foremen's Association

The International Railway General Foremen's Association will meet in Chicago, at the Lexington Hotel, June 1 to 5 exclusive. The headquarters will be established in the "Red Parlor," immediately off the parlor rotunda on first floor above the office. Members and guests are requested to register immediately upon arrival and receive a badge and program. The headquarters and general arrangements of the convention will be in charge of the executive committee of the railway supplymen.

The executive committee consists of: Frank Raymond Spear, chairman; Frank Baskerfield, Charles P. Storrs, Clifford A. Nathan, J. Will Johnson, secretary-treasurer.

Visiting members are requested to communicate with the hotel company direct for accommodations. Rates to members: Rooms without bath, $1.00 to $2.00 per day, single; $2.00 to $3.00 per day, double. Outside rooms with bath, $2.00 to $3.00 per day, single; $3.00 to $4.00 per day, double.

The meetings will begin each day at 9 A. M. and 2 P. M. Topical discussions will be made special order of business the last forty-five minutes of the morning session each day. The meetings will adjourn at 2:30 P. M. on the second day of the convention and the members will visit the railway appliance exhibition that will be on the parlor rotunda floor of the hotel.

Committees will report on the following subjects: Air brake equipment. Coaling of engines with mechanical devices, How to obtain the greatest despatch in handling engines through terminals, Installation of hot water washout and filling system, Best method of getting work through shop with economy and dispatch, Most approved type of ash pan conforming with requirements of Interstate Commerce Commission.

Topical Discussion.

1. Best method of arriving at cost of repairs, to be introduced by W. S. Cozad, Erie R. R., Meadville, Pa., followed by Mr. H. D. Kelly, C. & N. W., Chicago, Ill.

2. What class of repairs should be made at outside points where facilities are limited to be introduced by F. W. Rhuark, B. & O., Halloway, Ohio, followed by Mr. S. B. Clay, Frisco Ry., Ft. Smith, Ark.

3. The use of commercial gas for heating purposes in modern shop plants in place of gasoline or crude oil to be introduced by J. N. Davis, C. & S., Denver, Colo., followed by T. L. Drew, B. & O., Connellsville, Pa.

4. The use of oxy-actetylene process of welding fireboxes, boiler sheets, frames and other locomotive work.

5. The advantage, if any, which is derived from the use of the wide firebox over its predecessor, the narrow firebox, whether the wide firebox should be designed with a wide or narrow water leg and what should be done to overcome the present tendency to crack sheets under short periods of service, to be introduced by Lee R. Laizure, Erie, Hornell, N. Y., followed by P. F. Flavin, vice-president International Railway Boilermakers' Ass'n, St. Louis, Mo.

6. The location of the point of water delivery in the boiler, whether it would not be an advantage to deliver water at a point of six to eight inches above the mud ring just in the rear of the throat sheet than to deliver in the front end of the boiler near the flues, to be introduced by W. H. Kidneigh, Santa Fe, La Junta, Colo., followed by H. J. Carrier, Erie R. R., Huntington, Ind.

Mallet Articulated Compound Locomotives for the Southern Pacific Co.

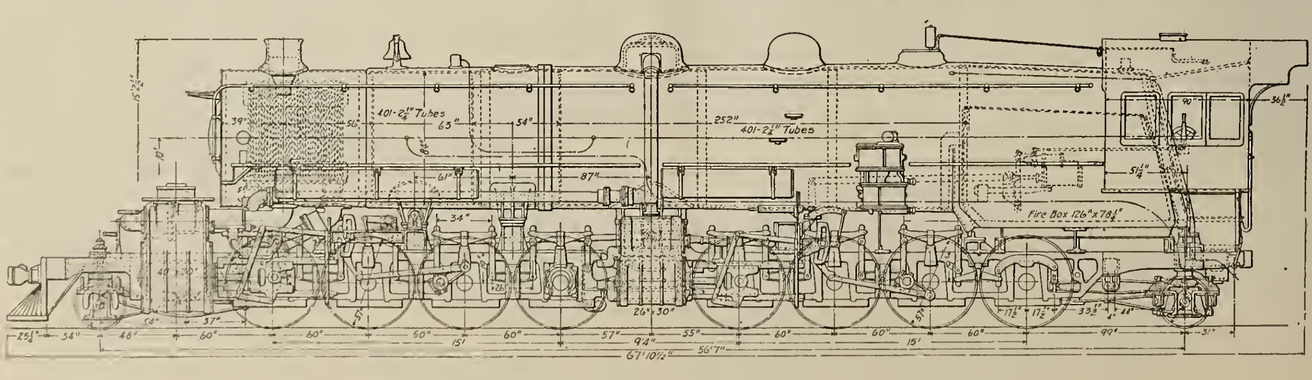
The Heaviest Locomotives in the World

The Baldwin Locomotive Works have recently completed for the Southern Pacific Company, two Mallet articulated compound locomotives, which are undoubtedly the heaviest engines thus far built for any railway. These locomotives have eight coupled wheels in each group, and in accordance with the previous practice of the builders, are equipped with two wheeled leading and trailing trucks. The constructive details embody various features of special interest. The calculated tractive force of this design is 94,640 lbs.

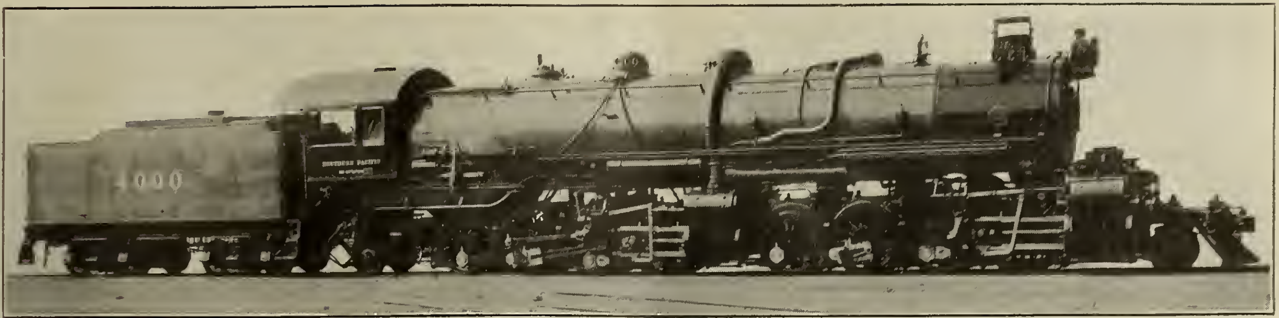
The boiler is straight topped, 84 ins. in diameter, and is equipped for oil burning. The fire tubes are 21 ft. long; they terminate in a combustion chamber, 54 ins. long, in front of which is a feed water heater 63 ins. in length. The tubes in the feed water heater are set in alinement with the fire tubes, and are equal to them in number and diameter. Two non-lifting injectors are provided, and they discharge, right and left, into the feed water heater chamber, which is kept constantly filled with water. The feed passes out through the top of the chamber, and is then delivered into the main barrel through two checks, placed right and left immediately back of the front tube sheet. A superheater, placed in the piping system between the high and low pressure cylinders, is located in the smokebox. The combustion chamber is provided with a man-hole, so that the tube ends are readily accessible.

In order to facilitate repairs, the boiler is provided with a separable joint, which is placed at the rear end of the combustion chamber. The joint is effected by riveting a ring to each boiler section, and uniting the rings by 42 bolts, 1¼ ins. in diameter. The rings are butted with a V-shaped fit. The waist-bearer under the combustion chamber is bolted into place, while the front waist-bearer and the high-pressure cylinder saddle, are riveted to the shell. The longitudinal seams in the barrel are placed on the top center line, and have "diamond" welt strips inside. Flexible stay bolts are liberally used in the sides, back and throat of the firebox, while the crown sheet is stayed with T irons hung on expansion links, in accordance with Associated Lines practice.

The dome, which is of cast steel, is placed immediately above the high-pressure cylinders, and the arrangement of the throttle and live steam pipes is similar to that used on heavy articulated locomotives previously built at these works. The exhaust from the high-pressure cylinders passes into two pipes which lead to the superheater. These pipes are of steel, and each is fitted, at the back end, with a slip joint made tight with a packed gland. The steam enters the superheater at the front end of the device and passes successively through six groups of tubes. It then enters a T-connection, from which it is conveyed to the low-pressure cylinders through a single pipe having a ball joint at each end and a slip joint in the middle. Each low pressure cylinder is cast separately, and is bolted to a large steel box casting, which is suitably cored out to convey the steam from the receiver pipe to a pair of short elbow pipes, making final connection with the low-pressure steam chests. The distribution is here controlled by 15-in. piston valves which are duplicates of those used on the high-pressure cylinders. The final exhaust



Elevation of Articulated Compound Locomotive, Southern Pacific Co.



New Articulated Locomotive, Southern Pacific Co.

passes out through the front of each casting, into a T-connection, which communicates with a flexible pipe leading to the smoke-box. The slip joint in this pipe is made tight by means of snap rings and leakage grooves. At the smoke-box end, the ball joint is fitted with a coiled spring which holds the pipe against its seat. The valves for both the high and low-pressure engines are set with a travel of 5½ ins. and a lead of 5-16 ins. The steam tap is 1 in. and the exhaust clearance 1-16 in. Reversing is effected by the Raggonet power gear, which is operated by compressed air and is self-locking. The gear is directly connected to the high-pressure reverse shaft. The reach rod connection to the low-pressure reverse shaft, is placed on the center line of the engine and is fitted with a universal joint located immediately above the articulated frame connection. The joint is guided between the inner walls of the high-pressure cylinder saddle. In this way the reversing connections are simplified, and when the engine is on a curve the angular position of the reach rod has practically no effect on the forward valve motion. This arrangement has been made the subject of a patent.

One of the locomotives is equipped with vanadium steel frames and the other with frames of carbon steel. The connection between the frames is single, and is effected by a cast steel radius-bar which also constitutes a most substantial tie for the rear end of the front frames. The fulcrum pin is 7 ins. in diameter; it is inserted from below, and held in place by a plate supported on a cast steel cross tie, which spans the bottom rails of the rear frames between the high-pressure cylinders. The weights on the two groups of wheels are equalized by contact between the front and rear frames, no equalizing bolts being used in this design.

The front frames are stopped immediately ahead of the leading driving pedestals, where they are securely bolted to a large steel box casting, previously mentioned, which supports the low-pressure cylinders. The cylinders are keyed at the front only. The bumper beam is of cast steel, 10 ft. long, while the maximum width over the low-pressure cylinders is approximately 11 ft. The boiler is supported on the front frames by two bearings, both of which have their sliding surfaces normally in contact. The front bearing carries the centering springs, and the wear is taken, in each case, by a cast iron shoe 2 ins. thick. Both bearings are fitted with clamps to keep the frames from falling away when the boiler is lifted.

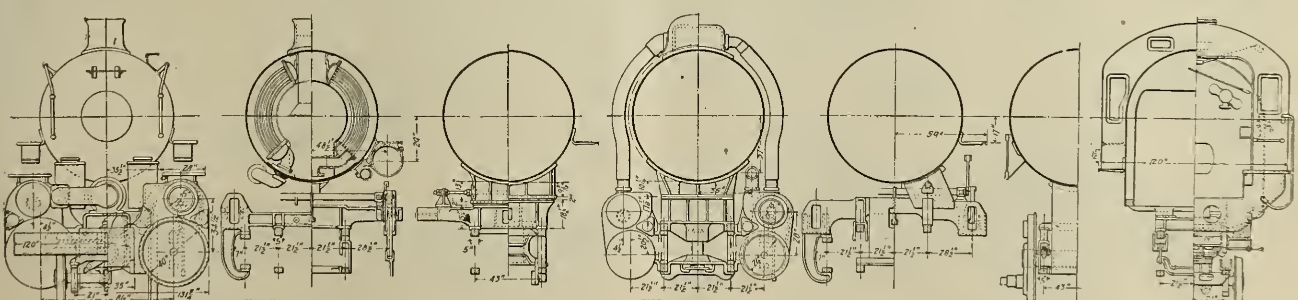
This locomotive naturally embodies in its design, many smaller details of interest. The cylinder and steam chest heads are of cast steel, the low-pressure heads being dished and strongly ribbed. The low-pressure pistons are also dished; they have cast steel bodies, and the snap rings are carried by a cast iron ring which is bolted to the body and widened on the bottom. The links for the low-pressure valve gear are placed outside the second pair of driving wheels, and are supported by cast steel bearers which span the distance between the guide yoke and the front waist bearer. The low-pressure valve stems are connected to long cross-heads, which slide in brackets bolted to the top guide bars. The locomotive is readily separable, as the joint in the boiler is but a short distance ahead of the articulated frame connection, and all pipes which pass the joint are provided with unions. The separable feature was tested by the builders, and proved entirely feasible. Sand is delivered to the rear group of driving wheels from a box placed on top of the boiler, and to the front group from two boxes placed right and left ahead of the leading drivers.

The tender is designed in accordance with Associated Lines standards, and is fitted with a 9,000 gallon water-bottom tank. The capacity for oil is 2,850 gallons.

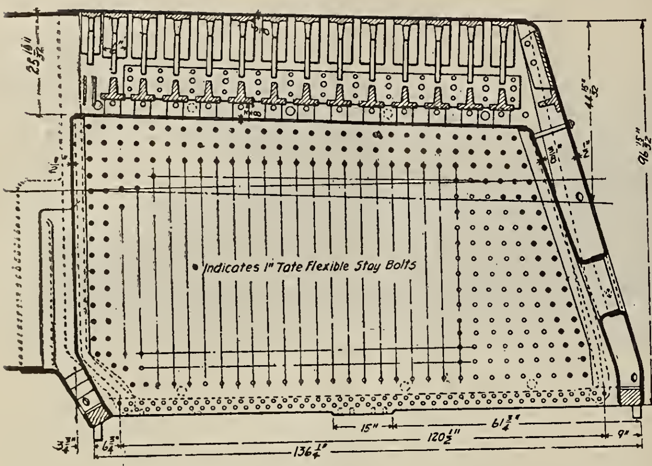
The detail parts of this locomotive have, where possible, been designed in accordance with existing standards of the Associated Lines. The engine is practically equivalent, in weight and capacity, to two large Consolidation type locomotives, and in spite of its great size, presents a pleasing and symmetrical appearance. The engine and tender trucks are equipped with "Standard" forged and rolled steel wheels.

The principal dimensions and weights are as follows:

Gauge .... 4x8½ in.
Cylinders .... 26 and 40 x 30 in.
Valves .... Balanced Piston.



Cross Sections of the Articulated Locomotive.



Longitudinal Section of Fire Box.

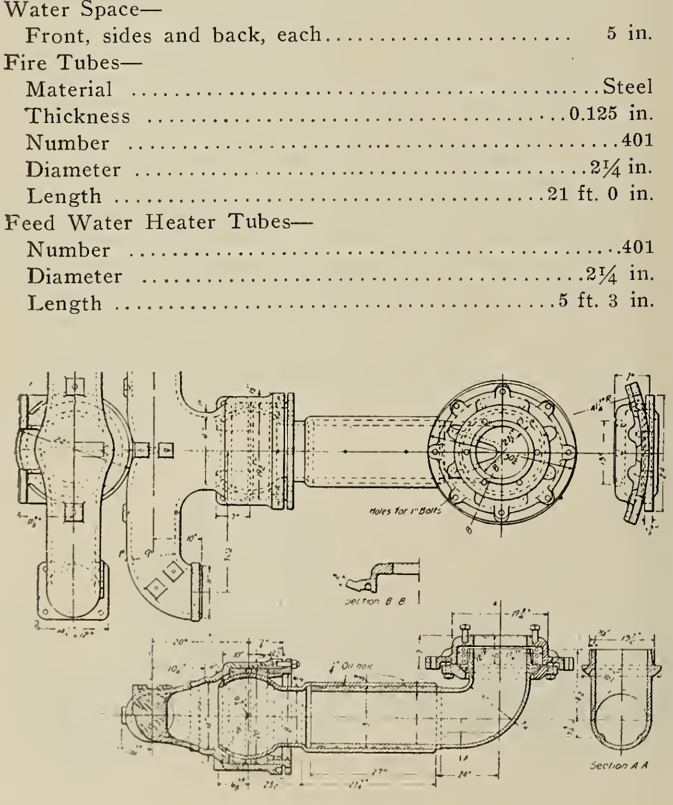
Boiler—
- Type .... Straight
- Material .... Steel
- Diameter .... 84 in.
- Thickness of sheets .... $\frac{13}{16}$ and $\frac{27}{32}$ in.
- Working pressure .... 200 lbs.
- Fuel .... Oil
- Staying .... T-crown bars

Fire Box—
- Material .... Steel
- Length .... 126 in.
- Width .... 78¼ in.
- Depth, front .... 75½ in.
- Depth, back .... 70½ in.
- Thickness of sheets, sides .... ⅜ in.
- Thickness of sheets, back .... ⅜ in.
- Thickness of sheets, crown .... ⅜ in.
- Thickness of tube .... ½ in.

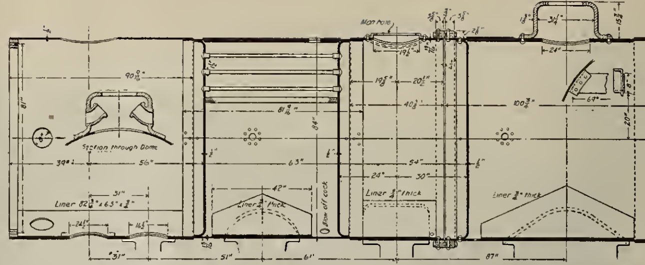
Water Space—
- Front, sides and back, each .... 5 in.

Fire Tubes—
- Material .... Steel
- Thickness .... 0.125 in.
- Number 401
- Diameter .... 2¼ in.
- Length .... 21 ft. 0 in.

Feed Water Heater Tubes—
- Number 401
- Diameter .... 2¼ in.
- Length .... 5 ft. 3 in.



Jointed Exhaust Pipe.



Section of Boiler Showing Combustion Chamber.

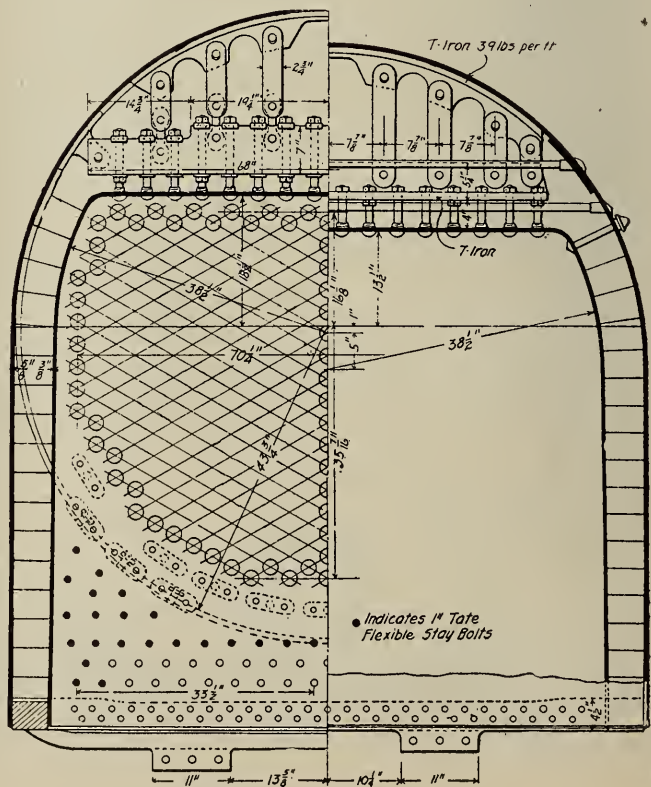
Heating Surface—
- Fire box .... 232 sq. ft.
- Fire tubes .... 4941 sq. ft.
- Feed-water Heater-tubes .... 1,220 sq. ft.
- Smoke-box—Superheater .... 655 sq. ft.
- Total .... 6,393 sq. ft.
- Grate area .... 68.4 sq. ft.

Driving Wheels—
- Outside diameter .... 57 in.
- Inside diameter .... 50 in.
- Journals, main .... 11x12 in.
- Journals, others .... 10x12 in.

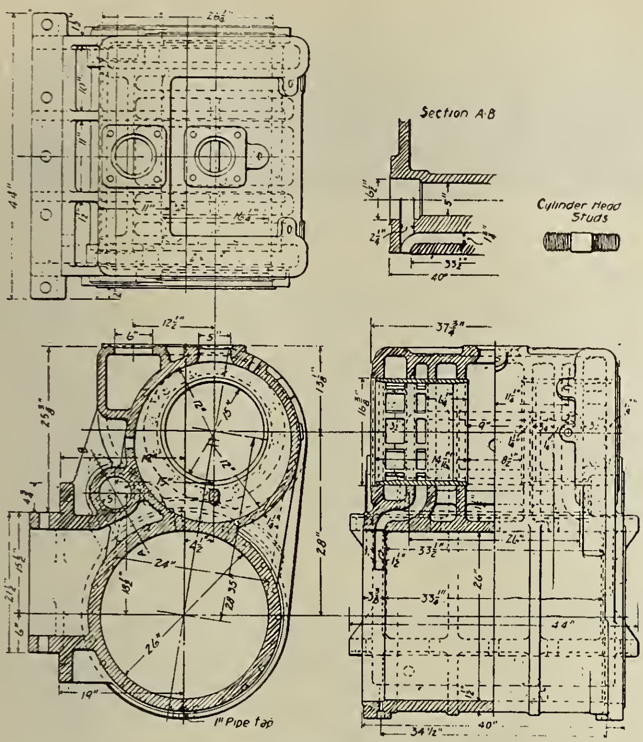
Engine Truck Wheels—
- Front diameter .... 30½ in.
- Journals .... 6x10 in.
- Back diameter .... 30½ in.
- Journals .... 6x10 in.

Wheel Base—
- Driving .... 39 ft. 4 in.
- Rigid .... 15 ft. 0 in.
- Total engine .... 56 ft. 7 in.
- Total engine and tender .... 83 ft. 6 in.

Weight—
- On driving wheels .... 394,150 lbs.
- On truck, front .... 14,500 lbs.
- On truck, back .... 17,250 lbs.



Fire Box Cross Section.



High Pressure Cylinder.

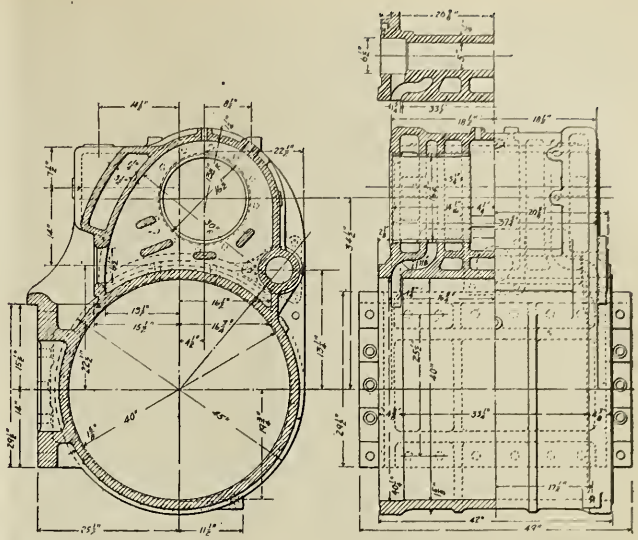
Total engine	425,900 lbs.
Total engine and tender	about 600,000 lbs.
Tender—	
Wheels	No. 8
Wheels, diameter	33½ ins.
Journals	6 ins. x 11 ins.
Tank capacity, water	9,000 gals.
Tank capacity oil	2,850 gals.
Service	Freight

Developement of the Mechanical Engineering Course at Wisconsin

By H. J. Thorkelson

The history of the development of the present system of courses given in modern engineering schools is very closely identified with the industrial growth of the country. It is not a great many years since all engineering works of any considerable magnitude required government support, and the engineers in charge were usually men who had been educated at the expense of the government. As civilization progressed, such undertakings were gradually assumed in part at least by private individuals, and the engineers in charge of these private enterprises were called Civil Engineers to distinguish them from the government engineers. As the duties and responsibilities assumed by Civil Engineers became more and more diverse, the necessity for different lines of study became evident, and special courses were given to those preparing to enter engineering fields in which comparatively little attention was paid to the construction of highways, bridges and aqueducts, and more was given to the development and application of the so-called mechanical powers.

Engineers engaged in this line of work were called Mechanical Engineers and still later, as this field of usefulness was further developed, Electrical, Chemical, Electro-Chemical and General Engineering courses have been established in many of our Engineering Colleges.

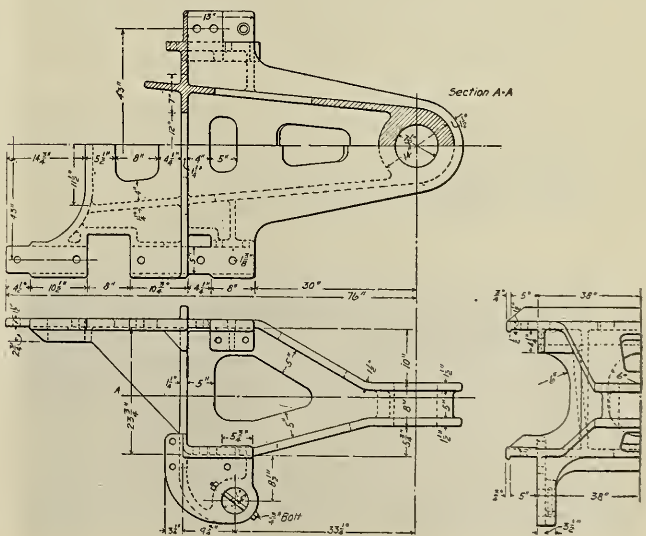


Low Pressure Cylinder.

Many educators have felt that this division has been carried to an extreme, and some colleges have recently reduced the number of kinds of degrees given, and are paying more attention to those studies which are fundamental to all engineering activities, realizing that at best they are equipping not engineers but men who will later, it is hoped, develop into engineers of the highest type.

In technical education, as in other industrial activities, Germany leads, and the first schools in existence were opened there by the government for educating engineers. These were in reality at the beginning only elementary industrial or building schools. This type of school, however, formed the basis for the present high grade Technische Hochschule, the first being one founded at Berlin in 1799 and followed in Europe by many similar schools in Germany, Austria, Switzerland and other European countries. The wisdom of the adoption of this system of technical education has been demonstrated by the remarkable activity of these countries in industrial fields.

In the United States the first technical engineering school was founded in 1824 at Troy, New York. This, the Rensselaer Polytechnic Institute, was followed in 1846 and 1847



Radius Bar Cross Tie.

by the Lawrence and Sheffield scientific schools. Later, schools were founded at other eastern points, the most important one being the Massachusetts Institute of Technology, which was founded in 1861.

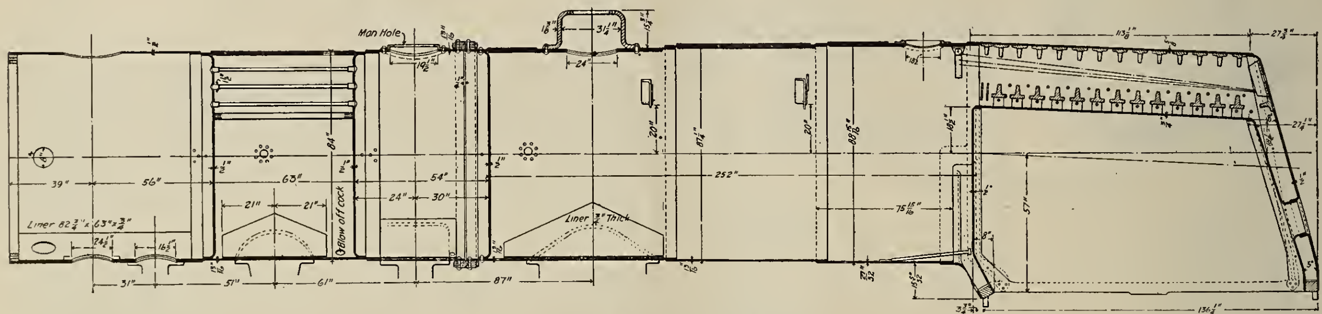
The passage of the Morrill land grant in 1862 resulted in the formation of agricultural and engineering schools in almost every state of the Union.

In Wisconsin, an examination of the alumni and faculty directory shows the first appointment of an engineering instructor in 1857, Mr. Thomas B. Coryell, serving for a year as Instructor in Surveying and Civil Engineering. In 1875 Mr. Allan D. Conover, who is now Chairman of the State Board of Control, was appointed assistant in civil engineering, and his promotion in 1879 to the position of Professor of Civil and Mechanical Engineering may well be considered the beginning of our present Mechanical Engineering course. The appointment of Mr. Conover was followed in 1877 by the appointment of the late C. I. King as Superintendent of machine shops and Instructor in practical mechanics, and in 1879, the late Storm Bull was appointed Instructor in Engineering. He was promoted in 1885 to the

New Round House at Richmond, Cal.

increased, and the present enrollment indicates that the future growth of the Mechanical Course will be even more rapid than the past.

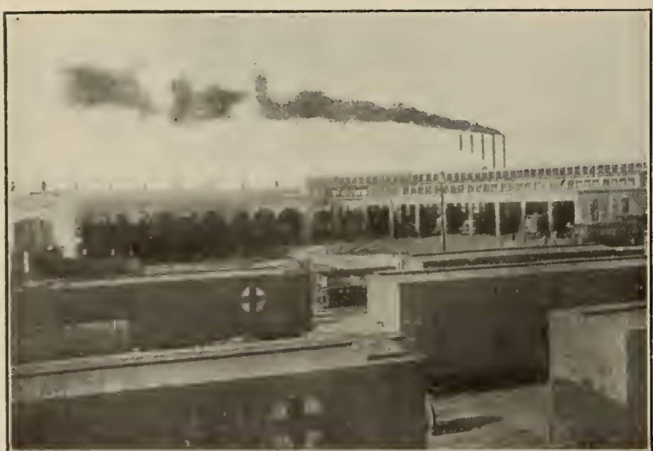
During this period of gradual development many changes have been made from time to time in the studies required for graduation. It is interesting to note that the important expositions of the world have been largely responsible for the early changes in the courses offered in the various engineering colleges. This is particularly true of such expositions as the one at London, 1851, that at Philadelphia in 1876, and still later the Chicago exposition in 1893.



Longitudinal Section of Boiler.

position of Assistant Professor of Mechanical Engineering, and from that time until his death in 1907 he was the practical head of the Mechanical Engineering Department.

In 1899 Professor J. B. Johnson was appointed as the first Dean of the College, and since that time the growth of the College has been remarkable. The first alumni to be credited as graduating from the engineering department were of the class of 1871, but strictly speaking were in reality graduates of the College of Letters and Science. The first graduate to receive the degree of Bachelor of Science, Mechanical Engineering Course, is the late Mr. Frank Challoner, who graduated in 1876. This degree was not conferred again until 1881, when Mr. J. N. Sanborn, now master mechanic of the Texas Southern Railway, received his degree. From that time on the number of graduates has slowly but gradually



New Round House at San Bernardino, Cal.

At Madison many new courses have been added year by year, and the standards required for entrance and for graduation have gradually been raised. The grade of instruction has also been improved, this improvement being brought about by the general policy of the University in endeavoring to secure strong men of national reputation as the heads of departments.

Among comparatively recent changes in the faculty may be mentioned the appointment of D. W. Mead, of Chicago, as head of the Department of Hydraulics. This change has resulted in considerable improvement in the method of presenting this subject to the students of the mechanical and other courses, and in the construction of a hydraulic laboratory, with an equipment that is unexcelled. Mr. J. C. Steen, who was for many years identified with the General Electric Company, has come from their Lynn, Mass., factory to take charge of the University shops, whose control is now in the Department of Machine Design.

The most recent change has been the appointment of Professor C. C. Thomas, of Cornell, to fill the position rendered vacant by the death of the late Professor Storm Bull. Professor Thomas is an authority on the subject of Steam Turbines and has invented and perfected the steam calorimeter which bears his name. His investigations on the subject of the specific heat of superheated steam have been immensely valuable to the engineering profession, and coming as he does with years of experience as a teacher and investigator, his appointment will add a great deal to the strength of our Faculty.

A number of very important changes have recently been made in the requirements for graduation. In the last three years the work given in the shop has been greatly modified, and students are now working under conditions that more nearly approach actual commercial requirements. For example, in lathe practice students are required to turn out work which must be up to standard, limit gauges being used in checking. The shop equipment has been greatly increased by turret lathes and milling machines of the latest type.

Perhaps the most important recent change has been the reduction of the number of fifths given. It has been felt that the requirements of the sophomore year were more severe than those of other years, and all courses in engineering for the second year have been reduced by the elimination of sophomore language.

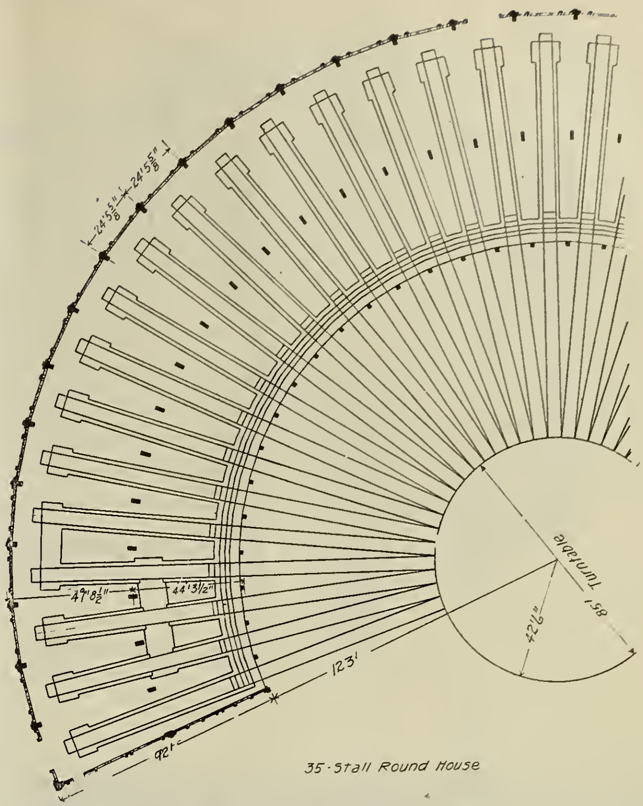
In the junior year the course of valve gears, which has been required for a number of years, will be dropped this year for the first time. Some work will be given in valve gears, but this will only serve as part of a larger course covering boilers, engines, heaters and all the essentials of a steam power plant. In the senior year the course in steam engine design is no longer a required course. Last year a course called commercial mechanical engineering was started for the first time, and the results seem to warrant more stress being laid on the commercial point of view. In this course, which is given throughout the year, lectures are given on the subjects of patents, shop organization and power plant, design and operation, these lectures being given by several different members of the University Faculty. This work is accompanied by problems and drafting room work together with considerable computation in estimating costs of manufacture and in appraising the value of plants in existence. A new course in computing the more important parts of steam engines, steam turbines, gas engines and producers is given this year to the senior engineers for the first time by Professor C. C. Thomas.

The character of the work given in the drafting rooms throughout the four years has been greatly improved, the standards and requirements being much higher than in years past. Similar standards and requirements are held for all four years in the different drafting courses, and the results have been most satisfactory.

In addition to the changes outlined above, new courses are now offered in the college covering five years. The principal difference between the new five year course and the present four year course lies in the addition of about one semester of work in the College of Letters and Science and one semester in the College of Engineering. The requirements for graduation being higher, the Faculty has decided to give the M.E. degree to graduates of this course.

Plans are under consideration for the formation of a third course which will permit students to spend part of their time in actual shop practice probably in some of the larger Milwaukee shops before graduation. These plans, however, have not yet matured, but they show the spirit of the Faculty in their endeavor to turn out men with the best preparation possible, and men trained to meet present day conditions.

It has been felt by the members of the mechanical engineering faculty in considering these changes that considerable effort should be directed to the training of the judgment, and the studies are so planned and conducted as to encourage and develop original study and research on the part of the student before graduation. The work of the modern mechanical engineer is one involving considerable use of judgment, as many of the problems met are not capable of as exact mathematical analysis as problems confronted by engineers in other fields. The commercial point of view is one which is being emphasized more in the later years than formerly, and it is hoped that the results will prove beneficial. More stress in the earlier years is laid on the fundamental subjects of physics, mechanics and mathematics, and with the increased standards the character of the graduates who leave the University should be such as to equal the high standard set by our older alumni.



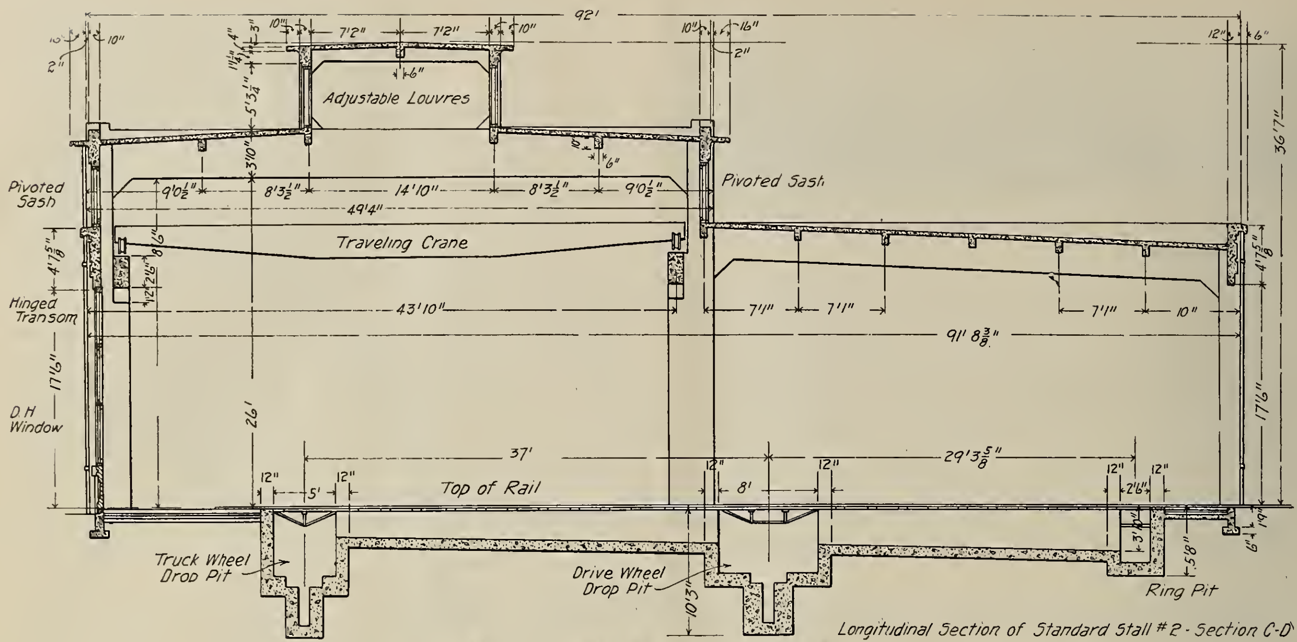
Half of Standard Round House.

Standard Construction of Terminals—A. T. & S. F. Ry.

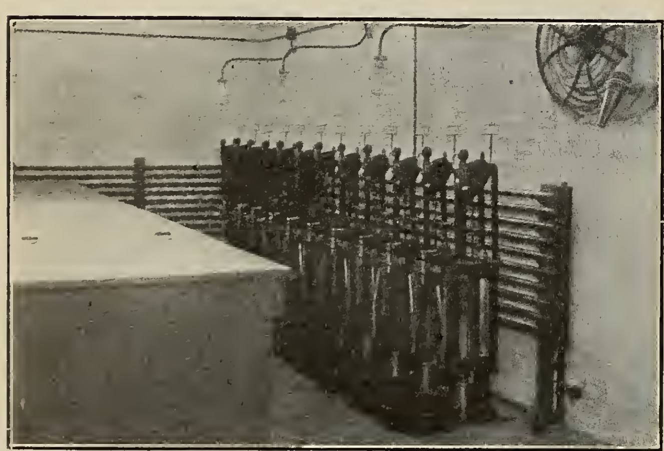
The mechanical officials of the Atchison, Topeka & Santa Fe Ry., have for some time past been making a study of division terminals with a view to standardizing the equipment and thus reducing the first and operating costs. The accompanying illustrations show how this work has progressed.

The mechanical difficulties incident to the operation of trains through the Southwest are well known and the conditions are practically the same for hundreds of miles. The opportunities for standardization are more frequent than those offered on most railroads. Of these difficulties it might be stated that along a very large part of the whole line the water is bad, along much of it the quantity is scanty, and for considerable distances there is none. For a thousand miles, from Gallup westward, there is no coal. For some hundred miles, including the sites of necessary and important division points, the climate is unfriendly, living is difficult, and labor is hard to get and harder to retain.

The roundhouse at San Bernardino, California, shown in one of the illustrations, is typical of the Santa Fe construction. The drawings show many of the dimensions used in the layout of this plant. It is the latest built and is regarded by many as one of the best engine houses in the country. The building contains thirty-five stalls, three drop pits for engine drivers and two for engine trucks; is amply equipped for boiler washing and filling facilities, with pipes for untreated water and for treated water; also with a steam line for firing up and a blow-off line which extends around the entire building. Metal lockers have been installed for the men, and the building is arranged for the installing of a traveling crane around the entire length of building. The building is pro-

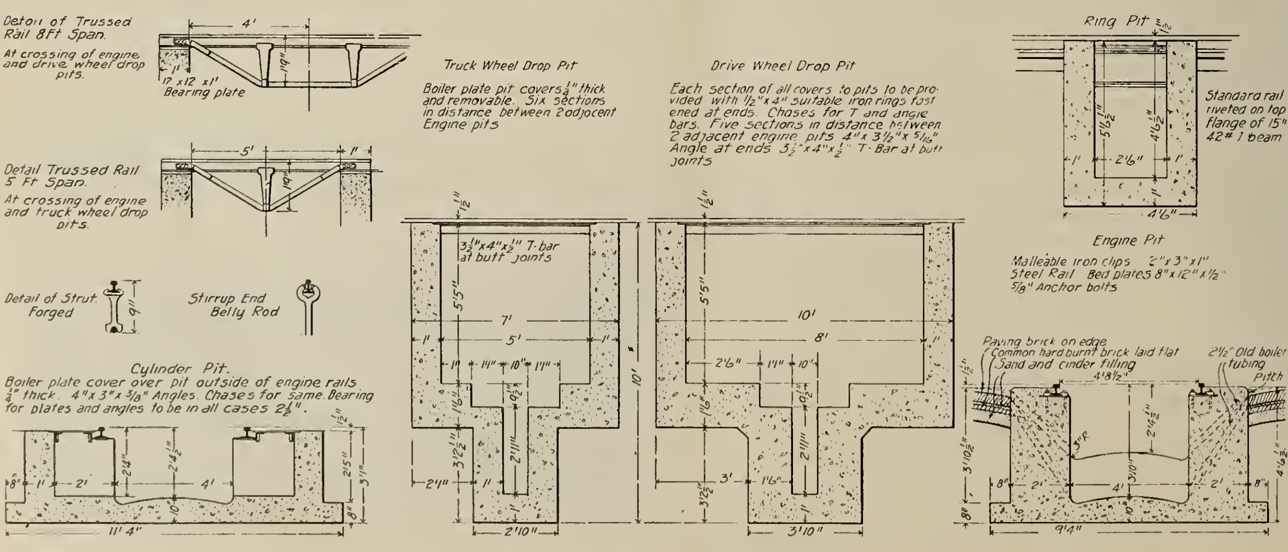


Section of Standard Roundhouse Stall.

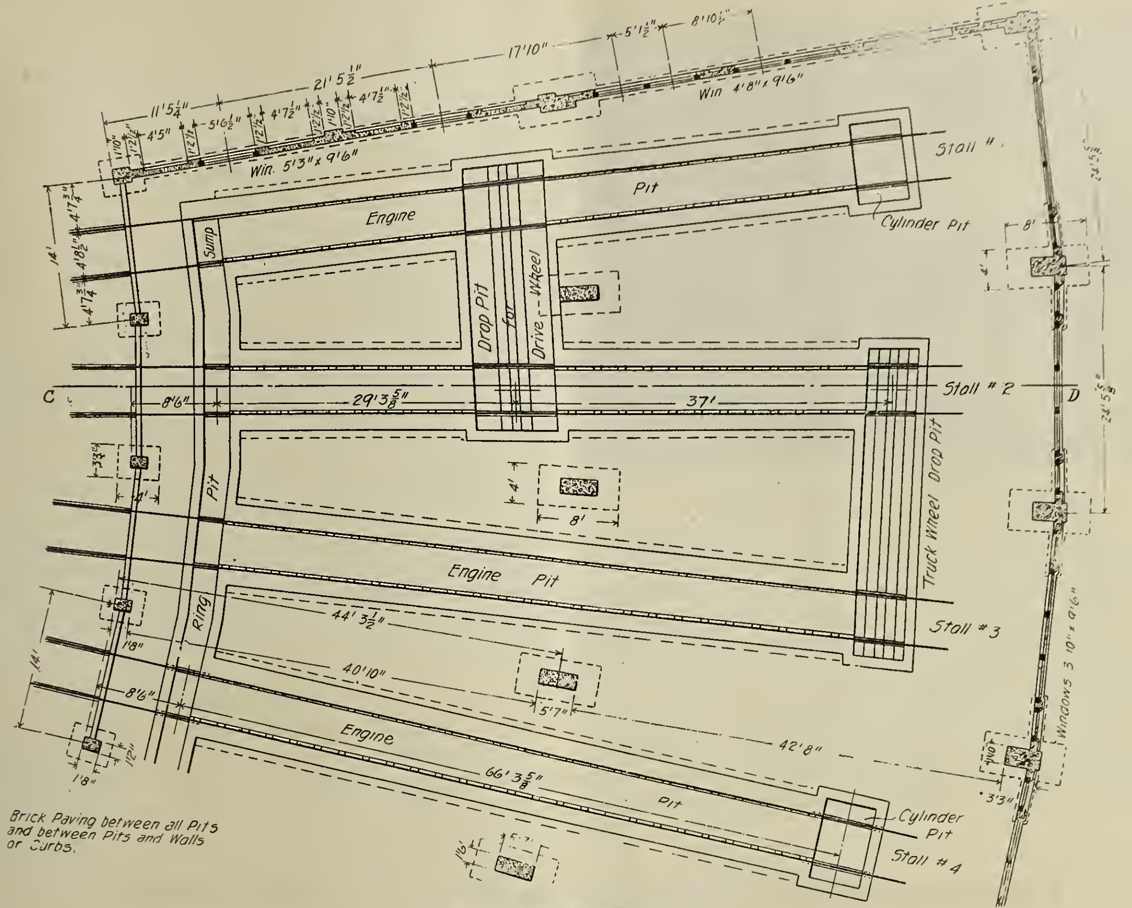


Oil Room, Chanute Storehouse.

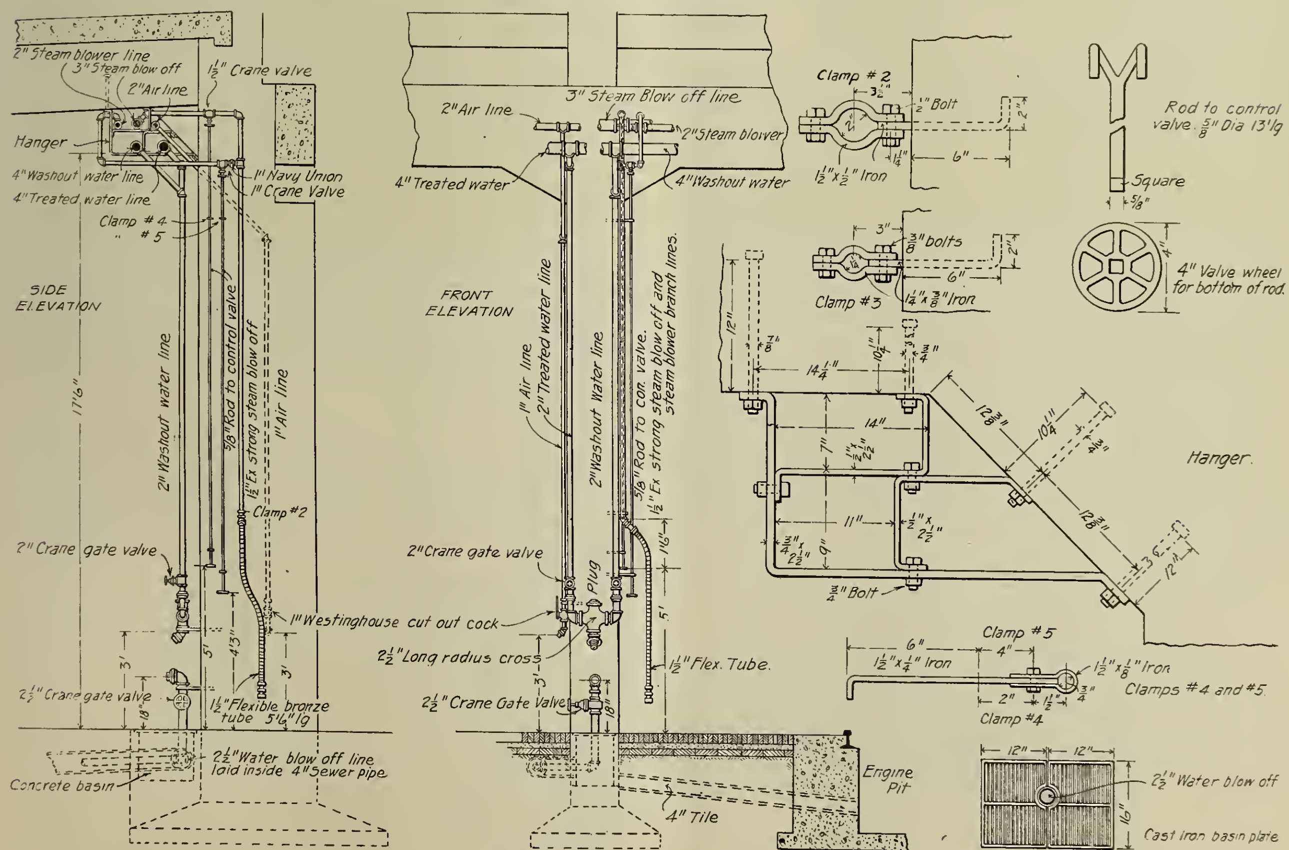
View in Round House at San Bernardino, Cal.



Details of Standard Wheel Pits.



Plan of Standard Stall.



Standard Round House Piping.

Interior of New Store House at Chanute.

vided with two in and out tracks, about 1,500 feet long, and one track extends from the roundhouse, through the tank shop and onto the transfer table, affording a convenient method of handling engines into the back shop. In connection with the roundhouse, the company has a water treating plant with a daily capacity of 300,000 gallons, and two oil storage tanks, each of 35,000 barrels.

An unusual illustration of older and newer designs is evidenced in the roundhouse at Richmond, Cal. As shown in the photograph, the old building has been extended by the addition of a section built along the modern standards, the left hand portion being the old building. The stacks of the power house appear over the roof.

In another illustration is shown an interior view of the concrete roundhouse at San Bernardino. The arrangement of piping is standard and the drops for washing and filling consist of three pipes, as shown. The center pipe is for steam, one of the outer pipes is for treated water for filling boilers and the third pipe carries raw water for washing. The temperature is nicely regulated in the mixer at the bottom. Arrangement for hot water washing with heat conservation is being installed in the newer houses. The design of the National Boiler Washing Co., is used in the Newton, Kans., roundhouse.

Standardization of terminal buildings has been extended to cover the construction of storehouses. The one at Newton, Kans., an exterior view of which is shown herewith, is a typical representation of present practice. An inner view of the storehouse at Chanute, Kans., shows the arrangement of shelving generally adopted.

Crane service adopted as standard for this class of terminal and as installed at Bakersfield, Cal., consists of a Whiting Foundry Equip. Co., 7½ ton crane, 44 foot span, to run on 65 lb. standard T rails. The traveling power is furnished by electric motors for 440-volt, 3-phase, 60 cycle, alternating current. The greatest load with the trolley at the end of the bridge is 16,100 lbs. The shipping weight is 27,600 lbs. The main hoist has a 7½ h. p. motor with a speed of 10 and 13 feet per minute. The bridge travel motor is 10 h. p. with a speed of 200 feet per minute and the trolley travel motor is of 5 h. p. with a speed of 80 feet per minute. The over-all height from the top of the crane runway rails to the highest point of trolley is 5 feet 4 in.

Developement in Air Brakes for Railroads*

In commencing this subject, we should like to state that the art of braking, or the application of brakes for the purpose of controlling trains, has received very little consideration outside of George Westinghouse himself and comparatively few scientific men throughout the world, and is therefore generally looked upon as the mere building of a piece of mechanical apparatus which can be applied in any haphazard fashion to the vehicle which it is intended to control. This, however, instead of indicating that the subject is a simple one, should be taken as evidence that the problems to be solved are exceedingly great, and we may say that there are comparatively few men in the world who comprehend what is involved.

One reason why the magnitude of this problem is not appreciated as it should be is the fact that the great majority of the men who have to do with the air brake are practical men —men coming from the ranks, with little or no technical education, and therefore working out the problems largely by the "rule of thumb" and "cut and try" methods and principles of the days before colleges were so numerous and education so easily obtained.

Now, however, the problems of deceleration, retardation and the flexible control of trains are receiving more and more attention from a scientific and technical standpoint, with the result that today theory and practice are being combined to produce the best results in the shortest time. This is necessary if the brake is to efficiently and satisfactorily meet the wonderfully changed conditions which have developed since the invention of the quick action, automatic brake.

Starting and stopping of trains are complementary factors in the problem of making time between stations, therefore it is evident that the best results can only be obtained where both factors are given due consideration. Generally, the starting factor is the only one fully considered, or, at least, the one more fully provided for, and this not withstanding that better results can be obtained if both are considered and the more efficient brake system installed.

In another sense, the question of stopping is the most important, as the safety of the service and the freedom of delays to a great degree depend upon it. The measure of the value of the brake is two-fold—1st, the ability to stop in the shortest possible distance when necessary; and 2nd, to permit short, smooth and accurate stops being made in regular operation, therefore both these factors should be considered when design is underway.

Unfortunately, the brake is usually looked upon as a safety device only, and we believe it is because of the prevalence of this idea that its installation and maintenance does not receive the consideration it merits. Considering the investment, there is no part of the railway equipment that will give greater material returns than the brake when properly installed, operated and maintained.

Few people have stopped to think that it takes a locomotive a distance of at least five miles to attain a speed of 60 miles per hour and what the consequences would be if it took as long to stop the train is illustrated in Figure 1. This curve was taken from the records of tests at Absecon, N. J., the train consisting of a locomotive and ten cars, the speed and momentum attained by the train in about six minutes, in a distance of about three and one half miles was overcome by the brakes in twenty seconds and in a distance of less than one thousand feet. The broken line represents what the stop would have been had no brakes been used. To build a

*From a paper by W. V. Turner and S. W. Dudley, read before the New York Railroad Club, April 16, 1909.

steam locomotive that would accelerate a train in the time that the brake stops it would be impossible.

As an example, however, of how little this is appreciated, we are often called upon to answer such a question as this, "In what distance should a train be stopped from a speed of fifty miles per hour?" Perfectly simple, isn't it? Here we have one known factor, from which we are expected, apparently, to derive all the other factors which are of equal importance and must be known before an answer of any value can be given to such a question. A few of these factors are: the light weights and loads of the vehicles composing the train; the percentage of braking power used with engine and cars; whether or not all wheels, including truck and trailer, (if any), of the locomotive were braked; what type of brake equipment was used; what pressures were carried; whether the train was accelerating or decelerating; on a curved or straight track; on an ascending or descending grade, or level; the condition of the rail; whether the brakes were applied in service or emergency, or ordinary service and then emergency; the piston travel on each vehicle; the losses due to friction of parts, brak beam release springs, etc.; wind resistance; quality and thickness of brake shoes. Furthermore, we do not mean to say that the precise effect of each of these could be accurately calculated, even though full information were at hand, and a little thought will make it evident that each of the factors mentioned above may have a considerable influence on the length of the stop.

The Application of the Problem.

The application of a straight air brake is comparatively a very simple proposition, although it has had to meet many varied conditions. But with the application of automatic brakes the problem becomes altogether different; many very valuable features possessed by the straight air brake had to be sacrificed to obtain the one prime factor in the braking of cars that is certainly nearest the heart of every manager of railway property in this country, that is, safety.

We may say here that with the automatic brake on connected cars a pipe runs through the train which is charged with air and is in communication with a triple valve under the car and that in turn with an auxiliary storage reservoir which is charged with compressed air for the braking of the vehicle on which it is carried, which in its turn is connected to the brake cylinder whenever the brake is applied. Consequently, if anything ruptures the pipe, thereby permitting the air to escape from the brake pipe side, but not from the auxiliary reservoir side, of the piston of the triple valve, the auxiliary reservoir pressure then acts upon the piston of the triple valve, moves it toward the lower pressure, carrying with it the slide valve, which in turn registers ports communicating with the brake cylinder, and the compressed air in the auxiliary reservoir then applies the brake. That is all there is to the automatic brake so far as its automatic feature is concerned.

When, however, the action of the brake on a rapidly moving train is carefully analyzed the factors affecting the final result are found to be most varied and complex in character. If the question were asked: "What stops a train?" no doubt most of you would say that it is the frictional force between the shoes and the wheels. No doubt that is the primary cause, but you can easily see that there must be some other factor in the case, because, if the rails were made of ice, for instance, it is obvious that the applications of the brake shoes to the wheels would not stop the train within a very long distance; it would simply lock the wheels so that they would slide, but not overcome the momentum of the train. If it were possible, when moving at a speed of, say, sixty miles per hour to lift the train from the tracks and then apply the brakes, you can readily see that the application would not stop the train. There must, therefore, be some other factor besides the friction of the shoes on the wheels, and that factor is the adhesion between the wheels and rail. Therefore, the highest possible retarding frictional force that can be obtained with a brake is such as would almost equal the adhesion of the wheels to the rail. If it is increased beyond this point, the wheels will slide, and, as you know, sliding friction is far less effective as a retarding force than rolling (static) friction, consequently, the stop would not be made in as short a distance as when the wheels are revolving, but being retarded by the friction between wheel and shoe. We have endeavored to produce with our brakes a means for obtaining the highest average braking power possible that will not slide the wheels under average conditions. That is all that can be done as far as brakes are concerned. You have heard, no doubt, of brake schemes whereby the apparatus would lock the wheels immediately in an emergency, and the train was thereby to be stopped in a shorter distance than by any other brake in existence. This is absurd, even if we neglect the flattening of the wheels that would result by such operation. The wheels must revolve; and in order to stop in the shortest possible distance the maximum braking power that will still permit this is required.

Not only must the brake dissipate energy due to momentum when bringing a train to a stop, but it must prevent the accumulation of energy, and this, at times, is its chief duty, as, for instance, when descending a grade. A train of 3,000 tons commencing the descent of a two per cent grade at a speed of ten miles per hour would, in three minutes, due to the acceleration of gravity alone, be moving at a speed of 64½ miles per hour and the kinetic or "wrecking" energy stored up in the train would be 417,500 foot tons, sufficient to raise the train to a height of 139.1 feet. Thus you see that the brakes must dissipate in three minutes 417,500 foot tons if the speed at the end of this time is not to be higher than at the beginning.

But the braking power at hand must be available not only for one application but for any number of them. With the automatic brake, the ability to recharge the auxiliary reservoirs has been the limit to the number of full applications obtainable. Therefore, in order to obtain the maximum possible safety with an automatic brake, two things are necessary. In the first place, the highest possible braking power; and in the second place, means of obtaining that power at any time, no matter how thoughtless or foolish the operator may be in wasting the air.

What has been said cannot fail to impress all of us with the importance of this problem of railroad operation, not only as affecting the safety of the passengers, the preservation of the freight, the protection of the rolling stock, but as also affecting economy of operation with respect to time and the earning power of both men and equipment, which is the important factor in determining whether the investment is profitable or otherwise. Obviously, the more congested the traffic the greater the loss in all these things if the brake, its maintenance and operation, is not what it should be. It is true that the returns of the brake are largely indirect, as are those of the road-bed or from the coal that goes through the fire box, but they are none the less sure and of greater per cent. On the other hand, if neglected, the effect is much the same as indirect taxes, by means of which, as you know, one may be taxed into bankruptcy without knowing it.

The Requirements of a Brake.

Where so much gain or loss depends upon the control of trains, it must therefore be remembered that although stopping power is the first, it is not the only consideration. In order to most efficiently meet the demands of modern service conditions and provide for those of the immediate future, the brake must combine with flexibility and simplicity, safety, besides being perfectly interchangeable with existing apparatus and as far as human foresight and ingenuity can make it, fool-proof. A brief consideration of these requirements of a perfect brake will make manifest their fundamental bearing on the problem.

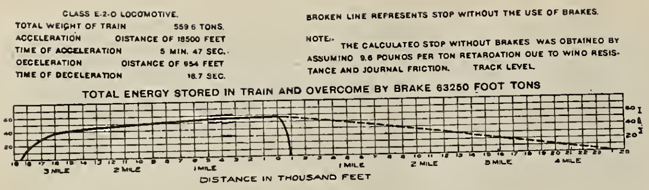


Fig. 1.—Curves of Acceleration and Deceleration.

A practically perfect brake must be automatic, durable, simple, always ready, responsive and flexible, the latter of which involves the elements of power, time and amount of reduction, and in addition it is imperative that in case of an emergency the maximum braking power covered in the design be obtained with the time and reduction elements reduced to a minimum, to the end that the stop be made in the shortest time possible; for service or regular operation, however, all these elements should be extended, to the end that trains can be handled without shock and accurate stops made, and these factors vary in importance and degree according to the service,—where the speed is generally high, the power element should have chief consideration, while where the speeds are generally low, the other elements should have predominance in the design, but it is where the speed varies from very high to very low (and this is often the case) that all elements must have equal consideration and each be developed along lines that will mean the least sacrifice to the others, keeping in mind at all times that, in time of danger, to stop is the chief consideration. These requirements are only fulfilled in the air brake, therefore, this will be the one considered. In order that the necessity for the progressive development of the air brake may be in mind, a brief review of operating conditions is pertinent.

In making ordinary service stops in passenger service there are always three things to be considered; accuracy, smoothness and the question of time. The shortest possible stop that can be made, is to apply the brake in full and allow the train to come to a standstill, but in so doing, two things are sacrificed—accuracy and smoothness, for it certainly would not be a smooth stop, and the accuracy would depend entirely upon the judgment of the operator when making that particular brake application. The smoothest possible stop is to shut off and drift to a standstill. In this case, a great amount of time is sacrificed, and the point where the stop would be completed would be altogether indefinite. As a result, neither of these methods can be used in practical operation.

To obtain all three points mentioned, we must have means of applying the brake with the maximum cylinder pressure that the speed will warrant, and when approaching the place at which the stop is to be made by this means, to feel our way to the proper point of stop and have comparatively little pressure left in the cylinder when the stop is completed. Thus we make the shortest stop, smoothness and accuracy considered, that is possible; and having very little, if any, pressure in the cylinder to get rid of, when the signal to start is given, the start may be made immediately. The brake which possesses all these features is certainly a flexible one. The brake which originally possessed them to a maximum degree was the straight air brake. But this perfection is now also possessed to the same degree by the new passenger brake equipments to be described, and has been secured through means which insure a higher degree of safety than ever obtained before in the art of braking.

Coming now to the point of simplicity, straight air also possessed that feature to a marked degree so far as operation is concerned. The degree of simplicity possessed by the straight air brake will, perhaps never be obtained in a purely automatic system because, as you are aware, certain complications arise in the operation of an automatic brake which are not present with straight air, as, for instance, when a number of cars are coupled together. The fact that we have complication is not necessarily detrimental, and it does not follow that a more complex system should not be adopted; we would not consider going back to the old wood-burning locomotive in place of the splendid, but vastly more complex, locomotives of today, simply because the latter are much more complicated. It is a question of results. If the results obtained justify the means employed, that is sufficient.

We feel that in the recent development of automatic brakes, especially those for passenger service, we have, all things considered, increased the simplicity, greatly over that of the old standard. With the latter, proper operation depended largely upon the kind of man who handled it—his experience, knowledge of the brake, judgment and intuition; being unable to graduate his release, he required a far greater perception of distance and speed and better judgment in making the stop, also knowledge of the road, condition of the rail, and other factors that necessarily enter into automatic brake operation. These affected the operation of the old brake in a much greater degree than the new.

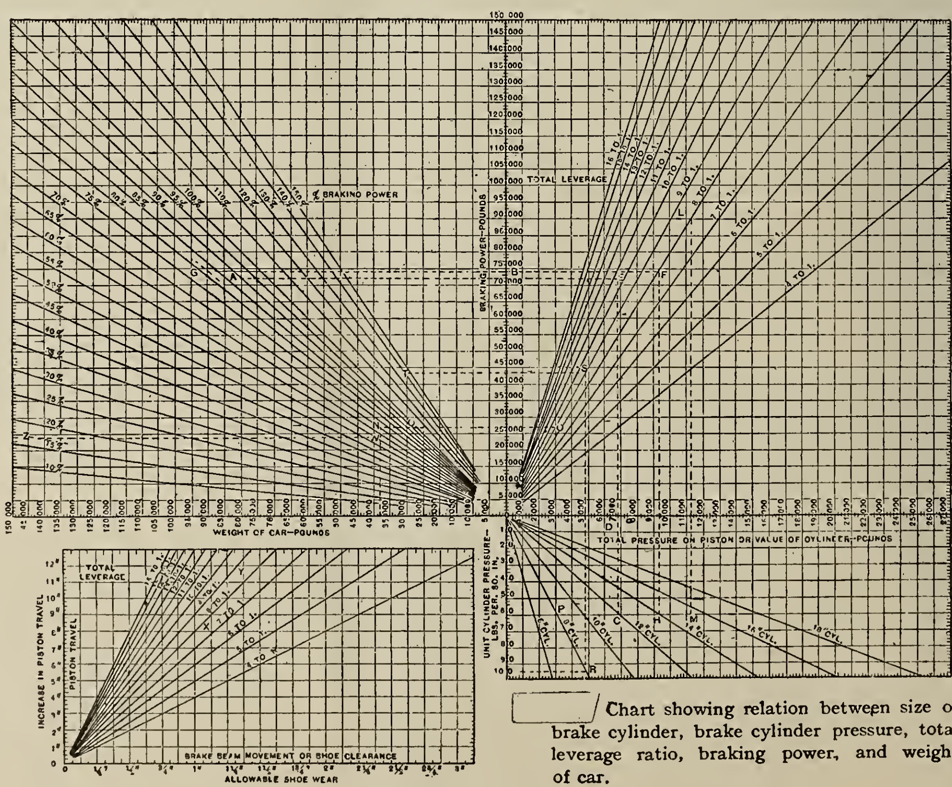


Chart showing relation between size of brake cylinder, brake cylinder pressure, total leverage ratio, braking power, and weight of car.

Fig. 2.

Coming now to the feature of "fool-proofness." By this we mean reducing the human element to the lowest possible factor. With the old standard type of passenger equipment, it was possible to so use the air supply as to seriously reduce the braking power. With the new equipment it is impossible to do this, as maximum braking power is at all times available. Also, the auxiliary reservoirs being constantly recharged, there is always the same stored pressure to draw from. Moreover, the brake will always respond and for a given reduction the same cylinder pressure will result. As a consequence, the engineer, knowing just what results he is to obtain, will have more confidence in the brake and his own ability, and the results will be apparent both in the schedule and power consumed.

The problems of installation, operation and manipulation, however, are infinite and the human equation is perhaps more of a factor than in any other mechanical science. Yet, I venture to say, that many railroad officials give more consideration to the color of the paint used on the rolling stock than to the problems enumerated above; paint is looked upon as attractive, the brake often as a necessary evil, all of which proves that a man cannot know anything about that of which he has no conception, for, aside, from any consideration of the safety feature, there are probably few investments that a railroad manager can make that will return as large a dividend as a good brake, properly installed and operated.

Fundamental Principles in Brake Design.

In the establishment of a logical basis of brake design, applicable to the conditions under which brakes in general must operate and involving a determination of the essential elements of an elementary brake system for any given car, we find that the starting point must be the light weight of the car and fortunately, as we shall see later, this can usually be determined in advance to any desired degree of accuracy. In order to fix our ideas, suppose for an instant that the car was fully equipped with a complete brake equipment and by an analysis of the factors involved in stopping the car, determine how these factors may best be provided for in the design.

The actual braking force acting on a car when the brakes are applied is the force of the friction between the brake shoes and the wheels, tending to retard the rotation of the wheels and thus stop the car. The relation which this bears to the energy stored up in the moving car, provided the "adhesion" of the wheel to the rail is not exceeded, determines the effectiveness of the brake and the length and time of stop. The energy of the moving car consists of two parts—that of the car as a whole due to the velocity of translation and that of the revolving wheels, due to their rotation, and varies as the weight of the car and as the square of its velocity. The frictional force between the brake shoes and wheels depends on the pressure acting on the shoes and the coefficient of friction btween the shoes and the wheels. In making a stop, therefore, the factors involved, so far as retarding the rotation of the wheels is concerned, are:

1st—The brake shoe pressure, commonly called the "braking power."

2nd—Coefficient of friction between the shoes and the wheels, by which the brake shoe pressure must be multiplied in order to determine the actual "braking" power.

3rd—The weight resting on the wheels.

4th—The velocity of the car.

5th—The rotative energy of the wheels, it being assumed throughout that the wheels do not skid.

The only one of these factors which we can even partially control in service, or fix arbitrarily in designing the brake system, is the pressure on the brake shoes, and inasmuch as the wheels must not skid when the weight resting on the wheels is least—that is, when the car is not loaded—the light weight of the car must be taken as the basis of calculation regarding brake shoe pressure, except in the case of some form of "empty and load" brake. Inasmuch as "braking power" is, by custom, measured by a scale of percentages wherein 100 per cent. represents a shoe pressure on each wheel equal to that wheel's pressure on the rail, the problem is then to determine and insure the obtaining of the proper relation between the brake shoe pressure and the light weight of the car.

As pointed out above, the factors involved, frictional coefficients, speed, weights, etc., are so subject to variation in service that no theoretical conditions can determine the proper nominal percentage braking power, (i. e., the ratio of brake shoe pressure to light weight of car) which shall best meet average road conditions. This can be fixed only by experiment and experience and is subject to modifications as conditions change or become more thoroughly understood. For example, many years' experience has proven that 90 per cent braking power for passenger cars gives satisfactory braking effects with a reasonable margin against wheel sliding and sufficient power for service stops.

From a consideration of conditions it is evident that it is practically impossible to provide for even an approximate uniformity of brake action on different cars in service by any method of design. The best that can be done is to establish assumed standards upon which such designs are based. These are as follows:

1st—The percentage of braking power in terms of light weight of the car.

2nd—The brake cylinder pressure upon which this is based.

The former, as has already been stated, must be determined from experiment and experience. The latter must be chosen arbitrarily, but it should have the same value for all brake calculations, in order to insure a common base being universally used and understood. Fig. 2 graphically illustrates the relations existing between these two factors for different weights of cars and total leverage ratios. The question now is, therefore, "What brake cylinder pressure should be used as a basis in designing the brake systems of all types and classes of cars??"

With a given auxiliary reservoir charged to a standard pressure, and with a given brake cylinder having standard piston travel, a certain definite pressure of equalization is obtained, which is constant so long as the other factors involved are kept constant.

When an emergency application is made, since a portion of the air in the brake pipe or other source of supply is used in addition to that in the auxiliary reservoir, the resulting brake cylinder pressure is augmented in proportion, and a higher maximum pressure therefore obtained. Evidently its value must depend upon the relation which the supplementary volume bears to that of the auxiliary reservoir and brake cylinder combined. With equipments now in general use this ratio must necessarily decrease as the size of the car increases because the brake pipe volume remains practically constant for all sizes of cars, while the brake cylinder and auxiliary reservoir volumes increase as the size of the car increases. It then follows that where air from the brake pipe alone is used to augment the brake cylinder pressure in emergency applications, the emergency pressure thus obtained must vary with the different combinations of auxiliary reservoir and brake cylinder necessary for different sizes of cars—the gain in pressure from this source over that obtained in full service equalization being greatest with the smallest sizes of auxiliary reservoirs and brake cylinders.

Hence in choosing a brake cylinder pressure on which to base brake calculations, that obtained in emergency, which was satisfactory where the brake cylinders were of such size that a uniform pressure was obtained in both service and emergency, is now excluded at the outset—from the standpoint of uniformity—since in the nature of the case it is not uniform for all weights of cars, as we now have brake cylinders varying from 6 in. to 18 in. in diameter with widely varying pressures in emergency. And if the braking power desired is based on a brake cylinder pressure higher than can actually be obtained, then for lower cylinder pressures the brake is not so effective as it might be made, were the braking power based on the pressure actually obtained. The smaller cars which do obtain this pressure, give the calculated braking power in emergency, but the heavier cars cannot, and there is a loss, both in uniformity of emergency action and possible efficiency.

On the other hand, for brake pipe reductions less than sufficient to produce equalization, the cylinder pressure obtained are uniform provided the other factors are uniform in value and the pressure at which the auxiliary reservoir and brake cylinder equalize is supposed to be the same for all combinations of reservoirs and cylinders, with the same initial pressure. To obtain this uniformity it is only necessary to properly proportion the reservoir volume to the brake cylinder volume for some standard piston travel. We then have a pressure base which will be constant when the other factors involved have their proper or standard values. It

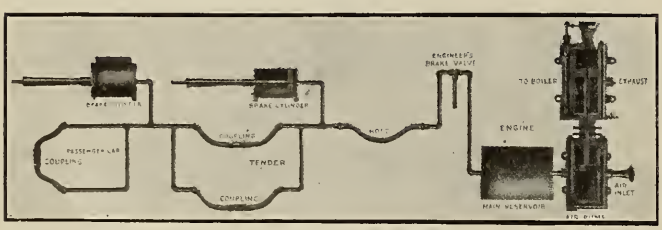


Fig. 3.—Straight Air Brake.

would then seem that this is the basis to which all braking power calculations should be referred, for the reason that it is the nearest approach to a uniform and constant pressure obtainable under the wide range of conditions governing this choice. This adds to the standards enumerated, the following:

3rd—This brake cylinder pressure must be the equalized pressure of the auxiliary reservoir and brake cylinder.

4th—A predetermined ratio between auxiliary reservoir volume and brake cylinder volume to produce this equalization must be adhered to.

The fundamental steps in designing a brake system for any given car may now be outlined as follows:

Given the light weight of the car—from results of experiment and experience, the proper braking power, per cent, has been established and this enables the total brake shoe pressure to be calculated.

Mechanical considerations fix the total leverage ratio between certain limits, the maximum and minimum values of which enable a maximum and minimum total brake piston pressure to be calculated from the preceding.

This total brake piston pressure depends upon the size cylinder and pressure per square inch used as a basis. The pressure basis to be used should be that agreed upon as a universal standard, for such calculations as this, and, as has already been pointed out, uniformity requires that the equalization pressure (50 lbs. per square inch) from the lowest standard pressure carried, should be the base chosen.

Having determined the unit pressure, the size of cylinder can be chosen from the standard sizes manufactured to give the desired braking power with a total leverage within the maximum and minimum limits as defined above.

To obtain the desired 50 lbs. equalization pressure from the standard 70 lbs. brake pipe pressure with a standard piston travel, is simply a matter of correctly proportioning the auxiliary reservoir volume to that of the brake cylinder at the piston travel employed as standard.

We then have an auxiliary reservoir which, at 70 lbs. initial pressure, will equalize with its brake cylinder, when this has eight inches piston travel, at 50 lbs., and the brake cylinder piston is of such an area that the total pressure thus obtained, when multiplied by the total leverage, will give a total brake shoe pressure equal to the desired percentage of the light weight of the car.

To be sure, in an emergency application, the braking power on all cars will be greater than that used in the design and the lighter the car the greater the variation between service and emergency braking powers. But such non-uniformity in actual service is bound to obtain, and always has, since an increase to 90 lbs. or 110 lbs. brake pipe pressure, or a variation in piston travel produces similar results, to say nothing of losses due to leakage, resistances and variations in frictional coefficients. The advantage gained, however, by the method of design outlined, is therefore, in the fixing of a uniform and actually obtainable brake cylinder pressure, which is necessary for service operations and is one of the most important factors in the calculation to be made.

It may be said in passing that with the more recent types of brake equipments for passenger service, using a supplementary reservoir volume, in addition to that of a brake pipe to produce high emergency brake cylinder pressure, the size of supplementary reservoir used is calculated to give practically uniform brake cylinder pressures in emergency applications with all sizes of brake cylinders, thus taking advantage of the principle of high pressures for emergency stops and at the same time conforming to the principles of uniformity laid down above, it being a fundamental principle of modern brake design to keep the service equalization brake cylinder pressure comparatively low, for reasons fully explained elsewhere, and use as high an emergency equalization pressure (as large a supplementary reservoir) as may be desirable.

In the attempt to secure a high emergency brake cylinder pressure without the aid of the supplementary reservoirs referred to above, the relationship between brake cylinder and auxiliary reservoir volumes existing in the original brake design was gradually lost; the auxiliary reservoir volume being increased slightly, from time to time, as heavier cars, requiring larger brake cylinders, were equipped. On the lighter equipment the variations thus introduced were relatively unimportant, but in the case of heavy cars, requiring the 16 in. and 18 in. cylinder, it was impossible to increase the auxiliary reservoir volume sufficiently to obtain the desired emergency pressure, without at the same time interfering to a marked degree with the proper operation of the equipment in service. Consequently, a compromise was made, so as to obtain as high an emergency cylinder pressure as possible without increasing the service equalization pressure to an extent inconsistent with the proper normal functions of the brake.

By the aid of a supplementary reservoir volume, however, reserved during service operation, but available in emergency applications of the brake, it is now possible to obtain the required increase in stopping power for emergencies and at the same time return to the original volume relationships, the correctness of which had been established by long experience.

These relationships are determined by the following principles, which will be recognized at once as having been followed, perhaps more or less unconsciously, in even the earliest automatic brake designs:

1st—For any given arrangement of leverage between the brake cylinder piston and the brake shoes, the "braking power" is directly proportionate to the gage pressure of air produced in the brake cylinder. (A)

2nd—The limitation of the maximum allowable pressure of air in the brake pipe limits thereto the available pressure in the auxiliary reservoirs. (B)

3rd—With this fixed maximum charge in the auxiliary reservoir, the highest pressure obtainable in the brake cylinder from this single source is that at which the air pressure equalizes between the two. This (absolute) pressure, therefore, equals the product of the initial absolute pressure in and the volume of the auxiliary reservoir divided by the sum of the volumes of the auxiliary reservoir and of the brake cylinder (neglecting all clearance volume), and the "braking power" is as the corresponding gage pressure. (C)

4th—This pressure of equalization should be limited because its height determines the range of those differences between final auxiliary reservoir pressure and initial brake pipe pressure, which range affords the control of "braking power" applied. (D)

5th—That while low pressure of equalization limits "full service" pressure, yet small range precludes nicety of control, especially as from the range there must be deducted such initial difference of pressures as are necessary to overcome the inertia and friction of the triple valve parts. (E)

6th—That to afford heightened brake cylinder pressure for use in emergency another quantity of air is necessary, and if this be, as in all past practice, that contained in the brake pipe, the resulting absolute pressure will be equal, theoretically, to the maximum absolute brake pipe pressure multiplied by the volume of the auxiliary reservoir plus the amount of air, in cubic inch pounds, obtained from the brake pipe, this sum then divided by the volume of the auxiliary reservoir plus that of the brake cylinder, so that the measure of the resulting braking pressure is the gage pressure corresponding to this resulting (absolute) pressure. (F)

Now, it is the interdependence and re-active results of these simple and recognized principles in their combination, together with a corresponding proportioning of leverages between the brake cylinder piston and the brake shoes that determine the relative efficiency of a brake design.

From (F) it is seen that if other parts be enlarged the volume of the brake pipe, which is practically the same on all cars, becomes relatively small and the emergency pressure sought is so insufficient that in the equipments for heavy rolling stock resort has been had to enlarged auxiliary reservoirs with a corresponding heightening of the "full service" pressure (C) and a resulting lessening of the range of control (D).

Again when (C) is heightened while (D) is lowered, the results of the lighter brake pipe reductions cause magnified effects in the service braking, so that, when it is realized that such range as is possible is lessened by the lack of sensitiveness of the triple valve (E), there is likelihood of roughness of service stops.

Such being the case, it is apparent:

1st—That there is a ratio of volume of auxiliary reservoir to that of brake cylinder that should not be exceeded.

2nd—That such service pressures as result in the brake cylinder should be made sufficient by a corresponding proportioning of the leverage.

3rd—That the volume of each car's part of the brake pipe should be supplemented by proper means so as to afford the required braking pressure in emergency.

Starting, therefore, with a brake cylinder of the size dictated by the vehicle to be equipped, as already explained, and by a proportioning of the leverage which shall accord with the service required, let us assume that.

C = Volume of brake cylinder, in cubic inches.
P = Service equalization pressure, in absolute units.
R = Volume of auxiliary reservoir, in cubic inches.
a = Absolute initial pressure in the auxiliary reservoir.
r = Permissible range of brake pipe reductions.

We have first, from the above definitions, that

$$r = a - P$$

and from (C), above, neglecting clearance volumes:

$$\frac{a \times R}{R + C} = P$$

from which

$$R = \frac{P}{a - P} \times C$$

$$= \frac{P}{r} \times C$$

which may be expressed in the following law:

The proper auxiliary reservoir volume, according to the principles laid down above, is equal to the volume of the brake cylinder determined upon multiplied by the ratio of the service equalization pressure fixed upon as standard to the permissible range of brake pipe reductions.

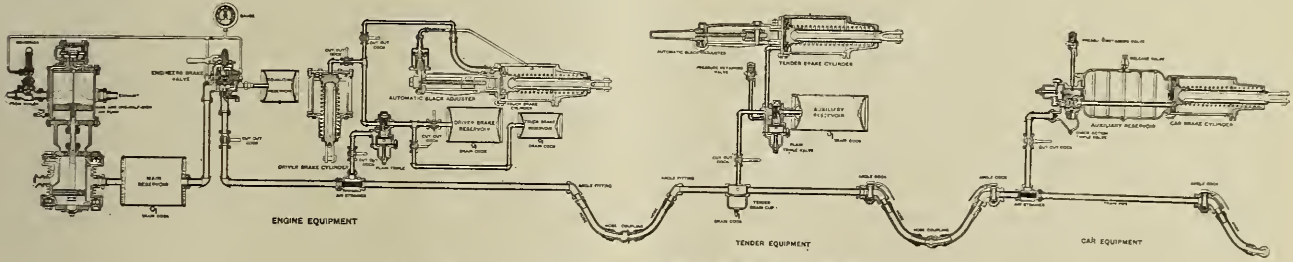


Fig. 4.—New Quick Action Automatic Brake for Freight Cars.

Assuming, as is current practice, that P = 50 lbs. per sq. in. (gage) and a = 70 lbs. per sq. in. (gage), then we have

$$r = a - P = 20 \text{ lbs.}$$

and

$$R = \frac{P}{r} \times C$$

$$= \frac{65}{20} \times C$$

$$= 3\tfrac{1}{4} \times C$$

That is, the volume of the auxiliary reservoir should be 3¼ times the volume of the brake cylinder. It is plain, however, that the effect of the clearance volumes, leakages, temperature and other adverse influence will be such that to obtain the desired results in actual service a somewhat higher auxiliary reservoir volume must be used than that found by the above calculations, for example, with the standard 8-in. equipment, an auxiliary reservoir volume of

1,620 cubic inches is used, which is about 3½ times the brake cylinder volume.

In determining the proper size of supplementary reservoir to be used—(F above)—a similar reasoning may be used. In addition to the symbols already defined, let

S = Volume of supplementary reservoir in cubic inches.

E = Absolute emergency equalization pressure.

Assuming for the purposes of calculation that the emergency pressure is the result of the equalization of the brake cylinder, auxiliary reservoir and supplementary reservoir volumes, we have

$$\frac{a\ (R+S)}{R+S+C} = E$$

whence, by proper substitution and reduction, we derive

$$S = \frac{a\ (E-P)}{r\ (a-E)} \times C$$

While the above expression is interesting as showing the simple relation which exists between the various volumes involved in the typical equipment as we have assumed it, it must be clearly understood, 1st, that we have supposed all the additional air supply in emergency to come from the supplementary reservoir, having taken no account of that vented from the brake pipe; and 2nd, that in any actual installation similar to that we have discussed, the equalization is dependent upon the movement of certain valves actuated by spring and air pressures in combination, the resultant effect of which is such that in the actual working equipment the state of affairs is by no means as simple as has been assumed for the typical equipment. Instead of equalization taking place between all the volumes concerned simultaneously, there are time limitations imposed on the rate of flow from the various sources of air supply to the brake cylinder, so as to derive the maximum possible benefit from the compressed air stored in each. Proper allowance being made for these limitations, a formula might be derived, in the same manner as above, to completely cover the more complicated conditions, but as we are concerned here only with laying down the principles involved, it is unnecessary to go further into details, particularly as these are accurately determined by experiment.

In the above analysis, as is necessarily the case with all theoretical considerations relative to mechanical apparatus of this character, certain assumptions were made to furnish a basis from which to start. Hence, it should always be remembered that the formulae derived must be interpreted, for any given case, in the light of the modification of these primary assumptions which the nature of the installation or the character of the apparatus used may involve. With this understanding, the above reasoning affords a logical and sound theoretical basis, not only for determining the correct proportions of new types of equipment, but also establishes a criterion, by means of which the shortcomings of incorrectly designed installations may be discovered.

Past and Present Conditions.

It is our effort to show, not that the air brake has advanced relatively to the requirements, but that it has endeavored to keep pace with the developments of locomotion; in other words, how and why we are able today to control and stop a train in approximately the same distance as when the weight and length of the train was less than one-fourth of that today and the speed correspondingly slower, which is quite an accomplishment since the length of the trains and the volume of air employed have rendered this vastly more difficult as to service control and the weight to the extent that it would require at least twice the distance in which to stop if the old brake had to be used with present day conditions.

It is difficult for one who has not given the subject careful thought to realize the great changes in railroad equipment and operative requirements which have taken place since the introduction of the air brake, but it is only necessary to review briefly these past and present conditions in order to appreciate the necessity for a similar development and improvement of the apparatus used for controlling trains under these new conditions.

Since the air brake was invented locomotives have increased in weight on drivers from 50,000 lbs. to 270,000 lbs., in draw-bar pull from 10,000 lbs. to over 50,000 lbs., and in total weight from 90,000 lbs to 500,000 lbs. and the working steam pressures have increased from 125 lbs. to 225 lbs. Freight equipment cars have increased from 9,000 lbs. light weight to 48,000 lbs., and in carrying capacity from 14,000 lbs. to 100,000 lbs. The length of freight trains has increased from 15 to 130 cars and tonnage from 300 to 4,500 tons. Passenger equipment cars have increased from about 20,000 lbs. to 150,000 lbs. weight and schedule speeds for passenger trains have increased from 30 miles per hour to as high as 65 miles per hour in certain cases.

A concrete example will show forcibly just what this increase in weight and speed means to the operating department. Under the former conditions the factor of safety in train handling was none too large and it is therefore imperative that we should be able to control modern trains under present existing conditions at least as safely and efficiently as formerly. To do this for five 150,000 lb. coaches, running at 65 m. p. h., it is necessary to provide means for controlling over 105,000,000 ft. lbs. of energy as compared with about 6,000,000 ft. lbs., which was all that the brake of the early 70's was called upon to control with a train of five 30,000 lb. cars running at 35 m. p. h. When the locomotive used with each train is considered, the total energy in the modern train becomes 162,000,000 ft. lbs., as compared with 9,800,000 ft. lbs., for the train of 1870. It is not surprising, therefore, that the air brake art demands thoughtful consideration from trained and experienced minds if the railroad traffic of today is to be handled with a safety and efficiency equal even to that of the days when the total energy to be reckoned with was 1/16 as great. Here again is found another close resemblance between the conditions of acceleration and deceleration, for while it is not especially difficult to increase the speed of a train from 30 m. p. h. to 40 m. p. h., it requires the expenditure of a vastly greater amount of energy to increase its speed from 60 m. p. h. to 70 m. h. p. In like manner, for any given increase in speed the additional amount of work required from the brake increases in geometrical, not arithmetical, ratio; therefore, if our improvements for the heavier trains and higher speeds of today enable us to stop in about the same distance as we could forty years ago the trains of that period, we should congratulate ourselves for having held our own.

The mere power necessary to accomplish this is indicated by the fact that the total maximum force exerted by the push rod of the 6 in. brake cylinder of the early equipment was 1,700 lbs., while with the 18 in. brake cylinder used on the heaviest coaches of today a maximum pressure on the push rod of 23,625 lbs. is obtainable.

From the above it will be apparent that many features must now be considered which did not exist when the brake was first invented, particularly on the physical side of the problem. For example, the amount of work required per square inch of brake shoe surface is vastly greater. This is a condition seldom noticed and yet of great significance, as the following comparison will show:

In the report of one of the earliest brake trials in the history of continuous brakes, made on the Midland Railway, near Newark, England, in 1875, and since known as the Newark trials, we find that the best brake performance there recorded was by a train of fifteen, 21,000-lb. (average) four-wheel carriages, fitted with a primitive form of the Westinghouse Automatic Brake, one cast-iron brake shoe being used on each wheel. The best stop was made from a speed of 52 m. p. h., the highest that could be obtained, in 18 seconds time. This corresponds to the performance of 15.5 foot tons (1 ton = 2,000 lbs.) of work per brake shoe per second. In the classic Westinghouse-Galton tests, which followed about three years later, the four-wheel experimental van used weighed 18,200 lbs. and was fitted with two brake shoes per wheel, and from 52 m. p. h speed a stop was made by the experimental van alone in 11½ seconds. Here the work done was only about 9 foot tons per brake shoe per second.

In 1875 the standard passenger coach used on the Pennsylvania Railroad weighed 39,300 lbs. and had four-wheeled trucks. To stop such a car from 52 m. p. h. in 18 seconds required only 12.33 foot tons of work per brake shoe per second, or less than that required of the brake on the Midland train, although the Pennsylvania car weighed 18,300 lbs. more. This is, of course, due to the fact that eight brake shoes were available to do the work, as compared with four on the Midland train. Contrast with the above a modern Pullman car weighing 160,000 lbs. and having six-wheel trucks. Assuming that from a speed of 52 m. p. h. the stop could be made in 18 seconds, the work done would be 33.5 foot tons per brake shoe per second, or over twice that of the Midland train, notwithstanding that there are twelve brake shoes to do the work instead of four. But modern express train speed may be expected to run frequently as high as 75 m. p. h., and to make a stop from this speed in, say 35 seconds, which would be about the best we could expect of the modern brake equipment, would require 35.8 foot tons per brake shoe per second, or not much more than when a stop of 52 m. p. h. is made in 18 seconds. But to have the same absolute safety under modern conditions as existed in 1875 would require the stop to be made in at least the same distance and time, and to stop a 160,000-lb. car from a speed of 75 m. p. h. in 18 seconds would require 69.6 foot tons of work per brake shoe per second or about 4½ times that in the case of the Midland train. (What this would be with four-wheeled trucks will be appreciated.) Even if we could use two brake shoes per wheel instead of one, we would still have over twice as much work to be performed by each brake shoe per second if the trains of today at the speeds now attained in high speed service are to be relatively as safe as the trains of thirty years ago.

The tremendous significance of this increase is, we believe, but faintly appreciated. We have today the cast-iron brake shoe practically as it was thirty years ago. This brake shoe must now do four times the amount of work by frictional resistance to the rotation of the wheel, as formerly. We may say "Why not quadruple the pressure per brake shoe?" But it must be remembered that when the brake shoe pressure is multiplied by four, the actual retarding force is by no means quadrupled, for we are then overlooking three vital adverse factors, viz., the effect of increased pressure, speed and temperature, on the coefficient of friction between the wheel and the shoe. Exactly how great an effect these may have depends, of course, on the conditions of the individual test considered, but that it is considerable is proven by the fact that a stop from a speed of 75 m. p. h. in 35 to 40 seconds, instead of 18 seconds, is considered good, although we are today using about four and a half times as much pressure per brake shoe as at the Newark trials.

We should mention that in the above no account is taken of the rotative energy of the wheels. If this is considered, it is evident that the figure for the modern conditions will be still more in excess of those of the past, on account of the wheels being heavier and there being a greater number per vehicle.

Again the difference in air pressure required to apply and release the brakes is by no means as easily obtained today as when trains were short. The air supply required for short trains with small brake cylinders was obtained with compressors of much less capacity than it is now necessary to employ; witness, the 6 in. air compressor of the early days of the brake, with its capacity of not over 15 cu. ft. per minute, as compared with the cross compound compressors now used, which have approximately 125 cu. ft. capacity. The reason for this is apparent, for it required, not so very long ago, about 25 to 30 cu. ft. for a full application; now 300 cu. ft. is required. In general, therefore, it may be stated that the brake which would satisfactorily meet the requirements of past conditions falls short of the maximum efficiency which it should be possible to attain in proportion to the increase of the requirements of present day service over those of the past. The force of this is apparent when we make the same comparison between the locomotives and cars of the two periods. This review of the conditions and what is involved, which is by no means exhaustive, will serve to give an idea of the magnitude of the problem; how we have endeavored to meet the various stages of this problem will be best shown by a consideration of the development of the brake.

Development of the Brake.

The operating conditions prevailing about 1870 were very different from those of the present time: then the tracks were not of the character of today and not suitable for such heavy and fast traffic; in fact, neither the locomotive nor the cars were capable of it, therefore, the brake required was something better than a hand brake, which was obtained when the straight air brake (Fig. 3) was applied to the equipment. This term implies that compressed air is used as a direct force from the main reservoir supply of the locomotive through direct piping to the brake cylinders on the vehicles to apply the brakes, simply requiring a valve on the locomotive to admit air to the brake pipe and brake cylinder in order to apply the brakes, to hold it there when admitted and to exhaust it when desiring to release the brakes. An early form of this apparatus is shown in Fig. 3. The air pump is one of the first forms to come into general use, the so-called "trigger" or "jigger" valve motion and square piston rod being recalled, no doubt, by many here present. The brake valve was the simplest form of three-way cock. The hose couplings were "butte end," male and female, which necessitated there being a male and a female coupling at each end so that a connection between cars might always be made.

This equipment had many good qualities and a very large degree of flexibility, but had shortcomings which made it unsuited for use on trains of any considerable length on account of the time required to apply and release the brake and the unequal braking effort throughout the train. The factor of safety was low as no warning was given in the event of the hose becoming uncoupled, and a parted train meant no brakes. Thus it is seen that it lacked the first essential of an efficient brake, which is, that it must be its own "tell-tale," that is, if an accident occurs to the system, it must result in a brake application instead of a loss of the brake.

In the natural process and development of railroads, the requirements became more exacting and it was evident that the straight air brake was not only unsuitable for these requirements, but that it lacked essential features. It became more than ever important that the brake must apply automatically in case of the train parting. This was so fundamentally necessary that even if the flexibility of the straight air brake had not already been lost to a large extent by the lengthening of the trains, it would have had to be abandoned because of the infinitely greater safety inherent in a brake of the "closed circuit type." Therefore, the straight air brake, having served its purpose as an advanced agent of something better, gave way to the automatic brake, which, when the quick action brake was invented, was called the "plain automatic brake" to distinguish it from the type that locally reduced the brake pipe pressure, thus producing what is called "quick action."

The automatic action of the brakes was accomplished by means of indirect application of the brakes through the medium of a valve device called a triple valve and an auxiliary storage reservoir which were added to the brake cylinder on each car. All of these valves were connected together by a continuous pipe with flexible connections between the cars; this pipe being charged with air whenever the brakes were in operating condition. By this means, the auxiliary reservoir was charged with compressed air for braking purposes on the vehicle to which it was attached; therefore, it was no longer necessary to transmit the air from the locomotive to the vehicle when an application of the brakes was desired. From what has been said, it is plain that the triple valve must be the essential mechanical element in such a system and that it must possess the three functions of charging and recharging the auxiliary reservoir and of applying and releasing the brakes, the medium for applying and releasing the brakes, for all general operations, being a manually operated brake valve on the locomotive.

The operation of the triple valve to apply the brake is brought about by reducing the brake pipe pressure, thus creating a differential of pressure in the auxiliary or braking reservoirs throughout the train; this reducing of the brake pipe pressure below that of the auxiliary reservoir pressure, permits the auxiliary reservoir pressure to force the triple piston and its slide valve to application position, in which position the brake cylinder outlet to the atmosphere is closed and a port opened from the auxiliary reservoir to the brake cylinder, when the auxiliary reservoir pressure will also reduce equally with that of the brake pipe into the brake cylinder and apply the brake. It is, perhaps, needless to say that these applications could be either partial or full; thus the brake possesses graduating features so far as the application was concerned. To release the brake, it is necessary to create a differential in the reverse order, that is, the brake pipe pressure must be increased above that of the auxiliary reservoir, when the triple valve will be forced to release position, opening the brake cylinder to the atmosphere and thus releasing the brake, and also opening the necessarily restricted passage from the brake pipe to the auxiliary reservoir that it might again be recharged to full braking pressure. There was no graduating feature to the release of this brake, therefore one of the elements of flexibility possessed by the straight air brake was lost, but, as has been said, this feature had already been very much reduced in value by the lengthening of the train.

Thus, through the use of triple valves, the equipment became automatic, which term applies to that application of the brakes which occurs through any material depletion of pressure from any cause in the brake pipe and auxiliary reservoir pressure, either at the will of the engineer, by hose parting, burst hose, leakage, or at the instance of the train crew, so that this system very materially increased the factor of safety and permitted the use of air brakes on longer passenger trains and on the already existing freight trains in a way that was not possible with the straight air brake equipment.

It is generally thought that the invention of the valve mechanism solved the problem of automatic brake operation and this is exceedingly unfortunate, for of an importance second only to the apparatus itself were the fixing of the conditions under which the brake would operate properly, namely,

1st.—The percentage of braking power to light weight of car.

2nd.—The times the cylinder valve could and should be multiplied to advantage and without detrimental results—that is, the fixing of the leverage ratio.

3rd.—The proportion of auxiliary reservoir volume to brake cylinder volume.

4th.—The percentage of braking power per pound of cylinder pressure.

5th.—The amount of reduction of brake pipe pressure to produce equalization and the time in which it should be done.

These things required a great amount of thought, experiment, and practical experience, and when Mr. Westinghouse had worked all these out, the brake itself, the governing factors of its operation, its installation and manipulation were practically perfect and have never been improved upon. We regret to say, however, that these things have often been changed and ignored to such an extent that the operation and efficiency have been seriously impaired, and while much has been said and written from the standpoint of stopping the train only, little or no consideration is given to the above mentioned factors, which are vital to the every day operation of the brake and make possible and permissible a much greater stopping power than can be used if these factors are not utilized. In fact, satisfactory operation and proper stopping power, as we have already pointed out in the consideration of the fundamental principles of brake design, are absolutely dependent upon them.

This plain automatic brake was a great improvement in many respects over straight air, but chiefly from an emergency or safety standpoint, for much of the flexibility (that is, ability of the operator to increase or decrease the cylinder pressure at will and for any number of times in rapid succession) for ordinary service brake operations had to be sacrificed. This brake served fairly well the purpose while trains were short and speeds, weights, and frequency low, but as these factors changed, its limitations became more and more apparent, particularly with reference to emergency operation, as the application was too slow with long trains, and for reasons differing only in degree from those which had effected the straight air brake. Thus, when a quick application was attempted, the shocks were great, nor was the stop as short as should be. The reason for this slowness of operation was because the air could not be quickly and uniformly reduced from the brake pipe; this, because of increased volume frictional resistance, and the necessity of its traveling to the one outlet, which was through the brake valve at one end of the train. This limitation was overcome by the invention of what came to be called the Quick-action Automatic Brake (Fig. 4), taking its name from the "quick action" triple valve which was identical with the plain triple valve as far as service operations were concerned, but different in emergency in that it locally invented the brake pipe pressure. The principle of operation of this feature of the valve is that if a sudden reduction is commenced at any part of the train, the piston and slide valve of the nearest triple valve will travel to a position not reached in service applications and cause the operation of a valve mechanism which makes a large opening from the brake pipe; the rapid reduction thus resulting is transmitted to the next valve and serially to all the valves in the train, thereby reducing the time of full application to about one-sixth of what is inherent with plain triple valves on a 50 car train, and shocks were therefore correspondingly lessened and stops shortened.

The feature of serial venting of the brake pipe was so important that a second one—which this made possible—was, and is today, overlooked by many, and perhaps we should say is not rated at its true value. We refer to the then possible attainment of a different and higher braking power for emergency than for service applications. Up to this time, the cylinder pressure attainable had been the same for both service and emergency applications, but now since the brake pipe pressure vented could be vented into the brake cylinder, the pressure therein was increased whenever quick action took place and as this, with the comparatively small cylinders of that day, raised the pressure from 50 lbs. equalization to 60 lbs. from an initial brake pipe pressure of 70 lbs., it will be seen that the increase in braking power was 20 per cent. This, for passenger service, was allowed to remain, for, because these trains were shorter than freight trains and the cars more rigid and of greater length, it was warranted; the measure on the one hand being property, the other both property and human life. This difference of braking power was utilized in another way in freight cars and wisely so. Instead of permitting this service percentage of braking power to remain the same as before, it was changed from 70 per cent on 50 lbs. cylinder pressure to 70 per cent on 60 lbs. cylinder pressure; thus making the brake much more flexible for service applications and reducing shocks, etc., because of the lower braking power for given reductions. From this it will be seen that to the automatic and graduating features of the brake two others were added, namely, serial quick action and difference or increase in braking power between service and emergency applications. All four of these are now generally recognized (though we are sorry to say not appreciated as they should be) as being fundamentally essential in a brake worthy the name. Moreover, though they leave nothing to be added, so far as we can see even in the present state of the art, these four features have had and still have great possibilities of extension and development. We would here again call attention to the wonderful adaptability of the original combination of brake cylinder, triple valve, and auxiliary reservoir to the ever-increasing need of a more powerful and what naturally follows, a more flexible brake. It is truly remarkable that through all subsequent improvements not one of the original functions of the triple valve has been discarded or improved upon.

So far the apparatus employed was the same for both passenger and freight cars, but the still greater frequency of trains, heavier vehicles, and higher speeds made necessary a greater possible braking power for passenger service, particularly for emergency applications, and this was possible only by increasing the air pressure, as any other method would have made the brake too severe for low speeds; in other words, the percentage of braking power per pound of cylinder pressure was already as great as practical operation would permit.

It was thought, however, that to increase the pressure sufficiently to get desired braking power would result in flattening of wheels and other damage from the high brake cylinder pressure obtainable; therefore, this was not done until the valve known as the "high speed reducing valve" was invented. The pressure was then raised from the generally adopted brake pipe pressure of 70 lbs. to 110 lbs., which would give about 85 lbs. cylinder pressure instead of about 60 lbs., or, in other words, raise the braking power from 90 to 125 per cent. With this improved equipment when an emergency application was made, full cylinder pressure (85 lbs.) was obtained, but was automatically reduced to 60 lbs. by means of the reducing valve; thus, if the stop was long enough, the initial braking power was 125 per cent., while the final was 90 per cent. In service applications, the opening from the reducing valve was larger than in emergency applications so that if such a reduction of brake pipe pressure was made as would cause the brake cylinder pressure to rise above 60 lbs., the reducing valve would open and vent the air, that would otherwise cause an undesirably high brake cylinder pressure, to the atmosphere.

Though it was known that the coefficient of friction is less at high speeds than at low speeds, it was predicted by many that much wheel sliding would result from raising the braking power above 100 per cent of the light weight of the car, but, on the contrary, wheel sliding was lessened and naturally so when the matter is analyzed.

These improvements were adopted by practically all the first class railroads of America and the results have fully justified their use, not from the standpoint of increased safety alone, but as a dividend earning asset. For example—in suburban service, a good brake is worth more than a good engine as a schedule maker. This combination, with the quick action triple valve, is known as the high speed brake.

The International Exposition of Railways and Land Transport will be held at Buenos Aires, Argentina, from May to November, 1910. It will be devoted exclusively to the business of land transportation and aims to cover railway equipment, motor cars, carriages, wagons, tram cars, motorcycles, bicycles, beasts of burden, road and track, postal service, telegraphs, telephones, military and ambulance conveyances, fire fighting equipment, airships, balloons, etc., as applied to transportation.

Consul General S. Listoe writes from Rotterdam that the old-fashioned Dutch windmills are not popular any more, as windmills are principally used in Holland for the purpose of pumping water out of ditches, which must be done regularly in order to keep the fields and meadows dry, the greater part of the Netherlands lying below the level of the sea. It is claimed that wind is too uncertain a motive power for the purpose mentioned, and hence gas motors are gradually being introduced.

For the fiscal year ending June 30, 1908, a total of 59,825 applications for patents of all descriptions were filed with the U. S. patent office. There were 7,467 applications for registration of trade marks; 810 for labels, and 339 for prints, making a total of 8,616. The number of patents granted was 34,003; design patents, 748; reissue patents, 151; trade marks, 6,135; labels, 636, and prints 279, or a total of 41,952. The expired patents which became public property numbered 24,270.

Guards on the grounds of the Alaska-Yukon-Pacific Exposition at Seattle this summer will wear pearl gray uniforms, and it is planned to make the force the best dressed police body even seen in this country.

The Browning Engineering Co., Cleveland, has published a set of pamphlets dealing with each of its more important machines. The books are neatly designed and are of the same size, so that they may be bound into one volume if desirable. The subjects are: Locomotive Cranes, Automatic Buckets, Steam Shovels, Magnets, Railway Ditchers, and Scraper Bucket Excavators.

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In the paper on the "Development of Air Brakes," published on another page of this issue, the point is brought out by the authors, that touches upon the reason why a train cannot be stopped in so short a time with the wheels sliding as it can if the wheels are kept rolling. Many locomotive engineers are unable to explain why they can stop a light train with an emergency application in quicker time if the throttle is left open than if steam is first shut off. A common experiment in the study of physics is a demonstration of the difference between "Friction of Rest" and "Friction of Motion." The force required to start a body sliding defines the first term and the second is defined as the force required to keep it sliding after it is started.

When the brake is set properly the friction between the shoe and the wheel is friction of motion, while that between the wheel and the rail is friction of rest, as any point on the rim of the wheel is longitudinally stationary with respect to a point on the rail. As the coefficient of friction of rest is considerably greater than that of friction of motion, if conditions are reversed and the wheel is locked, the train will be stopped only in a distance which will be greater in proportion to the difference between the coefficients of moving and stationary friction. This same theory applies when the engineer of the steam train reverses his engine, and gives it steam enough to slide the wheels backward. It also applies, when, in starting a heavy train, he admits so much steam to the cylinders that the wheels slip.

When George Westinghouse was perfecting his automatic system of the air brake, several railway companies rendered great aid in testing out each of these theories by experiment. Heavy and light trains running at high speed were stopped by both methods. The results were that each theory was borne out in full.

The Heaviest Engines Built

On another page of this issue we publish a description of the new Mallet articulated locomotives built by the Baldwin Locomotive Works for the Southern Pacific Co. Mr. Small, superintendent of motive power of this road, states that these engines are to be used between Roseville and Truckee on the Sacramento division where the maximum grade is one hundred and sixteen feet to the mile, the rating for these grades being twelve hundred and twelve tons exclusive of engine and tender.

There are several features about the construction of the articulated locomotive which render difficult several of the ordinary processes of operation and control. Among these might be mentioned the supplying of oil to the low pressure cylinders and the control of the forward valve gear. As the forward engine is continually oscillating even on straight tracks, oil cannot be piped to its cylinders without the use of a system of flexible joints and as these are often a source of more or less loss and inconvenience, the low pressure cylinders on these locomotives have been arranged to take their oil from a pump on the forward frame, operated by the valve gear. No attention is required on the part of the engineer as the pump starts delivering oil when the engine starts turning. It would seem, however, that cold weather would have an undesirable effect upon the efficiency of the pump in its exposed position. The forward valve gear is controlled by means of an ingenious arrangement of the radius bar described and illustrated on another page. Even with the Walschaerts motion the four gears would be too much for the engineer to operate unaided and for this reason a power reverse gear is provided. This is customary on articulated locomotives and the reversing of the engines is accomplished by moving the valve of a steam or air cylinder, the piston rod of which is connected directly to the main reverse lever. In order that the links may be held in proper position of the cut off, an oil cylinder is connected opposite the steam or air cylinder and passage of oil about its piston is controlled by the same mechanism as that which operates the reversing valve.

The construction of the boiler is, to say the least, novel, and the success of many of the new features embodied therein will be watched by all motive power men. The combination of a reheater and feed water heater with an inner combustion chamber has never before been attempted. Add to these peculiarities the fact that the boiler may be cut in two at the combustion chamber by the removal of a few bolts and the novelty of the engines is acknowledged. The bolted rings of the boiler are but a short distance in front of the frame articulation and all piping is equipped with unions at this point. This arrangement will probably be a useful one when the engines are sent in for general shopping. Whether, in the reheater, the gases will reheat the steam or the steam reheat the gases, will be a point of doubt in the minds of some men, to be settled only under service conditions.

Illinois Central R. R. Boiler Shop

At the Burnside shops of the Illinois Central R. R. there is a boiler repair department, the building for which is now about two years old. At the time it was planned, a great deal of consideration was given to individual opinions among the employees, especially to those of the superintendent and his assistants. Since the plant was completed ample time has passed to judge of its efficiency by comparisons. One of the striking features likely to impress the observer is the arrangement of machinery. A boiler shop equipment includes a large number of machines of somewhat awkward sizes and consequently an unimpeded isle through the shop is unusual. This shop, although equipped with the usual machines allows of several wide and clear truck ways from end to end of the building. All machines of length are placed longitudinally at the building, and are grouped along the walls where possible. Machines requiring attendance from all sides, such as flanging rolls, are placed in the center of the room, but always longitudinally of the building. Each machine of size sufficient to take work, beyond a man's strength in weight, is served by its own jib crane, in most cases, homemade devices and designed to fit special requirements after the machinery was installed.

A great deal of attention has been given to bulldozer and hammer forming tools. New possibilities seem to develop with each new former placed in service until all heavy steel parts, large numbers of which are required, are struck off in one or two operations under hammers or in bulldozers by means of ingeniously designed formers. That the superintendent and foremen do not consider that they are saving all the time which might be saved along this line, however, is demonstrated by the fact that one of the foreman was recently sent to Altoona to assimilate some of the ideas of the Pennsylvania R. R. blacksmiths. No doubt he was of as much aid to the Altoona men as they were to him. The manufacturers' products are not slighted in the shop in spite of the number of homemade devices. The machinery throughout is of the latest and best pattern. One of the heaviest and most powerful hydraulic presses for use in railroad work is installed at one end of the boiler shop where it is constantly in use on work which could not be attempted without it. Under this press, firebox door and flue sheets are flanged completely in one operation. Although there are still a few special designs for which there are no flanging formers, the greater number of the fireboxes are classed among the road's standards and for these shapes pressing formers are ready at hand.

Standard Construction of Terminals—A. T. & S. F. Ry.

The use of standards in railroad architecture is somewhat limited in scope when considered broadly. There is such a vast number of complications due to all manner of different conditions met with that a standardization in building construction is not possible. It is, however, possible to standardize along the lines of details and this can be carried much farther than would seem, at first consideration, possible.

On another page we show something of what the Atchison, Topeka & Santa Fe Ry. is doing in the standardization of division terminals. Due to the fact that there are a number of divisions on this road on which operating conditions and motive power requirements are much alike, it has been possible to build the roundhouses, yards, etc., at the terminals from the same general plans. Owing to the fact that designs were to apply on a number of installations, a great deal of care has been used in getting the best layout possible, and for this reason the results should be of a great deal of interest to other railroads contemplating division terminal improvements.

Danger of Contact with Electricity

May 1, 1909.

Editor, Railway Master Mechanic:

A great many people believe that the result of an electric shock is directly dependent upon the voltage of the current. An editor on one of the daily papers a few months ago took occasion editorially to condemn the New York method of capital punishment by electrocution as inefficient and therefore inhuman, because a man in Chicago had come in contact with an electric current of 40,000 volts and had not been killed. The point made was that as the current used for electrocution in New York is greatly less in voltage than the current which failed to kill the Chicago man, the victims of the chair could not be killed but were only temporarily rendered unconscious. Nothing was said about the alternating or direct feature, and it was a natural inference that the writer did not know the difference. In any case he was very much mistaken in his point, for, as most engineers know, the voltage of the current is not a direct criterion of the result of contact with it. The amperage or amount of electricity passed through the body is the thing which decides the result. For instance: a good contact with a 600 volt current is sometimes fatal when an imperfect contact with a 40,000 volt circuit might have no fatal effect. Moreover the currents at these extremely high pressures are usually alternating and it has been shown that a human being can be in perfect contact with a high frequency, high tension alternating current with little evil effect. But if the voltage is reduced, the victim (cat or dog) would be killed. Ordinarily speaking and other things being equal, the high tension current is the more dangerous because it will force a greater amperage through the body. The point made by the editor was, of course, far taken and indicative of the extent of the popular grasp on things electrical.

Master Mechanic.

Experiences of a Worker at Panama

Mr. Byron Kelso, an engineer on the Panama canal works, writes to "Rose Technic" as follows:

"When the United States made a treaty with the Republic of Panama, it gained supreme control over a strip of land as long as the isthmus is wide and ten miles broad: five miles on either side of the center line of the canal. This tract of land is known as the Canal Zone.

"The present plan of building a lock-type canal calls for what is practically a big lake, to be held in check by the now famous Gatun dam. The water for this lake is supplied by the Chagres River, and in order to know just what can be expected of this most eccentric of all rivers. the I. C. C. (Isthmian Canal Commission) is making extensive surveys of all the tributary drainage basins. So much has been written and is being written about the canal that I think I shall confine myself to my own experiences here, and especially to those on the Chagres River; but first I must explain the general conditions that lead to some phases of the work.

"At the expense of a deal of trouble, time and money, the sanitary and municipal departments of the commission have succeeded in stamping out all of the dread tropical diseases within the zone, and we now have really better sanitary conditions than in many of the southern parts of the states. However, the tributaries of the Chagres extend far beyond the pale of this healthful and carefully patroled zone, and into these remote regions must the new man go, for those already here are too wise to agree to any assignment that will take them into the tropical jungles where the same menaces to health exist now as centuries ago.

"So my first assignment was with a corps at work "up the river." I was given a day off, directed to go to the city of Panama and provide myself with a complete tropical surveying outfit. This outfit did not include provisions, tents, cots, revolvers and rifles, these being furnished by the I. C. C. All being in readiness, I proceeded to the end of the railroad, and then traveled in a native dugout canoe for two days and one night. This trip was rather monotonous, the only amusement being target practice at alligators, which we found quite numerous.

"Arriving at my destination, I found the party engaged in running a traverse around this section of the watershed. Or, rather, since the jungle was too thick to cut through, we did not run out the actual divides, but each party took a tributary and traversed it till they came to its head, thus establishing a point on the divide. Having a number of such points, a line could be drawn on the map connecting them, which would approximately represent the true drainage boundary. About every five miles we would move camp, this operation necessitating two trips with the canoes. One day, when about fifty miles from the zone, we were in the act of moving camp, out in the water up to our waists, pulling the boats up the rapids, when the worst flood on record came down upon us without an instant's warning. Our boats were swamped, we were swept off our feet, and all our outfit that would float danced off on the crest of the swirling torrent. Somehow we managed to regain the boats, and even saved the instruments and a few stray items on the grub list. Taking inventory, we found we had 128 hard tack and two sides of bacon as supplies to last three white men and seven natives indefinitely. By eating one hard tack and two slices of bacon per man per meal, we estimated that we might get along five days, and thought the flood would surely subside in that time. At the end of five days it had risen fifty-two feet, and was a surging, roaring torrent full of whirlpools. We made a desperate attempt to "ride the tide," but came so nearly being swamped again that we were only too glad to get back to the bank safely. Fortunately, the stream took a new tack the next day, and dropped twenty feet. We then set out on a rather dangerous journey to the place where we had left the other half of our outfit, only to find on our arrival that we were floating some thirty feet above it. The tents were the only part of the outfit that we secured. These had floated down some distance and were lodged in a patch of briars away above the water line as it was then. The only thing to do was to put back to the zone, and this we did in double-quick time on the high water. You may be sure it was a relief to get into a change of clothing; we had spent three weeks in the ones we brought back to civilization on our backs.

"Sleeping five nights in a steady downpour of rain was not without its effects on me, and I found myself in the grasp of yellow fever. Reporting promptly to the doctors, I received the best of care, and my case was not so far advanced that it could not be successfully handled.

"On my feet again, I was glad to receive an offer of transfer to actual construction, and reported at once to division engineer of Central Division. Here I was put upon the corps of engineers constructing highways through the jungle upon which to haul supplies and produce. This was interesting work indeed, as it is no small engineering problem to get up and around the steep hills—or, rather, mountains—and span the rivers, keeping all the while within a 5 per cent grade, which is the maximum allowed on highways here.

"After a few weeks of road work, the plans for the big suspension bridge across the canal were ready, and I was appointed assistant to the engineer in charge of construction. We have the excavations for the piers and anchorages completed, and will commence to drive piles for the foundations next week. This bridge has a span of 600 feet, and with the approaches makes quite a long structure.

"One thing has impressed me very strongly ever since the first day I set foot here, and that is the enormous, unbelievable waste of machinery by the old French company. Due to graft, poor management or something, numbers of good locomotives and other heavy machinery were dumped overboard in Colon harbor without so much as an attempt at landing them. Scores and hundreds of excavators, dredges and steam shovels were left scattered through the jungle, never being assembled. Graft must have been rife in the high places of the De Lesseps company when one can find a string of thirty or forty old French locomotives lined up in the bush without any sign of ever having been used. These machines are of such good material that, although they have stood for a quarter of a century in the moist tropical jungle, they still are very efficient when overhauled in the shops and put in working order. Several hundred small locomotives have been repaired by the I. C. C. and are now in active service.

"Having outlined some of my experiences during working hours, I will attempt a description of some other phases of an engineer's life here. The chief social medium in all the larger towns is the Y. M. C. A. These are operated on a broader and more efficient plan than those we have in the states, and nearly all the fellows spend most of their spare time in them. The reading rooms contain every engineering magazine published, and many other classes; there are billiard and pool rooms, bowling alleys, chess rooms, and they are even provided with confectioneries and cafes. The government controls these institutions, and they certainly do everything to make the fellows feel at home.

"Each good-sized town boasts a league park, where ball games are held frequently throughout the year. Dancing clubs are organized in each town, and altogether, if you could only forget that the United States existed, you would enjoy yourself here as much as at home. However, one is continually thinking that when ten months of service have been completed there will be a six weeks' vacation coming in which to pay the folks at home a much-desired visit.

"In the last few years the treatment of employes by the I. C. C. has improved very materially. The strictest sanitary regulations are in force, but the commission service is so efficient that it is not hard to conform to these. Of course, the quarters for all employes are maintained by the commission. When a man reports at the point to which he has been assigned, he is provided with free quarters, which are furnished with electric lights, shower baths, large mosquito nets, and all necessary conveniences. Rigid regulations govern the manner of airing and cleaning these quarters; a negro janitor sweeps out and airs them each day and scrubs everything twice a week. His work is carefully inspected at 4 p. m. daily."

Ingenious Rod Packing Moulding Machine

The illustrations show but poorly a machine devised by Mr. G. M. Crownover, superintendent of the Burnside shops of the Illinois Central Ry. As will be noted the machine is made double to hold two sets of dies or moulds at one time. It was originally built a single machine, but it has recently been reconstructed. Dies to suit all the different kinds of piston rod, valve stem and air pump piston rod packings used on the road are kept conveniently at hand and are quickly substituted.

As shown, the packing rings or cords come out in sets of three or the complete set for the packing gland. The machine is set near the melting furnace and, while pouring into the mould at one end of the machine, the other end is cooling its metal. After the cones are dropped out of the machine, they are carted to a band saw, where the slots are sawed out. The fillets left in casting are cut off by this saw. One man does the work which required several before the machine was installed, and the saving is a credit to the designer.

Half of Rod Packing Machine, Ill. Cent. Ry.

Piece or Premium System of Organization*

The piece work, or premium system, as applied to the Car Department is a plain understanding or contract between two interested parties, always acceptable by the first or second interest, if honestly introduced and correctly explained in the spirit which prompts its inauguration.

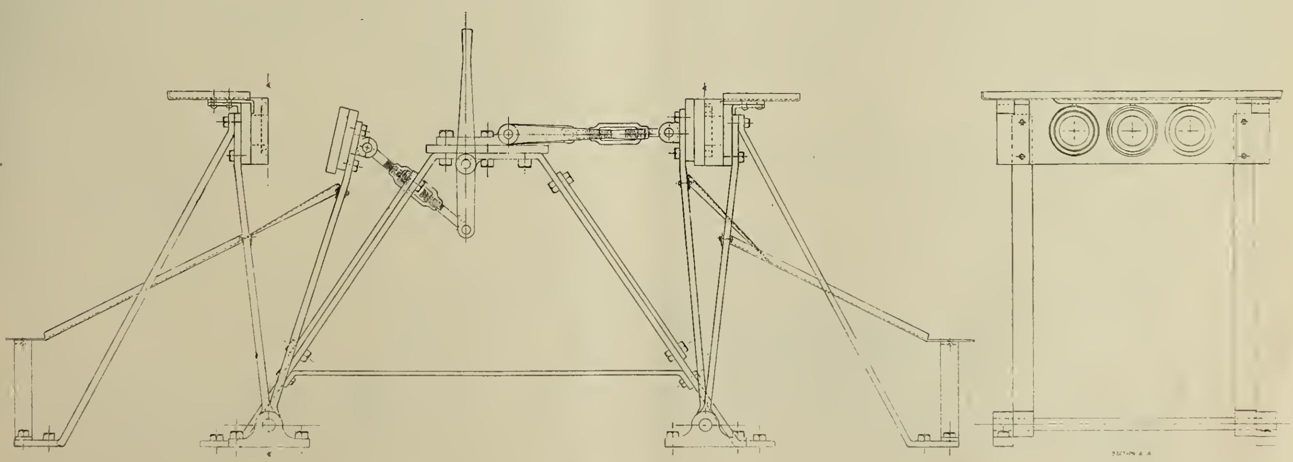
It would have been a crime against civilization to have permitted Abrahan Lincoln, Andrew Jackson and Patrick Henry to continue through life splitting rails and driving oxen. For the same reason, it is no less a crime against progress for railroads to retain in their service an officer who possesses no knowledge of organization. There is nothing so vital to the duties of a railroad officer as organization. The power of organization is so great, that organized wrong makes unorganized courage and right—wrong on battlefields in forcible acceptance of results and conditions. There are two classes of organization on the railroad, namely, practical, which is established and maintained by brief instructions, exclamation points and personal contact, theoretical, which is stimulated through voluminous correspondence and indiscriminate use of telegraph wires. Every improvement indicates better organization. Every attack aimed at the established principles of premium is a sword thrust at organization.

Organization bears as important a relation to economical accomplishments as Christianity does to morality: each is maintained through heavy expenditure and eternal vigilance,—one is the broad base of progress and civilization, the other marks the boundary line between animal and man.

Discipline, vigilance and justice are the trinities of organization, the essential commodities of which are adaptablity, love of duty and service, honesty and consistency of purposes, intentions and conduct, force of character and mutual action and sympathy.

When cause, remedy and effect are disregarded, organization deteriorates. Bad conditions are realities that are never created without a cause or permanently relieved without eliminating the cause. Rigid discipline in removing a cause also reaches the effect. Criticism, ignorant of remedy is nugatory. Railroad companies do not employ the spirit of "getting even" and shifting responsibility which plays so much "hellish" devastation with organization.

*From a paper by Mr. D. T. Taylor, foreman, Car Dept., St. L. & S. F. R. R., Morrett, Mo., read before the St. Louis Railway Club.



Drawing of Rod Packing Machine, Ill. Cent. Ry.

Things attempted without organization give birth to criticism and are desultory and transient, soon meeting with assault and defeat. The mistakes of history are recorded from the same source—proper organization insures success.

The car department represents one link in the chain of railroad service. Access and locations of our country's resources are questions of distance. Distance is shortened only when wheels turn. Economy of maintenance, unity and harmony with other links is a question open to improvement.

The advancement of premium is a magnetic power to attract talent, and under the "Law of the survival of the fittest," when trained talent and pampered ignorance meet upon the field of action the latter is always vanquished, and talent rules and reigns. Premium encourages interest, intelligent industry and harmonious action, singles out adaptability and develops man's best efforts. "It is no wonder to me that, man for man, you Americans lead the world, I can see ambition and determination stamped on the face of your newsboys," was expressed by a distinguished French traveler recently to a reporter. The results of the hidden principals of premium in a boy attracted the attention of a scholar, who doubtless was not aware that the army of young merchants referred to were operating on a piece work basis, creating high interest to duty and intense competition. The dress parade soldier who fights, or rather serves for a living in time of peace is a coward. In war to be successful in conflict, salary must be a secondary consideration in pursuit of merited reward. The time must come on the railroads when love of service equals remuneration—where standard piece work exists, the latter conditions are a reality now.

I believe that some railroad officers and employes are slow in recognizing facts and righting themselves to ever changing conditions. Each day is a precedent, and the finger marks, foot prints and tragedies of the preceding day should guide us. In seeking higher standards, improvement must be kept constantly in mind. Usually an improvement represents something new, the advantages of new things are never generally understood, resulting in arbitrary opposition and frequently temporary abandonment, before merits are revealed.

The principles of premium work are old in theory and proved in merit, the breadth of its application and accomplishments, the broad and comprehensive possibilities and adaptability to various links of the service at present apparently, almost universally unobserved and inconceived, will eventually reach a point of expansion and attain to an eminence of perfection beyond present calculation.

The foundation of day work is ancient and defective. The regulation as to the number of men required is an impossibility, a surplus of men destroys energy and creates indolence and demoralization. Piece work means fewer and better men, more easily directed, when properly distributed and concentrated; and best of all—rapid car movement. It is an unquestionable fact that an experienced day rate mechanic when commencing piece work, steadily and gradually increases his rate of pay for the first six months or more. This is sufficient conclusive evidence that not only superior thought and skill is not brought forth on a day rate basis, but the best efforts are not sufficiently productive. The former retards progressive citizenship, the latter stimulates ambition. Full measure of loyal co-operation must be forthcoming from subordinates in premium work—easily possible and readily maintained through constant touch of higher officers. Thus, regulation standard of supervision being understood, the advocates of piece work claim about 33 per cent advantage, made possible by direct reward of individual efforts. In the natural order of things, the system will reduce one hundred average day rate employes to seventy without a dismissal and without reducing the pay-roll, also reduce the number of defective cars 30 per cent and maintain the reduction. The responsibility for irregularity is entirely in the hands of the promoter who has access and control at all times. The system encourages industry and skill. The promoter should furnish standard supervision and piece work will advance and elevate the standard of citizenship in any community.

There was a flurry of excitement in Dayrateville when Miss Mary Weeks eloped with John Day—a day had consumed a Week—Father Time interceded and earnestly counseled patience and non-interference with the calendar. In due time the shortage was made good with brighter and younger Days. By the combined application of thought, skill and talent increased earnings are produced. Day rate in changing to piece work will cover a long distance in the direction of consuming a week. The elopement brought happiness and pleasure—the more a man produces or earns, the better he can live. The object of life is happiness, pleasure and living well. Organized piece work forces adaptability, adaptability never complains—loves work, loyalty and faithfulness, making labor and service as pleasant as recreation. Animals, not men, were created to drive on day basis. On day rate ten men not adapted will incriminate and jeopardize the reputation of one hundred mechanics. Piece work eliminates every suspicion from the men and places the responsibility upon the foreman, where it belongs. Increased remuneration is return for a larger output, makes the employes the greater beneficiary. At such points as his employer is willing to offer the premium, day rate should break the shackles from his hands, arouse and invigorate his dormant intelligence and go into business for himself. Normally, Nature and Providence are equal and fair in distribution of gifts to all. Man's station in life fluctuates in proportion to his adaptability in taking advantage of presented opportunities.

All things considered, Andrew Jackson and Abraham Lincoln were the two greatest Americans. They started with the least and accomplished the most. Their lives are a sublime illustration and inspiration to those seeking opportunity. Piece work rapidly settles the question of adaptability and in offering a perfect opportunity, transforms at least one department of a railroad into a solid "Smile Combine." As an upbuilder of citizenship, spreader of love, charity and peace and contentment, piece work honorably supervised, compares favorably with religion. Is it correct and proper that the rate of pay and reputations of 70 per cent of mechanics should suffer because 30 per cent is not adapted to the service? Under Piece System, no longer shall drones, incompetents or "artful dodgers," be permitted to saddle themselves upon the honest and efficient worker; diligence and skilled productiveness need not share perforce with indolence and sluggard impotence, either in credit or in gain—individual record and reputation, clear and clean of every form of favoritism.

In the ethics of good workmanship, piece work compared with day work, assumes about the relation that the Sunday school does to the penitentiary, in effect that it offers prizes in connection with instruction and emulation, as opposed to coercive measures. A totally blind mechanic who is opposed to piece work, can see more than he can evidently comprehend on the subject.

Piece work is a system of sane and honest methods, the ideal regimen providing for systematic arrangement of the aggregates of employment, employe and employer; establishing as it does, proper compense for effort, and salutary rebuke to indifference; and is from every point of view the best plan for the betterment of service in railroad mechanical departments, and the extension of industrial education.

Consolidation and Pacific Type Locomotives

Chicago & Alton R. R.

The Chicago & Alton R. R. has recently received 10 heavy consolidated freight locomotives and 5 large Pacific type locomotives, which were built at the Brooks Works of the American Locomotive Co.

One feature of interest, common to both classes of engines, is the Baker-Pillied valve gear. This type of gear, which is one of the latest developments in locomotive valve gears, has been applied on several roads during the past year with very satisfactory results. On the Chicago & Alton R. R. it was tried out on a Pacific type locomotive, with the result that it was specified for the engines here under consideration. Like the Walschaert valve gear, it gives a constant lead, the motion of the valve being derived from a return crank opposed at right angles to the crank pin and from the motion of the crosshead. In this gear, however, there are no links and sliding blocks as in the Walschaert; but it consists of a system of levers, cranks and rods, having pin connections and bearings. Reversing, therefore, requires no change in the reciprocating parts, but is effected by merely changing the angle of the reverse yoke from which the radius bar is suspended. This gear was fully described in the Railway Master Mechanic for July, 1908, and an extended discussion of it here is unnecessary.

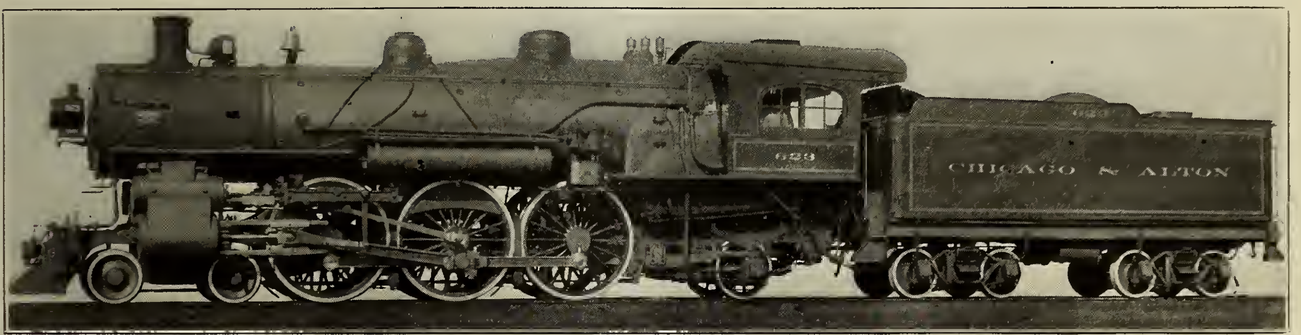
As will be seen from the accompanying illustration, the method of application is the same in both classes of engines. All the motion parts proper are carried in a cast steel cradle supported at the front end by the guide yoke and at the back end by a special crosstie extending over the frames, which in the case of the Pacific type engine, is located between the first and main driving wheels, and the Consolidation type just back of the intermediate driving wheels.

In working order the consolidation engines have a total weight of 228,000 lbs., of which 203,500 lbs., or 89.2 per cent, is carried on the driving wheels. The cylinders are 22 ins. in diameter and 30 ins. in stroke, which with driving wheels 62 ins. in diameter, and a boiler pressure of 200 lbs., gives a maximum tractive power of 39,800 lbs. Steam is distributed to the cylinders by means of 15-in. piston valves, having a maximum travel of 5½ ins. The valves have inside admission and are designed for 1-in. steam lap and no exhaust clearance, and are set for ¼-in. lead in full gear, which with the Baker-Pilliod valve gear, is, as before stated, constant.

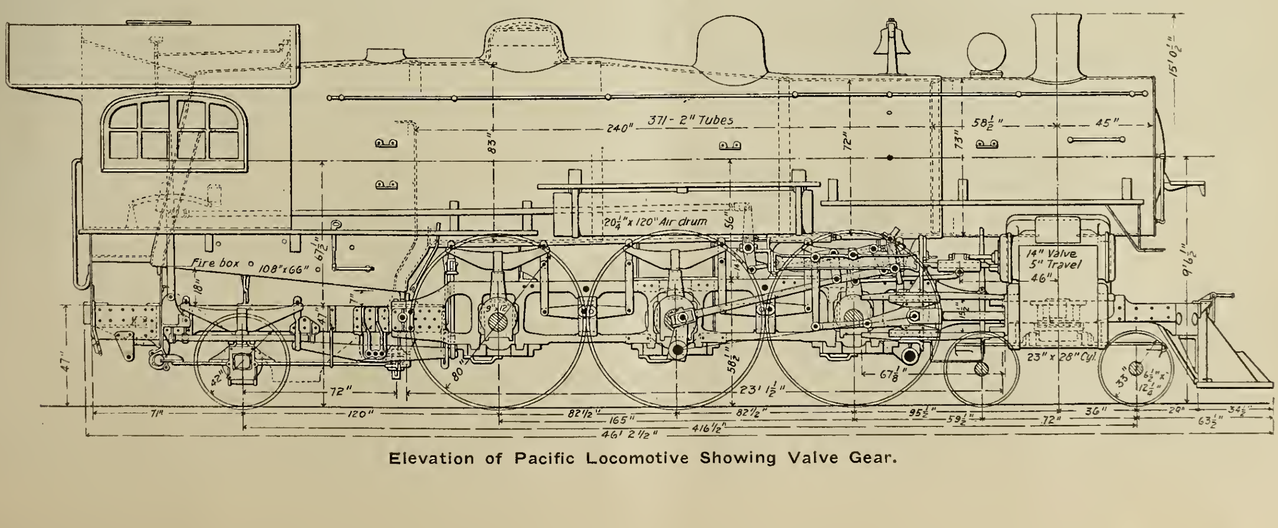
The frames, which are of wrought iron, with single front rail forged integral with the main frame, are 5 ins. wide. The valve gear being outside of the frames, ample opportunity is given for rigid frame bracing. In addition to the foot plate at the rear and the filling casting ahead of the cylinders, which extends back underneath the cylinders to their center; there is a heavy crosstie just back of the front pedestal and one between the intermediate and main driving wheels, all being of cast steel.

The boiler is of the straight top radial stayed type and is 80 ins. in diameter outside at the front ring. It contains 381 2-in. tubes 16 ft. long, and provides a total heating surface of 3,372 sq. ft., of which the tubes contribute 3,175 sq. ft., and the firebox the remainder.

The firebox is narrow, with sloping back head and straight throat sheet. It is 120⅛ ins. long and 40¼ ins wide, and has a grate area of 33.6 sq. ft. With the large boiler and narrow firebox, the ratio between grate area and heating surface is much greater than usual in this class of engine.



Pacific Locomotive for Chicago & Alton R. R.



Elevation of Pacific Locomotive Showing Valve Gear.

there being only one square foot of grate area for every 103 sq. ft. of heating surface. There is a liberal use of flexible staybolts in the sides, back and throat sheet of the firebox, there being 575 in all. The water spaces are 4 ins. wide at the mud ring on the front and sides, increasing in width at the crown sheet, and 4½ ins. wide at the throat sheet.

The Pacific type locomotives are among the heaviest and most powerful of this class of power built by this company, the only ones exceeding them in weight being those built for the New York Central lines and the one for the Pennsylvania R. R. In working order they have a total weight of 248,000 lbs., of which 149,500 lbs. is carried on the driving wheels. The cylinders are 23 ins. in diameter by 28 ins. in stroke, so that with a boiler pressure of 200 lbs. and driving wheels 80 ins. in diameter, the engines deliver a maximum tractive power of 31,475 lbs. The piston valves are 14 ins. in diameter, and have a maximum travel of 5 ins. They have inside admission and are designed with 1-in. steam lap and no exhaust lap or clearance, and are set with ¼ in. lead.

The frames, which are of wrought iron, consist of a main frame with single front rail integral with it and a slab form of trailing frame spliced to the main frame just back of the rear pedestal. The main frame is 5 ins. wide, while the slab frame is 2¼ ins. wide.

One of the most interesting features of the design is the trailing truck, which is the builder's latest arrangement of outside bearing radial trailing truck. As will be seen from the illustrations, this arrangement eliminates the use of the supplementary frames and heavy spreader castings required in former designs, thereby effecting a considerable reduction in weight. The truck frame is of wrought iron and has a pivot connection at the forward end to a cast steel crosstie between the frames underneath the front end of the firebox, which in this case also furnishes support for the firebox. The load is transmitted to the journal box in the usual manner by means of a semi-elliptic spring, connected at one end to an equalizing beam between it and the rear driving spring at the other end, to a cast steel bracket secured to the frame. The spring rests on a spring seat, having a flat sliding bearing on top of the box. This spring seat is carried on trunnions in a yoke shaped steel casting of I section, which is hinged at either end to brackets secured to the frame. This construction thus permits the spring seat to adjust itself to the alignment of the box as the later rises and falls relative to the frame.

A spring centering device, the same as that used in former designs, is provided to bring the truck back to its normal central position when the locomotive passes onto a tangent after a curve. This consists of a spring housing bolted to the foot plate in the center of the engine, fitted with transverse coil springs, having followers and fitted with horizontal thrust rods which have a ball and socket connection with the truck frame and also with the spring followers.

The boiler is of the extended wagon top type with wide firebox. The wide firebox is worthy of notice, inasmuch as most recent practice on this road has been in favor of the narrow firebox for all classes of engines, and the last engines of this same type were equipped with that form. The boiler has an outside diameter at the first ring of 72 ins. It is equipped with 371 2-in. tubes 20 ft. long. The total heating surface is 4,071 sq. ft., of which the tubes contribute 3,869 sq. ft. The firebox is 108 ins. long and 66 ins. wide, and provides a grate area of 49.5 sq. ft. The ratio of heating surface to grate area is thus 82, whereas in their previous engines of this type with similar design of boiler, but with narrow firebox, the ratio was as high as 119.

As in the consolidation engines, a large number of flexible staybolts are used, there being 376 in the sides, and 115 in the backhead, while all the throat stays are of the flexible type. The crown and side sheets of the firebox are in one piece, as are also the outside side sheets and roof.

Consolidation Locomotive for Chicago & Alton R. R.

The dimensions and weights of the consolidation locomotives follows:

Cylinder—Type, simple piston; diameter	22 ins.
Cylinder—Stroke	30 ins.
Track gauge	4 ft. x 8½ ins.
Tractive power	39.800
Wheel Base—Driving	17 ft. 9½ ins.
Wheel Base—Rigid	17 ft. 9½ ins.
Wheel Base—Total	26 ft. 9½ ins.
Wheel Base—Total, engine and tender	64 ft. 1 11/16 ins.
Weight—In working order	228,000 lbs.
Weight—On drivers	203,500 lbs.
Weight—In working order, engine and tender	393,100 lbs.
Heating Surface—Tubes	3175 sq. ft.
Heating Surface—Firebox	197 sq. ft.
Heating Surface—Total	3,372 sq. ft.
Grate area	33.6 sq. ft.
Axles—Driving journals, main	10½x12 ins.
Axles—Driving journals, others	9½x12 ins.
Axles—Engine truck journals, diameter	6½ ins.
Axles—Engine truck journals, length	12¼ ins.
Axles—Tender truck journals, diameter	5½ ins.
Axles—Tender truck journals, length	10 ins.
Boiler—Type, straight top; O. D. first ring	80 ins.
Boiler—Working pressure	200 lbs.
Fuel	Bituminous coal
Firebox—Type, narrow; length	120⅛ ins.
Firebox—Width	40¼ ins.
Firebox—Thickness of crown	⅜ in.
Firebox—Thickness of tube	½ in.
Firebox—Thickness of sides	⅜ in.
Firebox—Thickness of back	⅜ in.
Firebox—Water space, front	4½ ins.
Firebox—Water space, sides	4 ins.
Firebox—Water space, back	4 ins.
Crown staying	Radial

Tubes—Material, Spellerized steel No. 381; diameter...2 ins.
Tubes—Length ....16 ft.
Tubes—Gauge ....No. 11 B. W. G.
Boxes—Driving, main, cast steel; others..........Cast steel
Brake—Driver ....New York Auto.
Brake—Tender ....New York Auto.
Brake—Air signal ....New York
Brake—Pump ....5 Duplex
Engine Truck ....2-wheel swiveling
Exhaust pipe ....Single
Grate—Style ....Double rocking
Piston Rod—Diameter ....4 3/16 ins.
Piston packing ....Cast iron rings
Smoke Stack—Diameter ....18½ ins.
Smoke Stack—Top above rail ....15 ft. ½ in.
Tender frame .... 13 in. steel channels
Tank—Style ....Rectangular
Tank—Capacity ....8,500 gals.
Tank—Capacity fuel ....14 tons
Valves—Type, piston; travel ....5 ins.
Valves—Steam lap ....1 in.
Valves—Ex. lap ....line & line
Setting ....¼ in. lead constant
Wheels—Driving diameter outside tire ....62 ins.
Wheels—Centers diameter ....55 ins.
Wheels—Driving material, main ....Cast steel
Wheels—Driving material, others ....Cast steel
Wheels—Engine truck, diameter........................33 ins.
Wheels—Engine truck, kind ....Std. steel car
Wheels—Tender truck diameter ....36 ins.
Wheels—Tender truck, kind ....Std. steel car

Ratios.

Weight on Drivers÷Tractive effort ....= 5.11
Total Weight÷Tractive effort ....= 5.72
Tractive Effort×Diameter Drivers÷Heating surface.=731
Total Heating Surface÷Grate area..................=100.3
Firebox Heating Surface÷Total heating surface, per cent ....= 5.84
Weight on Drivers÷Total heating surface...........= 60.3
Total Weight÷Total heating surface................= 67.6
Volume both cylinders, cu. ft. ....= 13.2
Total Heating Surface÷Volume cylinders...........=255
Grate Area÷Volume cylinders ....= 2.55

Following are the dimensions and weights of the Pacific locomotives:

Cylinder—Type, simple piston; diameter..............23 ins.
Cylinder—Stroke ....28 ins.
Track gauge ....4 ft. 8½ ins.
Tractive power ....31,475 lbs.
Wheel Base—Driving ....13 ft. 9 ins.
Wheel Base—Rigid ....13 ft. 9 ins.
Wheel Base—Total .... 34 ft. 8½ ins.
Wheel Base—Total, engine and tender ....66 ft 4 ins.
Weight—In working order ....248,000 lbs.
Weight—In working order on drivers............149,500 lbs.
Weight—In working order, engine and tender....413,120 lbs.
Heating Surfaces—Tubes ....3,869 sq. ft.
Heating Surface—Firebox ....202 sq. ft.
Heating Surface—Total ....4,071 sq. ft.
Grate area ....49.5 sq. ft.
Axles—Driving journals, main ....10½x12 ins.
Axles—Driving journals, others ....9x12 ins.
Axles—Engine truck journals, diameter ....6½ ins.
Axles—Engine truck journals, length ....12¼ ins.
Axles—Trailing truck journals, diameter ....8 ins.
Axles—Engine truck journals, length ....14 ins.
Axles—Tender truck journals, diameter ....5½ ins.
Axles—Tender truck journals, length ....10 ins.
Boiler—Type, extended wagon top; O. D. first ring......72
Boiler—Working pressure ....200 lbs.
Fuel ....Soft coal
Firebox—Type, wide; length ....108 ins.
Firebox—Width ....66 ins.
Firebox—Thickness of tube ....½ in.
Firebox—Thickness of sides ....⅜ in.
Firebox—Thickness of back ....⅜ in.
Firebox—Crown and sides in one piece.
Firebox—Water space, front ....5 ins.
Firebox—Water space, sides ....5 ins.
Firebox—Water space, back ....5 ins.
Crown staying ....Radial
Tubes—Material, Spellerized steel No. 371; diameter..2 ins.
Tubes—Length ....20ft. 0 in.
Tubes—Gauge ....No. 11 B. W. G.
Boxes—Driving, main, cast steel; others..........Cast steel
Brake—Driver ....N. Y. high speed
Brake—Tender ....New York
Brake—Air signal ....New York
Brake—Pump 5-Duplex
Brake—Reservoir 120x20¼
Engine truck ....4 wheel swiveling
Trailing truck ....With outside journals
Exhaust pipe ....Single
Grate—Style ....Double rocking
Piston Rod—Diameter ....4 3/16 ins.
Piston packing ....Cast iron ring
Smoke Stack—Diameter ....18½ ins.
Smoke Stack—Top above rail ....15 ft. ½ in.
Tender frame ....13 in. channels
Tank—Style ....Rectangular water bottom
Tank—Capacity ....6,500 gals.
Tank—Capacity fuel...................................14 tons
Valves—Type, piston; travel ....5 ins.
Valves—Steam lap ....1 in.
Valves—Ex. lap ....line & line
Setting ....¼ in lead
Wheels—Driving diameter outside time ....80 ins.
Wheels—Centers diameter ....73 ins.
Wheels—Driving material, main, cast steel; others..Cast steel
Wheels—Engine truck, diameter ....33 ins.
Wheels—Engine truck, kind ....Std. steel car
Wheels—Trailing truck, diameter ....42 ins.
Wheels—Tender truck, diameter ....36 ins.
Wheels—Tender truck, kind ....Std. steel car

Ratios.

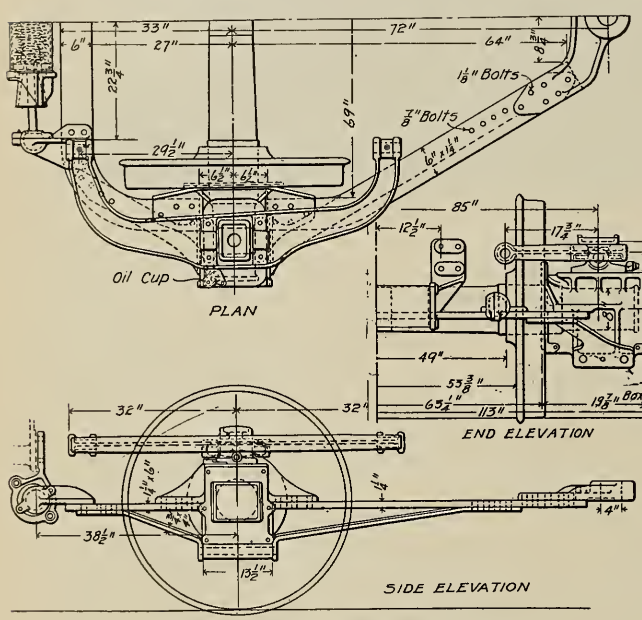
Weight on drivers÷Tractive effort..................= 4.75
Total weight÷Tractive effort ....= 7.87
Tractive effort × diam. drivers÷Heating surface....=618
Total heating surface÷Grate area ....= 82
Fire-box heating surface÷Total heating surface, per cent. ....= 4.96
Total weight÷Total heating surface..................= 60.9
Weight on drivers÷Total heating surface............= 36.7
Volume both cylinders, cu. ft.........................= 13.28
Total heating surface÷Volume cylinders............=306.5
Grate area÷Volume cylinders ....= 3.72

A concise way of stating the value of exhaust steam is that every six pounds of it is worth as much as one pound of coal, plus fireman's wages, plus interest and depreciation on boiler plant, plus six pounds of pure boiler-feed water. That is, provided you want the steam for heating, drying or similar purposes.

Influence of Ash on Value of Coal in Locomotive Service*

All motive power officials, locomotive engineers and firemen are familiar with the trouble occasioned by what is designated as "bad coal," which makes clinkers as well as fills the firebox with ashes, so that the capacity obtained from the locomotive is very materially reduced, resulting in delays and various other troubles, due not to inferiority in the coal itself, but to the fact that the ash in or associated with the fuel is excessive. But so far as the author is aware, no attempt has been made in railway service to place a definite value upon the effect of variation in quantity of ash, therefore it is the purpose of this paper to more particularly present two diagrams, Figs. 1 and 2, the first illustrating value of coal fuel with varying percentages of ash, and the second, showing the results of experiments from which Fig. 1 is derived.

These experiments were made with a Babcock & Wilcox boiler served with a chain grate stoker. A special lot of four cars of what is known as No. 4 washed coal from Williamson county, Ill., were provided to insure that no effect produced



Trailing Trucks of Pacific Locomotive.

would be due to irregularity in size. In preparation it was passed over a screen having round perforations ¼ in. in diameter, and through a screen having round perforations ¾ in. in diameter. The coal as received contained approximately 8 per cent ash. The first experiment was run with this coal in condition as received. In the test of the following day a small quantity of ash-pit refuse was mixed with it, and on each succeeding day a gradually increasing quantity of ash-pit refuse was added to the coal and thoroughly mixed. This process was continued until the efficiency and capacity dropped to zero, or in other words, until there was no water evaporated from the coal burned, notwithstanding the fact that 60 per cent of the fuel composition was pure coal.

The above mentioned experiments were conducted by the author for the Commonwealth Edison Company under the direction of Mr. W. L. Abbott of that company, and while they refer to conditions of stationary boiler service rather than that of locomotive, it is the only piece of data of this character which has been produced, although so far as the author's observations have gone, it appears that the conclusions have a useful application in any steam-making service. Some results plotted from tests made by the United States Geological Survey using coal containing ash ranging from 5 to 15 per cent on hand fired grates, conform very closely to the corresponding portion of the curve shown in Fig. 2.

The matter of ash in locomotive fuel may be considered from two standpoints, one, the desirability of employing fuel which is low in ash, the other, the removal of the ash as rapidly as it accumulates, each tending to the same result. It has been the author's experience that by frequently shaking the grate, the ash accumulation could be so disposed of that an engine would come in at the end of a division with the fire in apparently as good condition as when leaving. This, however, added very materially to the labor required on an engine, but more recently, grate-shaking apparatus operated by steam has been proposed and employed to a limited extent.

The whole matter of the ash in locomotive fuel is one of the very first importance, probably much greater than has been realized. The characteristic of smallness in size which cuts a considerable figure in stationary practice is largely absent in the case of locomotives, for the reason that the fine coal is carried out of the stack by the intense draft and does not clog the fuel to such harmful extent, leaving the

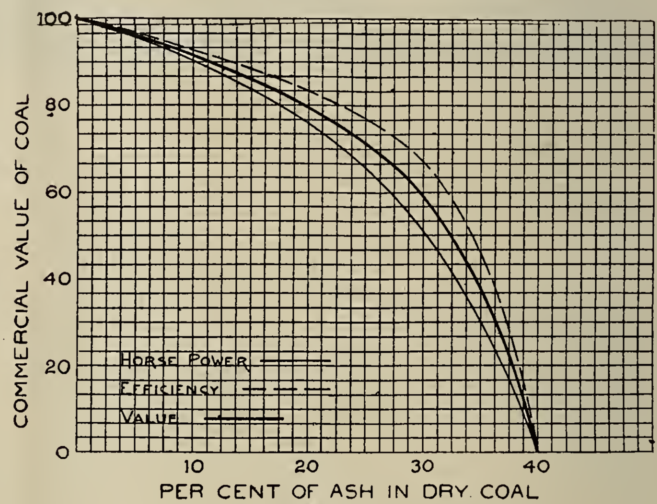


Fig. 1.

ash as the greatest cause of trouble with the railroad fuel, which results in many so-called engine failures.

*From a paper by A. Bement, read before the Western Railway Club, April 20, 1909.

Developements in Bituminous Gas Producers

For a number of years The Westinghouse Machine Co. has been engaged in the development of a satisfactory form of producer suitable for gasifying the usual grades of bituminous fuels. The unusual difficulties encountered in the utilization of this kind of fuel have resulted in the trying out of many different types, both of the producer itself and of the necessary auxiliaries for producing clean gas. For the past year and a half, however, the company has been negaged in carrying out upon a commercial scale, a producer plant which is now upon the market. These tests have not been conducted with a toy apparatus, but with a full-sized equipment of 175 h. p., including a standard gas engine of about the same power, by means of which the actual power value of the gas produced and the overall efficiency obtainable, were determined without possibility of error.

The above-mentioned tests were brought to a conclusion on April 3, by drawing the fire in the producer after it had been in continuous operation on various loads and on various fuels for a year past, these twelve months having been devoted to tests of one to four weeks' duration, both ten and twenty-four hours per day on standard fuels available for power purposes. These fuels included Pittsburg slack and run-of-mine, lignites from Northern Colorado, Texas and South America, also peat and other fuels from various parts of the country. Most of the tests the load on the equipment was maintained at full rating, although one special test of one month and a half duration was made to determine accurately the standby loss of the producer standing idle.

The drawing of this fire after one year's operation was made the occasion of a demonstration of the producer plant before government officials and engineers from various parts of the country especially interested in bituminous gas practice.

The fire was drawn without trouble or interruption as large clinker formations were entirely absent, although the producer had, just previous to this occasion, been running on a full load test for one month, using Pittsburg coal. The lining of the producer was found to be practically intact and in

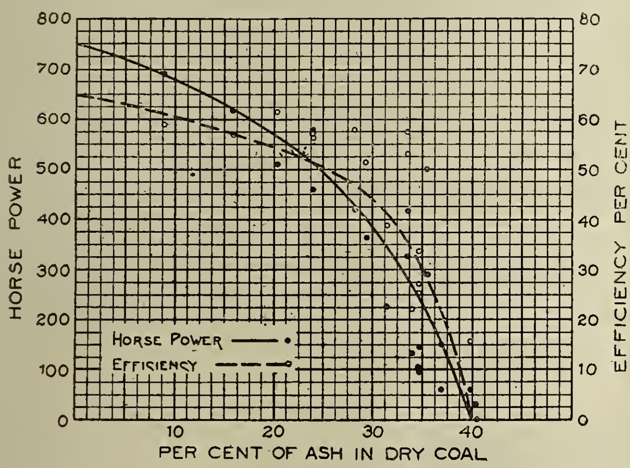


Fig. 2.

quite good enough condition for continued operation for an unlimited period. A detailed examination of the piping leading from the producer house to the engine on test, showed that during this long period of operation, there had been no deposits of tar or lampblack. As a matter of fact, this piping had not been examined for about two years and a half of producer experimentation.

The most important feature of the demonstration was the entire absence of tar formed in the producer gas. A similar examination of the mixing and inlet valves of the engine which has been used for the past year on this test, showed practically no deposits of tar or lampblack, such as would interfere with the operation of the engine. The Westinghouse plant uses no tar extractors, as no tar is made, simply a static washer of small size in the place of the usual bulky coke scrubber. A rotary exhauster draws the gas from the fuel bed and delivers it to the engine at a definite pressure.

No gas holder is used in this process, as the producer regulation is entirely automatic. The gas produced has a moderate heat value suitable for high compressions in the gas engine, and is uniform and clean, average samples showing not more than .02 to .03 grains per cu. ft. impurities. The ash is fairly clean, and analysis of samples from time to time shows that not more than 1 to 3 per cent of the combustible in the coal escapes in the ash.

The various fuels which have been used in this producer on test, have been gasified successfully, and have run as high as 34 per cent moisture, 35 per cent volatile and 15 per cent ash and 1½ per cent sulphur. The results of the tests show that with coal, such as Pittsburg slack or run-of-mine, an overall economy of 1.1 lbs. per brake horse power hour can be secured, equivalent to a little over $\frac{9}{10}$ lbs. per indicated h. p. hour. Moreover, the producer efficiency does not vary more than 10 per cent from full load on the plan to no load.

The results of this past year's tests have fully convinced the builders that the apparatus experimented with possesses unusual commercial value, and preparations are being made for extensive manufacture.

Use of Steel in Passenger Car Construction

The March issue of the Railway Master Mechanic contained a paper on the "Use of Steel in Passenger Car Construction," read by John McE Ames before the Central Railway Club in March. The discussion of this paper was interesting and we publish it in part, as follows:

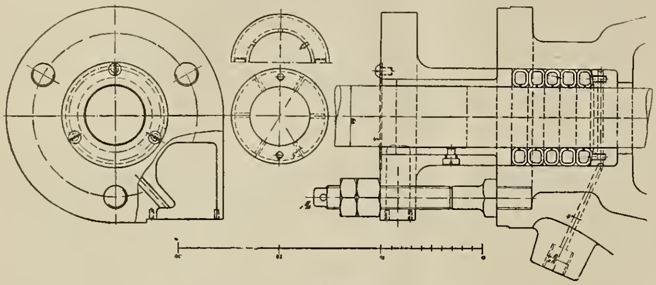
Mr. Lindstrum—The paper presented by Mr. Ames this evening treats on a very important subject, and is a very able explanation of the important points, and difficulties which must be considered, in the construction of steel passenger cars, and there are only a few thoughts which have come to my mind in connection with the various details of construction, etc., brought out in the paper, on which I will say a few words, as there is practically nothing new that can be brought out on this subject if Mr. Ames' paper is considered in connection with the report of the committee on Passenger Cars given in the M. C. B. Proceedings for 1908, and on which committee Mr. Ames, as well as myself, had the honor to be members.

Mr. Gibbs, general superintendent of motive power of the Pennsylvania R. R., writes from Altoona as follows: After carefully reading the paper, we find that there is very little that we can add, as Mr. Ames has quite fully covered everything that can be said on the subject, giving clearly the primary reasons for the use of steel in passenger cars and the ultimate advantages to passengers, and even to the railroad stockholders. From actual experience we can give you the following:

The first steel coach was built for the Pennsylvania Railroad with all steel framing and outside sheathing. The lining throughout, including doors and partitions, also the outside roof, was made of artificial board. It was found that this board did not stand the wear and tear of service as well as desired, for which reason the next coaches were equipped with steel lining and steel roof; in fact, all the coaches built since that time were literally all-steel cars, with the exception of window sash and seat arms. We still retained artificial board for headlining, for which it is apparently more satisfactory than any other material. The steel lining has proven more durable and less costly in repairs. On the other hand, as steel as a good conductor of heat, it is cold to the touch, even in a warm room, because it rapidly carries away the heat of the hand or body. This seems to indicate the necessity of making the window sills of wood, or other non-conducting material, and possibly covering the steel lining below the window sills with a thin coating of non-conducting material. One of the principal objections that is found in the use of wood, or artificial board, for inside lining, is that the metal frame will expand considerably in very warm weather, or at times when the sun's rays exert a maximum effect on the steel. For an increase in temperature of 100 degrees soft steel will expand 1 inch to 125 feet, while wood varies very little under change of temperature. This would indicate that decidedly more trouble would be experienced with wood lining than with steel lining, as the latter would be used in very thin sheets, and, naturally, would be sufficiently flexible to adjust itself to conditions of temperature differing between inside and outside of car. From the experience which we have had, we can, therefore, safely say that steel is the best material for outside sheathing and inside lining, except at such places where its coldness to the touch will be uncomfortable for passengers.

New Metallic Rod Packing

A metallic rod packing which has been applied with advantage on German and Austrian locomotives is shown in the packing gland cross section herewith. The packing rings consist of two sectioned, hollow rings, made of heavy anti-friction metal alloy, the ends of which are soldered. On the inner surface which lies against the rod, there are small holes through which the substance (graphite mixture), on the inside of the rings passes to the rod and acts as a lubricant.



Showing Huhn Metallic Packing.

For all ordinary purposes an alloy of lead, tin, antimony, zinc and copper is used which is guaranteed to withstand a cylinder temperature of 700 deg. Fahrenheit. For higher temperatures, a special copper alloy is used. The inner surfaces of the rings are provided with emission holes, through which the graphite is deposited on the rod. The graphite is fed out through the emission holes, and fills the triangular interstices between the rings, thus forming a smooth lubricated bearing surface for the rod.

Repairing Steel Car Plates in Position

The rapidity with which the steel car is supplanting the old wooden type has been due in considerable degree to the opportunity afforded by the former for the making of repairs with greater ease and economy. A large part of the work consists merely in straightening out bent and battered plates, and can be done in place, without the additional cost of removing the injured section; for such purposes as this portable tools have been particularly designed and have found wide favor. The Hauck oil burner, being entirely portable and self-contained, so that it can be used in any position, has been brought out especially for use in building and repairing steel cars, repairing engine frames, expanding tires and discs, boiler making, pipe bending and similar work common in the railroad, boiler and machine shop.

Aside from the powerful and even character of the flame, an important feature is found in the fact that it can be regulated either to heat a large surface or concentrated on a small area. The rapidity with which work of this character can be done is illustrated by a job recently handled with an ordinary No. 2 burner; a steel plate, ½ inch thick and measuring 6 by 10 feet, was bent to right angles the longer way in fifteen minutes a space 8 inches wide by 10 feet long being heated for this purpose. The burner is also adapted for brazing and welding work. It is built by the Hauck Manufacturing Company, Brooklyn and New York City.

A train from Chicago to Butte, Mont., on the Chicago, Milwaukee & St. Paul Ry., has been in operation for several months, but a second through train will be run daily to Miles City, Mont., leaving Chicago as the Pioneer Limited at 6:30 p. m., and leaving St. Paul at 9:30 the next morning, arriving at Miles City at 2:40 p. m. the third day.

Government Specifications for Coal

The plan inaugurated two years ago by the government for the purchase of coal on its heating value has resulted in the delivery of a better grade of fuel without a corresponding increase in cost and with therefore a saving to the government. At the present time, forty departmental buildings in Washington, the Panama Railroad, more than 300 public buildings, throughout the United States, navy yards, and arsenals are buying their fuel supplies on specifications the prime element in which fixes the amount of ash and moisture. Premiums are paid for any decrease of ash below 2 per cent from the standard at a rate of $0.01 per ton for each per cent. Deductions are made at an increasing rate for each per cent of ash when it exceeds the standard established by 2 per cent.

It has been demonstrated by the United States Geological Survey, Technologic Branch, which has charge of the analyses of the coal that under these specifications the government has been getting more nearly what it pays for, and paying for what it gets. The purchase of coal on specifications is but one of the activities of the government looking toward a more efficient use of the fuel resources of the country. Engineers of the Geological Survey are studying the problem in all its phases at the experiment plant, in Pittsburg, Pa. The investigations, by suggesting changes in furnace equipment and in methods of firing the coal, are indicating the practicability of the government purchasing cheaper fuels, such as bituminous coal and the smaller sizes of pea, buckwheat, etc., instead of the more expensive sizes of anthracite, with a corresponding saving in price. The fuel bill of the government now aggregates about $10,000,000 yearly, the saving on which, through securing coal containing less ash, alone amounts to $200,000.

Since the government has been purchasing coal on the basis of its heating value a growing interest has been manifest on the part of manufacturers and the general public in this important subject and a demand has been created for authentic information concerning the results accomplished. In response to this demand the results of the government's purchases of coal under the heat value specifications for the fiscal year 1907-8 have been assembled in a bulletin just issued by the survey in the hope of promoting a better understanding of this method of buying fuel. John Shober Burrows, the engineer in charge of this part of the fuel problem has included in the bulletin a list of the contracts with abstracts of the specifications for the current fiscal year.

Repairing Steel Car Plates with Burner.

In explaining the nature of the specifications, Mr. Burrows says:

"Government specifications are drawn with a view to the consideration of price and quality. For manufactured articles and materials of constant and uniform quality they generally can be reduced to a clear statement of what is desired. For coal, however, the variation in character makes this impracticable.

"This lack of uniformity is the feature recognized and provided for in the coal specifications prepared by the Geological Survey. Under these specifications, bidders are requested to quote prices on the various sizes of anthracite, a definite standard of quality being specified for each size, and to furnish the standard of quality with price for bituminous coal offered. Awards are then made to the lowest responsible bidder for anthracite and to the bidder offering the best bituminous coal for the lowest price. The specifications become part of the contract, and the standards of quality form the basis of payment for coal delivered during the life of the contract. For coal delivered which is of better quality than the standard, the contractor is paid a bonus proportional to the increased value of the coal. For deliveries of coal of poorer quality than the standard, deductions are made from the contract price proportional to the decreased value of the coal. The actual quality and value of coal delivered is determined by analysis and test of representative samples taken in a specified manner by agents of the government and analyzed in the government fuel-testing laboratory at Washington. The necessity of paying for coal on a sliding scale was fully discussed by D. T. Randall in a recent paper."

The advantages of buying coal on specifications are explained by Mr. Burrows as follows:

"The advantages of this system of purchasing coal may be briefly summarized as follows: "Bidders are placed on a strictly competitive basis as regards quality as well as price. This simplifies the selection of the most desirable bid and minimizes controversy and criticism in making awards.

"The field for both the government and dealers is broadened, as trade names are ignored and comparatively unknown coals offered by responsible bidders may be accepted without detriment to the government.

"The government is insured against the delivery of poor and dirty coal, and is saved from disputes arising from condemnation based on the usual visual inspection.

"Experience with the old form of government contract shows that it is not always expedient to reject poor coal, because of the difficulty, delay, and cost of removal. Under the present system rejectable coal may be accepted at a greatly reduced price.

"A definite basis for the cancellation of contract is provided.

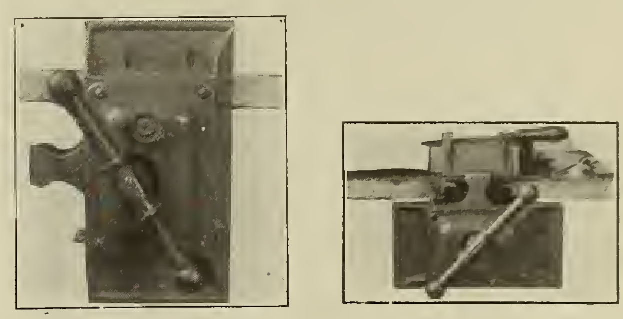
"The constant inspection and analysis of the coal delivered furnishes a check on the practical results obtained in burning the coal."

A few years prior to the adoption of the present system the necessity for a uniform standard in the purchase of coal became apparent to a few of the government departments, and the plan of purchasing on the heat-valve basis was introduced. It proved successful, especially in the Treasury Department, under which purchases are made for the post-offices and other public buildings throughout the United States. The Treasury Department had at that time a well-equipped laboratory and was thus enabled to do all of the necessary testing. Other departments were unable to follow the example of the Treasury because of lack of information and proper facilities. In 1904, at the Louisiana Purchase Exposition, at St. Louis, the Geological Survey began a comprehensive study on a practical scale of the utilization of coal, J. A. Holmes being placed in charge of the work. These investigations are still in progress at Pittsburg, Pa., and they have resulted in making authentic information of great practical value available to the public as well as to the government departments.

A Handy Vise

In the illustrations herewith, is shown a vise which adapts itself to a great many positions and classes of work. It is designed by means of short radii joints to act like the human hand in grasping objects. When the vise is in position on the side of a work bench, its top is flush with the top of the bench and it thus is not an obstruction. By tripping a trigger it can be swung in the arcs of circles, the planes of which are verticle and at right angles. This can also be done in a horizontal plane, and at any point the vise can be locked firmly in position.

The device, which is called the "Universal Pattern Makers



Universal Vise in Two Positions.

Vise," is made of iron and steel, and weighs about 75 lbs. The main jaws are 8x16 in., smoothly ground and moving normally parallel. The ends are squared, and the planed screw sleeve runs through the center so that the operator can place his work on either side, making it a right or left handed vise. Of the main jaws, the moving one is fitted with a device which throws the entire jaw out of parallel to permit the gripping of tapered work.

This vise is made by the G. M. Yost Mfg. Co., of Meadville, Pa.

Severe Test of Motive Power on Raton Mountain*

Late in the year 1878 the Santa Fe line was being pushed south from La Junta, Colo. The first objective point was Las Vegas, N. M., and from there, lines were to be projected southward to the Rio Grande and westward toward the coast. The mountain grades that interposed between La Junta and Las Vegas at once loomed up as the first great obstacle to be overcome by the company's engines. From La Junta to Trinidad the grade rises about 30 ft. to the mile; from Trinidad to Morley, 105.6 ft., and from Morley to the state line and beyond to Willow Springs the grade is 184.8 ft. per mile. Between the last-named points is Raton Mountain, which reaches an elevation of 7,677 ft. and is crossed by a 3.5 per cent grade only by means of a tunnel near the summit. From Willow Springs on the south side of the mountain to Las Veges a maximum grade of 70 ft. per mile exists. This entire stretch of country was a serious proposition for motive power in the pioneer days of railroading. Raton Mountain was the problem.

The Santa Fe surveyors under the direction of A. A. Rob-

*By G. D. Bradley, in the Santa Fe Employes' Magazine.

inson, chief engineer of the system at that time, readily conceived the idea of tunneling through the summit of this mountain to reduce the grade line. Such a tunnel, the same as now exists, is reached by a maximum grade of 3.5 per cent. It is 2,011 ft. in length and is located on a 1.9 per cent ascending gradient going south.

The surveys on the north slope of the mountain were begun in March, 1878, by Mr. Robinson, assisted by George B. Lake. The location on the south slope was made by R. L. Engle, division engineer, who had charge of the tunnel work. Excavation work was begun on June 1, 1878, but, as much solid rock was encountered, the work progressed slowly. By the end of August the work was far from completion and the laying of track had already reached a point 65 miles south of La Junta. One of two alternatives had to be chosen: Either traffic must be detained at the mountain awaiting the completion of the tunnel, or else a temporary track must be built over the mountain, to be used until the tunnel is completed. The Santa Fe board of directors accordingly met in New Mexico on the last day of August, 1878, and decided in favor of a temporary track or "switchback," the locating of which began immediately. Grading for this track was started on September 16 and was completed on November 10, 1878. Before the end of December the track over the mountain had been laid and construction southward toward Las Vegas was under full headway.

The switchback reached a maximum grade of 316.8 ft. per mile, or about 6 per cent, descending on the south slope with a grade of 4.9 per cent. The least radius of its curves was 359.3 ft. It was laid with 56-lb. iron rails, common splices, pine ties at the joints of rails and on all curves having less than 1,146-ft. radii. A cast iron bracket was fitted against the outer side of each rail on curves of 716-ft. radii or less, while a guard rail of iron was placed on the inner side of the inside rail.

This mountain road, when completed, at once assumed great importance, not only because it formed a connecting link with the main line northeastward, from whence materials and supplies could be forwarded to the advancing construction gangs, but it also began at once to transport large quantities of merchandise. In addition to the construction material and supplies for the company, about $160,000 worth of miscellaneous freight was transported over the switchback during the first three months after it was opened for traffic. The average daily tonnage over this track aggregated about 420 tons southbound and 200 tons northbound.

The first locomotives used on the switchback were the ordinary eight-wheeled American type machines, the specifications of which are herewith given:

Cylinders, 17-in. diameter; stroke, 24 ins.; drive wheels, 57 ins.; wheel base, 8 ft.; total wheel base, 22 ft. 6¼ ins.; number of tubes, 161; size of tubes, 2 ins. by 11 ft. 7½ ins.; firebox, 64$\frac{5}{16}$x34⅝ ins.; grate area, 15.6 sq. ft.; tube heating surface, 975 sq. ft.; total heating surface, 1,078 sq. ft.; weight on drive wheels, 47,000 lbs.; total weight, 73,000 lbs.; tank capacity, 2,300 gallons.

Such a locomotive could haul about eighty-six tons up the 3.5 per cent grade from Morley to the tunnel mouth. Over the 6 per cent elevation of the switchback it could haul about thirty-three tons, exclusive of its own weight. It was, then, to expedite this traffic that the famous "Uncle Dick" engine was built at the Baldwin Works in 1878 and forwarded to Raton Mountain early in the following year.

From a practical standpoint it is interesting to note the words of James D. Burr, civil engineer, before the American Society of Civil engineers, in June, 1879. Mr. Burr stated that the advent of the Uncle Dick, a consolidation eight-wheeled-connected engine from the Baldwin shops, revolutionized transportation on the "Mountain Top" line. This locomotive, which at that time held the world's record for size and tractive power, was of the following specifications:

Cylinders, 19-in. diameter; stroke, 26 ins.; drive wheels, 42 ins.; total wheel base, 22 ft. 10 ins.; rigid wheel base, 14 ft. 9 ins.; diameter of boiler, inside, 57 ins.; firebox, 119⅛x33⅜ ins.; number of tubes, 213; size of tubes, 2 ins. by 10 ft. 11½ ins.; heating surface of firebox, 153 sq. ft.; heating surface of flues, 1,223.84 sq. ft.; total heating surface, 1.376.84 sq. ft.; weight on drivers, 100,000 lbs.; total weight of engine, 115,000 lbs.

This engine had a saddle tank of 1,200 gallons capacity on its boiler, but a tender having a capacity of 2,500 gallons was also commonly used. The first and third pair of drive wheels had bald tires in order to pass curves of very short radius. To avoid the danger of skidding down the steep incline the machine was equipped to deliver sand along the rail in front of each wheel, and it was provided with two sets of air brakes acting simultaneously upon the driving wheels. As an additional precaution for sharp curving grades it was furnished with pipes for the purpose of sending a small spray of water along the flange of each drive wheel. The tractive power of the Uncle Dick was more than double that of two American-type engines with the 16x24-in. cylinders, yet it did not consume twice as much coal as a single light engine.

The average performance of the Uncle Dick, exclusive of its own weight, on this mountain division, was as follows: On the 2 per cent grade, Trinidad to Morley, 482½ tons hauled eight miles per hour; on the 3.5 per cent grade, Morley to the tunnel, 258½ tons hauled eight miles per hour; on the switchback 6 per cent incline, 194 tons hauled six miles per hour, including the time lost in opening and closing six switches. The ordinary round trip of 5½ miles over the switchback required fifty minutes time. The average train comprised seven loaded cars of 43,000 lbs. each and a tank of coal weighing 44,000 lbs., besides the weight of the engine loaded cars over at one trip, and on at least one occasion the Uncle Dick drew nine such loads over without mishap. In an average working day of ten hours it was thus possible to transport about 6,000,000 lbs. over the mountain.

This locomotive was named after the famous Uncle Dick Wootton, a striking character in frontier history and incidentally a Colorado pioneer who occupied a rather notorious roadhouse at the foot of the north slope of the mountain, near which spot the Santa Fe line now passes.

In an interview with the late George M. Hackney, who was superintendent of motive power when the switchback was operated and until the year 1888, he stated that, contrary to many statements, Uncle Dick Wooten was not only friendly but he gave much kindly assistance to the Santa Fe engineers by way of information as to the lay of the ground while the road was being surveyed over Raton Mountain.

Mr. Hackney stated that no locomotive engineer could be found who had the courage to take the Uncle Dick engine over the mountain for the first time. After some delay from this cause he inquired of a certain fireman named Jack Mahoney if he was afraid to make the trip. "Not if you will go along," replied Mahoney. And so the first trip over Raton Mountain for what was then the world's largest locomotive was made with the Santa Fe superintendent of motive power at the throttle. And this trip marked the beginning of a new era in mountain railroading.

In passing it might be noted that the Uncle Dick is still in service, being used as a switch engine. To the average observer, this engine today attracts no more attention in so far as size is concerned than any other dinky yard engine.

It is hopeless for this article to attempt a discussion of the various types of locomotives that have been doing service over the mountain since the Uncle Dick first appeared. In closing it is interesting by way of contrast to note the specifications of a Santa Fe type of the so-called "900-class" locomotives that are now being used over the same mountain grades:

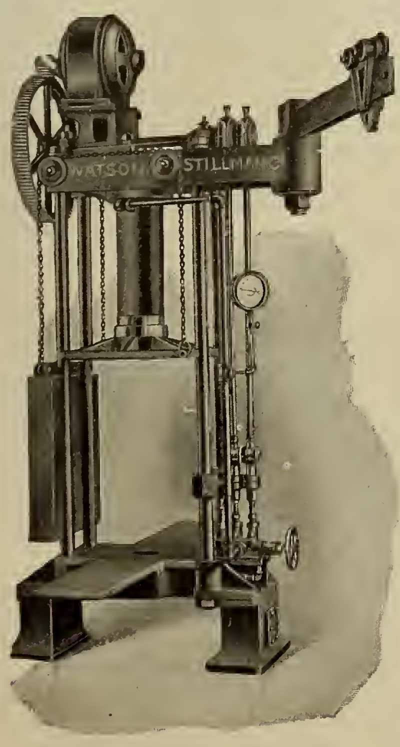
Cylinders, 19x32 ins.; stroke, 32 ins.; diameter of boiler, 78¾ ins.; working pressure, 225 lbs.; length of firebox, 108 ins.; width of firebox, 78 ins.; depth of firebox, front, 80¼ ins.; depth of firebox, rear, 78¼ ins.; number of tubes, 391; size of tubes, 2¼ ins. by 20 ft.; heating surface of firebox, 210 sq. ft.; heating surface of tubes, 4,586 sq. ft.; total surface of tubes, 4,586 sq. ft.; total surface, 4,796 sq. ft.; grate area, 58.5 sq. ft.; drive wheels, 57 ins.; wheel base of drivers, 19 ft. 9 ins.; rigid wheel base, 19 ft. 9 ins.; total wheel base of engine, 35 ft. 11 ins.; total wheel base of engine and tender, 66 ft.; weight on driving wheels, 234,580 lbs.; tank capacity, 8,500 gallons.

The Uncle Dick, as previously stated, could haul 258½ tons over the 3.5 per cent incline from Morley to the tunnel approach. One of the 900-class locomotives can draw more than 560 tons up the same grade. The Raton tunnel has been in operation nearly thirty years, and the switchback was gladly abandoned on September 7, 1879, when the tunnel was completed. The 3.5 per cent grade leading to the tunnel entrance of course still remains, and probably always will remain as a practical test of motive power.

New Reversed Cylinder Press

The Watson-Stillman Co., New York, has recently introduced a new reversed cylinder forcing press, which should prove a handy tool for pressing bearings and for miscellaneous work. As will be seen from the illustration, a crane bracket and beam extending from one end enables the operator to swing a heavy piece of work onto bracket shelves extending out from each side of the bottom platen. These shelves, 30 ins. long by 12 ins. wide, are detachable, can be lifted off on jobs where they would be in the way, and are sufficiently strong to support any work that will go into the machine. They will be appreciated by those who have had to push castings or parts into place on the ordinary small platen.

The motor, mounted upon pedestals on top of the press,



New Hydraulic Press.

drives the pump shaft through single reduction gearing. A hand or belted drive is furnished if desired instead of the motor. On the other end of the pump shaft are two eccentrics each driving one of the pistons of a ¾ in. by 2 in. twin pump, for which the pedestal legs act as reservoirs. The operating valve is of the single screw stem type, and connected to release the pressure from the work when opened, and start the ram down when closed. It will not retain the pressure unless the motor is stopped or the liquid driven through the safety valve. Other types of valves may be substituted to meet special conditions. A gauge is furnished to read in tons or pounds per square inch, as desired.

New Literature

RAILWAY WORKING AND APPLIANCES.—By Edward S. Hadley; cloth, 5x7½ inches; 120 pages; illustrated; published by Langman, Green & Co., London, England.

This book is the compilation in nontechnical language, of a series of lectures given by the author to employees of the Great Western Railway of England. There has been added a chapter on "Railway Sketching," and the articles have been carefully revised.

* * *

"How to Build up Furnace Efficiency," is the title of a pamphlet issued by Jos. W. Hayes, combustion engineer, Chicago. It deals with power plant operation and contains much matter of interest to those operating power plants.

* * *

The Northwestern Expanded Metal Co., Chicago, has published a booklet on the subject of steel beams and columns. The pamphlet contains tables and data necessary to the layout and design of steel-concrete buildings and structures, and should be very useful in that field.

* * *

The Scully Steel & Iron Co., Chicago, has recently published a stock list compiled in the form of tables. The book also contains data of general engineering interest.

* * *

"Drills and Sockets that Are Different," is the title of a pamphlet recently published by the American Specialty Co., Chicago. The subject matter is a description of a new type of drills and sockets. The ordinary flat twisted high speed drill is shown fitted with the common Morse taper shanks, and in addition the shank is flattened to fit the "Use-Em-Up" socket. The advantages are those of the flat twist combined with relief from the necessity of a special chuck and the obviation of trouble from twisted tangs or broken shanks,—surely something new.

* * *

Power plant condensers of the jet type which do not require the use of air pumps, are described and illustrated in a pamphlet recently issued by the Schutte & Koerting Co., Philadelphia. The pamphlet is useful to those dealing with steam plants, as it deals with new principles.

* * *

The Detroit Seamless Steel Tube Co., has published a folder illustrating the differences between lap-welded and seamless cold drawn locomotive flues. The explanation of the photographic reproductions is short and concise.

* * *

A very interesting book bound in board has been published by Oelrichs & Co., Forwarding Dept., New York. The book deals with subjects of interest to importers and exporters of merchandise, and contains a large amount of condensed information for shippers and travelers as well. Foreign and measures, and rates make the book a valuable one. American money exchange tables, tables of weights, measures and rates make the book a valuable one.

* * *

Those who are interested in iron, steel or shop machinery will find a recent pamphlet issued by Jos. T. Ryerson & Son, Chicago, of considerable value. The book is illustrated with photographic reproductions which show the plant, warehouses and the manufactured products of the company.

* * *

The Carlyle Johnson Machine Co., Hartford, Conn., has published a pamphlet describing and illustrating the Johnson friction clutch. A price list is included and diagrams add to the value of the book.

* * *

The Atchison, Topeka & Santa Fe Ry. has issued an interesting pamphlet entitled "A Trip to Old Mexico." The pictured scenes along the route are of interest to any one contemplating a trip to the southwest.

* * *

Victor Labadie of Dallas, Tex., has published a pamphlet describing and illustrating a recessed car diaphragn face plate. The device is a patented idea which is designed to prevent injury to the fingers if caught between vestibule diaphragm plates. The old face plates of cars are recessed by means of bull dozers and formers and are as adaptable as those specially constructed.

Mr. E. B. Leigh, president of the Chicago Railway Equipment Co., has published in pamphlet form his paper dealing with railroad legislation read before the American Malleable Castings Association in November, 1908. The book is well worth the reading.

* * *

"The Little Blue Flag," is the title of a periodical issued at intervals by the Lowe Bros. Co., makers of paints and varnishes, Dayton, Ohio. The current issue is excellently illustrated and should be of great interest to all users of paint, and particularly the tradesmen.

* * *

The Browning & Sharpe Mfg. Co's. pocket catalog for 1909 is of as much interest as the previous issues. This catalog is a standard necessity among tool makers and users. It comprises 550 pages and there is little information needed by the tool maker which is not contained between its covers. The company's address is Providence, R. I.

Trade Notes

The contract for the construction of the concrete pile foundations and concrete pile bulk-heads for the J. S. Young Co. plant of the MacAndrews-Forbes Co., Boston and Elliott Streets, Baltimore, has ben awarded to the Raymond Concrete Pile Company of New York and Chicago; C. Montgomery Anderson is the architect for the work.

Mr. Louis G. Henes, with office at 731 Monadnock Bldg., San Francisco, Cal., has associated himself with the Ward-Packer Supply Co., and will represent them on the Pacific Coast. The specialties in which he will interest himself particularly for this firm are the Corning Draft Gear, "W-P" Metallic Packing, Minnesota Boiler Compounds, Crosby Bell Ringer and the Ames Water Glass Shield.

The firm of Hodgkins & Dayton, of St. Louis, has been formed and it will continue the business heretofore conducted by Mr. Hodgkins, as dealer in railway specialties. The firm will also represent as sales agents for St. Louis and the Southwest the following manufacturers: The Railroad Supply Co., Chicago; The Dressel Railway Lamp Works, New York; Paul Dickinson, Inc., Chicago; Chicago Bridge & Iron Works, Chicago; The Wyandot Refineries Co., Crawford, Ohio.

The American Locomotive Sander Co. of Philadelphia will be represented at their Chicago office in the future by Mr. Morris B. Brewster, whose office will be at 509 Great Northern Bldg. This will apply as well to the United States Metalic Packing Co.

The Homestead Valve Mfg. Co., Pittsburg, reports several sales of "Homestead Valves" for use in a pipe line under 5,000 lbs. hydraulic pressure. The valves stand up well under this pressure and their service has prompted repeat orders.

The Grip Nut Co., manufacturer of the "Grip Nut" and "Universal Window Fixtures," is building a large addition to its works at South Whitley, Ind., in order to take care of their growing business. The addition is to be 50x270 ft., and will be two stories high, and of the most modern type.

The contract for the foundations, including concrete piling, for the new six story warehouse to be erected on Pier 2, Baltimore, Md., for the Standard Oil Co., has been awarded to the Raymond Concrete Pile Co., of New York and Chicago. Messrs. Haskell & Barnes, Baltimore, are the architects for the work, and William Ferguson & Bro., the general contractors.

The American Brake Shoe & Foundry Co. has established a manganese steel department in New York City and is prepared to furnish manganese steel for all purposes for which it is generally employed, such as mine car wheels, sheave rolls, crusher parts, etc. It is now rolling manganese steel in rounds, flats and other shapes and has a well equipped foundry, machine and grinding shops devoted exclusively to furnishing manganese steel to the trade in whatever shape required.

The Damascus Brake Beam Co., Cleveland, Ohio, in order to carry a larger stock of finished product, as well as to make room for additional machinery for the economical manufacture of its trussed beams, is extending its Sharon plant. The management also has under consideration the purchase of a site for a branch factory between Chicago and Gary.

L. G. Henes has been appointed representative in California, Nevada and Arizona for the Whiting Foundry & Equipment Co. He will have offices in the Monadnock building, San Francisco, and will handle the sale of cranes and foundry equipment in that territory.

James MacMartin, chief engineer of the Delaware & Hudson, has announced that on May 1 he will become vice-president and general manager of the Elmore & Hamilton Contracting Co., Tweddle building, Albany, N. Y., engaged in general railroad contracting.

The Williams Boltless Rail Joint Mfg. Co. have closed a deal whereby the manufacture and selling of their boltless rail joint, together with the 20th century steel tie and Oldham automatic car seal, has been taken over by Cortlandt F. Ames of this city, who has been identified with the railroad supply trade for a number of years. Mr. Emil Meyer, assistant general manager of the Williams Boltless Rail Joint Co., will remain with Mr. Ames. Mr. Ames has moved his office from the Great Northern building to room 503 Manhattan building.

The Safety Car Heating & Lighting Co., in the last five months have made an unusual showing in the sales of their buoys and buoy lanterns. The light-house establishment has recently decided upon a more liberal lighting for the lower New York harbor, and has placed orders for a sufficient number of Pintsch gas buoys, to enable the largest steamers to enter the harbor at night. The popularity of these buoys for harbor lighting is clearly evidenced by their general adoption, there being over 2,200 in service throughout the world.

On May 1, the Independent Pneumatic Tool Co. moved its general offices from the First National Bank building, Chicago, to its new Thorn building at 1307 Michigan avenue, Chicago, where it has larger space and better facilities for taking care of its increased business.

The Masey Vise Co. have removed to their new plant, 208-210 Michigan street, Chicago, where with their increased lines of vises for bench, planer and milling work, they are prepared to satisfy all comers.

The first bids for supplies of standard articles to be used in the Panama Canal work during the year ending June 30, 1910, will be opened on April 18, in the office of the General Purchasing Agent at Washington. These bids will be for steel and articles made of steel, and they will be followed at short intervals by bids for supplies of articles made entirely or partly of rubber, paints, oils, and other articles that have become standard in the Canal work. This method of contracting for standard supplies for a year is the same as that followed in other branches of the Government service and in large business establishments. Until recently it was not practicable to put it into effect in the Canal work, because it is only by experience that a conclusion can be reached as to what articles are standard and what quantities of each are needed. It was first proposed to ask for bids for a six months' supply, or for the period between January 1 and June 30, 1909, but the task of compiling the schedules was so great that advertisement could not be made before January 1, and the method of making separate contracts for supplies as they are needed will therefore be continued until the beginning of the next fiscal year. The new method is to place a contract for one class of articles with a qualified bidder on the condition that he will supply all of that article needed in the fiscal year at a fixed price. Over eight thousand articles are required, and these have been grouped into a convenient number of classes. For instance, the schedule for materials made wholly or partly of rubber includes 28 classes, on any one of which a bid will be received. Each class is composed of a number of separate articles. Class 1 of this schedule is made up of four items, each item including various quantities of four-ply armored air hose, in 25-foot lengths, covered with flat steel galvanized wire braided about the hose. The first item includes five different sizes of hose. Bids are made on classes, not on items. The schedule for standard supplies shows (1) the item number, (2) the quantity of each size required, (3) a complete description of the article, (4) Proposition A, (5) Proposition B. Proposition A is a proposal to furnish a certain quantity at a certain price subject to the right of the Commission to increase or reduce the quantity by 50 per cent or less. Proposition B is a proposal to furnish the articles subject to the right of the Commission to purchase any part or none of the quantities advertised for, and to increase or to diminish the quantities purchased by 50 per cent or less. The purpose of the alternate proposition is to determine whether bidders in certain lines will make better prices when the amount of material to be taken is known within certain limits, or will make the same price regardless of whether they are sure of a sale or not. The acceptance of any supplies is contingent on their passing inspection in the States, and in some cases articles must stand the additional test of use for a certain period on the Isthmus.

Personals

L. L. Dawson has been appointed superintendent of motive power of the Ft. Worth & Denver City Ry.

W. A. Deems has been appointed a master mechanic of the New York Central, with office at Tupper Lake, N. Y.

C. B. Keiser has been appointed master mechanic of the Pennsylvania Tunnel & Terminal, with office at New York.

S. E. Kildoyle, master mechanic of the Vera Cruz & Isthmus Ry., has resigned, and his position has been abolished. J. A. Baker, general foreman, has been appointed foreman of shops and locomotive repairs, with office at Tierra Blanca, V. C., Mex., and reports to the acting superintendent.

E. D. Andrews has been appointed master mechanic of the newly formed Omaha division of the Chicago, Burlington & Quincy Ry., with headquarters at Omaha. This division is formed of that section east of, but not including, Lincoln, Neb., which was formerly part of the Lincoln division.

W. H. Foster, master mechanic of the New York Central & Hudson River R. R., in charge of the Harlem division, with office at North White Plains, N. Y., has been transferred to High Bridge as master mechanic and put in charge of the Hudson and the New York & Putnam divisions, succeeding L. H. Raymond, resigned.

Levi B. Paxson, consulting mechanical engineer of the Philadelphia & Reading Ry., died April 10 at Reading, Pa. He was born in 1827 in Chester County, Pa., and began railway work on the Philadelphia & Reading as a brakeman. He later became master mechanic and then engineer of machinery. By 1888 he had become superintendent of motive power, and in August, 1899, he was made consulting mechanical engineer.

W. F. Smith has been promoted to general car and locomotive foreman of the Chicago, Milwaukee & St. Paul Ry. with office at Minneapolis.

C. F. Buttress succeeds H. J. Kohlstedt as master mechanic of the Holton Interurban Ry. at Holtonville, Cal.

H. D. Mackenzie has been appointed general locomotive foreman of the Intercolonial Ry. at Moncton, N. B.

A. B. McDonald has been appointed general car foreman of the Intercolonial Ry. at Moncton, N. B.

James Blair has been appointed mechanical foreman of the Intercolonial Ry.

F. Wertsheimer has been appointed superintendent of motive power of the Kansas City, Mexico & Orient Ry. of Texas with office at Sweetwater, Tex.

Samuel Smith succeeds C. F. Deckelman as master mechanic of the Nevada Northern Ry., with office at East Ely, Nev.

W. J. Bohan has been appointed electrical engineer of the Northern Pacific Ry., with office at St. Paul.

J. V. Reed has been appointed air brake repairman for the Pere Marquette R. R. at Grand Rapids, Mich.

Effective May 1, the Wisconsin Central Ry. became the Chicago division of the Minneapolis. St. Paul & Sault Ste. Marie Ry. The mechanical officials were transferred to corresponding positions under the new management and Minneapolis was made general headquarters. Fond du Lac shops are now operated as a division terminal and repair point.

Railway Mechanical Patents Issued During April

Nut lock, 916,634—Michele Valenti, Washington, D. C.

Headlight for cars, 916,639—Winfield S. Waltz, Medina, O.

Pneumatic rail brake, 916,644—Powell O. Adams, Cameron, Texas.

Retaining valve for automatic air brakes, 916,669—John M. Carter, Memphis, Tenn.

Railway signaling system, 916,674—Clyde J. Coleman, New York, N. Y.

Car and hose coupling, 916,759—Ebenezer Myers, Taylorsville, N. C.

Car door fastener, 916,804—Charles L. Troon, Pomeroy, Iowa.

Car fender, 916,892—Frank A. Seeley, New York, N. Y.

Centering mechanism for radially movable car couplings, 916,946—Richard D. Gallagher, Jr., New York, N. Y.

Passenger car end construction, 917,085—Charles A. Lindstrom, Pittsburg, Pa.

Car lock and seal, 917,089—John MacKenzie, Watervliet, N. Y.

Seal lock, 917,090—John MacKenzie, Watervliet, N. Y.

Air brake system, 917,091—George Macloskie, Schenectady, N. Y.

Mail catching device, 917,108—Thomas Neel, Williams and Frederick W. Owensney, Irondale, O.

Railway car, 917,114—Spencer Otis, Chicago, Ill.

Sash lock for car windows—William M. Peach, Bellevue, Pa.

Car roof, 917,128—Edward Posson, Chicago, Ill.

Mail bag catcher and deliverer, 917,307—Lasure B. Johnston, Lorain, O.

Dumping car, 917,313—Francis Knott, Phoenix, British Columbia, Canada.

Car door mechanism, 917,321—Charles A. Lindstrom, Pittsburg, Pa.

Railway mail catcher and deliverer, 917,338—Joseph H. Miller, Fremont, Ohio.

Car truck, 917,343—Sardine F. Morrison, Columbus, Ohio.

Fluid pressure controlling valve for car fenders, 917,345—Frank A. Nelson, Minneapolis, Minn.

Railway car, 917,361—Edward T. Robinson, St. Louis, Mo.

Car axle lubricator, 917,477—John C. Nichol, Montreal, Quebec, Canada.

Safety appliance for railway cars, 917,525—Robert Belden, Spanish Ranch, Cal.

Draft gear for railway cars, 917,537—Harry C. Bruhoup, Chicago, Ill.

Locomotive, 917,559—George W. Dillehay, Louisville, Ky.

Brake operating apparatus for railway cars, 917,569—Nathan Elliott, Kilsyth, W. Va.

Passenger car, 917,607—Henry Howson, Philadelphia, Pa.

Locomotive attachment, 917,631—Shepard Lyon, Sault Ste. Marie, Mich.

Safety appliance for railroad vehicles, 917,666—Giles Schlichter and Giles Franko, Nyiregyhaza, Austria-Hungary.

Metallic end frame for car bodies, 917,716—Charles E. Dath, Denver, Colo.

Smoke and cinder conveyor for locomotives and trains, 917,730—Frank Ishman, Martins Ferry, Ohio.

Ice clearing and contact wheel for electric railways, 917,735—Frank E. Kinsman, Plainfield, N. J.

Mail car fork, 917,775—Willis H. Lefevre, Lancaster, Pa.

Resilient car wheel, 917,855—George M. Eaton, Wilkinsburg, Pa.

Air brake cylinder attachment to railroad cars or the like, 917,891—Harry M. Pflager, St. Louis, Mo.

Mail bag catcher, 917,922—James M. Carver, Grand Rapids, Mich.

Car construction, 917,956—Charles A. Lindstrom, Allegheny, Pa.

Railway track structure, 917,957—Henry R. Luther, Newton, Mass.

Dust guard for journal boxes, 917,963—Adolph W. Neudeck, Kansas City, Kan.

Railway truck, 917,979—Henry H. Vaughan, Montreal, Quebec, Canada.

Train indicator, 918,028—Pasquino Ferrari, Fall River, Mass.

Car truck, 918,061—Albert A. Kellogg, Clinton, Mo.

Dump car, 918,092—Clinton W. Russell, Detroit, Mich.

Railway car, 918,098—Edgar W. Summers, Pittsburg, Pa.

Mold for casting rail bond terminals, 918,108—William H. Wherry, Cleveland, Ohio.

Combination rack and car, 918,109—John S. Wintermute, St. Thomas, Ontario, Canada.

Mail bag delivering and receiving apparatus, 918,136—Ignatius V. Fister, Springfield, Mass.

Automatic hose pipe coupling head, 918,230—John F. Ward and Charles L. Davidson, Indianapolis, Ind.

Mold for making chilled car wheels and other circular objects, 918,236—Thomas D. West, Sharpsville, Pa.

Draft gear for locomotive engines and tenders, 918,237—Charles T. Westlake and Albert R. Thomas, St. Louis, Mo.

Railway portable couch, 918,266—Elick Berlinger, New York, N. Y.

Railway track, 918,277—Charles J. Burbank, Enid, Okla.

Car lift, 918,313—Oscar V. Greene, Cleveland, Ohio.

Passenger car, 918,344—William J. Mackle, St. Louis, Mo.

Hopper car, 918,390—Edgar W. Summers, Pittsburg, Pa.

Articulated locomotive, 918,401—Samuel M. Vauclain, Philadelphia, Pa.

Air brake setting appliance, 918,435—Albert Gale and Doc M. Lilley, Bonham, Tex.

Brake actuating mechanism, 918,463—Patrick Mussleman, Fort Spring, W. Va.

Rail joint, 918,467—George H. Pickering, Pawtucket, R. I.

Air brake, 918,470—Edmund B. Powers, New York, N. Y.

Safety car truck frame, 918,521—Frank B. Ebert, Humboldt, Kans.

Dust guard for car axle boxes, 918,528—Harry C. Gamage, New York.

Car coupling and bumper, 918,580—Josef Nagy, Cleveland, Ohio.

Draw bar and yoke connection for railway draft-rigging, 918,583—John F. O'Connor, Chicago, Ill.

Brake shoe, 918,605—William O. Stark, Chicago, Ill.

Device for resisting swinging movements of suspended railway cars, 919,263—Frederick W. Vogt, Philadelphia, Pa.

Car step, 919,278—Lloyd Yeager, Jr., Catawissa, Pa.

Air brake system, 918,675—John Hughes, Jackson, Mich.

Driving and transmitting mechanism for wheeled vehicles, 918,685—William D. Marks, Westport, N. Y.

Railway car bolster, 918,736—Thomas A. Collison, Lebanon, Pa.

Clamping tool for holding and butting rail ends, beams, and the like during welding, 918,745—Hans Goldschmidt and Felix Lange, Essen-on-the-Ruhr, Germany.

Car coupling, 918,764—Fred Mikeal, Jacksboro, Tex.

Car coupling, 918,792—John Stankus, Onondaga, Pa.

Car truck, 918,807, 918,808 and 918,809—William E. Woodard, Schenectady, N. Y.

RAILWAY MASTER MECHANIC

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CONTENTS.

Representative Railway Mechanical Officials of America

We are publishing in this issue several hundred portraits of mechanical men of the American railroads. We would have been glad to publish more, and we have no doubt that many who were requested to send in their photographs, and who failed to do so, will feel as if they should have sent them in after all. The reasons given by some of those who failed to send in photographs are varied, but most of the "hold-backs" had no reason at all for refusing, they simply neglected what they should have considered a duty. One man said in his answering letter that we would be able to get his photograph by sending a certain amount of money to his photographer. Another said that we would first have to obtain permission from his superintendent of motive power, and then he would consider the matter.

In spite of our repeated cautions, several sent in their photographs without their names written on the back, and we, therefore, are in possession of several photographs which we cannot identify, and we hope that we have not made enemies of the owners. It is our request that those who sent in their photographs and who failed to find them reproduced on these pages, write us to this effect and we will attempt some species of reparation. Several portraits were lost in the process of engraving in spite of our care, but railroad men, and especially railroad mechanical men, are always patient, and it is to be hoped that their attitude towards us will be characterized by the same patience which they use in daily life.

Terminal Electrification and Public Opinion

Under the caption "Other Roads Can Do It" one of Chicago's supposedly conservative dailies recently published an editorial asking for state legislation which will give Chicago city officials the power to compel electrification of the Illinois Central tracks within the city. The article is so excellent an example of most of the arguments advanced in favor of electrification that we reprint it in essential detail herewith:

"The Reading road is letting contracts for the electrification of some of its tracks in Philadelphia. This change is not being forced on the road by popular sentiment. Its engines made no smoke. The great reason for electrification in Chicago is lacking in Philadelphia, and yet the Reading is preparing to get rid of some of its coal burning engines.

"It would not be making the new departure if it were not convinced that there was something to be gained by it in economy of operation or in improved facilities for doing business. If the cost of installation had been so alarming as the Illinois Central officials say it would be here, the Reading people would let electricity religiously alone. If its introduction were such a menace to the lives of trainmen as Illinois railroad men say it would be the employes of the Reading would protest. But they do not. Nor do they seem to think their wages will be in any danger.

"The difference between the Illinois Central and the Reading appears to be that the one is not a progressive road and the other is. The Reading officials have studied to some purpose the working of electricity as a motive power on the New York Central and New York, New Haven and Hartford roads. The Illinois Central officials say they are familiar with what has been done down east, and yet they do nothing. They could put an end to the smoke nuisance, as far as their road is concerned, but they will not.

"As they are deaf to the complaints of the public and the remonstrances of the city government, nothing remains but for the legislature to give Chicago the power to make the road do what it can do but will not do. Every member of the legislature who has seen the Chicago smoke nuisance ought to be willing to vote for the electrification bill."

Such argument, of course, would not be worthy of comment were it not for the fact that the great majority of people are no better educated in the railroad technical field than is the writer of this quoted editorial. Electrification of railroads means but one thing to these persons, and when its consummation on one or more roads seems to have met with fair success, they blindly argue that what one road can do, can be done as well by another. They do not understand differences in physical aspects, they know nothing of service adaptations, and they could, with fully as much dignity, argue for the use of marsh hay as a fuel for American freight locomotives since it does nicely, in that capacity, in some parts of South America.

One great problem confronts the officials of the Illinois Central as an obstacle to terminal electrification. That is the location of its large freight yards and the consequent heavy freight traffic on rails adjacent to its surburban tracks. The electrification of one class of traffic would neither be feasible or of material benefit, and electrification of the whole would be pioneering in a field so distinctly (in the eyes of the technically informed man) fraught with difficulties, that legislation to force its consummation would be unfair in the extreme. It is easy to see how the conservative railroad official may appear "obstinate" to the average daily paper editor, who tries, by drawing from his scanty stock of knowledge on the subject, to show the technically trained man how he could save by electrification.

General Foremen's Convention

That Chicago as well as Atlantic City can be made to serve well as a meeting point for railway mechanical men has been demonstrated by the success of the International Railway General Foremen's Association in convention from June 1 to June 5. At the Lexington hotel, the headquarters, the parlors were fully occupied by exhibitors and their exhibits. This association has met in convention only five times, this being the fifth annual congress, and judging from the history of other railroad organizations, its future is very bright. Each year has seen an increase in membership and in the general interest manifested by exhibits and attendance of supply men. Great credit is due the men who are pushing these conventions, as the benefits derived therefrom are admittedly numerous and great.

Air Compressor Explosions

The receivers of air compressors, in addition to the possibility of wasting, are liable to risk of explosion as a result of the accumulation of oily deposit. As usually arranged, an air compressor is an excellent dust trap, and situated, as it often is, near the boiler house, this largely consists of coal dust. Mixed with oil carried over from the cylinder, this forms a pasty mass which collects in corners and needs only the requisite temperature to start combustion, which, under suitable conditions, produces an explosive effect. The conditions favorable to this are a high degree of compression and imperfect cooling arrangements, coupled with irregular lubrication. The temperature that may be reached with adiabatic compression, i.e., without gain or loss of heat through the walls of the cylinder, and which is approximated to with imperfect cooling arrangements, is higher than the flash point of many oils, and therefore care should be taken that there is free circulation of the cooling water in the jacket of the compressor; and when the pressure is high, stage compression with inter-cooling, and also, where possible, after-cooling, should be adopted. The lubrication should be effected automatically, and not merely at the will of the attendant. Further, only oils of a high flash point should be used. The fish or animal oils, or petroleum, should be rigorously excluded. With reasonable care and attention there is no risk of explosion with air compressors, even with very high compression, but it is well that those working them should recognize the sources from which troubles may arise.—Mechanical Engineer.

Firemen's Strike on Georgia R. R.

A strike of locomotive engineers and firemen has been effective since May 23, on the Georgia R. R. The trouble arose from the employment of negro firemen. The train service has been seriously interfered with. The railroad applied to the federal mediation board for its services in settling the trouble, and Charles P. Neill, United States commissioner of labor, is at Atlanta, Ga., to confer with both sides to the dispute in the endeavor to effect a settlement. The Erdmann act gives jurisdiction to the mediation board in "a controversy concerning wages, hours of labor or conditions of employment" between an interstate carrier and its employees "seriously interrupting or threatening to interrupt the business of said carrier."

Locomotive Model For University

The American Locomotive Company has presented to the department of railway engineering of the University of Illinois a full size locomotive front end mounted as a model for inspection and study. The model represents a 2-cylinder compound. The whole exhibit includes a pair of full size cylinders with intercepting valve bolted up as in the actual engine. Upon these a ring representing the smoke box end of the boiler is mounted, and over this the usual locomotive stack. The full arrangement of steam and exhaust piping normal to the actual locomotive is arranged within the front end. The whole exhibit is such as will permit students to see at a glance many details entering into the construction of a steam locomotive, which ordinarily are not available for inspection. It is announced that the model will be shipped at an early date.

"Valuable Graphite Products" is a concise descriptive price-list of these products issued by the Joseph Dixon Crucible Co., Jersey City, N. J.

Representative Railway Mechanical Officials of America.

J. H. McGOFF,
Mechanical Supt., Atchison, Topeka & Santa Fe Ry.

WM. GARSTANG,
Supt. Motive Power, Cleveland, Cincinnati, Chicago & St. Louis Ry.

J. G. NEUFFER,
Supt. Machinery, Illinois Central Ry.

F. F. GAINES,
Supt. Motive Power, Central of Ga. Ry.

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LE GRAND PARISH,
Supt. Motive Power, Lake Shore & Michigan Southern Ry.

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Master Mechanic, C. N. O. & T. P. Ry.

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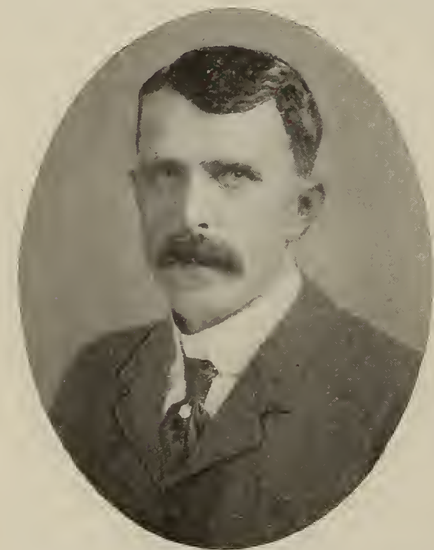
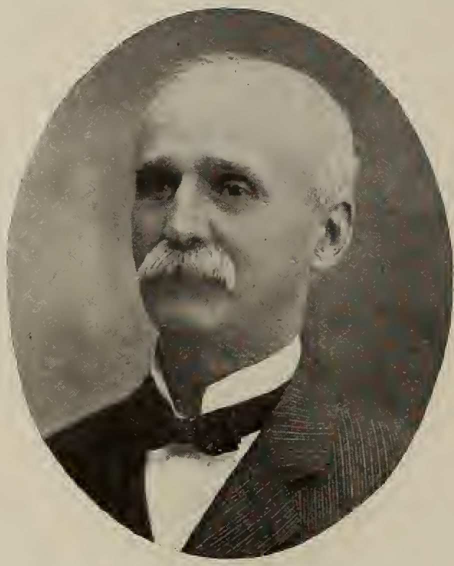


EUGENE GORDON,
Master Mechanic, El Paso & South Western Ry.



E. B. GILBERT,
Supt. Motive Power, Bessemer & Lake Erie Ry.

E. A. MILLER,
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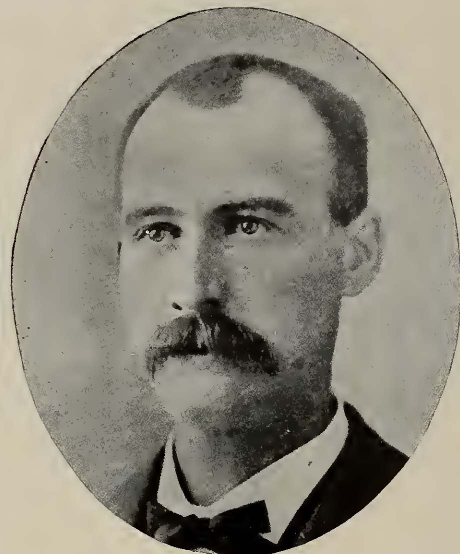

J. O. BRADEEN,
Supt. Motive Power, New York Central & Hudson River R. R.

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Gen'l Car Foreman, Chicago Great Western Ry.

J. B. MICHAEL,
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WM. H. HILL,
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T. A. FOQUE,
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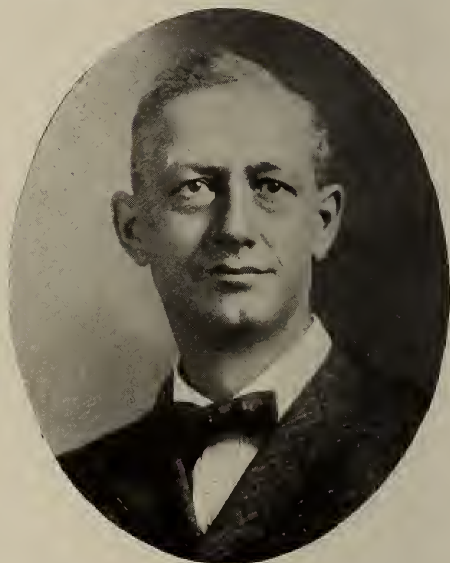

B. J. PEASLEY,
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J. E. GOODMAN,
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S. I. REAMES,
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J. W. WARREN,
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T. E. GOODMAN,
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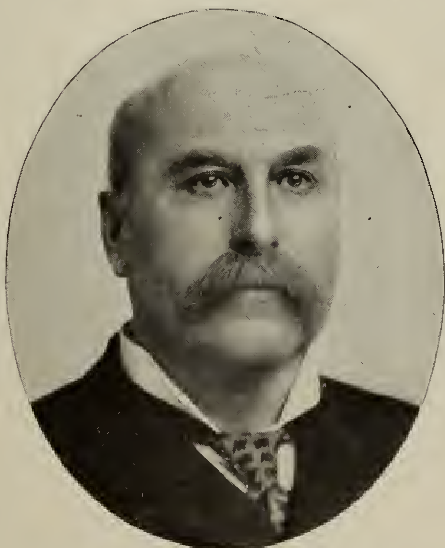
THEODORE N. ELY,
Chief of Motive Power, Pennsylvania R. R.

J. R. ONDERDONK,
Engineer of Tests, Baltimore & Ohio R. R.



A. E. MANCHESTER,
Supt. Motive Power, Chicago, Milwaukee & St. Paul Ry.

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Master Car Builder, N. Y. Central & Hudson River R. R.

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H. J. SMALL,
Gen'l Supt. Motive Power, Southern Pacific Co.

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D. J. DURRELL,
Master Mechanic, Penn. R. R., Lines West.

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R. F. KILPATRICK,
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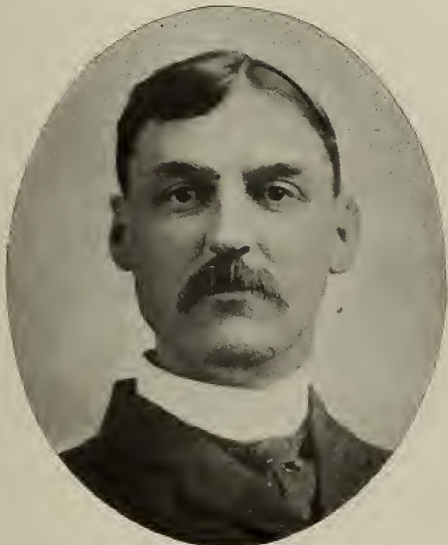
Asst. Supt. Motive Power, Chicago & Northwestern R. R.

JOHN F. WALSH,
Supt. of Motive Power, Chesapeake & Ohio R. R.



GRANT HALL,
Supt. Motive Power, Canadian Pacific Ry.

J. J. APPLETON,
Master Mechanic, Coahuila & Zacatecas Ry.

D. T. CRAWFORD,
Gen'l Supt. Motive Power, Pennsylvania Lines West.

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Gen. Foreman Loco. Dept., Southern Pacific Co.

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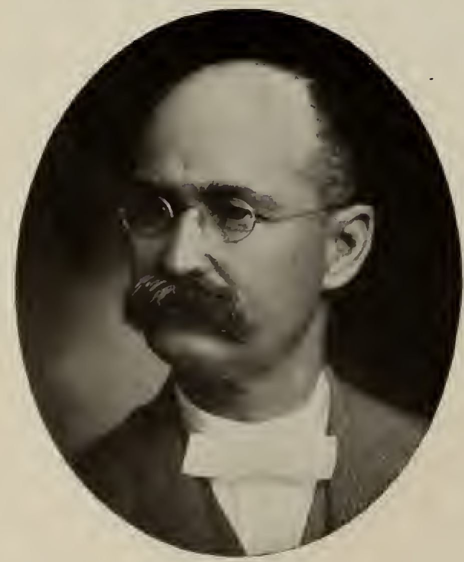
Master Mechanic, Chesapeake & Ohio Ry.

N. L. FRIESE,
Gen. Foreman Car Dept., Norfolk & Western Ry.

W. L. KELLOGG,
Master Mechanic, Pere Marquette R. R.



S. L. BEAN,
Mechanical Supt., Atchison, Topeka & Santa Fe Ry.

ROBERT GUNN,
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W. F. KIESEL, JR.,
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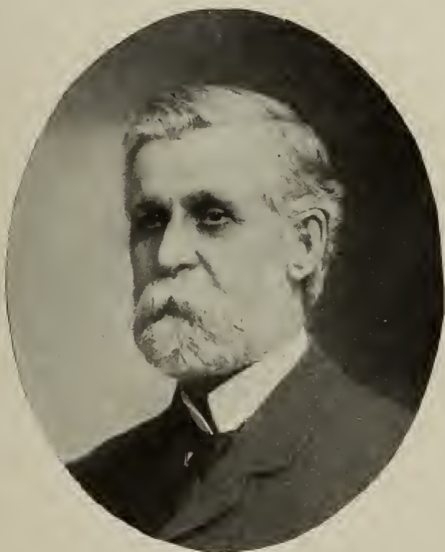
L. B. RHODES,
Master Mechanic, Georgia Southern & Florida Ry.

C. H. WIGGIN,
Supt. Motive Power, Boston & Maine R. R.



G. W. KENNEY,
Foreman Car Repair, Rutland R. R.

JNO. L. HODGSON,
Master Car Builder, Grand Trunk R. R.

J. H. MURPHY,
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G. H. GILMAN,
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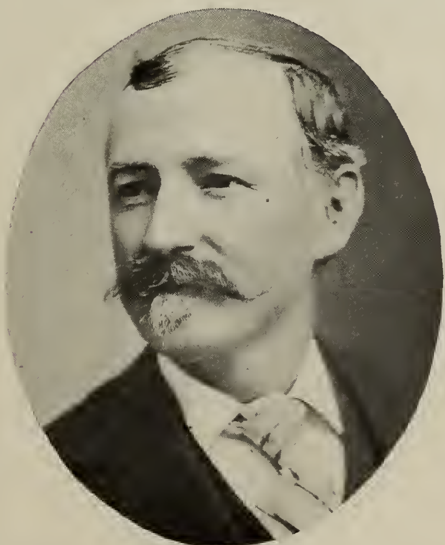

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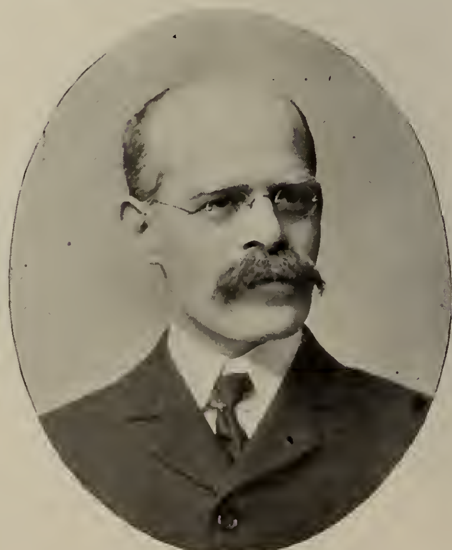
WM. B. THOMPSON,
Master Mechanic, St. Louis & San Francisco Ry.

J. H. MYERS,
Foreman Car Shop, Pennsylvania R. R.



OLIVER C. CROMWELL.
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Master Mechanic, Galveston, Houston & Henderson R. R.

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Asst. Supt. Motive Power & Machinery, Chicago & Northwestern Ry.

T. J. CUTLER,
Div. Master Mechanic, Northern Pacific Ry.

D. J. REDDING,
Master Mechanic, Pittsburg & Lake Erie R. R.

M. F. BURKE,
General Foreman, Toledo & Ohio Cent. Ry.

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Supt. Motive Power, Bangor & Aroostock R. R.

E. E. AUSTIN,
Div. Master Mechanic, Canadian Pacific Ry.

W. H. RUSSELL,
Master Mechanic, Southern Pacific Ry.

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M. C. B., Kentucky Midland R. R.

J. T. LENDRUM,
Div. Master Mechanic, Atchison, Topeka & Santa Fe Ry.

CHAS. N. SWANSON,
Gen. Car Inspector, Atchison, Topeka & Santa Fe Ry.

HENRY LA RUE,
Master Car Builder, Chicago, Rock Island & Pacific Ry.

WM. MOORE,
Master Mechanic, D., R. L. & W. Ry.

M. W. CAHILL,
Master Mechanic, Wadley Southern R. R.

R. T. EARLE,
Master Mechanic, Oregon & Eureka R. R.

CHAS. J. RULISON,
Master Mechanic, Virginia & Truckee Ry.

JAS. CONNORS,
Div. Master Mechanic, Chicago, Milwaukee & St. Paul Ry.

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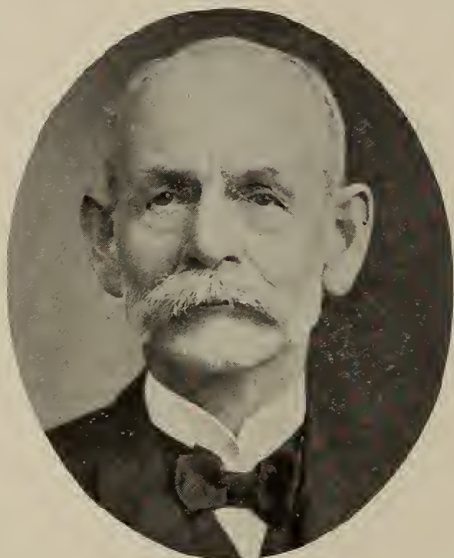
Master Mechanic, Missouri, Kansas & Texas Ry.

D. GRATTAN,
Master Mech., Butte, Anaconda & Pacific R. R.

W. J. PAMPLIN,
Master Mechanic, Atlantic Coast Line Ry.

J. S. PEARCE,
Master Mechanic, Norfolk & Western Ry.



J. W. MARDEN,
Supt. Car Dept., Boston & Maine R. R.

R. L. WYMAN,
Master Mechanic, Lehigh & New England R. R.

JNO. L. DRISCOLE,
Master Mechanic, Catskill Mt. R. R.

S. WATSON,
Div. Supt. Motive Power, N. Y. C. & H. R. R.

A. B. APPLER,
Mech. Engr., Delaware & Hudson Co.

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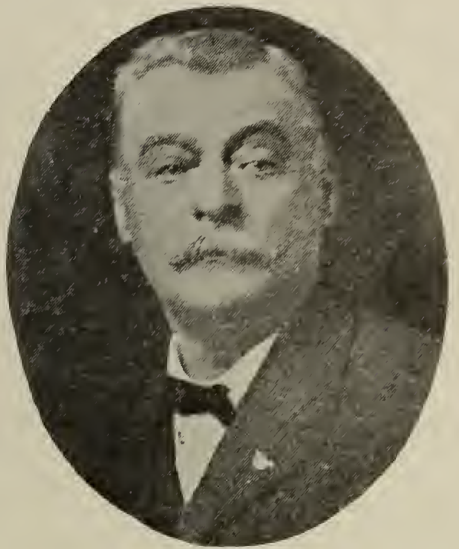
C. E. SPOOR,
Master Car Builder, Buffalo & Susquehanna Ry.

W. L. ALLISON,
Mechanical Engineer, Atchison, Topeka & Santa Fe Ry.



J. POTTON,
Div. Master Mechanic, Texas & Pacific R. R.

F. P. ROESCH,
Master Mechanic, El Paso & Southwestern System.

C. MONTGOMERY,
Master Mechanic, Pere Marquette R. R.

H. H. HALE,
Master Mechanic, Gulf & Ship Island R. R.

G. W. RINK,
Mechanical Engineer, Central R. R. of New Jersey.

GEORGE N. RILEY,
Supt. Motive Power, McKeesport Connecting R. R.

N. S. KIMBALL,
Div. Master Mechanic, Chicago, Milwaukee & St. Paul Ry.

A Short Section of the Rose-Strewn Pathway of the Master Mechanic

Mallet Articulated Compound Locomotives, Virginian Railway

Each month sees new developments in the design of articulated locomotives and we illustrate, herewith, the most important of the new features embodied in four Mallet articulated compound locomotives which are being built at the Richmond works of the American Locomotive Co. for the Virginian Railway. These engines will be completed in June and will be used as pushers or helping engines for the heavy coal trains on the Clark's Gap grade, which is 2.07 per cent compensated and 14 miles long. Later it is intended to use them in similar service on the White Thorne grade, which is .6 per cent compensated and 10 miles long.

They were built to designs and specifications prepared by Mr. R. P. C. Sanderson, superintendent of motive power of the Virginian Railway.

The wheel arrangement includes a two-wheel leading truck, the engines being of the 2-6-6-0 type. This truck is of the radial swinging bolster type; the bolster being suspended by three-point or stable equilibrium hangers and the load is transmitted to the journal boxes by means of coil springs seated on top of the box and supporting the truck frame. In working order, it is estimated that the engine will have a total weight of 330,000 pounds, of which 312,000 pounds is carried on the driving wheels. The calculated tractive effort, working compound, is 70,800 pounds. This can be increased about 20 per cent by working the engine simple, the engine being fitted with the Mellin intercepting valve, which allows live steam to be admitted to the low pressure cylinders, while the exhaust from the high pressure cylinder is diverted through a separate pipe to the exhaust pipe in the smoke box.

The boiler is of the radial stayed extended wagon top type and is 76 inches in diameter outside at the first ring. It contains 390 2¼-in. tubes 21 feet long and has a total heating surface of 5,065.9 sq. feet, 4,842 sq. feet of which is contributed by the tubes, 200 sq. feet by the firebox and the remainder by the arch tubes. The firebox is 114 inches long and 72 inches wide, with sloping back head and throat sheet and provides a grate area of 57 square feet. Large water spaces are provided around the firebox, these being 5 inches wide at the mud ring on the back and sides and 6 inches on the front. The firebox sides and crown sheet are in one piece, as are also the outside side sheets and roof. The dome, which is of cast steel, is located on the third course on the vertical center line of the high pressure cylinders. It is similar in design to that used on other Mallet articulated compounds built by this company, having an annular cavity extending around the front half of its circumference, which leads from the throttle pipe connection to the steam pipes on either side of the boiler, leading to the high pressure cylinders. The throttle, which also acts as a steam separator, is similar in design to that applied to the engine of this type built for the Erie Railroad.

As will be noticed from the illustrations, the throttle valve is operated through a system of levers by a crank arm on a horizontal shaft, passing out through a stuffing box in the side of the dome and fitted with a lever arm on the outer end, which is connected by a rod, extending along the outside of the boiler, to the throttle lever which is located on top of the boiler backhead. The arrangement of steam pipes to the high-pressure cylinders and the design of the cylinders follows the builders' usual practice for this type of engine. The high pressure cylinders, which are 22 inches in diameter by 30 inches in stroke, are cast in pairs with saddles and are separated at a point to the right of the center in order to provide room for the connection to the receiver pipe which extends along the center line of the engine.

As before stated, the Mellin system of compounding is used, the intercepting valve being located as usual in the left high pressure cylinder casting.

The emergency exhaust valve is contained in a separate chamber attached to the side of the left cylinder casting and communicating with the intercepting valve. From the emergency exhaust valve, a 4½-in. pipe, with universal joints, leads to the exhaust pipe in the smoke box. Exhaust steam from the right high pressure cylinder passes back through the casting into an outside U-shaped pipe connecting to a passage in the left cylinder casting, which leads up to the intercepting valve chamber into which steam from the left cylinder also exhausts. From the intercepting valve, it passes to the receiver pipe, leading to the low-pressure cylinders.

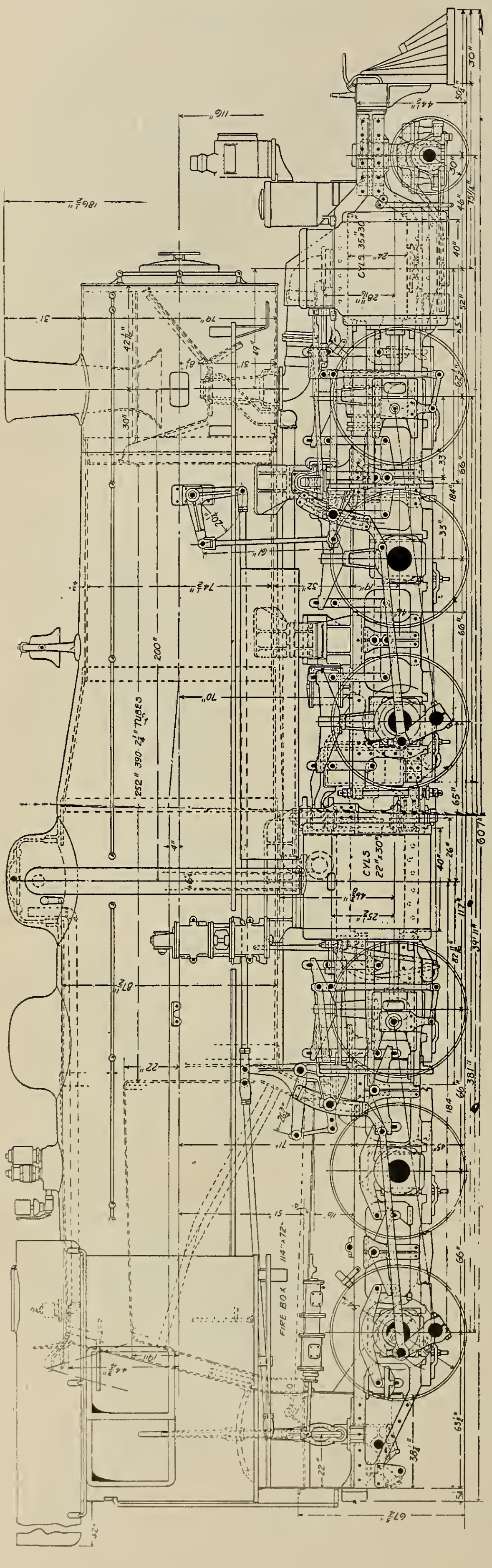
The receiver pipe has a ball joint connection with the high pressure cylinders and a slip joint at the front end where it connects to a Y-pipe, the branches of which connect to the cored passages in the low pressure cylinders.

The low pressure cylinders are 35 inches in diameter by 30 inches in stroke and are cast in pairs. Owing to the application of the leading truck and the consequent moving forward of the boiler it was necessary to use a different arrangement of flexible connections between the low pressure cylinders and the exhaust nozzle from that employed by the builders in other engines of this type without a truck.

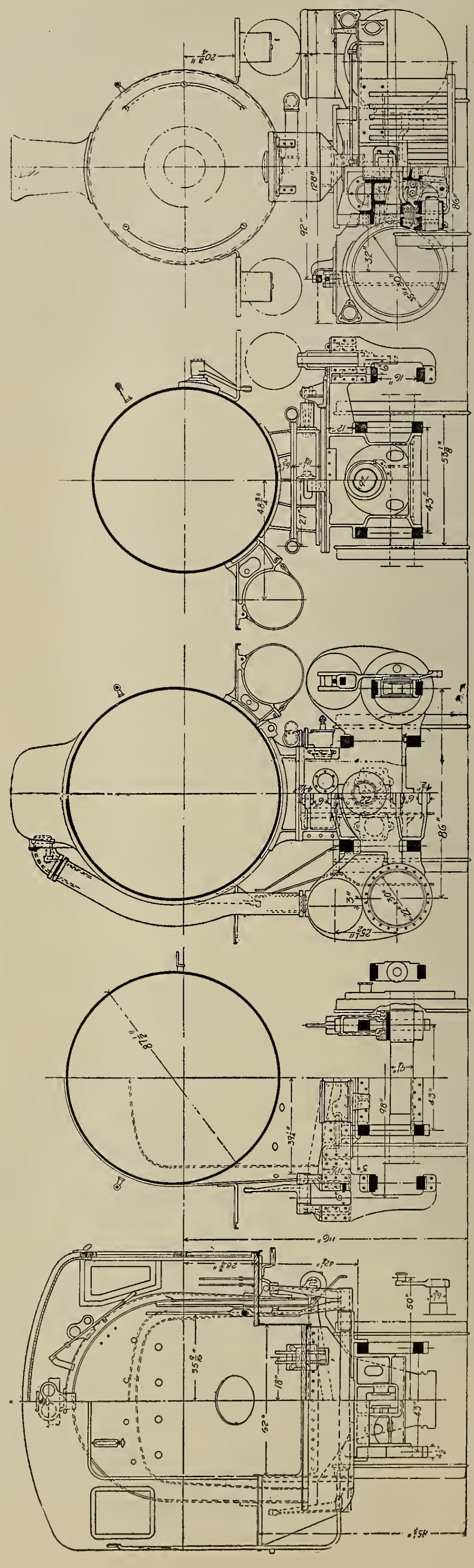
The two exhaust passages from the cylinders come together in the center of the cylinder saddle, and fitted to the single opening in the top of the saddle, is a cast iron flange which forms a stuffing box for the ball joint connection to a cast iron elbow. The back end of this elbow screws into the front section of the connecting pipe leading to the exhaust pipe in the smoke box. The two sections of this pipe have a slip joint connection between them and the rear section is provided with an elbow which has a ball joint connection with the exhaust pipe in the smoke box. This combination of ball joints and slip joint thus permits the connecting pipe to adjust itself to any lateral or vertical movement of the pressure cylinders relative to the smoke box.

The high pressure cylinders are equipped with piston valves, having internal admission, while the low pressure valves are provided with Allen-ported slide valves, having external admission. Both valves have a maximum travel of 6 inches and are set for 3-16 in. lead. The high pressure valves are designed with 1¼ in. steam lap and 5-16 in. exhaust clearance, but 3-16 in. less steam lap. The valves in each case are actuated by the Walschaert valve gear, and the two sets of gears are so arranged that the high pressure link block is raised while the low pressure one is lowered, when being thrown into forward gear and the two gears consequently counterbalance each other. As the high pressure valve had inside admission, and the low pressure outside admission, the eccentric crank thus leads the pin in each case. Reversing is effected by means of a hydro-pneumatic reversing device, the same as that used on the Mallet articulated compound built by this company for the Baltimore & Ohio R. R. The construction of the frames, which are of cast steel, and the arrangement of the articulated connection between the front and rear engines are also practically the same as in the Baltimore & Ohio engine.

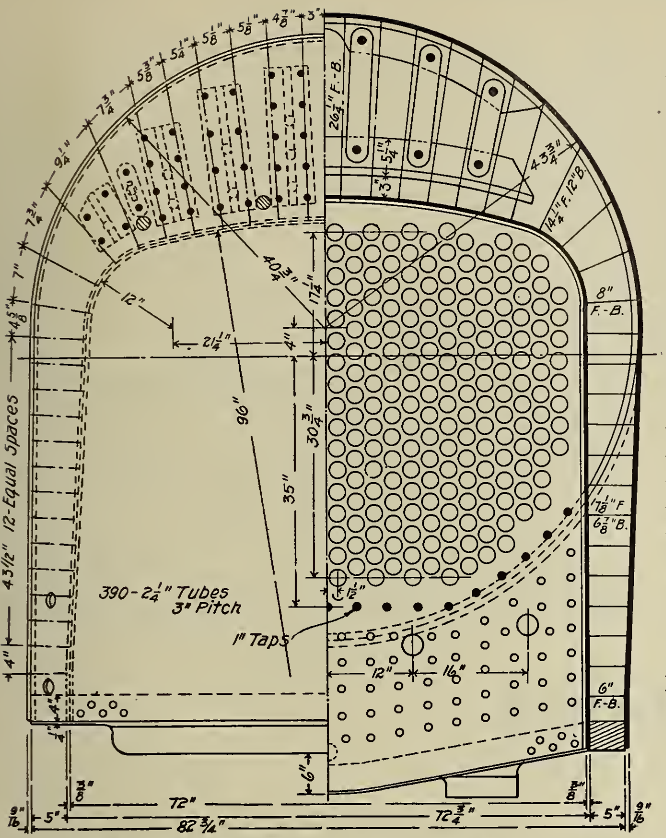
Because of the application of the front truck, it was necessary in this design to use two self-adjusting sliding bearings to support the boiler on the front frames, both of which carry load under normal conditions. Each of these bearings is provided, as usual, with safety straps to prevent the frames from dropping away from the boiler in case of derailment.



Elevation of Articulated Compound, Virginian Ry.



Section of Articulated Compound, Virginian Ry.



Firebox of Articulated Compound, Virginian Ry.

and the front bearing is provided with the builder's usual design of spring centering device.

The front and rear systems are equalized together by vertical bolts, connecting the upper rail of the front frame with the lower rail of the rear frame. But in this design the load on the bolt is supported by a coil spring, through which the lower end of the bolt passes and which bears up against the bottom of the rear frame rail, the spring cap having a ball joint with the frame.

A flexible support at this point was necessary in order that each of the three boiler supports namely the two sliding bearings and the equalizing bolt, might bear its proportion of the load in any variation in alignment of the three.

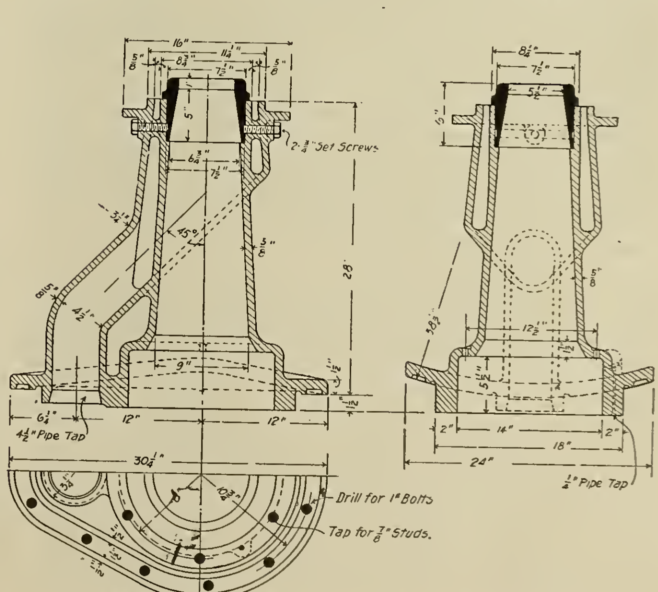
In order to obviate the necessity of flexible connections in the sand pipes, leading to the driving wheels on the front engine, sand is supplied to these wheels from a sand box supported on the front deck plate. The headlight is carried on a bracket bolted to the front of this sand box.

Another interesting detail of the design is the arrangement of the draw gear between the engine and tender, in which the draw bar pin is horizontal and is inserted through the side walls of the foot plate instead of being vertical and put in through the top of the foot plate as is the usual practice. This arrangement facilitates the extraction of the draw bar pin when it is necessary to disconnect the engine from the tender. The construction is clearly shown in the accompanying illustration which needs no further explanation.

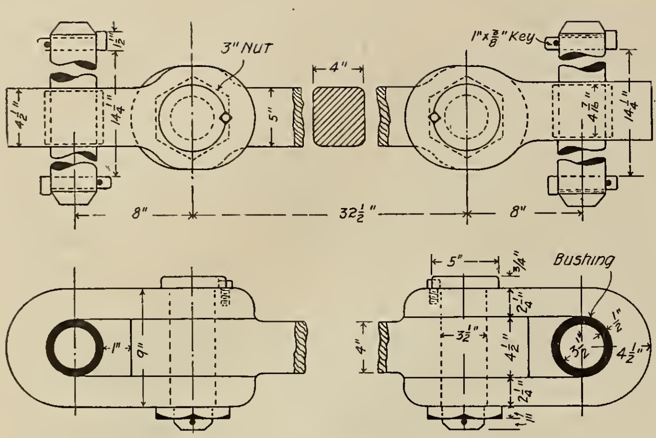
The tender is of the railroad company's design throughout, and is provided with a water bottom tank having a water capacity of 9500 gallons. The tender frame is of steel, the center sills being constructed of 15 in. channels and the side sills of 10 in. channels. The tender trucks are of the four-wheel equalized type.

The pricipal weight and dimensions are given in the table following:

Cylinder, type	Articulated Compound
Cylinder, diameter	22 in. and 35 in.
Cylinder, stroke	30 in.
Track gauge	4 ft. 8½ in.
Tractive power	70,800 lbs.
Wheel base, driving	31 ft. 9 in.
Wheel base, rigid	11 ft.
Wheel base, total	39 ft. 11 in.
Wheel base, total engine and tender	73 ft. 2 11-16 in.
Weight, in working order	330,000 lbs.
Weight, on drivers, estimated	312,000 lbs.
Weight, in working order, engine and tender	392,300 lbs.
Heating surface, tubes	4842 sq. ft.
Heating surface, firebox	200 sq. ft.
Heating surface, arch tubes	23.9 sq. ft.
Heating surface, total	5065.9 sq. ft.
Grate area	57 sq. ft.
Axles, driving journals, main	9½ in. x 12 in.
Axles, others	9½ in. x 12 in.
Axles, engine truck journals, diameter	5½ in.
Axles, engine truck journals, length	12 in.
Axles, tender truck journals, diameter	5½ in.
Axles tender truck journals, length	10 in.
Boiler, type	Extended Wagon Top
Boiler, O. D. first ring	76 in.
Boiler, working pressure	200 lbs.
Boiler, fuel	Soft Coal
Firebox, type	Wide
Firebox, length	114 in.
Firebox, width	72 in.
Firebox, thickness of crown	⅜ in.
Firebox, thickness of tube	9-16 in.
Firebox, thickness of sides	⅜ in.
Firebox, thickness of back	⅜ in.
Firebox, water space, front	6 in.
Firebox, water space, sides	5 in.
Firebox, water space, back	5 in.
Crown staying	Radial
Tubes, material	Charcoal iron
Tubes, number	390
Tubes, diameter	2¼ in.
Tubes, length	20 ft. 0 in.
Tubes, gauge	No. 11 B. W. G.
Boxes, driving, main	Annealed Cast Steel
Boxes, driving, others	Same
Brake, driver	West. Amer.
Brake. tender	Westinghouse
Boxes, pump	2 ft. 11 in.



Details of Double Exhaust Nozzle, Mallet Compound.



Engine Draw Bar, Mallet Compound.

Engine truck	Two Wheel Swing Motion
Exhaust pipe	Single
Exhaust pipe, nozzle	5½ in. x 6 in.
Grate, style	Rocking
Piston, rod diameter	3¾ in.
Piston packing	Cast iron rings
Smoke stack, diameter	16 in.
Smoke stack, top above rail	15 ft. 6½ in.
Tender frame	15 in. cast steel center channels
Tender frame	10 in. cast steel side channels
Tank, style	Water bottom with side water legs
Tank, capacity	9500 gallons
Tank capacity, fuel	14 tons
Valves, H. P., type	Piston
Valves, L. P., type	Allen Ported Slide
Valves, travel	6 in.
Valves, H. P., steam lap	1¼ in.
Valves, L. P., steam lap	1⅛ in.
Valves, ex. lap.	5-16 high and 5-16 low pressure
Setting	3-16 Constant Lead
Wheels, driv. diam., outside tire	54 in.
Wheels, driv., centers, diam.	47 in.
Wheels, driving, material, main,	O. H. Annealed Cast Steel
Wheels, driving, material, others	Same
Wheels, engine truck, diam.,	30 in.
Wheels, engine truck, kind	Rolled Steel Plate
Wheels, tender truck, diam.	33 in.
Wheels, tender truck, kind	Forged Steel Wheel Co.

Snow Fighting

By A. W. Wheatley, Mgr. Montreal Loco. Co.

Conditions in various parts of the country, from a snow-fighting standpoint, differ to a considerable extent. For instance, conditions in the middle West differ from those in the extreme eastern and western sections of the country, owing to the nature of the snow and the extreme cold which invariably follows a snow-storm or blizzard. Consequently, different methods must be followed in keeping a railroad open, and the writer will, with your indulgence, handle that section of the country first.

Care must be taken by the officials of the mechanical department to have snow-plows, in fact all snow-fighting equipment, in readiness at a date not later than November first, knowing that the equipment has been thoroughly overhauled during the summer months, this being a matter of consid- have snow fences in good condition.

Crews should be selected for rotary service, and regularly assigned, if necessary. Rotary snow-plows should be fired up and thoroughly tested. This should be repeated occasionally in the event of machines not being put into actual service. A supply of extra or repair parts should be put into stock and carefully maintained during season, for in many instances roads have been blocked for hours because of not having repair parts to apply to plow to replace those which have failed. Flangers should be applied to locomotives assigned to flanger-service, and thoroughly tested.

Where the old type of wedge-plow attached to a locomotive is used, we feel that it is better to use it in precisely the same way as you would use a Russell or similar type of plow; in other words, disconnect the engine, stripping same all possible, and use live power behind it for pushing. Very little is gained in power by use of the plow-engine, and it is a source of considerable annoyance and expense at the terminals, to say nothing of delays, sometimes resulting in the tying up of a road. When used as a push-plow, and handled by another locomotive, it can be set aside at the completion of its work without taking up a stall in the roundhouse, and when in actual service is not subject to failure; it also eliminates the necessity of taking the plow to the roundhouse for thawing out purposes, etc., and making certain repairs to the engine.

To cope with drifts fifteen to twenty feet high, something besides brute force is required. The old method of bucking drifts of this kind with the wedge plow pushed by several heavy locomotives, resulted in many casualties among the railroad men engaged in the dangerous work. The Rotary for such work is the best adapted, and will bore its way through drifts packed in a hard, icy mass with perfect safety to those operating. For mountain service, because of curves, side drifts, and dangers incidental to high speed, it is indispensable.

There is a sharp contrast in the slow and steady performance of the rotary plow when compared with the headlong rush of the old-fashioned wedge plow plunging at full speed into a heavy drift. One might almost say that the old plow had a devil-may-care disregard of consequences, as it made a bold rush at the mountain of snow ahead. We remember, some years ago, seeing the picture of a snow-plow train on a Western road ready for active service, or going to the front as if for war against the elements. The train, as it stood with plow in front in regular fighting trim, pushed by three "compound hogs," was the complete embodiment of force. After a successful dash the plow was again run through the beaten drift with nose down and wings out to complete the victory. There was something spectacular and dramatic in the performance.

In contrast with this, the old way, the work of the rotary appears. There is no headlong rush, there is no second drive against the drift, for the work is finished as the plow slowly forges through. It is applied science accomplishing the desired end, fully, powerfully, without haste, but with the steady endurance of the trained fighter.

Assuming that a description of the Rotary will be interesting, we offer the following:

Figure 1 shows the rotary without housing about boiler and machinery. The engine consists of two horizontal cylinders, with slide valves actuated by the Walschaert valve gear. The boiler is of the locomotive type, with Belpaire firebox. The wheel is driven by means of bevel gears on the main shaft and on the engine shafts.

The wheel is composed of ten hollow cone-shaped scoops, the surfaces of which are perfectly smooth, so that it is impossible for the snow to stick in any way. Each scoop is open its entire length on the front side, through which the snow is taken in. Knives are hinged on each side of the opening, arranged so as to adjust themselves automatically into cutting position.

The wheel is encased in a drum with a square front or hood, which is so designed as to present no dead surface to be forced into the snow. At the bottom, the hood projects only a few inches in advance of the cutting blades at the circumference of the wheel; while at the center of the wheel the knives are the first to encounter the snow. As a result, the whole front of the rotary is a sharp, cutting edge, and the power required to push the plow is very much decreased. The chute in the top of the drum is provided with an adjustable cover, which can be turned to suit the direction in which the wheel is throwing the snow.

Another excellent feature of the Rotary is the design of the flangers and ice-cutters, shown in figure 2. It has been proven that, with the ice cutters and flangers in perfect order, it is absolutely impossible for the rotary to be derailed by snow or ice. The ice cutters and flangers are connected by iron rods to cranks on the balance shaft, and may be raised and lowered by means of an air cylinder. An auxiliary steam connection from the boiler supplies steam to the flanger cylinder in case the air pump is disabled while the Rotary is in service.

The flangers are located on the rear end of the frame of the front truck, and are made up of two parts, the wings and the flanger points. The flanger points which go below the rails are bolted to the under side of the bottom of the wings, so that in case they strike an obstruction other than snow or ice, the bolts will be broken off and no other injury done to the flanger. Extra flanger points, with suitable bolts, are carried in the tool box, and it is only necessary to replace the flanger points to put the flanger again in perfect working order. By thus ensuring against delays due to the wrecking of the flangers or the ice cutters, a most important advantage is secured and the efficiency of the rotary greatly increased.

The Rotary is equipped with Westinghouse air brakes, with 9½ in. pump, and large reservoir capable of supplying both air brake cylinder and flanger cylinder.

In active service, three men are required to operate the Rotary—a pilot, an engineer, and a fireman. It is needless to state that these men should be carefully selected, having in mind temperament and physical condition. Except in the most extreme cases, one heavy consolidation locomotive provides sufficient power to push the Rotary.

As the most successful operation of the Rotary depends altogether upon the manner in which it is handled, it is therefore essential that the crew of both the Rotary and the pusher should be especially trained for the work. Inasmuch as it is often necessary to operate the Rotary for a longer period than it is possible for one crew to continue on duty without being relieved, an extra crew should be trained to handle the machine.

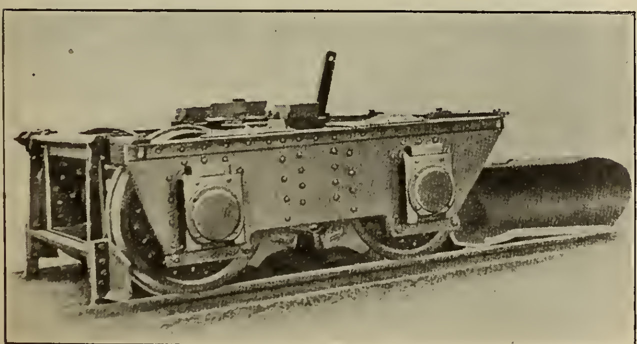


Fig. 2—Rotary Snow Plow Truck with Flanger.

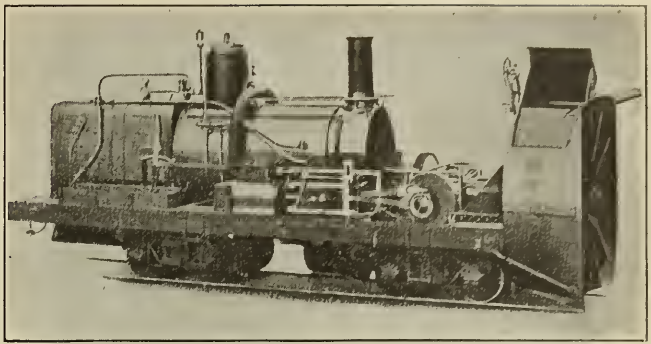


Fig. 1—Rotary Snow Plow, Stripped of Casing.

The pilot should control and operate the flangers and ice cutters, and should be responsible for their proper working while in service. As previously stated, it has been practically demonstrated that, with flangers and ice cutters in proper working order it is impossible for the Rotary to be derailed by snow or ice. Too much stress, therefore, cannot be laid upon the necessity of taking every precaution to keep both in working order. Before starting out, the pilot should see if flanger points or shearing bolts in the ice cutters need to be replaced. The flangers should always be raised when running the Rotary over a clear rail or in drawing it back over the line.

The steam whistle on the Rotary should be used for signaling the engineer on the pusher, and the air signal for signaling the engineer on the Rotary. The engineer on the pusher should never start the train until the pilot has given the proper signal.

Before starting the train, the pilot should first see that the flangers are raised, and then give the signal to the engineer on the Rotary to start the wheel. The signal to start the train should never be given until the wheel of the Rotary has been started and is running in the direction in which the chute is opened.

The engineer on the Rotary should never take his hand off the throttle lever while the train is in motion. The wheel of the Rotary should never be run while it is on a turntable or crossing a bridge or trestle. Because of the overhanging weight at each end, both Rotary and pusher should shut off before entering upon a bridge or trestle. The Rotary should never be run into a snow bank at a speed of over three or four miles an hour. When within fifty feet of a bank the pilot should signal the engineer on the Rotary, which should be the signal for him to regulate the speed of the wheel with the throttle and reverse lever to about 150 revolutions per minute. When about five feet from the bank, the pilot should give the second signal for the Rotary to come ahead, and the engineer should then increase the speed of the wheel. When the Rotary strikes the snow, the pilot should signal the pusher ahead. If he finds the Rotary can stand increased power of the pusher, he should give a second signal to come ahead, which should mean that the engineer on the pusher, or pushers, will increase the power. If the pusher is crowding the Rotary too much, the signal should be given to the engineer on the Rotary should understand to mean slow In case the pusher is still crowding the Rotary, the pilot should apply the air brakes to check the pusher. If unable to hold the pusher with the brakes, he should give the signal to the engineer of the pusher to shut off, who should respond

Row of Formers Made by C. L. Christian, Fm'n. Blacksmith.

instantly to avoid stalling the Rotary. When within about ten feet of the end of a drift, the pilot should give the engineer on the Rotary the signal to slow down, and when almost out of the bank, the signal to shut off, which the engineer on the Rotary should understand to mean slow down to normal speed of the wheel.

In case the Rotary is stalled, the pilot should at once give the signal to the engineer on the pusher to shut off. He should then raise the flanger and signal the pusher to back up, which the engineer should understand to mean to draw back only four or five feet from the bank. When again ready to start up, he should signal the engineer on the Rotary to come ahead; and, when the wheel is running, should give the signal to start the train, at the same instant giving the signal to increase the speed of the wheel. This rule should be carried out every time a stop is made in a bank.

The Rotary should never be bucked into a bank from a distance of more than four or five feet. If this is done, it is liable to disable the Rotary. In case the wheel of the Rotary becomes blocked with snow, the pilot should stop the train and give the signal to back up four or five feet. It is then only necessary for him to loosen the snow between the drum and the scoops, after which the wheel will clear itself.

The Rotary should not be forced through snow deeper than the hood. To attempt this is dangerous, and will result only in serious trouble and unnecessary delay. When the snow is deeper than the hood of the Rotary, the top of the bank should be shovelled off for a distance of ten or fifteen feet before the Rotary is brought into operation.

When operating in light snow, the wheel of the Rotary should not be run above a speed sufficient to throw the snow off out of the chute and clear of the tracks.

When cleaning side tracks or yards with the Rotary, a signal man should be stationed five or ten feet from the switch which the Rotary has to pass, and on the opposite side of the track from which the snow has to be thrown. This will enable the pilot to know when to raise the flangers and ice cutters.

The pilot should never reverse the wheel when the Rotary is in a bank. If necessary to reverse the wheel, and throw the snow on the opposite side of the track, this should be done while running from one bank to another.

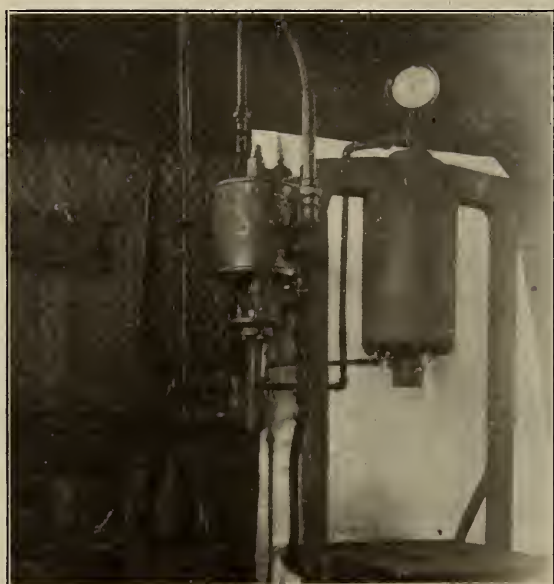
The engineer on the Rotary should watch carefully the height of the water in the boiler, as the rate of speed at which the engines are run will pull the water out of the boiler if it is allowed to get too high.

The Russell or Wedge plow renders very satisfactory service where the snow is not too heavy or deep, and the best results are obtained when manipulated at moderately high speed. These plows can be used to best advantage for keeping the track open when conditions warrant the tying up of traffic, during a severe storm or blizzard. In this respect the division officers are called upon to display rare judgment. Many mistakes have been made by dispatchers refusing to tie up trains and turn the "Flying Squadron" of wedge plows loose to keep the road open, resulting in the stalling of trains and a complete tie-up of the railroad. The advice of section foremen and others in this respect is, at times, very valuable, because of their knowledge, secured by years of experience, and the fact that they are on the ground.

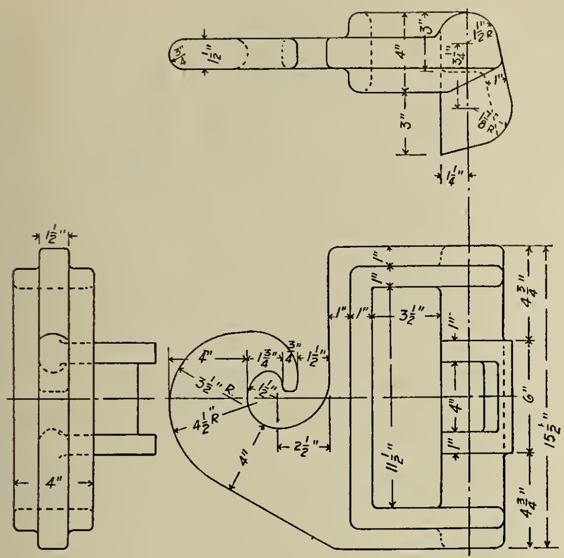
Many railroads follow the practice of equipping a large number of locomotives with flangers on each district, but the writer feels that better results can be obtained by equipping few small locomotives with flangers and assigning them to flanger service. Seldom is satisfactory service rendered by flangers on locomotives regularly assigned to road service; the exception to this, however, being branch line service. In yards, we feel that at least one switching engine should be equipped with flanger, as a clear rail and flange is of as much importance in the yard as on the main line. We feel that not enough attention is given to yards, and the importace of clear flange not fully appreciated.

Snow fences are of inestimable value in a country where bad storms are encountered, and the snow likely to drift. The maintenance of snow fences is a matter of considerable importance. Many tie-ups or blockades have been caused by neglect or failure to have snow fences in first-class condition. In sections of the country subject to severe winters it is not uncommon to have two or three mild, open, winters in succession. This tends to make divisional officers indifferent to snow fences, and the first thing they know a severe storm is upon them, and their portion of the road is buried, resulting in losses of thousands of dollars to the railroad company.

Little can be said on this subject applicable to the extreme Eastern and Western sections of the country. Such extreme measures are, of course, unnecessary, but in flanging service, conditions are about the same; therefore, what has been said in this respect can be applied to all sections of the country subject to heavy snows.



Home-made Hydraulic Press—Terminal R. R. of St. Louis.



Hook for Coal Chute Car Mover.

Many true stories could be told of the deeds performed by division officials and employes, from the superintendent down, which, if told, would tend to place these men in their true light in the eyes of the public, and secure for them the admiration and esteem due them, and possibly create toleration on the part of the public. For instance, mention might be made of the snow blockade on the Colorado & Midland R. R. in the winter of 1898-99, which was finally broken on April 14th. This will go down in history as the most remarkable snow blockade ever known in the Rocky Mountain region, and will probably never be exceeded, because of a combination of circumstances rendering the blockade very difficult to handle. From the evening of January 27th to the evening of April 14th, the railroad company used every effort to keep the road open, but without success. In this fight three Rotary snow-plows, each propelled by five locomotives, and assisted by large gangs of men, were pressed into service. At one time, one crew fought the storm forty-two hours without stopping, and at another time two engine crews were rescued from the mountain side after having been in continual service for 62 hours. On the last day, two locomotives were released that were frozen in for 73 days. One can better realize the difficulties encountered when told that in places the snow was banked to a height of 30 feet above the rail, and once, towards the end of the blockade, a gang of men on snowshoes hunted for two hours to to dig down to find the roof of a siow shed. In places it was necessary to tunnel the snow-bank and blow out the frozen mass with dynamite. The Colorado Southern Railway suffered almost as severely, although it abandoned the line between Breckenridge and Leadville, and made no effort to open up the road. On April 14th the road still remained closed. During the winter of 1906-07, the Northern Pacific had eight Rotary snow-plows in service, seven of which were at work practically continuously from January 1st until April 1st, and much of this time day and night. In the early part of April, 1904, the same road suffered on account of a severe blizzard in North Dakota, the snow drifting in places to a depth of 12 to 14 feet, the weather turning cold immediately afterwards; the snow-fighters having to contend with a temperature of 15 to 20 degrees below zero, with a strong wind blowing. In this particular instance, the snow-fighters started in to work at five o'clock Saturday morning and worked continuously, without sleep, until Monday noon.

Shops of the Terminal R. R. Ass'n of St. Louis

The repair shops of the Terminal R. R. Assn. of St. Louis are located at Brooklyn, Ill., near the extensive switch yards of East St. Louis. The shops are designed to care for the general repairs of about one hundred and twenty locomotives, both foreign and these owned by the home road. Since a large number of foreign engines are repaired it is not possible to standardize the tools and the work to the extent possible in most shops. On the other hand, there are very few cars to be handled, and the plant is given almost entirely to the repair of locomotives.

The general layout of the shops is good, and is illustrated herewith by courtesy of the engineering department of the road. The small drawings are all reproduced by courtesy of Mr. Wm. Bawden, master mechanic, and Mr. W. A. Houston, general shop foreman.

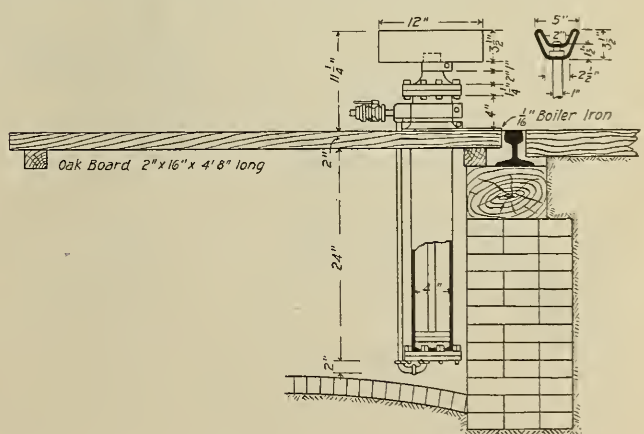
As is usual in small shops of this kind, the blacksmith's department has not the required type of machines to do a great amount of bull-dozer work. The next thing to this, however, is the use of formers under the steam hammer, and one of the photographs shows what the foreman blacksmith, Mr. C. L. Christian, has done in this line of work.

These formers are made to press out all manner of small parts, and even some tools are made in this way. Machinists pean hammers of 1¾ lbs. weight are pressed out in one heat, at a cost of about 8 cents per hammer. Old tire steel is used for this class of work and the hammers serve the purpose of those costing many times the price.

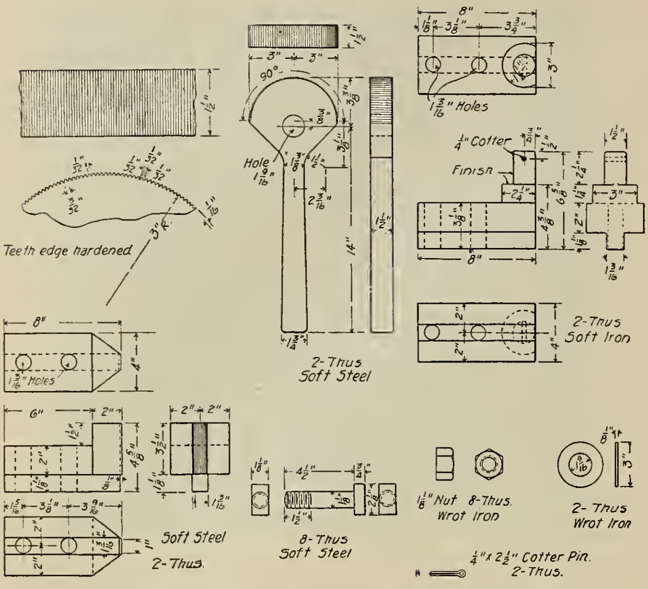
A device to allow of the replacing of headlight glasses, without the usual use of plaster of paris, has been devised and patented by Mr. C. B. Baker, of the headlight department, and one of the drawings herewith clearly explains the method. Both side and front glasses are inserted in a few seconds and the system is a great saver of time and money.

A hydraulic press which, as a home-made device, makes itself surprisingly useful, is shown in one of the photographs. This press was made from an air pump, the piston rod of which is arranged to work in a section of ordinary 1¼-in. pipe. The pressure obtained on the press is great enough to perform a large number of shop operations which otherwise would have to be done by hand or on the large wheel press.

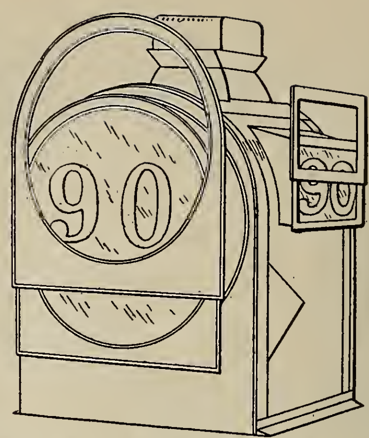
Mr. Bower, the foreman machinist, has developed a number of ideas in the way of time saving in the machine shop, among which might be mentioned a device for using boring bars of different sizes on the same spindle, and a set of tire clamps for clinching tires on the boring mill. This device is shown in detail in one of the drawings. He also has piped up the heavy hydraulic wheel press in such a way that the city water pressure will take up the slack between the



Air Hoist for Mounting Driver Boxes.



Details of Tire Chuck, Terminal R. R. of St. Louis.

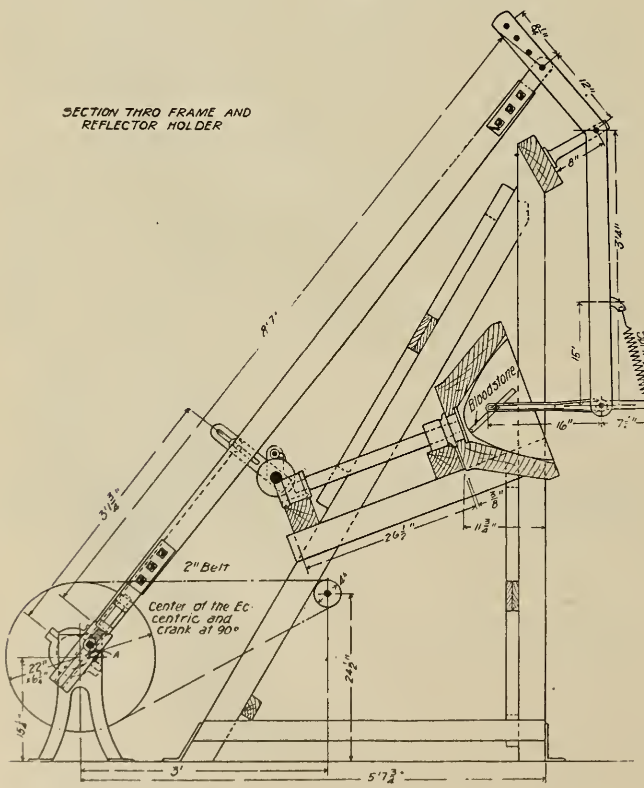


Headlight Glass Holder; C. B. Baker, Terminal R. R. of St. Louis.

This railroad also maintains a shop for light repairs in the switch yard of the Union Station at St. Louis, but all heavy repairs are made at the Brooklyn shops.

plunger and the wheel axle, thus saving the time incident to pumping the plunger for this distance. Mr. Bower has a tool in use in this shop which will turn rock shafts or any small cranked shafts in a lathe without the necessity of revolving it. The tool itself is revolved about the shaft. Unfortunately, the device is not illustrated herewith.

The second story of the erecting shop is given to the use of the pattern maker and to the electro-plating department. All headlight reflectors are silver-plated and burnished by means of an ingeniously contrived machine, illustrated in one of the drawings. On this floor is also located a tank from which the compound used for machine tool work as a cooling medium is piped to each machine in the shop. This saves a large number of small tanks about the shop.



Burnisher for Headlights, Terminal R. R. of St. Louis.

Recent Improvements on B. & O. R. R.*

By O. C. Cromwell, Mech. Eng.

During the past few years the Baltimore & Ohio Railroad has gone very extensively into the improvement of its rolling stock, terminal points and shops in general. Considerable consideration has been given to the lighter capacity of wooden freight car equipment in order to make them substantial enough to withstand the shocks they are subjected to in trains now composed of cars of 100,000 pounds capacity. The old and light design of draft gear with which these cars were equipped has been replaced by more modern and substantial types of gears, and the old combination and light designs of metal bolsters are giving way to more substantial designs of cast steel and built up bolsters, as well as a number of other minor changes pertaining to the different types of cars.

The locomotives and passenger cars which are not already equipped with high speed brakes are now having the same applied as they pass through the shops for repairs. Particular attention is being given to locomotive failures, which are being followed up closely and means adopted to correct the weaknesses that have developed, in order to reduce such failures to a minimum. All the improvements have been carefully and thoroughly worked out with a view of bringing the efficiency of the equipment up to the highest point attainable, and also to make the necessary changes to the designs that will be durable and last the longest per dollar expended, thereby eliminating the trouble, care and expense of replacement and avoid delays to trains, as would be the case if such failures were allowed to continue. With this policy in view, the greatest economy consistent with the greatest efficiency will undoubtedly be obtained.

The introduction of a uniform arrangement for the respective equipments is sure to reduce the inspection and repairs involved, as well as labor, supervision and records to a minimum. Such standards will reduce the confusion and variations when placing requisitions, and the parts can be made at repair points in large quantities instead of in small job lots.

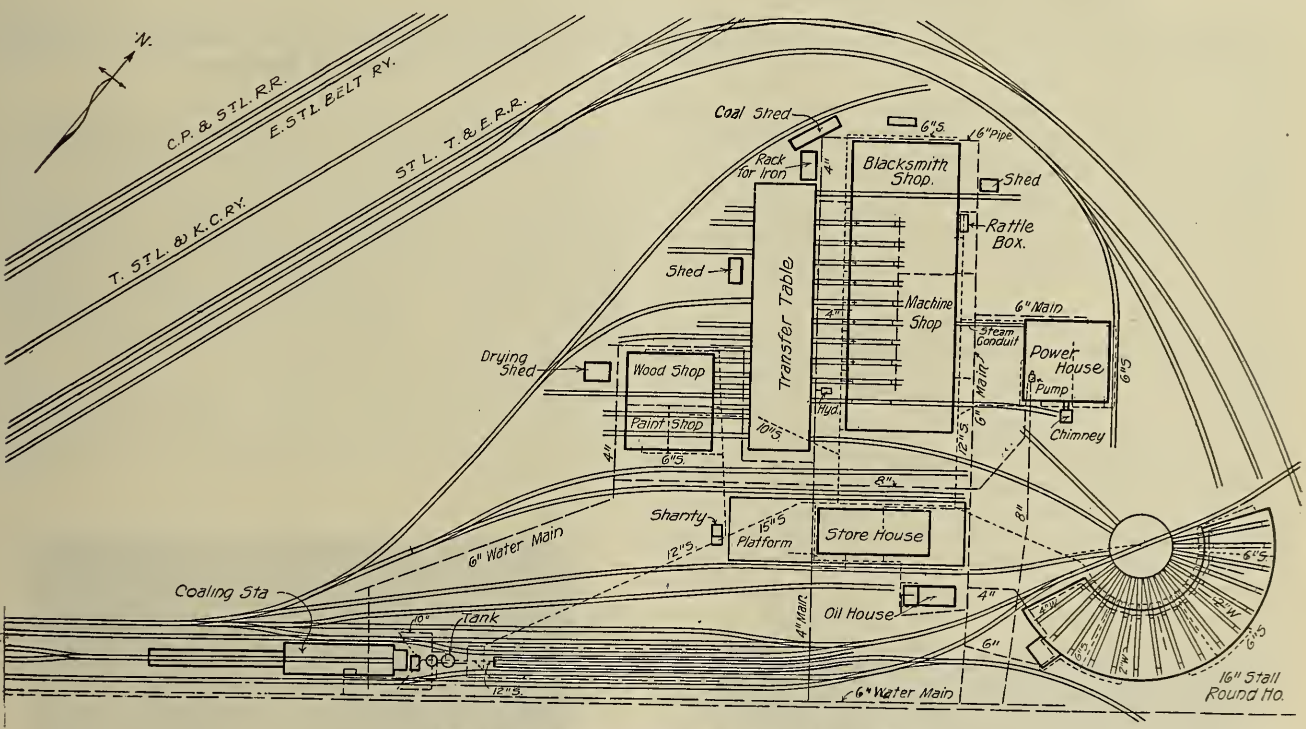
Shop improvements and facilities for handling equipment have also received their share in the undertaking of betterments. There has been constructed new roundhouses, ma-

*Mr. Cromwell's photograph appears on page 214.

chine, smith and other shops and buildings at thirteen different terminal points for the care and maintenance of the rolling stock. For turning locomotives at terminals and roundhouses there have been installed 80 ft. diameter turntables, which are all power driven, either by electric or pneumatic motors. In, the roundhouses a flexible metallic steam blower arrangement has been installed, which connects main blower line to the locomotive smoke box connections, thereby doing away with the hose as formerly used.

Special care and attention has been given to the welfare of shopmen and trainmen at the different roundhouses, shops and terminal points, provision having been made for the installation of clothes lockers, complete lavatories, and at a number of points, eating, lounging and sleeping rooms have also been provided, and in nearly all cases a separate building has been erected to care for these improvements.

Some of the most important of the improvements were the enlarging of the Mt. Clare erecting shop, with an addition of a new machine shop, and the rebuilding of the saw-mill at Mt. Clare, which has an arrangement of wood working tools and machinery driven by individual motors throughout. All of these motors are of the enclosed type, and in order to maintain their full h. p. rating a system of cold air ventilation has been installed to overcome heating which naturally arises in this type of motor. The air is supplied by three small electric motor-driven fans, through a conduit of piping to which each individual motor is connected.



General Shop Layout, Terminal R. R. of St. Louis.

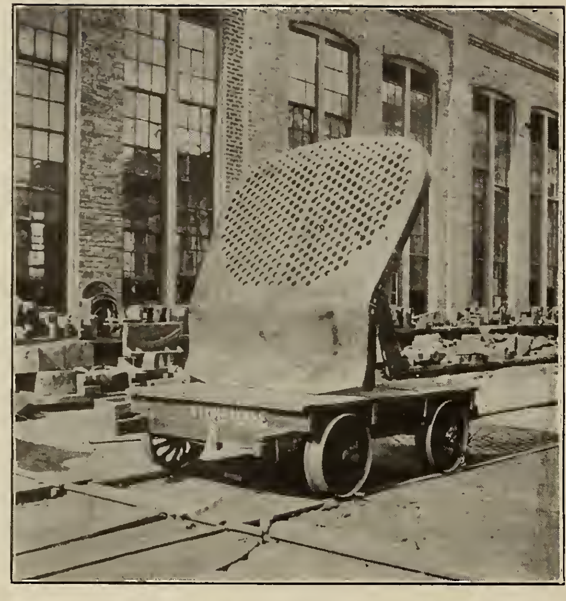
Classification of Motive Power on Indian Railways*

In view of the numerous patterns of locomotives which are running on Indian railways, the necessity was recognized some years ago by mechanical authorities for the establishment of an expression or formula which would give, firstly, the type of engine structurally, and, secondly, such dimensions as when read by any locomotive engineer would at once give him a definite idea of the calibre or power of the engine; the descriptive formula expressing this being made as concise as possible in order to be adaptable for general use.

The matter was very exhaustively discussed by the Locomotive and Carriage Superintendents in committee at their Calcutta convention in 1901, and again when they met at Bangalore the following year. At this latter meeting a powerful, in point of talent, sub-committee was appointed to go into the whole question in detail and to formulate and submit a form of classificaion for general approval. The report eventually published by this sub-committee was, in January, 1904, submitted to ballot by the members of the whole Committee, and, in the result, was approved of by a substantial majority, in fact, with the exception of some suggestions which were made with a view to slightly amplify the proposed formula, the ballot was practically unanimous.

The basis of the formula, as promulgated and adopted, is an expression in use on English Railways in describing engines of certain types, and this has been made the numerator of the Indian expression. The principle is, that the left-hand numerator states the number of free wheels at the leading end of the engine; the second numerator gives the driving wheels, while the third numerator includes any free wheels placed at the trailing end of the engine. When a tank engine is being described, a small T is placed after the third numerator, the absence of this letter indicating that the engine is a tender engine. It is apparent that this formula gives a very sufficient description as to the structural type of each engine, but to complete the classification more than a structural formula is necessary, and this necessity has been fully recognized and provided for by adding to it such dimensions as enable any locomotive engineer to readily realize the power and calibre of the engine. This is done by the addition of denominators, which, separated by the sign of multiplication, are, in the order given, diameter of cylinders, diameter of the driving wheels (single or coupled) and

*From Indian Engineering.



Showing Sheet Pressed with Offset.

the working boiler pressure, the complete formula reading like this:

No. of free wheels at the leading end of the engine.	×	No. of driving wheels and the No. of wheels coupled to the driving wheels.	×	No. of any free wheel placed at the trailing end of the engine.
Diameter of cylinders in inches.	×	Diameter of driving wheels in inches.	×	Working boiler pressure lbs. per square inch.

Although there is no actual provision for compound engines this can easily be arranged by placing two dimensions instead of one in the space allotted to the diameters of the cylinders.

The full formula gives, first of all, a code letter for the local use of each system for departmental reference, the key to which is the formula giving a classification of type supplemented by the detailed description of dimensions, which taken in combination are capable of conveying an adequate idea of any class of locomotive which may be under correspondence, discussion or reference, in the proceedings, reports or letters between the various administrations or between themselves and the Government, or themselves and the makers. It will be observed that the choice has been left to each railway to use its own code letter, rather than an arbitrary code having been fixed for all lines. While it was quite recognized that a fixed code letter would indicate the class of engine or engines, under reference, and that against that code letter in each office would be the formula adopted, it was felt that, owing to the numerous types of locomotives in the country, it would be better to allow each line to continue to use its own selected letters then, and now, in use.

To complete the classification, a formula for tenders is added, a matter which, in comparison with engines, was more or less simple, as only three classes of tenders had to be considered—four-wheel, six-wheel and bogie. The individual axle is dealt with in the same way by the number of wheels, the simple tender being described by the numerator 2 for each separate axle. In the bogie tender, the bogies become the unit, and 4 — 0 — 4 expresses a tender on two bogies, as in the case of wheels, 2 — 2 — 2 expresses a six-wheeled tender and 2 — 0 — 2 a four-wheeled one. To give an adequate idea of the general design and carrying capacity of each tender, three denominators have been added, separated, as in the case of the engine formula, by the multiplication sign. The first denominator gives the coal capacity in tons, the second the water capacity in gallons, and the third the diameter of the wheels in inches, thus—

$$\frac{2 — 2 — 2}{5 \times 2{,}000 \times 46\tfrac{1}{2}''} \qquad \frac{4 — 0 — 4}{7 \times 3{,}500 \times 42''}$$

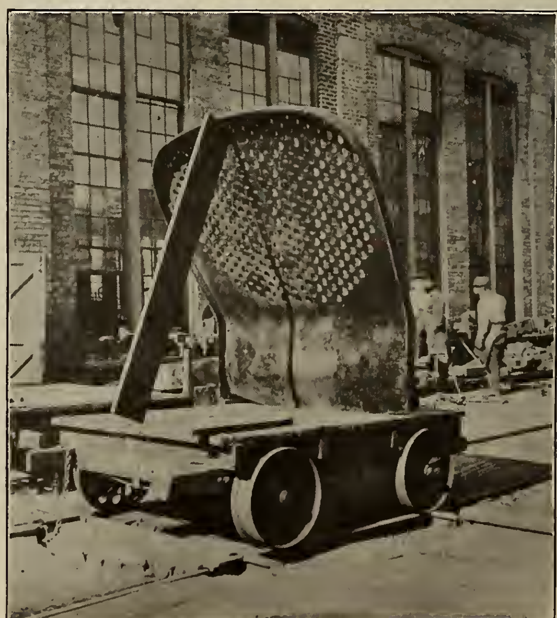
Since the formula we have just detailed was adopted, a proposal has come forward, for the addition, in the engine formula, of a figure giving the stroke underneath the figure representing the diameter of the cylinder, so as to enable the tractive force of any locomotive being readily calculated. We have remarked that this proposed addition has been mooted, but we have not heard of its adoption.

There is no doubt that the possession of this formula is of a distinct advantage to the locomotive superintendent, assisting him as it does to arrive without delay, and with a minimum of trouble, at the main details, both structural and dimensional, of any engines that he may have under review. Even if it served no other purpose, this one alone would amply compensate the trouble in elaborating it.

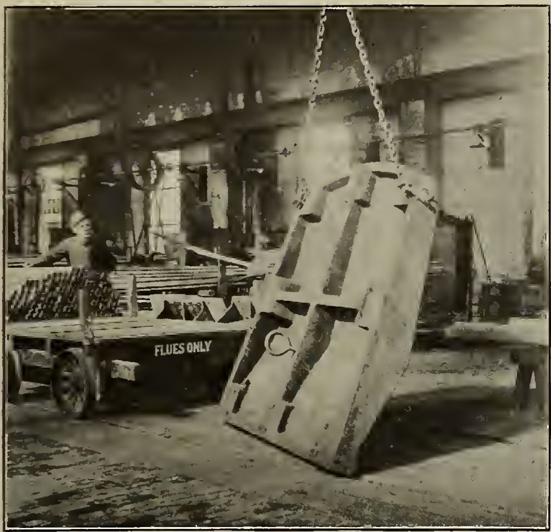
Use of Dies in the Boiler Shop of Illinois Central Railway

In The Railway Master Mechanic, issue for May, editorial mention was made of dies and formers in use at the Burnside boiler shop of the Illinois Central R. R. Through the courtesy of Mr. G. M. Crownover, the writer has since secured several photographs of the male die used to press out rear flue sheets for one of the largest classes of wide fire box locomotives in use on this road. The die is slightly complicated by the offset in the sheet, plainly shown in one of the illustrations herewith. A Niles-Bement-Pond hydraulic press is used to drive the dies and the sheet is flanged and bent to exact dimensions in one operation.

A better example of this class of work is the pressing of the firebox door sheets. Anyone of the sheets in use is pressed out in one operation of the die, the door hole being first cut square by punching, of course. The possibilities



Sheet Pressed Out by One Operation of Die.



Rear View of Male Die, Showing Arrangement of Metal.

for the saving of time in the blacksmith shop are only lightly touched upon by these illustrations and those who have experimented along this line feel that time expended in the design of dies and formers can hardly be wasted.

Development in Air Brakes.—II*

The Locomotive Brake.

In the early days of railroading practically no attention was paid to the necessity for braking power on the engine and tender on account of the service conditions prevailing and fear of flattening and slipping the driving wheel tires. A little later straight air brakes, similar to those under the cars, were applied to tenders; then the driver brake was added and later (after the automatic brake came into use), as it became necessary to utilize every possible means for obtaining braking power, the truck brake, thus forming the complete brake installation. Later such service as doubleheading led to the substitution of the quick action triple valve for the plain triple valve on the tender, it being necessary to risk occasional occurrences of undesired quick action from the head engine to the train. In the case of passenger locomotives, the development of the high speed brake equipment led also to the addition of the high speed devices to the locomotive equipment. Then for freight engines used in special service, such as grade work, switching, etc., the need for the independent control of the locomotive brakes became apparent, which led to the application of the straight air brake on such locomotives, which, in combination with the automatic brake increased the efficiency of the brake apparatus. Figure 1 shows the apparatus required in order to completely equip an engine and tender with the devices necessary to accomplish the desired results. It will be noted that all of the above changes have come about as additions to existing equipments forming a series of progressive steps in the attempt to provide a combination of devices permitting a maximum of safety and flexibility in train handling.

When further improvements became necessary, the undesirability of adding further to the existing equipments became apparent, and it was resolved to depart from the previous lines along which improvements had been made and to design outright an equipment which would combine the functions of several pieces of apparatus and include the features required of a brake which should meet the requirements arising from present-day conditions—this equipment to cover all kinds of service and classes and weights of locomotives. The immediate result of such a simplification would be to establish a uniformity in practice in regard to equipments on different locomotives and in different parts of the country, which would be appreciated not only by the management and purchasing agents, but make possible the attainment of the best possible results by the engineer with a minimum of time and expert training, because the operation and manipulation of only a single equipment would need to be learned.

This brake is called "The 'ET' Locomotive Brake Eqiupment," (Fig. 2), and, as will be pointed out, includes all of the advantageous features which have been worked into previous equipments, eliminates many of the undesirable features inseparable from former types, and provides many additional operative features which have been long desired but hitherto unobtainable with other types of equipment. It may be of interest to point out more in detail what some of these features are.

The space occupied by the equipment on a locomotive has been materially reduced, as many of the pieces of apparatus necessary with most of the advanced types of former equipments have been done away with. For example, the equipment includes one automatic brake valve, one independent brake valve, one feed valve, one reducing valve, one distributing valve, one safety valve, two gauges, and the brake cylinders, taking the place of the automatic brake valve, straight air brake valve, two feed valves and reversing cock, straight air reducing valve, two double check valves, two high-speed reducing valves, two retaining valves, three auxiliary reservoirs, two triple valves, tender drain cup, and the brake cylinders, all of which apparatus would have to be used in making up a complete equipment of the old standard while the results would still fall far short of approximating the operation of the "ET" equipment.

The new equipment is adapted for all classes of engines and all kinds of service and requires carrying but one size of operating devices in stock, since the only difference made in the equipment when applied to the different sizes of locomotives is in the size of brake cylinder employed.

The brake valve has very large ports, which the increased length of train and larger auxiliary reservoirs have made necessary. It is also constructed so that the wear of the rotary valve and seat has been more evenly distributed and the valve can therefore be operated with greater ease and maintained at less expense.

Male Die for Pressing Flue Sheets, Ill. Cent. Ry.

* Continuation of a paper by W. V. Turner and S. W. Dudley, read before the New York Railroad Club, April 16, 1909.

All of the valves used with the equipment, i. e., the brake valves, feed valves, reducing valves and distributing valve, are mounted on permanent bases or brackets to which the pipe connections are made once for all so that it is not necessary to break any pipe connection in order to remove the valves for cleaning or repairs. Consequently, if the engine should come into the round house with the feed valve or distributing valve needing attention, it could be replaced by another valve in a very short time, without causing any delay and avoiding any chance of getting dirt inside the valves, which might happen if the inspection or repairs were attempted with the valve in place on the locomotive.

The feed valve used with the equipment is of improved design and is provided with a hand wheel on the adjusting nut moving between two adjustable stops, so that a change from standard pressure to high-speed brake pressure, or vice versa, can be made by simply turning the hand wheel from one stop to the other.

The safety valve used in connection with the distributing valve is of improved type and is specially arranged so as to operate in a manner similar to the high speed reducing valve when an emergency application of the brake is made.

the drivers of the locomotive should slide, the pressure can instantly be released from the cylinders. In grade work, if there should be any danger from overheating the tires, the driver brakes can be prevented from applying or they can be released if they are applied and in descending grades the locomotive and train brakes can be alternated by first applying the train brakes and preventing the locomotive brake from applying, then applying the locomotive brake and holding the train by means of the locomotive while the train brakes are released and the reservoirs recharged, then again applying the train brakes and releasing the driver brakes—obtaining in this way much better control down the grade which permits of a higher average speed being maintained than would be possible otherwise. The train brakes can be released and the engine brakes held on keeping the slack bunched until the train brakes have released. The locomotive brakes can then be either let off quickly and entirely, or can be graduated off. This is of the greatest importance in releasing the brakes on a long freight train, as it prevents the great retardation which is still taking place at the rear end from pulling the train in two after the head brakes have released. Its advantage in passenger service is also obvious,

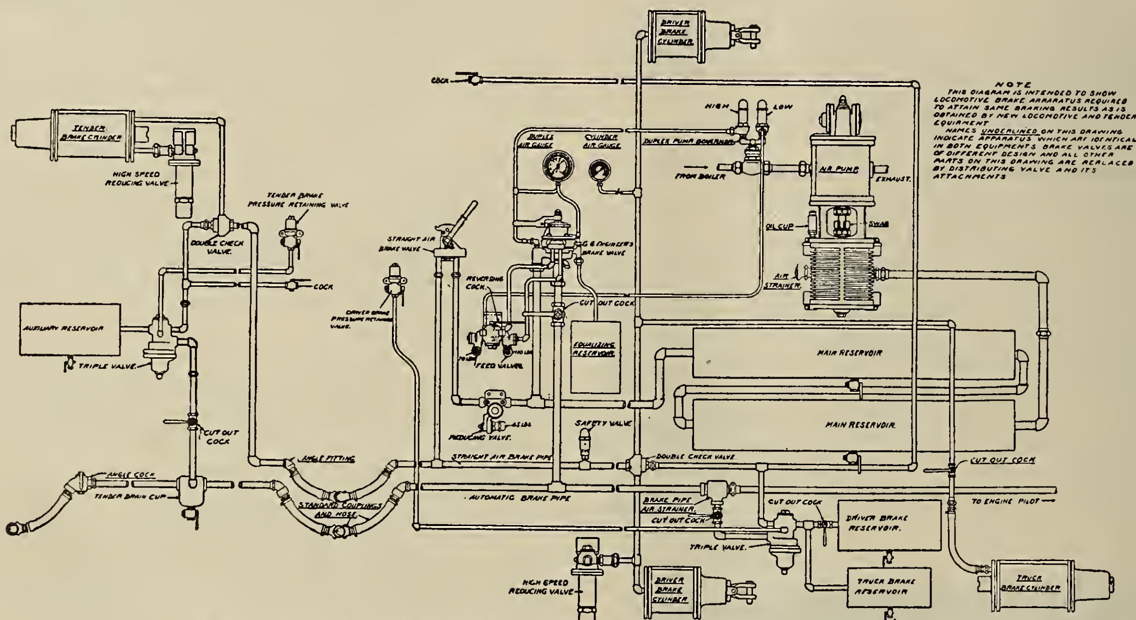


Fig. 1—Locomotive Brake Equipment, Combined Automatic and Straight Air.

The independent brake valve is provided with a double return spring which returns the handle from release to running position and from quick application to slow application position, thus relieving the engineer of the necessity for careful attention to these points when handling the independent brake.

The brake on the locomotive can be used independent of the train brakes, or in conjunction with them, at any and all times, as with the present equipment, or the engine brakes can be applied without applying the train brakes, by the use of the independent brake valve. It is unnecessary to point out in detail the advantages of this in connection with switching and handling long trains, especially on grades. The locomotive brake can be released without releasing the train brakes. The train brakes can be applied without applying the locomotive brake, by simply holding the independent brake valve handle in release position while applying with the automatic brake, if, for any reason, it should be necessary to prevent the application of the brakes on the locomotive. The locomotive brakes can be released without releasing the train brakes. The advantages of this are many; for instance, if

as the engineer can release his train brakes and graduate his locomotive brake off just as the stop is being completed, thus making an accurate stop without shock, as the trucks have been permitted to right themselves before the train comes to a standstill.

It prevents overcharging, with consequent stuck brakes, by compelling the engineer to return to running position at the proper time, thus insuring proper manipulation of the brake valve. It provides for a graduated release of the locomotive brakes, in connection with the new high speed brake. If it is necessary to hold the train for a short time as for a station stop on a grade, the independent brake alone can be used, permitting the train brakes to be fully recharged and enabling the engineer to start promptly when the signal is given. Full braking power is obtained at any time desired; that is to say, the equalizing point is not changed by leakage in the cylinders or their connections, or by long or short piston travel. For a given reduction, uniform pressure is obtained in all brake cylinders on the locomotive regardless of difference in piston travel or leakage which may exist. Any brake cylinder pressure obtained, whether partial or full application, is maintained constant against leakage up to the capacity of the compressor, whether the application is made by the independent or the automatic brake valve.

During emergency applications about 30 per cent. higher brake cylinder pressure is obtained on the locomotive than the maximum for service operations of the brake. This has long been an accepted principle of operation for all car brake equipments, but heretofore not provided for on the locomotive—the vehicle which, of all others, should take full advantage of this principle on account of the large proportion of braking power which it contributes to the total for the train, and the consequent danger of flattening the drivers or slipping the tires in service applications if the braking power of the locomotive exceeds that of the loaded cars.

The holding position of the automatic brake valve serves as an automatic pressure retaining valve, enabling the engineer to hold any desired pressure in the locomotive brake cylinders.

If the brake valve handle is returned to lap position after making a release of the train brakes, as is often done in making a two-application stop or when slowing down for a signal, it cannot be left there by mistake and forgotten, as atmosphere. The operation just described will be recognized as similar to that of a straight air brake and, as a matter of fact, it displaces the straight air portion of the old combined straight and automatic brake equipment, and gives what was not obtained with the former equipment, an independent locomotive brake, no matter whether the automatic brake is used or not.

During an automatic application of the brakes, the air delivered to the application cylinder comes from the second source of supply, viz., the large compartment of the double-chambered reservoir of the distributing valve, called the pressure chamber. The flow of air from pressure chamber to the application cylinder (which is in free communication, except when in emergency applications, with the smaller compartment of the double chambered reservoir, called the application chamber) and chamber is controlled by a slide valve (equalizing valve) and graduating valve, moved by a piston (the equalizing piston). The equalizing piston is exposed to brake pipe pressure on one side and pressure chamber pressure on the other. It therefore controls the flow of air from the pressure chamber to the application cylinder and chamber in exactly the same way that the flow of air from auxiliary

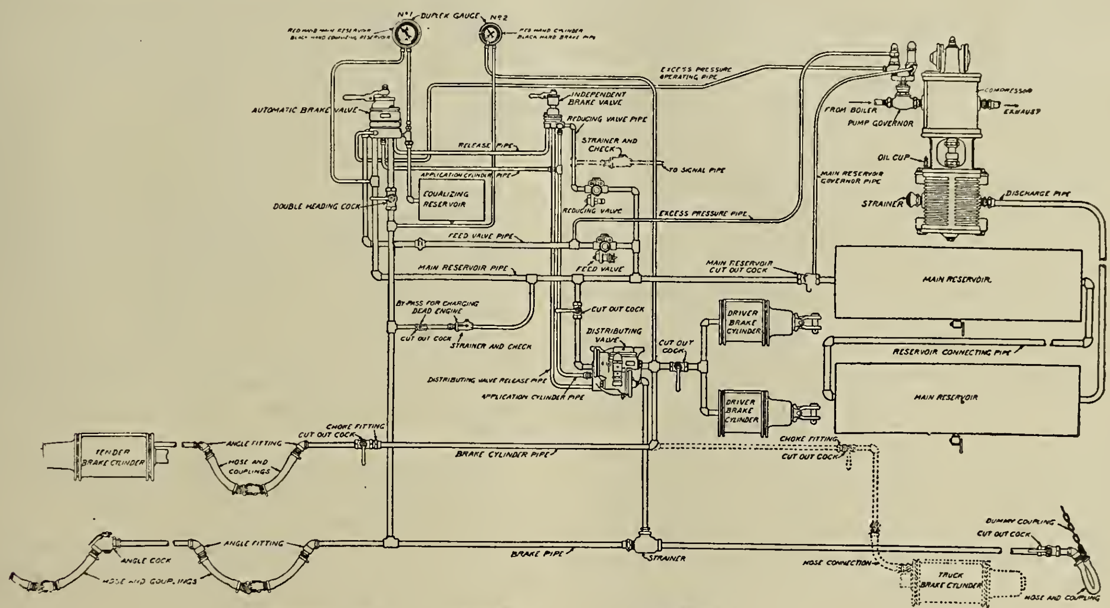


Fig. 2—The "E. T." Locomotive Brake.

the locomotive brake will remain applied and draw the engineer's attention to his oversight—a protective feature worthy of note.

When double-heading, the man on the second engine can operate his locomotive brake entirely independently of the other brakes in the train so that, in case of necessity, he is able to release his driver brake if the tires become over heated or the drivers slide and can assist the head man in alternating the locomotive and train brakes while descending grades.

It is thus seen that the greatest braking unit in the train is under the complete control of the engineer without regard to what is being done with the train brakes at any time.

By the use of this brake valve, the locomotive brakes can be applied or released without interfering with the automatic brake system in any way. There is, however, a pipe connection from the independent to the automatic brake valve so that normally, when operating the independent brake (the automatic brake valve then being in running position), the independent brake valve handle may be placed in running position to release the brakes, the exhaust then passing through the independent and automatic brake valves to the reservoir to the brake cylinder is controlled by the triple valve piston in ordinary car brake equipments. It will, therefore, be unnecessary to describe in detail how a given brake pipe reduction causes a certain fixed amount of air to be admitted from the pressure chamber to the application chamber and cylinder, except to point out that the volume of the latter is fixed and practically air tight, so that the relation of the volumes involved the same, and the pressure therein not subject to variation due to changes in piston travel or leakage. Therefore, the pressure obtained in the application cylinder for a given reduction in brake pipe pressure is always the same, and therefore, as already explained, the brake cylinder pressure obtained is constant likewise. This explains why a single equipment may be used for large or small locomotives alike, and, when the possibilities of independent operation of locomotive and train brakes are considered, why the equipment is adapted to all classes of engines in all kinds of service.

During automatic service applications, as well as when operating the independent brake, the safety valve on the distributing valve is connected to the application cylinders. This safety valve is of improved design and of large capacity so that ample and adequate protection is afforded against brake cylinder pressures higher than that determined by the setting of the safety valve.

When the automatic brake valve handle is placed in either release or running position the equalizing piston and its valves are moved back to release position, as in a triple valve, the exhaust cavity in the equalizing slide valve connecting the application chamber and cylinder to the distributing valve release pipe. This, instead of always being open to the atmosphere, as in the case of a triple valve exhaust, leads through the independent brake valve (when in running position) to the automatic brake valve and is open only in the running position of the latter. There is only one position of the automobile brake valve handle, therefore, viz., running, which will release the locomotive brakes and this only when the independent brake valve is in running position.

While the automatic brake valve handle is in release position during a release of the brakes, the locomotive brakes still remain applied, keeping the slack bunched and permitting the car brakes to get the start in releasing. A new position (Holding Position) is also provided on the automatic brake valve, which is exactly the same as running position except that the distributing valve exhaust port is closed. If it is desired, therefore, to still further hold the locomotive brakes applied while releasing the train brakes and recharging the auxiliary reservoirs, it can be done by returning the automatic brake valve from release to "holding" position, and the locomotive brake can then be graduated off by successive movements of the automatic brake valve between holding and running positions and in this way the automatic brake valve is made to perform at once the functions of a pressure retaining valve and a straight air brake valve.

When an emergency application is made, the application chamber of the distributing valve is cut out entirely and equalization takes place between the pressure chamber and the application cylinder only. This not only results in 30 per cent higher brake cylinder pressure being obtained, but, furthermore, the safety valve is at the same time connected to the application cylinder through a restricted port and air from above the automatic rotary valve flows through a small port in this valve to the application cylinder pipe and application cylinder, thus prolonging the time of blow-down of application cylinder pressure (and consequently of brake cylinder pressure) similar to the operation of the high speed reducing valve on car equipments.

It will be seen from what has been said regarding this equipment for locomotives that the flexibility and safety features of the brake have been greatly increased and that it is not only capable of taking care of the necessities of the present, but that ample provision has been made for the requirements of the future as far as they can be foreseen.

The Passenger Car Brake Equipment.

It will be remembered that from the time of the development of the high speed brake, it was apparent that the brake for passenger service and freight service would have to be worked out along radically different and distinct lines,—speed, frequency and weight being the governing factors in the one case, and length of train and a great difference between empty and loaded weights of cars, the vital factors in the other.

For a considerable period the high speed brake equipment already referred to fully accomplished the purpose for which it was designed and provided a train control approximately as efficient for the trains to which it was applied as was that of its predecessor for the earlier conditions.

But as time went on, further changes in conditions, which necessarily go with progress, reduced the comparative efficiency of this brake, and to a large extent neutralized the improvements that had been made from the older forms. For it is a remarkable fact that all improvements in rolling stock and train operation have been in a direction that has made train control more discult, and we have no hesitation in saying unless radical departures are made from present practice in other railroad equipment, that in spite of all the improvements we can make in the air brake, the controlling of trains, particularly when running at high speed, has so increased the energy to be dissipated that to make the stop in the same time and distance as with a lighter train, it is necessary to use still higher cylinder pressure, and as the work to be done and the duration of the stop causes such heating of shoes and tires as to maintain a low coefficient of friction, the full pressure obtained should be held throughout the stop.

In addition to the increased weight and speed of trains, there were, of course, increased number of parallel tracks and frequency of trains. These always bring with them braking problems quite as difficult of solution and as necessary to be solved as those which preceded them, particularly as the tendency is to neutralize or lower the value of many of the factors involved in producing and realizing retarding forces.

A careful analysis of these conditions and problems with reductions checked by experiment and test, notably at Albany; then after these tests were analyzed, of others at Absecon, and these again followed by others, and also by installations in actual service, led to a new design of brake embodying all the features of the old and a number of others, some considered essential from a safety standpoint, others very important from that of properly meeting operating conditions, reducing the personal equation, and in materially increasing the value and adding to the already great earning power of a good and an efficient brake. The features added to those already possessed by the brake are:

1st.—Quick recharge of the auxiliary reservoirs; this to offset longer trains, larger cylinders, and reservoirs, and make unnecessary large feed grooves; thus insuring prompt application and preventing depletion of auxiliary reservoir pressure.

2nd.—The quick service feature, to compensate for increased length of train and bring about more prompt, uniform and certain application of the brakes.

3rd.—The graduated release feature, to neutralize the shock effects of long and heavy trains, to add to the flexibility of the brake by making it possible to graduate the brakes off, as well as on, thus eliminating the loss of time required and risks incident to "two application stops;" making possible a proper and heavy application at the commencement of the stop and low cylinder pressure at the end, therefore saving much time and reducing wheel sliding; also making it possible to make a great number of applications without exhausting the air supply, and making it practically impossible for a train to run away on a grade; in fact, if the pump stops or its capacity is too low to furnish the air necessary to properly control the train, it will be brought to a standstill until the main reservoirs are replenished. This feature also insures against the very dangerous possibility of the engineer lapping the brake valve after a release and forgetting it; if he does, the train will be brought to a standstill.

4th.—More efficient protection against high cylinder pressure for service application, 1st, by limiting the cylinder pressure; 2nd, by using a reducing valve of proper capacity; thus wheel sliding is reduced and the proper margin maintained between the power of service and emergency applications.

5th.—For the same brake pipe pressure carried, a much higher cylinder pressure is obtained in emergency, which pressure is retained during the complete stop, thus materially shortening the stops and adding greatly to the safety of the trains.

6th.—The ability to obtain quick action and emergency cylinder pressure after a considerable service application has been made thus insuring maximum braking power at a time when it is most likely to be needed, viz., after a service application has been made and an emergency arises. This is most likely to happen at places where a service application for slow down has already been made.

The reasons why this higher cylinder pressure is necessary and permissible will be explained later. If, for any reason, this higher pressure is not desired or is not expedient, the same cylinder pressure as is now obtained from 110 lbs. brake pressure with the old high speed brake can be had with 90 lbs. brake pipe pressure—quite a profitable feature and important in many ways, not the least of which is that it leaves quite a wide margin for special and future necessities.

Not only were these operative features added to the brake, but it was modified in other ways; for example, 1st, smaller auxiliary reservoirs than previously employed were used with a given size of brake cylinder for the service operations, while for emergency operations, another and larger reservoir is added to the service reservoir and the volume of both used to give a much higher cylinder pressure than before—the reason for this has already been pointed out. 2nd, the braking power is calculated from 50 lbs. cylinder pressure instead of 60 lbs. as was formerly the case;—and, 3rd, while ample and efficient means are provided to limit the cylinder pressure to what is predetermined for service applications, in emergency a higher cylinder pressure is obtained and held until the stop, that is, the reducing valve is operative only in service applications. The importance of these modifications is beyond estimate and very far reaching, but time will not permit of a very extended explanation of the reasons or even mentioning all that is involved, but we will at least attempt to show that the reasons are sound and the gains from a legal and safety standpoint down to that of maintenance are such that, if understood, they cannot be ignored.

In two ways there had come into existence a considerable change from the original design of passenger car brake apparatus. The auxiliary reservoirs had become larger in proportion to the brake cylinder volumes to compensate for the lessened value of the air vented from the brake pipe to the brake cylinder in emergency applications because of increased size of brake cylinder with the brake pipe volume remaining practically constant. The leverage ratio had been increased also because of reluctance to use large cylinders as cars increased in weight. This continued until operation in service was adversely affected with regard to shoe clearance and the graduating features of the brake.

To properly meet the reqirements of service, it has become necessary to limit the leverage ratio employed to 9 to 1, and to base the braking power upon the service brake cylinder pressure actually obtained, and use an auxiliary reservoir bearing the same proportion to the brake cylinder volume as in the original brake design; an additional emergency reserovir being provided to compensate for the difference which there came to be between the added emergency pressure obtained from the brake pipe with the small cylinders of the earlier equipments and the very large cylinders of today.

In fact, once the necessity for this provision was established, it became evident that it could be carried further and the additional reservoir allowed to compensate, not only for the difference mentioned, but to give a still increased emergency brake cylinder pressure and, incidentally, be made use of during service applications to obtain other functions, such as furnishing a practically unlimited air supply, for obtaining a quick recharge of the auxiliary reservoirs, and permit of a graduated release—something heretofore impossible with an automatic system and characteristic of straight air and vacuum brakes only.

Not only is a higher pressure obtained in emergency than heretofore possible with a given pressure carried, but this pressure is held from the beginning to the end of the stop, the conditions making this desirable and possible being hereinafter mentioned.

It should not be inferred, however, that this high pressure is obtained during service applications, for this cannot occur for two reasons; 1st, the "emergency" or supplementary reservoir does not come into use during service applications; and 2nd, the maximum cylinder pressure which might be obtained from a high pressure reservoir carried in the ordinary service application auxiliary reservoir is prevented by means of a reducing valve which operates only in service applications, keeping the pressure down to what is predetermined, safe and necessary, but is automatically cut out when the emergency application is made, and we may say that we believe the successful use of the high speed brake requires an ample protection against excessive cylinder pressure for service applications, for it certainly would not be good engineering to take the thousand and one chances of individual wheel sliding, etc., in service, to the same extent as emergency applications. We do not want to be understood as being comitted to 60 lbs. as a maximum cylinder pressure permissible for service applications, but as giving illustration to what is self-evident; namely, that when once this pressure has been determined upon, the means used should be adequate to so limit it. In this connection we cannot too emphatically state that one of the most valuable features in connection with the new brake for passenger service is that the same stopping power can be obtained from 70 lbs. pressure carried instead of 110 lbs.; therefore, a brake equal to that at present in use and employing 110 lbs. brake pipe pressure can be had by the use of 70 lbs. pressure, thus leaving open the choice of taking advantage of the lower pressure and stopping in about the same distance as at present, or employ the same pressure as at present, and materially shortening the stop. In any case it will be seen that we have a brake of very wide range and extended adaptability.

There naturally arises, independent of the service operation of the brake, a question as to the implied departure from the principle of reducing the braking power as the speed reduces after an emergency application, but an understanding of the factors involved and the changes in the equipment and conditions that have occurred since this principle was first enunciated will show that this is not the case, but that the principle itself is as much a requirement as it ever was; as a matter of fact, it commonly exists to a marked degree in that the brake shoe itself now acts as a high speed reducing valve since, due to the much greater amount of work it has to perform because of increased weights and speeds, the coefficient of friction is neither so high nor is it increased to the same degree as before as the speed reduces.

Moreover, because of the greater rigidity of cars and foundation brake gear, greater resistances and losses, longer wheel base (which lessens the shifting of weight from one truck to another during a stop), greater uniformity of brake shoe metal employed and of braking power on all cars, the nominal braking power employed can be much greater than ever before; in fact, it is absolutely necessary if trains are to be stopped in the same distance now as when the conditions of forty years ago prevailed. A natural inference from these statements would be that, notwithstanding the improvements already referred to, stopping power has not been increased in proportion to the requirements. This is a fact; for, as has already been pointed out, with all the improvements mentioned, the trains of today cannot be stopped in any shorter distance than was possible at the time of the Westinghouse-Galton tests in 1878.

Thus we see that the principal laid down by Mr. Westinghouse at that time is not violated in the least, but on the contrary, its truth is being made more apparent from year to year, the difference being that instead of 360 per cent. braking power being required before it becomes necessary to reduce the pressure during a stop from 60 miles per hour speed, as the report of the above tests shows, it is more likely that 500 per cent. nominal braking power will be required before the reducing principle needs to be considered at such speeds, and correspondingly higher for greater speeds.

Nor should it be overlooked, in this connection, that it was necessary to pass through a stage of development and experience along these lines before such conclusions could be reached; it may therefore be seen that in this as well as in other developments mentioned before, experience and conditions have joined hands in bringing about the recent changes in air brake practice for passenger cars. We have in mind a number of tests made during the past few years in which the nominal braking power was 150 per cent. and this constantly maintained until the end of the stop for all speeds, without flattening wheels; in fact, the only result was to shorten the stop as compared with those of lower braking power.

That this question of high braking power may not be misconstrued, it may be well to state that the nominal braking power and the retarded force actually realized on the wheel are two different things, and we would earnestly recommend that all interested, if they have not already done so, read a paper entitled "What Stops a Moving Train?" which was presented before the Western Railway Club and published in their proceedings of May 15th, 1906, which throws considerable light on the subject.

To illustrate what is meant by this difference in nominal and actual braking power, it is sufficient to state that with a rail adhesion of 25 per cent (which is low) and a coefficient of friction of 7 per cent (which is high for present maximum speeds, materials and weights), a nominal 150 per cent braking power will give a retarding force of only 10½ per cent of the weight of the vehicle—still far short of being equal to the adhesion of the wheel and the rail, which is the force compelling its rotation. This naturally leads to a consideration of

Braking Power and Wheel Sliding.

The amount of braking power which can be applied to a car wheel, without causing it to slide, depends upon two things: 1st, the total amount of frictional force developed between the wheel and the rail; and 2nd, the total amount of frictional force developed between the brake shoe and the wheel; such forces as journal friction, friction between wheel flanges and rail, etc., which have more or less effect under certain conditions being disregarded.

As has been frequently pointed out, the maximum retarding effect is obtained when the brake shoe friction is as high as possible and yet not greater than the rail friction or "adhesion" and the greater the "adhesion" the greater the possible retardation. The effectiveness of a brake of high efficiency, utilizing to the greatest practicable extent the possibilities of a high "adhesion" coefficient, is illustrated in the case of the automobile brake. When the former does exceed the latter and thus causes the wheel to slide, a decided loss is retarding effort results.

As the *percentage of braking power* in terms of the light weight of the car and the *retarding force* are no longer convertible terms, the latter cannot be measured by such percentage, but is determined by the proportion of brake shoe pressure actually converted into frictional force between the shoe and the wheel, which varies inversely with the speed, pressure and time.

In each of the two prime factors, viz., rail friction or "adhesion" and brake shoe friction, mentioned above, there are two secondary factors concerned. The frictional force between the wheel and the rail, which is the force acting to keep the wheel rotating, depends upon the weight carried by the wheel and the coefficient of friction between the wheel and rail. The frictional force between the brake shoe and the wheel depends upon the pressure exerted upon the brake shoe, and on the coefficient of friction between the shoe and the wheel. In the problem of properly adjusting the braking power so that a maximum retarding effect may be obtained without sliding the wheels, there are, therefore, four variable factors to be considered, viz., weight on wheel, coefficient of rail friction, brake shoe pressure and coefficient of brake shoe friction.

That this problem is really a most complicated one will be realized on further consideration of each of these variable factors.

1st.—*The weight carried by any one wheel* can easily be determined for any given car, when it is not moving. But when in motion and the brakes are applied, new forces are introduced which so affect the distribution of pressure on the wheels that it becomes impossible to determine the exact weight carried by each wheel at different periods of the stop. The tendency of the car body to pitch forward and the tilting of each truck results in a heavier pressure being exerted on the forward truck and on the forward axle of each truck. The amount of these pressures depends not only on the rate of reduction in speed, but also to a large extent on the action of the cars ahead and behind the one considered.

2nd.—*The coefficient of friction between the wheel and the rail* is also a more or less uncertain quantity. While practically independent of the speed, it varies with the condition of the rail surface, and may have widely different values at different points on a given line of track, or under changing conditions of weather. This coefficient is also doubtless affected by the pressure, its value decreasing slightly as the pressure increased, but the exact relation is not yet thoroughly understood.

The frictional force exerted by the brake shoe depends upon the pressure exerted upon the brake shoe and the coefficient of friction betwen the brake shoe and wheel.

3rd.—*The brake shoe pressure* is the resultant of the pressures exerted by the brake beams and hanger links. As the wheels and shoes are constantly wearing, the inclination of the hanger link, when the brake is applied, is constantly changing. This exerts a variable influence on the pressure transmitted from the foundation brake gear through the brake beam to the shoe, so that in actual service the determination of the exact amount of pressure acting on the brake shoe is by no means a simple problem.

4th.—*The coefficient of friction at the brake shoe* is a variable quantity of the most complex character, depending upon the quality of the two metals in contact, the relative speed of the two surfaces in contact, the time during which the shoe remains applied, and to a certain extent on the pressure.

A determination of the proper amount of braking power to be used, which will give a reasonable margin of safety from wheel sliding, involves, therefore, a consideration of these four variable factors, viz.. weight on wheel, coefficient of rail friction, coefficient of brake shoe friction and the pressure on the brake shoe. Of these, the last is the only factor of the four over which we have any control, and that only partially; and it is this factor which must be properly decided upon in advance so as to give the maximum braking effect, consistent with safety from wheel sliding under the extremes determined by the other three factors involved, and this is rendered the more difficult by the fact that these coefficients of friction between the wheel and rail and between the wheel and the shoe are not only different, but each is constantly changing during a given stop. Therefore.

the statement that a car has so much "per cent braking power" is only a convenient way of specifying the amount of pressure applied to the shoes from the foundation brake gear. It does not convey any information regarding the existing margin of safety against wheel sliding, and very little as to the retarding force available to overcome the momentum of the car or train of cars. The best that can be done is to thoroughly analyze the factors as outlined above and be governed by the general lay in the case, expecting that extreme deviations will at times produce undesirable results, which, however, is by far the less of the two evils confronting us, viz., failure to properly control the train, particularly at times when danger is imminent; or, to properly control the train at all times, but with, perhaps, occasional wheel sliding.

A factor not mentioned up to this point is the rotative energy of the car wheel due to its inertia. Evidently, this would tend to keep the car wheel rotating, even if the brake shoe friction was equal to or slightly exceeded, even, the rail friction. This introduces another factor, varying with the square of the speed, requiring consideration at all speeds, but of considerable importance at high speeds. By neglecting to consider it, however, the error will always be on the safe side, as regards wheel sliding, as its effect is to keep the wheel rotating when otherwise it would stop.

In what has been said with reference to wheel sliding, and the conditions under which it is to be expected, no mention has been made of influences affecting the problem outside of the car itself. In other words, the statements made and conclusions reached up to this point have been concerning a single car, running alone. When coupled to other cars in a train, the circumstances are entirely different, for each car is then affected by the other cars to a greater or less extent and it frequently happens that the influence of one car upon another in the same train is much greater than all the other forces existing on that car. For example, the statement is often made that the most prolific cause of wheel sliding is unequal braking power in a train. What is meant by unequal braking power on two cars? Plainly, it must mean that the retarding force, the force which brings the cars to a standstill, is not the same on the two cars. A strain is, therefore, set up at once by the higher braked car tending to stop it much quicker than the lower braked car, and if this strain becomes sufficiently great, the adhesion of the wheels on the higher braked car to the rails is overcome by the pull or push of the lower braked car and they are skidded. It is important to notice just here that the fault was not with the car on which the wheels were skidded, but with the lower brake car on which the brakes were not doing as much in proportion to their load as were those of the higher braked car. The last statement then raises the question, "What is necessary to overcome this tendency of one car to run ahead of the other and force the latter 'off its feet'?" There must be the same retardation, or rate at which the speed is being decreased on each car. This can only be brought about when the proportion of retarding force to the momentum of the car is the same for each car. In other words, within reasonable limits, the braking percentage of the weight of the cars should be the same, the cylinder pressure obtained and retained should be the same, the composition of the brake shoes should be the same, and the nearer each wheel comes to carrying the same weight, the more uniform will be the retardation. These are not all the factors, but are illustrative of what is involved, and it is because they are more nearly uniform today than ever before, and because many variable factors are reduced to a minimum in the more recently developed brake for passenger cars that it is possible to utilize much higher nominal and actual braking power than ever before.

Another thought that may assist in distinguishing between nominal and actual braking power or retarding force is that if we brake a car at 100 per cent of its weight, it does not stop dead the instant the brake is applied for the reason that the actual resistance against which this braking power is acting is not the weight of the car, but the kinetic energy of the wheels may slide for a short distance, but as the stop the square of the speed at which it is moving. Therefore, as already stated, 100 per cent braking power is only a convenient way of stating the number of pounds braking force acting on the shoes. It does not mean that the momentum of the car is opposed by an equal resistance in the opposite direction, nor does it even mean that 100 per cent of the weight of the car is being exerted as retarding force, for, as has been pointed out, the actual retarding force, is entirely different from the brake shoe pressure.

Probably the thought uppermost in the minds of most of you now is: "What would be the effect of such a high nominal braking power as is proposed at low speeds and as the speed decreases during a stop from high speed?" At low speeds the stop will be completed before the maximum braking power can be obtained. At medium speeds some of the wheels may slide for a short distance, but as the stop will be much shorter than with a lower braking power, flat wheels will not result. As the speed is reduced during a high speed stop, the natural increase in coefficient of friction due to the decrease in speed is largely offset by the "time and work element" effect on the metals in contact, so that in many cases the coefficient of friction is less at the end of such a stop than at the beginning, owing to the heating of the metals.

Aside from all other considerations, it will be seen that the retarding force would have to be equal to over 16 per cent of the nominal braking power of 150 per cent before the wheel adhesion to the rail could be overcome and it is doubtful if any such coefficient of friction is obtained under modern conditions. But you say: "We slide wheels with much less braking power." This, as a general proposition, we do not grant, for it is apparent that a greater retarding force must be obtained than the adhesion of the wheel to the rail to cause wheel sliding and this cannot be obtained from, say, 100 per cent braking power and the average rail conditions.

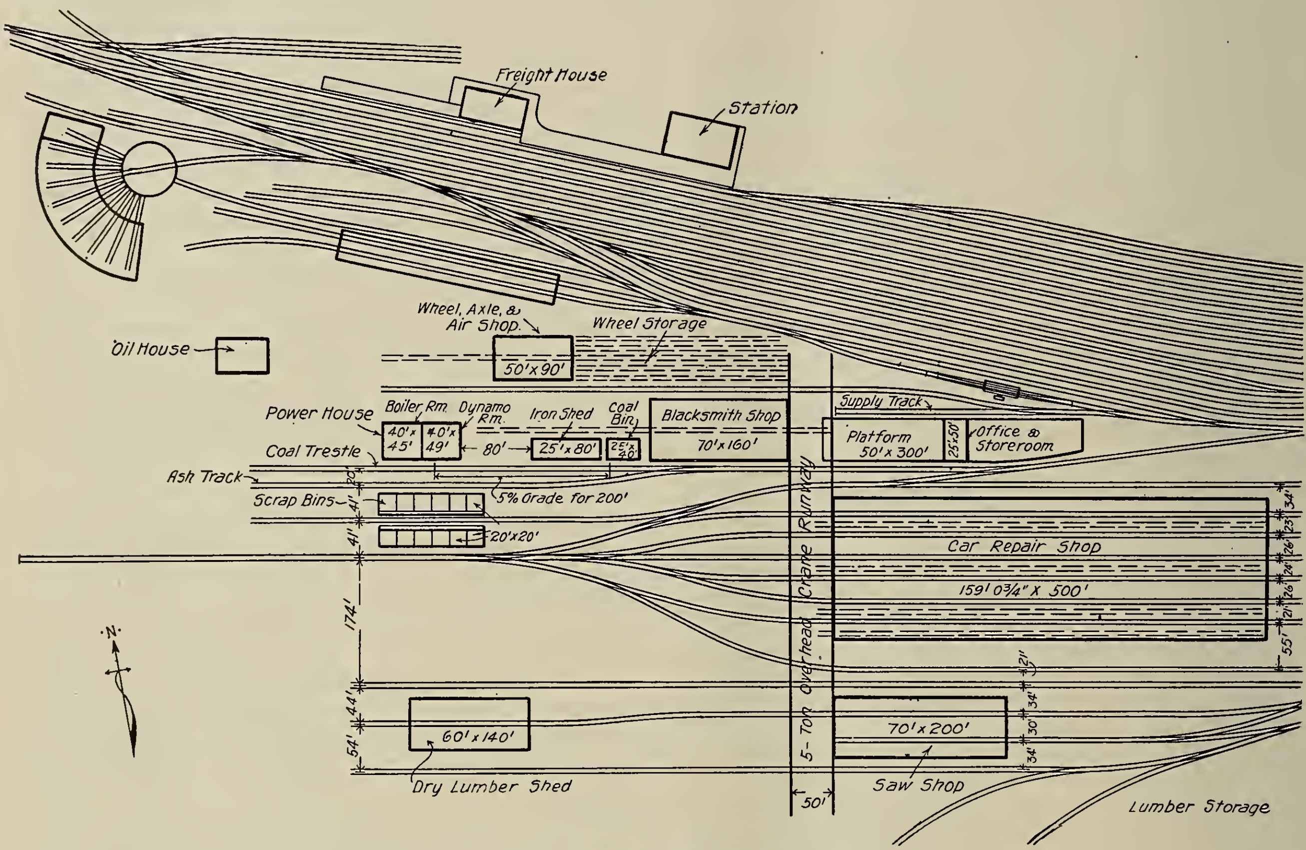
What causes wheel sliding is, primarily, unequal braking power which permits of the highest braked vehicles being "jerked or pushed off their feet" by the lower braked vehicles. In addition to this, there is the shifting of weight during a stop, the tendency of the wheels to run up on the shoes, brake hangers having a toggle joint effect and use of flanged brake shoes (which sometimes exert a tremendous leverage), improper piston travel, the effect of which few appreciate and the mistaken practice often followed of handling the brake valve in such a way that the maximum braking power is developed at the end instead of at the beginning of a stop. Of course, an important factor to be added to the above is the condition of the rail being otherwise than average, which consideration is, and should be, disregarded in a brake design, as there is no possible way to provide for it in advance.

Thus, you see, while granting that there is wheel sliding under present conditions, we attribute it to causes other than where the braking power is nominally high but more wheel sliding will be experienced with a low nominal braking power which will vary in service between wide extremes than where the braknig power is nominally high but more uniform. In fact, the proof of what has just been said is continually before you and needs only to be pointed out to be recognized; namely, that most wheel sliding takes place with the low braking powers of service applications and not with the high braking powers of emergency applications.

Moreover, with the more recent developments in passenger car brakes, most of the preceding causes of wheel sliding are reduced in a marked degree through the obtaining of the increased flexibility of service operation by return to the proper proportion of auxiliary reservoir to brake cylinder volumes, the quick service feature of the triple valve and quick recharge of the auxiliary reservoirs with the consequent prompt response of the brakes for reapplications and graduated releases and much more efficient retardation caused by proper cylinder pressure for service applications. However, in the last analysis, it must also be remembered that there should be no compromise between incidental, individual wheel sliding and safety.

Certain railways of Georgia have instituted proceedings to test the constitutionality of the state law requiring engines on main lines to be equipped with electric headlights. The court has referred the matter to a special master who will give a hearing May 24.

During the month of March, 909, the total number of dirt cars repaired by the mechanical division of the Panama Canal forces, including light and field repairs, at all points except Gorgona shops, was 11,190. The average number of cars remaining on hand in bad order each evening, exclusive of Gorgona, was 34. At Gorgona shops 372 cars were repaired, an average of between 12 and 13 per day. The low number of cars repaired at Gorgona is accounted for by the fact that at this point most of the work is on very heavy jobs, such as rebuilding and the renewal of broken rails. Over 3,000 cars were in construction service during March. The average number remaining on hand at all points in bad order each evening, including Gorgona, was only 130, which is a trifle over 4 per cent of the cars in service.



Layout of Car Shops, Hocking Valley Ry.

Painters state that few paints seen to adhere to galvanized iron, but flake off in a short time. A prominent chemist has said that red lead gives the best satisfaction of any paint as a first coat for this class of work. It has also been found that a wax solution added to the unmixed red lead paint prevents scaling and cracking, as it tends to prevent cracking resulting from contraction and expansion of the metal. The remedy suggested is to melt a cup of bees' wax, and when fluid pour it into a gallon of raw linseed oil heated to 200° F. One quart of the solution to every 100 lb. of mixed red lead paint.

While at work in the Pacific entrance to the Panama Canal recently at the crossing of the Rio Grande, about a mile above La Boca, one of the ladder dredges of the Pacific Division struck an obstacle which it could not handle, and was obliged to cease work. A diver was sent down, and it was discovered that a chain of dredge buckets which had dropped from one of the dredges in the French days had been struck. The buckets will be moved from the prism after which the dredge will resume its work at the crossing.

In an experiment made on nickel steel containing 45 per cent of carbon and a large number of blowholes, a French investigator has found that the gases contained in the blowholes consisted of carbon dioxide, carbon monoxide, hydrogen, and nitrogen. A volume of gas ten times that of nickel steel was obtained. The proportion of nitrogen gas was small, and while the carbon dioxide came off from the steel when heated (in vacuum) to about 520° C., the nitrogen required a higher temperature.

Hocking Valley Ry. Car Shops at Logan, Ohio*

By W. F. Cremean, General Foreman Car Department, Hocking Valley Ry.

As the Hocking Valley Ry. is one of a few of the American railroads to have a car shop independent of the locomotive department, of entirely modern construction and equipment, it would be of interest no doubt to the railroad public at large to have a description of the different buildings and machinery. The general lay out is shown in the accompanying drawing.

One of the most important points in the construction of the shops is the traveling train runway extending 100 ft. beyond the saw shop and 50 ft. beyond the blacksmith shop, thus giving service to all the important buildings as well as to the light repair tract, wheel storage and lumber yard.

The saw shop is built of hard paving brick on concrete foundation, the roof having eighteen large skylights with wire inserted glass, all supported by steel trusses. There is also a monitor running the entire length of the building to give light and ventilation. The machinery consists of a swing cut-off saw, tenoner, two combination gainer and three spindle borers, cross cut saw, two rip saws, hollow chisel mortiser, timber sizer, plainer and matcher, three spindle borer and band saws, together with the necessary grinding machines. All the machinery is electrically driven and so arranged that there is no backward movement of the timber from the time it enters in the rough until it goes out finished under the crane, to be delivered by the latter to the erecting shop, or to the dry shed for stock.

The erecting shop, 160x500 ft., is entirely of steel construction, with sides of corrugated steel, the roof being of tar paper and gravel. This building is equipped with rolling doors on the sides, and panels are alternated with large windows, working on pivots. The ends are made up of six large rolling doors, which, when opened, in connection with side doors, windows and monitor lights, makes more ventilation for the benefit of the workmen inside than is usually provided for. The heating system is hot air, furnished by two fans, connected up to two 50 h. p. motors. The capacity of the shop is 66 cars, accomodated by six tracks, four lorry tracks for the delivery of material alternate with the repair tracks, and with the traveling cranes inside of building, makes the handling of cars and all heavy material easy, compared with the old methods.

Running parallel with this building and extending to the outside crane runway, is located the material platform, and midway on this platform is located the storeroof and office building. This building is of salt glazed brick with slate roof.

West of the storage platform and abutting the outside crane runway is the blacksmith shop. This building, 160x70 ft., is similar in design and construction to the saw shop and contains a double end punch and shears, bar shears, two forging machines, bull dozer, steam hammer, Bradley hammer, eye bender, two drill presses and three triple head bolt cutters. There are four oil furnaces and eight forges, arranged in pairs. One feature of the arrangement of the machines is that from the shearing of the iron until the work goes out finished, there is no backward movement of same. All the tools are electrically driven. The artificial lighting is obtained from five arc lamps, and each machine has one or more incandescents.

The wheel and axle shop, 50x90 ft., is located northwest of blacksmith shop, and is similar in construction, being well lighted by windows and skylights. The air brake hose and pipe work is also done in this building. Tracks for the storage of mounted wheels extend to the crane runway.

The power house, 40x94 ft., is located north of blacksmith shop, and is built of glazed brick, contains two direct driven 200 kw. alternating current generators. There is also an air compressor of 1,200 cu. ft. capacity per minute. The boiler room contains three 200 h. p. water tube boilers, equipped with underfed stokers. Also the necessary pumps. The stack is 6x114 ft., and is the product of the Hocking Valley Ry. boiler shops at Columbus.

The oil house is located between the shops and round house, so as to be accessible to both, has three rooms with fire wall partitions. The storage tanks are in the basement and the oil is drawn by a system of self registering pumps. The paint and storage rooms are also in this building.

The grounds originally were very low, being gravel filled, of about 3 ft. average. Construction was started in March, 1907, and the shops were put in operation May 4, 1908. The present working force, independent of roundhouse, is 304 men, mostly on a piece work system.

*Mr. Cremean's portrait appears on page 198.

Increasing the Life of Locomotive Crank Axles

The extensive adoption of four-cylinder, four-crank locomotives in France has resulted in showing the necessity of some improvements in the crank axles. Their cost is very high, and cracks in the webs or cheeks begin to appear after a relatively short length of service. Under these conditions, the railway engineers have been compelled to investigate

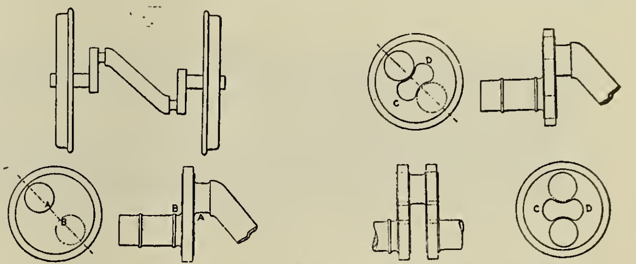


Fig. 1 and Fig. 2—Increasing Life of Crank Axles.

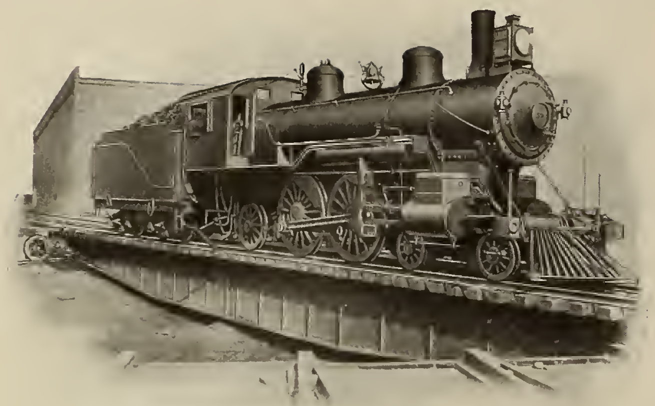
the best design of crank axle in order to increase its life and to reduce the maintenance expenses of the locomotives. On the Western Railway of France the following observations have been made on crank axles of the oblique type (as shown in Fig. 1) used on fast passenger engines.

(1) Of 13 ordinary axles of annealed open-hearth steel on locomotives of the 4 : 4 : 0 class, 10 were found to have cracks after runs of from 105,000 to 158,100 miles; (2) of 26 hollow axles from similar locomotives, three were found to have cracks after making runs of from 291,400 to 339,760 miles; (3) other things being equal, the crank axles of engines of the 4 : 4 : 2 class gave less service than those on engines of the 4 : 4 : 0 class, and on the former engines axles of annealed open-hearth steel have developed cracks after runs of from 45,800 to 124,000 miles.

The axles crack always in the filleted angles A or B, Fig. 1, under the influences of the violent shocks in service, the dynamic effects of the shocks being concentrated at these points, where they cannot be absorbed by the elasticity of the metal. Permanent deformation is set up, and in time a crack appears; its development is often facilitated by defects in the metal resulting from the segregation of metal in the ingot.

In order to avoid the formation of these cracks, Mr. Frémont, chief of works at the School of Mines, has devised

*From a paper by E. Hallard, Asst Mechanical Engineer, Southern Ry. of France.



Weir & Craig Turntable Tractor at Work.

the plan of cutting away the crank web in the part between the journal and the crankpin, as shown in Fig. 2. With this arrangement, the dynamic effects are not concentrated at a point, but are distributed around C and D, over the largest possible amount of metal, and the elasticity of which can absorb them. This method also removes the defective metal that may occur in the axis of the ingot. Fig. 2 shows the arrangement for double-web cranks on straight axles, as well as for single-web cranks on bent or oblique axles.

Five axles of the oblique type, which showed cracks after runs of 106,480 to 213,195 miles (on engines of the 4 : 4 : 0 class) had the webs slotted out in the Frémont plan so as to remove all traces of the cracks. Since then (and up to October, 1908) they had run for from 29,080 to 92,253 miles, and had shown no signs of cracks.

Four new crank axles with slotted webs were put in service on engines of the 4 : 4 : 2 class (with which cracks are omst likely to occur), and have run from 81,230 to 110,193 miles without showing any cracks. Axles made of the same metal, but with solid webs, were applied at the same time to similar engines in the same service; these showed cracks after running less than 62,000 miles.

Fatigue in Copper Pipes

In a paper recently read before the Northeast Coast Institution of Engineers and Ship-builders, Mr. James M. Allan drew attention to the enormous degree to which the strength and ductility of copper can be affected by good or bad methods of annealing. Most of the tests were made by determining the number of bends, backward and forward, which strips of copper heated in different ways, would stand before fracture. A strip tested thus, as received from the makers, stood 44 bends. Corresponding strips raised to a dull-red heat, and allowed to cool slowly in air, withstood 41 bends before fracture, while other specimens similarly heated and quenched in water required over 46 bends to break them. Raising the temperature to a bright instead of a dull red, and quenching in water, increased the resistance to 73½ bends, while similar specimens cooled slowly broke at 49 bends. Prolonged heating at a bright-red heat was found injurious, the resistance being lowered to 46 bends. The now well-known danger of heating copper in a reducing flame was very markedly shown in some further experiments. The number of bends before fracture was reduced in one case to fifteen only, and an examination of the surface to the metal proved it to be brittle and porous. The advantage of annealing in restoring ductility to copper hardened by mechanical strain was well shown by making comparative tensile tests on two sets of specimens. In each case the load was increased step by step by increments of ¼-ton at a time, the specimen being wholly relieved from stress between each successive addition of the load. In the one set of experiments the specimens were annealed between each successive application of new load, while this was not done with the other set. The specimens thus annealed extended uniformly throughout, the final extension being 105 to 123 per cent of the original length. With the unannealed specimens the final stretch ranged between but 46 and 53 per cent.—"Engineering" (London.)

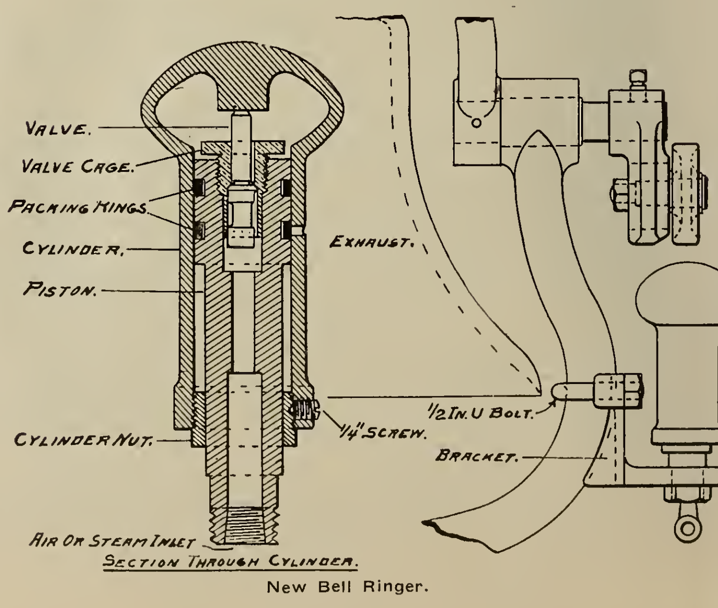
Turn Table Tractor, C. &. W. I. R. R.

The illustration shows a locomotive turntable installed on the Chicago & Western Indiana R. R. at 49th street, Chicago. The table is eighty-eight feet long, and is moving among others, Wabash engines of the 2000 class weighing one hundred and eighty-one tons and the Erie 2500 class, weighing two hundred and five tons. The Weir & Craig Manufacturing Co., Chicago, attached to this table one of their compressed air turntable tractors Feb. 7, 1907. From that time until May 1, 1909, it is stated that the records show the number of engines turned with this machine average seventy-three per day of twenty-four hours during this period, or a total of 59,422.

The total expense exclusive of power during this period for wages of operator, lubrication and repairs amounts to $3,157.40, or an average cost of slightly over five cents per engine. This cost is only a portion of the average saving gained by the installation of the machine and superseded at least four men night and day, the time consumed being more than double that required by the tractor, which moves the table while loaded in a complete circle in forty-eight seconds. This company also installs electric tractors which perform the same class of work.

New Locomotive Bell Ringer

A pressure bell ringer, which is said to be dust and cinder proof, has recently been put on the market by the Manufacturers' Western Distributing Agency, of St. Louis, Mo. The device is a simple one which may be clamped to the bracket of any bell, and the stroke of the bell adjusted by a couple of set-nuts. The motive power can be either steam or air, as desired, air being generally considered the best adapted to the purpose. This device is so designed as to be self starting, something of an advantage in bell ringers.



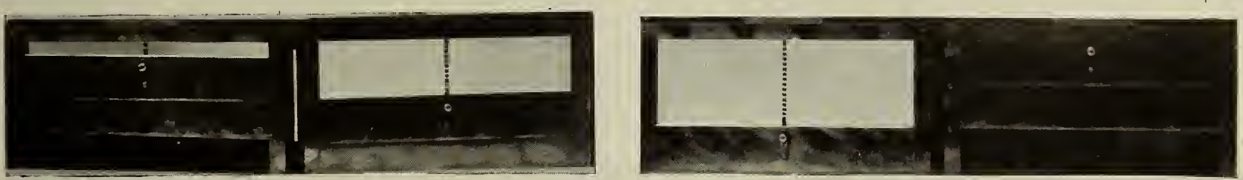
New Bell Ringer.

A New Car Window Screen

The American Car Screen Co., with head offices at Pittsburg, Pa., is now introducing an improvement in window screens for sleeping, parlor, buffet, and dining cars, which the photograph plainly shows. This improvement for the ventilation and regulation of air in cars is the invention of W. A. Scott, Jr., who is president and general manager of the company.

This screen has been pronounced to be not only a decided improvement over the screen heretofore in use, but really a necessity for the comfort and welfare of the traveling public. It is simple in construction, and can be adjusted with the tip of the finger, it is sanitary and is a preventive from colds so often contracted in cars, owing to weather changes. The screen heretofore in use was only a plain open screen, hinged in the center in order to allow of its being placed under the car window, which is done by the car porter. Should the weather change or rain or snow prevail, the screen would have to be removed and the window closed, which would be a great source of annoyance to the passenger. The "Scott" screen is made the same size and upon the same lines but it contains an adjustable shutter on the interior side, and is so arranged that the passenger can raise or lower the shutter—lower the shutter for air and ventilation and raise it to close out the air, dust, cinders, rain or snow, and the screen need not be removed from its position or the window closed, for when the shutter is completely closed it is air tight and dust proof.

The screen will be on exhibition at the conventions to be held on Young's Million Dollar Pier, at Atlantic City, N. J.



New Screen in Four Positions.

Annealing Temperatures and Graphite Formation in Tool Steel

The proper temperature at which to anneal tool steel is a problem whose solution has been attempted many times, and to which many answers have been made. Another question that has given a good deal of trouble is the condition or conditions that determine the separation of graphite carbon in cold rolled steel, or high carbon steel rolled to thin sections. This graphite gives the steel a black fracture, and it is known as black steel. Very often it is found in file steel of small section, giving black file steel. In a recent book, "Rapid Methods for the Chemical Analysis of Special Steels," etc., C. M. Johnson of the Crucible Steel Company of America, gives the results of his experience on these two subjects.

For plain carbon steels between 0.50 and 1.40 carbon he finds the best annealing temperature to be between 700° and 720° C. (1292° and 1348° F.). Steel that has been reheated and rolled or hammered need not be heated above this temperature, but steel in the cast should first be brought to 850° C. (1562° F.), held there for an hour, and then lowered as quickly as possible to 700° to 720° C. It should be held at this temperature from 10 to 12 hours, and can then be withdrawn and cooled rapidly or slowly.

Most chrome tungsten and chrome molybdenum steels—in other words, most of the high-speed tool steels—are also well annealed within the same limits. High manganese and nickel lower the temperature. Hadfield's manganese steel, containing about 12 per cent of manganese, after annealing for 24 hours at from 520° to 550° C., could be drilled with a high-speed tool, and readily machined on a planer. The steel proved to be remarkably brittle.

The formation of the black temper carbon in cold rolled steel he believes to be due entirely to the annealing to which such steel is subjected, the annealing being conducted within such a range of temperature that the combined carbon breaks down. Three different lots of cold rolled steel were subjected to prolonged annealing, and by means of analysis the formation of the graphite carbon noted.

A black fracture was produced by prolonged annealing between 600° and 700° C. (1112° to 1292° F.). With a carbon from 1.20 and upward it formed most readily, steels with 1 per cent and under being practically free from it. The temperature most favorable to its formation lies between 660° and 700° C. (1220° to 1292° F.). The reason that black fracture is associated with cold rolling is that steel is worked and repeatedly reheated within the dangerous range of temperature given above. Every precaution should be taken to make the periods of annealing and reheating as short as possible, and when reheatings occur during cold rolling to do this reheating at its lowest practicable temperature.

As a test for annealed steel, the author makes use of the ordinary color carbon determination. After dissolving the drillings in 1:20 nitric acid, the solution is examined by daylight. If the steel is unannealed, the carbon precipitate is flaky and floats in the solution. If the steel is perfectly annealed and has reached the highest degree of softness, the precipitate is in an extremely fine state of division, does not separate in flakes at all, but tends to run up the sides of the tube in a thin film.—Mechanical World.

Montreal and Quebec

A veritable edition de luxe among railroad pamphlets has been issued by the Grand Trunk System to proclaim amongst tourists the glories of the cities of Montreal and Quebec. The brochure is beautifully printed and generally arranged in the artictic style of earlier days, when the ornamentation of a volume was regarded as an important incident to its presentation of reading matter. It is also very well written, and gives an interesting description of the two most interesting cities in Canada, with many illustrations from photographs. Sent free to any address. Apply to G. W. Vaux, 917 Merchants Loan & Trust Bldg., Chicago, Ill.

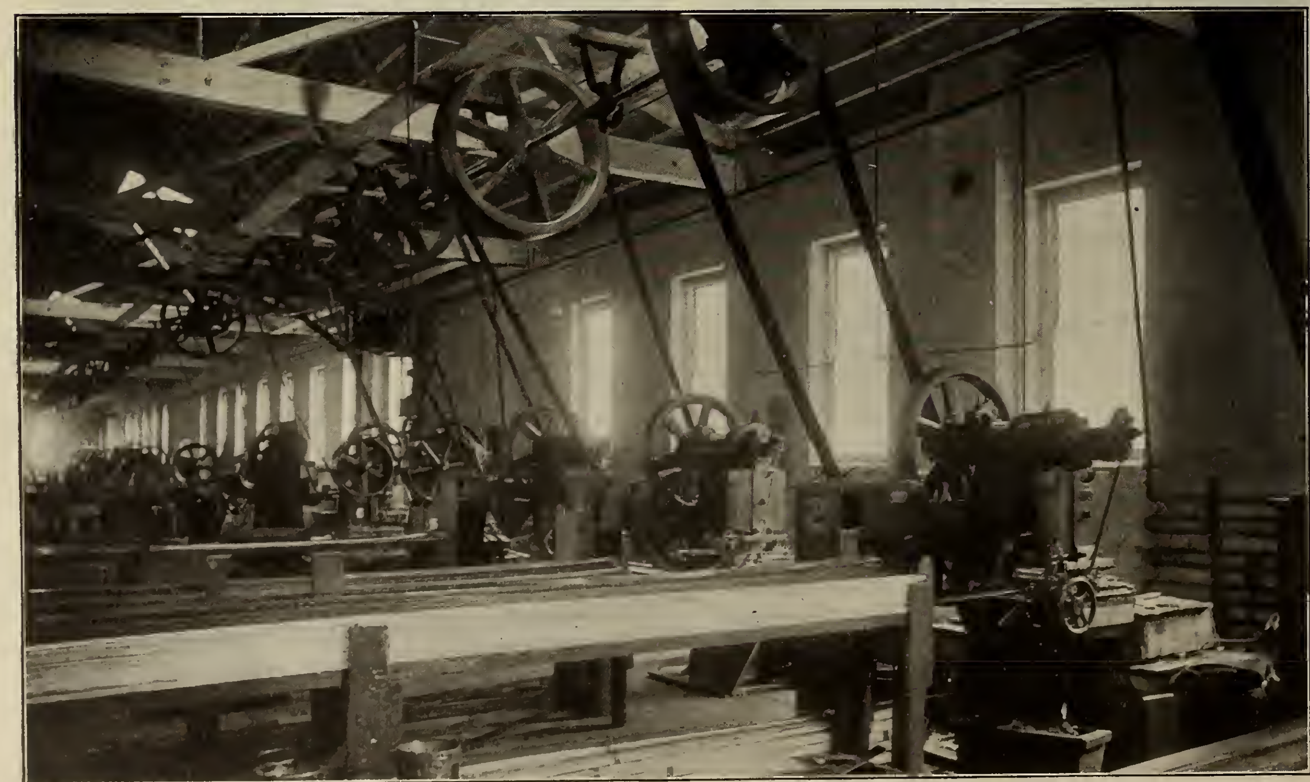
The production of pig iron in Canada for the year 1909 was 556,044 tons, or only 4.3 per cent less than in the preceding twelve months. The returns of the eight principal companies showed an output of finished steel rails, bars, spikes, rods, etc., of 538,842 tons, of which 291,039 were produced in the second half year, which therefore exceeded the total for the first half by 43,236 tons. The output of steel ingots for the year was 21 per cent less than for 1907, which compares with a shrinkage of over 50 per cent in the United States.

Plant of American Nut & Bolt Fastener Co.

Manufacture of Nut and Bolt Fasteners

The American Nut and Bolt Fastener Co., of Pittsburg, commenced the manufacture of nut and bolt fasteners in July, 1902, in a factory 24 ft.x40 ft., at which time the company made fasteners by hand; the machinery not being ready then. Fasteners had to be made to fill orders and about four hundred per day were made by twelve men. Now this company has a factory equipped with improved automatic machinery with a capacity of 200,000 fasteners per day. This company manufactures over 700 different kinds, shapes and sizes of Bartley Positive Fasteners, to make which, all that is required, is the size of bolt, and a pencil sketch showing surrounding dimensions.

These fasteners are constructed so that when applied the locking arm is bent into its locking position in an easy curve, and when it is to be removed for any cause it can be straightened out and reapplied many times, making the fastener a very cheap appliance for use or any device where a fastener is needed. The Bartley fastener can be removed with a hammer by driving the locking arm down just far



Nut and Bolt Fastener Machinery.

enough to let the nut pass when the latter can be removed and replaced, using the same fastener again.

The accompanying photographic reproductions show the plant and a part of the equipment. It is stated that there are now in use about 60,000,000 of these fasteners. Low carbon open-hearth steel is the raw material, and it is manufactured according to the company's own specifications.

Wireless Transmission of Power

A large number of persons at the Electrical Show in the Auditorium Building, Omaha, upon Wednesday evening, May 12th, 1909, witnessed one of the most remarkable demonstrations of "wireless" energy heretofore made in any country, in fact, a feat not accomplished before in the world's history, so far as is known, when Dr. Frederick H. Milloner, experimental electrician, Union Pacific R. R., Omaha, turned on the lights in the building, the impulse being sent from the Fort Omaha wireless tower, six miles distant. This demonstration was made possible through the courtesy of Colonel Glassford, Signal Corps, U. S. A. The wireless impulse operated on a specially constructed coherer (which is very delicate and will receive the faintest impulse) similar in construction to that used a year ago on the eletrically controlled (by "wireless") truck in the shop yards of the Union Pacific, at Omaha. By means of a large solonoid switch, which is closed when the impulse passes through the cohorer, seventy-five horse power were turned on and the Auditorium lighted. By means of a similar mechanism the power was turned off and the operation repeated several times—in other words, the local circuits in the Auditorium were closed by wireless impulse from Fort Omaha. The public is beginning to realize the immensity and the importance of the work being done by the Union Pacific Railroad, in its efforts to safeguard the lives of its passengers and the property of shippers, via its lines, and, by means of the experimental work being done by it, what an important factor it is in this country's progress.

New Literature

HOW TO USE SLIDE RULES; 70 pages, cloth; published by Kolesch & Co., New York. Price 50 cents.

This is a very complete manual on the use of the slide rule. To the second revised edition has been added a chapter each on the "Nestler Precision" Rule and the "Stadia" Slide Rule. The chapter on the "Triplex" Slide Rule has also been revised.

* * *

"Bulletin No. 29, Tests of Reinforced Concrete Beams: Resistance to Web Stresses," by Arthur N. Talbot, of the engineering experiment station of the University of Illinois, gives important new data on the resistance of reinforced concrete beams to web stresses or to so-called shear failures. Although a considerable fund of information has accumulated bearing on the part taken by the resistance of longitudinal reinforcement and the compressive resistance of concrete, the data on web resistance is less definite and less complete. The tests call attention again to the fact that diagonal tension failures should be carefully guarded against, since they may occur suddenly and without warning. The bulletin treats of the effect of strength of concrete, of the effectiveness of those elements which add stiffness to the beam, and of the advantages and effectiveness of different types of metallic web reinforcement. This monograph is one of the most important bulletins issued by the engineering experiment station.

* * *

A recent catalogue issued by the Safety Car Heating & Lighting Co., of New York, is a complete and comprehensive publication. It is arranged in loose-leaf form in a special post binder and the contents make clear the thorough manner in which the company is meeting the demands in the car lighting and heating fields. Among the devices which have been given special attention are the "Axle Dynamo Electric Lighting System" and the "Thermo-Jet System"

Interior, Nut & Bolt Fastener Co. Plant.

of heating which, because of their merit, have been receiving special recognition by the railroad managements. It is stated that these equipments have performed excellent service on the Kansas City Southern Ry., St. Louis Southwestern Ry., Pennsylvania R. R., Chicago, Rock Island & Pacific Ry., Grand Trunk Ry., and New York, Chicago & St. Louis R. R., and in the past few months orders have been booked for seventy equipments for the Chicago, Rock Island & Pacific Ry. The new "Thermo-Jet" system, which is a form of heating by direct steam, provides for an absolute regulation of the temperature of the radiating pipes both above and below 212 deg. and at all times just enough steam is used to heat the car comfortably. The operation of the valves is simpler even than in the direct steam heating systems, for the words "Mild" and "Cold" on the indicator quickly suggest to any trainman the direction in which the operating valve must be turned. In very cold weather the valves can be opened wide, admitting steam up to 25 pounds pressure and as soon as the car is warm, the pressure can be reduced to give any desired temperature of the radiator pipes; hence a most positive regulation of the car temperature.

* * *

The Duntley Manufacturing Co., Chicago, have published a neat descriptive catalogue of their Rockford gasoline motor car for railway inspection and section work. The catalogue is well illustrated with photographs of assembled cars and with detail drawings.

* * *

A profusely illustrated booklet entitled "Hunt Coal and Ore Handling Machinery" has been issued by the C. W. Hunt Co., of New York. The booklet is an engineer's edition and contains general information regarding Hunt machinery with many photographs of various installations.

* * *

The Gold Car Heating & Lighting Co., of New York, have issued leaflets descriptive of their new stop valve temperature regulator and their universal straight port steam hose coupler.

* * *

An improved locomotive tender and coal passer is described in a booklet published by the Ryan-Johnson Co., of Clinton, Iowa. The essential feature is a movable hopper for passing the coal forward.

* * *

The H. W. Johns-Manville Co., of New York, have issued a booklet setting forth the advantages of "J-M Permanite" sheet packing.

* * *

"A New Product" is a neat pamphlet describing the Detroit seamless hollow staybolt. It is published by the Detroit Seamless Steel Tubes Co., of Detroit.

* * *

Steel tired wheels representing the types generally used in steam and electric railway service are described in a recent catalogue of the Standard Steel Works Co., Philadelphia. The matter in the catalogue is clear and concise.

* * *

A pamphlet giving a few vital facts about the city of Corry, Pa., has been published by the Corry Business Men's Exchange.

* * *

The Gronkvist Drill Chuck Co., Jersey City, N. J., has issued a pamphlet giving a very complete description of the "Johansson" combination standard gages. The Johansson gages consist of parallel-lapped parts in which the two opposite sides of each part are absolutely parallel and the distance between them equal to the size marked upon the part.

* * *

A short simple description of an efficient and expense saving device is the foreword of a neatly printed pamphlet on the Clark blow-off system issued by the Horace L. Winslow Co., Chicago, successor to Julian L. Gale & Co. The application of the system is clearly shown in a two page drawing.

* * *

The Progress Reporter for May describes new driving wheel lathes and new car wheel lathes, giving many good photographs of the same. A new single screw tool clamp is also illustrated which has but one screw to tighten instead of four. The Progress Reporter is issued by the Niles-Bement-Pond Co., of New York.

* * *

The Atchison, Topeka and Santa Fe R. R. has issued four attractive folders entitled "A Colorado Summer," "The Great Lakes and East," "Reasons Why" and "Summer Outing in California." These pamphlets, as their names imply, are descriptive of Western scenery.

* * *

Catalogue "F" of the Buckeye Jack Manufacturing Co., of Louisville, Ohio, contains complete descriptions of their Buckeye jacks with illustrations and parts of same. An interesting illustration showing a test of their automobile jack is shown.

* * *

A catalogue descriptive of the "Maxon" patent lever and ratchet screw lifting jacks has recently been issued by the Dayton Iron Works, Dayton, Ohio., successors to the Boyer-Radford and Gordon Tank and Pump Co.

* * *

The 1909 catalogue of the Detroit Lubricator Co., of Detroit, Mich., contains descriptions and price lists of the many types of lubricators, oiling devices and valves manufactured by this company; also hints on the care of same. It is a very attractive looking booklet. A small folder has also been issued on the "Detroit" sight-feed air cylinder lubricator.

* * *

A brief account of some of the features of the St. Clair air brake is given in a booklet recently issued by the St. Clair Air Brake Co., of Indianapolis, Ind. The illustrations and reading matter are clear and to the point.

* * *

"Record Sixty Six" of the Baldwin Locomotive Works, of Philadelphia, Pa., takes up their "Smoke-box Superheater" and "Feed Water Heater." The pamphlet contains a reprint of an article by John W. Converse on the "Smoke-box Superheater," and also the reprint of an article by Lawford H. Fry, on "The Advantages of the Use of Moderately Superheated Steam in Locomotive Practice," General dimensions and illustrations of several types of locomotives add to the interest of the pamphlet.

* * *

The American Huhn Metallic Packing Co., of New York, has issued a booklet descriptive of the use of Huhn metallic packing for steam, water, ammonia, carbon dioxide and air. The booklet contains many references.

* * *

A neat little folder has been issued by the Westinghouse companies dealing with their new electric toaster stove. This is an entirely new product and is an article of interest to the owner of a modern American home.

"Among the Rockies," a guide to the principal attractions in the Rocky Mountains as seen from the train on the lines of the Denver & Rio Grande system, is an attractive little booklet now being distributed by the passenger department of that railroad.

* * *

"The Proper Care of Belts," is a new booklet of 24 pages, recently gotten up by the Joseph Dixon Crucible Co., Jersey City, N. J. It is divided into three sections, headed respectively: Belts; Belt Dressings; and Hints, Kinks, Tables. The first section deals with the running condition of belts; the second takes up treatment with various preparations; and the third, as the title indicates, has some general points upon belting and its use.

* * *

"The Monogram Bracket" is the title of a small leaflet issued by Guilford S. Wood, Great Northern Bldg., Chicago. It contains description and illustration of his bracket, which is a device for holding in place air brake train pipes.

* * *

The Milwaukee Locomotive Mfg. Co., of Milwaukee, Wis., has recently published a very interesting pamphlet describing and illustrating its line of gasoline driven locomotives. These engines are designed to take the place of steam switchers, manufacturing plants, mills, lumber yards and camps, mines, plantations, quarries, railroad, electric railway, tunnel and canal construction, and general freight and passenger transportation.

* * *

A flexible steam pipe joint of new design is described and illustrated under various conditions in a catalog recently published by the Moran Flexible Steam Joint Co., of Louisville, Ky. The joint is made in any size and has a great number of applications.

How to Obtain Government Timber and Agricultural Lands

The average individual thinks that the only way to get title to government lands is make a homestead entry and live on same five years before getting a title. He is of the opinion he is limited to 160 acres and he would not live on a tract of land five years if the Government would deed him over one-half of a state.

There is a way for any citizen of the United States to obtain title to any Government timber or agricultural land in any state in the Union without residence or cultivation.

The only way to do this is to buy United States Government land certificates and pay for your land with same.

Railroads and timbermen obtain title to Government land in this way.

The Government discontinued issuing these certificates about the year 1883, therefore they are getting very scarce. The firm of H. B. Sanders and Co., Judge Building, Salt Lake City, Utah, have secured a few thousand acres of them that they are offering at the rate of $25.00 per acre.

The certificates come in 80 and 120 acre pieces, and can be located on any timber or agricultural land in Alaska or any state in the Union. Each piece has a letter of approval attached to it from the Government, and there is no limit to the time in which to locate them.

According to the official report of the Department of the Interior, under date of July 1, 1908, there is still over 75 million acres of unappropriated land in Oregon, Washington, California and Idaho.

Some of the finest timber land in the world is open for entry in these states.

Any person wishing to get title to some timber land or anticipating starting a townsite in the west; can get full particulars by writing the above firm.

The Great North Country

Nimrod was a mighty hunter, but had he hunted in the "Temagami" region he would have been a mightier one. Nimrod hunted for glory, but Temagamians hunt for game. Those Indians who made the first canoe of birch bark long ago, were our greatest benefactors. The children of these Indians know the canoe, and they know how to use it, and if you go to Temagami this summer they will paddle your canoe in their own superb way. They will be the best guides you ever had. Students who camp in summer along the Temagami lakes are able to do two years' work in one. Finest of fishing and hunting. Good hotel accommodation. Easy of access by the Grand Trunk Railway System. Information and beautiful descriptive publication sent free on application to G. W. Vaux, 917 Merchants Loan & Trust Bldg., Chicago, Illinois.

Trade Notes

The Falls Hollow Staybolt Co., of Cuyahoga Falls, Ohio, announces that it recently received a large order for Falls Hollow Staybolt Iron from one of the largest railway systems in England. This railway company wishes to give Falls Hollow Staybolt Iron a preliminary test with a view of its adoption on their entire system.

The Homestead Valve Manufacturing Co., announces that it has secured the Woodward, Wright & Co., of New Orleans, La., to represent it in the South. They will carry a stock of Homestead Valves and will be pleased to answer all inquiries of either dealers or consumers and give prompt attention to all orders with which they are favored.

The Union Draft Gear Co., Chicago, announces that it has taken over the draft gear business of the Cardwell Manufacturing Co., in connection with which it proposes to manufacture and sell other improved types of friction and spring draft gear appliances. All orders and correspondence relative to the Cardwell Friction Draft Gear should be addressed to the Union Draft Gear Co.

The Cardwell Manufacturing Co. announces that it has transferred its draft gear business to the Union Draft Gear Co., J. R. Cardwell, president, effective April 1, 1909. All orders for Cardwell Friction Draft Gear, and all correspondence relative thereto should hereafter be addessed to the Union Draft Gear Co., Monadnock Block, Chicago, Ill.

The Rogers Journal Packing Co., of Chicago, has appointed Mr. Willis C. Squire, 307 Western Union Bldg., as its general sales agent for the well-known "Rogers Improved Journal Packing and Receptacles." All orders for Rogers packing should be sent to the general sales office at Western Union Bldg. The Rogers Journal Packing Co., is now manufacturing a much improved journal packing, using the original "Rogers Steel Wool" in combination with a high grade cotton waste mixed with sponge. The company is now prepared to fill orders in any amount for this packing.

The sales office of the Sligo Iron and Steel Co., formerly maintained in Pittsburg, were removed to the general offices at Connelsville, Pa., on April 1, 1909.

Mr. L. E. Burton is now in charge of sales for the American Blower Co., Detroit, in the states of Washington, Oregon and Idaho, with headquarters at 388 Arcade Annex, Seattle, Wash. Mr. Burton is a graduate of the engineering department of the University of Michigan, and has had considerable experience as engineering salesman for this compay at Detroit and out of the Chicago office. His later experience consists of engineering positions with Messrs. J. T. Mooney & Co., Nashville, Tenn., and more recently with the W. J. McPherson Co., Portland, Ore. Mr. Burton's experience particularly fits him for representing the lately consolidated interests of the "American Blower Co." and the "Sirocco Engineering Co."

Mr. Thos. W. Fitch, Jr., until recently sales manager for the Capell Fan and Engineering Co., is now connected with the American Blower Co., representing the "Sirocco" mine fan department in the bituminous coal district. Mr. Fitch makes his headquarters at the Pittsburg sales office, 1218 Empire building.

The Chicago, Milwaukee & St. Paul has specified National trap-doors, made by the General Railway Supply Co., Chicago, for the passenger cars ordered from the Pullman Company and from the Barney & Smith Car Co.

The business of the laboratory of engineering chemistry, 93 Broad street, at Boston, Mass., established in 1886, has been incorporated under the name Arthur D. Little, Inc. The company is prepared to undertake any work involving the application of chemistry to industry.

The Indiana Engineering Co., Indianapolis, Ind., has been incorporated with a capital stock of $30,000. The company proposes to costruct steam and interurban railways, etc., and to carry on a general construction business. The incorporators are Henry T. Wilkerson, Albert K. Roweswell and Gilbert Helm.

E. D. Giberson and Frank E. Olin, formerly connected with the New York sales agency of the National Tube Co., Pittsburg, Pa., have been appointed Eastern sales agents of the Ohio Seamless Tube Co., Shelby, Ohio, with offices at 2 Rector street, New York. The eastern territory will be handled by the New York office, and all inquiries originating in this territory should be addressed to that office.

The Davis-Bournonville Co., New York, will have at the M. C. B. and M. M. convention at Atlantic City a working exhibit of its oxy-acetylene welding and cutting apparatus. As it may be possible that some of the members of the associations have about their shops broken parts of machinery that require particularly skilful welding, the company wishes to announce that it will be glad to do any welding necessary on work sent to them express paid, Atlantic City.

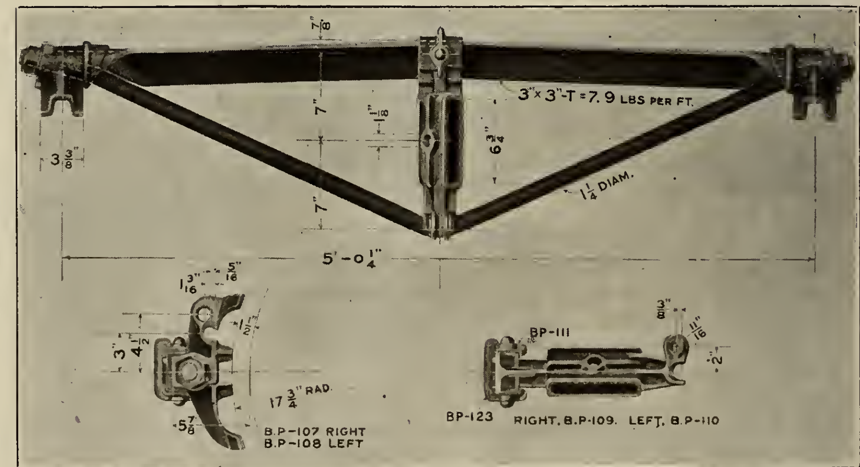
The partnership which, under varying names, has for about 75 years owned the Baldwin Locomotive Works, is expected to terminate in June and be succeeded by a stock corporation. The two weeks' legal notice has been given and application for a charter from the state of Pennsylvania will be made on June 3. No change in personnel is indicated by this change in form of organization, which has become desirable, primarily, because of Mr. Henszey's death and the age of the senior partner.

The Pittsburg office of the Darley Engineering Co., New York, has been abolished, and the engineering, purchasing and sales departments hitherto located there have been transferred to New York, where all communications should be sent. The Chicago office will remain, as at present, in the Monadnock building. The general officers of the company are now as follows: W. A. Stadelman, president and general manager; C. L. Inslee, vice-president; W. G. Hudson, vice-president; W. W. Ricker, treasurer; M. D. Chapman, secretary.

The Falls Hollow Staybolt Co. announces that it has just established an agency in Canada for the sale of its product in the territory west of Lake Superior, with the Brydges Engineering and Supply Co., 249 Notre Dame avenue, Winnipeg, Can., and with Mussens Limited 299 St. James street, Montreal, Can., for the sale of its product in the territory east of Lake Superior. Messrs. H. J. Skelton & Co., Royal London House, Finsbury Square, London, E. C. England, have been appointed sole representatives for the British Isles and India.

It has been announced that the Pullman Co. has placed contracts for the construction of new buildings at its plant at Pullman, Ill., which will increase the capaity of the shops to 30,000 cars a year, or about one-third, and which will involve an expenditure, including the equipment for the shops, of about $300,000. These buildings are to be equipped for the building of all steel freight and passenger cars. Work has already been started on two erecting shops for passenger cars, each 420x220 feet in size, with a transfer table between them for handling the car bodies. These are located to the east of the present buildings and are of steel construction. They will cost $400,000 and will be completed in ninety days. All of the new buildings planned are expected to be finished by September 1.

The Buffalo Brake Beam Co. of New York, Buffalo and St. Louis, has recently completed and now occupies its new factory located in Buffalo, N. Y., designed and built to meet their future requirements. The factory is equipped throughout with the latest design of individual motor driven machinery for manufacturing I-beams, special section and truss brake beams for tender, freight, passenger and interurban equipment. The company also manufactures a line of forgings consisting of brake heads, fulcrums, safety chain clips, wheel guards, hangers and steel backs for brake shoes. The illustration above shows its new No. 2 truss brake beam, also known as "the beam with the back bone," the name suggesting itself from the arrangement of the compression member which is made from a standard tee section with ends formed in a way that it maintains its full strength from end to end. The tension member is a rod, threaded on ends, passing over fulcrum through formed ends of compression member and heads. The arrangement for combining the



Tender Brake Beam.

members is simple yet effective. The feature of being able to keep the members in tension at all times is embodied in the arrangement. The truss beam is made in three sizes: No. 1 for equipment of less than 40 ton capacity; No. 2 for equipment with capacity of 40 tons and over; No. 3 with adjustable heads for high speed passenger service.

The United States Light and Heating Co., which was incorporated in January under the laws of Maine for the purpose of taking over several electric car-lighting properties, has completed its organization. The authorized capital of the new company is $17,500,000, consisting of $2,500,000 7 per cent cumulative preferred and $15,000,000 common. No bonds are authorized. The company has taken over the Bliss

Electric Car Lighting Co., of Milwaukee, the National Battery Co., of Buffalo, and the United States Lighting and Heating Co., of New Jersey, which has a plant at 22 Thames street, New York City. The directors are: Edwin Hawley, president and director of a number of railroads; Jules E. French, chairman of the board of directors of the Railway Steel Spring Co.; William H. Silverthorn, president of the Railway Steel Spring Co.; Theodore P. Shonts, president of the Interborough-Metropolitan; Newman Erb, president, Wisconsin Central R. R.; Charles A. Starbuck, president of the New York Air Brake, and Walter S. Crandall, who is connected with the firm of Hawley & Davis. The prospectus above referred to says that of the $17,500,000 capital stock, $1,000,000 preferred and $4,500,000 of common will be retained in the treasury. It is also stated that it is intended to produce a working capital of $267,000. The object of the incorporation is set forth as the manufacture of electric light apparatus in which the generating power is obtained from the car axle. It is also announced that the United States Lighting and Heating Co., of New Jersey, is the owner of a patent roller-bearing power transmission in which the strain is taken away from the armature. These are Moscowitz patents. Through the National Battery Co., the new concern expects to obtain its storage batteries at a saving; it is also claimed that thirty-five railroads are prepared to install the company's lighting service. One source of revenue, according to the prospectus, is the sale of the patent rights in foreign countries, which it is estimated will realize the sum of $6,000,000. The new revenue of the company after paying the dividend on the preferred stock is figured at $1,125,000. The officers of the new company are: W. H. Silverthorn, president; Jules E. French, first vice-president; Edwin Hawley, second vice-president; C. A. Starbuck, third vice-president, and W. S. Crandell, secretary and treasurer. The company expects to have a plant and be in operation within a few months; in the meantime, the plants of the subsidaries are being operated.

Mr. W. M. Lalor, sales engineer for the Bliss Electric Car Lighting Co., has just returned from a year and a half trip through South America, and while there superintended the installation of 60 electric light equipments for passenger coaches, which were built for the Chilean States Railway. The prospects for railway work in that country are excellent.

Mr. P. H. Wilhelm, who has represented the American Steel and Wire Co. in the East and South since 1904, has been appointed special railroad representative for the Asbestos Protected Metal Co., of Canton, Mass.

The Gold Car Heating and Lighting Co., of New York, has during the past year, made many improvements in car heating specialties, among which are the following: A locomotive reducing valve, a temperature regulator that will regulate as well as act as a stop valve; an improved gravity trap; a coupler that will take any size hose and gasket from 1¼ inches to 1½ inches, and will interchange with any small or medium size coupler on the market. There has also been perfected a combination system of car heating whereby either pressure or vapor can be used by the operation on one valve, each system being entirely independent of the other. These improved specialties will be exhibited in Sections No. 301 to 311 exhibition hall, during the Master Mechanics and Master Car Builders' convention June 16th to 23d.

The Lincoln Motor Works Co. announces that its name has been changed to Reliance Electric & Engineering Co., with offices at Cleveland, Ohio. The management remains the same, and the manufactured articles include the Lincoln variable speed motor with complete lines of constant speed motors. The company is specializing in machine shop practice, and is equipped to design and manufacture all mechanical details and driving mechanisms necessary in applying motor drive to any class of machinery.

R. H. Weatherly, formerly third vice-president in charge of sales of the Scullen-Gallagher Iron & Steel Company, St. Louis, Mo., has bought an interest in the Pilliod Company, Old Colony building, Chicago, makers of the Baker-Pilliod locomotive valve gear, and this company has been reorganized and the following officers elected: President, R. H. Weatherly; vice-president, A. D. Baker; secretary and treasurer, F. E. Pilliod; chief mechanical engineer, C. J. Pilliod. Mr. Weatherly has spent nearly his entire life in the railway supply business, and has a wide acquaintance among both supply men and railway men. After finishing his education in 1892 he went into the car seat business, where he remained for about six years. He was later connected with the Safety Car Heating & Lighting Company, New York, and with the Shickle-Harrison-Howard Iron Company. On the organization of the American Steel Foundries, Chicago, in 1902. he became assistant to the second vice-president. with offices in New York. From 1905 to 1907 he was third vice-president of the Scullin-Gallagher Iron & Steel Company, in charge of the eastern district, and in February, 1907, he was given charge of the entire sales of this company, with office at St. Louis.

The General Railway Supply Co., of St. Louis has taken over the Valley Railway Equipment Co. of East St. Louis, including warehouse, etc. The Valley Railway Equipment Co. was owned by Mr. Chas. Waughop.

Personals

G. W. Waite has been appointed electrical engineer of the Cleveland, Painesville & Eastern R. R.

H. E. West has been appointed mechanical engineer of the El Oro Mining and Ry. Co., vice C. A. Smith, resigned.

C. H. Everett has been appointed superintendent of motive power of the newly chartered Houston, Fostoria & Northern Ry. Co., with office at Fostoria, Tex.

F. E. French has been appointed superintendent of motive power, vice W. S. Temple.

G. E. Perry has been appointed master mechanic of the Missouri, Oklahoma & Gulf Ry.

Henry Garrick has been appointed master mechanic of the Montana division of the Oregon Short Line.

Geo. Ross has been appointed master mechanic of the Utah division of the Oregon Short Line.

A. H. Gairns has been appointed master mechanic of the Idaho division of the Oregon Short Line.

H. Woolatt has been appointed general car foreman of the Pere Marquette R. R. at St. Thomas, Ont.

J. H. Yoder has been appointed foreman car shops of Philadelphia & Reading Ry., at Palo Alto, Pa.

A. Stewart has been appointed general superintendent of motive power and equipment of the Southern Ry. at Washington, D. C.

J. L. Carlton has been appointed roundhouse foreman of the Texas & New Orleans R. R.

D. C. Monro has been appointed master car builder of the Vera Cruz & Isthmus R. R.

D. T. Burke has been appointed master car builder of the Virginia Truckee Ry., vice C. A. Brulin, resigned.

Mr. L. B. Ferguson, whose portrait is published on another page, has invented and has placed on the market a new and interesting watch dial. The hour hand and hour-figures of this watch are red while the minute hand and minute figures are in black. The dial is a very convenient one for any watch, and will no doubt prove a great success.

Railway Mechanical Patents Issued During May

Mail-pouch catching and delivery device, 919,336—George M. Foley, Chicago, Ill.

Clamping and heating device, 919,350—Albert B. Herrick, Cleveland, Ohio.

Car-underframe, 919,356—Clarence H. Howard, St. Louis, Mo.

Guard or protector for locomotive-cabs, etc., 919,379—Thomas J. Quirk, Buffalo, N. Y.

Adjustable platform for railway cars, 919,383—William Robinson, Brooklyn, N. Y.

Brake-shoe, 919,518—Charles W. Armbrust, Chicago, Ill.

Finger-guard for brake-beams, 919,565—William E. Fowler, Jr., Hammond, Ind.

Control of railway apparatus, 919,573—Laurence A. Hawkins, Schenectady, N. Y.

Coupling device, 919,469—Oscar Rude, Burke, Wis.

Automatic air-brake system, 919,609—George Macloskie, Schenectady, N. Y.

Brake, 919,671—Walter S. Adams, Philadelphia, Pa.

Brake-hanger for car-trucks, 919,676—James H. Baker, Pittsburg, Pa.

Side frame for car-trucks, 919,677—James H. Baker, Pittsburg, Pa.

Truck-bolster and car-truck, 919,690—Jacob J. Byers, Cameron,Mo.

Car brake, 919,746—John S. McWhirter, New York, N. Y.

Truck brake, 919,747—John S. McWhirter, New York, N. Y.

Railroad track structure, 919,757—Webster D. Peaslee, Whitefield, Me.

Railway car truck, 919,770—Willard F. Richards, Depew, N. Y.

Maximum traction truck, 919,803—Walter S. Adams, Philadelphia, Pa.

Mail bag catcher or transferrer, 919,911—George J. Meier, Buffalo, N. Y.

Car roof construction, 919,931—Lars G. Nelson, Hoboken, N. J.

Uncoupling device for car couplings, 919,949—Thomas M. Ramsdell, Richmond, Va.

Apparatus for control of railway trains, 919,982—Per Utne, New York, N. Y.

Car truck, 919,305—Asa F. Batchelder, Schenectady, N. Y.

Car coupling, 919,331—James F. Durbin and Votaw S. Durbin, Fort Scott, Kans.

Folding step for subway cars, 919,333—Julius M. Ernst, Brooklyn, N. Y.

Mail pouch catcher, 920,002—Julian Anderson, Helena, Mont.

Semi-convertible car, 920,020—Eza S. Bucknam, Philadelphia, Pa.

Smoke jacks for railway engine houses, 920,041—Richard J. Evans, Franklin, Pa.

Pasenger car, 920,062—Henry Howson, Philadelphia, Pa.

Hub plate for locomotive driving wheels, 920,094—Frederick H. Smith, Pittsburg, Kans.

Railway steam motor car, 920,114—Theorore H. Curtis, Louisville, Ky.

Railroad cash fare receipt, 920,182—George M. Rose, Jr., Nashvillefi Tenn.

Car underframe, 920,384—Allen E. Ostrander, New York, N. Y.

Air brake, 920,389—Frank B. Rae, New York, N. Y.

Train number indicator for locomotives, 920,403—Henry J. Small, San Francisco, Cal.

Brake head, 920,434—James M. Coleman, St. Lambert, Quebec, Canada.

Rotary wheel guard for cars, 920,467—Frederick E. Hutchings, New York, N. Y.

Mail bag catcher and deliverer, 920,568—Robert R. Hedgpeth, Phoenix, Ariz.

Passenger car construction, 920,594—Grant W. Lillie, St. Louis, Mo.

Dump car, 920,616—Thomas R. McKnight, Aurora, Ill.

Mail bag catcher and deliverer, 920,628—Monroe Nugent, East Quogue, N. Y.

Underframe for freight cars, 920,759—William J. Lage, Topeka, Kan.

Smoke jack, 920,763—Peter J. Lauritzen, New York, N. Y.

Car axle bearing, 920,802—George A. Woodman, Chicago, Ill.

Car underframe, 920,813—Anton Becker; Columbus, Ohio.

Chuck for boring and turning locomotive tires, etc., 921,066—George L. Bennett, Topeka, Kans.

Car underframe, 921,112—Clarence H. Howard, St. Louis, Mo.

Knuckle for car couplings, 921,158—Walter S. Pirie, Halifax, Nova Scotia.

Means for lubricating flanges of car wheels, 921,162—Frederick Regenold, Memphis, Tenn.

Car buffer, 921,208—Mark L. Dean, Centerville, Tenn.

Dump car, 921,300—Thomas H. Stagg, Columbus, O.

Car brake, 921,309—Walter L. Taylor, De Ridder, La.

Post seat for cars, 921,310—James D. Tharp, Ardara, Pa.

Steam generator for motor cars, 921,315—Henry A. Turnbull and Alfred Goding, Surrey Hills, Victoria, Australia.

Brake beam, 921,344—Edward H. Bauer, Chicago, Ill.

Locking device for dump cars, 921,376—Charles H. Doty, William L. Burner, and Thomas H. Stagg, Columbus, O.

Automatic brake to prevent cars from leaving tracks, 921,388—Francis M. Evans, Cairnes, Ky.

Valve gear, 921,413—Lynn King, Lyman, Miss.

Car truck, 921,455—Enoch Prouty, Chicago, Ill.

Car coupling, 921,482—Allan Tawlks, Harvey, N. D.

Driving mechanism for railway cars, 921,491—Rollin H. White, Cleveland, O.

Automatic coupling and central buffer device for railway cars, 921,564—Anders A. Rosengren, Malmo, Sweden.

By-pass valve for locomotives, 921,583—James G. Blunt, Schenectady, N. Y.

Car oiler, 921,594—Guy G. Crane, Rockford, Ill.

Truck, 921,798 and 921,799—Alfred L. Clark, Dubuque, Iowa.

Passenger car, 921,848—Felix Koch, Bellevue, Pa.

Journal box, 922,083—Peter A. Campbell, Chicago, Ill.

Locomotive sanding apparatus, 922,109—Samuel H. Dunning, Paterson, N. J.

Car wheel, 922,168—Samuel H. Lanyon, Seattle, Wash.

Car door lock, 922,168—Charles H. Lewis, Chillicothe, O.

Superheater for boilers of the locomotive type, 922,200—Wilhelm Schmidt, Wilhelmshöhe, near Cassel, Germany.

Valve gear, 922,250—Edward L. Bowen, McComb, Miss.

Car seal, 922,251—James W. Bowers, Seymour, Ind.

Nut lock, 922,261—Percy Clay, Gibson, La.

Freight car, 922,293—Henry W. Kirchner, St. Louis, Mo.

Coupling head, 922,347—James S. Sheafe, Chicago, Ill.

Safety check for automatic couplings, 922,348—Samuel T. Shroyer, Bellefontaine, Ohio.

Superheater for locomotives, 922,365 and 922,366—Samuel M. Vauclain, Philadelphia, Pa.

Driving mechanism for motor driven vehicles, 922,367—Samuel M. Vauclain, Philadelphia, Pa.

Passenger car, 922,395—Samuel M. Curwen, Haverford, Pa.

Articulated locomotive, 922,426—George W. Henry, Jr., Philadelphia, Pa.

Passenger car, 922,430—Henry Howson, Philadelphia, Pa.

Water closet valve for cars, 922,441—Charles W. Pearsall, Binghamton, N. Y.

RAILWAY MASTER MECHANIC

Established 1878

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Fuel Economy

One of the most interesting discussions of the Master Mechanics' convention was that relating to fuel economies. This discussion is printed in full on another page and it should surely be read by all interested men who failed to attend the convention. Mr. Quayle's statement that if he could have every fireman on the Northwestern road as good a fireman as any one of a hundred he would select, he could save the company $500,000 per year, was an eye opener. Coming from a man of Mr. Quayle's standing such a statement should be food for thought. It would seem that if this saving is a real possibility, it would pay the railroad well to take each of these one hundred good firemen and let them teach the others their methods and not only teach them but follow them so closely that better service would have to come. Even if only one-half or one-quarter of the amount mentioned were saved, still the company would have more than the equivalent of these men's salaries saved by the venture.

It is generally admitted that traveling engineers and traveling firemen amply repay the railroad in results, but, as thus far their numbers are limited, no such thing as a close watch of the men is possible. As was brought out at the convention, the difficulty does not lie so much in the fact that the firemen are ignorant of the best methods of their trade as in the fact that they become careless of results. This condition is bound to follow a knowledge that they are not securing proper credit for good work when they do perform it. A large number of traveling officials would surely tend to relieve this condition.

A great difficulty in the way of proper methods in firing is the fact that the enginemen do not consider the question with the same seriousness as they do the question of making schedule time. They realize that a delay chargeable to them is a much more serious crime than the use of an abnormal amount of fuel. It is usually the case that the fear of delay so predominates in the mind of the fireman that the saving of a few hundred pounds of coal seems a very small matter indeed. This is particularly true of men placed on new runs. Many locomotive engineers, on account of nervousness, refuse to allow a variation of as much as five pounds gauge pressure below the blowing point. The result is that the valve is fluttering on its seat most of the time and at each stop it is wasting stored energy in very appreciable quantities. Until the number of traveling supervisors is such that the enginemen are equally as impressed with the importance of fuel economy as they are with the importance of making their schedule time, no results of consequence will follow the efforts of motive power men.

It would seem, from the viewpoint of this paper, that the approaching decision of the executive committee of the Railway Supply Manufacturers' Association on its secretaryship should be based upon qualifications aside from so-called politics; and the publishing or advertising field is not the place to look for such a man. A great deal of what is inelegantly termed spite work has prevailed in some periods of the past, and it seems that one of the highly necessary qualifications of a man who is up for consideration, should be a shouting omission of this characterization in his past business and social intercourse.

That there are such members of the association no one will doubt. In selection, however, there are always differences of opinion, and the strongest men have the most enemies as well as the staunchest friends. Select, therefore, the man who will not be biased by the fact that he has enemies, for there are men upon whom the opinion as to the lacking quality mentioned will be unanimous.

The report of the Master Mechanics' committee on the bill for Federal locomotive boiler inspection recently presented before the U. S. Senate was unfavorable. There has been some agitation of this subject recently and it is interesting that the lesser mechanical employees generally are working for its passage.

It seems to have become a matter of principle, no matter what the issue, for these men to take sides against their employers, perhaps, because this is always the more popular course.

After careful consideration the committee was unable to see any advantage in such a law. On the other hand there is a prospect of so much limitation or restriction which always goes with Government red tape that serious handicaps would result. It is hard indeed to see where the present methods employed in railroad shops and roundhouses could be improved by Government interference. Surely comparisons between the annual number of steamship and railroad boiler explosions are not favorable to Government methods.

Pacific Type Locomotives

Chicago, Burlington & Quincy R. R.

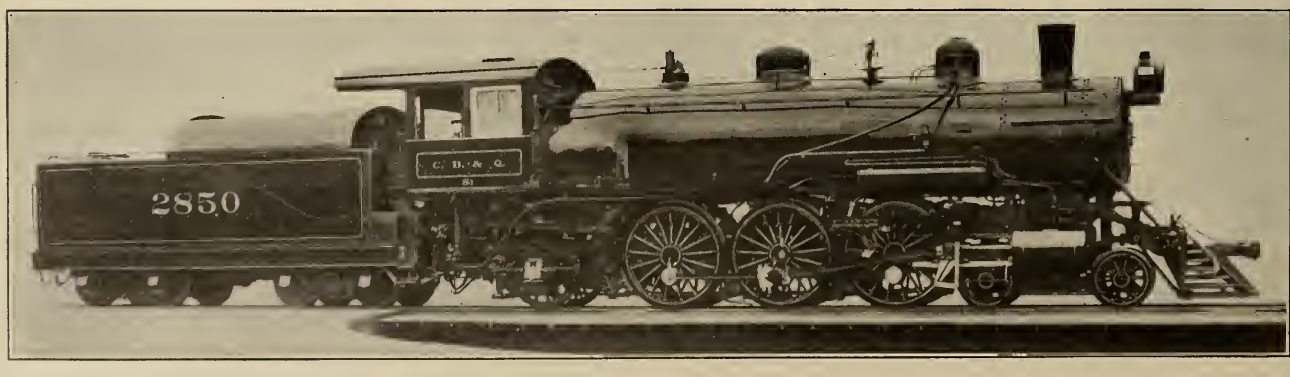
In the years 1906 and 1907, the Baldwin Locomotive Works constructed 30 heavy Pacific type locomotives for the Chicago, Burlington & Quincy R. R. These engines were built to specifications furnished by the railroad company, and were fitted with wide firebox boilers, piston valves, and Stephenson valve gear. Their successful performance is indicated by the fact that the road has recently received from the same builders, twenty-five additional Pacific type locomotives, which are generally similar to those built three years ago. The most important change is the introduction of Walschaerts valve gear; while various other details have been modified, with a view to improving the design where possible.

The same cylinder pattern is used for these engines as for the previous locomotives, and the valve gear design embodies special features because of the peculiar location of the steam chests. These are placed between the top and bottom frame rails, with their centers 43 inches apart transversely, and 7 inches above the cylinder centers. This necessitates driving the valves through rockers, and these are of cast steel, with a webbed section designed to remove all superfluous material. Each rocker is keyed to a steel shaft 4 inches in diameter and 4¼ inches long, which is supported by cast steel bearings bolted to the guide yoke. The valve rods have knuckle joints, and are connected directly to the inner arms of the rockers, while the combining levers are pinned to the outer arms. The links are carried outside the leading driving wheels by means of suitable bearers. These are bolted in front to the guide yoke, and at the back to a crosstie, which also supports the reverse shaft bearings.

Because of the location of the steam chests, the steam and exhaust passages are unusually free from abrupt changes in direction. The piston valves are 12 inches in diameter; they have a steam lap of 1⅛ inches and an exhaust clearance of ⅛ inch, and are set with a maximum travel of 5¾ inches and a constant lead of ¼ inch.

The main frames are of cast steel, 5 inches wide, and made in one piece with the lower front rails. The latter are stopped immediately in front of the cylinders, and the bumper is braced by supplemental lower rails, placed 23 inches between centers, and firmly bolted to the cylinder castings. The rear frames, in accordance with the railroad company's practice, are placed outside the trailing wheels, and are connected to the main frames by a substantial steel casting, which serves as a transverse brace under the front end of the firebox. The trailing wheels are allowed a limited amount of side play, and the boxes are braced transversely by tie-rods. The load is transferred to the box through cast iron plates having inclined sliding surfaces. The top plate constitutes a fulcrum for a pair of beams which are connected in the equalization system. When the wheels are displaced on a curve, the top plates are lifted owing to the inclination of the sliding surfaces, and this results in a tendency to bring the wheels back into line. The frames are supported at the read by full elliptic springs. The driving spring saddles and equalizers are of cast steel, while the spring hangers are of forged iron. The frame braces include a broad steel casting which is placed between the second and third pairs of driving wheels.

The boiler is of the wagon-top type, with a long gusset



One of 25 New Pacific's, C., B. & Q. R. R.

in the first ring. The dome is placed on the middle ring, which has a welded seam on top, with a liner inside. The longitudinal seams on the first and third rings are butt-jointed, with wide welt strips and eight rows of rivets.

The firebox has a sloping throat, and the back head slopes forward above the fire door. In accordance with the railroad company's practice, the door opening is formed by flanging both sheets outward, and riveting them directly together. An interesting feature is the mud ring, which tapers in width at the sides, from 6 inches in front to 4 inches at the back. The side water legs are vertical and widen towards the top. The front end of the crown is stayed by four rows of expansion links, there being 14 in each row. The throat sheet completely encircles the barrel, and is flanged out of a single plate. The safety valves and whistles are mounted on an auxiliary dome, which is placed in front of the firebox.

The smoke box has a short extension, and is fitted with a spark hopper and a low single exhaust nozzle. The diaphragm plates are of cast iron, and are placed immediately in front of the tubes. The grate is of the rocking type, and the bars are supported in rectangular frames. These are mounted on trunions and may be tilted through a wide angle when dumping the fire. The ash pan has draft openings under the mud ring; it is of steel plate, with a cast iron drop door in each hopper.

Fuel ....Soft coal
Staying ....Radial

Fire Box.

Material ....Steel
Length ....108⅛ in.
Width ....72¼ in.
Depth front ....73¼ in.
Depth back ....61⅞ in.
Thickness of sheets, sides ....⅜ in.
Thickness of sheets, back ....⅜ in.
Thickness of sheets, crown ....⅜ in.
Thickness of sheets, tube ....½ in.

Water Space.

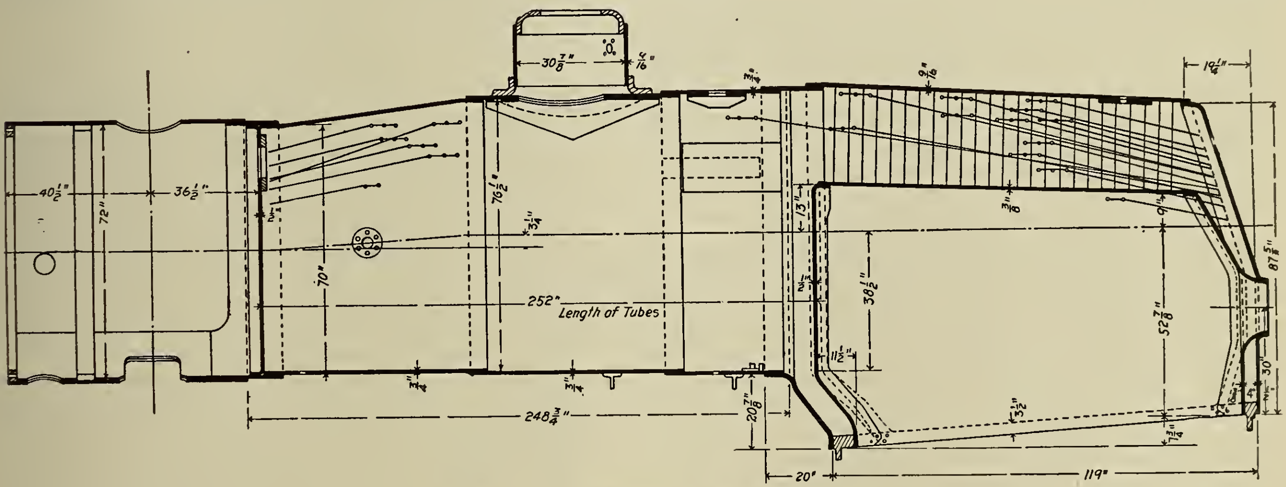
Front ....6 in.
Sides ....6 in. to 4 in.
Back ....4 in.

Tubes.

Material ....Iron
Wire gauge ....No. 11
Number 293
Diameter ....2¼ in.
Length ....20 ft.

Heating Surface

Fire box ....194 sq. ft.
Tubes ....3,610 sq. ft.



Boiler of New Pacific's, C., B. & Q. R. R.

The tender has capacity for 8,200 gallons of water and 13 tons of coal, and is designed with a low center of gravity. The frame is steel, with the exception of the front bumper, which is oak. The trucks are of the equalized pedestal type, with cast steel bolsters and steel-tired wheels. These latter, as well as the engine truck and trailing wheels, were supplied by the Standard Steel Works Co.

These engines exert a tractive force of 31,130 pounds, and with a liberal weight on driving wheels and high boiler power they are well adapted to handling heavy and fast passenger traffic. The constantly extending use of the Pacific type is conclusive proof of its suitability for this class of service.

The general dimensions, weights, etc., are as follows:

Gauge ....4 ft. 8½ in.
Cylinder ....22 in. x 28 in.
Valve ....Balanced piston

Boiler.

Type ....Wagon top
Material ....Steel
Diameter ....70 in.
Thickness of sheets ....¾ ins.
Working pressure ....200 lbs.

Total ....3,804 sq. ft.
Grate area ....55 sq. ft.

Driving Wheels

Diameter, outside ....74 in.
Diameter, center ....66 in.
Journals, main ....10 in. x 12 in.
Journals, others ....10 in. x 12 in.

Engine Truck Wheels.

Diameter, front ....37¼ in.
Journals ....6 in. x 12 in.

Trailing Wheels.

Diameter ....48¼ in.
Journals ....8 in. x 12 in.

Wheel Base.

Driving ....12 ft. 10 in.
Rigid ....12 ft. 10 in.
Total engine ....32 ft. 9 in.
Total engine and tender ....64 ft. 3¼ in.

Weight.

On driving wheels ....160,150 lbs.
On truck, front ....37,350 lbs.

On trailing wheels	37,400 lbs.
Total engine	234,900 lbs.
Total engine and tender, about	390,000 lbs.
Tender.	
Wheels, number	8
Wheels, diameter	37¼ in.
Journals	5½ x 10 in.
Tank capacity	8,200 gals.
Fuel capacity	13 tons
Service	Passenger

Staybolts of electrolytic copper have given bad results in locomotives on Prussian railways in the last few years. An unusual number of staybolt fractures occurred during recent years, in a period when electrolytic copper was adopted as material in place of furnace copper. As many of the fractures occurred on wide fireboxes there was doubt as to whether the construction or the material was responsible. Staybolts that broke were therefore collected, for a period, and tested. Of 23 samples it was found that only 2 were of furnace copper, and 21 of electrolytic copper. Of the electrolytic samples, only one contained arsenic, while all the staybolts of furnace copper showed arsenic. The Italian railways and the railways of the British colonies, it is stated, specify a percentage of 0.15 to 0.55 per cent arsenic in copper.

Report of the Forty-Second Annual Convention of the Master Mechanics' Association

Proceedings of the First Session, Wednesday, June 16.

The first session of the American Railway Master Mechanics' Association was held in the Greek Temple on Young's Million Dollar Pier, Atlantic City, N. J., on Wednesday, June 16.

The president, H. H. Vaughan, Canadian Pacific, called the meeting to order and invited the past presidents of the Master Car Builders' Association and the Master Mechanics' Association, and the officers and members of the executive committees of those two associations to come up on the platform. The Rev. Dr. Newton D. Cadwell, pastor of the Olivet Presbyterian Church, opened the meeting with prayer.

President Vaughan then read his address, which, in part, was as follows:

Address of President Vaughan.

In 1868 six master mechanics attending the Master Car Builders' convention at Dayton decided to call a general meeting at Cleveland to organize an association of the master mechanics of the United States and Canada. At that meeting, which was held later on in the same year, fifty were present, representing many of the most important lines of railways in the country, and a constitution was adopted with the following preamble:

"We, the undersigned railway master mechanics, believe that the interests of the companies by whom we are employed may be advanced by the organization of an association which shall enable us to exchange information upon the many important questions connected with our business."

These words outlined the object with which the new society began its career, adopting as its purpose the discussion of the best methods of construction and operation of the locomotive at a time when it had just emerged from the experimental stage and was assuming a permanent and fairly uniform design. It had already taken its place in the world as the most powerful and economical engine of transportation, but few even who were connected with it in those days could have foreseen the development it was to undergo, or the extent to which it would render possible the cheapening and extension of the transportation facilities of the world, the chief factor in the wonderful change that has taken place in the relations of nations, the distribution of food supplies and the growth of manufactures, cities and continents.

The association so quietly started was well founded. It had chosen for its aim a work that was needed, and as the railways of the country grew, it grew with them, until now, forty-one years later, we have a membership of nine hundred and sixty-one (961), representing every railway in the United States and Canada, and a large number of those in foreign countries. It has been unique in its devotion to the locomotive and its problems alone, but its object has proved worthy of its attention, and we are today confronted with problems just as important as those which our predecessors considered, none the less vital to us because they are broader in scope and because financial considerations are now more closely connected with those which are purely technical.

It is impossible to review in detail the work which has been accomplished; the mass of information contained in our proceedings is too great for individual reference. To even touch on the more important subjects would necessarily result in a mere catalogue. Figures are but a poor way of illustrating results, but in the forty-one years of our proceedings three hundred and fifty-one (351) reports of committees, sixty (60) individual papers and one hundred and fifteen (115) topical subjects have been presented and discussed. Of these reports and discussions it may be stated that one hundred and twenty-six (126) contain information of special interest at the present time, while two hundred and eighty-three (283) are of specific value either in whole or in part.

Our work has not been limited to the exchange of information, but from the very beginning our committees have done far more than obtain and report existing facts or give the opinion they have formed as a result of their inquiries. This has been an important and valuable portion of their work, and our history shows that in the large majority of cases it has been done well. The answers received to the letters of inquiry have frequently indicated a great divergence of opinion or a lack of proper knowledge, while our later experience has justified the committee's decision. Their reports have presented carefully thought out and correct conclusions, which have, through their evidence of thorough investigation and the standing of the members of the committees, been widely accepted and of valuable assistance in establishing advanced practice. A development of their work to which I wish to call your attention has not, I believe, been generally awarded the credit it deserved, yet it has been the source of the greatest influence exerted by our association, and of the importance of its service to the railways. I refer to the investigation of the scientific principles underlying the questions assigned to our committees, the tests and experiments they have carried out when necessary to determine additional data, and the correct and practical conclusions they have deduced. As a result their work stands today as the basis of most of our scientific knowledge of the locomotive, the engineering principles on which it is designed, and the reasons for the methods by which it is operated.

I do not mean that we have to look to our committee for all the knowledge that is available on the theoretical mechanics of the locomotive, or for such researches as those on the properties of steam, the strength of materials, or the chemistry of combustion. That has been the work of the mathematician or physicist, and its value in solving the practical problems of engineering is limited by the vast number of factors which enter into actual working conditions. Our work on the other hand, has been the observation and interpretation of results in a scientific manner, and through being carried on by practical men, who have established the relation between the facts they ascertained, and the theoretical principles underlying them, has been sound in its basis, and rendered general in its application.

Probably the best example is the series of experiments on exhaust nozzles, stacks and steam passages. This began with the road tests which were carefully carried out in 1879, the experiments carried out in 1890, which were independent of road conditions, the first record of that kind in our proceedings, and in 1891 tests of a high degree of scientific excellence which indicated the benefits obtained by lowering the nozzle. It was then intended to continue the experiments at Purdue, but when that laboratory was destroyed by fire a locomotive testing plant was constructed by the chairman of the committee which was, with the exception of that at Purdue, the first in existence. The experiments made upon it were the first careful and thorough investigations of the action of the blast and the result of variations in design of nozzles and stacks that had been carried out on an actual locomotive on a testing plant on which uniform working conditions could be maintained. The results were given in the report of 1894 and the great report of 1896, which will be remembered as the best report up to that time presented to this or any other society on a subject connected with locomotive engineering. Supplemented by the more recent work, this subject stands as one of the most scientifically and carefully investigated details of the locomotive, and its history is one of which our association should be proud.

The test of compound locomotives presented in 1892 marked an important advance through recording the first complete and properly conducted road test, using the dynamometer car, indicators, accurate measurement of coal and feed water, the quality of the steam, and the measurement of various losses. These methods although previously applied along similar lines on stationary plants yet marked a decided advance in locomotive work, and supplemented by the report on the standard method of conducting locomotive tests have assisted materially in defining conditions that should be observed if accurate results are desired.

The subject of locomotive capacity has always been well handled and our recommendations in this respect have exerted a considerable influence and have been widely used. One report is of special interest, that of 1897, in which was presented the first comprehensive study of the characteristics of the locomotive, since made familiar to us by the work at Purdue University and the St. Louis Testing Plant. Then, however, the subject was broadly new and such a method of treatment almost unknown, but it marked the important discovery of the locomotive as a machine with definable properties, although of wide variations, as opposed to the indefinite views on its capacity and economy which were previously held.

Other notable reports of a general character were those on high steam pressures in 1898, the loss of power from friction in the machinery of a locomotive in 1906, and the results obtained from briquetted coal in 1908. There have been many others of more detailed nature, but which indicate the valuable character of our experimental work. Among the more important are those on driving wheel tire wear, in which the forces acting were carefully analyzed and compared with the wear actually found, showing distinctly the cause of the trouble; the report on engine truck swing hangers in which indicating apparatus was used to determine the action of an engine with different types of suspension; the report on slide valves, in which the dynamometer was used in the valve stem, and the forces shown compared with those determined by elaborate calculations of the various stresses; the reports on counterbalancing which have established the allowable disturbing weight, and the specifications for materials in which laboratory tests have been compared with an enormous number of service results. Add to these reports others, which by their high degree of merit have had a far-reaching effect on our railway work, such as those on ton-mile statistics, repair shops, and the education of apprentices, and the whole forms a series of progressive and leading contributions to the science of locomotive design and operation which has produced a permanent effect and demonstrated correct principles to the entire locomotive world. For years past locomotive practice in America has been based on scientific knowledge, and such questions as the proportions of heating surface and cylinder capacity, and the designs of front ends have been decided by the analyzed experience of the entire country, or carefully conducted experiments. In foreign countries where no such association as ours has existed, these matters have been left to the judgment of the individual or what are practically rule of thumb methods. Few realize what this work has done for the railroads of the country, but the result is seen in the general success of our locomotive practice.

What further can we do to increase our usefulness and develop into still more important fields of work? I feel that in making suggestions I am recording my own sins of omission, and yet when a man endeavors to seriously consider such a question, ideas occur to him that previously lay dormant or unthought of, and this must be my excuse for recommending now what I have not done. Our opportunities are somewhat different from those of our great sister society, the Master Car Builders' Association. We have no such business relationships to regulate between one road and another as those involved in the interchange of equipment. The possibilities of establishing additional standards that would be extensively used are few, and indeed it is very doubtful whether standards are of much value for the locomotives of an entire country. We must consequently ask ourselves whether we are obtaining all classes of information that are of possible value, and whether our committee reports, individual papers and topical discussions could be advantageously supplemented by any other activities.

We are face to face with certain changes in the development of our motive power and the department having charge of it. The steam locomotive, that has been supreme for so many years, is finding its superiority questioned by a new invention, the electric locomotive. The small railway with its individual methods is being absorbed into large systems, and superintending and recording the work under the charge of our members is becoming more difficult. The growth of the large mechanical departments has made it impossible and in fact undesirable for their heads to retain the same touch with minor mechanical and operating details that they formerly had to, and has increased the importance of the financial and business questions they should control as compared to those of a mere technical nature. Unless this association and its members concern themselves seriously with these new and larger problems, there is danger of their work being undertaken by others in place of by ourselves.

The articulated locomotive has increased the field of the steam locomotive and enabled it to compete on more favorable terms with its younger and more powerful rival. We should be informed of every development in this line, the results and the experiences that are being obtained and the reduction in the cost of transportation that is being realized. We should also, I feel, know more of electric operation, so that as motive power officers we may be better informed as to its advantages and disadvantages, and may be in position to assist in deciding on the proper system to employ.

The advice of men experienced in motive power matters is needed by the railways in making decisions on this question. To be of value it must be based on a thorough understanding of the subject and a familiarity with its difficulties. I would urge your giving earnest attention to this important subject, which thus far has received too little consideration by the men who best understand railway motive power conditions.

Systems of organization are changing with the changes in our railways and new methods are being introduced for watching results. We should compare experience as to the efficiency of various types of organizations, obtain more information as to the best forms of records, statements that are actually found useful and successful in practical service; comparisons that can be made on a reasonable basis and are interchangeable.

I believe we should endeavor to pay more attention to the commercial side of our work than we have done in the past. Excellent as our work has been, it has with few exceptions investigated the technical rather than the business problems of the locomotive.

We certainly do not want to decrease our attention to technical matters, but could we not with advantage to our members and to the railways take more interest in, and exchange information with each other more fully on, factors connected with the cost of operation?

In short, without in any way reducing the interest we have in locomotive engineering, we must take up a far more businesslike and serious way the financial problems connected with the operation of the locomotive department, the form of organization that will give the best results, the commercial aspect of the work of a motive power official in conducting his department as though he were manager of a large business enterprise.

Take as an instance of comparing costs the operation of our repair shops. We manage the largest collection of factories in the world devoted to one substantially uniform product, the repairing of locomotives, and our total expenditure for this item alone amounts to about eighty million dollars per year. Each and all have the keenest interest in knowing whether our methods are the best and our costs among the lowest. A few years ago comparisons would have elicited little, but some statements of performances which were exceptionally worthy of imitation; today, with the progress that has been made in shop engineering, there is no reason why properly trained observers should not record time studies containing the necessary data to prepare intelligent and valuable statements about one operation after another that is performed on substantially the same parts in hundreds of shops from the Atlantic to the Pacific. Such work is possible and it has already been performed in several shops by experienced engineers. If carried on by a properly organized bureau under our auspices, it should be of the greatest value not only to the railways of this country as a whole, but to our members individually. By comparing operation by operation their results with those of other roads, and by analyzing their methods and available machinery, they would be enabled to improve the one or justify their expenditure for additions to the other. This is but one of many questions connected with the operation of our mechanical department which will occur to you, on which some systematic interchange of information would be of material assistance.

What I wish most strongly to impress on you is that while still carrying on the technical work that has been so splendidly successful, we should pay more attention to the business problems under our control in which we can be of such mutual service.

Our methods of obtaining information might also, I consider, be supplemented to advantage by effecting closer relations with the various railway clubs. The circular letter has been a practical failure in obtaining general information, and I feel sure that the railway clubs would welcome reference to them of certain subjects for their opinion, especially those on which the experience of the men actually in touch with the work is required. They have a large membership, representing every section of the country and every class of men engaged in locomotive work. On many subjects their views would be of far greater value than those obtained in answer to circular letters, especially on questions similar to those suggested for topical discussion.

A valuable practice which obtained in the past, but which has been discontinued in recent years, was the appointment of a committee to report on the advancement in locomotive practice during the year. There are numerous small improvements devised in railway shops which would be collected by a committee gaining its information from the railway clubs. These improvements, while not of sufficient importance in themselves to justify a report or paper, are of considerable value in our successful operation, and presented by a committee would have sufficient indorsement to insure their being carefully considered.

Co-operation with the railway clubs would also relieve the association of the discussion of details of minor importance which have occupied so much time in the past. Such discussion is necessary, and, in fact, of the greatest value, but it more properly belongs to local societies where local conditions are understood and where it can be carried on just as efficiently and satisfactorily as when occupying the time of a national association.

The present system of holding the conventions of the Master Mechanics' and Master Car Builders' Associations in two separate weeks prevents many from attending one or the other. The consequence is, the attendance is largely divided, and unfortunately so, as the majority of the members of either association are equally interested in the other. There are two remedies: the first ,to hold the two conventions in one week; the second, to unite the two associations. When this was last proposed by the late Mr. Pulaski Leed in 1898, our executive committee was instructed to confer with that of the Master Car Builders' Association, but, although a report was made to the succeeding convention, suggesting that both conventions should be held during the same week, nothing was done.

It is a reflection on the business ability of our mechanical departments to continue an arrangement that necessitates a man being away from his work for practically two weeks at the meetings of important associations, which he should, for his own sake, and that of the railway employing him, attend and take part in.

There is to-day no valid reason for maintaining two separate mechanical railway associations. All the officers and members of the executive committee of the Master Car Builders' Association, with the exception of two, seventy-five (75) per cent. of the members of the standing committees, and seventy (70) per cent. of the members of the special committees, hold joint department titles.

These figures demonstrate most clearly the amalgamation that has taken place between the car and locomotive departments on our railways. They justify the statement that the time has arrived not for the absorption of one of our associations by the other, but for their uniting into one society, call it, if you please, the American Railway Mechanical Association, which would consider both car and locomotive matters. Such a step is demanded by the spirit of the times, to conserve the forces of our railway officers and economize their time. It is one of the most important questions we have to deal with, and I would impress on you the necessity for action being taken to remedy the present conditions.

Ladies and gentlemen, with sincere pleasure and a deep personal appreciation of the privilege, I welcome you to this, the fourth convention at Atlantic City, and the forty-second in the history of the association; I hope also, to a meeting that may prove to be of the same value to the motive power departments of our railways, of the same interest to our members, and of the same high standard from an engineering and executive standpoint, as has one convention after another in the past. In at least one respect this convention is specially fortunate, the exhibition of railway tools and appliances that has been arranged by the Railway Supply Manufacturers' Association. While, during the past year, the depression in business affairs which began in 1907 has continued with but slight improvement until the last few months, it has only spurred our manufacturers to fresh endeavors, and we are met this year with the finest collection of exhibits we have ever been fortunate enough to view installed in an orderly and systematic fashion. Such an exhibition is in itself a valid reason for our attendance, were it simply to see the latest and best in railway material, and I have no hesitation in voicing the thanks of the association to the men who have organized and carried out this work with such ability and enterprise.

Secretary Taylor then presented his report.

The report showed total active membership June 1908, 828; new members during the year, 74; total June, 1909, 902. Associate members, June, 1909, 19; honorary members, June, 1909, 40. Total membership, 961.

The secretary's report showed the following financial transactions during the year: Receipts, $6,319.79; expenses, $6,248.29; balance, $71.50.

The secretary's report stated that H. A. Houston was filling the Joseph T. Ryerson scholarship at Purdue University in an excellent manner; also that R. S. Booth, son of the Master Mechanic of the Carolina & Northwestern, was entitled to one of the scholarships which will be vacant at Stevens Institute in June, 1909.

The secretary's report referred to the deaths of the following active members: R. H. Soule, President 1896-7; G. W. West, President 1902-3; G. W. Butcher, J. W. Roberts, A. B. McHaffie, M. J. Lynn and H. M. Minto.

The secretary further stated that under the will of Emma A. Tillotson, deceased, widow of Luther G. Tillotson, of New York, the American Railway Master Mechanics' Association had received a legacy of $5,000. The Executive Committee had decided to receive and invest this, the interest to be applied to such investigations as the Executive Committee may recommend to the association to defray the cost of such investigations; the form of investment to be left to the treasurer, subject to the approval of the Executive Committee.

The secretary then presented the report of the treasurer, which showed a balance on hand June 16, 1909, of $1,283.73.

The action of the Executive Committee in fixing the dues of the association for the coming year at $5 per year was approved.

C. H. Hogan, representing the Traveling Engineers' Association, was extended the privilege of the floor during the convention.

The following committees were appointed: On Auditing: L. R. Pomeroy, O. M. Foster and D. F. Crawford.

To report on the recommendation in the president's address: L. G. Parish, F. H. Clark and B. P. Flory.

On Obituaries: G. R. Henderson on R. H. Soule, P. H. Minshull for George W. West, J. J. Ryan for George W. Butcher, B. D. Lockwood on J. W. Roberts, W. H. Wilson on M. J. Lynn, .G. R. Joughins on A. B. McHaffiie.

Correspondence and Resolutions: G. M. Basford, L. G. Parish and C. A. Seley.

Henry Schacks was elected an honorary member, and E. C. Schmidt (Univ. of Ill.), an associate member of the Association.

The President—Is there any more new business to be brought before the Association?

C. A. Seley (C. R. I. & P.)—There will appear before the Master Car Builders' Association a committee from the Railway Storekeepers' Association to urge the passage of a resolution calling for a committee in that Association to cooperate with a similar committee in the Storekeepers in the matter of arranging systematic specifications for lumber. It has been thought desirable that this Association be also represented by a committee to take part in this consideration, and I therefore move the following resolutoin:

"Whereas the wide variations which exist in the specifications for different classes of lumber which have been adopted as standard by the individual railways, departing as they do in many cases from the established commercial customs of the lumber manufacturers, and as there is a lack of standard lumber grades to meet all of the railway's requirements, tending to increase the difficulties of the railways in securing an adequate and uniform supply of lumber of a suitable quality, promoting differences between the manufacturers and the railways in regard to the proper inspection, and to increase the price which the railways are obliged to pay for their supply of lumber;

"Therefore be it resolved that a committee be appointed to act jointly with similar committees from other railway associations to formulate recommendations as to lumber grading suitable for railway use, as an official description of the different qualities or grades of lumber to be used for all railway work, and that in determining upon the proper quality of lumber to be used for any purpose, each member of this Association may be guided by said standard grading rules and may select from among the different grades therein described such quality as shall be considered best adapted for the particular purpose in view and may arrange with the purchasing and supply departments to place their orders and inspect the lumber in conformity therewith."

I move the adoption of that resolution, the committee to be appointed after the committee has been appointed in the Master Car Builders' Association, in order to have a good combination.

Motion carried.

D. F. Crawford (Penna.).—As most of us know there is a bill before the Federal Congress in regard to the inspection of locomotive boilers. I think it is a subject we are all interested in, especially as to getting uniform information regarding the subject of the inspection of locomotive boilers; and I would like to move that a committee of this association be appointed to report here Friday morning as to whether there is any action this association could take to assist the railroads in getting data on the subject, or any other information regarding the bill.

The President—I will appoint Messrs. Crawford, Manchester, McIntosh and Curtis as members of the committee.

The first report to be presented was on Mechanical Stokers. Mr. Rumney, chairman of the committee, was not present, and Mr. Crawford presented the report.

Discussion on Mechanical Stokers.

E. D. Nelson (Pennsylvania)—The committee gives in the table the fuel hours per ton mile, which, I presume, means the fuel per hour per ton mile. We are familiar with the fuel per ton mile, but it is not quite clear to me how the hourly factor is of value in that connection. The same thing applies to the combustible hours per ton mile.

G. R. Henderson—On page 4 of the report reference is made to the increase in tractive power of large locomotives and in the increased fuel consumed per mile to maintain this tractive force, and that a successful automatic stoker should render locomotive firing more attractive and raise the standard of the service.

When this subject was discussed last year, we called attention to the fact that a great many of the large modern locomotives were not giving returns in hauling capacity commensurate with the size and cost of the locomotive, apparently on account of the impossibility of one fireman getting sufficient coal into the firebox, and we advanced the argument that an automatic stoker would be necessary in order to realize the full benefit of such large locomotives. Since the last meeting we have had occasion to estimate the probable advantages on a large Mallet locomotive of an automatic stoker, and we thought that the figures might be interesting to the members of this associaion.

The division to be covered by this locomotive was 100 miles in length, against the traffic, of which there is a 0.5 per cent. compensated up-grade 40 miles long, and the remaining 60 miles are practically all down-grade. The locomotive upon which our figures were based was of the Mallet type, having a tractive force of 65,000 lbs., which would enable it to haul at slow speeds 4,200 tons up the 0.5 per cent. grade, on which our figures were made, ascending the grade at 6, 10 and 15 miles per hour. It was assumed that one fireman could handle 3,000 to 4,000 lbs. per hour throughout the 40 miles up-grade, or that two men, by working in relays, would be needed to supply 6,000 to 8,000 lbs. an hour, but for quantities over this a mechanical stoker would be necessary. As the grate area of this locomotive is 78 sq. ft., it will be seen at once that it would be possible to burn from 12,00 to 15,000 lbs. of coal per hour if found desirable or necessary. In making these figures, the following units were assumed: The actual time between terminals would be 20 per cent. greater than the running time, this allowing for lay-overs, etc.; the down-hill speed would be 30 miles an hour; the cost of the coal was taken at $1 per ton and of water at 5 cents per thousand gallons. Allowances were also made for repairs, renewals, pay of enginemen, handling at terminals and interest on investment. It was considered that there would be 5 hours consumed in turning the engine at the terminals of the division, and the cost of train supplies, car repairs, pay of trainmen, etc., were included, so that the figures show the actual cost of operating the train, but, of course, do not cover the general expenses of superintendence, maintenance of track, buildings, bridges and other data except the usual train operation, which figures really comprise only about 40 per cent. of the total cost due to all expenditures of the road. The cost was figured out for the total movement on one trip, also for 1,000 ton miles of train back of engine, including the weight of the cars and ton miles per hour performed by the engine, with the allowance of five hours for turning, as above mentioned. These figures, therefore, enable one to see at a glance the variation in cost and capacity due to one or two firemen, or to a mechanical stoker. The figures are given below:

Speed, up hill, m. p. h.....	6	10	10	15	15	15
Cost, movement, per trip.	$79.93	$82.35	$62.18	$87.05	$67.00	$50.38
Cost, per 1,000 train-miles	.19	.20	.21	.22	.22	.25
Ton-miles, per hour......	27,300	34,400	24,600	38,000	28,300	19,000
Weight of train, tons*....	4,200	4,200	3,000	4,000	3,000	2,000
Method of firing..........	1 fireman.	2 firemen.	1 fireman.	Stoker	2 firemen.	1 fireman.

*Train back of tender.

It is seen therefore that by far the greatest amount of work done by the engine is with the use of a stoker and running up hill at a speed of 15 miles per hour, the assumption being in this case that there would be 15,000 lbs. of coal burned per hour, while running up the grade. The cost per 1,000-ton miles is less than if we attempted to run with half the load at the same speed up hill with only one fireman, and it is only 3 cents greater than if we went up the hill at six miles an hour with a single fireman. At ten miles an hour two firemen would give nearly the same capacity of the locomotive and at somewhat lower cost, but it is rather uncertain whether two firemen can be managed satisfactorily on a locomotive, and where a large amount of traffic is to be gotten over the road, the advantage of being able to push the engine to its full capacity and at a fairly high speed is shown without any uncertainty.

At 15 miles an hour, considered economical speed for general operation, one fireman could handle 19,000-ton miles at a cost of 25 cents, two firemen 28,000-ton miles at a cost of 22 cents, and the stoker 38,000-ton miles per hour at a cost of 22 cents. You will see, with a slight additional increase or cost of stoker over one man at slow speeds, a much larger amount of ton miles can be attended to, and at speeds of 15 miles an hour the cost of the stoker is considerably less than that of one fireman, and double the amount of ton mileage can be made with the engine.

The President—The Alton road has been experimenting, I believe, with a stoker. Mr. Maher, of that road, is present, and we would like to have any information on this subject which he can give us.

Mr. Maher—I would rather hear first from some of the representatives of other roads who have been on the Alton during the last 60 days, following the engines equipped with the stoker. Mr. Smith, of the Boston & Maine; Mr. MacBain, Mr. Webb and Mr. Foster of the New York Central Lines; Mr. Gossett, of the Iowa Central; Mr. Clark, of the Minneapolis & St. Louis.

C. E. Gossett (Ia. Cent.)—I witnessed the action of the stoker of the Chicago & Alton, and wish to state frankly that I consider it beyond the experimental stage so far as the principle is concerned. On the trip that I made out of Bloomington the consolidation engine was rated at 2,800 tons. The engine on this day had 3,300 tons, or 500 tons more than the rating, using mine-run Illinois coal. The fireman experienced no troubles whatever in keeping the engine hot, in fact he was at no time hurried about his work. The engine made an average speed of 17 miles an hour for a distance of 88 miles. In that 88 miles the fireman moved his grate slightly three times. On arriving at the terminus the fire was apparently as good as it was when we started, and the variation of the steam pressure throughout the trip was not to exceed 4 lbs. at any place. Another important factor to be considered in using the stoker is when the engineer started to shut off for drifting or station stop, on account of the fire being in such perfect condition there was very little blowing off, and, as stated before, when we arrived at Joliet, after being on the road about seven hours, the fire appeared to be in such condition that it could go on several times that distance without cleaning. I consider the stoker a complete success.

John Tonge (M. & St. L.)—I was with Mr. Gossett on the trip referred to, and I think he omitted the most important part of the statement which he should have made—that is that the stoker did not receive any repairs for a month and that the determination was to let it run until it would quit the service to see what would be the trouble, and how long it would run. The trip we made was successful in every respect. The steam gage did not move. As Mr. Gossett said, the normal rating was about 2,800 tons and they had 3,300 tons for that trip. I am positive that is about 200 tons short of what the engine could have hauled. They had increased the nozzle from 5¼ to 5¾ in., and the traveling engineer insists on another ¼ in. I was not looking much at the matter of coal saving under the conditions referred to. While it is a fact that even firing must necessarily save coal, when you can increase your tonnage 500, or 700 or 1,000 tons you can afford to use any amount of coal required by the engine, without giving the matter much consideration. After we reached Joliet, we took the Alton Limited and I noticed the same thing on the passenger engine; she fired perfectly satisfactorily and easy, the engineer with his head out of the window all the time, never bothering about anything, his ex-injector steadily working, and the run was satisfactory in every respect. The coal was going in very regularly. When we got to Chicago I examined the fire and I never saw a better. I asked the engineer how much further he could have gone with that fire. He said he could have turned back and gone to St. Louis without touching the fire.

H. T. Bentley (C. & N. W.)—As I understand it, the Strouse stoker is a hand-fired arrangement, and has no conveyor to carry the coal to the hopper. We experimented with one of these stokers in the early days, but probably great improvements have been made in that time. Our men told us at the time we experimented with the stoker that they would rather fire by hand than handle the coal from the tender into the hopper. That was 12 or 18 months ago, and perhaps changes have been made in the stoker which would overcome the complaint of the firemen. Another objection we had to the stoker was the noise it made in operation. Our men said that with the stoker on the engine, if a torpedo went off and they did not hear it we should not hold them responsible. We took that matter up with the manufacturers and it is possible they have overcome the two defects mentioned.

Mr. Gossett—In applying the stokers to our locomotives I figured on raising the deck about 10 in., that is, the shovel sheet, which will make it easier for the fireman to elevate the coal into the hopper. As it is now, it is rather laborious for the fireman to reach down to the level plane where he is standing, which is necessary to get the proper swing for shoveling by hand firing, but by elevating the deck 10 in., the fireman can stand at his post with a straight back and that is not so laborious. The present machine runs as silently as a sewing machine.

The President—I wish to say one or two words in connection with this discussion. We are getting dangerously near the discussion of specific devices in the stoker situation. I think it should be understood, when we begin to discuss devices manufactured by one concern or another, that our members should feel at perfect liberty to condemn a machine, or at least tell us of its faults, or the things that are not in its favor, as freely as they do the things that are in its favor. When we get down to the stoker question, it is necessary for our own information to discuss specific makes of stokers, and if there is anything against the stokers our members should tell us of their faults as freely as if it was not a patented or special device. We know the stoker matter has been coming along for several years, and we have felt that it is still in the experimental stage, but perhaps the successful stoker has at last been produced, but if there is anything within the knowledge of our members that makes its success questionable we should hear about that fully. There can be little doubt that the stoker is going to be an important feature with us, especially in view of the introduction of new and larger types of locomotives, which are so generally coming into use. I would ask anyone who has any information on this question, or anyone who has experimented with the stoker to give us the benefit of his experience.

Mr. Maher—In the case of the first stoker we put on, we took it off the engine at the end of four or five miles—it did not work satisfactorily. We connected it up to a temporary firebox and worked on it for almost a week and got it operating all right. We then put it back on a locomotive and it has been in constant use ever since, about 60 days. We have now 12 engines equipped and two more engines being equipped this week and five more engines to be equipped next week, which will make a total of 20 engines. We have had some little trouble with the type of packing used on the piston in the end of the stoker where the steam cushions. When that gets to blowing it takes away the cushioning in the cylinder, and we have had one or two failures on the road, but we are putting a tandem metal packing in the piston now, which we are satisfied will overcome that difficulty. One other feature is the condensation from the steam pipe will have to be taken care of and kept out of the cylinder. We are overcoming that by having a valve to let the water out.

We ran a consolidation engine, 22 in. x 30 in. cylinder from Brighton Park to East St. Louis, a distance of 276 miles, without cleaning the fire. There was practically no stop, the train going through in 12 hours and 25 minutes. On the arrival of the train at the terminus the road foreman and the roundhouse foreman advised that the fire was in good condition and the engine could have gone over another division without attention to the fire. We have had one engine in particular working between Chicago and Brighton Park, on heavy tonnage trains, where we handled 3,500 tons, and we have made that distance of 122 miles from Bloomington to Brighton Park in from 7 hours and 15 minutes running time to 9 hours, as conditions may warrant.

We have also used the stoker on a Pacific type passenger engine, 23 in. x 28 in. cylinder, and have handled as high as 114 cars without any difficulty, maintaining 200 lbs. easily with the stoker. If no unfavorable developments occur it is the intention to equip all our heavy locomotives with them.

F. H. Clark (C. B. & Q.)—It has been hoped by many of us who have been watching the development of stokers that when we finally found a satisfactory stoker, one that would keep the coal fed properly, and possibly make a saving, we would also have the advantage of smokeless firing. I should be glad to know what kind of a record the Strouse stoker is making as to smoke.

Mr. Maher—I do not think you are going to get smokeless firing with a stoker to the extent we hoped, for the reason that it is so different from hand firing that there will be more continuous production of smoke in the firebox than where the fireman puts in a load and lets it burn out at intervals. The stoker spreads the coal into the firebox all over the grate surface, and much of that commences to burn before it reaches the surface of the fire. For that reason I do not think we will get away from smoke.

W. McIntosh (Central of New Jersey)—Can brick arches be used in connection with mechanical stokers?

Mr. Maher—We do not use the brick arch. It would depend on the height of the arch from the grate surface.

The President—With the Strouse stoker is the firing dependent upon perfectly uniform distribution all the time?

Mr. Maher—It is a uniform distribution.

The President—You cannot vary this spray?

Mr. Maher—You do not need to. It distributes the coal over the surface evenly.

The President—But suppose you want to direct a little extra coal to one place, can you do that with the stoker in the back corner, for instance?

Mr. Maher—It will put it in the back corner of a 66-in. box, and it put it in the corner of a 75-in. box in a test. The amount is controlled by the fireman's adjustment of the lever of the stoker.

J. F. Walsh (C. & O.)—The stoker can be used in connection with a brick arch. We are experimenting with the Strouse stoker at this moment, but have not gone far enough yet. It is working with a brick arch.

Mr. Curtin (Louisville & Nashville)—I would like to ask what percentage of ash the coal on the Alton contains. I should judge that the stoker is burning some very good coal. How does it work when the firebox begins to fill with ashes and other impurities?

Mr. Maher—We haven't experienced any trouble with the coal we are using, through having the firebox fill up. Of course, local conditions will enter into the efficiency and practicability of the stoker in different parts of the country.

D. R. MacBain (N. Y. C.)—Two weeks ago I made a trip of 122 miles on a consolidation engine on the Alton. The engine was 22 in. x 30 in., and had 33 sq. ft. of grate surface. We had 3,305 tons, 63 cars, and made the run, deducting delays, from Bloomington to Brighton Park, 122 miles, in 6 hours and 17 minutes. In starting out we smoked, and at the first stop I observed that the fire was very light, only 2 or 3 in. in some parts of the box. Then the fire was built up to 6 in. all over, and from that station on the engine seemed to work perfectly. It was absolutely within the control of the fireman to place the coal where he wanted it. The last 40 miles, from Joliet to Chicago, was at a speed of 22 miles an hour, and when we got to Chicago I again looked at the fire, which had not been touched from the start, and there was very little ashes in the pan and the fire was clean and ready to start back with. Considering we had burned about 20 tons of coal in that section of the country and had an abundance of steam all the way, I consider it a very good record.

Mr. Crawford—The whole stoker situation as I see it resolves itself now into a fairly successful overfeed stoker, and experimentation with two designs of underfeed stoker, One of the underfeed stokers is on the Burlington and the other is being tried under my direction. It has been in service on one of our freight engines, in the hands of a regular crew, for a little over two months and made in that time about 6,400 miles.

The stoker has what I call a seventy-five per cent. job. We have got to fire about twenty-five per cent of the coal by hand. On a through train the amount of hand firing is reduced; on a slow freight, put on sidings from time to time, the fire must be built up by hand. The only point we have actually determined regarding the stoker has been the smoke proposition. We find with readings on Ringelmann's charts that a hand-fired engine with proper tonnage for its class, fired as carefully as we can, makes an average smoke reading of 2.7. The stoker engine on a run where eighteen per cent. was supplied by hand, made a smoke of 0.9.

It is the intention to put an engine equipped with this stoker on the testing plant at Altoona, and also some other stokers as opportunity offers. We therefore hope to be able to give the committee and the Association next year more data as to the working of these stokers.

The President—It is a standing committee, Mr. McIntosh.

The next report was on revision of standards.

Discussion on Revision of Standards.

The President—It will be necessary to take some action on these matters. The first few paragraphs refer chiefly to clerical errors and can be handled by direct vote of the Association, without ballot.

The paragraph regarding vertical clearance in journal bearings would have to be handled by a committee, or by a communication with the Master Car Builders' Association, for the sake of obtaining uniformity.

The letter from the Association of American Steel Manufacturers demands our action. We should take that matter up seriously and see if we cannot get away from the terrible muddle in the sheet metal and wire industries.

Mr. Wildin—Regarding the change of clearance from $\frac{1}{16}$ to $\frac{1}{8}$ in., that was put in at my suggestion, and I made the same suggestion to the committee of the Master Car Builders' Association. I move that this matter be taken up with the executive committee of the Master Car Builders' Association, and that we recommend the adoption of the change.

Motion carried.

The President—What action do you wish to take upon the letter of the Association of American Steel Manufacturers?

F. H. Clark (Chicago, Burlington & Quincy)—I do not fully understand what they are recommending. Their recommendation, I suppose, is made clear from the booklet which was to accompany the letter, but which we have not here.

The President—Mr. Wildin has not a copy of the booklet. Mr. Rosing appears to be the only member of the committee that has a copy.

Mr. Crawford (Pennsylvania Lines)—I have not a copy of the booklet, nor have I seen it; but as I understand this proposition it is this: We have in the master mechanics' decimal gages something we call 0.125. As a matter of fact, the manufacturers make it 0.135, and therefore when we order 0.125 we get 0.135. I understand the idea that has been presented to me was that we should change our method of ordering and order 0.135. We agreed in one of our specifications recently, where we stated we wanted 0.125 used. As a matter of fact, it would be a special size for us. The manufacturer was making 0.134, and therefore he wanted us to change these specifications and order the commercial product.

The President—It appears that the Association of American Steel Manufacturers has decided on certain sizes which are to be ruled.

Mr. Crawford—That is my understanding.

The President—But they are not to call for arbitrary gage names, but 0.135, so that when we order a wire we are to know that we get a definite size, and not a number. It appears to me we would be doing a useful thing in co-operating with them in getting this new gage used.

Mr. Seley—Should we not change our gage to correspond to their standard sizes?

G. R. Henderson (New York)—I was chairman of the committee that originally proposed that gage and also a member of the general committee. The question was taken up with the manufacturers at that time and everybody agreed in the suggestion to co-operate with the work; so if the manufacturers are to take up the sizes I think they are remiss too. I think the manufacturers should help to make those standard sizes if the members order them. I believe they still order by gage instead of the decimal size.

The President—Isn't the trouble due to the fact that the members of the Master Mechanics' Association have only to a slight extent adopted their own gage?

Mr. Henderson—That is the trouble. We started this and then did not carry it out.

The President—As we have not carried out our own recommendation and as this American Association of Steel Manufacturers is an important body and able to control the rolling and the drawing mills, should we not co-operate with them?

Mr. Henderson—I move that a committee be appointed to reply to this letter of the American Steel Manufacturers' Association, and request them to appoint a committee to meet and discuss it.

Motion carried.

The President—That will be a recommendation to the Executive Committee. There will be two more recommendations of this committee on which some action should be taken. I suppose the last portion of the report, in relation to the appointment of committees, should be referred to the Executive committee for action.

Mr. Maher—The subject of safety appliances for locomotives is something we should look into very carefully. A number of states require that a road engine temporarily in switching service should have suitable steps, grab irons, etc., and we have not decided which is the best step to apply to a road engine temporarily in switching service. We frequently have to put a road engine in switching service where we have few facilities for taking the pilot off.

Mr. Johnson—I move that the suggestions of the committee on the Revision of Standards dealing with this subject be referred to the Executive Committee for their consideration.

Motion carried.

The report on Motor Cars was then presented.

Discussion on Motor Cars.

After reading the report Mr. Fuller said that it was thought, as this work was retarded, and the committee was not able to get out circulars, that a good deal of information could be obtained from the members on the floor to-day, which, if the committee were continued, or a new committee appointed, would help the committee in its work of preparing a final paper for next year.

C. A. Seley (C., R. I. & P.)—The Rock Island has not gone into the gasolene car, except in the case of a very small type of car which we have under experiment at the present time. It is not exactly a motor car, but a special type of car for a small special situation.

For branch line operation we have tried two different types of steam cars; the result of one experiment not being satisfactory, the car was returned. We have at present a steam motor car that is more advanced, but I am not prepared to say that we have obtained absolutely satisfactory results at this time. It seems to me the success of a steam motor car or the gasolene motor car depends upon operating conditions rather than on mechanical features, and thus far the Rock Island has found difficulty in placing a motor car where it could meet with continued service that would be satisfactory from the transportation standpoint.

The President—I might say, gentlemen, that we have had some experience with the motor car. Before we got a motor car, the passenger business of the road depended on our developing a motor car. After we got a motor car we could not find any place in which we wanted to use it. That has been our experience for the last three years. Personally, I do not believe, unless the gasolene motor car can be made a satisfactory car, that there is anything in a motor car for railway service. The whole matter of the combining of a steam engine in a passenger coach is, to my mind, radically wrong. The proper place to put a passenger coach at night is in the passenger car yard. The proper place to put a steam engine at night is in the roundhouse. If you put a passenger car in the roundhouse, which is full of smoke, the car becomes dirty and grimy and you have got to send your car cleaners from the car yard to the roundhouse to clean the motor car. If you put the car in the passenger car yard, that means that you must send your men from the roundhouse to the passenger car yard to repair the engine.

There is nothing radical about a motor car. It is simply a small steam engine; it takes about as much coal per mile as any other engine, possibly a little more; it is easier to fire, because it is small; and its capacity is limited.

We have had cases where our people thought the motor car should pull two or three trailers with ease, and the car will not do it. It is simply applicable for a light service, which, in most of our conditions, which are, of course, rather different from those further south, can be handled by mixed trains better than they can by motor car service. You must, in the majority of cases, run three men, an engineer, a fireman and a conductor, and it seems to me that a very much better solution of the question is to build a little tank engine with a baggage compartment on it, in which you can get a fireman to attend to the baggage and let the conductor look after the tickets. We have prepared designs for such a car, and now await the passenger department to find a place where they want to run it. The motor car question is going along very quietly with us and we are not spending any money on it.

Angus Sinclair—I have just returned from a trip I made to Omaha, where I examined the motor car which the McKeen company is building for the Erie. I have had considerable experience with the running of automobiles, which is a good way of working up towards gasolene railway motors. I have found gasolene automobiles as nearly perfect as anything you could expect in the mechanical line. One peculiarity about the gasolene motors was that the designers seemed to think that they would never need any repairs. They designed them so it would take you half a day to get a screw out—one of the kind of screws that is always getting loose. But I find in the later cars that they have learned a good deal of what the locomotive men did in the early days; namely, that it was good to make a machine which was easily repaired.

H. W. Jacobs (A., T. & S. F.)—About two months ago the Santa Fé, after looking around for cars, concluded to get two of the McKeen motor cars. One was put into service in Southern California, making the loop running from San Bernardino. I had occasion to go out there some two or three weeks ago and both the master mechanic and the transportation department spoke very favorably and enthusiastically over the performance of the car. It has developed a profitable passenger business, and we have had very little trouble in operation. We have one in Southern Kansas and it also has developed a profitable passenger business and the repairs have been low.

C. B. Smith (B. & M.)—It seemed to us on the Boston & Maine a short time ago that the motor car ought to have a field on such a road as ours, where the distances are short and a large number of branch lines intermesh with each other. Some study was given to the subject, but under the conditions of many grade crossings, etc., it did not appear that there would be any economy in the operation of such a motor car or cars. With the competition of electric service it is desirable that such motor cars should run frequently, which, of course, they cannot do under their present design. It appeared to be an essential feature of such a car that it must be turned around, and hence the maintenance of existing turntables, or new and larger ones, or the installation of Y's in order to turn the cars. There seems to be no motor car developed that can be operated from each end of the motor, and in my opinion that will be an essential characteristic of the future successful motor car, at least under such conditions as exist in some parts of New England. I do not recall having seen any allusion made to this condition, but think it would be well for the committee to take it under consideration. Further, there does not seem to be any diminution of the number of operators possible, especially under state laws, whereby the cost of operation could be reduced.

E. I. Dodds (Erie)—We have been operating on the Erie one of the McKeen motor cars for about a year. We ran it from Newburgh to Turners' Junction, about 14 miles. The grade going from Newburgh is very steep, being at some places 90 ft. to the mile. The car always ran on schedule time, and its operation was very satisfactory. It is operated now on the Rochester division, giving entire satisfaction. It has been running, in all, for about two years. I think the future of the motor car is great. We have been working for eighty years on the steam engine, and we are just beginning to get about it right; motor cars, those of the gasolene type particularly, are rapidly reaching a point where the difficulties of operation are being solved, more rapidly in the case of the gasolene than the steam car.

Mr. Fuller—The remark was made that the passenger department of one of the roads, after it got a motor car, wanted it to haul a train. What Mr. Vaughan said is true, the motor car is not built to haul a train. It will haul a trailer, but if you are going to put a train on the motor car you had better put a steam train on the road in the usual way. It is a fact that the motor car fails, and when anything happens to a motor car the statement is made "She is going to pieces." If it were a locomotive which had the difficulty, nothing would be said about it and the locomotive would be sent to the roundhouse for repairs and another locomotive would be put in. The motor car must receive attention. You cannot make runs from 7 o'clock in the morning until 10 o'clock at night expecting the car to make the same run the next day and do this for 365 days a year without giving the car some attention any more than you would think that your automobile would be in a position to do this work. You must give the same consideration to the motor car that is given to the steam locomotive, and if you do this there is no reason why you should have any particular trouble. The motor car, however, should be put on branch lines or in sections where the greatest return for the money will be made. It should not be put in between two or three express trains.

The topical discussions which were to be taken up next were postponed to the following day.

E. D. Nelson (Pennsylvania Lines) then presented his paper on Bank vs. Level Firing.

Discussion on Bank vs. Level Firing.

The President—I consider we are privileged to obtain a paper of this sort. It gives us information that a few years ago we could not have obtained by any means, and it is important in enabling us to get reliable information as to the value of these different methods of firing.

J. F. De Voy (C., M. & St. P.)—It appears to me that the question of bank or level firing depends entirely on the design of the firebox. A level firebox will require more of the level firing, and a sloping firebox will require what is called here the bank system. About five years ago, when we were beginning to construct heavy locomotives with narrow fireboxes, my attention was first directed to the so-called bank firing. Level firing in that boiler appeared impossible. I have seen the best firemen fail in their efforts to fire that boiler by the level system. We finally came to the conclusion that the way to fire that boiler was to drop the coal just inside the fire door and let it distribute itself, and it will distribute itself. The same plan worked successfully on a 60-in. wide box with about the same drop.

In regard to the effect of heat at the fire door on the fireman, that is governed entirely by the distance of the top of the grate from the bottom of the fire door.

H. T. Bentley (C. & N. W.)—I do not entirely agree with Mr. DeVoy. I do not think the design of the firebox has so much to do with it as he says. I think practically the thing having the greatest effect on the matter of the bank or level method of firing is the character of the coal used. I have known engines to be fired with the bank method of firing, which was the only way you could handle them. That was 30 years ago. In Great Britain, with the South Wales coal, the only way to feed an engine was to fill the firebox and have the coal taper off toward the front, while Northwest Wales coal used this way would kill the same design of engine. Therefore, it is not so much a question of the design of the engine as the kind of coal you are using.

C. E. Chambers (Cent. of N. J.)—I quite agree with Mr. Bentley. I did all my firing in the Middle West, and was considered a good fireman. I always fired with the level method. I came to eastern roads in 1901 and found that the men were firing with the bank system. I thought I would break that up and have the men fire by the level method; but the engines would not steam. It was necessary to fire with the bank system to get successful results.

Mr. Crawford—To give the association a little idea of what led to these tests: We have on the Pennsylvania Lines, East and West, about 1,800 engines. A great majority of them are fired with the level firing. They are fired with all of the coals used on the lines in the eastern territory, out to the extreme western end of the road, including Indiana and Illinois coals. But of the 1,800 engines I think I am quite safe in saying that 1,600 of them are fired with level firing. The level firing has always been so successful in those engines that when some of our men proposed to fire them with bank firing our road foreman of engines objected to it. Our firemen had been brought up to the other way of firing. The attempts to fire them were met with difficulties from a number of kinds of coal. One fireman on his trip would use a bank fire and the other a level fire. The road foreman of engines brought the question to me. I was born a level fireman, just as I was born a Republican, and I decided that level firing was the proper way to fire a locomotive, but I was not satisfied with my own decision and I asked Mr. Gibbs if he would try to test it out on an engine. In one test it represents a coal used in the East and the other a coal from the West, used on our western lines.

Mr. Chambers—Is there any noticeable difference in clinkering between level and bank firing?

Mr. Johnson—In these tests we did not obtain the amount of clinker and ash separately as we had in other cases, but from general observation I should say there would be no difference.

This subject was not entered into for the purpose of trying sloping and level grates, or to determine questions as to large or small ratios between heating surfaces and grate areas; but it was a definite question to settle, as Mr. Crawford has explained. How the tests affect other modifications of grate area and heating surface, we cannot say positively, but from general observation, with this test, and the conditions there, and with the type of locomotive used, as well as the Atlantic locomotive, and over 60 different kinds of coal, tried at different times, it seems to be the general conclusion that each square foot of firebox should give a definite proportion of work. The coal per square foot of grate is larger in front than in the back, and we think that with these forms of grate which we have used, with uniform burning over the surface of the grate, and, therefore, approximately, level firing, they produce the most desirable results.

The President—We hope the splendid results supplied on this occasion will be followed by others in similar papers from the Pennsylvania.

Proceedings of the Second Session, Thursday, June 17.

President Vaughan called the meeting to order at 9:35 o'clock and announced the first order of business to be the report of the Committee on Castle Nuts.

J. F. De Voy (C., M. & St. P.) presented the report.

The secretary then read a communication from W. L. Austin, a member of the committee, saying he approved the report with the following exceptions:

(1) The nuts should be U. S. standard in thickness, not more.

(2) The thread should be turned off the outer end of the bolt, but the bolt should have a bearing of the full thickness of nut, in order to utilize all of the thread. (This incidentally avoids a little crevice in the nut for the accumulation of dirt.)

(3) There should be but one style of cotter, namely, the common cotter pin. If we use a solid taper pin we lose the lock nut feature, as such a pin is liable to jar out.

The following telegram from John Player, a member of the committee, was read:

"Report approved except following: Plate 3A, 1⅝ in. and 2¼ in. nuts; dimensions, H1 should be minus 1/16, and H2 plus 1/16."

Discussion on Castle Nuts.

Mr. De Voy—Referring to the size of cotter, the committee thought best not to recommend any particular kind of cotter pin, but if it was desired to use the Player pin it could be done.

The President—We ought to take some action on this report. The subject seems to me a very important one simply from the point of view of adopting a definite standard for these nuts, so that we may be able to induce manufacturers to put down machinery for making them and see if they cannot be made more cheaply in quantities than is possible when only a small number is manufactured. Before disposing of it, the matter should, I think, be referred to a ballot of the association, but before referring it to letter ballot I think the minority report should be considered. Mr. Austin's principal objection, as has been told you by the secretary, is to the thickness of the nut. He considers that the thickness of the nut should be the United States standard thickness. The committee, on the other hand, has recommended a greater thickness than the United States standard for the regular sizes of castle nut. Mr. De Voy, do you recommend turning the thread for the outer end of the bolt?

Mr. De Voy—This committee thought that it had done all it could if it recommended a nut. That is about as far as we care to go. We do not care to say anything at all concerning the bolt, leaving that to the option of the members. Referring to Mr. Player's objection, we got just as far as near to the nearest sixteenth as it was possible, and let it go at that. There is no recommendation for finishing other than what is noted, so that it is about as near as you can get in a forged nut. We thought we would get as near to the ordinary practice as it is possible for us to do. The committee also left open the question of drilling two holes instead of one.

H. T. Bentley (C. & N. W.)—We have had a great deal of difficulty with the castle nut breaking. We had that difficulty with engines from the locomotive builders and also with nuts purchased from the manufacturers. I have taken up the matter with both concerns, to see if they would make a steel nut.

In regard to the difficulty of the cotter pin coming out, I suggest that if it is thought advisable to use a cotter pin, it be split at the ends as has been the practice frequently.

In regard to two holes, while that practice is not within the province of the committee to speak about, I think on the larger sized bolts it is absolutely necessary to have a second hole, so that final adjustment can be made, and I therefore suggest that people who go into the use of the castle nut should use the two holes, as that practice will certainly facilitate the ease with which the adjustments can be made.

F. H. Clark (C., B. & Q.)—It seems the principal point of difference between the nut recommended by the committee and that which Mr. Austin has in mind is that the committee recommend a taper nut and recess the top portion of the nut, removing the thread. Mr. Austin feels that a somewhat shallower nut would be satisfactory, but that the thread should be continued the full length of the nut. It seems to me there are some advantages in that construction, and I should like to know what objections there are to it from the standpoint of the committee.

David Brown (D., L. & W.)—The use of the castle nut will undoubtedly assist us very much, but I think we should complete the matter by giving all dimensions. I have seen nuts for a 2¼-in. bolt reduced down to ⅜ in. at the bottom, and did not wonder at them splitting. We should make a decision on what size we intend to have the nut, as regards depth, and the size of the slot, and we certainly should decide on the size of the pin, so that we will all use the same sizes, but we should bear in mind to make them as large as we possibly can. Some roads now use a ⅛-in. nut, another a ¼-in., etc., whereas if we decide they should all be ¼ in. or ⅜ in., whatever size the bolt should have, it will make the practice uniform, and duplicates can be easily obtained. We certainly should have depth enough to keep it from splitting.

The President—Mr. De Voy, do I understand the committee has recommended taking the threads off the nuts? You are recommending tapping the nuts straight through?

Mr. De Voy—Yes.

The President—The only point raised by Mr. Austin is that in the plate shown in the report, the end of the bolt is shown straight instead of threaded, which is a matter you do not deal with.

Mr. De Voy—We do not care to make any recommendation on that point.

The President—You are simply providing a standard for the nut?

Mr. De Voy—That is all. We want it to go as far toward the present practice as possible. I do not think it is in the province of the committee to say how far the bolt should go on the nut, or what the method of tapping should be. When you get home and plat these different nuts out you will find it difficult to fit absolutely within the range of dimensions you have been using on your standard nuts, that is, as far as length and depth of slot, etc., is concerned. We believe we have done as near what came within our province as was possible. In reference to the so-called Player cotter pin, that is really the one that was proposed by the American Locomotive Company. At the meeting of the committee, on account of the slight differences of opinion, particularly on the part of Mr. Player, as to whether we would have a Player cotter pin in the report or not, we finally compromised with Mr. Player in order to get home on the train that night, and called it the Player cotter pin. You can call it what you like.

The President—In order to get the matter straight, would it not be as well to take the sense of the meeting on the two points raised by the minority report?

The first point is as to whether the nut should be the U. S. standard in thickness and not more, or the thickness recommended by the committee. I know we are using the thickness recommended by the committee, and would not care to go down to the U. S. standard thickness for the majority of our castle nuts. I think if we take up that point and decide it, then we could take up the second point and make a possible recommendation.

Mr. De Voy—You will find that the reference to the U. S. standard is only as concerns the length of the nut. It does not have anything to do with the depth. It is really immaterial, and you cannot adopt the U. S. standard of length and obtain the proper depth of castle required for a cotter pin and for a taper pin. If Mr. Austin wants to use a thickness other than referred to in this report, it is up to him to do it. It is not any trouble to change the dies for that purpose. It is a question which the committee left open.

G. W. Wildin (N. Y., N. H. & H.)—I move that the association accept the committee's report as the standard of the association as to thickness.

Motion carried.

The President—The next point is a misunderstanding as to turning the thread for the outer end of the bolt, because it is not referred to in the report and is immaterial, so, if there is some objection, we will not consider it.

The third point is the style of cotter pin. The committee has shown three styles of cotter pin, what is known as the Player cotter pin, the ordinary cotter pin, and the taper pin. The point we would settle would be as to whether or not we should eliminate the Player cotter pin and the taper pin from the report, or adopt all three.

C. A. Seley (C., R. I. & P.)—I move that the cotter pin shown in plate No. 4A stand as the cotter pin approved by the association.

Motion carried.

H. P. Meredith (Pennsylvania)—Our committee reported on standard castle nuts, and has given you three strings to your bow as to the method of preventing the castle nut from turning. We thought it was advisable to do that, because we do think there are some good points in favor of the design of cotter submitted by Mr. Player, and we do know it is the desire, at least of some roads, to use the taper point. Therefore we show the taper point and lengths required for each size of nut, for the reason we have to show which method of fastening the nut or preventing it from turning was best suited in each case. We laid down our standard for the depth and width of the slot in the top of the nut within the range of these three methods of fastening. I think, therefore, that all three of the methods of fastening shown be left standing as they are. There is nothing compulsory as to what method each railway shall use. We have standardized the nut.

Mr. Wildin—When you get engines constructed at locomotive works—for example, at the American Locomotive Company's Works—they would use in the latter case what is called the Player cotter. It might be the practice of your road to use a taper pin, and you would either have to get down to small details in your specifications and require that the taper pin be used along with the castle nut, or you could not use the nuts on the engine interchangeably with your other engines.

Mr. Gaines—I think the question of the cotter pin is far from the point at issue. What we want is a standard castle nut, so that we can obtain them, if necessary, from outside manufacturers. We have a slot in the nut that will take one of three or four pins, and I think the discussion of the specific character of the pin, or the method of fastening, is out of order in this discussion.

The President—This discussion is out of order, under any circumstances, as the plate No. 4A has been accepted by the association.

A. W. Gibbs (Penna.)—In connection with plate No. 4A, will the committee explain what use it proposes to make of that thin nut with the special thread of 8 threads ranging all the way from 1 in. to 3 in.? I think most of the members will recall how much trouble there was in getting the length standardized. When you propose to go away from that standard, good reasons should be given. We have had one serious breaking away in the case of the automobile people in using nuts of small size with less threads. Here is another proposed breaking away. Unless there is a good reason for this, I think we should stick to the U. S. threads, even if we have to make use of liners.

Mr. De Voy—That was provided to take care of the bolt which was revolving or in motion, in which there was a possibility that another style of thread would be used. I was in hopes that the member of the committee from the Pennsylvania Railroad would have answered that, because it is really one of the pins he requested. It is simply designed to take care of special cases.

Mr. Gibbs—There should be some way of explaining what you have in mind, because the use of that, I imagine, might cause serious confusion.

Mr. De Voy—The point is well taken.

Mr. Wildin—I move that we eliminate all dimensions referring to the bolt on plate No. 4A and also all those referring to special threads in the nut on the same sheet.

Motion seconded.

Mr. Seley—I hope that motion will not prevail. I believe that there are very many locomotives in the United States with thin crank pin nuts that are United States standard threads. Here is an opportunity to get together. So far as I have studied the question the number of threads is quite acceptable. I believe the table should be maintained as it is.

C. B. Smith (B. & M.)—In reference to the use of United States standard threads on crank pin nuts it has been the practice of the Boston & Maine on all new work to apply the United States standard threads.

Mr. Seley—On crank pin nuts?

Mr. Smith—Yes.

Mr. Seley—How thin?

Mr. Smith—The thickness of ¾ in., or possibly ⅝ in. There was an insistent demand that that should be done, and in introducing special taps it would be required in tapping the nuts.

F. F. Gaines (Central of Georgia)—I agree with Mr. Seley. I think we must have these special nuts. While there may be an exception or two to the United States standard on thin nuts, the majority of the roads are using standard nuts on cross-head pins and knuckle pins of finer thread. I think we should keep it in.

F. H. Clark (C. B. & Q.)—I agree with Mr. Gaines, and Mr. Seley, that fine threads are probably desirable for certain parts, but I do not believe that we should adopt the recommendation to change our pitch to conform to the recommended standard. I presume the pitch and diameter varies considerably on different railways, and I believe that we should stick to what we have, whether it is standard or not, rather than make a change. I know that would be true in our case, and would probably be true in the case of other railways.

Mr. De Voy—I do not understand the reason for this discussion. We have tried to cover every case we know of, so that you will not be tied up in any way relative to the thread. If you look at your locomotives you will find that you must have special threads. You will not do away with these special threads. Why not be consistent and vote for just what you will do when you get home? I do not understand this discussion relative to the number of threads. You are not tying yourself up in any way in regard to the number of threads, and there is nothing in this report that the committee has not argued pretty well. It will suit you all if you will try it for a few years.

Mr. Seley—It appears to me we are trying to start a standard for the manufacturer, not necessarily the railway standard. If the manufacturers line up their practice and we can get castle nuts of approximately the standard shown in the plate and have thin castle nuts and other bolts where they want a case-hardened nut completely finished by the manufacturer, we would probably get a better price and better delivery on a standard than on an odd thread. I do not care if three-quarters of the railways do not follow it. If the other quarter does, they will get the advantage with the manufacturer of standard material, and I believe in starting with a quarter if you cannot start with three-quarters.

Mr. De Voy—I move that the report of this committee as a whole be referred to the association for letter ballot.

The President—That would have to be an amendment to Mr. Wildin's motion.

Mr. De Voy—I move it as an amendment.

M. D. Fraley (L. S. & M. S.)—In seconding the amendment to the motion, I would say that I believe the committee has presented to us a very complete report on the question of castle nuts. I believe that the subject is fully covered and it is within the province of each railway to use whatever standard they see fit. I believe they will make no mistake in adopting the first standard recommended, and they will find it is possible to use that particular dimension in every bolt on the locomotive, with the exception of possibly a few knuckle joint pins or crank pin nuts. If those sizes are required specially, it is within the province of the user to so order them. I believe the convention will make a mistake if it does not accept the report of the committee as presented.

The President—Mr. Wildin made a motion to eliminate from plate No. 4A all dimensions referring to the bolt, and also all reference to special threads in the nut on the same sheet. There is an amendment to the motion, proposed by Mr. De Voy, that the report as a whole be referred to the association for adoption as standard. That is hardly an amendment. I think it would be really better to vote on Mr. Wildin's motion first and settle that.

Mr. De Voy—I am going to vote against Mr. Wildin's motion, but I do not like to vote against it all, so that if you can get at it by some other method it would be just as well.

Mr. Wildin—Mr. President, I just want to say one word more if I am not out of order. My object in making the motion was this: We have been going on for a number of years establishing standards in ordinary nuts for this association, and we have never got down to specifying the special nuts. Now, when we come to the castle nut, we are all right in going so far as we can in specifying it for a U. S.

standard nut. When we go further than that, we are going further than we ever went in the ordinary nut. I do not think anybody will pay any attention to it, anyway, and I see no use in burdening our reports with stuff that nobody will pay any attention to when we get home.

The President—In order to keep this matter straight, we will divide Mr. Wildin's motion into two parts and vote first on whether the number of threads per inch for specially thin castle nuts should be accepted by the assocaition and retained in the report.

The President—The next portion of Mr. Wildin's motion is as to whether we should retain the dimensions of the bolts. Mr. Wildin moves that the dimensions of the bolts should be taken out of the report.

Motion defeated.

Mr. De Voy's motion, that the report as a whole be accepted and referred to letter ballot of the association for adoption as a standard, was then carried.

Secretary Taylor then read the report on Safety Valves.

Discussion on Superheaters.

Mr. Seley—It is desired to submit some information obtained since the Superheater Committee report was printed. This consists of the results of some passenger engine tests made on the Illinois division of the C., R. I. & P. this year between April 18 and May 11. This division is 181.2 miles between terminals, no heavy gradient nor curvature.

The trains were Nos. 11 and 6. The average total time was 4 hrs. 24 min., and the average running time, 4 hrs. 9 min. The average number of stops was 7, and the average speed, actual running time, 43.7 m. p. h. The average number of cars in trains was 7.58 and the average weight of trains 425 tons.

The coal was sacked and weighed and the water measured by tank calibration and three round trips ran with each engine. There were five engines tested, two with superheaters and three non-superheater simple engins.

Test engine No. 4 was a new Pacific non-superheater engine which had just been received on the road, in very good shape, and she gave a practically perfect performance. The water economy was 1.62 lbs. of water per ton mile, which figure, for the purpose of comparison with the other engines, was taken as 100 per cent. The pounds of dry coal per ton-mile were 0.1826, also rated at 100 per cent. Test engine No. 1 was an Atlantic type, with superheater, that had made 62,347 miles before the test was made. Its performance was 1.36 lbs. of water per ton-mile, or 84 per cent. of the performance of the base engine. Due to the poor condition of its boiler, on account of the time it had been running, 62,000 oddmiles, the performance in coal was 0.1816, or 99.4 per cent. of the base engine performance. Test engine No. 2 was a Pacific type superheater engine which had made 35,504 miles before the test. Its record was 1.37 bls. of water per ton-mile, or only 0.01 of a pound difference from the first engine, and its percentage of base engine was 84.5. Its coal performance was 0.1655 lbs. of dry coal per ton-mile and 90.6 per cent. of the performance of the base engine. No. 3 was an Atlantic superheater that had only made 5,260 miles, in very good condition. The pounds of water per ton-mile were 1.53, or 94.4 per cent. of the base engine. I consider the explanation of this is that the engine was somewhat better suited to the weight of the train than the base engine. The performance of his engine in coal was 0.1926, or 100.5 per cent. of the base engine. No. 5 was a Pacific non-superheater that was a shop candidate, and in fact went to the shop directly after the test, having made 77,281 miles. Her performance in water was 1.774, or 109.5 per cent. of the base engine. The pounds of dry coal per ton-mile was 0.2309, or 126 per cent. of the base engine.

The two superheater engines, notwithstanding the fact that they had made respectively 62,347 and 35,504 miles before the test, did their work with 16 per cent less water than a new non-superheater engine. The coal performance is not so high as in water, as would naturally be the case in comparing the performance of a new clean boiler and one after 62,000 miles' service, so that No. 1 shows but a trifle of advantage, but No. 2 nearly 10 per cent, which, in connection with the 15.5 per cent water economy is certainly a fine performance.

The low record of No. 5, aside from its general condition, is no doubt partly due to having a different proportion of cylinders and smaller wheels than on engine No. 4.

The fine performance of engine No. 3 is no doubt due to its proportions being very well adapted to the weight of train and character of road, while no doubt engine No. 4 could have taken a heavier train with as good or better results, these engines being designed for heavier service than the trains on which tests were made.

Some of the dimensions of the engines tested are given in the following table:

No.	Cylinders.	Drivers.	Steam pressure.	Grate area.	Total weight, engine and tender loaded.	Tractive power.
1	.......21x26	73	185	44.86	335,300	24700
2	.......22x26	69	190	44.86	366,000	31000
3	.......21x26	73	185	44.86	330,300	24700
4	.......23x28	73	185	45.00	376,000	31600
5	.......22x26	69	190	44.86	362,000	31000

The Rock Island superheater engines were acquired in 1905 and put in service to ascertain their ability to do business without causing train delays or unduly increasing maintenance expense due to the superheater features. It was felt that these were matters of detail that should be worked out before any records or tests for economies were necessary or advisable. We had a number of difficulties of one kind and another, but through them all the advantages due to the superheater features were sufficiently apparent to warrant the effort to overcome them, which we have now done in large measure and feel confident that the showing here made is an honest, consistent one.

Prof. Goss' paper on Locomotive Performance under Saturated and Superheated Steam was next considered.

Discussion of Paper on Locomotive Performance Under Saturated and Superheated Steam.

In the absence of Prof. Goss, Prof. E. C. Schmidt, of the University of Illinois, presented his paper.

(Prof. Schmidt gave an abstract of the report referred to.)

The President—I think that we should extend to Professor Goss our hearty thanks for the magnificent report that he has compiled for us, and to Professor Schmidt for the able way in which he has presented it.

Mr. Seley—Mr. President, I take great pleasure in moving a cordial vote of thanks of the association to Professor Goss, and to Professor Schmidt, on the lines of your suggestion. (Motion carried.)

The President—The paper is open for discussion.

Mr. Seley—I wish to call attention to the absolute parallel in the results obtained in the test which I gave supplementary to the report, and in the final conclusions in Professor Goss' paper. I have not seen Professor Goss' paper before coming to Atlantic City, and it is a great gratification to find the agreement between a road test and a laboratory test.

Robert Quayle (C. & N. W.)—The paper is put together so well that "a wayfaring man, though a fool, need not err therein." It is so elaborate, too, that I believe it behooves every one of us, when we get back to our homes, to just set ourselves aside from our business for a little while and take it up, paragraph by paragraph, and know more about it—find out just what it means.

One thought expressed here is, that we will not expect to get these same values, or percentages, or reductions, in the use of fuel that are shown in this paper. I think that is true with every test that we make. When we are out on a locomotive-making special test everybody is alert. The fireman is doing his very best, he is not "slugging" the fire, as we say in railroad parlance, but he is distributing the coal at proper intervals and in proper amounts at each interval, so that combustion is being properly taken care of in the firebox, the products of combustion are being consumed there, and we are getting the results from the heat rather than letting it go out of the stack. The superheater that we have, which is of the same type as here experimented with, was used from May to October of the following year, without any repairs being made to it, or changes of any kind, and the man that was running the engine, and running it almost continuously, making 276 miles every day, said that if he couldn't have the superheater on the engine he would like to buy one; he always considered that his engine, with the superheater, was a "sleeping car" better than the engine without it. We did not, however, find that he was doing his work with very much less fuel when we came to get our monthly statements in. Sometimes we thought that he did and at other times we were quite well assured it was not so. But when a man has an engine that will do a little better than the other fellow, it may not be in evidence in the performance sheet because the train despatcher makes him do just a little more work, and he does it.

We are endeavoring now to have an engine made, built along with some others we are getting, with the superheater, and expect during the next year to make some exhaustive tests, as nearly accurate as we can, in road service, and find out more as to results, and I am sure that this most excellent paper will give us a line-up on not only what we might expect, but how to do the work in order to get the results.

J. B. Elliott (C. P. R.).—On the Quebec section of the Canadian Pacific, this is the first year we have been able to run 120 per cent engines. We were very anxious to make the time with what is known as the "Empress Special." The district master mechanic, being a locomotive engineer, said: "Mr. Elliott, if you will let us have a superheated engine I think we can make the time you want us to make." I said, "I don't wish to pull superheated engines from the other sections, but I would like to see what you can do with superheated compared with non-superheated engines of the same class, just out of the shop about the same time." We found that we could not make the time with the engines that did not have the superheater. We are running that train now with superheater engines and making excellent time; no engine failures that amount to anything.

J. Snowden Bell—There was a paper by Prof. Thurston, which was published, I think, in 1896, in the Transactions of the Society of Mechanical Engineers, in which he says that in 1860 superheating was tried on the Baltimore & Ohio by bending some of the tubes up into the steam space, and he states that the result was a serious cutting of the cylinders. Mr. Cromwell, of the B. & O., made a very careful examination, but was not able to find any records whatever of any work of that kind having been done. It must have been done prior to 1860, because Mr. Tyson left the road in 1859. I assume that the difficulty is more apparent than real, especially as I have heard no objection of that kind lately, but I think it would be well to know from some of the gentlemen who have been using superheaters whether any objection of that kind has been developed, and if so, to what extent.

A. E. Manchester (C., M. & St. P.).—A year ago we listened to a very able paper of the results obtained from the compound engine and the simple engine as tested on the Pennsylvania plant. I am sorry that I have neglected to make a comparison of the results as shown in that paper with the paper under discussion, and I rise now to suggest, or ask, if the gentleman who presented that paper a year ago is here; if so, that he just give us the results on the Pennsylvania testing plant as compared with the results in the paper. My recollection is that the results obtained on the Pennsylvania plant were a fuel economy of something like forty-three per cent, and the results given here by Prof. Goss range from four to sixteen per cent.

L. R. Johnson (Canadian Pacific)—I believe there is no road on this continent which has so large a proportion of superheated engines today as the Canadian Pacific, and I would like to answer the question raised just now in regard to the difference in the conditions in which we find the valves and cylinders on the superheated engines and the saturated steam engines. From my experience (and I have had continually a large number of these engines of both types in the shops) I find there is hardly any difference at all. There is nothing, certainly, to cause any fear on anyone's part as to adopting superheated steam with the idea of its giving bad results in the cyinders and valves. I have not yet come across a single engine which shows any bad results from the use of superheated steam in either valves or cylinders.

C. E. Fuller (Union Pacific)—I would ask Mr. Johnson whether he is using superheaters on engines equipped with balanced valves or piston valves?

Mr. Johnson—Piston valves.

Mr. Fuller—Are any of the members using slide valve with superheat?

The President—We have done it, but we took the superheaters off last year.

Mr. Fuller—The reason I ask the question is that we are running a slide valve engine with a superheater, and we had a lot of trouble on account of the valves cutting. I am sorry I have not the full information, but, if my memory serves me correctly, we have overcome a great deal of it by the application of bronze seats—false seats—in place of cast iron. That is the only change that has been made.

I would ask another question from the Canadian Pacific. That is as to whether or not they are maintaning 200 lbs. pressure with the superheater, or have reduced the pressure with the superheater?

Mr. Johnson—We keep the same pressure.

Mr. Fuller—Do you use the same sized cylinders or have you increased the size of the cylinders?

The President—We have increased from a 21-in. cylinder to 22½-in. on all our freight engines, but retained the 200-lbs. pressure. Recently we noticed that the engines were not quite as snappy with 22½-in. cylinders, and 180 lbs. of steam, as with 21-in. cylinder and 200 lbs. of steam. The difference is hardly enough to notice in the freight service, but we do not want to take any chance at having a passenger engine as all"logy" on account of having too small a valve.

Apart from my own impression, I'll say that our talks with our various master mechanics, and the superintendent of motive power of our western lines, which really constitute an independent organization to a great extent, are such that the question of applying superheaters with us never comes up. We look upon it just as much as an attachment to the locomotive today as we do the cylinders. We would not think of giving it up. The only question is as to what type of superheater we shall use, or what shall be done to take care of it and things of that sort. We have not for the past two or three years really seriously considered the question whether we should use the superheaters or not—they have been used as a matter of course. We have between 200 and 300 compound engines, and the other day a request came from the general manager of the western lines that he wanted some compounds, that were bought only four years ago, converted to superheaters for the sake of the economy in the maintenance. Superheater engines are so much cheaper to maintain that he wanted the change made for the sake of his accounts.

I am in a rather peculiar position with respect to this report. We have always said we got an increased economy of from 10 to 15 per cent in freight service and 15 to 20 per cent in passenger service from the use of superheated steam, and these figures are rather higher than could be justified, based on Professor Goss' report; in other words, we are not in the position of finding that we do not get as good results in practice as are given on the testing plant, but we are in the position of having given actual coal chute figures extending over months of service, which show a higher economy than can apparently be justified by the experiments conducted by Professor Goss. There is no possible criticism that could be made of Professor Goss' experiments. No practical road test could compare with them for a minute in accuracy or the care with which they are conducted, but I think there are one or two things which enter into road conditions that must be taken into consideration. In the first place, this superheater is applied to a comparatively small engine. You will notice that the number of 2-in. tubes is reduced from 200 to 111 by the application of the superheater. In applying it to a large modern engine we do not reduce the amount of evaporating surface to the same extent, in applying the superheater, as has been the case in this application to a small 16-in. engine. I have always said, not from a scientific standpoint, but from our practical observation, that, peculiar as it may seem, we have always found more saving in coal than we had in water. That is the universal experience of our men. The saving in coal is more than the saving in water. The result of this test would not indicate that. All I can say is it may be due to the fact that the boiler of this engine is disturbed more by the application of this superheater than the boiler of a large engine would be, in which so much heating surface was not cut out.

Another matter of importance is this. In testing plant work, whether you are testing superheated steam engines or saturated steam engines, you can practically depend on perfect hand firing. The men are used to uniform conditions, maintain the fire in a perfect condition, and whatever the rate at which the work is being taken off the engine, the firing is practically uniform. That is exhibited closely in the heat balances. There is no tired fireman, no shoving in any amount of coal in order to get along in the test-plant work. If you apply a device to a locomotive on hard runs that is going to mean that the demands on the boiler are 15 and 20 per cent less at the time the engine is working hard, you are not only going to save the coal shown on the test plant, but you will have a more efficient fire, because you are firing within the limits which the fireman can attend to instead of putting him up against a job which he will neglect and fall down on. I think we save in the firemen.

Those who have compared testing-plant results on saturated steam, with the results secured from road tests on saturated steam have found a considerable discrepancy. We do not operate as economically on the road as on a testing plant. I can only put that forward as a suggestion, but it is possible, if you lighten the work of the firemen; and I can say that we have not a run with a superheated steam engine where the fireman is taxed at all. Even when the engine is working hard, on a hill, the fireman is not taxed, therefore with engines the size we are running, it is possible we get a certain amount of saving from that source that would not occur in the testing plant.

Another thing we should remember is, that when we had the report from Prof. Goss on saturated steam, he called attention to the fact that we could hardly regard the laboratory results at high pressure as the equivalent of road results; that while they were running the Schenectady No. 2 at 160 lbs. pressure there was comparatively little difficulty in maintaining the packing and the joints tight, and that sort of thing, whereas in the tests of engines at 200 to 240 lbs. pressure they were continually attending to these details to keep the engine in proper condition.

In comparing an engine at 160 lbs. with one at 240 lbs., we were told, and undoubtedly correctly, that you could not expect to get, by going to 240 lbs., the increased economy that the test results on saturated steam show, simply because you could not keep the engine up in the same manner in which it was kept on the testing plant, if you used the high pressures. So, if you grant that high pressures for simple engines are very questionable in practical use, you must also grant that the practical engine running at 160 lbs. and using superheated steam should be compared with the saturated steam engine running at 160 lbs., and not with the saturated steam engine running at 240 lbs.

Professor Goss has called attention to the use of steam at a temperature of 600 deg. F. abroad. I am pleased to have him do that, as there have been many criticisms of the fire-tube superheater using steam at a temperature of about 550 deg. F., which has been equaled in superheater steam engines. As a matter of fact, that would not be known as high superheat abroad, but medium.

One speaker asked about cylinder troubles. We have had a great deal of trouble in the past few years with piston rings, but very little trouble with valve rings; but we did have considerable valve trouble. Now, strangely enough, when we first went into superheating, we did not have much trouble in that respect, and I can only say that I am not at all satisfied yet whether our trouble is due to superheated steam or due to changes in our foundry practice. Roads using saturated steam have occasionally had serious packing troubles, the wear of piston rings, etc., depending on the metal being porous. We are going into the question of improving our packing, and think we are obtaining considerably better results. The trouble does not occur in all cases, but it is a serious question with us; that is to say, we have rings that have worn out as quickly as six weeks or two months, and others will last eight or nine months. We have experimented with the substitution of Dunbar for split-ring packing, and we have found that has lasted some nine or ten months without renewal, and we believe, after we use the Dunbar packing generally, we will have no serious trouble with the cylinders. The bushings in both the cylinders and the valve chests are not hurt; the valve rings are not hurt, but we have a certain amount to learn about the proper material and proper style of packing ring to use. We do not consider the matter very serious and it does not show up on our repair bills.

I have spoken about failures. The other day I had our superheater failures in passenger service compiled for the eight months, from July, 1908, to February, 1909. I do not pretend to say that we have every detention in. With a road of the character of the Canadian Pacific, we are likely to have small detentions that do not come in, but the important failures, where 15 or 20 minutes or more was lost through the failure of superheater parts, are, I think, included.

On our Pacific type engines we made a total of 1,666,000 miles in the passenger service in these eight months, and there were a total of five superheater failures, about 300,000 miles for each failure of a superheater part, and three of these failures were on the same engine on successive days. Taking the failures that have occurred on passenger service engines equipped with superheated steam we have, for a total of 1,777,000 miles, nine failures—about 197,000 miles for each failure of a superheater part. But in that statement I am unable to allow mileage credited for certain mixed traffic and freight engines that have made passenger mileage during the time. I do not want to put this statement forward as a very accurate one—it is so good that I have sent it back to the motive power department, and also to the transportation department, to have it checked—but I wish to present it, and I do think it shows that the extent of superheater failures, with reasonable maintenance, is not going to be serious.

F. F. Gaines (Cent. of Ga.)—About two years ago, when we were ordering a number of locomotives we had one equipped with this superheater and one with a feed-water heater. The superheater engine has slide valves, and we enlarged the cylinder 1 in. to get the steam pressure down to 180 lbs., against others with 200 lbs. The engine has given no trouble at all with the valves or piston. We are not employing a high degree of superheat, only a moderate one, but it has been a very satisfactory engine. It is a favorite with the engineers, and the repairs have been very slight.

The peculiar part of the situation arises in connection with coal economy. Our feedwater heater engine has the superheated engine greatly outdistanced in this respect—there is no comparison. Without desiring to throw cold water on the superheater proposition, as carried out in other railways, we have had such excellent results from the feed-water heater that we rather lean that way.

In regard to both engines in comparison with the plain engine: Whereas the plain engines require their pipes to be taken out and the flues renewed after a year's service, the engines with the feed-water heater and the superheater will go longer before requiring any attention to these matters. The use of the feed-water heater and the superheater does not have the same effect in the construction of the flues that you get through putting cold water into the boilers.

G. W. Wildin (N. Y., N. H. & H.)—I believe they have two types of superheaters on the Canadian Pacific. Mr. Vaughan did not mention whether it was the Schmidt or Vaughan-Horsey type to which he referred.

The President—They include all types.

Mr. Wildin—What type gave you the most trouble? About a year ago you were in my office and gave me quite a shock about superheaters. You told me you were ready to advocate them for passenger engines, but that you were not ready to advocate them for freight engines. I presume your conversion has come about since a year ago, as you say there is no question today, when an engine is being designed, that a superheater should go on it.

The President—I do not think you give my position correctly. When I made that statement I was not talking about our conditions. I have always taken the position that I believe that through passenger engines should be equipped with superheaters, and I do not care what the price of coal is. It is worth it for the capacity you get in the engine. Whether you equip your freight engines with the superheater is a question of the cost of coal. I doubt if it will pay a road with cheap coal to put superheaters in service. So much coal is lost lying around on side-tracks and in yards, that economy in the use of superheaters is not realized in the consumption of coal, and I think that the application of superheaters to freight engines is a matter for later development; but in the passenger service there is a big saving in the work demanded of the firemen—we estimate the increase in the capacity of the firemen at 10 per cent—and a saving in coal has shown up better in the passenger service than it does in the freight service. I feel, as a general proposition, that superheaters should be applied in the passenger service without any question, and as for freight service, that will be a matter for future development.

Mr. Wildin—What price of coal would you draw the line at?

The President—I would not worry as to what price of coal should serve as a limiting line in the application of superheaters to engines in freight service, until you put them on the engines in passenger service, and then you will find out whether you want to put them on the engines in freight service.

Prof. H. Wade Hibbard (Univ. of Mo.)—The statement is made on page 44: "The results sustain a claim which has been put forward by advocates of the practice of superheating to the effect that the adoption of such practice permits a material reduction in steam pressure as compared with pressures now common in locomotive service, without materially sacrificing efficiency."

I believe that that statement should be taken with a mental reservation that the information upon which it is based is obtained from the use of only 150 deg. of superheat, giving the superheat curve in Fig. 30 its bottom or most efficient point at 200 lbs. boiler pressure. Unless the information is given to us that that same curve will be retained with a greater degree of superheat, then we should not be too sure of the usefulness of this sentence I have just read. We know that with the general introduction of the Mallet compound locomotive we may very likely have that bottom point in that curve shoved toward the right, enabling us with a higher degree of superheat to carry also a higher steam pressure, and still obtain a greater degree of efficiency. Especially when we consider the engine with the boiler, and refer to Fig. 8, which gives the evaporation per pound of coal under different conditions of pressure, we find that practically no more heat is required to evaporate a pound of water at the higher pressure, and that, in connection with the use of the compound locomotive, should enable the use of a higher degree of superheat without wasting the heat into the atmosphere. Of course, the motive power department naturally wishes to make a locomotive which is the least expensive to keep in repair and the least costly in the use of coal and water. But the motive power department should forever keep in mind that the stockholder is not so much interested in the economy of the motive power department as he is in the economy of transportation as a whole. If with higher superheat hauling capacity or speed per ton of locomotive, thus gaining economy of transportation as a whole, then the motive power department will have to accept the higher pressures, rather than to take a retrograde step towards the lower pressures—a retrograde position, let us say, from the point of view of efficiency of transportation, though apparently not retrograde from the point of cheapening the cost of boiler maintenance. So I think this sentence which I have quoted should be read with the fact in mind that it is based only on the figures of 150 deg. superheat, and that until we have figures showing the shape of the curve at higher degrees of superheat we should not place too great dependence on that statement.

L. R. Pomeroy—I wish to call attention to one point spoken of inferentially in the report, and it would go to show that, practically, the locomotive boiler with 180 lbs. pressure is as serviceable, with the use of the superheater, in producing like results(as one of 210 lbs. pressure without the superheater. Supposing that the initial cost, and the cost of repairs generally speaking is somewhat proportional to the pressure, there is a saving due to first cost and maintenance that should be credited to the superheater. The difference between 210 lbs. pressure and 180 lbs. pressure is 15 per cent. Suppose 3 per cent on cost of repairs should be saved in that reduction, that surely should be added to the economy of the superheater.

M. J. Drury (Santa Fe)—We find by the introduction of the superheater that we have reduced the repairs on our fireboxes, and have also reduced the expenses attendant upon cylinder packing and valve bushing.

H. W. Jacobs (Santa Fe)—I have lately had occasion to get some figures on five superheater engines that were formerly saturated steam engines. The reductions in repairs to these engines were from 23 to 33 per cent. We find with our superheater engines that there is no additional cost for cylinder packing or for the valves.

G. R. Henderson—Were the pressures in both cases the same ,or was there a different pressure?

Mr. Jacobs—In saturated steam engines 225 lbs. pressure, and the superheated engines 160 lbs. pressure.

Mr. Henderson—That is responsible for the saving.

C. E. Chambers (C. of N. J.)—Were the tests made in both cases just after the engines were turned out of the shop or was one engine tested after being turned out of the shop, and the other after the engine was out on the road for some time?

Mr. Jacobs—Both engines were tested as they were turned out of the shop. Another thing I would add is the very satisfactory manner in which the firemen and engineers take to these engines. They seem to be very much in favor of the superheated engine.

F. C. Cleaver (Rutland)—I have been looking up the question of superheat during the last two months and find that the claims made for superheated engines are substantiated in my experience; that is, I find that the men are in favor of them, they prefer them to the saturated steam engines, and almost invariably say that the superheating feature gives little trouble. You know that engineers are not very favorable to things that have got to be constantly operated. It is a fact that in actual running between certain points with the same train, in two cases that I have in mind, with exactly the same care ,the same schedule, same time of day, same weather, I noted a difference of nearly forty per cent in the amount of fuel actually consumed. That was for a short distance only and cannot be taken as reliable for long distances, only as an indication. These figures are undoubtedly too high, but that is the way they come out. I have had a good deal of experience in handling locomotives. You can pretty nearly tell, when you step on an engine that is running, even with your eyes shut, whether the engine is smart or "logy." I have ridden on a number of superheated engines and the peculiar feeling of the engine in motion indicates a smart engine. I have ridden on superheated engines and on compound engines of pretty nearly the same weights, both being of the same capacity, and the difference was very great in that respect. The engine was snappy and quick in one case and "logy" in another. I have not completed the investigation I was making, and am speaking offhand just from notes which I have made, which are not tabulated, and you must consider that in thinking about what I have said.

G. R. Henderson—Can we get more information about the point Mr. Jacobs spoke of? I understood him to say that the pressure was reduced. That must have reduced the hauling power unless the cylinders were enlarged in proportion, and if the hauling power was reduced the ton mileage was reduced. It would be interesting to know if the figures of repairs were on a yearly basis, a ton mileage basis, or an engine mileage basis.

Mr. Jacobs—They were on an engine mileage basis.

C. E. Fuller—Was it a simple or compound engine you are figuring on in the reduction in cost?

Mr. Jacobs—These engines I am speaking of were formerly compound engines.

Mr. Fuller—Do you attribute the reduction to the increased cost of maintenance of the compound, or is your compound maintenance any heavier than the simple engines? I think it has a bearing on this subject, whether or not the reduction in cost is obtained by the application of the superheater or whether it is obtained by the reduction of the compound features.

Mr. Jacobs—My belief is that a portion of the saving was undoubtedly brought about through the rather heavy cost of repairs on this particular type of compound, but nevertheless I also believe that the superheater had a great deal to do with it. I may add for Mr. Henderson's information that the sizes of the cylinders were enlarged, and they gave increased hauling power. I cannot give the actual figures, but there has been an increase, because we are able to get greater speed and the engines are much more snappy.

The President—If there is no further discussion on this subject I would ask Prof. Schmidt and Mr. Seley to reply.

Professor Schmidt—I think Mr. Vaughan's intepretation of the former publication of the saturated steam results, as regards the maintenance under high pressures, was correct and the inference he drew from these facts it seems to me are also true. It seems to me also that his remarks concerning the differences between the testing plant conditions and the conditions in service and the probable results of those differences upon performance are justified.

In reply to Prof. Hibbard I would say that the sentence he read is intended to apply only to the conditions of the test, and is justified, of course, by the appearance of the curve directly above the statement on that same page 44, and in the absence of further information concerning the shape of a similar curve at higher superheats, I thing the statement might be considered a justifiable one.

Proceedings of the Third Session, Friday, June 18.

President Vaughan called the meeting to order at 9:40 o'clock, and announced as the first order of business the report on tender trucks. H. T. Bentley (C. & N. W.) read the report.

Discussion on Tender Trucks.

The President—This is rather a serious subject on a good many roads, I think, and it seems to me it is one we could afford to discuss with the greatest freedom.

A long discussion followed, which it was finally decided will not be made public until the Executive Committee passes upon it.

The report of the Committee on Fuel Economies was read by Mr. Hayes.

Discussion on Fuel Economies.

D. R. MacBain (N. Y. C. & H. R.)—Mr. Hayes has had the bulk of the work to do, as I understand, in getting up this report, and it is, in my opinion, one of the most important subjects that this association has had before it at the present time. The possibilities of economy in the consumption of fuel on almost any of the railways, including our own, are, of course, very great, and whether the fuel costs $1 a ton or $5 a ton, the time is coming when the big men in the motive power department will have to sit up and take notice of the saving of a cent. For that reason, I believe something should be done with this report, that this association should appoint another committee, or hold the present committee over, and give them a year longer to make further and more definite recommendations.

C. A. Seley (C., R. I. & P.)—I fully agree with the idea of the importance of this subject, and in connection with the report of the Committee on Lubrication believe that this association could wisely constitute a standing committee on each of these important subjects to keep the record up from year to year. I believe it would be well for us to have progress reports each year, and I would like to make the suggestion, perhaps not for action here, but to get the members thinking about the desirability of assigning these two important subjects to standing committees.

Angus Sinclair—The greatest single item of expenditure on railways I believe to be that of fuel, and I do not know of any question that has been so loosely handled. Ever since I remember there has been pressure put upon the mechanical department to save fuel—do something, change your boilers, improve your boilers, improve your methods of combustion, and get more results out of your coal. The people who are responsible for the purchasing of the coal paid no attention whatever to the quality of the coal they were receiving. You had to pay as much for the poorest quality as you did for the best quality, and the consequence was that the tendency was to get the poor quality of coal. On one end of a division you would get a quality very different from what you received at the other end, with the result that you had to adjust draft appliances to suit the poorest quality of coal, and they were not adapted to the higher qualities of coal. I think the greatest reform necessary is some change in the method of purchasing a uniform quality of fuel, based on its steam heating properties. I notice that the Erie people have been paying a great deal of attention to that lately. They specified the coal to have a certain amount of heating properties. That is the right principle, and it ought to be followed more closely than it is by every railway in the country. That is the reform necessary. It is not greater heating surface, nor better methods of admitting air, nor anything of that sort in connection with the combustion. It is the fuel itself that needs to be reformed.

Robert Quayle (C. & N. W.)—I agree with what Mr. Sinclair has said. Now, we will suppose we have the fuel right and the specification is all right, the purchasing agent is all right and the delivery on the ground all right. I made this statement to 22 locomotive firemen within the last two weeks —that I could select 100 locomotive firemen on the Chicago & North Western, and I would guarantee that if I had every other on the railway equally as good firemen as the hundred I could select, that I could save easily $500,000 a year in fuel. Now, then, if that be true it is a matter of education. It is first a matter of the man's fitness for the job he is filling. Second, it is the education of the man to get him up to that standard where he knows just when to put the scoop of coal into the firebox, and he knows just where to put it; then he knows all the conditions necessary to get the maximum result out of a pound of coal. If he knows all that, the most important thing to follow is to get him to do it, and that is where the railway men are up against it. The problem I have in mind is to get the men to do their best in line with the information they have. I know that when the road foreman of engines or the traveling fireman is on the engine the men do their work splendidly. They keep the decks clean and every pound of coal they handle is utilized in the firebox, and, as suggested in the paper, their props are not open and they are not losing a quarter of a pound of coal per second of time the pop is open, but are utilizing the steam generated in the boiler for the engine. They secure the best results from the engine under those circumstances. If there is any man who can point me to the direction I should follow in my efforts to discover how you can get your men to do the best they can, I shall be glad to hear it. I believe there is nothing which you and I can do which will bring greater financial results to the treasury of the railways with which you and I are connected than to go after the fuel problem and the men who use it.

P. G. Baker (Panama)—On page 14 the committee points out the way to get the men to do the work, and that is the sixth proposition—full and fair accounting. That is all. Just give the men credit for the work they do and blame and punish them for what they do not do, and it will be done properly.

J. H. Setchel—I was much interested in this discussion, for the reason that it was a live subject 20 years ago. I had the honor then of being president of this association, and in my annual address I recommended, as a line in which there was the most economy that could be observed by the mechanical department, the proper consideration of the saving of fuel. A committee was appointed on fuel, and whether the committee has been standing or not, I think there has been a committee on fuel ever since. I believe that committee ought to be continued, for as one of the speakers has said, it is one of the largest items of expense in the motive power department, and it varies with every railway and with every kind of coal and with every variation of executive ability on the part of the officers of the railway company. I remember a number of years ago the lamented Forney, whom you all know, said in this connection that he would agree, speaking of the devices that were introduced from time to time for the improvement of the consumption of coal, that if he could get the motive power men to pay close attention to the locomotive which he would provide, he could save 25 per cent in fuel just as long as they would go according to his directions. He said: "All I will do is to paint the smokestack sky-blue, and that will do the work." Application is what we need. As Mr. Quayle very fully said, if we can get men to do what they know it is their duty to do, and continue doing that, then there will be a permanent saving in the consumption of fuel and it will increase from time to time as long as locomotives are run, but the trouble is you cannot keep men trained to do all the time a thing that they know to be right.

The committee stated that the officers should be responsible to the motive power department, and that, I believe, is the keystone to the whole situation. When an officer is working in one department and has no responsibility to another department, he does not care what the other fellow says. Very often the man is broad enough to look at all points of the question, and do what is right and best for all departments, but that is not always the case. The man who has the supervision of the fuel should be appointed by the motive power department, and that man should be responsible to the head of the motive power department, so that when you call him up and stand him up in a corner and question him as to what has been done, and what he knows ought to be done, and what he does not do, you will be in a better position to control him and secure the results which you are seeking.

John Tonge (M. & St. L.)—I do not think the machinery department is altogether to blame for the waste of coal. There is a train which in going a division will occupy 17 hours, we will say. The running time between the stations is 5½ hours, but through the incompetency of the dispatcher to handle the trains properly the running time is increased very largely. Should the locomotive be charged with the coal consumed during the other 11 hours? No. It seems to me that improper dispatching has much effect on the waste of fuel. You men located in the East compile your figures before you start the train, and it gets there on time. I can tell you of railways in this eastern district where they do not pay a dollar for overtime of enginemen and crews. What do we pay? Now, then, it is in such conditions as this that we have to shoulder this waste caused by the dispatcher who does not know his business.

Mr. Quayle—So far as the road I am connected with is concerned, the motive power department has all to say about the men on the engines, the motive power department has all to say as to how they shall handle them, the motive power department has all to say about the coal and how it shall be used. Notwithstanding that, notwithstanding it is up to the motive power department to get results, I suppose we have as much trouble as the other fellow does. The engineers and firemen have all kinds of excuses—did not get enough coal or had very poor coal, or had a hard run, or the engineer did not pump his engine right, or worked it down in the corner too far. You talk to the engineer, and he puts all the blame on the fireman. We are trying, as best we can, to get results, and we talk to the men very seriously about it. I have had men in my office to whom I have said somewhat as follows: "You are in a group of engines of which we have kept statistics, and it cost us so much for the fuel on your locomotive last year. I can afford to give you a thousand dollars a year and send you home, retire you. The road would make money if you were out of the service." We keep a tabulated record of all the men's supplies, his oil and his fuel account, and when we place the matter before the man in this form he begins to think pretty deeply. We then say to the man: "We will give you four months to improve, and if you are not as good as the average man on the road you will have to get out and make room for someone who will do the work properly." The man begins to take pride, and he says to the fireman, "The old man has a bad opinion of us, and you and I must work together to improve so that we can change his opinion." That is what we need. We need team work. The engineer and fireman should co-operate so well that every movement on the part of the engineer will be anticipated by the fireman, and everything the other man does will be anticipated by his mate. If they were to work together so that they would keep the proper amount of water in the boiler when climbing hills, that would be a factor in fuel economy; too much water is an enemy to the lubrication of the valves and cylinders, the water being carried through the throttle box into the dry pipe and into the valve chambers and cylinders, thus washing the oil away and increasing the friction and thereby requiring more steam to do the same work and more coal to generate the steam. When the men work together we get better results, but there is a tendency in the case of these men to get further apart and not take an interest in each other. These men are in their cabs together one-third of the time at least. If we could get those men to take an interest in each other and feel that each was the other's helper and each ought to bear the burdens of the other fellow, and get them to work together in such a way that they would enjoy their work, then we would get results. You and I, unless we have a pleasure in our work, will not get results, and neither will the fireman. If we can devise ways and means by which we will get these men together on common ground, so that they will help each other instead of warring against each other, and feel that this work they are doing is a real pleasure to them, then they will begin to work in the direction of getting economy and getting the largest possible results.

G. W. Wildin (N. Y., N. H. & H.)—I have been listening to what Mr. Quayle has said very attentively. I agree with him; he is right, but he has left out the third party, and that is the roundhouse foreman. There is a great amount of fuel wasted because of poor roundhouse practice, and we cannot lay it all to the engineer. About nine out of ten times the men put a split in the nozzle instead of caring for the base where it leaks, and they increase that split as long as they get steam. You cannot blame the fireman for that, nor the engineer. I find that about one-third of the carelessness is in the roundhouse and the other two-thirds is on the engine.

Mr. Quayle—The suggestion I might make there is the circular letter sent every 90 days to the master mechanic to give me the number of every locomotive, the size of the nozzle, or the split or tip in every nozzle, and tell me when it was put in and who put it there. That helps to fix that.

F. F. Gaines (C. of G.)—In line with what Mr. Quayle has just said, we have a practice that we think works out very nicely in that respect. We have every month the engineers' mileage, the coal burned, sizes of nozzle, and the whole arrangement. That is not only posted in the roundhouses, but the master mechanic has a copy and a copy comes to my office. If I find one condition on a certain type of engine using a small nozzle, we can go back, check up and find the reason. I think getting the size of the nozzles, not every 90 days, but every 30 days, and the arrangement and everything, is a good thing to do.

Mr. Wildin—My idea was to try to get the right feeling in the roundhouse man just as well as in the engineman, not the checking him up all the time and having to hang him every few days or weeks. We want to get him interested in the coal pile as well as the engineer and the fireman, so he will not put these splits in.

A. M. Waitt—It has been said that there have been for the past 20 years committees on the subject of fuel economy, which is true. There have been presented by the present committee some six proper essentials of fuel economy. This is a broad subject. On every one of these six essentials there is a great deal of difference of opinion. Would it not be wise for the committee to be continued, with instructions to take for next year one of those six essentials and thresh it out to a finish and present a report that the members could go home and put in practice—definite, well worked-out ideas? If they have done their work well, then another year take another of the subjects, and at the end of a certain reasonable length of time each one of those essentials that the committee have very properly mentioned would be well worked out and the members would have something very definite to work upon and put in force as the result of the best practice in the country. If it were in order I would move that the committee be continued with such instructions.

Mr. Brown—I am somewhat surprised at the manner in which this work is received. To my mind it is not received with the seriousness which the question justifies. There are many conditions affecting this. The roundhouse is equally responsible with the engine people. The selection of fuel is an important matter, and the question of tools is an important matter. What I had in mind was to make an amendment to Mr. Waitt's motion, that the committee be continued and also take up the question of engine supplies, fuel economy and construction of engine rules. Care in the roundhouse is so closely related that I feel it should be a part of the work of this committee.

D. R. MacBain (N. Y. C.)—I do not agree with all the speakers, especially with Mr. Brown. I believe we should leave this fuel committee just as it is, a fuel committee. I do not believe we should add any more to what they have to do; and as a suggestion to bring about the results that Mr. Quayle has referred to as being possible, it would appear to me that on a railroad where $500,000 a year could be saved by a proper effort on the part of all the locomotive firemen and engineers, it would be well worthy of the time and attention of any railroad to go after half of that amount of money; and as a means of doing that, my suggestion would be that the railroad companies who are vitally interested in the matter of fuel economy appoint to take care of the firemen who do not know the whole thing, a sufficient number of high class engine instructors to take care of probably 50 firemen, or 75 at the most. Confine that man's duty to the matter of saving fuel alone. It has been my experience that most of the men, whether they be of a high grade of intelligence or a low grade of intelligence, are willing to do that which is easiest to do, and I have always found that when I could show a man an easy way of doing a day's task, easier than the one he has been pursuing, he was willing to take hold. It seems to me, therefore, that the first step in the matter is to take care of the woful waste that we know is going on, appoint a sufficient number of instructors to take care of your men, have them give the necessary instructions from week to week, if not from day to day, and do not load the special men down with other duties which are largely post-mortem, and which is the practice on most railways today, sending a traveling fireman off to look for something that is weeks old. Let him attend to his duties as instructor of firemen and I guarantee that the results will be amazing.

C. A. Seley (C., R. I. & P.)—The theory of the executive committee in proposing these subjects was that of a progress report, and while, no doubt, these branches of the particular subject under discussion could be enlarged upon, or taken up serially one by one and threshed out to a certain amount of conclusion—I don't mean the end of it, I believe that if the committee could be continued, or made a standing committee, they should do what is stated here in their opening paragraph, give the progress of the art from year to year. We are meeting all the time. Not only by actual designs, but by methods of instruction, and all of those matters that have been spoken of, particularly by Mr. Quayle and Mr. MacBain, those are matters coming properly within the progress report from year to year. Suppose some railroad gets out a method such as Mr. MacBain has outlined. Let us have the results of such a method as that, and so on from year to year let us gather into this association the latest progress in fuel; and I make the same suggestion with regard to lubrication.

The President—Mr. Waitt's motion is before the house, that the committee be continued and requested to take up in more detail and report recommendations on one of the six essentials which they consider the most important as bearing upon fuel economy.

The motion was lost.

The report on lubricating economies was presented by G. J. DeVilbiss (H. V.), of the committee.

Discussion on Lubricating Economies.

C. A. Seley (C., R. I. & P.)—I think that this report is also of value, as I stated with reference to the previous report, as a basis for a matter of progress. There is just one matter I would like to speak of in discussion of this report, and that is that undue importance is often given lubricating economies as compared with fuel economies, losing sight of the cold dollars and cents proposition. In reporting the performance of superheater engines, the superheater undoubtedly takes more oil, and unless that oil is stated in dollars and cents, instead of pints, it gives undue importance to the extra amount of oil consumed.

H. T. Bentley (C. & N. W.)—I move that the committee be continued for further report. (Motion carried.)

The Chairman—The next order of business is an individual paper entitled "Transfer of Heat," by Prof. Charles E. Lucke. As the writer of the paper is not here, and it is purely a technical paper, if there is no objection it will be received and printed in the Proceedings.

The next order of business is the report of the Committee on Revision of Constitution and By-Laws.

D. F. Crawford (Penn. Lines), chairman of the committee, read the report.

The President—In accordance with our constitution, the constitution and by-laws can be amended in accordance with this report by a vote of the members present.

Mr. Crawford—I would say for the information of members that this circular was sent out in December as well as being presented here today.

Mr. Quayle—I move that the constitution be amended in accordance with the report of the committee; that the report of the committee on revision of constitution and by-laws be adopted by this association, and that the constitution and by-laws be revised as recommended by this committee.

The motion was carried.

The President—The next order of business is the report of the committee on subjects.

Mr. Quayle presented the report.

The Secretary—Mr. Quayle wrote me under date of May 20 as follows: "When our committee report is presented to the executive committee for their consideration I would offer the following subject for their consideration as a matter for committee work: Frame Construction for Engines with Outside Valve Gear. This subject was suggested to the committee after their report was forwarded to you, but I believe it is a subject worthy of some consideration."

That will simply be taken as a part of the report of the committee on subjects.

Mr. Crawford—I move that the report of the Committee on Subjects be referred to the incoming Executive Committee for consideration. (Carried.)

The President—The next order of business is the presentation of the report on Resolutions, Correspondence, etc.

G. M. Basford presented the report, and it was adopted as the sense of the convention.

The secretary read the report of the Auditing Committee, stating that they had examined the accounts of the secretary and treasurer and found them correct.

The report of the Committee on the Bill for Federal Boiler Inspection, which was presented to the United States Senate, was read by D. F. Crawford (Pennsylvania Lines,) chairman of the committee, and the recommendation which it contained was adopted.

The report of the Committee on Recommendations contained in the president's address was read by L. G. Parish and its recommendations adopted.

Officers for the ensuing year were elected as follows: President, G. W. Wildin, N. Y., N. H. & H.; first vice-president, C. E. Fuller, Union Pacific; second vice-president, H. T. Bentley, C. & N. W.; third vice-president, D. F. Crawford, Pennsylvania Lines; treasurer, Angus Sinclair, Railway and Locomotive Engineering. Members of the Executive Committee—C. A. Seley, C., R. I. & P. (two years), D. R. MacBain, N. Y. C. & H. R. (two years), and F. M. Whyte, N. Y. C. & H. R. (one year).

President Vaughan—This concludes the business arranged for by the program, but before surrendering the position of president of this association to my illustrious successor I wish to thank the Executive Committee for the ability with which they have assisted in conducting the work of the association; the members of the committees for the work they have done in preparing reports and papers; and the members of the association for the help they have given me in this work. Gentlemen, I will ask that the same assistance and help be given to my successor, Mr. Wildin, to whom I have great pleasure in resigning the chair.

President-elect Wildin—I wish to express my high appreciation of the honor which you have conferred upon me today. My appreciation is such that I cannot express it in words, but I sincerely hope when the time comes for me to turn the gavel over to my successor you will at least all feel that I have made an honest effort to maintain the high standing set by many illustrious past presidents of the association. Again thanking you, I wish you a prosperous year.

C. E. Fuller—I offer a vote of thanks to our retiring president, Mr. Vaughan, for his energy and ability, shown in his office of President—his untiring work and efforts, which have enabled us all to enjoy fully one of the most successful conventions that it has been my pleasure to attend. I feel that there have not been many presidents who have been as thoughtful and have had the ability to not only handle the meetings of this association, but to manage a menagerie and side show, that has been appreciated by a great many of our members. Our president has been ably assisted by our secretary, who was able to round up the force and bring them in without saying a word or disturbing the meeting.

President Wildin—Gentlemen, I notice at my left Mr. Turner, the president of the Railway Supply Men's Association, who whispered to me that he had something to bring before this convention, a duty which it will be a pleasure for him to perform.

Mr. Turner—I take great pleasure in introducing George A. Post, who has been requested to represent the Supply Men's Association in your closing exercises.

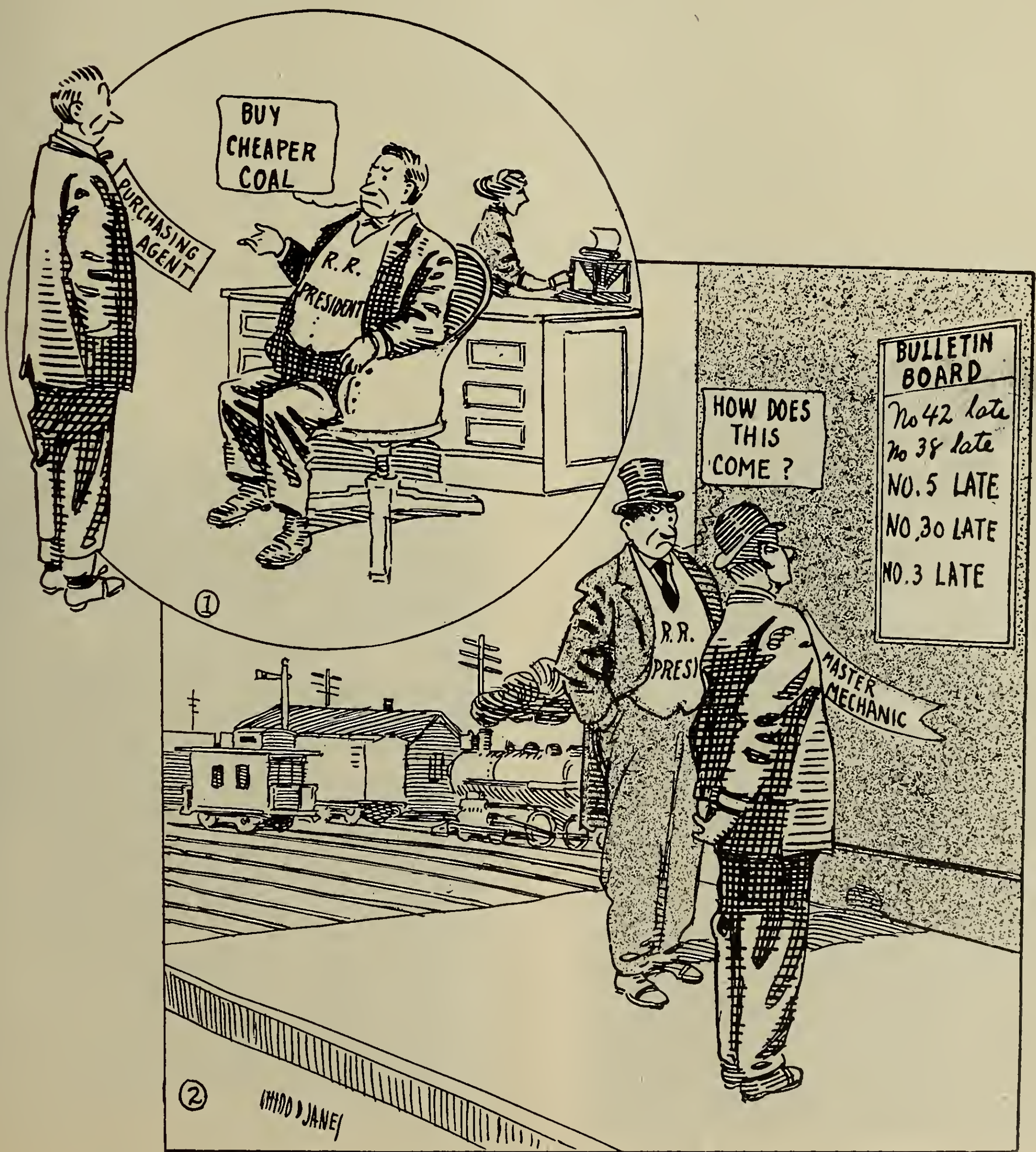
George A. Post—A delightful and highly-prized honor has been conferred upon me by Mr. Turner. At his behest I appear before you charged with a commission in the performance of which I will detain you but a few moments.

Mr. Vaughan, this is a very happy moment for me, and it is a justly proud one for you, as we face this assembly of distinguished railway officials over whom you have presided so ably and acceptably during the past year; my heart beats exultantly as I recall the thrilling story of your brilliant achievements since first we met. In striking contrast with the picture that hangs upon the wall of my memory compared with the present exalted station you enjoy, is that of the young man bending over the drawing board in the office of Mr. Pattee, of the Great Northern up in St. Paul, some 15 years ago. It has been with intense pleasure that I have seen you swiftly and surely ascend the heights that are only attained by men possessed of pluck and brains. It is not by accident that men become president of the American Railway Master Mechanics' Association. It is a distinction conferred by men qualified to discern and to reward merit. It is a prominence to be coveted. It is a goal, sir, that you have reached by sturdy persevering strides.

This badge (exhibiting President's badge) is a prize that is well worth having, and that it is my pleasure to present it to you is tinged with a delicious romance that gives me great joy. I fear that I have completely reversed the familiar story of John Alden and Priscilla, in that I have spoken too much of my own feelings at this moment rather than those who sent me here to speak for them. To convey to you the congratulations and the best wishes of a legion of friends and admirers was my mission. I trust, Mr. Vaughan, that you will accept delivery and make no note of the delay in transmission. Just say that you received it post haste.

Mr. Vaughan—Mr. Post, it is impossible for me to adequately thank you for the presentation you have made and the kindliness and friendliness you have shown. I can only say I shall always look upon this badge as a memento of the great good fortune I have enjoyed in being president of the American Railway Master Mechanics' Association, an honor which I shall always regard as the highest which I ever could have hoped for and the greatest honor in my career. When such an honor is accompanied by expressions of kindliness and friendliness from friends whom I have known as long as I have known you, Mr. Post, it is made doubly pleasant and I thank you from the bottom of my heart.

Adjourned.



Who's to Blame?

List of Exhibits at the Mechanical Conventions

A. B. C. Bearing Corporation, Chicago, Ill.—Journal bearings. Represented by W. D. Thomas and F. A. Lester.

Adams & Westlake Company, Chicago, Ill.—Adlake-Newbold electric car lighting; (axle generation) Adlake acetylene gas car lighting; electric and gas fixtures; continuous basket racks with detachable bottoms; car trimmings; signal lamps and lanterns. Represented by E. L. Langworthy, G. L. Walters, A. S. Anderson, F. N. Grigg, Wm. J. Piersen, E. H. Stearns and R. M. Newbold.

Ajax Manufacturing Company, Cleveland, O.—Improved "Ajax" bolt heading; upsetting and forging machine; new type of high-speed bulldozing and bending machine, with stop motion device; reclaiming rolls for re-rolling scrap; hot sawing and burring machine and sample forgings. Represented by J. R. Blakeslee, J. A. Murray, A. L. Guilford and Henry Gaul.

American Balance Valve Company, Jersey Shore, Pa.—Balanced main valves for slide valve engines of highest pressures; balanced main valves for piston valve engines; simple and compound engine valves; piston valves after service; Walschaerts valve gear model; model of modified Stevens valve gear with internal admission and Jack Wilson double-acting valves. Represented by J. T. Wilson, F. Trump and C. C. Young.

American Blower Company, Detroit, Mich.—Blowers for forges and furnaces; heating and ventilating apparatus for stations, shops and roundhouses; mechanical draft apparatus for stationary boilers; automatic return steam traps; vertical enclosed self-oiling steam engines for electric lighting and pumping; Sirocco portable electric ventilating fans. Represented by Ralph T. Coe, Clayton W. Old and Benjamin Adams.

American Brake Company, St. Louis, Mo.—Automatic slack adjuster and flexible metallic joint for use between the engine and tender. Represented by E. L. Adreon.

C. E. Gossett, Wm. Bawden and C. W. Allen on a tour of inspection.

American Brake Shoe & Foundry Company, Mahwah, N. J.—Steel back brake shoes for locomotives; steel back brake shoes for coaches; steel back brake shoes for freight cars; reinforced extra durable high friction brake shoes for all kinds of railway equipment; malleable iron brake heads. Represented by Otis H. Cutler, Jos. B. Terbell, Joel S. Coffin, F. W. Sargent, W. S. McGowan, E. L. Janes, G. R. Law, E. B. Smith, R. M. Brower, E. J. Searles, R. E. Holt, F. H. Coolidge, E. A. Gregory, N. J. Holden, J. H. Yardley, B. H. Grundy, J. S. Thompson, C. C. Higgins and L. R. Dewey.

American Car & Foundry Company, New York, St. Louis and Chicago.—Reception booth only. Represented by Scott H. Blewett, John McEwen Ames, William C. Dickerman, George Johnson, Clark D. Eaton, S. S. De Lano, A. E. Ostrander and William M. Hager.

American Joxyl Company, New York, N. Y.—Car ceiling and panels; decorations in wood. Represented by C. H. Spotts and Edgard Josz.

American Locomotive Company, New York, N. Y.—Reception booth only. Represented by W. H. Marshall, C. J. Donahue, G. M. Basford, David Van Alstyne, James McNaughton, J. D. Sawyer, J. E. Dixon, W. S. Seamans, Jr., H. C. Hequembourg, J. R. Marshall, J. R. Magarvey, W. E. Woodard, S. W. Miller, C. A. Strom, George Gurry, J. B. Ennis, C. J. Mellin, Wm. Dalton, A. M. White, W. L. Reid, A. W. Wheatley, F. J. Cole, F. W. Cooke, F. A. Haughton, J. G. Blunt and A. Haller.

American Mason Safety Tread Company, Boston, Mass.—Mason safety treads; Empire treads; Karbolith composition floors for coaches and buildings. Represented by Henry C. King.

American Nut & Bolt Fastener Company, Pittsburg, Pa.—One side of diamond arch bar truck equipped with Bartley fasteners; model showing multiple and wood fasteners as applied for general use; samples of Bartley fasteners. Represented by Milton Bartley, Edwin M. White, Christopher Murphy and Robert Spencer.

Henry Hardie, of the L. & N., and L. C. Brown. Mr. Brown is such a handsome man and submits so gracefully that it's a pleasure to take his picture.

Railroad Men's Baseball Team.

Supply Men's Baseball Team.

American Radiator Company, Chicago, Ill.—Steam and hot water boilers; radiators; tank heaters; hot blast heaters; improved car heaters; packless valves; temperature regulators and automatic air valves. Represented by James H. Davis, George D. Hoffman and J. H. Ives.

American Specialty Company, Chicago, Ill.—"Use-Em-Up" drill sockets and sleeves; Collis high speed flat and flat twisted drills; Universal adjustable blade reamers. Represented by H. L. Mills.

American Vanadium Company, Pittsburg, Pa.—Vanadium ores, alloys and steels, both wrought and cast; Vanadium cast iron; Vanadium brasses, bronzes and copper, also Vanadium aluminum and other products. Represented by J. J. Flannery, Jos. M. Flannery, J. Kent Smith, G. L. Norris and W. J. Bird.

Armstrong-Blum Manufacturing Company, Chicago, Ill.—Marvel power hack saw machines; portable grinders for lathes and planers; lever punches and shears; Metallic weather strip for coaches. Represented by Francis J. Blum.

Anchor Packing Company, Philadelphia, Pa.—Metal and fibrous packings and mechanical rubber goods. Represented by L. E. Adams, W. R. Haggart and E. C. Adams.

Armstrong Brothers Tool Company, Chicago, Ill.—Tool holders, ratchet drills and machine shop specialties. Represented by E. V. Galen, John McBride and Paul Armstrong.

Asbestos Protected Metal Company, Canton, Mass.

Ashton Valve Company, Boston, Mass.—Locomotive gages and pop valves; dynamometer recording gages. Represented by F. A. Casey and J. W. Motherwell.

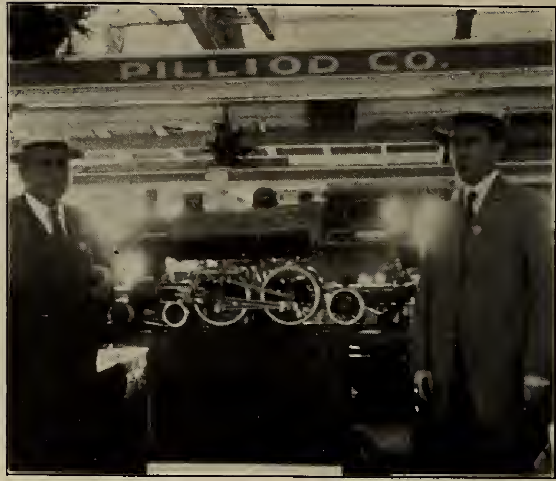
Atha Steel Casting Company, Newark, N. J.—Atha cast steel body and truck bolsters; manganese steel railway motor gears and pinions. Represented by C. W. Owston, Jr., G. T. Paraschos, A. S. Blanchard, J. Kissick, Jr., L. M. Atha and L. A. Shepard.

Barnett Equipment Company of America, New York, N. Y.—The Barnett connector, the Universal steam coupler. Represented by Stephen D. Barnett, David E. Green and Lewis G. Morris.

Mr. Ralston, of the Ralston Steel Car Co., and F. S. Barks, of the Commonwealth Steel Co., got caught. We don't know the other man, but it might be F. E. Symons.

Geo. P. Nichols strolling along the pier. The "How-dare-you" expression is due to the slow work of the artist in not snapping the camera before Mr. Nichols had time to object.

W. H. Wood and the exhibit of his company—The Wm. H. Wood Loco. Firebox & Tube Plate Co.



H. J. Pilliod and Chas. J. Pilliod with the interesting model of their valve gear.

Besly & Co., Charles H., Chicago, Ill.—No. 14 Besly spiral disc grinder, Helmet spiral circles, temper taps, oil and babbitt. Represented by Edward P. Welles, Charles A. Knill and W. H. Allen.

Bettendorf Axle Company, Davenport, Ia.

Boker & Co., Herrmann, New York, N. Y.—Novo superior steel, the new high-speed steel; also various high-speed tools, etc.; intra steel and other brands of steels. Represented by Ellsworth Haring.

Booth Company, L. M., New York, N. Y.—Booth water softener, 2,500 gallons per hour purifying capacity, in operation; photographs, drawings, etc., of installations. Represented by W. R. Toppan, L. M. Booth and A. J. Donniez.

Bordo Company, L. J., Philadelphia, Pa.—Bordo blow-off valve; swing joints; Bordo water gage. Represented by L. J. Bordo, C. W. Allen and C. R. Weaver.

Bowser & Co., Inc., S. F., Fort Wayne, Ind.—Oil storage systems complete; long distance self-measuring pumps; power pumps; automatic registering oil meters; oil storage tanks of all sizes and shapes, with pumps for handling and measuring all kinds of lubricating, paint and other oils, including gasoline, etc.; suitable for storehouses, machine and paint shops, roundhouses, engine rooms, signal towers, automobile garages, etc. Represented by C. A. Dunkelberg, W. T. Simpson and F. T. Hyndman.

Brighton Brass & Bronze Company, Pittsburg, Pa.—Journal bearings made of various mixtures and "Brighton" bearings; engine brasses; driving boxes; rod bushings; mill brasses. Represented by W. H. Schoen and T. M. May.

Brown & Sharpe Manufacturing Company, Providence, R. I.—Vertical spindle milling machines, plain milling machines and attachments for milling machines. Represented by R. T. Eaton, R. W. McLaren and W. H. Sherman.

Buckeye Steel Castings Company, Columbus, O.—Major and Columbia freight car couplers and Ohio passenger couplers, cast steel journal boxes of various sizes; cast steel Buckeye yokes; full sized freight car truck equipped with Buckeye cast steel frames and cast steel journal boxes. Represented by S. P. Bush, George Groobey, C. B. Goodspeed, A. H. Thomas, Geo. T. Johnson and J. C. Whitridge.

Buffalo Brake-Beam Company, New York, N. Y.—Truss I-beams and special section brake-beams for all classes of equipment; also forged heads, fulcrums, chain clips and wheel guards. Represented by S. A. Crone, E. Strassburger, R. C. Fraser and C. E. Barrett.

Bullard Car Door Equipment Company, Birmingham, Ala.—Car doors. Represented by R. G. Bullard and D. S. Walreven.

Bullard Machine Tool Company, Bridgeport, Conn.—Bullard vertical turret lathe in operation. Represented by S. H. Bullard, J. W. Bray, R. H. Snider, J. H. Van Yorx, Jr., and Wm. J. Alles.

Burroughs Adding Machine Company, Detroit, Mich.—Burroughs adding and listing machines for all departments of railway work. Style 15 for motive power and general railway accounting; No. 11 for car accounting; No. 9 for division superintendents and local freight accounts, and Nos. 7 and 6x for local freight, ticket and express accounts. Represented by F. A. Willard, Ward Gavett and E. G. Griffith.

Exhibit of the Flannery Bolt Co.

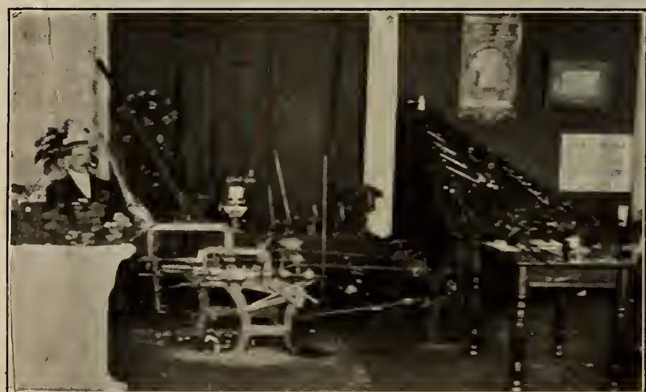


Exhibit of the Armstrong-Blum Mfg. Co. The smiling face of Mr. Blum may be seen nestling among the flowers.

Exhibit of Chicago Railway Equipment Co.

Carborundum Company, Niagara Falls, N. Y.—Carborundum wheels; sharpening stones; rubbing bricks; carborundum paper and cloth; garnet paper; carborundum valve grinding compound. Represented by George R. Rayner, W. W. Sanderson, R. B. Fuller, C. C. Schumaker and Chas. Nicholson.

Cardwell Manufacturing Company, Chicago, Ill.—Cardwell rocker side bearings. Represented by J. R. Cardwell, John D. Ristine, C. H. Tobias and W. K. Grauser.

Carnegie Steel Company, Pittsburg, Pa.

Carter Iron Company, Pittsburg, Pa.—Stay-bolt iron; chain cable iron; engine bolt iron. Represented by W. C. Johnston, Christopher Murphy and Robert Spencer.

Celfor Tool Company, Chicago, Ill.—Celfor high-speed drills, reamers, countersinks, three-lipped drills, Rich flat drills, Celfor duplex and precision chucks, reamer sockets, etc. Represented by E. B. Clark, William Brewster, M. L. Hanlin, W. E. McCabe, J. J. Dale, Chas. A. Bucher and Edwin B. Ross.

Chase & Company, L. C., Boston, Mass.—Goat brand car plushes in plain and frieze effects; Angora mohair showing process of manufacture; Chase's car seat duck. Represented by Frank Hopewell and R. R. Bishop, Jr.

Chicago Car Heating Company, Chicago, Ill.—Vapor system of car heating with multiple regulation of heat; steam hose coupler, train-pipe valves, car heater specialties and Baker heater

Exhibit of the Detroit Lubricator Co.

specialties. Represented by Egbert H. Gold, E. A. Schreiber, Frank F. Coggin, W. H. Hooper, B. A. Keeler and Eugene E. Smith.

Chicago Pneumatic Tool Company, Chicago, Ill.—Compressor in the power-house on Young's Pier. Represented by W. O. Duntley, Thos. Aldcorn, G. A. Barden, J. C. Campbell, John Sanborn, W. F. Heacock, Harry Griner.

Chicago Railway Equipment Company, Chicago, Ill.—Brake-beams of the Creco, Diamond, National Hollow, Kewanee, Reliance, Sterlingworth, Ninety-six and Monarch types; Monitor bolsters, Creco roller side bearings, Creco slack adjuster, Creco journal box and lid, Creco brake jaw, automatically adjustable brake heads. Represented by E. B. Leigh, F. T. De Long, E. G. Buchanan, Geo. A. Cooper, F. G. Ely, H. W. Finnell, Harry W. Frost, B. F. Pilson, Raymond H. Pilson, G. N. Sweringen, C. H. Williams, Jr., and C. P. Williams.

Chicago Varnish Company, Chicago, Ill.

Chisholm & Moore Manufacturing Company, Cleveland, O.—One thirty-ton chain hoist, largest ever made; trolley hoists of various sizes. Represented by H. E. Dickerman and E. Y. Moore.

Chrome Steel Works, Chrome, N. J.—Steel car wheels with cast steel centers and forged tires, tires interlocking and keyed to center. Represented by F. E. Canda and William Corry.

Cincinnati Bickford Tool Company, Cincinnati, O.

Cincinnati Planer Company, Cincinnati, O.—One 37x37x8-ft. forge planer with four heads and variable speed motor drive.

Exhibit of the Trenton Malleable Iron Co. showing their car door.

J. Christopher, of the T., H. & B. Ry.; Jas. Ogilvie, of the Board of Ry. Commissioners of Canada, and W. C. Nunn, of the Convertible Car Co., also representative of the Love Brake Shoe Co. in Canada.

The sign in this picture tells the whole story. The journal boxes themselves can be seen at either side of the entrance.

Represented by B. B. Quillen, George Langen and Joseph Herman.

Cleveland Twist Drill Company, Cleveland, O.—Twist drills, reamers, taps and sockets. Represented by E. H. Jung, E. G. Buckwell and W. E. Caldwell.

Coale Muffler & Safety Valve Company, Baltimore, Md.—With the exhibit of the Nathan Manufacturing Company. Locomotive muffled safety valve. Represented by H. C. McCarty.

Clow & Sons, James B., Chicago, Ill.

Coe Brass Manufacturing Company, Ansonia, Conn.—Extruded metal in the form of special shaped brass bars. Represented by E. J. Steele, Wm. W. Cotter, Wm. H. Rippere and Chas. E. Van Riper.

Coe Manufacturing Company, W. H., Providence, R. I.—Coe's ribbon gold leaf and Coe's gilding wheels. Represented by Chas. H. Bowers and Wm. H. Larney.

Commercial Acetylene Company, New York City, N. Y.—Acetylene headlights; acetylene signal lamps and car lighting system; acetylene safety storage tank, showing asbestos packing. Flashing apparatus as used by S. U. government for buoys, beacons and lighthouses, with sun valve, which automatically shuts off and turns on the gas. Represented by R. E. Bruckner, H. G. Doran, R. J. Faure and Oscar F. Ostby.

Commonwealth Steel Company, St. Louis, Mo.—Aluminum models of car and locomotive underframes and bolsters, also photographs of various devices made by the company. Represented by Harry M. Pflager, Geo. E. Howard and Frank S. Barks.

Mr. Chase and exhibit of the National Acme Mfg. Co.

Consolidated Car-Heating Company, Albany, N. Y.—Quick opening end valves, vapor and pressure steam heating systems, improved types of steam couplers and signaling system. Represented by Cornell S. Hawley, W. S. Hammond, Jr., Thomas Farmer, Jr., C. C. Nuckols, H. L. Hawley and J. E. Marble.

Consolidated Railway Electric Lighting & Equipment Company, New York, N. Y.—Standard type "D" equipment of 4 kw. capacity and its standard type "F" equipment of 2 kw. capacity, both assembled and in parts. Also the Kennedy regulator. Represented by P. Kennedy, J. L. Watson, Thos. L. Mount and L. J. Kennedy.

Cooper-Hewitt Electric Company, New York, N. Y.—Cooper-Hewitt lamps for shop and train-shed lighting. Represented by Chas. B. Hill, H. B. Buckman and J. H. O'Shea.

Crane Company, Chicago, Ill.—Locomotive pop safety valves, locomotive blow-off valves, locomotive special globe and angle valves, Crane valves for superheated steam, steel valves and fittings for superheated steam, ferrosteel valves and fittings, pipe bends, steam separators, special exhibit of Crane tilt steam traps in operation. Represented by F. D. Fenn.

Crosby Steam Gage & Valve Company, Boston, Mass.—Locomotive safety valves; gages; blow-off valves; chime whistles, and other articles for locomotives. Represented by E. C. Kenyon, J. J. McConnick and A. B. Carhart.

A. M. Kittredge, President Barney & Smith Car Co., Dayton, O.

Exhibit of the General Railway Supply Co. Mr. H. O. Morton in the foreground.

Exhibit of the McConway & Torley Co.

Exhibit of the Kerite Insulated Wire & Cable Co.

Curtain Supply Company, Chicago, Ill.—Ring fixtures, Forsyth roller tip fixture, vestibule curtain handle and curtain materials of all kinds. Represented by W. H. Forsyth, R. F. Hayes and S. W. Midgley.

Dake-American Steam Turbine Co., Grand Rapids, Mich.

Damascus Brake-Beam Company, Cleveland, O.

Davis-Bournonville Company, New York, N. Y.

Davis Expansion Boring Tool Company, St. Louis, Mo.—Expansion boring tools for metal working. Represented by E. E. Davis and J. W. McKeen.

Davis Solid Truss Brake Beam Company, Wilmington, Del.

Dayton Malleable Iron Company, Dayton, O.—General railroad malleables and specialties. Represented by Pierce D. Schenck, Jos. G. Crane and R. A. Herbruck.

Dearborn Drug & Chemical Works, Chicago, Ill.—Method of scientific treatment of boiler feed water. Represented by Robert F. Carr, George R. Carr, G. W. Spear, J. D. Purcell, H. G. McConnaughy, C. H. Everett, Paul T. Payne, A. W. Crouch and D. E. Cain.

Detroit Lubricator Company, Detroit, Mich.—Locomotive lubricators Nos. 0, 5, 11, 21. Sectional of 21, 31, 41, 61. Single and double sight feed air cylinder lubricators. Improved air brake lubricator; standard stationary lubricator. No. 400 bull's-eye type stationary lubricator. "Detroit" sight feed guide cup and improved rod cup. Represented by F. W. Hodges, A. D. Homard and Herbert I. Lord.

Diamond Rubber Company, Akron, O.

Dickinson, Paul, Inc., Chicago, Ill.—Dickinson smokejacks shown in cast iron, fire-proofed wood and a combination of these two materials; cast iron ventilators and cast iron chimneys. Represented by Arthur J. Filkins and John A. Meaden.

Dixon Crucible Company, Joseph, Jersey City, N. J.—Dixon's silica graphite paint for steel cars; also lubricants and other graphite products. Represented by Wm. Houston, H. A. Nealley, De Witt C. Smith, L. H. Snyder and T. J. Tucker.

Dressel Railway Lamp Works, New York, N. Y.—Locomotive headlights, locomotive classification lamps, passenger car tail lamps, center coach lamps, semaphore lamps, switch lamps, station lamps and gage lamps. Represented by F. W. Dressel, Robert Black, H. S. Hoskinson, F. W. Edmunds, Edw. W. Hodgkins and W. E. Chester.

Dudgeon ,Richard, New York, N. Y.—Universal jacks and test pumps in many forms, including car inspector's, railway, plain, base, claw, independent claw, horizontal and traversing jacks; electrical power pump, and several types of hand-operated pressure pumps. Represented by James W. Nelson, William H. Mathers and J. J. Dickinson.

Duff Manufacturing Company, Pittsburg, Pa.—Barrett track and car jacks, "Duff-Bethlehem" forged steel hydraulic jacks, Duff ball-bearing screw jacks, journal jacks, geared ratchet jacks and wrecking jacks. Represented by Thos. A. McGinley, E. A. Johnson and Geo. A. Edgin.

Duntley Manufacturing Company, Chicago, Ill.—Duntley vacuum cleaners for passenger coaches and the smaller vacuum cleaners for household purposes. Represented by Charles E. Walker, C. R. Ely and James Boswell.

Edwards Company, O. M., Syracuse, N. Y.

Electric Hose & Rubber Company, Wilmington, Del.—Braided fabric rubber hose. Represented by W. P. Barnum, A. W. Archer, Jr., Wm. M. Sibley, E. F. Brownworth, C. R. Blanchard and C. D. Garretson.

Electric Storage Battery Company, Philadelphia, Pa.

Fairbanks, Morse & Co., Chicago, Ill.—Two gasoline hand cars, one in exhibit booth and one on the P. & R. tracks; Sheffield telescopic water column; Duff hydraulic jack of a new style; F. M. & Co. tool grinder. Represented by George J. Akers, A. A. Taylor, R. A. Patterson, J. A. Steele and R. E. Derby.

Farlow Draft Gear Company, Baltimore, Md.—Farlow twin

Exhibit of the American Car Screen Co. of Pittsburg. Represented by W. A. Scott and L. S. Klein.

Exhibit of the Cleveland Twist Drill Co., showing Edward H. Jung and W. E. Caldwell.

F. F. Gaines, Supt., Ga. Cent.; Jas. Clarke, M. M., P. & R.; D. H. Deeter, M. M., P. & R.

John W. Fogg, M. S. Monroe and C. W. Seddon viewing Atlantic City.

spring draft gear as applied to both channel and wooden sills. Farlow twin spring draft gear as applied to engine tenders. Farlow draft gear attachment with friction barrels applied to channel sills. Represented by M. A. Garrett, D. F. Mallory, I. O. Wright, B. S. Johnson and C. M. Garrett.

Fisher & Norris ("Eagle" Anvil Works), Trenton, N. J.—Steel faced anvils for blacksmiths, band-saw and saw makers, chain makers and axe makers. Coppersmiths' stakes. Fisher double-screw parallel leg vises, Fisher-Brooks solid nut stationary and swivel base bench vises. Fisher-Brooks special woodworkers' vise; blacksmiths' swage-block and stand; "Cross-Pene," "Dog-Head" and "Twist-Face" hand made hammers. Represented by Mrs. Harriet Fisher and Harold Fisher Brooks.

Flannery Bolt Company, Pittsburg, Pa.—Tate flexible staybolts and installation tools for applying same; "F. B. C." arch bar and continuous nut locks. Represented by J. Rogers Flannery, W. M. Wilson, Barton H. Grundy, B. E. D. Stafford, Harry A. Pike, Jos. M. Flannery, Tom R. Davis, Thos. J. Leahy and Jas. J. Flannery.

Foster, Walter H., New York, N. Y.

Forsyth Brothers Company, Chicago, Ill.—Forsyth high capacity buffing device for passenger cars; radial draw-bar centering device; metallic window sash and safety deck sash ratchers. Represented by George H. Forsyth, A. H. Sisson and A. L. Whipple.

Forsyth Steel Tie Company, Pittsburg, Pa.—Steel cross ties; tie plates; brake shoe keys; follower plates; brake levers; trolley poles; railbanders; sheet piling; tie braces; railway forgings. Represented by W. D. Forsyth, A. C. Schiller and T. D. Dallmeyer.

France Packing Co., Tacony, Pa.—Metallic and fibrous packings. Represented by A. W. France.

Franklin Manufacturing Company, Franklin, Pa.—Reinforced corrugated asbestos roofing or siding, asbestos century shingles, asbestos building lumber, asbestos building lumber smoke-jacks; 85 per cent. K. & M. brand magnesia sectional locomotive lagging; Franklin rubber roofing; asbestos pipe coverings; asbestos ring air pump and throttle packing; asbestos dust guards; papers, boards, packings and other asbestos railway supplies; wool and cotton waste. Represented by R. J. Evans, E. R. Rayburn, G. S. Stuart and L. B. Melville.

Franklin Railway Supply Company, New York, N. Y.—Frank-

Harry Quest and L. C. Brown. Note the worried appearance of the hard working members of the transportation committee.

Mr. Forsyth of the Forsyth Steel Tie Co. arriving at the pier. It is late and he is in a hurry as may be noted.

"Use-Em-Up" Socket, Mills and his hoodoo. (You have three guesses to find the hoodoo.)

Cass Kennicott—Just think soft water

lin automatic driving box lubricator; Franklin pneumatic fire door; McLaughlin flexible joint; Franklin grate shaker; Franklin ball joint; McLaughlin lock nut; Franklin grease forming machine; Franklin steam chest plug. Represented by J. C. Coffin, Samuel G. Allen, A. G. Elvin, C. L. Winey, Paul Weiller, W. H. Coyle, R. G. Coburn and H. S. Hayward, Jr.

Frost Railway Supply Company, Detroit, Mich.

Galena-Signal Oil Company, Franklin, Pa.—Reception booth. Represented by Samuel A. Megeath, Edw. V. Sedgwick, Harry Hillyer, W. E. Brumble, J. W. Bunn, Lewis Gleason, J. F. Gettrust, E. W. Hayes, D. J. Justice, J. E. Linahen, G. E. McVicar, C. B. Royal, J. A. Whalen, A. B. Wright, C. C. Steinbrenner, W. A. Trubee, F. A. Guild, E. H. Baker, B. H. Grundy, G. L. Morton, J. S. Patterson, J. E. Hall, Robert McVicar.

Garlock Packing Co., Palmyra, N. Y.

General Compressed Air & Vacuum Machinery Company, St. Louis, Mo.

General Electric Company, Schenectady, N. Y.

General Railway Supply Company, Chicago, Ill.—Metallic (steel) sheathing; National steel trap doors and lifting device; Schroyer friction curtain rollers and fixtures; Garland ventilators; end of a vestibuled passenger coach equipped to show the application of Flexolith composition flooring; National vestibule curtain catches; National standard roofing; Imperial car window screens; Perfection sash balance and roller deck sash ratchet. Represented by F. L. Wells, H. U. Morton, L. C. Bassford and W. S. Humes, Jr.

Gold Car Heating & Lighting Company, New York, N. Y.—Car heating and car lighting apparatus. Represented by Edward E. Gold, William E. Banks, E. B. Wilson, W. H. Stocks, Geo. F. Ivers, F. A. Purdy, J. M. Stayman, F. T. Kitchen, J. O. Brombaugh and F. H. Smith.

Goldschmidt Thermit Company, New York, N. Y.

Gould Coupler Company, New York, N. Y.—M. C. B. couplers; Gould malleable iron journal boxes; Gould side-unlock coupler; Moritz M. C. B. coupler; Gould friction draft gears; Gould cast steel side frame; Gould cast steel journal box; Crown bolster that has been tested; Gould special electric locomotive coupler; Hartman ball-bearing center plates and side bearings; special malleable iron draft rigging and striking plates. Frame with Gould body bolster freight coupler, friction draft gear and

This picture represents the acme of content (not paint), K. J. Bowers and D. E. Robinson of the Acme White Lead & Color Works.

A trio of well known supply men, R. T. Brydon, A. L. Holtzman and F. M. Murray.

Christopher Murphy and "General" Milton Bartley enjoying a chair ride and cigar.

steel draft frames. Gould draft gear, new passenger coupler, rightning device and Gould vestibule. Represented by F. P. Huntley, G. G. Milne, H. N. Loomis, C. E. Rood, S. R. Fuller, Jr., V. F. Richards, W. M. Rogovine and Dr. C. W. Gould.

Gould & Eberhardt, Newark, N. J.

Gray & Sons, Inc., Peter, E. Cambridge, Mass.—Lamps, lanterns and sheet metal specialties for every department of railway service. Represented by George M. Gray, C. O. Harrington and J. M. Brown.

Greene, Tweed & Co., New York, N. Y.—Palmetto braided and twist packing; Palmetto air pump packing; Palmetto throttle valve packing; Manhattan packing; Favorite reversible ratchet wrench. Represented by F. E. Ransley and B. M. Bulkley.

Grip Nut Company, Chicago, Ill.—Grip nuts; Universal window fixtures; steel sash; Universal deck sash ratchets and car trimmings. Represented by E. R. Hibbard, B. C. McClellan, F. E. Miner, Herbert Green and J. W. Hibbard.

Hale & Kilburn Manufacturing Company, Philadelphia, Pa.

Heywood Brothers & Wakefield Co., Wakefield, Mass.

Hill, Clarke & Co., Inc., Boston, Mass.

Hammett, H. G., Troy, N. Y.—Trojan metallic packing; link radius grinder; Trojan bell-ringer; oil cups. Represented by H. G. Hammett, E. C. Sawyer and A. O. Van Dervort.

Exhibit of the Watson-Stillman Co.

Exhibit of Paul Dickinson, smoke jacks.

Hanlon Locomotive Sander Company, Winchester, Mass.—The Hanlon sander. Represented by J. W. Russell, Jr., John H. Hanlon and W. J. Hanlon.

Harrington, Edwin, Son & Co., Inc., Philadelphia, Pa.

Home Rubber Company, Trenton, N. J.

Hunt-Spiller Manufacturing Corporation, South Boston, Mass.—Locomotive parts made of Hunt-Spiller gun iron; crosshead shoes; piston valve packing rings; cylinder packing rings; eccentrics and straps, etc.; Hunt-Spiller gun iron; driving boxes; piston valve gages; piston valve packing; cylinder packing; shoes and wedges; gears; crosshead shoes, etc. Represented by Gordon Dexter, W. B. Leach and J. G. Platt.

Hutchins Car Roofing Company, Detroit, Mich.—Hutchins plastic car roofing, 2-ply, 3-ply and improved and surface-coated; Hutchins outside and inside metal roofs; Hutchins all-steel carlin roof; Detroit car door. On the exhibit track—Car M. C. 43,155 (equipped with Hutchins all-steel carlin roof); car Wabash 63,276 (equipped with Hutchins all-steel carlin roof and Detroit car door. Represented by Wm. D. Thompson, C. E. Latta and Carter Blatchford.

Illinois Malleable Iron Company, Chicago, Ill.—Brake shoes, smoke jacks and unions. Represented by E. M. Marshall and R. C. Warner.

R. T. Walbank visiting Mr. Morrison of the Mason Regulator Co., in booth of latter company.

S. J. Johnson and the "New Era" journal box and lid .with which he has been so successfully identified.

Jenkins Brothers, New York, N. Y.—Valves; 96 packnig; pump valves; gasket tubing; discs; Seller's injectors and Graber automatic water gage. Represented by A. C. Langston, H. D. Gordon, Frank Martin, B. J. Neely and Chas. Wick.

Johns-Manville Company, H. W., New York, N. Y.

Joliet Railway Supply Company, Joliet, Ill.—Twelve new and tested Huntoon brake beams; twenty-four new and old service tested Perry side bearings; one electric vacuum cleaner. Represented by C. F. Huntoon, H. M. Perry and E. A. Laughlin.

Joyce, Cridland Company, Dayton, O.—Railway jacks. Represented by Geo. W. Llewellyn, P. J. Ford and N. Kohl.

Keller Manufacturing Company, Philadelphia, Pa.—Vacuum cleaners. Represented by Julius Keller, W. P. Pressinger, Harry Keller and Howard Small.

Kelly-Arnold Manufacturing Co., Wilkes-Barre, Pa.

Kerite Insulated Wire & Cable Company, New York, N. Y.—Section of Colon-Panama submarine cable, samples of aerial, underground and submarine cables, railway signal wire, sections of cables which have been in service from thirty to forty years, Kerite tape. Represented by R. D. Brixey, Azel Ames, P. W. Miller and J. A. Renton.

Keystone Drop Forge Works, Chester, Pa.—Keystone connecting link, Keystone safety shackle hook, special locomotive and car forgings. Represented by Geo. H. Berlin.

C. M. Walsh, Edward F. Chaffee and C. H. Rockwell strolling along the pier doing no harm.

Scully Steel & Iron Co. and the Chicago Steel Car Co., H. C. Priebe, H. H. Gilbert and H. C. Finlay.

Keystone Lantern Company, Philadelphia, Pa.—The Casey standard railway hand-lantern. Represented by John T. Casey and Arthur H. McOwen.

Lackawanna Steel Company, New York, N. Y.

Landis Machine Company, Waynesboro, Pa.—Motor-driven bolt and pipe threading machine, showing high-speed threading; samples of threaded work; bolt pointer. Represented by J. G. Benedict, Ira D. Grove and H. L. Fisher.

Landis Tool Company, Waynesboro, Pa.—Two rotary tool grinders. Represented by W. H. Foster.

Lightbody Safety Brake Rigging, Waterville, Me.—Fox truck fitted with lever support; safety loop; safety bracket; safety chain; brake-beam rods and levers connected; brake-beam with safety appliance attached. Represented by J. A. Lightbody.

Linde Air Products Company, Buffalo, N. Y.—Oxy-Acetylene welding and Oxy-Coal gas cutting apparatus. Represented by Cecil Lightfoot, F. W. Wolff, F. C. Phillips, G. E. Kershaw, F. Schoonmaker and W. S. Roberts.

Link-Belt Company, Philadelphia, Pa.

John D. Hurley, of the Independent Pneumatic Tool Co. Note the pose of authority.

Mr. and Mrs. Peter Braucher, Mr. Hibbs and Mr. D. C. Barbee viewing Reading Engine 303.

Geo. Tozzer, E. Chamberlain and R. T. Walbank.

Lodge & Shipley Machinery Tool Company, Cincinnati, O.—One 24-in. x 12 ft. patent head motor-driven lathe; one 18-in. x 8 ft. patent head motor-driven lathe. Represented by Wallace Carroll and Robert D. Betts.

Love Brake Shoe Company, Chicago, Ill.—Armburst steel connector locomotive driver brake-shoes, steel connector flanged coach shoes, steel connector unflanged car shoes, steel connector electric railway brake shoes, steel connector motor and coach shoes for elevated railway service. Represented by C. W. Armbrust, W. C. Nunn and E. H. Pilson.

Lupton's Sons Company, David, Philadelphia, Pa.—Lupton rolled steel skylight, Lupton rolled steel windows, Lupton hollow metal fire door and Pond operating device (for pivoted sash.) Represented by Clarke P. Pond.

Manning, Maxwell & Moore, New York, N. Y.—Lathes; shapers, drills, borers, millers, Hancock inspirators, steam and check valves and globe and angle valves; Metropolitan injectors; hose strainers, blow-off valves, oil cups, tank wells, whistles, consolidated pop safety valves, Ashcroft pressure and vacuum gages, Tabor steam indicators, and Edison recording gages. Represented by P. M. Brotherhood, J. N. Derby, W. O. Jacquette, Chas. L. Lyle, C. E. Randall, M. A. Sherritt and Frank P. Smith.

F. W. Miller, of the Miller Heating Co.

Mason Regulator Company, Boston, Mass.—Mason locomotive reducing valve, Mason reducing valves for steam, water and air; balanced valves, pump governors, pump pressure regulators, damper regulators, gravity pump governors and steam pumps. Represented by Frank A. Morrison.

Modoc Soap Company, Philadelphia, Pa.—Perfected car cleaner, renovator and linseed oil soap; Idealo car cleaner. Represented by Henry Roever and Jas. D. Holtzinger.

Monarch Steel Castings Company, Detroit, Mich.—Monarch No. 2 M. C. B. coupler and Monarch graduated draft gear. Represented by T. H. Simnson, A. B. Wetmore, Charles Gifford, A. R. Wilson and T. N. Motley.

Moran Flexible Steam Joint Company, Louisville, Ky.—Flexible joints for steam, air, gas and liquid steam coupler for use between engine and dynamo car. Represented by C. H. Jenkins.

McConway & Torley Company, Pittsburg, Pa.—Pitt and Janney "X" freight couplers, Pitt tender coupler, Kelso passenger coupler, Buhoup 3-stem passenger coupler, McConway steel-tired wheel. Represented by Stephen C. Mason, E. M. Grove, Wm. McConway, Jr., Geo. W. McCandless, H. C. Buhoup and I. H. Milliken.

This is self-explanatory.

John W. Faessler, D. C. Barbee and F. A. Mayer. The good looking man in the center is Faessler, maker of "Boss" Boiler Tools. Mr. Barbee, the Journal Bearing man, is at his left, and Mr. Mayer, of the Southern Railway, is at his right.

MacLeod & Company, Walter, Cincinnati, O.—Working model of water softener and purifier, several tests of locomotive fire heaters, flue welding machine; also furnace, carbide lights for wrecking outfits and construction work, oil rivet forges, Buckeye heaters for repairing steel cars; the Buckeye light; also a new type of sand-blast machine. Represented by Walter MacLeod and W. F. Stoddr.

McCord & Company, Chicago, Ill.—Freight and passenger journal boxes, draft gear, force feed locomotive lubricators, spring dampeners, gaskets. Represented by Clive Runnells, J. A. Lamon, W. J. Schlacks and D. J. McOsker.

McIlvain & Company, J. Gibson, Philadelphia, Pa.

Mogul Paint Company, New York, N. Y.—Mogul non-slip track bolt compound. Represented by A. Grothwell and T. A. Forster.

Nathan Manufacturing Company, New York, N. Y.—Locomotive injectors of the lifting and non-lifting type, fire extinguisher, boiler washer and tester, reversible stop boiler check valve, Phillips double stop boiler check valve, steam whistles, relief valves, gage cocks, water gages, oilers and various other appliances for locomotives and stationary engine purposes. Represented by J. C. Currie, C. R. Kearns, S. Keeler, J. E. Minor, J. S. Seeley, M. Stettheimer and E. S. Toothe.

Mr. and Mrs. McKedy and Mr. and Mrs. H. C. Oviatt on the Board Walk.

National-Acme Manufacturing Company, Cleveland, O.—Acme automatic multiple spindle screw machines, single belt drive and motor drive. Represented by L. M. Waite, W. S. Chase and J. F. Judd.

National Boiler Washing Company, Chicago, Ill.—Blue prints and photographs of boiler-washing systems installed. Represented by W. White.

National Lock Washer Company, Newark, N. J.—Car curtains, curtain fixtures, sash locks, sash balances, window fixtures, lock washers and nut locks. Represented by F. B. Archibald, W. C. Dodd, Daniel Hoyt and John B. Seymour.

National Malleable Casting Company, Cleveland, O.—Tower, Climax and Sharon couplers. Represented by F. R. Angell, C. A. Bieder, W. E. Coffin, J. V. Davison, R. T. Hatch, H. D. Hammond, J. H. Jaschka, K. R. Johnston, G. V. Martin, B. Nields, Jr., R. H. Pilson, J. A. Slater, S. L. Smith, E. O. Warner and L. S. Wright.

National Tube Company, Pittsburg, Pa.—Seamless steel locomotive tubes, Spellerized locomotive tubes, seamless steel locomotive bells, seamless tubes for mechanical purposes, Kewanee unions, valves and air pump unions. Represented by Geo. N. Riley, L. R. Phillips, James C. Batesman, C. R. Cummings, H. C. Brown, L. F. Hamilton, W. S. Bitting, H. O. Ramsey and A. J. Hamilton.

John E. Ward and the splendid exhibit of his company.

Two exhibits, those of the Scully Steel & Iron Co. and the Chicago Steel Car Co., H. C. Finlay, A. E. Barron, J. E. Chisholm, W. H. Dangel and H. H. Gilbert.

Exhibit of L. M. Booth Co.

Three long-time friends, Robt. Patterson, M. M., G. T. Ry.; J. T. McGrath, M. M., G. T. Ry.; Arthur Allan, M. M., T. & N. O. Ry.

Newton Machine Tool Works, Inc., Philadelphia, Pa.—High duty radial drilling machine; cold saw cutting off machine; rapid production bolt threading machine. Represented by Harry W. Champion and Nicholas P. Lloyd.

New York Air Brake Company, New York, N. Y.

National Railway Devices Company, Chicago, Ill.—Shroyer uncoupling apparatus; Dohlin automatic car door fastener; Nicholas car door fastener; Schoemaker fire-box door operator; Turnbull driving wheel flange lubricator and Rubbertex roofing. Represented by J. W. Luttrell, Frank Schoemaker, Jay G. Robinson and Percy P. Hinckley.

Newhall Engineering Company, George M., Philadelphia, Pa. —N. B. air-brake and signal hose connection, photographs showing products of Industrial Works of Bay City, Mich.; Pablow pneumatic tool appliances, throttle handles, hose couplings, air valves, etc. Represented by W. L. Brown, M. L. Newhall and David Newhall.

Niles-Bement-Pond Company, New York.—This exhibit includes also an exhibit of the Pratt & Whitney Company. Pond rigid turret lathe; single screw tool clamp for Pond car wheel lathe; P. & W. 16-in. precision lathe for tool-room use; P. & W. high speed twisted drills. Represented by J. K. Cullen, J. T. McMurray, D. J. Normoyle, G. F. Mills, F. G. Payson, E. L. Leeds, N. C. Walpole, E. S. Cullen, D. H. Teas and M. Estabrook.

Norton Company, Worcester, Mass.—Large wall case of Norton grinding wheels made of alundum; large wall case of India oil stones. Represented by Geo. C. Montague.

Norton Grinding Company, Worcester, Mass.—Norton gap-grinding machine for locomotive work, 18 in. and 30 in. x 96 in.; samples of automobile crank shaft ground on a Norton grinding machine; pair of car wheels illustrating a flat wheel and a wheel ground on a Norton car wheel grinder. Represented by Hans Wickstrom.

Noscalon Company, New York, N. Y.—Noscalon material and machine for introducing material into locomotive boilers and machine for introducing material into stationary boilers. Represented by Wm. H. Stevens, John J. Healey, Jr., Robert T. Weaver and Frank H. Clark.

Pantasote Company, New York, N. Y.—Pantasote car curtains and upholstery materials; Agosote head linings, panels, partition, etc. Represented by John M. High, Geo. N. Boyd and Wm. O. Lake.

Parkesburg Iron Company, Parkesburg, Pa.—Knobbled hammered charcoal iron boiler tubes, safe ends, arch tubes and water grates. Represented by H. A. Beale, Jr., G. Thomas, 3d, C. L. Humpton, J. A. Kinkead, W. H. S. Bateman and L. P. Mercer.

Milton Bartley, Christopher Murphy and Mr. Spencer at the booth of the American Nut & Bolt Fastener Co.

Exhibit of the Northern Railway Supply Co., showing the Rodgers dust proof journal box.

Exhibit of the Trenton Malleable Iron Co.

Pilliod Company, Swanton, O.—Two models of Baker-Pilliod locomotive valve gear. Represented by R. H. Weatherly, Frederick E. Pilliod, Charles J. Pilliod, Henry J. Pilliod and F. S. Wilcoxen.

Pittsburg Equipment Company, Pittsburg, Pa.—Side frame, journal boxes, draft casting, body bolster and structural truck bolster. Represented by H. V. Seth and O. S. Pulliam.

Pratt & Whitney Company, New York, N. Y.—With Niles-Bement-Pond Company.

Pressed Steel Car Company, Pittsburg, Pa.—Photographic reproduction of product in booth 515. Represented by O. C. Gayley, J. S. Turner, C. E. Postlethwaite, J. H. Mitchell, L. O. Cameron, F. von Hiller, J. H. Regan, W. H. Wilkinson, F. M. Robinson, J. G. Bower, C. D. Terrell, V. von Schlegell, G. H. Glover, Jr., M. S. Simpson, C. D. Jenks and G. T. Merwin.

Queen City Machine Company, Cincinnati, O.—One 24-in. motor-driven shaper, with gear box and a Westinghouse recording watt meter in operation. Represented by Mark Muggeridge and A. M. Watcher.

Harry L. Osman, Donald C. Barbee and J. E. Tesseyman arriving at the pier.

Exhibit of the Western Tool & Mfg. Co.

Railway Business Association, New York, N. Y.—No exhibit. Represented by Geo. A. Post, Frank W. Noxon and George A. Post, Jr.

Railway Materials Company, Chicago, Ill.—Steel back brakeshoes for locomotive, car and electric service, Ferguson oil furnaces, Rymco journal boxes. Represented by W. M. Simpson, Geo. L. Bourne, C. M. Mendenhall, T. B. Cram and Geo. Hoeffle.

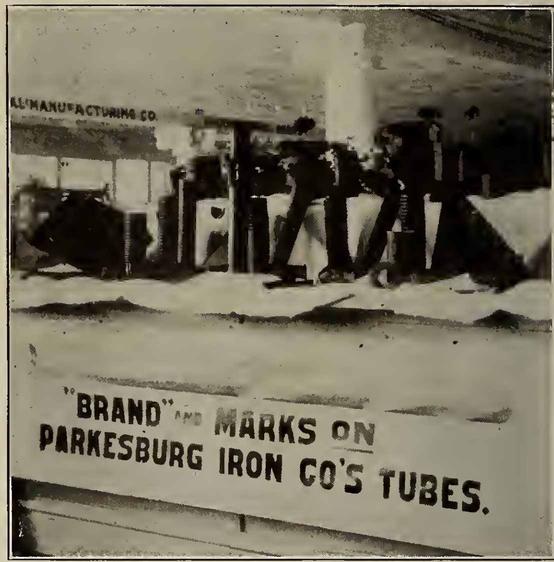
Rapp, John W., New York, N. Y.—Steel doors.

Revolute Machine Company, New York, N. Y.—Continuous electric blue-print machine. Represented by J. V. McAdam, C. J. Everett and T. W. Holcomb.

Ritter Folding Door Company, The, Cincinnati, O.—Model Ritter folding door, constructed of wood and glass as used in roundhouses and machine shops. Represented by T. N. Motley, F. A. Barbey, W. Moore Wharton, W. C. Lawson and J. M. Crowe.

Exhibit of the Ritter Folding Door Co. J. M. Crowe in the foreground.

W. D. Thompson, of the Hutchins Car Roof Co., and F. S. Hidland, of the Patton Paint Co.



Showing a few of the many products exhibited by the Parkesburg Iron Co.

Robinson Company, Boston, Mass.—Robinson exhaust nozzle, rail anchor, air strainer. Represented by Gordon Dexter, Frederic Parker, Frank Robinson and Charles L. Snow.

Royersford Foundry & Machine Company, Inc., Royersford, Pa.—Punch and shearing machines. Represented by G. C. Freed and A. Loomis.

Rubberset Brush Company, Newark, N. J.—Paint brushes set in rubber, adapted for railway use. Represented by A. L. Holtzman and Wm. R. Wright.

Russell, Burdsall & Ward Bolt & Nut Company, Port Chester, N. Y.—Finished and semi-finished castellated nuts; semi-finished hexagon nuts; finished case hardened nuts; cold punched chamfered and trimmed nuts; monel metal bolts and nuts; machine bolts and bolts for all classes of work for engines and cars. Represented by R. B. M. Cook and T. S. Hickox.

Ryerson & Son, Joseph T., Chicago, Ill.—Lennox rotary bevel shear; Ryerson high-speed friction saw; Ryerson portable automatic key-seating machine; Ryerson crank-pin truing machine; Ryerson flue welding machine; Hartz flue welding machine; model of the Ryerson flue cleaning machine; Ryerson cylinder boring bar; Ryerson internal combustion riveter; Ryerson high-speed chain hoist and trolleys; Ryerson valve seat facing machine; glyco-lined M. C. B. standard car journal bearings. The company's representatives at the convention are: G. H. Pearsall, E. T. Hendee, Fred Gardner, J. Kunzer, M. C. White and O. C. Duryea.

Safety Angle Cock and Air Brake Hose Coupler Company, Baltimore, Md.—Safety angle cock and air-brake hose coupler. Represented by John C. Hooper.

Safety Car Heating & Lighting Company, New York, N. Y.—Latest type single mantle lamps; axle-driven dynamo electric lighting equipment; lighting fixtures; demonstration of vapor lighting equipment for branch line service; and the Safety heatign system for passenger trains. Represented by R. M. Dixon, J. A. Dixon, L. R. Pomeroy, R. C. Schaal, G. E. Hulse, J. S. Henry, Wm. St. John, D. W. Pye, J. M. Town, R. C. Moore and C. B. Adams.

St. Clair Air-Brake Company, Indianapolis, Ind.—Two air-brakes. Represented by Augustus A. St. Clair and Newton Claypool.

Scullin-Gallagher Iron & Steel Company, St. Louis, Mo.—All open-hearth steel castings, consisting of body and truck bolsters, side truck frames, excel couplers, engine frames, car and tender underframes, driving wheel centers and miscellaneous car and locomotive castings. Represented by Harry Scullin, Thos. M. Gallagher, C. L. Harris, W. W. Pettis, P. J. Howard, J. O. Timms, F. W. Graves, F. L. Norton and R. B. Clark.

Exhibit of the American Blower Co.

Exhibit of the Bullard Car Door Equipment Co.

W. R. Toppan at the left is thinking "things worth remembering." The others are L. M. Booth, Mr. and Mrs. White and A. J. Donniez.

Keller Mfg. Co. exhibit in which may be seen Harry Keller and Howard Small.

Scully Steel & Iron Company, Chicago, Ill.—Everlasting blow-off valves, Simplex car and track jacks, homo-laminated staybolts, Wangler rotary bevel shear, Scully rotary plate shear, Lucas pneumatic tube expanders, Scully railway flue cutter, reversible staybolt chuck, Scully journal jacks, Scully wrought steel floor plate, Scully hose couplings and boiler shop tools. Represented by A. B. Scully, H. C. Finlay, W. H. Dangel, W. B. Templeton, A. E. Barron, John H. Allen, F. M. Patterson and H. H. Gilbert.

Sellers & Company, Wm., Ins., Philadelphia, Pa.—Locomotive injectors and valves. Represented by S. L. Kneass, J. D. McClintock, C. B. Conger, Geo. H. Wilson, Chas. T. Wilson and Edward L. Holljes.

Spencer Turbine Cleaner Company, Hartford, Conn.—Showing method and machinery for cleaning by suction carpets, car seats and slatted floors of trolley cars. Represented by E. W. Muzzy, S. W. Bowerman, Roy B. Smith and G. H. Noble.

Standard Coupler Company, New York, N. Y.—Standard steel platform; buffing mechanism; Sessions-Standard friction draft gear; Standard slack adjuster; Standard sustaining valve for air brake cylinders. Represented by Geo. A. Post, A. P. Dennis, E. H. Walker, R. D. Gallagher, Jr., George A. Post, Jr., and W. H. Sauvage.

Standard Steel Car Company, New York, N. Y.—Forged steel wheels. Represented by James B. Brady, R. L. Gordon, H. G. Macdonald, Wm. A. Libkeman and C. W. Wright.

Standard Steel Works Company, Philadelphia, Pa.—No material but occupying spaces in booth. Represented by H. de H. Bright, Charles Riddell, C. H. Peterson, E. B. Halsey, H. W. Sheldon, F. Weston, G. F. Jones and E. S. Lewis.

Standard Tool Co., The, Cleveland, O.—Twist drills, reamers, taps, milling cutters and chucks. Represented by F. T. McGuire.

Sterling Steel Foundry Company, Pittsburg, Pa.—Sterling automatic coupler. Represented by H. E. Wainwright and G. J. Chandler.

Stoever Foundry & Mfg. Co., New York, N. Y.—One No. 2 motor-driven automatic pipe-bending machine, capacity 1 in. to 2 in.; one No. 8 motor-driven pipe-threading and cutting-off machine, 1909 model, capacity 2½ in to 8 in. Represented by Ed. R. Euston and W. E. Farrell.

Storrs Mica Company, Owego, N. Y.—Samples of mica headlight chimneys and other styles of mica lamp chimneys. Represented by A. P. Storrs and Charles P. Storrs.

Symington Company, T. H., Baltimore, Md.—Malleable iron freight journal boxes, Symington iron passenger journal boxes, Symington flexible dust guards and miscellaneous malleable iron castings. Represented by T. H. Symington, J. F. Symington, C. J. Symington, T. C. deRosset, A. H. Weston, D. Symington and W. W. Rosser.

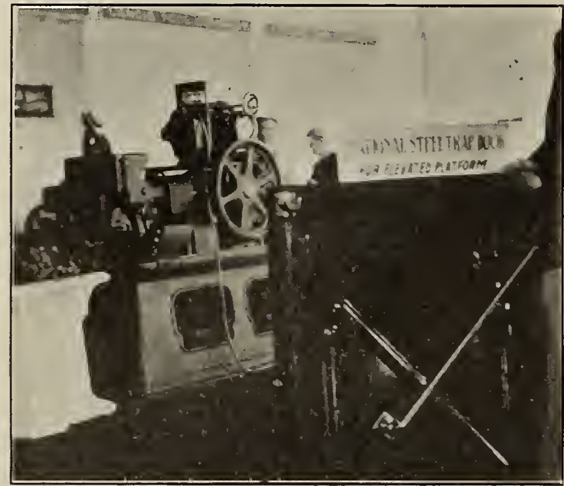
Taylor Company, W. P., Buffalo, N. Y.—Taylor improved dustproof self-locking journal boxes for freight and passenger service. Represented by W. P. Taylor, Jas. W. Gibney, A. L. Kendall and Wm. C. Wilson.

Taylor Mfg. Company, James L., Bloomfield, N. J.—Quick adjusting and self-locking screw clamps. Represented by James L. Taylor and E. C. Blake.

Tindel-Morris Company, Eddystone, Pa.—High duty inserted tooth cold saw blades; sawing machines; crank shaft lathes and grinding machines. Represented by Eugene C. Batchelar.

Exhibit of the Chisholm & Moore Co.

Exhib' of Richard Dudgeon. The man at the desk is W. H. Mathers.



Showing the National Steel Trap-door which was a very attractive part of the exhibit of the General Ry. Supply Co.

This is a railroad man, but we are not sure who it is. We will give as a prize for the first correct guess, a year's subscription to the Master Mechanic.

Topping Brothers, New York, N. Y.—Burrows ball-bearing jacks and Burrows cone-bearing jacks. Represented by W. R. Burrows, W. C. Burrows, Edward Dugan, W. T. Goodnow, W. B. Kilpatrick and H. W. Topping.

Trenton Malleable Iron Co., Trenton, N. J.—Trenton flush car door; Trenton refrigerator car door; Trenton hopper door; Malleable iron castings and emergency flue nipple. Represented by Sinclair J. Johnson, R. C. Fraser, R. C. Oliphant and A. R. Gould.

Underwood & Co., H. B., Philadelphia, Pa.—Portable cylinder boring bar, portable crank-pin returning machine, new portable crank-pin rivet head facer, portable rotary boiler tube cleaner and a new vertical machine for boring small cylinders, such as air-brakes, etc. Represented by A. D. Pedrick and D. W. Pedrick, 2d.

Union Draft Gear Company, Chicago, Ill.—The Cardwell friction draft-gear. Represented by J. R. Cardwell, John D. Ristine, C. H. Tobias and W. G. Krauser.

Union Fibre Company, Winona, Minn.—Linofelt refrigerator car lining; special fire and waterproof lith for lining steel cars. Represented by A. G. Brown, J. H. Bracken, F. J. Bingham and S. E. McPartlin.

Union Spring & Manufacturing Company, Pittsburg, Pa.—Coil and elliptic springs; pressed steel journal box lids and spring plates; Kensington all-steel journal box. Represented by A. M. McCrea, L. G. Woods, C. S. Foller, A. Stucki, T. B. Arnold and A. C. Woods.

U. S. Metal & Manufacturing Company, New York, N. Y.

Urquhart, Henry H., Paducah, Ky.—An improved brake shoe for locomotives. Represented by Henry H. Urquhart and Chas. L. Puffer.

Ward Equipment Company, New York, N. Y.—Ward's complete heating equipment for railway cars and locomotives, improved locomotive reducing valve, starting valve, steam couplers, end train line valves, steam traps and low-pressure attachment, passenger car ventilator, Ward's yard plug, used for charging storage batteries on electrically lighted cars. Represented by John E. Ward, Alfred W. Kiddle, George B. Culver and Richard Voges.

Watson Insulated Wire Company, New York, N. Y.—With the Kerite Insulated Wire & Cable Company. Represented by J. V. Watson.

Watson Stillman Company, New York, N. Y.—Hydraulic car wheel and crank-pin presses, hydraulic rail benders and jacks, turbine pumps. Represented by G. L. Gillon, Richard Baker and H. A. Prindle.

Exhibit of the Union Draft Gear.

Exhibit of the American Joxyl Co.

Exhibit of the American Vanadium Co.

This gives an idea of the excellent exhibit of Walter Macleod & Co. Mr. Stoddard is almost hidden by the many specialties.

Watters, J. H., Augusta, Ga.—Strainer valves, track sanders, cushion cleaners, truck wheels. Represented by J. H. Watters.

Waugh Draft Gear Company, Chicago, Ill.—Draft gears and truck springs. Represented by J. M. Waugh and D. MacFarland.

Welsbach Company, Gloucester, N. J.—Incandescent gas lamps for railway station yard and shop lighting, incandescent gas mantles. Represented by Chas. W. Wardell, Townsend Stiles, Thos. J. Litle and Milton C. Whitaker.

West Disinfecting Co., Inc., New York, N. Y.

Western Railway Equipment Company, St. Louis, Mo.—Republic friction draft gear; Acme automatic brake slack adjuster; combination lug and follower casting; interchangeable door; Western flush car door; slack adjuster; Downing card holder; Linstrom non-freezing suction pipe; Acme pipe clamps; Western angle cock holder; Western sill pockets; Western tie dating nails; St. Louis door; bell ringer; Missouri door; Security dust guard; Linstrom eccentric; Hoerr fish hook tie plates; brake jaws and brake jaw pins. Represented by S. H. Campbell.

Western Steel Car & Foundry Company, Chicago, Ill.—With the Pressed Steel Car Company and the same representatives.

Western Tool & Manufacturing Company, Springfield, O.—Toolholders, many new designs of machinists' tools; Champion expanding mandrels, movable benches. Represented by Henry Morris and J. Z. Wells.

Westinghouse Automatic Air & Steam Coupler Company, St. Louis, Mo.—Sample of their automatic air and steam coupler. Represented by N. F. Niederlander and E. L. Adreon.

Westinghouse Air-Brake Company, Pittsburg, Pa.—Triple valve test rack operative centrifugal dirt collector and sectioned (demonstration); 8½-in. cross compound air compressor connected in tandem with sectionel pump, demonstrating operation; rack demonstrating operation of K-2 triple valve (sectioned); enameled main reservoirs; motor-driven air compressor; "hose protecting" couplings; annealed steel hose clamps; demonstration of force required to separate hose couplings between cars as compared with standard hose couplings. Represented by A. L. Humphrey, J. R. Ellicott, E. L. Adreon, E. A. Craig, W. V. Turner, C. F. Street, A. Johnson, H. F. Woernley, G. L. McIntyre, H. C. Donaldson, C. C. Farmer, F. V. Green, W. S. Bartholomew, C. J. Olmstead, F. T. Reese, S. J. Kidder and P. H. Donovan.

Westinghouse Electric Manufacturing Company, Pittsburg, Pa.—Turbine train lighting set; stationary electric motors; arc lamps; incandescent, including carbon filament, metalized filament and Tungsten lamps; blowers, ventilating fans; current measuring instruments. Represented by A. C. McQuiston, J. H. Klinck, R. F. Moon, Chas. Talbot, H. M. Perry and A. F. Chamberlain.

Westinghouse Machine Company, The, Pittsburg, Pa.—Turbine train lighting set; electric storage batteries for railway use. Represented by H. P. Childs, D. C. Arlington, S. B. Dusinberre and W. G. Davis.

H. U. Morton, of the General Railway Supply Co.

Roland C. Fraser and S. D. Anderson.

Jos. Ralston, J. E. Tesseyman and F. S. Symons, of the Ralston Steel Car Co.

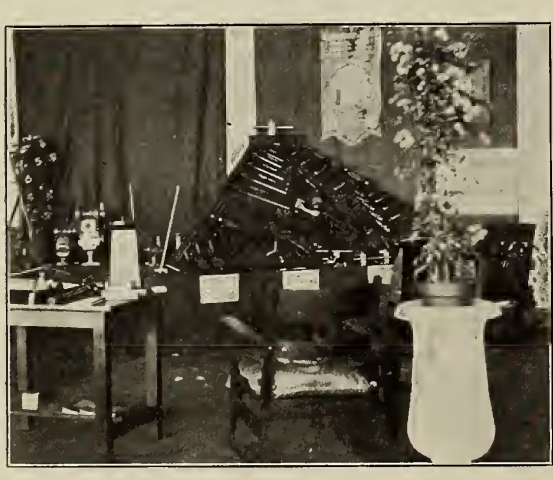


Exhibit of the Armstrong Bros. Tool Co.

Sam. Allen and Albert G. Elvin, of the Franklin Ry. & Supply Co.,

J. M. Crowe, who has recently been made president of the Central Western Supply Co., Cincinnati, O.

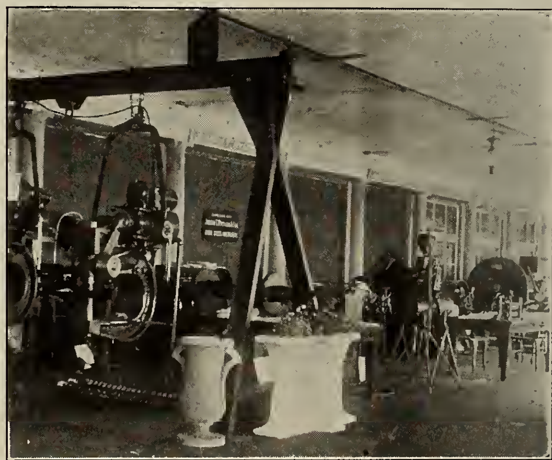


Exhibit of J. T. Ryerson & Son. One of the most interesting exhibits of the convention.

Horace L. Winslow and H. A. Varney at the exhibit of the Horace L. Winslow Co.

Wheel Truing Brake-Shoe Company, Detroit, Mich.—Abrasive brake-shoes for truing up flat wheels, dressing down tread-worn tires and long flanges. Represented by J. M. Griffin.

Wickes Boiler Company, Saginaw, Mich.—The Wickes vertical water tube safety steam boiler. Represented by C. F. Wilson and L. Beebe.

Winslow Company, Horace L., Chicago, Ill.—Clark blow-off system; two-in-one journal bearing. Represented by H. L. Winslow, W. C. Smith and H. A. Varney.

Wood, Guilford S., Chicago, Ill.—Wood's flexible nipple end hose protector, the monogram bracket, P. & W. hose preservative, upholsterer's leather, copper ferrules, car heating hose. Represented by Guilford S. Wood, D. F. Jennings and J. C. Stuart.

Wood Locomotive Fire Box & Tube Plate Company, W. H., Media, Pa.—Samples of flanging and pictures of boilers and fire boxes. Represented by William H. Wood, F. H. Snell and William T. Kolp.

Wright Safety Air Brake Company, Greensboro, N. C.—A device for automatically setting the brakes in event of any abnormal relation of truck to car body. Represented by John B. Wright and Clement G. Wright.

Yale & Towne Manufacturing Company, New York, N. Y.—Electric hoists, Triplex chain blocks, I-beam trolleys, electric triplex hoists, padlocks, door checks, night latches, builders' hardware. Represented by C. W. Beaver and C. H. Van Winkle.

Report of the Forty-Third Annual Convention of the Master Car Builders' Association

Proceedings of the First Session, Monday, June 21.

The first session of the Master Car Builders' Association's convention was held in the Greek Temple on Young's Million Dollar Pier on Monday, June 21.

President McKenna called the meeting to order at 10 o'clock and introduced Rev. Newton W. Cadwell, D. D., pastor of Olivet Presbyterian Church, Atlantic City, who opened the meeting with prayer.

Address of President McKenna.

In opening this, the Forty-third Annual Convention of the Master Car Builders' Association, it is my pleasant privilege to extend personal greetings to all members and friends here assembled, with assurance of a keen appreciation of the honor and confidence reposed in me.

From a purely business viewpoint we could meet under circumstances more pleasing; but the vast commercial industries of our country are daily resuming active operations in mills and factories that have long been idle, and as railways are being benefited by these improved conditions, we can reasonably assume that better times are assured.

Rigid economy by railway companies throughout the country has prevailed during the past year. It has been largely compelled by federal and state legislation that caused investors to hesitate in accepting securities offered, and mechanical departments of railways have suffered. This condition has been more acute during the period mentioned than at any time since 1894, and at no time in the history of railways has their ownership and management been subjected to so much adverse criticism from those who have no intimate knowledge of railway affairs.

With an ill-advised desire to gain popularity, certain public men and some of the press have constituted themselves guardians of public welfare. To achieve their ends they have caused great injury to commercial life, and corresponding damage to railway companies. Until legislative bodies repeal disastrous federal and state laws they have enacted, the public at large, which includes railway owners, managers, employees and patrons of the transportation companies, will continue to be more or less affected.

Railway companies in their zeal to economize, to protect themselves, and to conserve the best interests of all concerned, are buying only such materials and employing no more labor than is absolutely essential to the daily conduct of affairs, husbanding their resources until conditions again become stable. Appearances suggest that there is to be a respite from unfair legislation, and incidentally unjust criticism.

The people of this broad continent are our rulers. As they now realize the deterrent effect of extreme measures forced upon the railway companies, they view the matters that have been a subject of undue agitation in a more sane and logical manner.

As highways of commerce railways have been remarkably successful in surviving efforts made to oppress them, and have given conclusive proof of their strength and stability.

Those of us upon whom has developed the maintenance of vehicles used in the transportation of the vast resources of this continent have had a hard task. That we have been successful is evidenced by the good condition in which we have kept the 2,000,000 freight cars and 45,000 passenger cars that go to make up the equipment of the railway companies which constitute the maintaining membership of this association.

The founders of this association could hardly have anticipated its growth, nor the demand that would be made upon it in the way of improvement in car construction, regulating car interchange, etc. On the strong foundation that they built has been erected not only this great association, but from year to year other associations have been added, all of which are closely allied with us, and all working in perfect harmony. These, with the several railway clubs scattered throughout the country, have been valuable auxiliaries; many of the reforms in car construction, car interchange, etc., having their inception in their meetings and being worked out to a conclusion in our annual conventions.

Speaking for the association as a whole, it is my desire to express appreciation of the work performed by the various committees during the past year. A special effort was made to have committee reports in the hands of members at a much earlier date than formerly, and this was accomplished.

The few cases referred to the Arbitration Committee during the past year demonstrate conclusively that the work of that committee in drafting of rules, etc., was most thorough and well done.

The report submitted by the Committee on Standards suggests but few changes, indicating the care taken in considering the elimination of old standards or the adoption of new.

The report of the Committee on Car Wheels contemplates radical changes. It is hoped that the association as a whole will consider these most carefully, with a view of adopting such as will result in a more satisfactory wheel being furnished for the requirements of our various railways. In the great labor incident to the preparation of this report, the committee was most ably assisted by the Association of Chilled Car Wheel Manufacturers. The recommendations submitted were the result of research on the part of those who gave the subject their most careful attention. It is pleasing to know that the wheel manufacturers heartily cooperated with the railway representatives in the effort to reach conclusions which seem to give a wheel that will prove much more satisfactory than has been furnished in the past.

The Arbitration Committee has devoted studious care to the preparation of the rules of interchange, and the rules promulgated by them are eminently fair, both to car owners and to companies making repairs. Practices that should be frowned upon have become general on certain lines, resulting in great annoyance, and often in decided financial loss to car owners. Mechanical departmental and divisional heads should therefore instruct foremen, inspectors, repairmen, billing clerks and others that bills must of necessity be prepared in accordance with the prescribed rules of the association. The unfair practices that are being followed by certain car owners can be made a matter of history if mechanical department heads issue necessary instructions, and in fairness to all concerned this should be done.

Care should be taken by the various committees of the association, and also by the association itself, in adopting new standards or advancing recommended practices to standards; but when, after due care and thought on the part of committees of the association, standards are adopted, they should be more generally followed by car owners.

The question of an M. C. B. standard coupler deserves the most careful thought and research on the part of car owners and coupler manufacturers. Something should be done without any unnecessary delay to relieve the railway companies of the necessity of carrying vast quantities of detailed repair parts for various makes of couplers. Interchangeability is possible and should be worked out to a satisfactory conclusion. It would perhaps be well if the association, at the time recognized the side as well as the center unlocking arrangement for couplers.

We are called upon to provide a closer working arrangement with the American Railway Association, and there will be presented for your consideration the report of committee on proposed changes in our constitution and by-laws. Conditions in certain respects have changed of recent years, and this committee will recommend a revision that seems necessary to present requirements.

For years the question of consolidating the Master Car Builders' and the American Railway Master Mechanics' Associations has been the subject of discussion. Such action has heretofore not been deemed either necessary or desirable, and conditions at present do not indicate that it would now result in any benefit to railway companies. Unless improvement is possible, changes should not be favored. The two associations are separate and distinct so far as their line of action is concerned. The Master Mechanics' is of a technical character, having no legislative powers, and as the Master Car Builders' find it impossible to devote sufficient time to the proper consideration of the various reports submitted to them, the proposed consolidation seems unwise, especially as new topics, new subjects and new discussions would be introduced into our deliberations. There is sufficient work for each association in its own particular field, and as the method of procedure in handling work incident to locomotive repairs and construction, car repairs, construction and interchange, differs so very materially, it would seem desirable to handle them as two separate and distinct branches, so that the questions incident to each will be considered by two separate and distinct associations.

The electrification of railways is receiving the attention of the railway mechanical profession. We recognize that the time is near when electrification started on certain roads will extend to others. In view of the fact that all roads having representatives in this association will sooner or later be interested in the subject, it is recommended that a special committee be appointed to report to this association, from time to time, the best methods to be followed in arranging our present equipment for electric traction.

It is yearly becoming more difficult to secure lumber of the quantity and quality desired, and in fact required by the railways of this continent. It would be well to have a special committee appointed who would work in conjunction with departments of purchases and supplies of the various railways, and with the lumber dealers' associations, with a view of preparing specifications that would enable us to supply our lumber requirements to the best advantage of all concerned.

The Committee on Standards and Recommended Practice, whose report will be submitted to the association, has called attention to the necessity of revision of the plates, text, etc., of the proceedings of our annual conventions. This is a most important matter, and its careful consideration by the association as a whole is urged.

It is with great regret we recall that death has taken from us during the past year honored members of our association as follows: George W. West, R. H. Soule, J. Wohrle and G. W. Butcher.

The ladies who have honored us with their presence it is hoped will so enjoy themselves that we will have them with us every year so long as this association endures.

To the members permit me to express my gratitude for the honor due me in permitting me to preside over your deliberations, and to extend my thanks for the uniform courtesy that has been shown during the past year.

To the members of the press here with us we express our appreciation for valued assistance given in carefully preparing and distributing the proceedings of our various meetings.

For the association as a whole, and for myself personally, thanks are extended to our worthy secretary, who for years has been a strong pillar in the support of this association. His ability is well known and appreciated by all.

Secretary Taylor then submitted his report, which, among other things, showed the following:

Active members in June, 1908, 424; 1909, 447; representative membership in 1908, 275; 1909, 292; associate membership, 1908, 14; 1909, 13; life members, 1908, 14; 1909, 17. Total membership, June, 1909, 769.

Number of cars represented in the Association, 1909, 2,403,961; 1908, 2,283,330, a gain in 1909 of 120,363. The receipts and expenditures for the year were $17,610.95.

The Secretary reported further that there were no bills remaining unpaid, except for the printing of one or two reports, which came in late after the books of the secretary were closed.

The secretary further reported that 23 railways and private car lines had signified their desire during the year to become subscribers to the rules governing freight cars, and their names would appear in the rules of interchange. Two railways also signified their acceptance of the code of rules governing the interchange of passenger cars.

The treasurer's report was presented by the secretary, and showed a balance on hand of $526.11. The report of the treasurer was referred to the auditing committee.

The executive committee's recommendation that the dues for the current year remain as at present, $4 per vote, was approved.

The secretary has appointed the following committees:

On Obituaries—B. F. Flory, on G. W. West; G. R. Henderson, on R. H. Soule; S. S. Stiffey, on John Wohrle; G. W. Taylor, on G. W. Butcher; H. E. Passmore, on J. B. Morgan.

On Resolutions—L. R. Pomeroy, Le Grand Parish, C. A. Schroyer.

On Nominations—J. S. Lentz, G. N. Dow, J. E. Buker, A. E. Manchester, D. M. Perine.

Prof. Charles H. Benjamin, Dean of the School of Engineering of Purdue University, was elected an associate member.

E. W. Grieves, a past president of the association, was elected an honorary member.

W. C. Ennis, who has been a member of the association since 1884, and has withdrawn from active railway service, was elected a life member.

A letter from C. E. Fuller (Union Pac.) regarding standard height of drawbars was then read:

"I suggest that you take the matter up with the members of the executive committee, with a view of formulating a substitute resolution as an amendment to the Safety Appliance Act, which will remove the ambiguity which it is pretty generally admitted, exists in the resolution submitted to the Interstate Commerce Commission in 1893.

"For your information, I have recommended to the management of the Union Pacific the following resolution to take the place of the original resolution submitted to the Interstate Commerce Commission, and I think the executive committee should agree on some such form of resolution so that we may be in position to promptly give our recommendation when the time comes for doing so.

"'Resolved, That the maximum height of drawbars for freight cars measured perpendicular from the level of the tops of rails to the centers of drawbars for standard gage railways in the United States shall be 34½ inches, and the minimum height of drawbars for freight cars measured in the same manner shall be 31½ inches.'"

Mr. Fuller.—The reason for that suggestion was this: There seems to be an opinion that an empty car has to be 34½ inches or thereabouts to be accepted, and eliminating the words "loaded" and "light" is the only change in the proposed amendment. As near as I can find out it was not the intention that a car either loaded or empty was to be rejected if it came within the maximum and minimum height. There seems to be some question on that. Judge Moody, I believe, rendered a decision, and it seems to us that it is up to this body to set this matter right, so that it will remove any possible objection or friction.

The resolutions were received and adopted.

The secretary then announced that through the will of Mrs. Emma A. Tillotson, the Master Car Builders' Association was bequeathed the sum of $5,000. It was decided that the bequest be received and invested and the interest thereon applied to such investigations as the Executive Committee may recommend to the association, the form of investment to be left with the treasurer subject to the approval of the Executive Committee.

The Secretary.—A communication from the General Storekeepers' Association regarding uniform specifications for lumber was considered by the Executive Committee at its meeting yesterday. This subject was considered by the Master Mechanics' Association, and was thought of such importance that it recommended that the subject be referred to the incoming executive committee to appoint a committee to confer with similar committees from other organizations looking toward the adoption of uniform specifications for lumber. The executive committee recommends similar action on the part of this association and I would like to have Mr. Seley present the same matter that was presented at the Master Mechanics' Association.

C. A. Seley (C., R. I. & P.) then read the resolution passed by the Master Mechanics' Association.

This resolution was then adopted.

Messrs. Pomeroy, Evarts and Dodds were elected members of the Auditing Committee.

The first report was that of the committee on Revision of Standards and Recommended Practice, which was abstracted by Mr. Buker.

Discussion on Standards and Recommended Practice.

Mr. Kleine then presented the minority report of the committee.

The majority report was considered paragraph by paragraph.

C. A. Schroyer (C. & N. W.)—I wish to say, as regards paragraph 8, which reads, "A member suggests striking out the word 'malleable' for Journal Box Wedges, substituting therefor 'drog forged.'" That, I think, is a most excellent suggestion. In so far as the breaking of the wedges is concerned, we have never had any trouble, but I know you have trouble with the malleable iron wedges from the fact that they are made of such soft metal. The brass casting with the pattern number and with the size of the brass and initials of the road and initials of the M. C. B. Association on top wear up into the face of the wedge. We have had to take hundreds of our malleable wedges out and send them to the machine shop and with an emery wheel grind them off level again, because of the difficulty we have had in putting the brass into boxes with the malleable iron wedge. Where the branding on the top of the brass does not come right with the branding on the former brass, you have not a level bearing between the brass and the wedge.

William McIntosh (C. of N. J.)—If the principal difficulty with the malleable iron wedge is on account of the raised condition of the letters, would it not be possible to eliminate that feature, which I understand is done if we use a drop forged wedge? Further, would it not be possible to provide a steel wedge that would answer the purpose?

Mr. Schroyer—It is possible. The difficulty with malleable iron as a wedge is due to the fact that you must core it out and leave nothing but a shell. The coring out is made necessary for the purpose of getting the benefit of the malleable feature. If you make the wedges of drop forgings or or steel, you can get a good, broad, wide bearing on top which will prevent wear and you can get a solid bearing between the wedge and the brass which will prevent wear. Those are the two things we are trying to obtain, and they cannot be obtained with the malleable iron wedge.

Mr. Buker—In paragraph 30, the committee approves the use of drop forged wedges for 100,000 lbs. capacity cars, and I do not believe that will bar the use of malleable iron wedges for light passenger cars. The committee believes that for the higher capacity cars the wedges should be drop forged.

R. P. C. Sanderson (Virginian)—Is there any reason why we should not use a properly made cast steel wedge? Why limit ourselves to drop forgings? I do not think that is right.

F. W. Brazier (N. Y. Central)—The easiest way out would be to say. "Drop forged or equivalent."

Mr. Seley—I move that the suggestion of the committee be approved by the convention.

Motion carried.

F. H. Stark (Pittsburg Coal Co.)—It has been suggested here that we add to that "drop forged or cast steel," so as to give the option of using either a drop forge wedge or a cast steel wedge.

Mr. Kleine—Cast steel is already designated on the standard sheet, and the substitution recommended here is simply to drop out "malleable" and insert "drop forged."

D. F. Crawford (Pa. Lines)—I move that the minority report, paragraph 40, be substituted for the report of the majority, paragraph 40.

Motion carried.

Mr. Crawford—I would move that the report of the minority, paragraph 48, be substituted for the report of the majority on this question of lettering, numbering and marking of freight cars.

Motion carried.

Mr. Seley—In regard to No. 43, the committee's recommendation I think should be adopted, as we show one width of box and another width of pedestal in our present cuts, owing to the fact that the report of the committee last year approved one and did not approve the other; whereas, both the box and the pedestal were increased in width in the committee report.

Mr. Crawford—This report is really presented to the convention twice this morning, and I would make a motion that such of the recommendations as the committee on standards have concurred in be referred to committees for investigation as they suggest be referred to letter ballot as may be necessary, and wherever they call attention to typographical or similar errors in plates or text, that those instructions be given through the proper channels for making such corrections.

Motion carried.

The next committee report was that on Train Brake and Signal Equipment. Mr. Pratt read the report.

Discussion on Train Brake and Signal Equipment.

Mr. Pratt (continuing)—Two manufacturers have furnished the requisite number of test triple valves at this time, but they were not received until about 10 days ago. too late for a test and report at this convention, but the committee has under consideration the conducting of those tests presently.

H. La Rue (C., R. I. & P.)—I would like to ask the committee if it is the intention, in the next to the last paragraph, to suggest that we discontinue the use of malleable iron to the extent of including the head with the wrought iron connection.

Mr. Pratt—I do not think I can answer that offhand. There was a notation, as I remember, on the cut in the M. C. B. design. Perhaps the secretary has that cut and can answer the question. I think it gave an alternative there.

Mr. Seley—My recollection of the standard is that this sheet shows a malleable iron bottom connection, a star connection, and it is my understanding that the committee wishes to substitute wrought iron or steel round iron in place of the star shaped malleable. Is that correct, Mr. Pratt?

Mr. Pratt—I think that is, Mr. Seley, but I do not seem to have that very plainly in mind.

W. E. Dunham (C. & N. W.)—It is the intention that that star section bottom rod be omitted.

Mr. Sanderson—There is one question I would like to raise with reference to the brake shaft. It is no doubt the best way to get at information of this kind, to send out a circular inquiry, tabulate and diagram the results; but it does not seem to me that we want to be guided by the average of those results if we are trying to get up something better or an advance on present practice. If the executive committee felt that the brake shaft practice was inefficient and bad, and needed reform, it does not seem to me that to go back to the average of all bad practice, is making any advance. The point I want to raise particularly is this—I believe it is common practice, and is conceded, that a square fit in the brake wheel is absolutely necessary. If it is necessary in the hand wheel on the top, it is more than ever necessary in the ratchet wheel half way down the shaft. You don't get a fit with these malleable ratchet wheels in the fit of a key on a flat that is made to the side of a shaft. They get loose and twist around, and I contend that there ought to be a square foot there. I think the committee in following what was the average practice in that way, has not gone as far as they ought to have in improving for a future standard.

Mr. Pratt—If you had seen the tabulated figures in detail you would have seen that Mr. Sanderson is quite consistent. He has not adopted anything that anybody else ever used. but the committee could hardly go to the extreme that some railroads have. What is meant more particularly by this "splitting the difference," as you might say, is one railroad uses a 1¾-in. brake staff and another uses 1⅛ in. It was considered good practice perhaps to use 1¼ in., but not to go to 2 in. or cut down to ⅞ in. But there was no attempt to compromise as between a square and a round hole, or a hole with a key or a square fit. It is understood that we have the right to adopt one or the other. It was thought, although a recommended practice or a standard might not be applicable to all cars existing, that our company, for instance, not conforming to the standard, could have certain patterns changed, and as cars equipped with the standard came on our road, we could have a set of fittings that would apply to that car; and the same way with other members, instead of carrying a vast stock of different sizes and dimensions. So it was thought that as a whole it would be a benefit almost immediately, and as the years went by the standard would become more uniform and greater advantage gained from it.

Mr. Sanderson—I wanted to know whether the committee really felt that a round fit with a key was as good as a square fit for future use? If "yes," why didn't they use the same fit on the top?

Mr. Hennessey—As the brake staff comes in practically under safety devices, I think this is something that should be handled with great care. The brake staff submitted by the committee will answer all purposes, but at the same time there are many constructions of cars to which it would be very hard to adapt this particular brake staff. We are getting a little off the lines of emergency, as I might call it. If we have been able to get along with a brake staff that was not very expensive when the hand brakes were practically the only brakes used on a road, I do not see why the railways should be compelled today to go to the more expensive brake staffs. In fact, braking by hand is almost done away with today. Even in the switching yards, your switchmen do not pretend to ride the cars and use the hand brakes, and sometimes I think in looking through large yards that there is reason to ask why we are carrying brake staffs at all.

Mr. Miller—Regarding the matter of adopting a square hole for the ratchet wheel, it is no trouble to make the hole in a wheel about the size of the shaft so that there will be no slack motion there. But it is very expensive. The general way of getting this square hole in the wheel is by means of a core, and consequently you have a good deal of slack motion. If you have a key or a set screw there, you have a positive fit; if you go to a square hole you have no fit at all, and there is more than one source of slack in the brake wheel. Consequently when the brakeman lets up on his brake wheel, if he does attempt to set it up, there is considerable slack there.

Mr. Stark—In support of the committee's report I would like to consider the question of the mechanical work required to provide for a square on the shaft.

Mr. Sanderson—Square bar iron all the way down.

Mr. Stark—Then it would be necessary to draw out the balance of the bar.

Mr. Sanderson—Don't draw it out; just leave it square.

Mr. Stark—Another question is the matter of repairs. If you have a square fit on a ratchet wheel it makes it far more difficult to withdraw the shaft for repairs, which has to be done very commonly.

Eugene Chamberlain (N. Y. Cent.)—It seems to me that the remarks of Mr. Hennessey are so vital that they should be called to the attention of each member present, in pointing out the fact that the method of applying brakes upon cars today is principally by air, while we are now attempting to strengthen up an apparatus which we used for years before air was applied. It seems to me that the general public will not think much of it if you go strengthening an apparatus of that character today, when it is just a trifle late.

T. L. Burton (Cent. of N. J.)—I fail to understand where the committee has shown a disposition to adopt anything different from what we already have, as reference was made by the last speaker and by Mr. Hennessey. The association is on record as recommending nothing except the maximum height of shaft from the rail. I do not think the committee can justly be accused of having shown a disposition to recommend a more expensive shaft than has yet been used, inasmuch as we have not done anything so far as recommendation is concerned.

Mr. Hennessey—My intention was not to criticise the committee's report, but what I had in mind was that in the near future there is a possibility of the M. C. B. standards becoming the law of this land, and you have to go pretty carefully in what standards you adopt. If they once become a standard by law what is it going to cost you then to meet the requirements of your standards?

C. A. Schroyer (C. & N. W.)—The question is to get the most efficient brake shaft by the easiest and simplest mechanical methods, and at the least cost, not only first cost, but cost of maintenance. The question was brought up for consideration before this association at one time regarding the making of the brake shafts all in one piece and not having any weld in them at all. While we have never had any trouble ourselves regarding the breaking of the welds, breaking of the staffs in the welds, we have always continued to make them in practically the manner that is illustrated here. I believe that is the general practice throughout the country. I know that some roads are now making brake shafts of 1½-in. round iron and making them in one piece all the way, but in that case you have got to make a seat for your key, and I think a safeguard and precaution that would be an economical and efficient one would be to put a set screw through the hub of the brake ratchet right at the corner of the key so that it could not possibly get out or move. The use of a square brake shaft would entail the drawing out of a round in the center, or else make a thimble to slip down over the shaft so as to work in the box and prevent buckling or warping of the same. I think the brake staff that is indicated here is an excellent one. It met all our requirements in the years when we had to use hand brakes and it certainly should do it now when we do not have very much occasion to use hand brakes.

A. W. Gibbs (Penna.)—I think the committee is right that we should work with the idea of bettering our hand brake. With the introduction of hump yards the braking is as necessary as ever it was, and if we leave our rods as they were before we used the heavy cars the men will hesitate to use the brakes, as they will be afraid of their breaking. We have enough men killed from the breaking of rods. We require very severe braking in the classification of hump yards, and they are growing. We can do away with the whole thing, and let the cars slide and take our medicine, but many roads, ours among them, habitually ride each draft down, and we feel the requirement of making the hand brake in one piece is of such importance that we have made it a standard for many years in our own shops, and have recommended its use on other roads. I do not agree with Mr. Hennessey that the hand brake is becoming useless. I think the committee is correct in recommending that it be made in one piece.

Mr. Seley—I believe it is generally customary, in introducing new matter into the records of the association, that they should first go to recommended practice before being advanced to standard. I therefore move that the plate submitted by the committee, proposed brake shaft and fittings, Fig. 2, be made a plate of the association under Recommended Practice.

Motion carried.

Mr. Schroyer—I move the acceptance of the report, and that we submit the same to letter ballot, in accordance with the recommendations of the committee, for adoption as Recommended Practice or as Standard, as they may be required.

Motion carried.

Discussion on Brake Shoe Tests.

Mr. Lockwood—I might say in regard to this that the scale has been received and has already been in service for over a month. We have with us Professor Endsley, of Purdue University, who might make some remarks on some of the shoes he has tested and as to the accuracy with which the scale performs its work, the claim being made that it is sensitive to within one-thousandth of a pound.

The privilege of the floor was extended to Professor Endsley.

Professor Endsley—I have no written report to make. The scale was received about May 10 and installed upon a date which had been previously arranged by the society. An attempt was made to weigh in the open laboratory, but it was found that the slight draft, which could not be detected by a person, would affect the accuracy of the scale. A small house or covering was built over the scale, and an attempt was made to check its accuracy from day to day. By inserting a bicycle ball between the wheel and the connection between the machine, so that the alinement was exactly the same at all times, we were able to check from time to time to within one one-thousandth of a pound, or better, the scale never being off more than a little less than one one-thousandth of a pound. After the scale is balanced on any given day, a small bird shot weighing one five-thousandths of a pound will unbalance the scale by putting the bird shot out on either side. This is as accurate as anything could reasonably be expected to be. You can detect a difference of from one one-thousandth to one five-thousandth of a pound from day to day, caused either by the barometer reading or something we have not been able to detect, which affects the accuracy of the scale to about one one-thousandth of a pound.

Mr. Schroyer—I want to say that it is extremely gratifying to me that we have had a committee on brake-shoes for the last twenty years, and almost annually we have had a report from the committee, but I want to call attention to the fact that we are still making brake-shoes as we did twenty years ago. We apparently had this solution of the problem, that we now have a weighing machine that will weigh the wheel with great accuracy.

Mr. Lockwood—If the Brake Shoe Committee's labors are going to be of any importance, we must not only determine the individual wear of the shoe on different classes of wheels, but must note how much that particular shoe wears the wheel itself. It was down to a fine point when we had a scale that could be adjusted to one five-hundredth of a pound, but now with our scale, which can be adjusted to within one five-thousandth of a pound, it should be possible for us to do even more accurate work than in the past.

The report of the committee was received and the work ordered continued.

Proceedings of the Second Session, Tuesday, June 21.

President McKenna called the meeting to order at 9 o'clock.

The secretary announced that M. E. Endsley, Associate Professor of Railway Mechanical Engineering at Purdue University, had been proposed for associate membership in the association. In accordance with the provisions of the constitution, this proposal will lie over until the next annual meeting.

Discussion on Coupler and Draft Equipment.

Mr. Stark—I might add that we have the gages here for gaging the coupler shack butts and also the test of the coupler face, which can be examined by anyone interested. We are greatly indebted to the Pennsylvania Railroad for the manner in which they accorded the committee the facilities for making these tests. They provided a train of 14 cars loaded to the maximum capacity, with the dynamometer car used for recording the drawbar pull and a special head for the recording of side clearance. This special train has been operated over various divisions of the Pennsylvania with a corps of experts to carefully make a record. A number of these gentlemen are here and are ready to answer any questions that may arise.

R. P. C. Sanderson (Virginian)—I think the drop tests, as they stand today, the amount of the weight and the height, is ample for all testing purposes by impact, but I do believe we should increase the pulling test limit. In getting couplers built for our very heavy service I went into the matter with the coupler manufacturers and had couplers made and tested. In some cases we got 320,000 lbs. pulling test before we reached the limits of opening of the test requirements of the M. C. B. specifications, ⅜ of an inch, I think it is, showing that with the present contour lines and limits it is possible to go beyond the testing limits We want the best couplers we can get. We do not want broken trains, and if by raising the pulling test limit we can better the quality of the coupler, I think it would be an excellent thing to do.

R. L. Kleine (Pennsylvania)—In regard to the face test being a suitable substitute for the former guard arm test, in addition to the test for which it was designed, I would say that we measure the deflections between the point of knuckle and the guard arm on these face tests as well as the bending in the shank, which will show any very soft metal in the couplers.

In so far as increasing the pulling test is concerned, you all know that the pulling test was increased last year to 150,000 lbs. Some couplers which have been tested in the pulling test, as stated by Mr. Sanderson, that run up to 300,000 and 320,000 lbs., do not necessarily stand up very well under some of the other tests, such as striking test and the former guard-arm test. I do not believe we should make any change in the pulling test at this time.

In regard to the different lengths of overhanging of cars and their influence on side coupler pressure, it was necessary to take cars of one length, in order to keep out so many variables, and work from that standpoint. Really, the tests that were made, were made on as high as a 22-degree curve, and showed that really the side pressure was the resultant of the drawbar pull and the side pressure registered on the dynamometer. Therefore, the different lengths of overhang of cars would not cut very much of a figure on what we may term the regular road curves. They do make a decided difference when we get into short curves in industrial sidings, and even on crossovers that are commonly used. The different lengths of overhang do not exert a side pressure on the end sills of the cars sufficiently to be detrimental.

Mr. Kleine—On a 62-foot reverse curve without tangent between, we made a test on cars which were 44 ft. 11 in. long, with the face to face coupler, and we found that the couplers had a side displacement of as much as 39 in. But of course that is rather an impracticable condition for the cars to go around. The wheels at the same time interfered with the center sills. We had an auxiliary coupler when we made that test, and the cars were loaded. We got pretty well on to the center of the curve when the auxiliary coupler broke; we measured the displacement of the two cars, and it was 39 in.

F. F. Gaines (Cent. of Ga.)—I do not see that the committee has said anything about the question of having holes in the butt a split wall bore. I know I brought that question up before, but I have been experimenting along that line for some little time. We had trouble with loose coupler yokes, and while I do not question that the lip properly applied is going to keep them tight, the average employee we have applying coupler yokes is going to make a quick job. There are a number of roads I know of that are using three rivet holes to overcome the trouble. Some others have gone to making a solid wall all through the rivet butt, and the rivets are squeezed in and bent up. You can put in the rivet under hydraulic pressure or pneumatic pressure and get a solid job, and while the committee has not made any mention of it, it seems to me that is a point that will overcome a good deal of the difficulty in attaching couplers.

Mr. Kleine—Last year I believe the Coupler Committee touched on the yoke and rivet question very much in detail. As a matter of fact, the committee was very much surprised when they had some of the work done at the shop to see what an absolutely poor fit and poor method of applying the rivets was being practiced. We had some butts cut apart, both from cars in service and from newly riveted yokes to coupler butts, and the pictures, I believe, were in last year's report. The gages presented here will unquestionably relieve that situation a good deal. If the coupler with the lips fits the butt properly and the rivets are properly applied, I believe we will be relatively free from shearing of rivets. Just how much strain these lips will take off the rivets we will not determine by test, but it is a simple matter to do it, and I have no doubt whatever that if the fitting is properly done, which has not been done heretofore, the trouble from the shearing of the rivets will be practically eliminated.

W. E. Fowler (Can. Pac.)—I want to endorse what the gentleman has just said, not from the standpoint of tests, but from the service standpoint. I have proven not only to my own satisfaction, but to the entire satisfaction of all of my staff, that a properly fitted yoke when the coupler and yoke are first assembled, will go right through years of service without any failure, and I have proven that time after time by asking my friends who question the statement to go through the scrap pile. I do not think there is any better demonstration than to see how many couplers and yokes are in the scrap pile.

I have been such a strong believer in the proper fitting of the yoke and coupler that in going through the blacksmith shop, where, perhaps, we fit more couplers than most roads, I make it a practice to see what kind of a fit we get with the lip or yoke up against the shoulder of the butt, and since I have made it a practice of being extremely particular about that—in fact, I have gone to the extent of ordering a coupler sent back from the erecting shop to the blacksmith shop, if any were found not properly fitted—I want to tell you we have eliminated in the last five years; I should say, 60 per cent of the yoke failures. I do not know whether that is exceptional or not, but it is the sum of the experience we have had on the Canadian Pacific.

Mr. Schroyer—I think if you will put one of these draw bars, with the pocket attachments having a lug, in a testing machine, and one without the lug in a testing machine, you will find that the one without the lugs has a strength equal to the shearing strength of the rivets. If you will put the other one in the testing machine and test it out, you will find it will have a strength equal to the shearing strength of the rivets, plus the straightening strain necessary on the pocket. That would be an additional strength, and that strength would be amplified in proportion to the distance between the shoulder of the lug and the rivet. If the rivet could be passed down through the lug itself, you would find that the increased strength would be amazing, and it would be equal to the shearing strength of the iron, which, in the case of the standard pocket, I should say, would be anywhere from 100,000 to 150,000 lbs. in that particular point.

J. R. Onderdonk (B. & O.)—On the Baltimore & Ohio we made a number of tests of the action of the coupler yoke, principally under the drop test, as we felt that that more nearly represented the service conditions than the ordinary pulling test. With a yoke with a small radius at the bend of the back, the coupler and the yoke failed at this point with a very few blows. By increasing the radius to the present standard the failures were principally due to the shearing off of the rivets. By bending the yoke over as at present it increased the number of blows necessary about 50 per cent before final failure, especially if the lug was brought down to bear against the tail of the coupler, but even with this and good workmanship we still had the loose rivets in service. This seemed to be brought about by the tendency in curving, of causing the yoke and coupler to bend more or less at the connection, and when the rivets were found to be loose, they were not loose in a longitudinal direction, but transversely of the coupler, showing that there was considerable side strain that cause the rivets to be loose. I think possibly some form of connection between the yoke and coupler that will give some flexibility will probably give better service.

Discussion on Arbitration Committee Report.

The Secretary presented the following additional report of the Arbitration Committee, which was discussed paragraph by paragraph.

Rule 7—Your committee would recommend that an additional paragraph be added to this rule as follows:

"Brake Burn—Wheels having defective treads on account of cracks or shelling out due to heating."

H. La Rue (C., R. I. & P.)—I would like to strike out the words "brake burn." I do not think it is policy to use those words.

Mr. Schroyer—What would you use?

Mr. La Rue—Give a description of the defect.

Mr. Hennessey—The question of just how to word that was discussed possibly a half hour yesterday. It is a new term in wheel defects, and it was the sense of a large majority of the gentlemen present that it was about the best term that could be used, and not go into something that would be very misleading. The first part of the rule refers to shelled out. This describes the brake burn.

G. E. Carson (New York Central)—Wheel manufacturers claim there is no such thing as shelled out or brake burn, for for which they are responsible. I do not think the words "brake burn" should appear in our rules.

Mr. McIntosh—I agree with the last speaker that the words "brake burn" should not appear in any of our records regarding defects on the tread of a wheel. The wheel should be built to withstand the action of the brake-shoe. If it does not do that, under ordinary circumstances, it is not a good wheel. I think that the only condition that should be described in that connection is a slid flat wheel. If it is a slid flat wheel, I fancy that relieves the wheel maker, but if there are any defects that develop under ordinary breaking conditions, those are defects that should be made good by the wheel makers.

I. S. Downing (L. S. & M. S.)—If you have a wheel which fails on account of a trade hole which is a manufacturer's defect, the owner would reclaim on the bill rendered against them.

A. W. Gibbs (Pennsylvania)—It is necessary to have a distinction, and to define brake burn. On looking over some papers this morning, I find a report on the failure of wheels and find a large number of wheels recorded as shelled out. Why? Because inspectors do not know any other recognized term to describe it. They are not really "shelled out" wheels in a sense we used to describe them, the raised center with the ring around. I do not know of any term by which we can describe them better than brake burn. This table shows a large number of shelled out. They are not shelled out. They are these defects that everybody knows of as a brake burn, and we might as well recognize that officially. Our correspondence is full of matters relating to brake burn. Why not recognize that, when it is a fact?

Mr. Onderdonk—We designate two forms on the B. & O. One is the shelled out, where it is the manufacturer's defect, with the raised center; when it is due to burning of the crystals of the chill, gradually dropping out, it is designated as a blotch.

The President—The question is whether we shall accept the term "brake burn" or not.

Mr. Brazier—I move that the recommendation of the committee in regard to the definition of brake burn be adopted.

Motion carried.

The secretary then read the amendment to rule 23: "Your committee would withdraw the first recommendation under this rule, and would substitute therefor the recommendation made in the report of the committee on tank cars for the stenciling of tank cars with limit weight, as follows:

"All cars except tank cars to have their light weight and capacity or their light weight and maximum weight stenciled on them.

"All tank cars to have Limit Weight I. or Limit Weight II. stenciled on them."

The recommendation of the committee was adopted.

The secretary then read the proposed rule 33:

"Your committee approves in a general way the suggestion of the Committee on Air-Brake Hose, but would suggest, in order to make the rule clear, that it be changed to read as follows:

"Cars equipped with air-brake hose other than M. C. B. standard after September 1, 1909 (owners responsible), except cars offered in interchange where delivering company is responsible.

"Note—Cars equipped with 1¼-in. M. C. B. standard hose, and so branded, applied prior to September 1, 1909, will be accepted in interchange."

Mr. Schroyer—The question to be voted on is as to whether the hose shall be 1⅜ in. I have no objection to using it, if anything is to be gained. We know that with the larger sized hose it will cost more money and the pressure will be increased over the 1¼-in. hose with the expanded end. We have 1¼-in. pipe and fittings now, and what is the occasion for putting in 1⅜-in. hose? Why not continue with the 1¼-in. hose with the expanded end and get a uniform opening throughout?

Mr. Hennessey—As to the size of the hose, that is a question that will require more thought than we were able to give to it last night. I move that the size of the hose be referred to the Committee on Standards. The question to be decided today is: when will we put the rule into effect? We have been dilly-dallying with it for several years, and the committee thought by putting the rule into effect September 1, 1909, we would accomplish something.

The secretary read the following in relation to rule 34:

"Owing to the recommendations made regarding rule 33, which if adopted will preclude the use of any hose other than M. C. B. standard, your committee would recommend the elimination of this rule."

The recommendation of the committee was adopted.

The secretary read the following relating to rule 41:

"To clearly define the meaning of the different cards described in the recommendations of your committee pertaining to this rule, a further modification is proposed:

"1. Routing cards—Cars bearing information required by the railroads, such as initial and number of shipment, route, etc. These cards may be issued by consignor.

"3. Symbol cards (i. e., fast freight line, manifest freight, etc.) and various M. C. B. cards—Cards prescribed by individual roads for special purposes. Their size, use, text and method of application will be prescribed by each individual road to suit its requirements. These cards may only be issued by railways and may include same information as routine cards, except name of the consignor."

The Secretary—It simply means the addition of the last seven words: "These cards may be issued by consignor."

The recommendation was adopted.

The secretary read the matter relating to rule 58:

"Your committee would suggest an additional sentence in the next to the last line, as follows:

"White pine, yellow pine, fir, or cypress may be used when repairing siding on foreign cars, when of equal grade and quality to the material standard to the car."

The recommendation was adopted.

The secretary read the matter pertaining to rule 59:

"Your committee would approve the recommendation of the Railway Club of Pittsburg, that an additional paragraph be added to this rule, as follows:

"When necessary to renew brake beams, any metal brake beam meeting M. C. B. specifications may be used, provided that the beam applied is as strong as the beam standard to the car and does not require any change in hangers or other details."

The recommendation was adopted.

The secretary read the matter relating to rule 61:

"Your committee would suggest that the last sentence of this rule be changed to read:

"Couplers that exceed the distance of 5⅛ in. between point of knuckle and guard arm measured perpendicularly to guard arm must be repaired, in which case owners are responsible except on cars offered in interchange."

The recommendation of the committee was adopted.

The secretary read the matter relating to rule 66:

"Your committee has conferred with the Committee on Car Wheels, and would now approve the recommendation of that committee that a new paragraph be added, as follows:

"'In no case may two new wheels having maximum thick flanges be mounted on the same axle.'"

The recommendation of the committee was adopted.

The secretary then read the matter relating to rule 112:

"Your committee would recommend that the letters 'R and R' be added to the item reading 'Angle cock, grinding in, 28 cents,' in order to cover the total cost of removing, grinding in and replacing the angle cock."

The recommendation was adopted.

The secretary read the matter relating to rules 125, 127 and 128:

"On account of the fact that the present wording of these rules conflicts with the new Rule 14 of the code of Car Service Rules as adopted by the American Railway Association at its meeting May 19, 1909; that the routing of a car has no direct location in the M. C. B. rules, because it is a traffic matter; that changes are being made from time to time on the part of the American Railway Association or other traffic associations which necessitates changes in the rules and to avoid these changes it is suggested that any reference to the routing of cars be eliminated from the rules. To this end, your committee would suggest from Rule 125 the omission of the following paragraph:

"'If the route coincides with that over which the car passed to the point where it became unserviceable, no liability shall be incurred as between the owner and the road handling the car or for service during this movement,' and also the entire elimination of Rules 127 and 128."

The recommendations were adopted.

The report of the Arbitration Committee as presented and amended was accepted and adopted.

Discussion on Freight Car Repair Bills

Mr. Crawford (Continuing): The committee made some changes due to the use of the proposed card, which I understand have been referred to the Arbitration Committee and approved. I would say these changes are merely in the wording of the present rules to permit of substituting the words "billing repair card" for "stub" and such changes as that.

The President—Gentlemen, if you will refer to page 19 of the report of the Arbitration Committee, it will be seen that this recommendation of the special committee has virtually been adopted by favorable action on the report of the Arbitration Committee, so that all that is necessary is a motion to receive this report.

The report was received.

The next report was that on Air Brake Hose. Mr. Parish presented the report.

Discussion of Air-Brake Hose.

Mr. Parish—The first recommendation has been discussed, that question of the air brake hose, the date at which the new rule will go into effect. That has been passed upon by the convention, so we will pass that. The recommendation last year referred to the question of the standard air hose coupling, standard design, and we have presented a suggested plan, giving the detail outlines, which is only a slight modification of both the New York and the Westinghouse coupling, and this will necessarily be referred to the Committee on Standards, but action will have to be taken by this convention. The only difference between this and the Westinghouse and New York is a slight difference in the gasket seat.

Discussion on Car Wheels.

A. W. Gibbs (Pennsylvania)—I would like to ask the committee just what they had in view in paragraph 8, page 17: "All wheels must be numbered consecutively in accordance with instructions from the railroad company purchasing them, and must have the initials of such railroad company." Was it the intention of the committee that a railroad company should not buy wheels having any other initials than its own? For instance, you inspect a lot of wheels, and you reject them. They will not pass the Big Four requirements. They are cast; they have the Big Four initials on them. Is it your intention that those wheels shall not be marketed and that no one else is to buy them? I can easily see that if I buy your rejected Big Four wheels and use them in interchange, I may get you in a hole on them; they are wheels which your testers rejected; I buy them at a low figure and use them on repair work, foreign cars, and they go out with your advertisement. Is there a complication there?

Mr. Garstang—I do not think this association can prevent railroads from buying such wheels as they may think proper. The initials are recommended to be placed on the wheels for the protection of the railroad; first, so that if any particular lot of wheels was condemned we would know which ones they were, and, second, we find that different railroad companies use the same numbers on their wheels. The Pennsylvania will have a wheel "999," the Big Four will have a wheel "999," and some other road may have the same number. We find in auditing bills presented by foreign roads that we cannot tell whether the "999" wheel belongs to the Big Four road or to some other road, and for that reason this is recommended.

W. E. Fowler (Can. Pac.)—I think Mr. Gibbs has lost sight of one of the greatest recommendations of this committee; that is, with regard to the tests made by inspectors before the wheels are received. I don't think the Pennsylvania or any other road has any right to buy a wheel that has been rejected by another road after a proper test. In other words, if wheels are offered by a wheel manufacturer which have already been rejected by the inspector of another road, if the inspector representing the second road does his duty he will also reject those wheels.

Mr. Gibbs—Mr. Fowler, you assume then that because certain wheels fail to stand the test that all of them would fail to stand the test? Experience doesn't show that that is necessarily true.

Mr. Fowler—Nevertheless, that is the principle of the adoption of the test. We have agreed for a good many years to a test of couplers, wheels, air brake hose and everything else by certain representatives who are chosen at random, and in the case of the wheel I do not see how we can avoid applying the prescribed number.

Mr. Gibbs—The point I am trying to get at is this: It strikes me that there is some moral obligation, that if you test and reject wheels, you should remove your initials. You should not leave those wheels lying round loose to get into the general trade. I can imagine there would be some awkward complications in the case of finding a wheel marked with your road, which I buy at some low rate and put it in.. If some of these wheel disputes come up that would be taken as prima facie evidence that you had put that in. As a matter of fact, you didn't do anything of the kind. So it seems to me that if you do not want a wheel, that rejected wheel ought not to exist, having your initials; that you ought to have them chipped off if you do not want the wheel.

T. H. Curtis (L. & N.)—The matter of the inspection of cast-iron wheels has been brought to my attention lately, where wheels were rejected according to the M. C . B. specifications, and I had reason to believe there was good cause for the rejection. However, the rejecting of these wheels didn't amount to so very much to the manufacturer. It was only a matter of giving the car to somebody else. Those wheels come back in railway service. If there is anything we can do to keep that wheel out of railway service, I think we ought to do it, and putting the initial of the railroad on the wheel, will be, I believe, a step in the right direction.

R. P. C. Sanderson (Va.)—I side with Mr. Fowler and Mr. Curtis on that, and the committee. I have personal knowledge of rejected wheels of the kind that Mr. Curtis has spoken of being bought by small railroads and car owners in job lots and put into their cars, notwithstanding they have been rejected previously and for good cause.

The next report was on Splicing Sills. I. S. Downing (L. S. & M. S.) presented the report of this committee.

The Secretary—I would like to say that the Arbitration Committee took no action on this recommendation for the simple reason that in Rule 65, it now say: "Cars delivered in interchange with the form of splice shown in Figure 9-B will be accepted." That is the same of the form of splice shown in the report.

Mr. Downing—There is one recommendation in regard to center sills that really is not covered in the rules. There probably would have to be some action on that.

J. J. Hennessey (C. M. & St. P.)—I really think this is a very important subject, and I would move that this committee be continued for another year, as to the form of splices. I think this center sill splice is correct. I don't think there is any question about that, where it is properly applied, and I think they might go into it a little further to see just how many splices we may put into a car, and give the different cars for splicing. We have come now to a time, with some of our old wooden cars, when they ought to be allowed, I think, considerable splicing. I make that as a motion, Mr. President, that the committee be continued and make a further report.

The President—And that the matter be referred to letter ballot as the report stands at present?

Mr. Hennessey—As recommended practice.

The motion was carried.

The next committee report was on Tank Cars. At the request of the chairman of the committee, R. L. Kleine (Penna.) presented the report.

Discussion on Tank Cars.

Mr. Kleine—I might say that the vents marked A and B and shown in the committee's report are patented devices. This your committee learned after they had designed the vents and printed them in the report, and we believe it would be a good thing to show them in the report but not submit the vents A and B for recommended practice.

R. P. C. Sanderson (Virginian)—As I understand it, the recommendations are to be modified, omitting the recommendation of those two patented devices, A and B.

The President—Yes, that is to be eliminated on the statement of the chairman.

Mr. Sanderson—I move that the report be submitted to letter ballot on the recommendations of the committee.

D. F. Crawford (Penn. Lines)—I wish to amend the motion that this Committee on Tank Cars be continued. I do not think the entire subject has been cleaned up. I believe the committee should be continued for another year at least.

The amended motion was carried.

The next report was on Safety Appliances. It was read by Mr. Seley.

Discussion on Safety Appliances.

Mr. Seley—I might say, in addition, that the committee has received a few communications on minor matters since the date of the closing of the report, April 1, and these matters will be taken up and presented with the next report of the committee.

F. W. Brazier (N. Y. Cent.)—It was my duty to appear before a committee of Congressmen in Washington last spring. There was a bill before Congress which aimed to make the M. C. B. rules the law of the land. I had a great many pertinent questions put to me by that Congressional committee. I tried to show them that the M. C. B. rules were made by practical car men and not by members of organizations that were demanding changes, etc. I impressed upon them that we knew what we were talking about and that what we wanted was right. They asked me a question: How many inches do you think the grab handle should be from the edge of the roof? I made my answer by getting up on the table and showed them that the way we had located the handle it was all right. The next question was: How long do you think it would take to come to a standard location of roof handles? I told them that I thought it would take about four years; by that time the old equipment would probably be wiped out, and that would give us time in which to have a standard location of the roof handles.

William Garstang (C., C., C. & St. L.)—I think the matter of hand holds on roofs of box cars should be given very careful consideration, and it should have more attention than this association has given to it in the past. We find the hand hold on the roofs located all the way from two or three inches from the edge of the roof up to 15 and 16 inches. I do not think a hand hold located within 2 or 3 inches of the edge of the roof gives a good leverage by which a man can lift himself from the top round of the latter on to the top of the roof. I think we should agree on some specified distances and work to that end.

Mr. Hennessey—Take, for illustration, the hand holds on refrigerator cars; it would not be advisable to locate them on those cars the same as on box cars, in fact you could not do it. Your hatchway is where the M. C. B. recommendations would place the hand hold. The recommendation is not arbitrary and I believe it should not be made arbitrary, because in certain construction of cars you cannot meet the requirements, especially on refrigerator cars.

The recommendations as contained in paragraph 46 were ordered submitted to letter ballot.

Proceedings of the Third Session, Wednesday, June 23.

President McKenna called the meeting to order at 9:15 o'clock.

The first report was that on Freight Car Trucks. The secretary presented the report. There was no discussion and the report was ordered to letter ballot.

Discussion on Painting Steel Cars.

C. E. Fuller (Union Pacific)—I would like to ask whether or not the committee gaged the thickness of the sheets to find out what the deterioration was in thickness, by sandblast, on the inside.

Mr. Carson—There was no gage. The first thing we did was to go into the outside coat. Our main object was to paint on there under ordinary service. I believe the preservation of the inside of steel cars is pretty nearly hopeless. I do not see how you are going to get at it. One of the best things for the inside of steel cars is to keep them in active service. I have in mind steel cars that have been in service ten years, that are constantly busy, and the plates today are in excellent shape; they are good for 10 or 11 more years, but deterioration takes place very rapidly when the car is standing. One month's time idle is equal to two or three years in service, so far as deterioration is concerned.

Mr. Fuller—I think this committee omitted the most important part of its investigation. What we want to know is the life of a steel car, and I feel that they should have gaged the different cars, getting the thickness of the metal by scraping the paint off and then gaging it after their sandblast. Some years ago I went into this matter very carefully, gaging cars every six months. We found it reduced the life of the car to continually clean the inside of it. Every time you remove the rust you increase the rapidity of deterioration.

A. W. Gibbs (Penn.)—I ask the committee whether it has been in touch with the American Society for Testing Materials. There is a committee from the paint makers' association which is carrying on extensive tests on the results of cleaning the different pigments. I believe they have some hundred samples of painted surfaces exposed at Atlantic City here. They have been here for a year or more and it has developed that certain pigments distinctly hurry up the corrosion and some others retard it.

The President—Are you in touch with that committee, Mr. Carson, in connection with the work of your committee?

Mr. Carson—No.

F. W. Brazier (N. Y. Cent.)—I move that the report of the committee be accepted and the recommendations adopted and that the committee be continued for another year to make further tests, taking up the points which Mr. Gibbs speaks of.

The recommendations of the committee were accepted and the committee ordered continued.

The next report was that on Box-Car Doors and Fixtures. Mr. Morse presented the report.

Discussion on Box Car Doors.

R. L. Kleine (Penna.)—The number and spacing of bottom door guides shown on plate No. 1 of the report will be satisfactory, providing the open door stops are changed to show lips engaging the door in the open position; otherwise an additional bottom door guide should be added to secure the door in the open position.

No provision is made for covering the joint between the sections of grain doors shown on plate No. 2. It is possible that grain will leak out between the sections forming the complete grain door, and I feel the joint strip should be added, which will require a change in the construction of the section of grain door submitted.

Mr. Morse—There are two door guide brackets, which engage the door at every possible position from the entirely shut to the entirely open. The open door stops are not provided with lips for the reason that we consider the brackets sufficient for that purpose, and that the lips would only be of use when the door was entirely open. The door has been stiffened up by means of this single iron at the top and the Z-bar at the bottom, so that there would not be much danger of warping. I believe with a bracket in the center of the door and one at the front corner, that when the door is in the open position, lips on the open door stops are not necessary.

As regards the joint between the temporary doors, the committee considered that quite carefully, but was not able to arrive at any satisfactory solution, except that the door should be made with straight edges, and I believe the specifications call for that. The doors manufactured have a rough edge, and I presume the man applying the door will put a strip over it if necessary.

D. F. Crawford (Penn.)—This subject of box car doors and fixtures seems to be growing in importance. We have had on the Pennsylvania lines several accidents, which were fortunately slight, caused by loose doors. In view of the possibility of accidents and injury to persons, I believe the committee should take all precautions and add lips on the open door stops and additional brackets, rather than run this risk. I do not think we should be content with two door stops, as shown, for the open position, when one is entirely out at the edge of the door. It really means that there is one effective door stop holding the door when it is in the open position. I know we have instructions to close the doors, but instructions are not always carried out. If it is possible, or parliamentary, I would like to move that we put an additional bottom door bracket on this door.

M. K. Barnum (C., B. & Q.)—I would like to say that the road I am associated with is spending $200,000 a year on grain doors. We have had a committee for the last two years, appointed to investigate the subject and report at our annual meeting, and up to this time we have not found any permanent door that seemed to be satisfactory. We have concluded, though, that a permanent door, in order to be satisfactory, must be made of steel, for the reason that the men at the elevators that open the temporary doors ordinarily, open them with a crowbar or an ax, and any wooden permanent door, so-called, is almost sure to be partially destroyed every time it is opened at an elevator. Of course, we also have reports which show that in the Chicago elevators a number of so-called permanent doors are usually in more or less bad order. For that reason our company has, up to this time, continued to use the temporary door, but we make what we consider a better door than that used by many of our connecting roads. We use a double door and have comparatively little trouble with its breaking under load or bulging, as must occur in a 6-ft. opening with a single door, made of the class of material ordinarily used for grain doors. We found, further, in investigating this subject, that while the Burlington is a grain-carrying road, our 25,000 box-cars averaged about eight carloads of grain per year, or I may say, grain or other commodities which would require something in the form of a grain door to retain them. So that for the other lading during the year, aside from the eight carloads, we would be carrying around a door, with the additional weight and the cost of maintenance, and have no use for it: so that that is an argument which perhaps has not been altogether considered by many who have thought somewhat on the question. I believe if a movement could be started for using a better temporary door, that condition that one of the members mentioned, that they were very unsatisfactory, would be remedied after some experience. Our experience with a good temporary door is that it is pretty hard to beat, because it can be used with either side opening or the end opening, and, as some of the gentlemen have said, it makes a good pig pen. But, we have overcome a good deal of that trouble by additional supervision at the elevators and at our stations along the line, and we have now two divisions a plan on trial for checking out to the agent the doors delivered to him and requiring him to make a monthly report. The worst source of loss that most of the roads in the Middle West are subject to in connection with temporary grain doors is that pertaining to the doors which go off the line and for which no receipt can be obtained, or allowance, from such roads as do not return loads of grain. That is a question that I think the Master Car Builders' Association could look into and take some action on, which would help the situation and reduce the matter of cost of grain doors.

Mr. Morse—In regard to the door hasp, the design is based upon ordinary practice, which we strengthened somewhat. There was no criticism on the design presented at the last meeting, and we did not give it further consideration in revising the plate this year. As regards a door fastener, it is almost universal practice to use a patented device, and, believing that the members of the association would not use the device which we would recommend if we recommended one, we decided to eliminate that from the drawing. We showed the holes for the door fastener and bolts with the idea of having the manufacturers of door fasteners arrive at a common standard, so the different fasteners could be used in repairs if necessary. Further than that we did not think it desirable to go.

J. W. Marden (B. & M.)—The discussion brings out the fact that we are not quite ready to adopt the recommendations of the committee as Recommended Practice, and in view of the information that has been given the committee by the members in the discussion, I move that the report be accepted and the committee continued.

Mr. Kleine—If the committee can have another year's time on this—it is a very difficult problem—it will present something to us which we can finally adopt. I think they should take into consideration Mr. Sanderson's remarks, which are very essential.

The motion to accept the recommendations of the committee and continue it was carried.

The officers for the ensuing year are as follows:

President—F. H. Clark (C., B. & Q.).
First Vice-President—T. H. Curtis (L. & N.).
Second Vice-President—LeGrand Parish (L. S. & M. S.).
Third Vice-President—A. Stewart (Southern).
Treasurer—John Kirby, Adrian, Mich.
Executive Committee—D. F. Crawford (Pa. Lines); F. W. Brazier (N. Y. Cent.); C. A. Schroyer (C. & N. W.); J. D. Harris (B. & O.); C. E. Fuller (U. P.) (hold over); H. D. Taylor(P. & R.) (hold over).

The President—It is my pleasure at this time to turn over the gavel to my worthy successor, Mr. Clark. I want to thank you for the kind consideration extended to me during the few days past during the convention.

President-elect Clark—Gentlemen, I want to thank you for the honor conferred upon me in naming me president of the association. I have had an idea that you could have done better, but you have used your usual good judgment in the selection of the remainder of the ticket and so assured yourselves, I think, of a safe and sane administration. In the adoption of the new constitution, Article VI, Section 4, it is provided that "the Executive Committee shall offer to the convention the name of ten active or representative members, not officers of the association, as candidates for the Committee on Nominations, provided that on the adoption of these amendments the president will apoint a Committee on Nominations of five members to serve until their successors are elected."

Effective June 1, 1909, the Oregon R. R. and Navigation Co. and the Southern Pacific Co. will decline to accept from connecting lines cars equipped with "B-25" triple valves.

Dinner to Hugh M. Wilson

A dinner given in honor of Hugh M. Wilson at the Chelsea Hotel, Atlantic City, on the evening of June 19, proved an inspiring tribute to the honored guest of the donors. Those who participated in the flow of wit and wisdom and their subjects are as follows: W. H. Boardman, The Railroad Press and the Railroads; Harry W. Frost, Reminiscences; Geo. A. Post, Appreciation.

Mr. Wilson then responded in part as follows:

I have had many difficult assignments in my time, but never one so hard as this. A newspaper man—reformed though he be—is always embarrassed by public plaudits. The air which he is accustomed to breathe is usually charged with criticism. The rarified atmosphere of applause is to him a thing rare indeed. That alone makes this occasion a mystery, and I believe it is more of a mystery to me than to any one else.

I am proud of the fact that I have been a newspaper man and a publisher. I am proud of the fact that I have been connected with the railway and technical press. I am yet more proud of the friends and acquaintances which that connection has brought to me. I am inclined to think that the functions, the opportunities and the merits of the technical press are not as fully understood and appreciated as they should be. Nor is the ignorance in this respect confined to readers and patrons. Some editors and publishers are among the guilty.

One of the greatest menaces to public sanity and public morality in this country is the jaundiced irresponsibility of a large section of the daily press and of many popular magazines. Under the guise of upholding public morality they are following a policy of commercialism that is frequently conscienceless and that is always dangerous in its tendencies. A great popular journal is not now a great moral force. It is a great commercial enterprise which exploits the poorer classes of the people. As money makers, as manipulators of the public for profit, our "railway barons" and our "captains of industry" are mere babies and sucklings in comparison with them.

There are men here who have been friends to me indeed, because they were friends in need. There are men here who, when the skies were dark, gave me words of cheer and made me believe that the clouds had silver linings, though the linings were invisible as all good linings should be. There are men here who have spoken good words for me where they never intended that I should hear of it, and where their potency was great because they were disinterested. There are men here who, not given to speech, have clapped me on the back and helped me to push when the load had to go up hill and when the hill was rough and steep. There are men here who have taken my word for things when my word was all I had to give. There are men here who have been sympathetic and reasonable when on the face of the returns they had just cause for disbelief in my good faith. There are men here who have shown forebearance and trust and faith when forebearance and trust and faith were the things I needed most. There are men here who have shown me that they are my friends in spite of evil report and false accusation. There are men here who have "boosted" when they might have "knocked," and there are those who "knocked" gently when they might have hit hard. There are here former business associates, former partners, who are also friends, to whose help, ability, and devoted loyalty I owe more than any words ever can express.

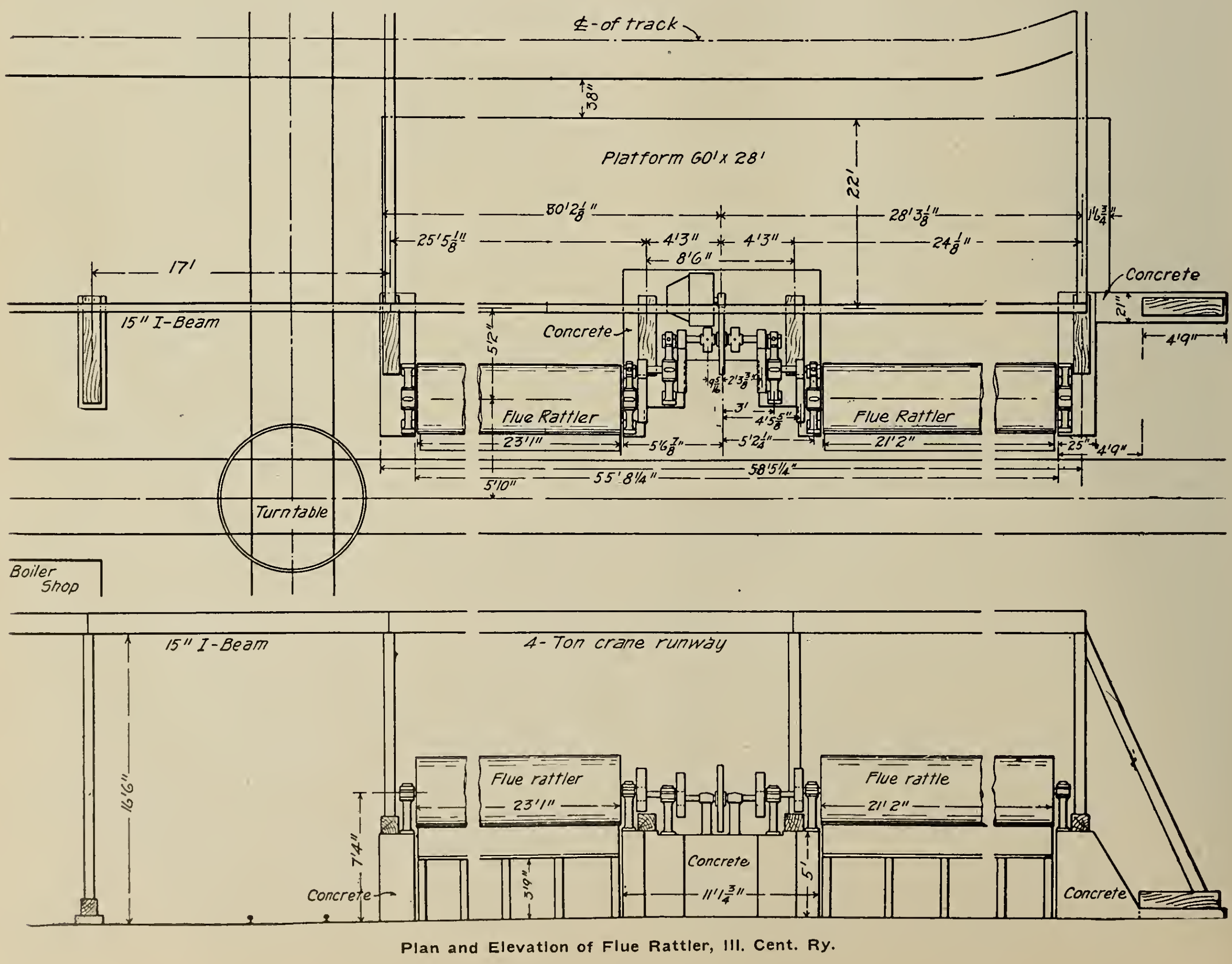
The following accepted invitations to the dinner:

W. B. Albright, Thos. Aldcorn, Samuel G. Allen, J. Wesley Allison, J. Stewart Andrews, F. Atwater, E. L. Adreon, E. H. Baker, F. A. Barbey, W. S. Bartholomew, G. M. Basford, J. G. Bateman, W. H. S. Bateman, H. A. Beale, Jr. J. V. Bell, Leigh Best, W. P. Bettendorf, E. Bjerregaard, Robert Black, W. A. Blanchard, Scott H. Blewett, W. H. Boardman, J. S. Bonsall, Geo. L. Bourne, Stephen J. Bowling, L. F. Brain, J. Alexander Brown, John T. Brown, E. G. Buchanan, J. E. Buker, S. P. Bush, D. W. Call, Geo. R. Carr, Robert F. Carr, F. A. Casey, Chas. C. Castle, J. T. Chamberlain, Walter Chur, C. Peter Clark, F. H. Clark, J. S. Coffin, J. C. Currie, Otis H. Cutler, Geo. L. L. Davis, Wm. V. Dee, J. F. Deems, F. A. Delano, A. P. Dennis, Frank Dinsmore, Chas. L. Dinsmore, Robert M. Dixon, S. O. Dunn, F. W. Edmunds, O. M. Edwards, J. R. Ellicott, P. M. Elliott, F. F. Fitzpatrick, Wm. Forsyth, Geo. L. Fowler, Harry W. Frost, Frank W. Furry, S. R. Fuller, W. A. Gardner, M. A. Garrett, Wm. Garstang, O. C. Gayley, A. W. Gibbs, J. Parker Gowing, W. Ross Gravener, Geo. Groobey, Reuben C. Hallett, John Havron, C. S. Hawley, H. S. Hawley, Scott R. Hayes, B. A. Hegeman, Jr.,T. W. Heintzelman, E. T. Hendee, Geo. R. Henderson, J. S. Henry, W. T. Henry, E. M. Herr, John M. High, John A. Hill, Maj. Chas. Hine, W. W. Hoit, C. W. Hotchkiss, Clarence H. Howard, H. C. Howell, A. L. Humphrey, F. P. Huntley, John D. Hurley, R. F. Huyet, F. A. Angalls, D. F. Jennings, A. B. Johnson, R. B. Kendig, Cass L. Kennicott, A. M. Kittredge, H. G. Kittredge, Chas. K. Knickerbocker, J. A. Lamon, Robert P. Lamont, F. W. Lane, E. B. Leigh, C. A. Lindstrom, Thos. Madill, Wm. Marshall, A. D. McAdam, Jas. J. McCarthy, W. S. McGowan, Wm. E. Magraw, Wm. McIntosh, Jas. McNaughton, J. C. McQuiston, Robert McVicar, J. H. Milliken, C. R. Mills, Geo. F. Mills, J. T. Milner, A. E.Mitchell, Geo. E. Molleson, Ray Morris, A. H. Milliken, J. G. Neuffer, J. Newton Nind, D. C. Noble, A. F. Old, O. F. Ostby, Spencer Otis, G. H. Pearsall, C. C. Peirce, H. M. Pflager, S. R. Phillips, B. F. Pilson, L. R. Pomeroy, Geo. A. Post, Geo. A. Post, Jr., C. E. Postlethwaite, D. W. Pye, Robert Quayle, F. T. Reese, John N. Reynolds, Chas. Riddell, R. H. Ripley, Mark A. Ross, Daniel Royse, Clive Runnells, W. W. Salmon, J. D. Sawyer, W. J. Schlacks, C. A. Echroyer, C. A. Seley, Louis A. Shepard, L. B. Sherman, Chas. Shults, F. K. Shults, E. A. Simmons, T. H. Simpson, W. M. Simpson, Angus Sinclair, E. R. Stagle, Willard A. Smith, B. E. D. Stafford, Geo. Stanton, J. B. Terbell, John H. Thomas, Edward S. Toothe, Alexander Turner, A. M. Waitt, J. M. Wakeman, R. T. Walbank, Chas. E. Walker, E. H. Walker, John E. Ward, Albert Waycott, A. B. Wetmore, A. L. Whipple, G. W. Wildin, E. M. Williams, John T. Wilson, Geo. G. Yeomans.

Large Capacity, Homemade Flue Rattler

In connection with its new boiler shop, the Illinois Central R. R. has a flue rattler which has no equal in the country. Mr. G. M. Crownover, superintendent of the Burnside shops, worked out the design and its success does him credit. The accompanying drawings illustrate the machine only partially, but the general principle will be at once understood.

The tubes are brought from the boiler shop on narrow guage push cars on the track shown in the plan view. When opposite the platform of the rattler, the 4-ton yard crane picks them up by means of chains and lifts them

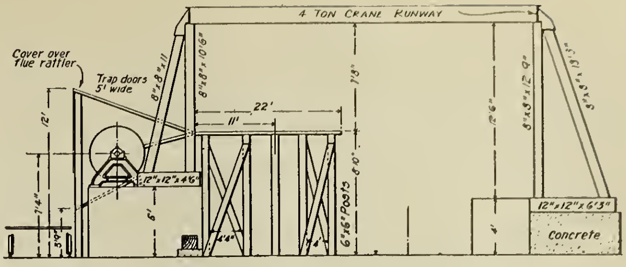


Plan and Elevation of Flue Rattler, Ill. Cent. Ry.

slightly above the level of the rattling cylinder. As fast as needed the operator drops them into the cylinder, and after they are rattled they are rolled onto empty cars on the other side.

The capacity of this machine is so great that it does not need to be run more than four hours a day to rattle the tubes of all the engines handled in the shops, whereas the rattling of the tubes in the old way was considerable of a problem and required the services of several men night and day. One man only is necessary to operate Mr. Crownover's machine; he stands on the platform between the two cylinders where the motor is located.

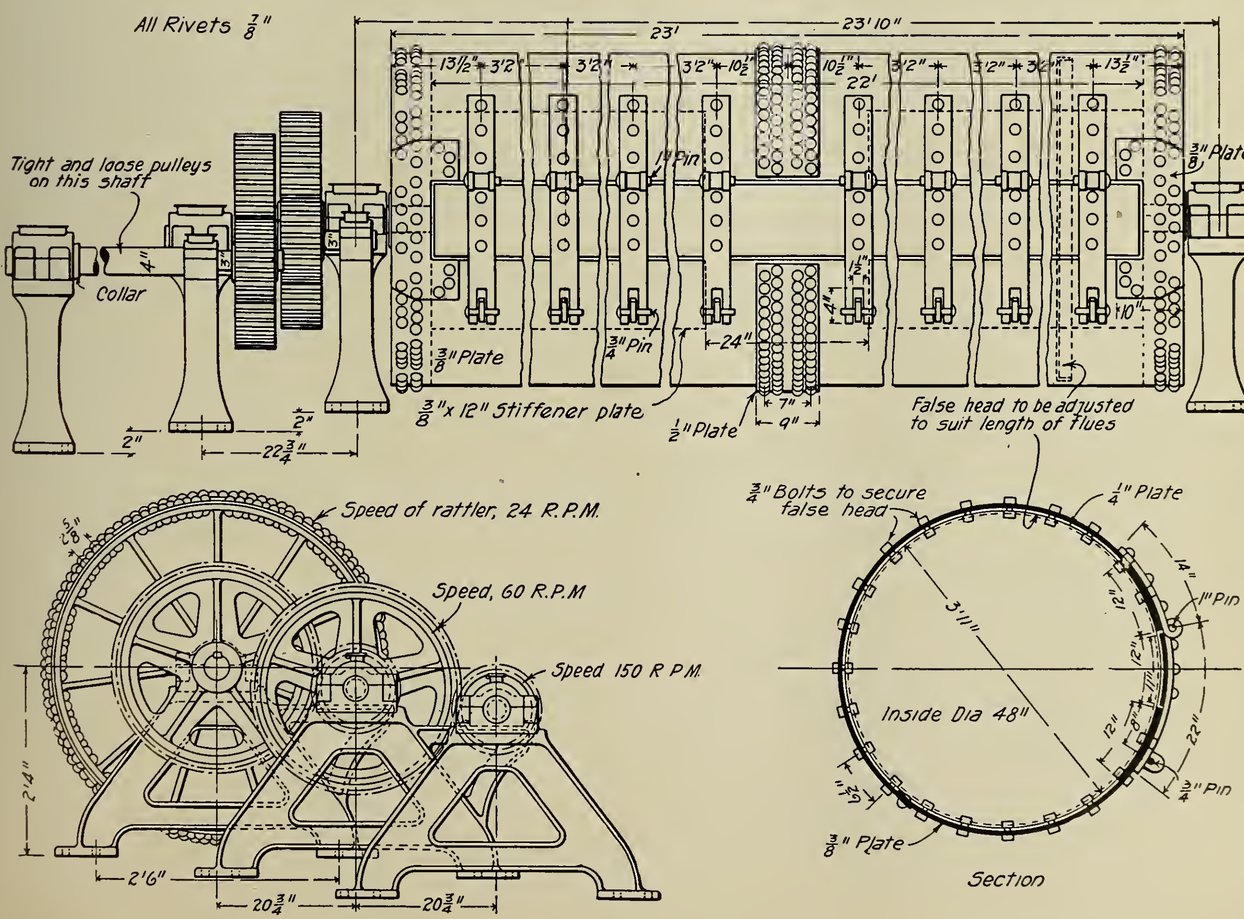
The details of the cylinders and framing show heavy construction throughout, and the foundations of concrete eliminate a great deal of the vibration. It might be added that the lime from the tubes falls into pits beneath the cylinders, where it can be easily reached.



End Elevation of Flue Rattler.

Registration of Members of the Master Mechanics' Association

Adams, A. C., M. M., N. Y., N. H. & H. R. R.
Akans, Geo., Southern R. R.
Aldcorn, Thomas, Chicago Pneumatic Tool Co
Allan, Arthur, M. M., T. & N. O. Ry. —
Allen, C. W.
Allen, G. S., M. M., Philadelphia & Reading R. R.
Allison, W. L., M. E., A., T. & S. F. Ry.
Arp, W. P., S. M. P., Vandalia.
Arthur, C. G., M. M., Southern R. R.
Atkinson, Roger.
Ayers, A. R., Asst. M. M., L. S. & M. S. Ry.
Bagley, J. J., M. M.
Baltz, Valentine, Chief Joint Car Inspector, Wheeling Ter.
Bawden, Wm., M. M., Terminal Railroad Association.
Bennett, W. J., A. S. M. P., Chicago, Indianapolis & Louisville.
Bennett, W. H., M. M., P. R. R.
Billingham, R. A., S. M. P., Pitts., Shaw. & N.
Black, W. G., M. M., N. Y. C. & St. L. R. R.
Barton, T. F., M. M., D., L. & W. R. R.
Basford, G. M., American Locomotive Co.
Beamer, James A., M. M., Pennsylvania R. R.
Blunt, J. G., American Locomotive Co.
Boldridge, R. M., M. M., Central of Georgia.
Bowles, C. K., M. M., Tidewater & Western.
Boyden, N. N., M. M., Southern Ry.
Bridges, E. A., M. M., Durham & Southern Ry. Co.



Details of Flue Rattler, Ill. Cent. Ry.

Brown, David, A. S. M. P., Delaware, Lackawanna & Western.
Brown, H. B., M. M., Erie R. R.
Brown, W. A., M. M., Kanawha & Michigan.
Buchanan, A., Jr., Public Service Commission.
Burton, T. L., Philadelphia & Reading.
Bush, S. P., G. M., Buckeye Steel Castings Co.
Bussing, G. H., S. M. P. and R. S., Evansville & Terre Haute R. R.
Brazier, F. W., M. M., N. Y. C. & H. R. R. R.
Canfield, J. B., M. M., Boston & Albany.
Carroll, J. T., M. M., L. E. & W.
Chamberlain, E.
Chambers, John S., S. M. P., Atlantic Coast Line.
Cheronworth, M. E.
Chester, W. E., Atlanta.
Chidley, Jos., M. M., Lake Shore & Michigan Southern R. R.
Chisholm, J. E.
Christopher, J., M. M., Toronto, Hamilton & Buffalo R. R.
Clark, F. H., G. S. M. P., Chicago, Burlington & Quincy.
Cleaver, F. C., S. M. P., Rutland.
Collier, L. L., M. M., L. & N. R. R.
Connolly, J. J., S. M. P., Duluth, So. Shore & Atlantic R. R.
Cooper, F. R., S. M. P., Kansas City Southern Railway.
Cory, Chas. H.
Coutant, M. R., M. M., Ulster & Delaware.
Cullinan, John, M. M., Central Indiana Railroad.
Cunningham, D. W., A. S. M., Missouri Pacific Railway.
Curtis, Theo. H., S. M., Louisville & Nashville Lines.
Crawford, D. E., G. S. M. P., Pennsylvania Lines.
Cross, C. W., S. A., New York Central Lines.
Davis, M. J., A. M., Pennsylvania Railroad.
Davisson, F. E., S. M., San Pedro, Los Angeles & Salt Lake.
Depue, G. T., M. M., Erie.
DeVoy, J. F., M. E., Chicago, Milwaukee & St. Paul R. R.
Desmond, D. G., M. M., Morgantown & Kingwood.
Dickerson, S. K., A. S. M. P., Lake Shore & Michigan Southern R. R.
Diehr, C. P., M. M., New York Central & Hudson River R. R., Jersey Shore, Pa.
Dodds, E. I., A. S. C. E.
Dooley, M. M., Cincinnati, New Orleans & Texas Pacific.
Dunham, W. E., M. M., Chicago & North-Western.
Dunn, J. F., S. M. P., Oregon Short Line.
Drury, Michael J., M. M., Atchison, Topeka & Santa Fe R. R.
Edwards, J. B., M. M., Columbia, Newberry & Laurens.
Ettinger, R. L., C. M. E., Southern Railway.
New, W. E., M. M., Kansas City Belt Railway Co.
English, Richard, San Francisco, Cal.
Enright, J. F., S. M. P., International & Great Northern R. R.
Fairbank, J. F., M. M., Malvern & Freer Valley.
Ferguson, L. B., M. M., Vicksburg, Shreveport & Pacific R. R.
Flynn, Walter H., M. M., Michigan Central, St. Thomas.
Fowler, Geo. L.
Ferguson, G. A., Boston & Albany Railroad.
Fetner, W. H., M. M., Central of Georgia Railway.
Fitzmorris, Jas., M. M., Chicago Junction Railroad.
Flavin, J. T., M. M., Chicago, Indiana & Southern R. R.
Flory, B. P., M. E., Central of New Jersey Railroad.
Forsyth, Wm., M. E., The Railroad Age Gazette.
Fogg J. W., M. M., Chicago Terminal Transfer.
Foster, O. M., M. M., L. S. & M. S. Railway.
Franey, M. D., S. S., Lake Shore & Michigan Southern Ry.
Fuller, C. E., S. M. P., Union Pacific Railway.
Fulmer, J. H., M. M., Pennsylvania Railroad.
Gaines, F. F., S. M. P., Central of Georgia.
Gardner, Henry, N. Y. C.
Garstang, Wm., S. M. P., C. C. C. & St. L.
Gauthier, Jesse, M. M., Copper Range.
Gentry, T. W., American Locomotive Co.
Glass, John C., M. M., Pennsylvania R. R.
Gordon, H. D., 71 John St.
Gorey, E. H., G. F., L. & N. R. R.
Gossett, C. E., M. M., Iowa Central.
Graham, Charles, Am. Loco. Co.
Green, H., 500 Fifth Ave.
Grimshaw, F. G., M. M.
Gross, E. G., M. M., Central of Georgia.
Hamilton, W. H., M. M., Atchison, Topeka & Santa Fe.
Haggett, E. C., Supt., Am. Loco. Co.
Haig, M. H., M. P. A., A., T. & S. F.
Hair, John, S. M. P., Baltimore & Ohio, S.-W.
Hainen, J., S. M. P., Southern.
Hale, H. H., M. M., G. & S. I.
Harrington, H. H., M. M.
Harris, C. M., M. M., Washington Terminal.
Harrison, F. J., M. M., Buffalo, Rochester & Pittsburg.
Haug, H., M. M., Brownstone & Middletown.
Hayes, J. F., M. M., Grand Rapids & Indiana.
Hardie, Henry, M. M., L. & N.
Hayward, H. S., S. M. P., Pennsylvania.
Heintzleman, T. W., S. M. P., Southern Pacific.
Henderson, G. R., 20 W. 34th St.
Henry, W. C. A., S. M. P., Penn. Lines West.
Hill, W. H., M. M., Cornwall R. R.
Hinckley, A. C., M. M., Cincinnati, Hamilton & Dayton.
Hogan, C. H., D. S. M. P., N. Y. C. & H.
Hobson, W. P., A. M. M., Chesapeake & Ohio.
Hodgins, George, 136 Liberty St.
Hoffmann, C. M., M. M., Southern.
Howson, G. N., M. M., Southern.
Hyndman, F. T., 1472 Chapel St.
Jacobs, H. W., A. S. M. P., A., T. & S. F.
Jaynes, R. T., M. M., Lehigh & Hudson River.
Johan, Jacob, 5323 Delaney St., Philadelphia.
Johnson, L. R., S. M. P., Canadian Pacific.
Jones, Harry, C., R. I. & P.
Justice, D. J.
James, Charles, M. M., Erie.
Johnson, R. H., Ortega, Mex., D. F.
Kneass, Strickland L., Wm. Sellers Co., Ltd.
Kapp, W. F., S. S. & M., Rich, Fred. & Potomac.
Kaderly, W. F., M. M., Southern.
Kellogg, W. L., M. M., Pere Marquette.
Kilpatrick, J. B., A. S. M. P., Chicago, R. I. & Pacific.
Kilpatrick, R. F., A. S. M. P., D. & R. G.
Kinney, M. A., M. M., Hocking Valley.
Kinney, W. H., M. M., N. Y., Ontario & Western.
Keenan, C. E., M. M., N. Y. C. Lines.
Kendig, R. B., M. E., Lake Shore & Mich. Southern.
Kurman, A. G., M. M., Mt. Jewett, Kinzua & Riterville.
Kyle, C., M. M., C. P. R.
Lane, F. W.
Lape, C. F.
Leach, H. L.
Leach, W. B.
Luscombe, J. T., M. M., T. & O. C. Ry.
Lewis, W. H., S. M. P., Norfolk & Western.
Leyonmarck, John H., M. E., C. & A.
Likert, G. H., Supt., N. P.
Lowell, Geo. H., Asst. M. M., L. & N.
Lovell, Alfred.
Lyon, Tracy, Westinghouse Electric & Mfg. Co.
Mathis, J. E., M. M., Ga. & Fla.
Manchester, H. C., A. S. M. P., Maine Central.
Maxfield, H. H., M. M., P. R. R.
Miller, S. W., American Locomotive Co.

Moll, George, M. M., Philadelphia & Reading.
Moriarty, G. A., M. M., N. Y., N. H. & H.
Mullinix, S. W., S. M. P., C. R. I. & P.
Mackenzie, John.
Maher, P., S. M. P., Chicago & Alton, Toledo & St. Louis & Western.
Manchester, A. E., S. M. P., Chicago, Milwaukee & St. Paul.
Marea, M., M. M., T. St. L. & W.
Margarvey, J. R., American Locomotive Co.
Meuree, M. S., M. M., Elgin, Joliet & Eastern.
McCarthy, M. J., S. S., C. C. C. & St. L.
McCuen, J. P., S. M. P., C. N. O. & T. P. and A. G. S.
McFetters, F. R., Supt., Union.
Michael, J. B., M. M., Southern.
Miller, W. J., M. M., St. L. Southwestern of Texas.
Monahan, J. J., M. M., Louisville & Nashville.
Murrian, W. S., S. M. P., Southern.
McBain, D. R., A. S., M. P., N. Y. C. & H.
McBeth, H. A., M. M., N. Y., Chicago & St. Louis.
McGrath, J. T., M. M., Grand Trunk.
McIntosh, Wm., S. M. P., Central R. R. of N. J.
McKee, G. S., S. M. P., Mobile & Ohio.
McMann, J. B., Supt. Bangor & Aroostook.
McNaughton, Jas., American Locomotive Co.
McNulty, F. M., M. M., Monongahela Connecting.
McRae, J. A., M. E., Michigan Central.
Marshall, J. R., Supt. American Locomotive Co.
May, H. C., M. M., L. & N.
May, Walter, M. M., C. C. C. & St. L.
Meister, C. L., M. E., Atlantic Coast Line.
Mellin, C. J., American Locomotive Co.
Miller, E. A., S. M. P., N. Y. C. & St. L.
Minshull, P. H., M. M., N. Y., O. & W.
Moir, William, M. S., Northern Pacific, St. Paul, Minn
Meredith, H. P., Asst. Engineer M. P., P. R. R.
Montgomery, Donald, Bangor & Aroostook.
Montgomery, Hugh, S. M. P., Bangor & Aroostook.
Murphy, J. H., M. M., Cin., New Orleans & Tex. Pac.
Nash, N. H., M. M., Ill. Central.
Nicholson, Jno., S. M. P. & M., St. L., B. & M. R.
Nelson, E. D., E. of T., Pennsylvania R. R.
New, W. E., M. M., K. C. Belt R. R.
Newhouse, J. F., M. M., Kan. & Ind. Bridge & R.
Newton, C. H. H., M. G. B., Ga. R.
Norris, W. B., Gen. Fore., Altoona shops.
Noxon, Frank W., sec'y Ry. Business Asso.
O'Hearne, J. E., M. M., Wheeling & Lake Erie.
O'Herin, Wm., S. M., Mo., Kan. & Tex.
Owens, W. H., M. M., Southern Ry.
Passmore, H. E., M. M., Toledo & Ohio Cent.
Pearce, J. S., M M., Norfolk & Western.
Peck, Peter H.
Phillips, C., M. M., New Orleans & Northeastern.
Phipps, M. M., Canadian Pacific.
Platt, J. G.
Parish, Le Grand, S. M. P., Lake Shore & Michigan Southern.
Patterson, J. S., Galena Signal Oil Co.
Patterson, Robt., M. M., Grand Trunk.
Petrie, L. A., M. M., Oaho Ry. & Land Co.
Pilcher, J. A., M. E., Norfolk & Western.
Place, F. E., Buda Foundry & Machine Co.
Poole, A. J., G. M. M., Seaboard Air Line.
Preston, Robert, M. M., Canadian Pacific.
Quackenbush, A. W., M. M., Omaha & Kansas City.
Quayle, Robert, S. M. P. & M., Chi. & N. W.
Quigley, Jos., M. M., C. N. O. & T. P.
Rae, C. H., Gen. M. M., L. & N.
Redding, D. J., M. M., Pittsburg & Lake Erie.
Roberts, E. M., C. & O.
Reid, H. G., M. M., Canadian Pacific.
Reid, W. L., American Locomotive Co.
Reynolds, O. H., Bethlehem Steel Co.
Riley, George N., M. M., McKeesport Connecting.
Rogers, R. H.
Robinson, Frank, Robinson Co
Rosing, W. H. V., M. E.
Royal, C. B.
Russell, W. B., Franklin Union.
Rink, G. W., M. E., C. R. R. of N. J.
Rydberg, C. F., Supt. Shops, Canadian Pacific.
Sasser, E. C., M. M., Southern.
Schlafge, Wm., M. S., Erie.
Scheffer, F. H., S. M. P., Nash., Chat. & St. Louis.
Seabrook, C. H., S. M. P. E., T. & R. Y.
Sechrist, T. O., M. M., Cin., N. O. & Texas Pacific.
Sedgwick, E. V., Galena Signal Oil Co.
Seidell, G. W., Supt. Shops, Chi., Rock Island & Pacific.
Seddon, C. W., S. M. P., Duluth, Missabe & Northern.
Seley, C. A., Mech. Engr., C., R. I. & P.
Setchel, J. H.
Shoemaker, H., M. M., Del., Lack. & Western.
Sheahan, J. F., M. M., Southern.
Sinclair, Angus.
Slater, Frank, M. M., Chi. & North-Western.
Smith, C. B., M. E., Boston & Maine.
Smith, John L., G. F., Pitts., Shawmut & Northern.
Smith, W. T., M. M., Chesapeake & Ohio.
Smith, W. A.
Smith, R. D., A. S. M., B. & A.
Smock, F. A., M. M., P. R.
Steel, Frank, M. M., N. Y. C. & H. R.
Stewart, C. J., M. M., Central New England.
Stewart, A. F., M. M., Chesapeake & Ohio.
Stewart, A., M. S., Southern.
Stocks, W. H.
Stuart, C. M., M. M., P. & R.
Stulb, W. H., M. M., Cent. of Ga.
Street, Clement F., W. A. B. Co.
Sweetman, E. M., M. M., So. R.
Taylor, C. M., S. M. P., Chicago, Rock Island & Pacific.
Taylor, C. W., S. M. P., San Antonio & Aransas Pass.
Taylor, Jos. M., Secretary, Amer. Ry. M. M. Ass'n.
Taylor, Wm. H., M. M., N. Y., Susq. & Western.
Taylor, Grant W., G. S. T.
Terrill, C. H., M. M., Chesapeake & Ohio.
Thomas, H. T., M. M., Detroit & Mackinac.
Tuma, Frank, M. M., Erie.
Thompson, E. B., S. M. P. C., St. P., M. & O.
Thomas, J. J., Jr., M. M., Atlantic Coast Line.
Thomas, W. H., 4230 Spruce St.
Tollerton, W. J., A. G. S. M. P., C., R. I. & P.
Tonge, John, M. M., Minneapolis & St. Louis.
Tracy, W. L., A. S. Machinery, Missouri Pacific.
Trumbull, A. G., M. S., Erie.
Turner, Calvin G., M. M., Phila., Balt. & Wash.
Vaughan H. H., Asst. to V. P., Canadian Pacific.
Vought, Harry D., Secretary, New York & Central Railway Clubs.
Van Buskirk, H. C., S. M. P., Colorado & Southern.
Van Doren, G. L., S. S., Central of N. J.
Wagstaff, George, Amer. Loco. Equipment Co.
Wahlen, John, M. M., Montpelier & Wells River.
Walsh, F. O., M. M., A. & W. P. & W. of Ala.
Walsh, J. F., S. M. P., Chesapeake & Ohio.
Warnock, H. R., G. F. L. D., Monongahela.
Waters, J. J., S. M., Mex. Cent.
Warthen, J. O., M. M., D. & W.
Watson, R. R., Engr. Tests, Erie.
Weisgerber, E. L., M. M., Baltimore & Ohio.
Wells, Reuben, Paterson.

Wilson, W. H., S. M. P., B., R. & P.
Watson, R. B., Supt. of Tests, Lexington.
Watson, Samuel, M. M., N. Y. C. & H. R.
Watters, J. H., A. M. M.
Watts, Amos H., M. M., Cincinnati Northern.
Wildin, G. W., M. S., N. Y., N. H. & H.
Williams, W. H., M. M., B., R. & P.
Wilson, Charles, M. M., Lehigh Valley.
Wright, R. V., American Engineer.
Young, C. D., A. E. M. P., Penna. Lines West.

Paint for Steel Cars

A committee of the Master Car Builders' Association will report at the June convention upon the methods of protecting steel from corrosion especially as they are applicable to steel cars. It is needless to say that the variety of paints and coatings for this purpose are innumerable. But, despite this fact, authorities are unamimously agreed that there are certain fundamental principles involved that should be applied and embodied in all paints. In the first place the film should be continuous; for if it is broken at any point, moisture and air will enter and attack the exposed surface of the metal, with the results that rust will be carried down over the outer surface of the paint and will become an important and powerful faction in its deterioration. The second point is that, in drying, the paint should not only become firm and remain closely adherent to the metal, but should maintain its elasticity so that it may expand and contract with variations of temperature without developing cracks which will be sure to hasten its destruction. Finally, it is desirable that the pigments used should be of such a character that they shall not only be unaffected by external conditions, such as moisture, acid or other deteriorating or oxydizing effects, but may themselves serve to protect the vehicle that carries them from deterioration by these influences that are so detrimental to the durability of oils. If such conditions as these can be obtained the pigments will serve not only to protect the metal but also to preserve the very paint itself from deterioration after the outer coating of the vehicle has been worn away. Among the materials that will meet this requirement, silica and graphite are probably the best known.

Both are inert and unaffected by acid or moisture and silicia has the added physical advantage of presenting what is known as a 'tooth,' which fits it exceedingly well for repainting. Silica is inert as an extender or filler in paint and does not comibne with any other pigment or vehicle."

The amount of silica which may be safely addede to a mixed paint without detracting from its covering property, and which will increase its wearing quality, is one-third of the total pigment used, and if graphite is diluted with a heavier base, a good paint is formed, and many of the characteristics, chemical and physical defects of lead are largely reduced and frequently eliminated when it is mixed, in a proper proportion, with graphite; a high grade of graphite, when finely ground with linseed oil acting as a lubricant and sliding under the brush. If, therecfore, graphite is mixed with a heavier base such as silica, good results will be produced.

In the course of some independent investigations that have been made during the past year upon the enduring qualities of a silica graphite paint when subjected to exceedingly severe laboratory conditions, it was found that the identical conditions, outlined above obtained. The paint was subjected to a strong acid reaction consisting of a bath of sulphuric acid in water, that cut into and ate away the coating of the vehicle that covered the particles of the pigment. At the end of three and a half months of this treatment, the surface of the paint appeared unchanged to the naked eye, except for a dulling and loss of the original gloss. But when examined under the microscope the whole nature seemed changed. Instead of the smooth glossy, semi polish of the original coat, the surface was seen to be densely covered with a coating of exceeding fine silica sand that appeared to be imbedded in the vehicle beneath, and to be protecting it from further deterioration, while parts scraped off were as pliable and elastic as when first applied.

That these laboratory results will be reproduced in the actual service to which such a paint may be exposed is evidenced by the condition of certain cars that have been painted with a silica graphite paint. The cars referred to were painted in September, 1907, with a paint made by the Jos. Dixon Crucible Co., for the Cornwall & Lebanon R. R., and have been in use ever since.

A number of photographs shown herewith were taken on the occasion of a recent inspection. They are of cars and

Car Painted with Silica-Graphite Paint After Eighteen Months' Service.

surface painted not only with a silica graphite, but with a common red paint, and in this inspection no selection was possible because no notification of it was sent to the road, and only such cars were available as happened to be in the yard at the time, and these were taken to be typical and representative of the others.

The cars are of the low-side gondola type and are in the ore and pig metal service. The type and apparent condition of which is shown.

In scraping off portions of the paint film, it was found to be as smooth and apparently as soft and elastic as when it had first been applied, wherever, on the surface of the car, it had not been subjected to some abrasive action. The average condition of the surfaces of these cars is well shown by the accompanying reproduction of a photograph of the painted surface of a car which is a portion of the same car that is shown in full. That the paint is still flexible and elastic is shown by the fact that, in several instances, where the cars had been damaged and the steel badly distorted, the paint was not broken or cracked at such points. Such a state of affairs is brought out very clearly by the accompanying illustration which shows how roughly the metal may be bent without injury to the paint. In this case the stakes had been badly bent out of shape, the indentations in them were very sharp and irregular, and yet there was not the slightest crack or fracture in the paint to be found. It is a clear dem-

Car Painted with Common Red Paint After Eighteen Months' Service.

onstration of the amount of punishment a really elastic paint can sustain.

Of course no paint can withstand actual abrasion, such as that resulting from a blow received by the interior and top rail of coal and ore cars, when the lading is rumped in from a chute, and many builders and owners doubt the advisability of painting these parts at all, because the film is cut away and rubbed off with almost the first loading.

In contrast to this durability of a silicia graphite paint, as shown by the illustrations, an engraving is presented of the end of a car that had been painted with a common red paint about six months prior to the others inspected. The condition of this car is so well shown that comment is hardly necessary. It will be seen that the paint was scaling off in large blisters from all points on the surface, and when these still adherent scales were pulled off they crumbled into powder between the fingers. So, though this paint had been in service for a somewhat longer period than the other, it is hardly probable that the smooth surfaces of the silicia graphite paint, here shown, would deteriorate to the condition of the common red paint in six months more of service, which is that of the regular traffic of the road principally carrying iron and ore with an occasionel loading of coal. Of course, no attempt has been made to favor these cars in any way, and there are instances where the paint showed evidences of an unfair treatment in that it had been knocked off by blows from hard materials striking it.

The endurance tests of service, therefore, seem to warrant the inferences drawn from the results of the laboratory tests, and it is quite probable that, if these sheets were to be subjected to a microscopic examination, they would show the particles of silica imbedded in the vehicle and thus serving as a protection to it, because of the inertness of the pigment.

Paints of different constituents have also been examined in the same manner, and it has been found that, where the constituent elements of the pigment are not inert, but are capable of chemically combining with the vehicle, the resultant film is apt to be dry and hard and friable, and will crack if there is any distortion of the plate either by violence or under the ordinary conditions of expansion and contraction. And, further, that, when an attempt is made to remove such a paint with the knife it scrapes off as as a fine powder and not as a pliable and elastic sheet.

The North-Western Metal Manufacturing Co., of Minneapolis, Minn., have been appointed exclusive sales-agents for the "Plunger Plastic" throttle packing.

Development in Air Brakes

The following letters are self-explanatory:

Parkersburg, W. Va., June 21, 1909.

Editor, Railway Master Mechanic:

I note in the editorial columns of the May issue of the Railway Master Mechanic this statement: "Many locomotive engineers are unable to explain why they can stop a light train with an emergency application in quicker time if the throttle is left open than if steam is first shut off." Being a locomotive engineer and a reader of the Railway Master Mechanic for a number of years, I confess I do not understand what the conditions should be to make the statement referred to above theoretically correct. I am aware of the fact that sliding friction is less than rolling friction. If the wheels were kept rolling the train would not stop. If the brakes are set and the steam is not shut off, the force that moves the train is still applied, and must be overcome or the train will continue to move. It takes braking power to stop the wheels from rolling. If the locomotive was powerful enough would it not continue to move the train even though all the wheels on the train were sliding? It seems to me that if your theory is correct, that in case of danger or to avoid a collision it would not be policy to shut off steam. In my opinion the only time when the throttle should be opened is when the drivers are skidding and the engine is moving faster than it would if the drivers were rolling. This skidding generally occurs only when engine or train is moving very slowly. If the throttle had been left open until the speed had been reduced till the whels skidded, would not the train have covered a greater distance between the first application of the brakes and the point at which the wheels skidded if the throttle were left open than if throttle were closed? Would it not be a very difficult proposition to attempt to open the throttle just enough to keep the wheels from sliding and not sufficient to overcome the retarding force of the brakes? H. L. Bartels.

Parkersburg, W. Va., June 28, 1909.

Editor, Railway Master Mechanic.

Since reading your letter it is clear to me that I did not catch your idea in the editorial, which left me in doubt as to whether you intended to shut off steam or intended to leave the throttle open to prevent the wheels from sliding, which might happen when the speed is very much reduced, especially if the rail is wet. I think you are right in applying the brakes first, then closing the throttle. The reason is this, that the retarding force of the brakes in conjunction with the rolling and axle friction, resistance of curves and atmospheric resistance is greater than the propelling power of the steam. If the steam was not shut off the train would stop on application of the brakes, but not in so

Car Painted with Silica-Graphite Paint Showing Condition of Paint on Damaged Stake.

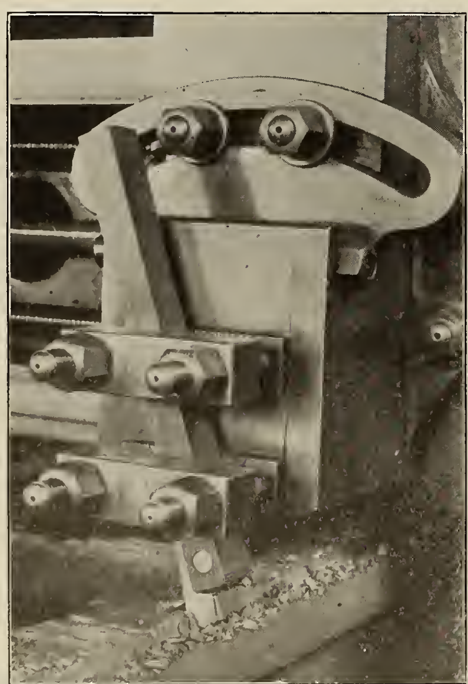
short a distance as when throttle is closed and steam shut off. It has been my experience that it takes the ordinary 17x24-in. cylinder locomotive, steam pressure 175 lbs., a distance of nearly three miles to raise the speed to sixty miles an hour, with a four-passenger car train. This train could probably be stopped with the ordinary, not high speed quick action brake, in less than 2,000 ft.

I became interested in the article on air brake equipment, "Development in Air Brakes for Railroads," and while I have not had time to thoroughly digest all the ideas set forth in it, I consider it the most ably written paper on the subject that has come to my notice. H. L. Bartels.

A New Tool Holder

The illustrations show a new tool for railroad shop work, the essential features of which are understood at a glance. The tool was developed for the purpose of taking the place of the solid tools as well to cover the field of the ordinary tool holder. The cutters are triangular in shape and are rolled from high-speed steel and can be bought in either the bar or in cutter lengths.

The cutter is held, as will be noted, in a dove-tail slot off to one side of the holder, thus allowing of the use of a larger



New Tool Holder in Different Positions.

cutter than would be possible, if it were inserted in the center. This method of inserting the tool does away with any obstruction on the cutting side, so that the tool may be fed up to a shoulder, and it is not necessary to have an off-set tool in order to face down the side. This shape of cutter weighs less per foot than if it were made of a square section, and, therefore, while using a much deeper cutter point it is very economical in the use of high speed steel. When used in the vertical mill or planer the cutter may be twice the usual length, while in the ordinary tool bolt a cutter of the usual length can be used to advantage. It will be noticed that the top angles of cutter points are always correct and require no grinding. The method of clamping the cutter in holder is very positive at the same time avoiding the grinding action between the cutter and binding bolt. The nut being at the bottom of the holder does away with the swelled head on top and leaves free chip room. This is a very important feature, especially in turning hard steel where the chips have a tendency to wedge in between the holder and the work. The cutter being forced down into a V slot for its seat, gives it a wedge bearing, which prevents it from slipping back away from the cut. The holders are made by the G. R. Lang Co., Meadville, Pa.

New Literature

THE WESTINGHOUSE E-T AIR BRAKE INSTRUCTION POCKET BOOK; by W. W. Wood, 250 pages, cloth, 5x7 inches; illustrated. Price, $2.00: Published by the Norman W. Henley Publishing Co., New York.

This is a book for locomotive engineers, and also for those who wish to become proficiently acquainted with the improved Westinghouse E-T (engine-tender) air brake and brake equipment. The first portion of the book is devoted to chapters on the parts of the equipment and names of piping, arrangement of apparatus, explanation of the principles and operation of the automatic air brake and rudiments of the distributing valve. The larger portion of the book is devoted particularly to the E-T equipment, both to the No. 5 and the improved style No. 6, as applied to freight and passenger service. Complete descriptions are given of the various details of the mechanism. In addition there is a set of examination questions and answers on the E-T locomotive brake equipment which is very complete. There are more than forty illustrations, most of which are colored diagrams of the piping, details of valves, etc. Each zone of air pressure is given a different color in the diagrams, and the latter are to a large extent self-explanatory.

* * *

The Long & Allstatter Co., of Hamilton, Ohio., has recently issued their annual catalog No. 21, entitled "Power Punching and Shearing Machinery," which shows very completely a large line of punching and shearing machines, as well as bending rolls, hammers, riveters and tire welders. There are more than 150 illustrations of the various machines, each accompanied by a description of the same. The catalog contains about 200 pages and is bound in light cardboard with a very neat and attractive cover.

* * *

The Grip Nut Co., of Chicago and New York, has just issued catalog No. 17 entitled "Universal Car Window Fixtures and Accessories." Car window frames and fixtures are usually a source of annoyance to the management of railroads. "Universal" fixtures present some novel and distinct features, such as the "Gravity Wedging Locks," and it is claimed that the usual difficulties are eliminated. The catalog is handsomely illustrated with colored reproductions of the fixtures, showing clearly their application to the window.

* * *

"A Few Facts" about the Baker-Pilliod valve gear as applied to locomotives are given in a booklet recently issued by the Pilliod Co., of Chicago. The booklet is illustrated with a number of excellent photographs of different types of engines equipped with this valve gear. One of these showing the Baker-Pilliod at close range is particularly good.

* * *

The University of Illinois has issued a very attractive booklet descriptive of the equipment and work of the College of Engineering. There is given an outline of the different courses in engineering and many photographs of the campus, buildings and equipment. One of the interesting features is a number of original drawings by the students in the Department of Architecture.

The Ball & Wood Co., of Elizabethport, N. J., has issued a pamphlet entitled "Rateau-Smoot Turbines and Generators." These turbines are of the low pressure, impulse type operating on exhaust steam and are fully described in this pamphlet.

* * *

"The Pennsylvania System of Railroads expended for improvements in Greater Pittsburg and vicinity since Jan. 1, 1902, an aggregate of $25,560,000." This is the statement on the first page of a very interesting booklet issued by the Pennsylvania System. Although the reading matter deals largely with the Pennsylvania in and around Pittsburg, it is of general interest as showing what is being done by this road.

* * *

"Lubrication versus Friction" is the title of a booklet issued by the Dearborn Drug & Chemical Works, of New York and Chicago. Among other things it contains reading matter on the sources of lubricants, methods of distillation and refining and methods of determining the physical properties of lubricants.

* * *

The Ralston Steel Car Co., Columbus, Ohio, is the cause of a little sketch entitled "Midnight on the Alkali Southwestern." It is intended to give a little light reading during the hot weather and avoids the subject of steel cars.

* * *

"Standard" solid forged and rolled steel wheels are fully described and illustrated in a catalog recently issued by the Standard Steel Works Co., of Philadelphia. The catalog is prefaced by an excellent photograph of the plant of the company.

* * *

Catalog No. 26, issued by J. Faessler Manufacturing Co., of Moberly, Mo., describes standard and special boiler makers' tools made by them. This company has devoted especial efforts in this particular field.

To Die No More

A. Bradshaw Holmes, secretary and treasurer of the Independent Pneumatic Tool Co. and Aurora Automatic Machinery Co., Chicago, died on June 30, 1909, from injuries sustained by accidentally falling from the piazza of his hotel. He was 31 years of age and unmarried. Mr. Holmes was well known in the pneumatic tool business, having been connected with the Standard Pneumatic Tool Co. and the Rand Drill Co. for a number of years prior to his connection with the Independent Pneumatic Tool Co., of which corporation he was secretary and treasurer since its organization. He was a man of exceptional business ability, honorable and upright in all his dealings, and his loss will be keenly felt by his business associates and all who knew him.

W. F. Elrod, assistant superintendent of the Toledo & Ohio Central, with office at Bucyrus, Ohio, died June 25 after an operation for tonsilitis.

E. H. Millington, superintendent of telegraph for the past seven years of the Michigan Central at Detroit, Mich., died at St. Thomas, Ont., June 22, following an attack of paralysis.

Major Frederick Bush, formerly president of the Columbia & Greenville, died at Springfield, Mass., June 24, at the age of 89. Major Bush formed a syndicate to buy the property of the Columbia & Greenville after the Civil War, and rebuilt part of it and reorganized it and later sold it to the South Carolina Railroad, which road was later taken over by the Southern Railway.

The Selling Side

C. W. Armbrust, president of the Love Brake Shoe Co., Chicago, Ill., has for several weeks past been seriously ill and

C. W. Armbrust.

for this reason he was unable to attend the mechanical conventions. He has recently been improving, however, and will soon be back at his business.

By mutual agreement, the firm of Burnham, Williams & Co. has been dissolved, and its entire property and interests in the locomotive business have been sold to the Baldwin Locomotive Works. The officers of the corporation are as follows: President, John H. Converse; vice-president and engineer, William L. Austin; vice-president and treasurer, Alba B. Johnson; general superintendent, Samuel M. Vauclain; secretary and assistant treasurer, William DeKrafft.

The American Nut & Bolt Fastener Co., manufacturers of the Bartley Positive Fastener, reports its business improving very rapidly. Its orders for the past six months have averaged seven hundred thousand fasteners per month. The president of the company expects the increase of business by the first of January, 1910, to exceed one million five hundred thousand fasteners per month.

Increase of business has compelled the Carlyle Johnson Machine Co. to seek larger and better quarters. It is now located at Manchester, Conn., 9 miles east of Hartford, on the Willimantic Division of the N. Y., N. H. & H. R. R., where its facilities are much improved.

The General Railway Supply Co., Chicago, has received an order for metallic steel sheathing for use on 10 coaches, 10 sleepers and 4 diners, to be built for the Chicago, Minneapolis & St. Paul. Flexolite composition flooring, furnished by the General Railway Supply Co., is also being used in these cars.

The George M. Newhall Engineering Co., Philadelphia, Pa., which was recently appointed to represent in the East the Industrial Works, Bay City, Mich., for the sale of cranes, has booked the following orders: Western Maryland, 100-ton wrecking crane; Richard Heckshcr Sons Co., Swedeland, Pa., 15-ton locomotive crane; Southern Ry., 100-ton wrecking crane, and Cranford Paving Co., Washington, D. C., 10-ton bucket crane.

B. D. Lockwood, mechanical engineer of the Cleveland, Cincinnati, Chicago & St. Louis, has gone to the Pressed Steel Car Co., Pittsburg, Pa., as assistant chief engineer.

The Chicago Railway Equipment Company was informed by the Westinghouse Air Brake Company, about the first of the year, that the latter's new "LN" high speed brake equipment designed to use a large supplementary reservoir in addition to the ordinary auxiliary reservoir and for use on new and heavier equipment for such trains as the "Pennsylvania Special" and the "Twentieth Century Limited," would necessitate the manufacture of a stronger beam than the present "Diamond Special," it was suggested that the former company immediately prepare a new high speed brake beam and the requirements were fixed at a deflection of not more than 1/16 in. at 40,000-lb. load. The difficulty of designing a beam of such strength lay in the fact that the Pullman people could not allow for any more room than provided in the present triple trucks and because it was necessary to get this unusual strength in the brake beam structure without deepening the truss or enlarging the beam ends or changing any dimensions that would prevent the interchange of the new beam with the old 2½-in. "National Hollow" and "Diamond Special" beams now in use. This has, however, been accomplished by a design, to be made public very shortly, which has not only shown a carrying capacity of more than 40,000 lbs. at 1/16-in. deflection, but a design that offers possibilities in the production of brake beams of greater strength than 40,000 lbs. at 1/16-in. deflection.

Mrs. A. Fenton Walker, the deservedly popular advertising representative of the Railway and Marine World, Toronto, Canada, has gone on an extensive trip to the West, visiting all the prominent Pacific Coast points. Mrs. Walker's efforts have contributed largely to the success of the bright journal which she represents.

Few men have filled the office of president of the Railway Supply Manufacturers' Association more acceptably than Mr. Alexander Turner, who has displayed not only remarkable tact and executive ability but the spirit back of

ALEX. TURNER.

it was, in the Rooseveltian language, to give all a square deal. Mr. Turner retires from the Galena Signal Oil Company after several years service to accept new duties as manager of sales of the Metal Corporation, Hillburn, N. Y. His future spells success.

The contract for placing the concrete piles in the foundations of the Denison-Harvard viaduct at Cleveland, Ohio, has been awarded to the Raymond Concrete Pile Company, of New York and Chicago. The viaduct will spen a stretch of low land situated on the outskirts of Cleveland. A. M. Folgate, county bridge engineer; Concrete Steel Construction Company, general contractors.

The improvement in business generally noticeable is reflected in recent advices from the firm of John F. Allen, 370-372 Gerard avenue, New York City, builders of the well-known "Allen" riveting machines. They state: "Our May output was the largest since October, 1907. June opened up with a satisfactory amount of orders on hand and development of orders to date is very satisfactory, promising to close out the month with an increased output over last month. During the depression we took occasion to devote closer study to improving our machines, the result being that we have succeeded in developing greater tonnage on the dies and with a much smoother movement, eliminating the jar noticeable at times in pneumatic riveters, and which some users have found objectionable."

The book departments of the McGraw Publishing Co. and the Hill Publishing Co. have consolidated under the corporate name of the McGraw-Hill Book Co., with offices, after July 1st, at 239 West 39th street, New York. This consolidation brings together two of the most active publishers of technical books in the country. The new company takes over the book departments of both houses with a list of about 250 titles, both industrial and college text books, covering all lines of engineering. It will continue as well the retail, importing and jobbing business of the two houses. The officers of the new company are: President, John A. Hill; vice-president, James H. McGraw; treasurer, Edward Caldwell; secretary, Martin M. Foss.

An interest of Safety Car Heating & Lighting Co. states that the improvement in the equipment situation during the past two months has been greater than in any similar previous period in the history of the industry. Although the demand for some lines of supplies is still considerably below normal, in others it is equally as good, and in a few somewhat above the level of this season in 1907. Judging by the amount of improvement in the way of new rolling stock and other equipment projected by the railroads for the current year the outlook is as good if not better than at this time two years ago. The Pintsch lighting system, which the company owns outright, is now applied to over 33,000 cars in the United States, Canada and Mexico and to approximately 165,000 cars throughout the world. Another system of lighting, which it has taken the company some years to develop and which is rapidly coming into favor with the railroads, embodies the axle-driven dynamo together with the lamp voltage regulator. Recent orders for equipping cars with this system are as folows: Chicago, Rock Island & Pacific, 157; Southern Railway, 125; New York Central, 25; Lehigh Valley, 15, and Pullman Co., 10. Each gas plant has a department equipped with the necessary machinery for taking care of the equipment in service and the company is renting as well as selling it.

Mr. Hugh M. Wilson, formerly editor and publisher of The Railway Age, will, on August 1st, become associated with the Barney & Smith Car Co., Dayton, Ohio, of which he has been elected a director and a vice-president. Mr. Wilson disposed of his publishing business over a year ago and has only recently returned to the United States after nearly a year spent in foreign travel.

Hugh M. Wilson.

W. E. Fowler.

Personals

F. D. Sadlico has been appointed district master mechanic of the western division and J. Scott has been appointed district master mechanic of the central division of the Canadian Pacific Ry.

W. E. Fowler has announced his resignation from the office of master car builder of the Canadian Pacific Ry. Mr. Fowler has served the Canadian Pacific in this office since April 1st, 1902, and is one of the most prominent members of his profession. His retirement is necessitated by the fact that several surgical operations, recently performed, have left him in a weakened condition. A long rest will probably have the effect of restoring his health to the normal.

C. D. Ashmore, J. J. Murphy, and F. A. Nelson have recently been appointed shop foreman on the Chicago & Northwestern Ry.

Gustave Larson succeeds J. W. Muney as master car builder of the Chicago, St. Paul, Minneapolis & Omaha Ry.

C. E. Chambers has been promoted from division master mechanic to general master mechanic of the Central R. R. of New Jersey.

Geo. W. Robb has been appointed master mechanic on the Grand Trunk Pacific Ry., succeeding Wm. Gell, who has resigned on account of ill health.

H. McComb has been appointed a locomotive foreman on the Great Northern Ry.

John May succeeds C. Wilhelmsen as master mechanic of the Kentwood & Eastern Ry.

B. B. Moore has been appointed master mechanic of the Mississippi Central R. R.

Harry L. Roth has been appointed master mechanic of the Ocean Shore Ry.

P. L. Dunn has been appointed a master mechanic on the Pennsylvania Lines.

P. H. McGraw and J. O. Mowry have been promoted to road foremen of engines on the Pennsylvania Lines.

W. H. Caswell has been appointed master mechanic of the Sandy River & Rangeley Lake R. R.

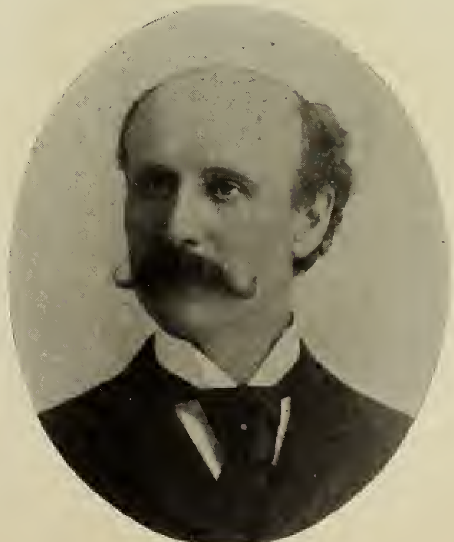
T. C. Stone succeeds Wm. H. Cole as master mechanic of the United Verde & Pacific Ry.

R. C. Hinds, B. F. Seisler and H. Zimmerman have been appointed master mechanics on the Wabash R. R.

The jurisdiction of T. O. Sechrist, a master mechanic on the Cincinnati, New Orleans & Texas Pacific Ry., with office at the Ferguson shops, has been extended over the entire Chattanooga division.

J. H. Murphy has been appointed general foreman at the Ludlow shops of the Cincinnati, New Orleans & Texas Pacific Ry. His jurisdiction over the mechanical forces extends from Cincinnati to Lexington.

T. O. Sechrist.



J. H. Murphy.

Railway Mechanical Patents Issued During June

Shovel car, 922,450—Erastus S. Bennett, New York, N. Y.

Car underframe, 922,586—Clarence H. Howard, St. Louis, Mo.

Guide bracket for edgewise movable doors, 922,612—Theodore Mull, Old Fort, Ohio.

Friction draft rigging for railway cars, 922,617, 922,618 and 922,619—John F. O'Connor, Chicago, Ill.

Turntable, 922,643—Holly M. Verplanck, Lansing, Mich.

Manufacture of car wheels, 922,655—Charles E. Wolle, Burnham, Pa.

Draft gear for railway cars, 922,708—William R. Matthews, Pittsburg, Pa.

Railway truck, 922,750—Albert M. Clark, Marshalltown, Ia.

Underground subway for street railways, etc., 922,768—George W. Jackson, Chicago, Ill.

Passenger car, 922,782—Felix Koch, Bellevue, Pa.

Underframe for cars and tenders, 922,787, 922,788 and 922,789—William D. Lowry, St. Louis, Mo.

Car wheel, 922,844—Eli A. Booser, Altoona, Pa.

Car construction, 922,846—Jerome G. Bower, Chicago, Ill.

Upper berth for sleeping cars, 922,850—Edward G. Budd, Philadelphia, Pa.

Upper berth for sleeping cars, 922,913—John B. Kilburn and Edward G. Budd, Philadelphia, Pa.

Dump car, 922,923—Arthur Lipschutz, Chicago, Ill.

Steel underframe for railways cars, 922,955—George B. Robbins, Hinsdale, and William E. Sharp, Chicago, Ill.

Car truck, 922,966 and 922,967—Charles S. Shallenberger, St. Louis, Mo.

Ash pan cleaner, 923,607—Jesse E. McRoberts, Woonsocket, S. D.

Coupling for air brake pipes, 923,112—John E. Brodie, Rochester, N. Y.

Car ventilator, 923,241—George C. Breidert, Chicago, Ill.

Car body construction, 923,292—Lars G. Neilson, Hoboken, N. J.

Composition of matter to be used in packing journals of railway cars, 923,304—William M. Simmons, Hinton, W. Va.

Mail delivering and collecting apparatus, 923,336—William M. Corthell, Chicago, Ill.

Nut lock, 923,365—Frank E. Mensinger, Mainville, Pa.

Draft and buffing gear for cars, 923,398—Ira O. Wright, Baltimore, Md.

Triple valve for brakes, 922,418—Joseph Doyen, Schaerbeek, near Brussels, Belgium.

Car brace, 923,463—William I. Taylor, Decatur, Ill.

Brake beam, 923,475—Henry Ziemss, Jr., Chicago, Ill.

Truck support for contact plows, 923,484—Samuel T. Bole, Philadelphia, Pa.

Locomotive for logging and the like, 923,564—John R. McGiffert, Duluth, Minn.

Car heating system, 923,570—Thomas Parker, London, Ontario, Canada.

Brake shoe, 923,572—Bernard Peducasse, Lyons, France.

Car derailing device, 923,683—Walter M. Mitchell, Pratt City, Ala.

Dump car, 923,695—Spencer Otis, Chicago, Ill.

Train signaling apparatus, 923,719—George A. Shoemaker, Urbana, Va.

Friction draft rigging, 923,735—Clinton A. Tower, Cleveland, Ohio.

Car and engine replacer, 923,785—John Flynn, London, Ontario, Canada.

Automatic-slack-adjuster, 923,927—Charles O. Anderson, Neb.

Car-door, 923,961—Zeb R. English, Milton, Pa.

Curtain for car-vestibule diaphragms, 924,004—Harry H. Schroyer, Chicago, Ill.

Draft-gear and coupling, 924,028—Benjamin Banyay, Newark, Ohio.

Grain-door for cars, 924,064 and 924,065—John Henry, Grand Forks, N. D.

Air-brake piston, 924,087—John E. Meek, New York, N. Y.

Railroad-track sweeper, 924,114—Samuel Speer, Pittsburg, Pa.

Railway postal car, 924,165—Patrick Kennedy, New York, N. Y.

Car-wheel and method of manufacture, 924,314—George H. Bryant, Chicago, Ill.

Mechanical stoker for locomotive-boilers, 924,364—Joseph H. Lowe, St. Jerome, Quebec, Canada.

Car windor curtain rod, 924,419—Charles O. Birney, St. Louis, Mo.

Mechanism for turning car seats, 924,458—Fred H. Henry, Philadelphia, Pa.

Train stopping device, 924,482—John E. Maloney, John Harvey, and Charles Paul, Salamanaca, N. Y.

Lock for doors for railway and other cars, 924,502—Otto Schaller, Steglitz, near Berlin, Germany.

Extension car step, 924,537—Ulysses E. Crofut, Jr., Scranton, Pa.

Coupling, 924,608—Edward E. Gold, New York, N. Y.

Means for refrigerating cars, 924,620—Le Roy M. Lyon, Cranford, N. J.

Car brake, 924,645—Jacob A. Davis and Davy L. Reed, Wright, W. Va.

Car door hanger, 924,648—Percy M. Elliott, Chicago, Ill.

Railway car truck, 924,652—George F. Floyd, Granite, Ill.

Car truck, 924,653—George G. Floyd, Granite, Ill.

Device for disposing of ashes and cinders from locomotives, 924,678—Thomas S. Leake, St. Louis, Mo.

Pilot for locomotives and the like, 924,709—Chas. T. Westlake, St. Louis, Mo.

Dumping car, 924,726—James L. Blaker, Blaker Mills, W. Va.

Automatic air brake appliance, 924,742—James A. Couch and Lee F. Couch, Nashville, Ark.

Center sill for railway cars, 924,748—Irving G. Downs, Hollis, N. Y.

Signaling device for car doors, 924,803—Andrew H. Long, Roland, N. Y.

Railway sleeping car and other berth section, 924,823—Henry Pearson, Springfield, Mass.

Journal bearing, 924,843—Eliel L. Sharpneck and William S. Sharpneck, Boston, Mass.

Automatic burglar proof car door lock, 924,874—Harry L. App and John H. Baker, Richmond, and Edward G. Bolton, Fresno, Cal.

Brake shoe, 924,930—Clifton D. Pettis, Chicago, Ill.

Pilot for locomotives and the like, 924,949—Chas. T. Westlake, St. Louis, Mo.

Railway car truck, 924,976—George G. Floyd, Granite, Ill.

Emergency brake, 925,020—William D. Payne, Washington, D. C.

Car seat, 925,066—Hubert Witte and Joseph B. Schuermann, St. Louis, Mo.

Dump car, 925,087—Louis P. Gaston, Somerville, N. J.

Car axle, 925,090—George Haigh, Fairfield, Wash.

Car window, 925,091—Emery A. Haitinger, Passaic, N. J.

Angle cock for railway cars, 925,103—Louis A. Hoerr, St. Louis, Mo.

Semi-convertible car, 925,133—Edward T. Robinson, St. Louis, Mo.

Automatic brake system, 925,137—William U. G. Shaw and Oscar Johnson, La Fayette, Ind.

Railway car door or gate, 925,139—Louis A. Sherman, Detroit, Mich.

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CONTENTS.

Gas Producer Power in Railroad Shops

During the last few years the gas producer has come to occupy a prominent place as a means of power for large and small plants. Its development has taken place largely within the past ten years and while it is not entirely perfected as yet, it has reached a high degree of efficiency. In the average railroad shop the gas producer power plant offers a number of advantages. The producer requires less attention than the steam boiler. After cleaning the fire, filling the producer and "blowing up" the fire in the morning, the only attentions required through the day are the occasional barring of the fire and the throwing in of a few buckets of coal. The writer knows of one power plant equipped with seven 150-h. p. units, where the producers are taken care of by two men. In this particular case each producer is barred and given a few buckets of coal twice or three times a day. There seems to be an erroneous impression current that the producer attendant does not need to be as experienced a man as a fireman, for instance, and while this is more or less true, still the fireman placed in charge of a producer finds the firing of a producer a different proposition from the firing of a boiler. For instance, as the fire is, for the most part, out of sight, the producer man must learn to know the condition of his fire by the "feel" of the bar.

Tests have been made on producers, giving a coal consumption of a pound of coal per h. p. hour and less, but in practice this runs nearer one and two-tenths. This is scarcely better than the steam plant but the producer effects a saving at times of light and no loads, there being scarcely any fuel consumption when the engine is shut down. The bituminous coal producer has not as yet been developed to the same degree of reliability as the anthracite producer but we may soon hope for better producers of this type as a great deal of effort is being put forth at this time to perfect the soft coal producer. A number of shops having producer plants, are utilizing the producer gas for babbitting furnaces, iron heaters and the like, the gas being piped to various places about the shop and being placed under low pressure by a blower. The plan is satisfactory and has in some cases been productive of economy. Moreover the gas engine is rapidly becoming an important factor in power plant work on account of its compactness and efficiency. A few years ago a unit of 500 h. p. was spoken of as a large gas engine, while to-day the gas engine is built in units of 4,000 h. p.

Superheated Steam in Locomotive Practice

The use of superheated steam in locomotive practice has now been more or less prevalent for five years and data as to superheater equipments with respect to reliability, ease of operation, and economy should be ready at hand. Last fall it was stated before the Traveling Engineers in convention that five hundred and ninety-four locomotives in the United States and Canada were equipped with superheaters. Investigation shows that fuel economy of from ten to twenty per cent is resulting from these superheater installations. However, there are so many other advantages to be taken into account that this economy falls into a back place. Generally speaking superheater engines are handling their trains more easily, more quickly and with a resultant increase in tonnage hauled.

There have been many difficulties in connection with the operation of superheater engines which have necessitated much and, in some cases, costly experimental work. For those who care to take advantage of the experience of others the road is open to immediate saving by the installation of one of the types of superheaters of which many have demonstrated their value. The principal difficulties and troubles encountered in the use of superheated steam occur with the piston rings and valve rings, smoke flues filling up with cinders and ashes, leaking of the large smoke flues at the firebox end, splitting of superheater elements and leaking and failure of superheater connections. As proof that these difficulties have been overcome to a great extent, is the fact that shop men no longer present serious objections to superheater equipment. Backing up this statement is the expression from several motive power heads that superheaters have not increased the cost of locomotive upkeep per mile.

Motor Cars

While the field of the railway passenger motor car is not as broad as some people would have us believe, still there is a field and some of the most conservative of our mechanical officials are devoting considerable time to the problem of the motor car and its peculiarities. We publish, on another page of this issue, the description of a very successful German car of original and interesting design. The description is not as technically complete as it should be, but the illustrations convey much that the description omits. The article is evidence that European railroads have discovered a field for the motor car.

The steaming capacity of this car seems small but the high boiler pressure and large superheater surface probably operate to make the car compare favorably in speed and power with any American built car of like size. The double connected pistons driving directly the forward and rear wheels of the truck on each side, is a unique feature and would seem to render unnecessary the side rods connecting these wheels.

Of the many classes of motor cars now in operation and on the market each has its advantages and disadvantages until it seems that honors are about evenly divided between those using the gasoline internal combustion engine and those fitted with the old reliable steam engine. Conditions are about the same where the operation of cars is concerned, unless it might be where water supply stations are located rather far apart. Those who favor the steam car have the advantage of knowledge gained from longer experience with this class of prime mover. Those who have been working in the newer gasoline field have made creditable progress, however, until the gasoline car has in some cases, at least, taken the precedence.

The University of Michigan announces a "Railway Administration" course of study which is expected to give the student a fair technical knowledge of each branch of railroad work after four years study. We will therefore be forced to wait at least four or five years before the personnel of the railroad executive departments is made up of men whose knowledge of railroad operation is gleaned from the college text books and the professor's lecture.

New Locomotives for the Bessemer & Lake Erie R. R.

The Baldwin Locomotive Works has recently completed for the Bessemer & Lake Erie R. R. two consolidation and four six-wheeled switching locomotives, which are exceptionally heavy engines for their respective classes. Four additional consolidation type locomotives, closely similar to the Bessemer engines, have been built for the Union R. R. The accompanying illustrations represent the Bessemer locomotives. The designs are based on drawings and specifications furnished by the railroad company.

The Consolidation type locomotives have 24x32 in. cylinders, and with driving wheels 54 in. in diameter, and a steam pressure of 220 lbs., the tractive force exerted is 63,820 lbs. The cylinders are strongly ribbed and built with heavy walls, and are fitted with balanced slide valves. Stephenson link motion is employed; the gear is arranged with transmission bars which span the second driving axle, and so connect the link blocks with the rockers. The eccentric rods are straight and short. These engines are equipped with cast steel frames, which are 4½ inches wide throughout, and measure 7 inches in depth over the pedestals. The front rails are also of cast steel; they are made with horizontal lugs, and to these is bolted a steel plate, ⅞ inches thick, which extends across the engine and forms a strong brace in front of the cylinders. The front bumper, on the Bessemer engines, is built up of two heavy channels with suitable filling pieces, while on the Union engines it is of cast steel, in one piece.

The leading drivers only are equalized with the engine truck, while the three rear pairs are separately equalized. Inverted leaf springs support the frames at the rear, and these are connected with the springs over the main journals by yokes fulcrumed on the back driving boxes.

The boiler is straight topped, 84 inches in diameter, and the barrel plates are one inch thick. The fire-box is placed over the frames, and has a sloping back-head and roof sheet. The staying is radial, with one T bar supporting the forward end of the crown. The side and crown sheets are in separate pieces, a similar arrangement being used for the outside shell. The barrel is built with three rings, and the longitudinal seams are sextuple riveted and placed on the top center line. The tender carries 8,000 gallons of water and 14 tons of coal. The frame has 13-inch channels for the center sills, and 10-inch channels for the side sills, and the trucks are of the arch-bar type, with cast steel bolsters.

The locomotives for the Union R. R. are not quite as heavy as those described above. The boilers are of the same general dimensions, but they have thinner shell plates and carry a steam pressure of 210 pounds. The tank has capacity for 7,500 gallons of water and 12 tons of coal.

The six-coupled switching locomotives for the Bessemer R. R. are the heaviest engines of their type thus far constructed by the builders. They exert a tractive force of 41,460 pounds, and as the weight on the driving wheels is 183,750 pounds, the ration of adhesion is 4.43.

In general design, these locomotives follow the consolidation type engines, using the same details where practicable. The main rods are connected to the second pair of driving wheels, and the eccentrics are placed on the main axle. With this arrangement, the link blocks are connected directly to the rockers, no transmission bars being required. The boiler carries a steam pressure of 180 pounds; it has a long firebox placed above the frames, and is of high capacity for an engine of this type. The tender has a sloping back tank, and carries 6,000 gallons of water and 10 tons of coal. The great weight and high tractive force of this engine make it particularly suitable for "hump yard" service.

These designs are of interest in that they follow conservative lines, and are at the same time of unusual weight and capacity. The data given in the tables following applies to the switching locomotives and to the consolidation type engines for the Bessemer and Lake Erie R. R.

Consolidation Locomotives, B. & L. E. R. R.

Gauge	4 ft. 8½ in.
Cylinder	24 in. x 32 in.
Valve	Balanced

Boiler.

Type	Straight
Material	Steel
Diameter	84 in.
Thickness of sheets	1 in.
Working pressure	220 lbs.
Fuel	Soft coal
Staying	Radial

Driving Wheels.

Outside diameter	54 in.
Inside diameter	48 in.
Journals, main	10 in. x 13 in.
Journals, others	9 in. x 13 in.

Engine Truck Wheels.

Front diameter	30 in.
Journals	6 in. x 12 in.

Wheel Base.

Driving	15 ft. 7 in.
Rigid	15 ft. 7 in.
Total Engine	24 ft. 4 in.
Total Engine and Tender	61 ft. 5½ in.

Weight.

On Driving Wheels	229,450 lbs.
On Truck, front	24,500 lbs.
Total Engine	253,950 lbs.
Total Engine and Tender about	414,000 lbs.

Tender.

Wheels, number	8
Wheels, diameter	33 in.
Journals	5½ in. x 10 in.
Tank Capacity, water	8,000 gals.
Tank Capacity, coal	14 tons
Service	Freight

Switching Locomotives, B. & L. E. R. R.

Gauge	4 ft. 8½ in.
Cylinder	22 in. x 28 in.

Consolidation Locomotive, Bessemer & Lake Erie R. R.

Fire Box.

Material	Steel
Length	132⅛ in.
Width	40¼ in.
Depth, front	83 in.
Depth, back	79¼ in.
Thickness of sheets, sides	⅜ in.
Thickness of sheets, back	⅜ in.
Thickness of sheets, crown	7/16 in.
Thickness of sheets, tube	½ in.

Water Space.

Front	4 in.
Sides	4 in.
Back	4 in.

Tubes.

Material	Steel
Wire gauge	No. 11
Number	406
Diameter	2¼ in.
Length	15 ft. 0 in.

Heating Surface.

Fire box	236 sq. ft.
Tubes	3,565 sq. ft.
Total	3,801 sq. ft.
Grate area	36.9 sq. ft.

Valve	Balanced

Boiler.

Type	Straight
Material	Steel
Diameter	80 in.
Thickness of sheets	13/16 in.
Working Pressure	180 lbs.
Fuel	Soft coal
Staying	Radial

Fire Box.

Material	Steel
Length	120⅛ in.
Width	40¼ in.
Depth, front	79 in.
Depth, back	76 in.
Thickness of sheets, sides	⅜ in.
Thickness of sheets, back	⅜ in.
Thickness of sheets, crown	7/16 in.
Thickness of sheets, tube	½ in.

Water Space.

Front	4½ in.
Sides	4 in.
Back	4 in.

Tubes.	
Material	Steel
Wire gauge	No. 11
Number	339
Diameter	2¼ in.
Length	13 ft. 0 in.
Heating Surface.	
Fire box	196 sq. ft.
Tubes	2,577 sq. ft.
Total	2,773 sq. ft.
Grate Area	33.5 sq. ft.
Driving Wheels.	
Outside diameter	50 in.
Inside diameter	44 in.
Journals, main	10 in. x 13 in.
Journals, others	10 in. x 13 in.
Wheel Base.	
Driving	12 ft. 0 in.
Rigid	12 ft. 0 in.
Total Engine	12 ft. 0 in.
Total Engine	183,750 lbs.
Total Engine and Tender	47 ft. 2 in.
Weight.	
On Driving Wheels	183,750 lbs.
Total Engine and Tender about	304,000 lbs.

of the locomotive for economical working but it would appear to me that we shall have to look more to the boiler than to the engine in the future. The fireboxes of locomotive boilers have been extended, as well as the grate surface, in order to get results at the expense of fuel. What is requisite for economy is not to increase the size of the firebox and the grate surface, but to increase the direct heating surface in the regular size fireboxes and tube plates. It has been conclusively proved that this can be done, by flanging, to an extent of from 20 to 30%, and in flanging, as is shown on the fireboxes which I have designed. It will be noted that the natural tendency of steel to expand and contract is fully taken care of, and by its formation the box is made over 50% stronger than if made in the regular form with flat plates, to be bound up with stays, so that the natural element of steel cannot exert itself. We have here an example that is in accord with President Vaughan's remarks in regard to the saving of fuel, for undoubtedly we shall have to look, as before stated, to the boiler for economy in fuel in the future. It must not be lost sight of that we shall have to devote our attention to eliminating all horizontal and vertical riveted seams in fireboxes, the elimination of which is possible in order to allow the strains set up by contraction and expansion to be neutralized; and the reduction of stays is an important factor, consistent with taking care of the heavy pressures at which the boilers are worked.

Switch Engine, Bessemer & Lake Erie R. R.

Tender.	
Wheels, number	8
Wheels, diameter	33 in.
Journals	5½ in. x 10 in.
Tank Capacity, water	6,000 gals.
Tank Capacity, coal	10 tons
Service	Switching

It will be noted that such firms as Worth Brothers Co. and the Otis Steel Co., especially, are increasing the size of their rolls, so as to roll firebox sheets 146 ins. wide. From this fact it shows that there is to be a demand for fireboxes made from one sheet. Wm. H. Wood, Engineer.

Locomotive Fuel Economy

Media, Pa., June 17, 1909.

Editor, Railway Master Mechanic:

President Vaughn's remarks in convention in regard to the enormous consumption of fuel for the locomotives of the United States amounting in round numbers to about 200,000,000 tons annually at a cost of about $80,000,000, and recommending that superintendents of motive power should give their attention to decreasing the consumption of fuel on the locomotives, were surely timely and good advice. It is a well known fact that the duties of a superintendent of motive power are so numerous that it is next to impossible for him to take time to look into what might be of great assistance to accomplishing the purpose recommended by the president in his address.

It is a well known fact that a great amount of labor, time and ingenuity has been spent on improving the engine part

Bolt Extracting Device

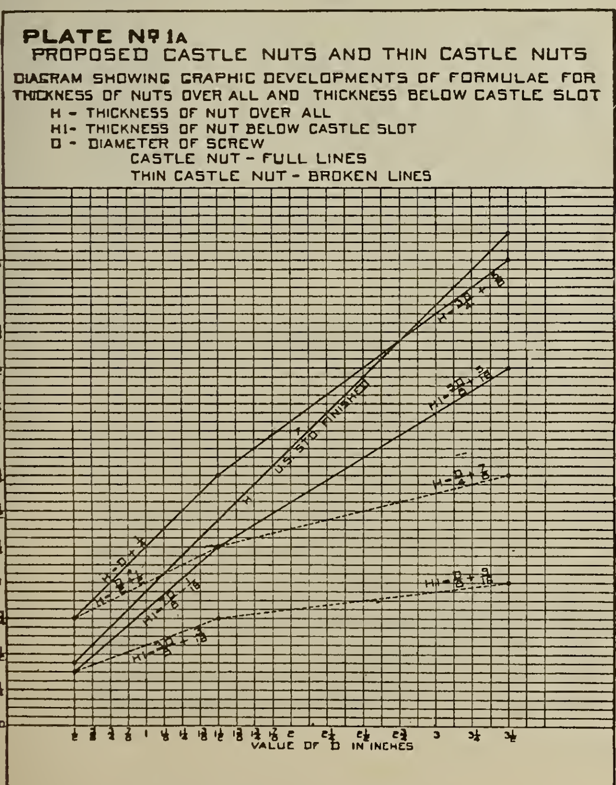
A bolt extractor has recently been manufactured at the Gorgona shops for use in extracting bolts from the floor of Lidgerwood flat cars undergoing heavy repairs. The machine consists of a cylinder made of a 12-inch length of 8-inch wrought iron pipe, bored and turned true, with a head in each end; top head tapped for ½-inch pipe connection and bottom head equipped with a stuffing box and tapped for ¾-inch pipe connection, heads being fitted to cylinder with 16 threads per inch by ½-inch deep in cylinder. The piston head is made of wrought iron forging, faced and turned to fit cylinder, with a leather cup and follower of ½-inch boiler plate attached, and is also threaded to fit piston rod. The piston rod is made of 2-inch round, cold rolled steel, 14 inches long, bored to 1½ inches, 6½ inches deep in each end, leaving a wall of 1 inch in the center, with a 5-16 inch hole through, and countersunk on top side for a steel ball, which is prevented from coming out by a cap placed in top of bore. This ball is necessary to keep the compression in the cylinder from interfering with the operation of the hammer in piston rod.

A 1½ by 5-inch hammer is contained in bottom of piston rod, operating automatically, with a 1½-inch stroke, the rod being tapped for air connection, 1½ inches from bottom. The head for bottom of rod is made of 2½-inch round machine steel 3 inches long, tapped in one end to fit piston rod, while in the other a T slot is cut and beveled out to slip over the head of bolts.

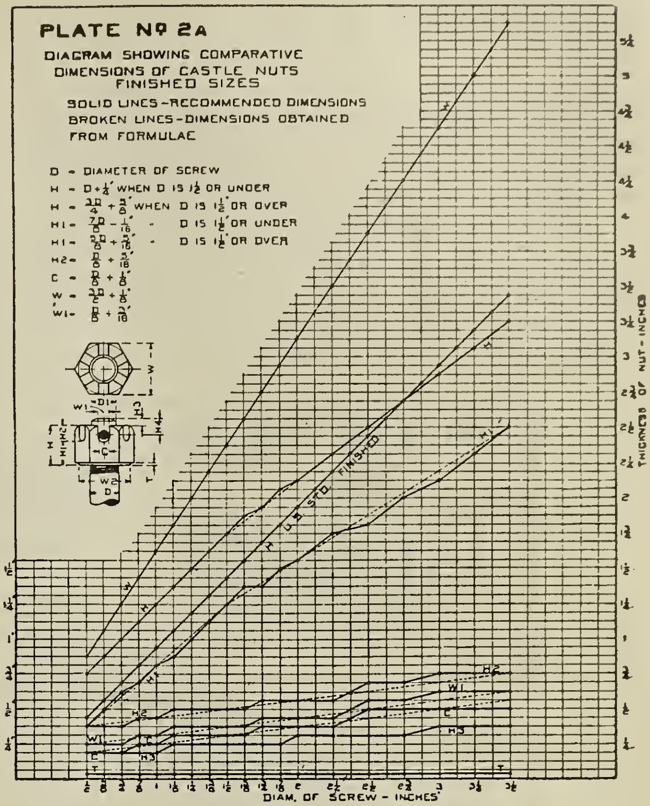
The piping from top of cylinder is arranged respectively as follows: A ⅜-inch by ½-inch bushing, ⅜-inch street elbow, ⅜-inch by 1¼-inch nipple, ⅜-inch female elbow, ⅜-inch by 2½-inch nipple, ⅜-inch female union, ⅜-inch by 1½-inch nipple, 3-way specially made valve, 2-inch reservoir. ¾-inch tee, with a nipple and street elbow connection to bottom of cylinder; a bushing and a hose, making connection at botton of piston rod to operate the hammer.

The cylinder is supported by two pieces of T iron tied together at the top by T iron of the same size, and at the bottom with ½-inch flange, made of boiler plate and cut out in center to clear piston rod. A flange of ½-inch boiler plate is attached to bottom of cylinder and slotted a sliding fit on T iron, the cylinder resting on two triangles, which the flange on T iron is notched to fit at two places 10 inches apart, thus allowing the cylinder to be raised in frame, and making it possible to extract a bolt of twice the length of the stroke of the piston. The cylinder may be raised with piston resting on bolt by admitting air into the top of cylinder.

Suitable handles are attached to the T iron, low enough to clear the triangles when in lower notch. One man can extract one 10-inch bolt every two minutes; two men one each minute. One of the time-saving features of this machine, over a jack, lies in the fact that it takes about the same length of time to raise the jack with a comparatively loose bolt as with a tight one, this machine pulling a loose bolt instantly. Another is that this machine pulls directly over the bolt, having a tendency to straighten and not to bend the bolt. The machine weighs 80 pounds complete, and is operated by compressed air at 80 pounds pressure.—Canal Record.



Graphical Development of Formulae.



Finished Sizes of Castle Nuts.

Castle Nuts*

At the convention last year the dimensions of castle nuts as formulated by the committee were recommended for use during the current year, with a view to adopting them as standard if found satisfactory. The committee was continued to get in touch with the manufacturers of castle nuts and with other parties interested, with a view of establishing them as a regular standard of the association.

Circulars of inquiry were sent to the members of the association, and a number of nut manufacturers. From the replies received the committee has made some few revisions and some correction of errors in the dimension.

It has prepared Plate No. 4-A to accompany this report as a substitution for Plate No. 4, of last year's report.

1. Last year the committee recommended widths across flats or short diameter of hexagon to be the same as the U. S. standard dimension for finished hexagon nuts, finish to be obtained by grinding or milling, at the option of the user.

2. An error has been corrected in the diameter of facing collar for the ⅝-in. size, making it 1 in. instead of 15-16 in.

3. On account of increase in dimensions of widths across flats the formulae for length of common cotter pin was corrected to suit, and the lengths recommended for cotter pins have been revised, where necessary, to agree with the nearest manufacturers' standard length to that found by the revised formula. The lengths affected by this change are in the ¾-in., 1¼-in., 1⅜-in., 1½-in., 1¾-in. and 2½-in. sizes.

4. The lengths of taper pins as recommended were found to be too short to conform with good practice, and have therefore been corrected so that now they correspond very nearly with the lengths recommended for common cotter pins. The difference between the taper pin and the cot-

*Report presented at the annual meeting of the American Railway Master Mechanics' Association. Committee: R. B. Kendig (chairman), J. F. De Voy, H. P. Meredith, J. N. Mowrey, G. S. Edmunds.

ter lengths were only made necessary to conform with the manufacturers' standard lengths for the sizes of taper pins specified.

5. In increasing the length of taper pins there were several instances where the change necessitated an increase in diameter or size of pin in order to come within the manufacturers' list of sizes. To accommodate this it was necessary to increase the width of slot and corresponding depth for sizes 1⅛ in., 1¼ in., 2½ in., 3 in., 3¼ in. and 3½ in.

6. In increasing the width and depth of slot it was necessary to increase several of the sizes of cotters, making them a size larger in the 1⅛-in., 1¼-in. and 2½-in. sizes.

7. Deepening the slot required a revision of the length of reduced end of bolt in the sizes affected by the change in the depth of slot.

8. In order to be consistent with the smaller sizes the distance from center of cotter-pin hole to end of bolt was corrected in the sizes above 1⅞ in.

9. Changing the length of taper pin required changes in the sizes of taper pins in the 1⅛-in., 1¼-in., 1⅜-in., 1½-in., 1⅝-in., 2-in., 2¼-in., 2½-in., 3-in., 3¼-in. and 3½-in. sizes, to agree with manufacturers' standards.

The committee found that the castle nut is being extensively used on locomotives in all sections of the country. The parts of the locomotive on which the castle is being used include the following: Rod bolts, frame pedestal binder bolts, cross-head pins, cross-head shoe bolts, guide bolts, all valve-motion bolts and pins, brake-connection pins, driving box wedge bolts, spring-hanger bolts, air-pump bracket bolts,

PLATE No 4A

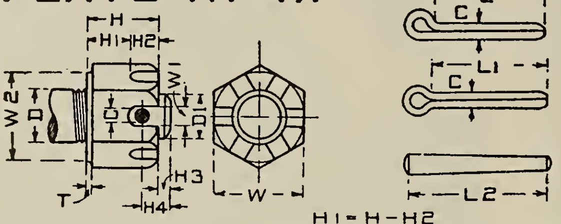


TABLE OF DIMENSIONS FOR CASTLE NUTS AND THIN CASTLE NUTS

DIMENSIONS GIVEN ARE IN INCHES

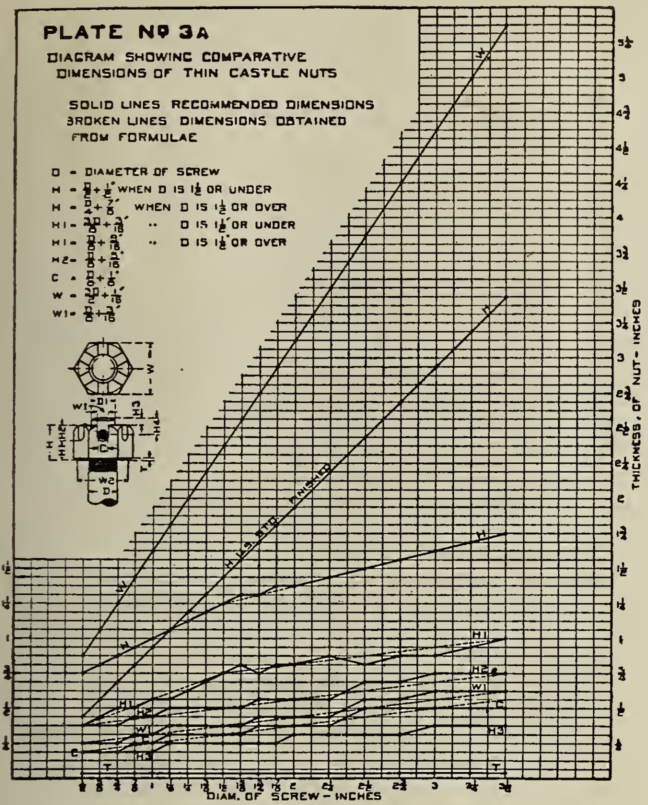
RECOMMENDED DIMENSIONS

NUT	D	DIAMETER OF SCREW	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2
NUT		NO. OF THREADS PER INCH U. S. STANDARD CASTLE AND THIN CASTLE NUT	13	11	10	9	8	7	7	6	6	5 1/2	5	5	4 1/2	4 1/2	4	4	3 1/2	3 1/2	3 1/4
NUT		NO. OF THREADS PER INCH FOR SPECIAL THIN CASTLE NUT	13	11	10	9	8	8	8	8	8	8	8	8	8	8	8	8	8	6	6
NUT	W	DIAMETER ACROSS FLATS ROUGH SIZE	7/8	1 1/16	1 1/4	1 7/16	1 5/8	1 13/16	2	2 3/16	2 3/8	2 9/16	2 3/4	2 15/16	3 1/8	3 1/2	3 7/8	4 1/4	4 5/8	5	5 3/8
NUT	W2	DIAMETER OF FACING COLLAR	13/16	1	1 3/16	1 3/8	1 9/16	1 3/4	1 15/16	2 1/8	2 5/16	2 1/2	2 11/16	2 7/8	3 1/16	3 7/16	3 13/16	4 3/16	4 9/16	4 15/16	5 5/16
NUT	T	THICKNESS OF FACING COLLAR	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32
NUT	H	THICKNESS OF CASTLE NUT—ROUGH	13/16	15/16	1 1/16	1 3/16	1 5/16	1 7/16	1 9/16	1 11/16	1 13/16	1 15/16	2	2 1/8	2 3/16	2 3/8	2 9/16	2 3/4	2 15/16	3 1/8	3 5/16
NUT	H	THICKNESS OF CASTLE NUT—FINISHED	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	1 15/16	2 1/16	2 1/8	2 5/16	2 1/2	2 11/16	2 7/8	3 1/16	3 1/4
NUT	H	THICKNESS OF THIN CASTLE NUT—ROUGH	13/16	7/8	15/16	1	1 1/16	1 1/8	1 3/16	1 1/4	1 5/16	1 3/8	1 3/8	1 7/16	1 7/16	1 1/2	1 9/16	1 5/8	1 11/16	1 3/4	1 13/16
NUT	H	THICKNESS OF THIN CASTLE NUT—FINISHED	3/4	13/16	7/8	15/16	1	1 1/16	1 1/8	1 3/16	1 1/4	1 5/16	1 5/16	1 3/8	1 3/8	1 7/16	1 1/2	1 9/16	1 5/8	1 11/16	1 3/4
NUT		NO. OF SLOTS IN CASTLE	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
NUT	W1	WIDTH OF SLOT IN CASTLE	1/4	1/4	1/4	5/16	5/16	3/8	3/8	3/8	3/8	3/8	7/16	7/16	7/16	7/16	9/16	9/16	5/8	5/8	5/8
NUT	H2	DEPTH OF SLOT IN CASTLE	3/8	3/8	3/8	7/16	7/16	1/2	1/2	1/2	1/2	1/2	9/16	9/16	9/16	9/16	11/16	11/16	3/4	3/4	3/4
BOLT	C	DIAMETER OF COTTER PIN HOLE IN BOLT	3/16	3/16	3/16	1/4	1/4	5/16	5/16	5/16	5/16	5/16	3/8	3/8	3/8	3/8	1/2	1/2	1/2	1/2	1/2
BOLT	H3	PROJECTION OF BOLT BEYOND TOP OF NUT	3/16	3/16	3/16	3/16	3/16	1/4	1/4	1/4	1/4	1/4	1/4	1/4	5/16	5/16	5/16	5/16	3/8	3/8	3/8
BOLT	D1	DIAMETER OF REDUCED END OF BOLT	3/8	7/16	9/16	11/16	13/16	7/8	1	1 1/8	1 1/4	1 5/16	1 7/16	1 9/16	1 11/16	1 7/8	2 1/8	2 5/16	2 9/16	2 3/4	3
BOLT	H2+H3	LENGTH OF REDUCED END OF BOLT	9/16	9/16	9/16	5/8	5/8	3/4	3/4	3/4	3/4	3/4	13/16	13/16	7/8	7/8	1	1	1 1/8	1 1/8	1 1/8
BOLT	H4	DISTANCE FROM CENTER OF COTTER PIN HOLE TO END OF BOLT	3/8	3/8	3/8	7/16	7/16	1/2	1/2	1/2	1/2	1/2	9/16	9/16	5/8	5/8	11/16	11/16	13/16	13/16	13/16
COTTER	C	NOMINAL DIAMETER OF COTTER PIN	3/16	3/16	3/16	1/4	1/4	5/16	5/16	5/16	5/16	5/16	3/8	3/8	3/8	3/8	1/2	1/2	1/2	1/2	1/2
COTTER	L	LENGTH OF PLAYER COTTER PIN	7/8	1	1 1/4	1 1/2	1 1/2	1 3/4	1 3/4	2	2	2	2 1/2	2 1/2	3	3	3 1/2	3 1/2	4	5	5
COTTER	L1	LENGTH OF COMMON COTTER PIN	1 1/4	1 1/2	1 3/4	2	2	2 1/4	2 1/2	2 1/2	3	3	3 1/2	3 1/2	3 1/2	4	5	5	5	6	6
TAPER PIN		SIZE OF TAPER PIN USED IN PLACE OF COTTER	•2	•2	•2	•4	•4	•6	•6	•6	•6	•6	•6	•6	•7	•7	•8	•8	•9	•9	•9
TAPER PIN	L2	LENGTH OF TAPER PIN	1 1/4	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/4	3 1/2	3 3/4	4 1/4	4 1/2	5	5 1/4	5 3/4

DIMENSIONS OBTAINED FROM FORMULAE

FORMULAE																				
D	DIAMETER OF SCREW	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2
$W=\frac{3D}{2}+\frac{1}{8}''$	DIAMETER ACROSS FLATS OF ROUGH NUT PLAIN U.S., CASTLE AND THIN CASTLE NUT	7/8	1 1/16	1 1/4	1 7/16	1 5/8	1 13/16	2	2 3/16	2 3/8	2 9/16	2 3/4	2 15/16	3 1/8	3 1/2	3 7/8	4 1/4	4 5/8	5	5 3/8
$H=D+\frac{5}{16}''$	THICKNESS OF CASTLE NUT 1/2" TO 1 1/2" DIAM. ROUGH	13/16	15/16	1 1/16	1 3/16	1 5/16	1 7/16	1 9/16	1 11/16	1 13/16	—	—	—	—	—	—	—	—	—	—
$H=\frac{3D}{4}+\frac{11}{16}''$	THICKNESS OF CASTLE NUT 1 1/2" TO 3 1/2" DIAM. ROUGH	—	—	—	—	—	—	—	—	1 13/16	1 29/32	2	2 3/32	2 3/15	2 3/8	2 9/16	2 3/4	2 15/16	3 1/8	3 5/16
$H=D+\frac{1}{4}''$	THICKNESS OF CASTLE NUT 1/2" TO 1 1/2" DIAM. FINISHED	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	—	—	—	—	—	—	—	—	—	—
$H=\frac{3D}{4}+\frac{5}{8}''$	THICKNESS OF CASTLE NUT 1 1/2" TO 3 1/2" DIAM. FINISHED	—	—	—	—	—	—	—	—	1 3/4	1 27/32	1 15/16	2 1/32	2 1/8	2 5/16	2 1/2	2 11/16	2 7/8	3 1/16	3 1/4
$H=\frac{D}{2}+\frac{9}{16}''$	THICKNESS OF THIN CASTLE NUT 1/2" TO 1 1/2" DIAM. ROUGH	13/16	7/8	15/16	1	1 1/16	1 1/8	1 3/16	1 1/4	1 5/16	—	—	—	—	—	—	—	—	—	—
$H=\frac{D}{4}+\frac{15}{16}''$	THICKNESS OF THIN CASTLE NUT 1 1/2" TO 3 1/2" DIAM. ROUGH	—	—	—	—	—	—	—	—	1 5/16	1 11/32	1 3/8	1 13/32	1 7/16	1 1/2	1 9/16	1 5/8	1 11/16	1 3/4	1 13/16
$H=\frac{D}{2}+\frac{1}{2}''$	THICKNESS OF THIN CASTLE NUT 1/2" TO 1 1/2" DIAM. FINISHED	3/4	13/16	7/8	15/16	1	1 1/16	1 1/8	1 3/16	1 1/4	—	—	—	—	—	—	—	—	—	—
$H=\frac{D}{2}+\frac{7}{8}''$	THICKNESS OF THIN CASTLE NUT 1 1/2" TO 3 1/2" DIAM. FINISHED	—	—	—	—	—	—	—	—	1 1/4	1 9/32	1 5/16	1 11/32	1 3/8	1 7/16	1 1/2	1 9/16	1 5/8	1 11/16	1 3/4
$W1=\frac{D}{8}+\frac{3}{16}''$	WIDTH OF SLOT IN CASTLE	1/4	17/64	9/32	19/64	5/16	21/64	11/32	23/64	3/8	25/64	13/32	27/64	7/16	15/32	1/2	17/32	9/16	19/32	5/8
$H2=\frac{D}{8}+\frac{5}{16}''$	DEPTH OF SLOT IN CASTLE	3/8	25/64	13/32	27/64	7/16	29/64	15/32	31/64	1/2	33/64	17/32	35/64	9/16	19/32	5/8	21/32	11/16	23/32	3/4
$C=\frac{D}{8}+\frac{1}{8}''$	DIAM. OF COTTER PIN AND DIAM. OF HOLE IN BOLT	3/16	13/64	7/32	15/64	1/4	17/64	9/32	19/64	5/16	21/64	11/32	23/64	3/8	13/32	7/16	15/32	1/2	17/32	9/16
$L=\frac{19D}{16}+\frac{1}{4}''$	LENGTH OF PLAYER COTTER PIN	27/32	1	1 9/64	1 19/64	1 7/16	1 37/64	1 47/64	1 7/8	2 1/32	2 3/16	2 21/64	2 15/32	2 5/8	2 59/64	3 7/32	3 33/64	3 13/16	4 7/64	4 13/32
$L1=\frac{3D}{2}+\frac{1}{2}''$	LENGTH OF COMMON COTTER PIN	1 1/4	1 7/16	1 5/8	1 13/16	2	2 3/16	2 3/8	2 9/16	2 3/4	2 15/16	3 1/8	3 5/16	3 1/2	3 7/8	4 1/4	4 5/8	5	5 3/8	5 3/4

Dimensions of Castle Nuts and Thin Castle Nuts.



Comparative Dimensions of Thin Castle Nuts.

chafing-iron bolts, engine-truck radius bar and radius-bar brace bolts, engine-truck frame bolts, radius-bar carrier bolts, engine-truck pedestal bolts, brake-connection pins on tenders, brake-hanger pins, arch-bar and column bolts, and, in fact, on all bolts of the locomotive subject to any motion or wear.

There were reported, however, a number of roads not yet using the castle nuts on account of the excessive cost of manufacture. It is believed by the committee that the adoption of standard dimensions will have a tendency to put the castle nut on a proper manufacturing basis, with the consequent reduction in cost of manufacture. Several railways, on account of the excessive cost, have found it advantageous to equip their forging machines for the manufacture of the castle nut, and from their experience it is evident that the nuts can be thus manufactured at considerably less cost, in the larger sizes at least, than they can now be obtained from the bolt and nut manufacturers.

Plates Nos. 1, 2 and 3, showing the development of formula, have been reissued, having corrections made in dimensions previously referred to as shown on Plate No. 4-A. The corrected plates which accompany this report bear the numbers 1-A, 2-A, 3-A.

Several users of the castle nuts suggested drilling two cotter holes spaced 90 degrees in the larger bolts, for the reason that on the coarser threads 1/12th turn instead of 1/6th would be decidedly preferable. The committee decided not to make any recommendation on this point, preferring only to consider that feature of the bolt necessary to determine dimensions for the castle nut.

The committee makes the following recommendations, the dimensions for each of which is given in detail on Plate No. 4-A, under the heading "Recommended Dimensions":

1. A series of castle nuts having U. S. standard thread with dimensions as shown.

2. A series of thin castle nuts having U. S. standard thread with dimensions as shown.

3. A series of special thin castle nuts having outward proportion the same as thin castle nuts, but having special number of U. S. threads, as shown.

4. Rough castle nuts to have diameter across the flats as shown. These dimensions correspond with U. S. standard dimensions for hexagon nuts. Finish of flats to be obtained by grinding and buffing, or by milling, the same practice as obtains with the U. S. standard nuts.

5. Finished nuts to have facing washer on bottom with dimensions as shown. Rough nuts to have bottom corner slightly chamfered.

6. A series of standard cotter pins with dimensions as shown.

7. A series of Player cotter pins with dimensions as shown.

8. A series of taper pins with dimensions as shown.

9. Bolt ends projecting beyond the bolt with cotter-pin hole location as shown.

John Player and W. L. Austin did not approve of certain details contained in the report, therefore their names are not appended to the report.

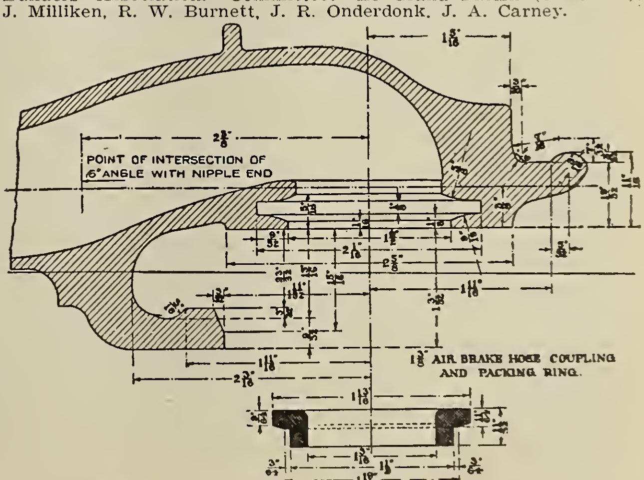
Air Brake Hose*

The committee strongly recommends that railways make extensive experiments with devices designed to distribute the bending strain over nipple end of hose and afford protection from the damage by being struck with coupling when hose are uncoupled under pressure, without parting by hand. This latter condition of damage might be considerably reduced by some improvements in the design of hose coupling which would materially decrease the strains of uncoupling when parted under pressure other than by hand. Upon request of the executive committee it submits recommendations for standard dimensions of air-brake hose couplings and gaskets, as shown in the drawing. It also recommends the following change in Rule 33, page 17: Omit "and hose applied without swelled end and not conforming to M. C. B. Standard hose," making it read: "Cars equipped with air-brake hose other than M. C. B. Standard, on and after June 1, 1909, except 1¼-in. M. C. B. Standard hose and so branded, which hose has been manufactured previous to June 1, 1909. —Owners responsible.

"Except cars offered in interchange, where delivering company is responsible."—Delivering company responsible.

The recommendation in regard to change in Rule 33 is made on account of the fact that under the present rule old M. C. B. Standard 1¼-in. hose would not be permissible after June 1, 1909. This change is suggested to clear up a misunderstanding relative to this question.

*Report presented at the annual convention of the Master Car Builders' Association. Committee: Le Grand Parish (chairman), J. Milliken, R. W. Burnett, J. R. Onderdonk, J. A. Carney.



Air Brake Hose Coupling.

Topical Discussions at the M. C. B. Convention

The Application of Suitable Lugs to Steel and Steel Underframe Cars for Jacking Up of Car Bodies.

T. A. Paxton (E. P. & S. W.)—The application of jacking lugs to steel and steel underframe cars is a matter of detail looking toward the convenience of handling those classes of cars on the repair tracks only (wrecks excepted), as the lugs add nothing to the car's strength, symmetry or carrying capacity. While there are numbers of cars on which jacking lugs would not be necessary, as the jack placed under the side sills at the bolster has ample room to clear the journal boxes, steel underframe box, stock or other house cars; flat and gondola cars having the stake pockets placed on the outer faces of side sills; narrow bodied, all-steel gondolas and special service cars, however, are especially hard to handle on the repair tracks, when it is necesary to jack them up to remove the trucks for any purpose. The all-steel car is so nearly indestructible as a whole that we seem to have overlooked the fact that certain of its parts, such as wheels, axles, arch bars, journal boxes, center plates, etc., require quite as frequent repairs or renewals as the older forms of wood construction. Cars having fish-bellied side sills are especially difficult to jack up, if loaded, and with this class of car it is usual to do the jacking in two operations, the first with the jacks under the end sill.

In order to ascertain the practice in different parts of the country a circular of inquiry was addressed to a number of the roads operating steel and steel underframed cars. The following questions were asked, viz.:

(1) Are lugs for jacking up car bodies to facilitate the removal of the trucks standard to your steel and steel underframed cars?

(2) Do you consider these lugs necessary?

(3) Have you applied, or are you now applying, these lugs to old equipment, where such were not embodied in the original construction?

(4) Do you prefer lugs of malleable iron, cast steel or pressed steel?

(5) What is the average cost per car for applying these lugs (a) to new equipment; (b) to old equipment?

(6) Do you consider the expense of applying lugs to old equipment justified?

(7) What area of base do you consider necessary?

(8) Have you placed these lugs at any other points along the side sills than at the bolsters?

(9) Do you prefer a rectangular base on lug?

(10) Please furnish prints of your standard lugs.

The above inquiry was sent to but a few roads. The responses were prompt, though inconclusive, and show a lack of uniformity as regards the practice of applying jacking lugs.

From roads operating a hundred thousand steel cars the replies indicate that views are about equally divided as to whether these lugs are necessary. Where the lugs are standard they have usually been applied when cars were built, and but very little data can be obtained as to the cost of same, but it will probably amount to between $8 and $10 per car.

There is also great diversity of opinion regarding the proper area for the base of lug, same varying from 36 to 96 sq. in. The design of car would influence the area of lug somewhat.

An inspection of steel and steel underframe cars without jacking lugs will show that in many cases the lower flanges of the side sills are badly distorted, and this damage seems to be greater with the pressed than with the rolled sections. If the car is wide enough for the jack to clear the tracks, there are many cases where a reinforcing plate would be an advantage. On some roads it is the practice to combine the features of a jacking lug and roping iron in one casting, which may possibly be one of the best forms. It is understood this design is patented.

The practice of the car builders is not to provide jacking lugs unless specified by the purchaser, although the cost of applying them at time cars were built would add very little to the cost of the car. There are a number of special service cars (ore cars and the like) on which the journal box projects beyond the side sills.

Prints showing the relative positions of journal box and side sills, for a number of different classes of cars, are submitted as follows:

X-40	100,000	lbs. capacity	box car.........	Lugs are necessary
X-41	"	" "	ore car.........	" " "
X-42	"	" "	ore car.........	" " "
X-43	"	" "	gondola	No lugs required
X-44	"	" "	coke car........	" " "
X-45	80,000	" "	oil car.........	" " "
X-46	"	" "	gondola	" " "
X-47	60,000	" "	stock car.......	" " "
X-48	100,000	" "	flat car.........	Lugs are necessary
X-49	"	" "	flat car.........	Application of lug to X-48
X-50	"	" "	ore car.........	Lugs are necessary

These prints represent only a few of the many designs of car underframing, but they indicate in a measure what may be encountered almost daily on any railroad repair track. In many cases where no lugs are required, it would be advisable to provide some stiffening for the lower flanges of the side sills. It would appear that cast steel has the preference for material for the lugs, though for some designs of cars pressed steel would offer advantages. No design of lug could be made applicable to all classes of cars, yet there should be some limiting dimensions, and approved methods of attachment to bodies. The general practice of those companies using jacking lugs is to locate them at the bolsters.

For all future construction of steel or steel underframe cars it would seem desirable to require that jacking lugs be placed at the bolsters, or the idea of extending the lower member of the bolster to such a distance beyond the side sills as would provide a suitable resting place for the jack head might be usefully employed, so that the tracks may be removed without having to reset the jack; that the lugs may be of any suitable material, preferably of cast steel; that the dimensions of the base may be of any desired shape, but of an area not less than 50 sq. in.

Suitable Push-Pole Pockets.

A circular of inquiry was also sent to a number of railroads using steel and steel underframe cars, as follows:

(1) Do you apply push-pole pockets to steel and steel underframe cars to (a) old equipment, and (b) to new equipment?

(2) Do you have end sills damaged by poling, or by bumping cars into clear, by cornering with other cars, when push-pole pockets are not provided or are of improper design?

(3) Do you prefer pockets of malleable iron, cast steel, or pressed steel?

(4) Have you found the ordinary methods of diagonal bracing able to withstand the stresses set up by poling?

(5) Do you consider a push-pole pocket riveted to the end sill better than a depression made in the face of the end sill itself, and, if so, why?

(6) Is it your practice to plash push-pole pockets as close to the corners of the car as possible?

(7) Please furnish prints of your standard push-pole pockets.

The replies to the above questions indicate that it is the general practice to (1) apply pushpole pockets to steel and steel underframe cars; (2) there seems to be a general trouble of having end sills damaged even when push-pole pockets are provided, and still greater damage, when pockets are not provided; (3) the preference is for pockets made of malleable cast iron, though a number prefer pressed or cast steel; (4) the bracing has generally proven satisfactory; (5) the choice for pockets riveted to end sills (generally forming the connection between end and side sills) seems to be universal, the depression in end sills being of insufficient depth and strength; (6) it is also the prevailing custom to place pockets directly at the corners; (7) the general design of push-pole pocket has a more or less spherical depression, varying from 1¼ to 2 in. in depth, and from 4½ to 6½ in. diameter. This depression is made at various angles to the end and side sills. While most steel and steel underframe cars are equipped with push-pole pockets, there are a large number that have "push-plates" which are only a poor substitute, and while all cars should have them, it would seem desirable for all future construction to have a standard depth and diameter, whatever the method of attachment may be.

The above discussion was read by the secretary, Mr. Paxton being absent.

F. W. Brazier (N. Y. Central)—I hope some of the linesmen will feel free to get up here and give their opinions on this subject. I certainly have had my attention called a great many times to the advisability of providing some way to jack up these heavy capacity steel cars, especially of the pressed steel type.

J. F. De Voy (C., M. & St. P.)—It is altogether probable that a jacking iron or push-pole pocket is desirable. So far as I have been able to discover, it is almost an impossibility from a commercial standpoint to provide the proper strength in either that portion directly adjacent to the push-pole pocket or the jacking iron to justify the expense of the same. I refer particularly now to a steel underframe under a box car. If you apply a jacking iron at or near the bolster, as a general proposition the side sill, whatever form it may be, either in a channel, Z-bar or other construction, has to be reinforced if you are to obtain any results. I doubt, as I said, whether it is possible from a commercial standpoint to design a car with the underframe construction to withstand such appliances. It is no doubt true that they are desirable. In nine cases out of ten that I have observed the push-pole pocket, whether it is malleable iron or pressed into the steel-end sill, is not used. In a poling yard I have noticed that invariably the pole is put directly on the end corner of the car. In such cases, nine times out of ten, the construction is absolutely inadequate to meet the requirements or to meet the stress that is put on it. The whole question, in my mind, resolves itself into whether it will pay to provide additional so-called needle beams, gusset plates or other construction to withstand it. That seems to be the whole thing. There is no question but that it is desirable.

Wheel Defects. Is a Brake Burn Due to Prolonged Brake Application Properly an Owner's Defect? How is it to Be Distinguished from the Defect Known as Shelled Out?

H. D. Taylor (P. & R.)—I think we should begin the discussion by saying "is not the defect properly an owner's defect?" In the first place, all wheels are made to carry their load. Any wheel in legitimate service that cannot carry its load is defective. The defect known as shelled out is simply a foundryman's defect in the manufacture of the wheel. The defect known as slid flat is simply from the improper application of the brake, generally on grades. In between that we have what is known as a brake burn. The shelled out defect is very easily distinguished. The metal shells out and the appearance underneath is very much like an oyster shell. It will be high in the center and the metal perfectly clean and hard. You all know the appearance of a slid flat. It simply slides along and leaves flat spots with radiating cracks. Now, in the brake burning due to continuous application of the brake on down grades, we have neither of these conditions.

Tests have been made recently on one of the prominent eastern lines in which a 100,000-lb. car was loaded with 110,000 lbs. of scrap, making a total weight of 150,000 lbs. of load. The wheels put under this car were all of one manufacture, and all presumably as good as could be put into service for this test. The car was taken out and pulled down a mountain grade of about 4 per cent. for 12 miles, and the test was repeated four times. The wheels at the end of the test were still round and had no flat spots, but the surface was cracked from the application of the brakes, checks running out radiating in all directions, and in two places the plates were cracked. If under ordinary conditions these wheels continued in service, they would, if not immediately detected, in a short space of time begin to shell out, and then there would be a controversy as to who was responsible for the trouble. As a matter of fact, such wheels would run but a very short time before they would pound out in spots. The appearance of the wheel would not be like the ordinary shelled out wheel, and yet it would not have the appearance of an ordinary slid flat wheel. I would like to place the responsibility for such wheels on the manufacturer or the car owner.

In making these tests the brakes were set first by hand, with a lever about 4 ft. long, hard enough, so that they would just not slide, simply revolve. Afterward the air-brake was used, but in neither case was there a slid flat wheel. They were constantly watched. We are all having more or less trouble in our interchange in this subject, and particularly with the owners of private car lines. They are accusing us continually of charging them for wheels which have not owner's defects. We think that the brake burn is an owner's defect, inasmuch as the wheel should stand up in service.

The condition is more marked, of course, with some makes of cast iron wheels than others. The steel wheel will stand up in service and a high-grade cast iron wheel will stand up, but the ordinary run of wheels falls down very fast. Tests were made of special cast iron wheels, as compared with the ordinary wheel which we were buying. In a year and a half not a single one of the special cast iron wheels has been removed, but they are removing the ordinary wheels by wholesale all of the time in absolutely the same service. I have some photographs here showing the condition of these wheels after the tests had been made.

R. P. C. Sanderson (Virginian)—Mr. Taylor, as you have gone into this matter as thoroughly as this, I ask if you have done anything toward making a chemical analysis of the iron to enable us to tell whether certain combinations of iron are more or less subject to this cracking. You stated a while ago, which was entirely right, that certain makes of wheels would give long service and others would fall down very fast. In other words, the wheels that were made to sell—the ordinary run of wheels which we buy in the market—failed, while a wheel made in a painstaking manner, with good foundry practice, will stand. I would ask what constitutes good iron for a wheel in order to get the service which we desire? We have had a lot of discussion with the wheel manufacturers about tying them up with chemical specifications, the same as we do with regard to rails and billets, etc. Have you made any progress in this connection of making analyses of irons of which the wheels are manufactured, so as to be able to say what combination of materials will produce the best wheels?

Mr. Taylor—The tests have not yet been made. The tests have just been completed and there has been no time to make any analyses. The special wheels were made of Norway and Sweden and Salisbury iron, high-grade iron.

William McIntosh (C. of N. J.—I did not understand whether Mr. Taylor has continued the wheels in service after he had discovered that there was a bad surface produced by the breaking effects that he told us about. It would be, I think, very important if that had been done.

Mr. Taylor—They have been put in service and have been watched right along to see how long they will remain in service before selling out.

Mr. McIntosh—You have not discovered the shelling yet?

Mr. Taylor—The test was only started this past week.

W. E. Sharp (Armour Car Lines)—I understand Mr. Taylor to say that all of these wheels were selected for the test and it was discovered that the common gray iron wheel would fail rapidly, while the special wheel would stand the service. I ask if he has any information to give the members at this time as to what this special wheel is. Is it a wheel in general use and on the market, or was it a wheel specially made for the test?

Mr. Taylor—They were not made for the test at all. I spoke in a general way of special wheels in service for a year and a half not failing, not one failing out of several thousand. The wheels tested were simply A No. 1 selected wheels that are in ordinary use, a cast iron wheel, 700-lb. wheel, but they were selected as being good wheels and perfect in every way.

T. H. Curtis (L. & N.)—I would like to confirm what Mr. Taylor has said by relating a circumstance that came to my notice. A wreck was caused on a certain railway by the breaking of a wheel flange, about three-quarters of it being broken off. The matter was taken up in the presence of the wheel makers and they said that the flange of the wheel was made defective by brake burns. This wheel showed large discolored portions where cracks were. We then examined the quarter of the flange that still remained and it showed a few surface cracks. We examined the opposite wheel which was mounted on the same axle. This wheel surely made the same mileage and was operated under the same braking conditions. It was made by the same manufacturer and in the same month, and the flanges on both wheels were full, not worn to any extent. We broke the remaining quarter of the flange on the wheel that was said to have caused the wreck, and we found it to be discolored and having so-called brake burns. After breaking the other wheel on the opposite side of the axle in small places, we found there was not a defect and no brake burn in that wheel. Following up this line, we suggested that certain kinds of metal brake burn, while others do not. I have made several investigations of broken flanges, and three times I have found that the wheel on the opposite side did not have the so-called brake burns. This leads me to believe that the liability to brake burn is in the casting, or the material used, and that it can be eliminated if we know the proper kind of material to use in our wheels.

A. W. Gibbs (Penn.)—I would correct Mr. Taylor a trifle, as I was instrumental in having this test made. The results of the test show that nearly all of the wheels have cracked plates to a dangerous extent, so that the subsequent running tests have to be made on a special track, as it would be unsafe to continue the wheels and cars in regular service.

The whole thing about the matter is that we are being accused of bad faith in withdrawing wheels which, for want of some better term, are called shelled out. I do not understand that brake burn is a common car builder's defect, but all of us will sooner or later have these charges brought against us because we may do the original damage on our road. We are testing the wheels now to find out how soon after brake burn the pieces drop out of the wheels. You send a bill to the car owner for the replacing of the defective wheel and he will disclaim his responsibility for the damage. He will claim that they were either brake burned or brake slid, and hold that he is not responsible for the damage.

I think we should fix now the question whether it is an owner's defect or not. If it is incident to the wheel, so much the worse for the wheel, but it will stimulate the demand for something better.

William McIntosh—Were these wheels submitted to thermal treatment?

Mr. Taylor—Not at all.

A. E. Manchester (C., M. & St. P.)—I have often observed the condition already referred to, of one wheel showing the burn and the other wheel showing no indications of trouble. I think it is a corresponding condition to the one that we experienced where one wheel wears out much more rapidly than the other and runs toward the flange. I think the greatest problem we have before us today in getting the best mileage out of wheels is to know how to make wheels good, absolutely of the same hardness. They may have the same mixture and be molded by the same men, but if a slight difference in temperatures, or some of the other 97 defects that the manufacturer claims arise in the manufacture of a wheel, creeps in there, we get two wheels of unequal hardness mated together. I believe this question has much to do with that feature of one wheel showing up poorly and the other standing up well, under exactly the same conditions.

F. H. Stark (Pittsburg Coal Co.)—I agree with what Mr. Manchester has said, and I believe that Mr. Curtis' experience is an exception rather than the rule. While it is true that we get occasionally a case where a flange fails, where there is no perceptible flange wear, that is a rare case. If our chief joint inspectors here would get up and express themselves I believe they would confirm the fact that in 90 cases out of 100 flange failures occur where the flange shows wear. There are a number of elements that enter into the case. First, in the increased braking power at the present time and the increased car loads. We find that a large majority of the flange failures occur under 100,000-lbs. capacity cars, and then, too, largely in the hopper cars. We do not have very many failures under cars of 80,000 lbs. or less. You have the increased braking power, the increased load, which creates a greater pressure between the flange and the rail, which causes heat. You have, too, the effect of the rail joints. If you have a pressure against the flange constantly, and subject it to constant pounding of rail joints, it will cause separation of the metal. While you may have a case where one wheel fails with a full bearing, such occurrences are rare. The question of side bearings enters into it also. If the car truck does not ride properly you have increased pressure against the rail. I know of wheels made by the same manufacturer and placed under cars with metal truck bolsters and the flange failures were but very few.

Mr. Schroyer—This is not a question of flange failure, but a question of brake burning.

Mr. Stark—Flange failure is caused by these brake burns, and causes the seam next to the throat of the flange. The average shelled out wheel is from a different cause.

The Secretary—Mr. Gibbs submits this sample and asks whether this is a brake burn or an owner's defect. (A number of samples of a broken wheel were then exhibited to the members for their inspection.)

D. F. Crawford (Penn.)—I would move that we refer this question to the arbitration committee to be considered at its meeting this afternoon, and to have a recommendation made to the association when the committee makes its regular report tomorrow morning.

Motion carried.

The President—Mr. Gibbs would like an informal vote on the question whether these are brake burns or not. I will put the motion in this way: Is that a brake burn (pointing to the piece of broken car wheel)?

E. T. Millar (B. & M.)—I looked at the piece of cast iron and I looked at the depth of the chill. In my opinion it has a good deal to do with the condition of the wheel as to the state of the iron when it is poured; that is, whether the iron was slack or not. In my opinion the iron was slack when that wheel was manufactured. It was on account of the slackness of the iron at the time the metal was poured that the burn occurred.

F. W. Brazier (N. Y. C.)—I was brought up to believe that brake burns were owner's defects. We have had considerable trouble in settling with wheel manufacturers on our guarantees on account of the difference of opinion as to whether a wheel shelled out was caused by poor material or caused by a brake burn. I am of the opinion that wheels should be made of good material in order to withstand the so-called brake burn. The manufacturers should make the wheels sufficiently good.

Mr. Manchester—We will have to vote, I believe, that it is a brake burn, but I do not believe that should influence the question as to whether it is a manufacturer's defect or not.

The President—Not at all.

Mr. Manchester—If it was made of the proper material it perhaps would not have burned.

E. W. Pratt (C. & N. W.)—I do not believe there will be anything gained by taking a vote on this subject, and I move that the motion be laid on the table.

Motion carried.

Mr. Gibbs—May I ask that the arbitration committee make a ruling as to what is considered a brake burn? It is not a master car builders' term. It is a common term we all use, but I do not think there is any special authority for it. I think the committee should describe in some way what this thing is, and then state whether it is an owner's defect or not.

The President—That matter has been referred to the arbitration committee and it will bring in its recommendation in connection with it tomorrow.

Abuse of the M. C. B. Repair Card.

W. H. Lewis (N. A. W.)—The repair card unfortunately makes possible the misuse which there can be no doubt is often indulged in. Prominent railways quite frequently render bills for defects which seem unreasonable on their face. It seems very evident that unfair advantage is often taken in the preparation of bills, and always in favor of the road presenting them. It is quite impossible to comprehend the extent of this practice as well as the volume of the bills often rendered for a particular line of work, which apparently has been picked out as a specialty. They come from roads least suspected. Some of the bills seem so inconsistent and so unreasonable that one would hesitate to mention it to the higher officials.

Persistent and honest efforts have been made, but in vain. The only way it can be corrected and made fair to all concerned is by the abolition of the owner's defects, at least to the extent of reverting to the practice which was in vogue prior to 1893. The question might introduce some phases of the private line exchange, but that side of the question will have to be worked out so that it will be fair and equitable to all concerned, and it may possibly mean a revision of the rule permitting private lines to be handled on a somewhat different basis. One of the technical magazines, recently in commenting upon the frequent misuse of the defect card, concluded by suggesting that a committee compored of representatives from different roads be appointed to visit yards throughout the country and check their methods and practices, but this we hardly think would produce the desired results for the reason that they would soon be known and the knowledge of their presence would be sufficient to defeat the object.

To better illustrate, I have taken the opportunity to pick out a few such bills as representative of those that have attracted attention. Of these items, all were taken from current bills without making any attempt to compile special data, but to gather up some of those in the course of preparation for voucher.

One road renders three bills covering three different months. These bills happened to reach the desk at the same time, due to various questions having come up for adjustment.

Bill No. 1 amounted to $281.43. In this bill is found 22 charges for air brakes cleaned at one station.

Bill No. 2 amounted to $233.66. This bill contained 19 charges for cylinder and triple valves cleaned at one station.

Bill No. 3 amounted to $224.08. This bill contained 46 charge for cylinder and triple valves cleaned at one station.

Another road presents a bill for $6,186.40. This bill contained charges for 490 air hose applied. All this work, as alleged, was performed at one station in approximately one and one-half months' time. This, indeed, raises some question, as the number of hose reported as having been applied represented a very large percentage of the total number that were applied on the system, still the road making the bill handles only a small proportion of the equipment in interchange.

Another road presents a bill amounting to $368. In charges made against 98 cars find 11 couplers, 29 knuckles, 23 knuckle pins, 15 knuckle locks renewed on account of being found broken.

Another road presents a bill amounting to $409.65. This bill enumerates 60 cars, of which 48 received 119 brake shoes. All of those brake shoes were applied in a little less than 30 days.

Another road presents a bill amounting to $72.62. This bill enumerates 60 cars, of which 40 are charged with a total of 5 couplers, 4 knuckles, 3 knuckle locks, 29 lock pins and 22 knuckle pins, all applied at one station. The bill covers a period of approximately 1½ months.

Another road presents a bill amounting to $878.25. In this bill is found 35 cars receiving repairs of a period of one month. Of these cars 25 received 32 brasses at one shop.

Another road presents a bill amounting to $2,728.40. This bill contains charges for 257 air hose, alleged to have been applied on account of old ones being torn and burst; 981 brake shoes being replaced on account of old ones being worn out. These two items alone amounted to $702.70, or over 25 per cent. of the entire bill.

Another road presents a bill amounting to $645.87. In this bill 139 cars were repaired at one station in a period of one month. The charges included 70 brake shoes being applied on 63 cars on account of old ones being worn out, 28 pairs of wheels applied to 26 cars. At another shop 86 cars were repaired, of which 10 received 10 pairs of wheels. In the same bill charges were made for 45 brasses applied on account of old ones being worn out. It will be noted that this one road alone in 30 days made 38 charges for 38 pairs of wheels, and it is work done at two of their shops, still this road handles but a small proportion of the equipment.

Another road presents a bill amounting to $86.09. This bill, while covering a period of but one month, shows 112 different cars repaired. To 86 of them are charged 72 brake shoes, 24 knuckle pins, on account of old ones being broken; 24 of the 72 shoes were applied at one shop. This road handles a very small proportion of the equipment, and is many miles distant, but at the same time the shop applying the 24 shoes must be very small, as renewing of brake shoes not only seems to be its specialty, but the extent of their work.

In a bill from another road several items were selected of more or less interest. One repair card shows the application of one air hose to A end of car, and two days later another air hose is applied to the same end of same car.

Another repair card shows the application of two new brake shoes at A and B end of a certain car; on the same date, two more brake shoes were applied at the same ends of the same car and by the same inspector.

Another card shows the application of two new standard air hose to a certain car and four days later another card is applied to same car for another air hose, which shows that one of the new standard air hose lasted but four days, which was not long enough to get the car off of their tracks.

Another card was applied for a new air hose to a certain car at A end. On the same day another hose was applied to the same end of the same car and by the same inspector. Here is a case where two new hose were applied to the same end of the same car on the same day and by the same inspector.

Another card shows the application of a new air hose to A end of a certain car and on the following day another air hose was applied to the same end of the same car. Here is another case where the air hose lasted less than a day and not long enough to get the car out of the yard and perhaps not off of the repair tracks.

Another road presents a bill for $408.42 and as curious as it may seem, as the shop where the repairs were alleged to have been made is over 1,000 miles distant, $158.89 of the bill is charged for coupler repairs affecting 158 cars. The average cost of repairs on this bill amounted to $2.58½ per car.

From another road two repair cards were picked up showing repairs to two cars. On the first car a new steel Climax coupler was mentioned as being applied at A end, but when card was received home it carried a Melrose at that end, which was standard to the car, and no evidence of the coupler having been removed. The other card, which was for the second car, showed one air hose applied at B end, but when the car was received it was found that evidently repairs had not been made, as the air hose at that end bore the stencil of another road, the date on the label showing that application had been made about two months prior to date of repair card in question.

There is no doubt but that a number of inspectors, perhaps not with the knowledge of the management, have been marking triple valves as cleaned without doing any other work to the valves whatever. To better illustrate: Three cars were found on June 4, the cylinders and triple valves of which bore stencil marks indicating that they had been cleaned June, 1909, which meant that if the work had been done it had been taken care of during the previous three days. But these particular cars were discovered passing through a certain yard about 200 miles from the interchange point, hence it is reasonable to suppose if the work, if done at all, must have been taken care of on the 1st or the 2nd of the month. The dates attracting attention, an examination was made developing the fact that not one of the valves had been touched, nor even had the nuts and gaskets been disturbed. As but three days had elapsed since the work could possibly have been done, according to the dates, there is no room for doubt but that the stenciling constituted all the work the triples received. Unfortunately this is not particularly unusual and represents what is often found to be the case.

Another case was found where a certain car arrived at a certain station with three flat wheels, measuring approximately 4 in. As the marks on the cylinders indicated that it had been cleaned that month, and it was then only the 9th day, directions were given for an examination of the cylinder and triple, which developed the fact that the cylinder and triple were very dirty. the conditions clearly indicating that they were as they would be expected to be had they run 10 or 12 months.

It is not at all unusual to find many different names of inspectors on repair cards at one station, which rather indicates that each inspector is supplied with a book and the application of cards is being carried on very extensively; in fact, it is an open secret, as has been reported by roaming repair men, letters of commendation have been issued at the end of the month for the greatest number of repair cards issued, which, if true, is not surprising or is the inspector largely responsible for a productive of the large volume of repair cards issued.

Another case of recent date is a certain car bearing a repair card from a certain road indicating that two 1½-in. truck-raising boards had been applied, one to each truck. The car was examined a few days later, as was shown by the repair card developing the fact that at A end there was a 1¼-in. raising piece on bolster, but it was very old and discolored to exactly the same color of the bolster itself, leaving the impression that it was perhaps applied at the date of application of bolster. The truck at B end had no raising board at all and the indications show that it never had one.

It is not at all unusual to find repair cards covering column and box nuts applied where the indications show no evidence of any disturbance of the bolt or any work having been done. The alleged application of box and column bolt nuts seems to be very general. These with other small jobs seem to have been done in the greatest quantity, but as it is so often very evident that the work is not done we cannot help believing that it is a sharp practice, and then if the work is done it is largely to make the shop forces self-sustaining.

Reading over another repair card from a certain road it appears that on May 5, 1909, the following repairs were made to a certain car:

1 S H 5x5 steel Tower coupler, complete........A end.
1 S H 5x5 Munton coupler, complete ....B end.
4 pocket rivets ....B end.

Reason for repairs—2 5x5 Major coupler bodies broken.

To find a coupler at one end of the car broken is not unusual; in fact, not questionable, but to find a card reporting two couplers broken, and they have failed in the body, it is quite uncommon for the particular coupler mentioned. It is rather difficult to understand how it could occur under fair usage; in fact, it is the rarest thing to find such conditions even as a result of a wreck. Still the report is made in this shape and certified to by the inspector.

Eugene Chamberlain (N. Y. C.)—We all have some troubles that are not purely imaginary, and a great many of these troubles are derived from rule 76. It will in no wise do to return to the period which existed before 1893 and say that ropes and wheels shall be owner's defects, and that sort of thing, for the reason that you would retard the movement of freight in this country to a degree that would simply be a distortion of the traffic. To charge dishonesty, without absolute proof, one would have no standing in any court and would be immediately ejected.

For high average of intelligence, integrity and honesty the railway men as a body have no peers. You all appreciate in the use of this repair card the difficulties when a train of 55 cars come along and a German inspector equipped with rubber boots and woolen mittens makes out these cards and attaches them to the cars with his thumb. As a matter of fact, it is not generally done, but you are pretty sure to receive the stub and a bill accompanying it, which you pay, to save trouble in tracing up. It is going to be necessary, gentlemen, that everyone shall employ a sufficient number of men, clerical help, to absolutely comply with this rule.

This rule can be made absolutely efficient by a proper compliance with the rule. We must, gentlemen, as men of honor, protect the intermediate road, the road which did not make these wrong repairs. It is your duty and my duty to protect that road, and that must be done by indicating the road which actually made the repairs, and that may be done by this card if properly used. It is impossible for the Erie or the Lackawanna to go on to the B. & O. and discipline their men; it would not be thought of for a moment. But the B. & O. officials can discipline their own men. They can say to their men: You have no material interest in enlarging the bills of this company against any other company. We desire you to be absolutely honest, and unless you are honest we shall not require your services. Further than that, gentlemen, there should be no attempt to equalize your account against the other road. Some of us, unfortunately, own more ancient equipment than others. It must occur to you, that being the case, that the equipment which is of the greater age is going to require more attention and greater cost for maintenance. This whole proposition seems to be up to you. You are a fair, honest, competent body of men and it only requires that all in authority should be absolutely fair in order to have this matter handled to the satisfaction of all.

F. F. Gaines (Cent. of Ga.)—I would like to ask one question. What are we to do when we have the absolute proof that work has not been done and we have been billed for it? As I understand it, the arbitration committee will not handle a case of that kind. I had personal experience less than a year ago, where a road billed us for applying 15 5x7 couplers. We thought it curious that so large a number of couplers were applied in one place and we got the cars home and we found that the couplers had not been changed, and yet we cannot take that case to the arbitration committee or refuse to pay that bill. There should be some way, when we find positively that the work has not been done, and can prove it, by which we can legitimately avoid the payment of the bill rendered.

F. W. Brazier (N. Y. Cent.)—The policy of the members of this association in this matter should be absolute honesty. As a general thing what we should all practice and what should be in our rules is the Golden Rule. If we cannot trust each other, if you will not take my word and I will not take yours, the M. C. B. Association rules might as well be thrown into the waste basket. I regret to say that on the road I represent we make mistakes, but if I have a man that makes a false charge and I know it, he will not be in the service 24 hours. I have a special man who goes all over our system, whose duty it is to see that the New York Central gets every cent that belongs to it, but not one cent dishonestly. Neither do we make a bill for work not done, nor on defect cards where we do not do the work. We tear them up or return them to the owners. We are holding in Springfield, Mass., today a private line car that they will not take my word for, that they will not take Mr. Smith's word for. They tell me that car was put through their shops in December. overhauled. The car man who says they put that car through his shop and overhauled it is not telling the truth. There was scarcely anything done to it, beyond giving it a coat of paint. I have personally inspected the car. There ought to be some way by which these dishonest practices could be shown up. Now I say that we have letters come to us—I am glad to say that we do not have many—sometimes questioning our charges. We look into it. We make mistakes. Our inspectors should be commended for the manner in which they have to get out in storms and serious weather to make their records, and they make mistakes in numbers. That is all right. But they should not make mistakes in saying they put on a brake shoe unless they have done it, and we as the heads of departments should look into it. We of the New York Central Lines would thank anyone if he could find a case in which we have billed for a thing that we did not do. It looks to me like a simple thing to do. If we would all say that we would discharge a man that is known to do it, it would be a good thing. I do not believe in swelling up my showing on charges for foreign repairs, but if I do the work and do it honestly, I ought to have the credit. I have been reading with a great deal of interest Mr. Hennessey's remarks before the Western Railway Club. It seems to have become necessary for us to have to talk a lot about the application of repair cards. I take the word of Mr. Gibbs or anyone that writes to me on the conditions of our cars. I never question. Sometimes we write back and ask if they have not been in a wreck. Chief clerks, inspectors and others sometimes handle the correspondence and get a little over-zealous, but when it comes to the heads of departments we ought to frown upon anything that looks like dishonesty.

Mr. Garstang—I am in full sympathy with what has been said. I am connected with a railroad where the foreign mileage is greater than the mileage of its own cars on the road, and there is a splendid opportunity for making bills and charges. I want to say for the information of the gentlemen here that the bills against the road that I am connected with for the year 1908 were more than $140,000 greater than ours against foreign lines, notwithstanding that the foreign mileage was greater on our road than our own.

Mr. Hennessey—The question to be considered seriously is, are we going back to inspection for protection, or are we going to inspect for safety? If we go back to inspection for protection then this association has practically come to an end. If we take the position for one minute—and I am free to say I do not take that position and do not believe in it—I believe the heads of every car department in America today are honest. Without honesty this association is a mere farce, there is nothing left of it so far as the interchange rules are concerned. But I am sorry to say that there are in my opinion a great many subordinates who are dishonest. They are small men and they think they are building up a reputation for themselves by pretending to do work that they have not done. Now, I could enumerate case after case, but that is not the question. The question to be discussed is the question of the remedy. We must remedy it. It is absolutely necessary. The railroads that send us here are going to demand it. Now, if we go back to inspection for protection we tie up traffic. I believe sincerely that if every superintendent of motive power and head of car department would send out a circular letter, and say to every inspector, "If we find you making repairs without putting on repair cards you will be dismissed from the service"—when I say that I do not mean impossibilities, we are not talking about the brake shoe key nor a brake shoe, nor an air hose that has to be put in in the yard—I do not think there is a gentleman in this hall that has ever protested a brake shoe or a key or a hose—I am talking about the repairs that have been pretty extensively done on the repair tracks, and when a car is on the repair track there is no excuse, no honest excuse, for not applying the repair card. There is another question of importance. They make wrong repairs. Now, that shows that it is more indifference than anything else, that the foreman or the clerk is simply shifting responsibility. If I make wrong repairs to your car a bill can be put on a defect card and a counter bill rendered by making it right, when you do the work. I believe there should be a resolution and that every man should get down to business and insist upon honesty on his particular line, and if that is done I do not think we will have to bring this question up in this convention again. We did it in 1896, 1897 and 1898 right along. I want to know why we can't do it now. It is simply because things are running smoothly, nobody calls particular attention to it, it is left to this clerk and that clerk, to some inspector or foreman, who is making a little capital for himself. But we have got to return, gentlemen, to the principle of honesty. If we do not, this association is a farce.

E. A. Miller (N. Y., C. & St. L.)—I agree with Mr. Hennessey that it is incumbent on every railway official connected with the work of repairs of cars to impose it on the men making those repairs that honesty is necessary. But the fact is that we have that letter which has just been written, before this convention, and which shows conclusively that there is dishonesty. I can say to you, gentlemen, that I can duplicate that letter and give you facts that are worse than those represented here. There was laughter over the house when that letter was read, but it is a serious matter. It is a matter of dishonesty. As I said, that letter is only a duplication of a letter that went from my office to our auditor some months ago. I am not surprised that there are mistakes and errors in the vast amount of billing that is done. It has to be expected, but there is a vast difference between mistakes and errors and dishonesty. When we see our bills climbing up in about three months from $250 or $300 to $1,000, we naturally begin to think there is something wrong. When we trace the matter up we find cases similar to and worse than those given in that letter, where cars have had some repairs made two or three times over the same road. We get bills for cars that have been out of the builders' shops less than six months, for air brake hose and wheels and all sorts of such dishonest usage. I am glad to say that those are rare cases. I am glad to say that I believe nine out of ten, or 99 out of 100, of the railroad men of this country are honest, but I want to say that the one-hundredth man needs to be made honest, and it is our place to make him so. We know the roads that are sending in bills that are not right, and it is our place to make them right. We should be able to do it. I do not know that I should continue this discussion. I do know that we have had the same experience and worse than the letter that has been read here recites, and I know that when we look it up to see what the repairs of cars were costing on that road, we found that that man was keeping up his car equipment at about 50 per cent. of what the average cost was over the country. His annual report showed that he was keeping up his car repairs at a very much less cost than any other road that we looked up was doing. Now it looks as though in those cases the zeal of the men making the bills was encouraged by heads of departments.

H. Bartlett (B. & M.)—Mr. Lewis' statement shows a very serious state of affairs and I am rather sorry that such is the fact, but in my opinion one remedy is that we do justice to the road that has made the repairs, or that has made the charges, and notify it of the fact, giving it a chance to remedy the wrong. If we do not do that I do not think we are doing justice to the road that made the bills. If Mr. Brazier or Mr. Hennessey have made bills against the Boston & Maine which are found to be incorrect, I think it is my duty to inform them and give them a chance to apply the remedy, when I am informed of the facts.

R. P. C. Sanderson (Virginian)—With reference to this matter there is a side of it I want to touch on a little bit. To illustrate the point, some years ago it was found in the office of the railroad that I was working for then, that we had a large number of cars passing a certain point on a connecting line that had, I think it was, two brake shoes and two brasses applied. There were never more nor never less, as I remember it. It was checked up with the car record office and it was found that every car that passed that point appeared on the bill. I didn't know exactly what to do, but I went to the interchange points and stayed there long enough to have a very considerable number of cars jacked up and personally examined the brasses with the marks on them, for their newness or second hand condition of the brake shoes, and to see whether they were new and where they came from. I took that record, waited till the bills came in, and found the same thing again. I then arranged to have the bills sent back to the office of the mechanical head of the railroad and got a reply in due time from the master car builder of the road, with an endorsement on it that the bills were correct, that the work had been done, and it was sent back to me over the signature of the superintendent of motive power signed by his chief clerk. I did not believe the gentleman had anything to do with it or would have countenanced it for one moment. I carried the papers down to his office. He was out of town. He came in the next day and he was very glad to see me, we sat down in his private office, talked for a few minutes about the weather, then I laid this batch of papers before him and told him I presented them to him without criticism for such action as he saw fit to take. He read them part way through and he was very much ashamed—very much ashamed. He called in his chief clerk and said to him: "Did you look at that correspondence?" He said, "Yes, I looked at it." "Did you look at it closely?" "Well, I saw that the master car builder had said that it was all right and I signed your name to it and sent it back." That was all that was necessary. There is where the whole thing lies. The man that is responsible for the action of his subordinates in too many cases does not see this correspondence. It is handled by chief clerks over his name. He is busy, he gets in the routine habit of signing his name right along, it goes backward and forward, and then these practices creep in. How many of the men here today who are the real car builders, the really responsible men, actually closely review the bills to look for these things? Very few. It is handled by clerks and becomes perfunctory. If we were able to handle it ourselves, personally, if we could afford or were allowed to employ men, practical car builders and practical inspectors who understood the honest purpose of this association to review those bills with the same criticisms with which they review the bills to come to them before sending them out, I do not believe there would be very much cause for complaint.

Mr. Hennessey—I want to make just one remark to the gentleman who said that the arbitration committee refused to arbitrate cases. The arbitration committee is a committee to define the rules, not to decide on the veracity of two conflicting men. Consequently it is one of the cases where, when a dispute comes up and the man shows positive evidence that he did a certain piece of work, it doesn't make any difference what our opinions are in the matter, here is positive evidence before that committee that the work was done. The other fellow comes along and says that the car came back in two or three or four months, that he knows there was a standard knuckle, etc., but here was positive evidence by the gentleman that did the work. Now what can the court do? It cannot go by what it thinks. It simply can define the law, and that is as far as the arbitration committee can go on the case.

Mr. Parish—In order to put this matter in such shape that we can do something with it, I would offer a resolution that all of the members of this association who have any evidence of dishonesty in the use of the repair card submit such evidence to the executive committee, who will undertake to investigate the whole matter thoroughly and handle it in such manner as seems best to the interests of this organization.

Mr. Stark—I will second the remarks of Mr. Hennessey, that it would be impossible to go back to the old system of protection, but on the other hand I am sure that some means has got to be taken to protect the integrity of this association. While I am representing private car interests I want to say that I represent more railroad cars than I do private cars. Repairs by foreign lines have gradually increased from year to year, brought about, I believe, to a considerable extent by the piece work system, especially during the hard times. The foreman and inspectors will not scrutinize repairs made on foreign cars as they would on their own. I can present facts that are pretty closely parallel to those in the letter that has been mentioned, but I am not disposed to bring them out. But I think the time will come when we will have to have inspectors employed by the executive committee or the American Railway Association, whose business it will be to go about the country and investigate all the repair points, not only as to the observance of the repair card, but the instructions to the repair men. I had a bill recently where there were eight pairs of wheels charged to our company with all the flanges sharp, both wheels on the same axle sharp, eight pairs, and the wheels were all cast nearly on the same date, showing that they were originally mounted together. Now that is an evidence of ignorance on the part of the inspector or the billing clerk.

The P. & L. E. during the same time removed 36 pairs of wheels and there was only one sharp wheel on the axle, and that company gave us credit for 36 good wheels. We all know that a man does not find two sharp wheels on the same axle more than once in a lifetime. I cannot say how many pairs of wheels are charged up on account of chipped flanges, or that the inspector failed to put on lugs, whether inside or outside, or that the repair man applied second hand wheels, which was evidence that he did not inspect the wheels, but the billing clerk in the absence of that information, billed up for the wheels and they advised us that they had a record as to the location of the flange.

I made one suggestion yesterday, or repeated what has been asked by the railway clubs, for the further identification of parts, and we received as much support as any other subject that was brought before the arbitration committee, and yet they turned it down. Now, that would be a step in the right direction, and I believe, gentlemen, the time will come when you will find it necessary to have inspectors. You cannot depend on our men, the representatives of these large systems coming here, and discussing matters, but it is the fellows like myself, who represent the small interests, that find out what there is in the charges, and pick it out personally. I do not mean to reflect on the men holding the larger positions, but their responsibilities are such that they cannot give those details personal attention. I heartily agree with the motion that is made, that everybody present to the executive committee his grievances and then they can read between the lines and apply the remedy.

Mr. Parish—I just want to say one word more in connection with that. It should be distinctly understood that no case should be presented to this committee until it has been sent to the head of the department that is questioned. Now, our executive committee cannot attempt for one minute to handle any case on the simple statement that somebody has done something wrong, until it has been presented to the head of that department, and in that way we will get both sides of the case.

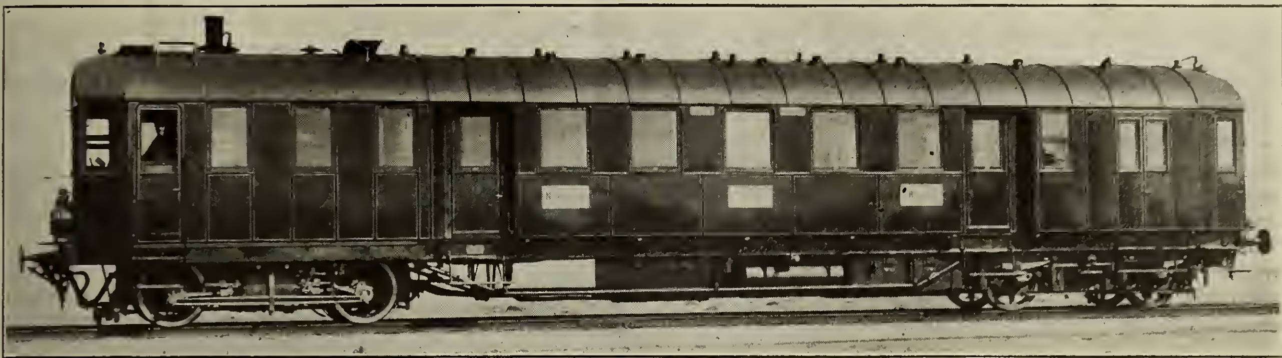
The president put the question on Mr. Parish's motion and it was carried.

The Clermont, a replica of Robert Fulton's famous steamboat, which will play an important part in the Hudson-Fulton celebration this autumn, is being built at the yards of the Staten Island Shipbuilding Co., New York City. The bottom of the boat is flat for its entire length, the sides are almost perfectly perpendicular, and the bows are wedge-shaped. Despite her strange appearance those in charge of the work declare that she is remarkably seaworthy. Most of the parts of the reproduction of the engine have been made and are ready for installation. The old-fashioned boiler is finished, and but for the installation of certain safety devices, now required by law, but unknown in Fulton's time, the Clermont will be seen as on August 17, 1809, when she made her first trip.

New German Steam Motor Car

A motor car of German construction and of very interesting design has recently been placed in service on the Royal Bavarian States Ry. The illustrations very clearly show the construction of both car and steam engine equipment, the latter being mounted on the forward truck.

The boiler is built to carry a pressure of 225 lbs. per sq. in. and has a heating surface of 442 sq. ft. It is provided with a superheater of 75.5 sq. ft. and the area of the grate surface is 9.5 sq. ft. The wheel base of the forward or driving truck which carries the engine and boiler is 9 ft., and the weight of this machinery ready for service is 18.2 tons.



New German Motor Car.

An interesting feature is the connection of the pistons, through rods to both sets of driving wheels, the piston rods being extended through both the cylinder heads to crossheads running in ordinary guides at each end. The cylinders are 8 ins. in diameter by 10.4 in. stroke and the driving wheels are 40 ins. in diameter.

The total length of the car over the buffers is 65 ft. 7 ins., the total wheel base is 51 ft. 6 ins., and the total weight of the car supplied with coal and water is 53 tons.

The car has a baggage compartment of good size and a passenger seating capacity of 55. It will operate successfully with trailers up to 40 tons and has been giving good satisfaction in service.

New Binding Agent for Coal Briquets

Mr. Geo. E. Eager, U. S. Consul at Barmen, Germany, writes on the subject of coal briquetting as follows:

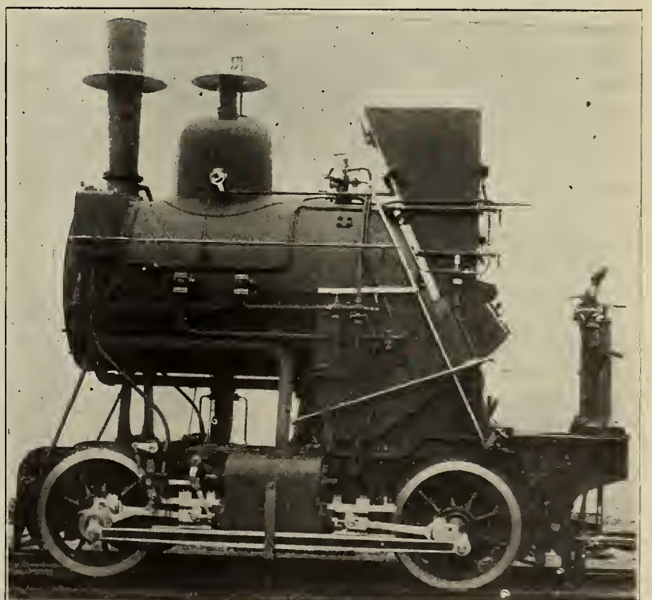
Only fifty years ago the dust of coal was considered to be entirely useless, but since then a great change has taken place and at present in Rhenish Westphalia the Ruhr coal district alone produces 3,000,000 tons of briquets each year. The same increase is shown in the other European coal districts, i. e., Silesia, Belgium, England, etc.

Up to the present, coal-tar pitch has been used for making coal briquets, and its production in the past ten years has increased about 100 per cent. Most of the coal-tar pitch is produced in England and Germany, the latter country only being able to produce for its own consumption, while England supplies the remaining consumers, i. e., America, Russia and Belgium. As stated, the coal-tar pitch production is limited, and consequently in the United States and Russia only comparatively few briquet manufactories are to be found.

The coal-tar pitch is an excellent binding agent for baking and coking coal, especially bituminous; it burns easily and gives the briquets hardness for long-distance transport, but various qualities of good briquet material cannot be bound with it, thus making its common availability impossible. Its numerous disadvantages are as follows: It produces very much smoke and has a very disagreeable odor; it cannot stand high temperature, and becomes soft and difficult to use in hot or extreme weather; the dust and fumes of coal tar, being corrosive, are very injurious to the skin, eyes and lungs of the workmen employed, causing diseases of those organs. The low temperature at which it ignites, although an advantage when used with soft bituminous coal, becomes a great disadvantage when the attempt is made to use materials that burn less easily. The coal tar becomes soft and burns much more rapidly than the coal flowing out of the briquet, leaving the coal to fall to pieces in dust and remaining unconsumed.

For this reason it has been impossible to briquet anthracite, semi-anthracite, or coke gravel with coal-tar pitch, it being unable to resist the heat and pressure of the blast furnaces; therefore a binding agent which overcomes all of the difficulties mentioned ought to have the most brilliant prospects for the future.

This long-sought-for binding agent has been found in the "sulphite pitch." The material is obtained in the process of manufacturing sulphite cellulose. The wood is put through a washing process in lye by which the fiber is cleared of all resinous ingredients, it being pressed out from the wood pulp. Thus far this material has been entirely useless. Through a cooking process it is reduced to a highly glutinous substance called "sulphite pitch."



Power Plant of Motor Car.

The sulphite pitch possesses many qualities which show its excellent advantages as a binding agent. It is intensely glutinous and possesses a high binding power. In the ordinary briquet of bituminous coal from 7 to 10 per cent of coal tar is used to give it the proper hardness, and with the use of sulphite pitch the same results can be obtained by the use of 5 per cent. There are qualities of coal and ore that can easily be made into briquets with from 2 to 3 per cent of the sulphite pitch.

Sulphite pitch burns without smoke or odor and is an ideal fuel for the household as well as for industrial purposes. In cities where the smoke nuisance has heretofore prevailed the use of briquets made with this sulphite pitch will form a solution of the smoke question. Trials have already been made with coke briquets made with this new process in blast furnaces and on torpedo boats, with the most sanguine results. The former tests not only showed a saving of 30 per cent coal, but the iron showed almost an entire freedom from sulphur. In its trial on the torpedo boats it not only proved a perfect fuel, but the entire absence of smoke proved its advantage over other fuels in time of war. Ocean liners, warships, railway engines and factories could all use this fuel to advantage and not only economize in the amount of fuel necessary, but would relieve the cities from smoke nuisance.

Sulphite pitch does not soften under heat and burns at a high temperature. It can be ground to any consistency or can be produced directly in any form of powder; it can be had in every country where there are cellulose mills, and it is very cheap, unlike the coal-tar pitch, which is rare and expensive Many attempts have been made to briquet anthracite, lignite, coke gravel, or dross, even with a very high per cent of coal tar, but without success. These disadvantages all disappear with the use of the sulphite pitch. Anthracite briquets for household use (egg form for American stoves) manufactured with sulphite pitch burn smokelessly and without scent; therefore, they are not only an excellent substitute for the anthracite nuts, but are even superior to them.

Recent trials to briquet coke gravel and dross (the remainder of coke—hitherto useless) with tar pitch have proved failures, but the situation changed immediately as soon as sulphite pitch was used as the binding agent, and the results show a briquet that can be considered a perfect substitute for coke. Practical trials of these briquets in both blast and cupola furnaces have shown that the briquets do not fall to pieces even under the highest temperatures, but burn while gradually shrinking. On account of their consistence they enter deeply into the melting zone of the furnace, thereby naturally contributing materially to the melting effect. Fine ore, bog iron ore, brown ore, manganese ore, oxide, furnace cadmia (iron dust from blast furnaces), and other ores can all be made into briquets by the use of sulphite pitch and successfully melted in the furnace. All trials of these materials with coal-tar pitch have failed, because the binding agent burned away at a lower temperature, leaving the material in dust as before. With sulphite pitch it is possible to briquet furnace cadmia so that it can be melted in a blast furnace. This alone means a great saving to the iron industry.

In general, sulphite pitch consists of the following substances: Coke, 25 to 35 per cent.; volatile matter, 50 to 60 per cent.; ashes, 8 to 12 per cent.; water, 10 to 15 per cent.

The latest chemical tests have proved that the percentage of ashes can be materially reduced. Through the origin of sulphite pitch its ashes contain sulphur up to 20 per cent, or 2.5 per cent of the sulphite pitch. The sulphur, however, is tied up to iron and lime, which latter substances are always present in abundance, so that the sulphur remains in the ashes and cannot do any damage. It is true that sulphite pitch can be dissolved in water, and that briquets made from it are not waterproof; but this is of no great importance, as in most cases a waterproof briquet is not needed. The sulphite-pitch briquet is, however, more waterproof than the lignite briquet, the making of which has become a flourishing industry. The sulphite briquet is not hygroscopic, and can be made absolutely waterproof, if necessary, by a simple special treatment.

It is not thought that sulphite pitch will in any way interfere with the coal-tar pitch in its use for soft bituminous coals, but the superiority of sulphite as a binding agent for the harder coals and cokes, also iron dust and other ores, opens up a new and very important industry.

Car and Locomotive Painters' Convention

The fortieth annual convention of the Master Car and Locomotive Painters' Association will be held at Niagara Falls, N. Y., September 14, 15, 16 and 17, 1909. Arrangements have been made for headquarters at the Cataract House. The list of subjects is as follows:

Subject No. 1.

"What is the best method of painting new steel passenger cars; also maintaining of same?"—H. C. Lafferty, Standard Steel Co., New Castle, Pa.; Wm. A. Breithaupt, Pullman Co., Chicago, Ill.; C. C. Abel, Am. Car & Foundry Co., Berwick, Pa.

Report of Committee on Tests.

By W. O. Quest, P. & L. E. Ry., Chairman.

Paper.

"Excluding and Rust Inhibiting Properties of Paint Pigments for the Protection of Steel and Iron"—By Henry A. Gardner, Chief Chemist Scientific Section Paint Manufacturers' Association of the United States.

Query No. 1.

"Can Decalcomanic Transfers be used to advantage for lettering the exterior of passenger train cars?"—Discussion opened by J. D. Wright, B. & O., Baltimore, Md.

Subject No. 2.

"The use of Cork, or other materials, as a preventative of moisture or dampness in the finishing of steel passenger cars"—John F. Gearhart, Penn. R. R., Altoona, Pa.; W. H. Green, Am. Car & Foundry Co., Wilmington, Del.; Geo. W. Arnold, N. Y. Shipbuilding Co., Camden, N. J.; Harry Carson, Harlin Hollingsworth, Wilmington, Del.

Query No. 2.

"The Maintenance of Passenger Car Floors"—Discussion opened by A. J. Bruning, L. & N., Evansville, Ind.

Subject No. 3.

"What is the best method of treating and maintaining the interior of Refrigerator Cars new and old?"—W. J. Orr, Erie Railway, Buffalo, N. Y.; T. J. Mullally, Armour Car Line, Chicago, Ill.; O. P. Wilkins, Norfolk & Western, Roanoke, Va.

Query No. 3.

"What improvement has been made in the cleaning and maintaining the front ends of Locomotives?"—Discussion opened by M. L. Shaffer, Northern Central Ry., Baltimore, Md.

Essay.

"The Master Car and Locomotive Painter, Past, Present and Future"—By an Ex-Master Painter.

Subject No. 4.

"Lead vs. Glue—From the Painter's point of view; which gives best results when used in the application of car sheathing and battens?"—B. E. Miller, Lackawanna Ry., Kingsland, N. J.; J. T. McCracken, Interboro R. T. Co., New York, N. Y.; W. H. Truman, Norfolk & Southern Ry., Newberne, N. C.

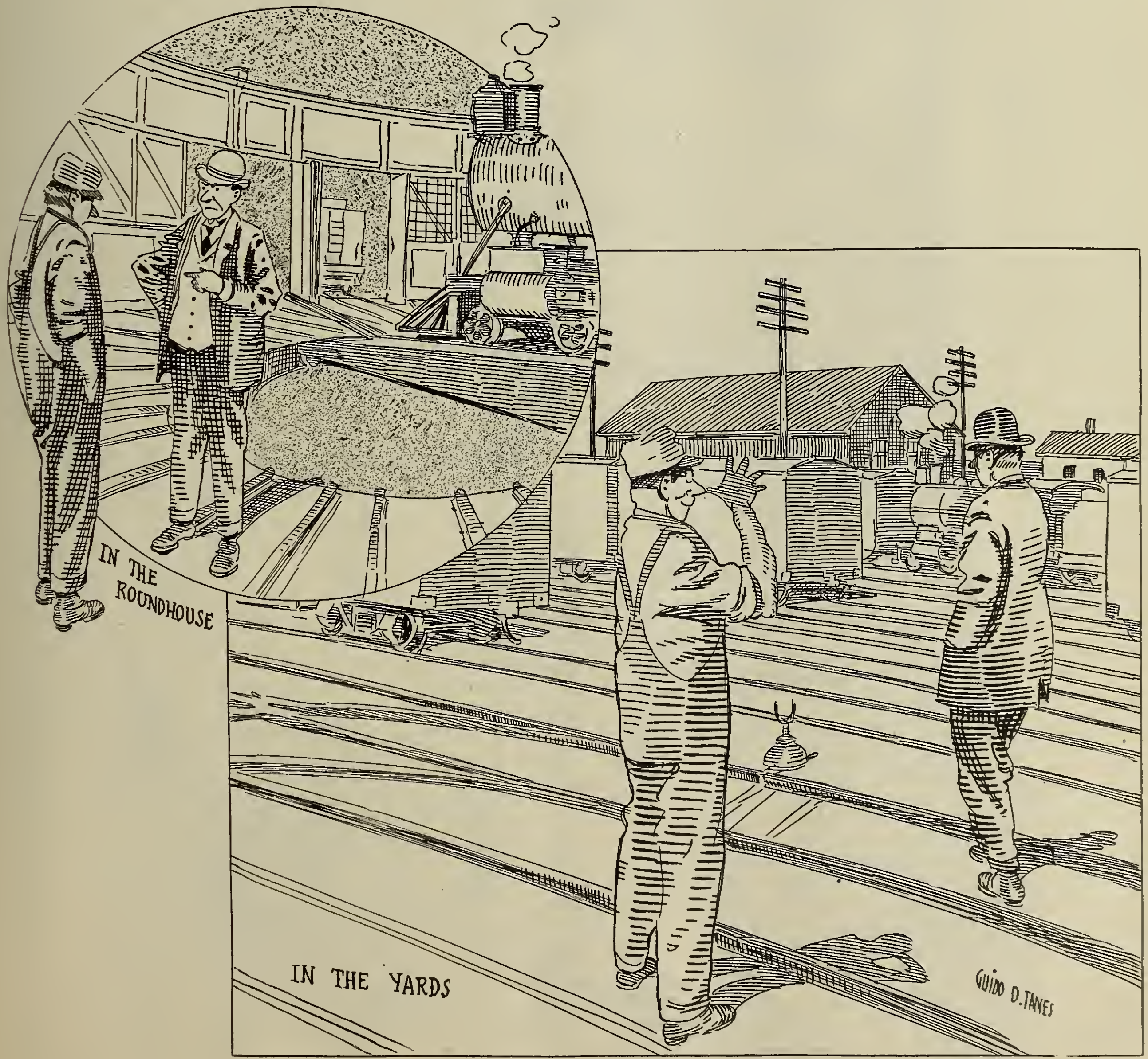
Subject No. 4.

"Is the expense involved in the maintenance of silvered gothic glass warranted by artistic effect gained in its use?"—Discussion opened by A. H. Phillips, N. Y., O. & W. R. R., Middletown, N. Y.

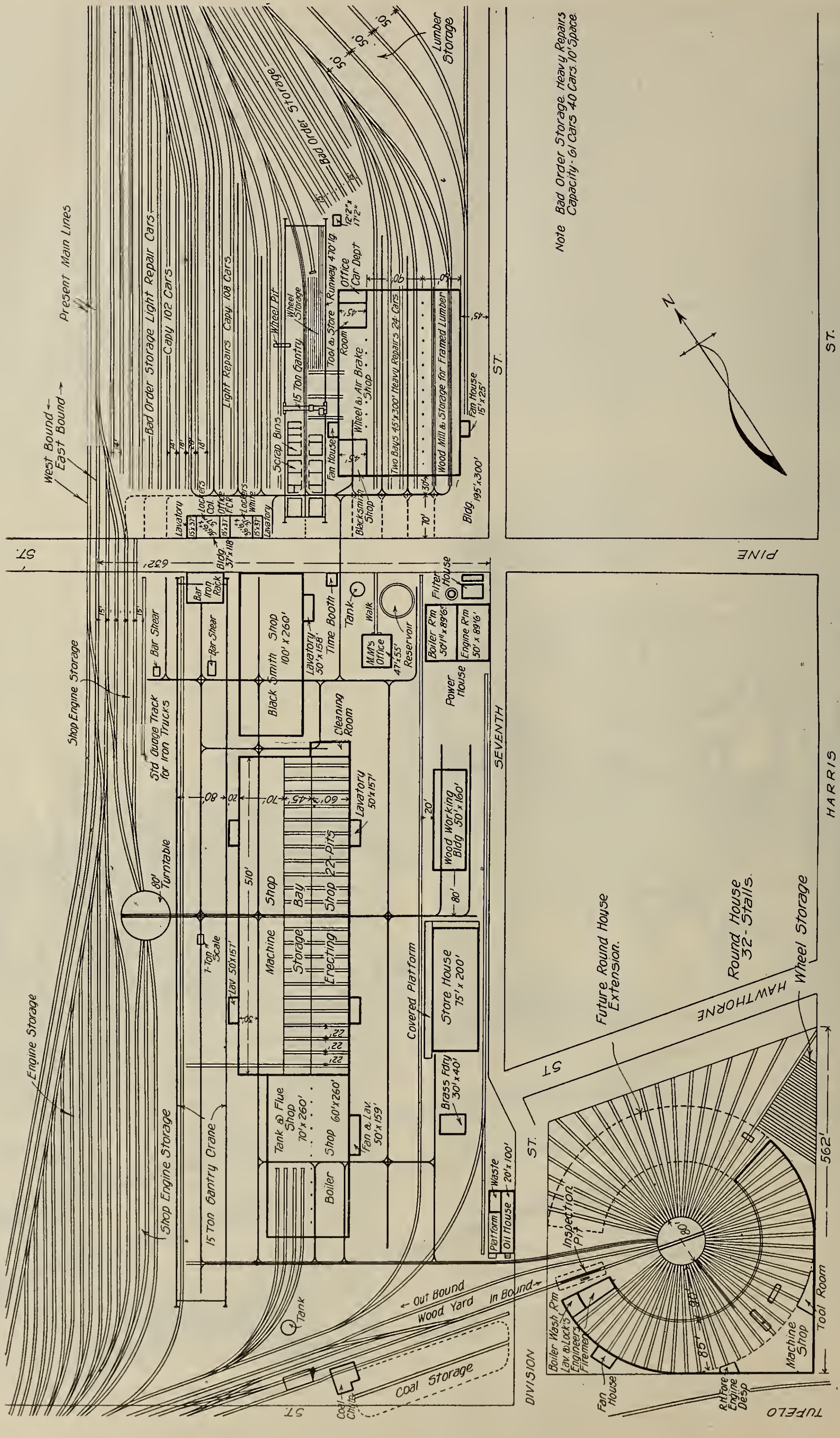
Railway Construction in England

The practically stationary condition of railway construction in the United Kingdom for many years past has rendered it all the more necessary for builders of locomotives and rolling stock, and makers of permanent-way material, to be constantly on the watch for developments in export markets with the object of securing orders to keep the works employed as far as possible. In the circumstances it is somewhat promising to learn that notwithstanding the insignificant amount of new construction which has been decided to be carried out in India during the present financial year, works are proposed in certain other countries which should result in at least a portion of the orders being placed with British firms. We have, for instance, the decision of the management of the Central South African Railways to proceed at once with the construction of 500 miles of railway, most of which will be in the Transvaal and the remainder in Orange River Colony, the cost being estimated at £1,500,000. In the second place, the government of the flourishing Argentine Republic intends to expend £2,400,000 on the construction of new lines, whilst several millions sterling will be required to carry out the extensive schemes of railway work projected in Turkey. The Chinese market should also be open, although diplomatic pressure in this direction may be necessary to secure the observance of open competition provided for by certain treaties. But apart from China, various opportunities for seeking fresh business in different parts are held in prospect for the near future.—Mechanical Engineer.

Machinists' hammers may be successfully hardened on the striking face by heating the head to a cherry red and dipping the face to be hardened into a water tank in which is a pipe leading up from the bottom with the opening a short distance below the water surface. The other end of the pipe is connected to the city water mains or other supply from which some head may be obtained. By turning on the water so that it flows through the pipe with sufficient force to agitate the surface and holding the hot hammer head with the face just below the surface of the water, the face will be hardened and the rest of the head remain soft.



Not an Unusual Situation. The Mechanic's Jurisdiction Should be Extended.



General Layout of Macon Shops, Central of Georgia Ry.

Macon Shops of the Central of Georgia Ry.

By F. F. Gaines, S. M. P.

A general plan of the shops of the Central of Georgia Ry. is shown herewith. The shops are not completed, but work, which was commenced two years ago, is still in progress. The car department and power house have been completed and in service a year. The round house and engine terminal are nearing completion, and will be ready for occupancy about the middle of August. The remaining work has been authorized and some of the contracts let.

The power house equipment consists of 1,250 h.p. in Babcock & Wilcox, Taylor-Altman type boilers. The generating units are one 300 kw. and one 500 kw. Parsons turbines. There is also a Chicago Pneumatic Tool Co. 2,000-ft. Corliss type air compressor. Space has been left in the power plant for 500 h.p. additional in boilers, one 500 kw. turbine and an additional 2,000-ft. air compressor.

In the round house the square corner at the center has been built with the idea of using this space for a round house machine shop, to avoid the necessity for carrying work to the main shop; the idea being that we will have a force of men at this point to look after the round house repairs, with the necessary machine tools for doing so. There is also to be, in one corner of the round house, a complete boiler washing outfit for washing boilers and refilling them with hot water.

The main erecting shop consists of 22 pits, which will be served by one 125-ton crane on the upper runway and one 10-ton crane on the lower runway. The lower runway extends into the cleaning room on the right, and is also continuous through the boiler shop, enabling the crane in the boiler shop to go into the erecting shop and remove boilers requiring fireboxes, etc., to the boiler shop. The 45-ft. storage bay shown on the drawing has two floors. The lower floor is used for the storage of wheels, with pits between tracks for storage of engine parts that are being repaired. The second floor will be a light machine bay.

The main machine bay will be served by a 20-ton crane. The tank and flue shop will also have crane service, and there will be an 80-ft. traveling gantry crane outside the shop, equipped with a magnet.

Topical Discussions at the Master Mechanics' Convention

Is the Additional Cost of Flexible Staybolts Justifiable?

H. D. Brown (Erie)—I wrote to a number of our members asking their experience in the matter under consideration. I presented six questions to them. For my own part I very much favor the use of flexible staybolts, and to my great surprise all the answers to my letters were in the affirmative too. Four of the replies suggested that there should be a committee appointed to work up modern methods for the application of flexible staybolts. It seems there has not been any method in universal use of proper adjustment of the flexible bolts. It was suggested that that matter should be given careful attention. Another subject suggested was that the committee, if such a committee were appointed, should tram up the boiler with reference to locating the expansion of the firebox with regard to the outside shell and the throat sheet and back heads. There was a decided request that there should be opportunities afforded of making tests to determine the best method of applying flexible staybolts to staying boilers.

H. T. Bentley (C. & N. W.)—It seems to me that it would be necessary to know whether we are breaking an abnormally large number of staybolts or not. It would seem that with a very small staybolt breakage the use of the flexible bolt is unnecessary. I believe under some certain conditions staybolts are breaking very frequently and probably in those cases a flexible staybolt would be necessary, but I would like to ask Mr. Brown if he knows what his breakage of staybolts per engine per year amounts to, whether it is with any particular type of engine he is having trouble and whether a change in the position of the firebox may not overcome some of the difficulties he may have on account of having an excessive number of staybolts broken.

Mr. Brown—In one case only did I get any information as to the number of staybolts broken. In that case the statement was made that the number of rigid or solid bolts that were broken was very large, running up into something like 400 a year. That was on the Wooten firebox. In many cases we find the cost of application of the flexible staybolt high. In other cases it runs from about 35 to 50 per cent higher than the application of the rigid bolt.

Mr. Bentley—One of our engines gave us trouble with the staybolts and in re-designing the firebox, so as to get longer staybolts in, we reduced the breakage from fifty to sixty per year, in that engine, down to six or seven. With the type of flexible staybolt in general use, is it possible to detect whether they are broken or not?

Mr. Brown—I find the general practice is to put air pressure in the boiler and then make the test. We find it easiest to make the test by removiing the cap.

J. F. De Voy (C., M. & St. P.)—I wish to raise the point as to whether any of the members have ever tried a flexible staybolt with the idea of preventing cracked side sheets. I have this suggestion to make, which I think is new: On a certain Atlantic type engine we have a boiler which has a very shallow firebox. About eighteen inches from the mud ring, and about the center between the forward and back part of the side sheet, we found it was an absolute impossibility to retain the side sheet in the boiler more than six months. There would be a crack developed at that point possibly twenty-four inches long. We increased the width by adding to the side sheet, a distance of four and one-half inches above the point mentioned to a point about seven inches below, and the additional length did not appear to help the case at all. I recommended to the superintendent of motive power that we apply flexible staybolts to what I term the cracking zone of the side sheets, or, in other words, two or three rows above where the crack occurred and two or three below. I understand, gentlemen, this is entirely at variance with the usual custom of placing staybolts. The results are more than anyone could expect. I do not know whether anyone else has ever tried this, but I would recommend the plan. It has certainly increased the life of these side sheets in this particular type of boiler. In my opinion, if the boiler was designed on different lines we would not have trouble from crack side sheets.

Is the usual front row of crown bolts in a locomotive boiler beneficial or otherwise?

C. A. Seley (C., R. I. &P.)—The function of an expansion staybolt, from its name, as well as its construction, is to facilitate the expansion of the flue sheets, as well as performing its usual duties of supporting the sheets which it connects. If the expansion stay does perform its duties as such, then the crown-sheet is unsupported from flue sheet to first non-expanding staybolt, and therefore the expansion staybolt is useless, because it does not support and may be left out without harm.

If on the contrary the expansion stay does not perform its duties as such, then the expansion feature is useless and may be replaced by a solid staybolt, giving cheaper and better construction.

Briefly, then, the condition is this: If an expansion staybolt does expand, it is no good, on account of not supporting the sheet. If it does not expand, it is no good, because it does not work.

L. R. Pomeroy—I think one of the important features of this discussion is the fact that all of these so-called flexible staybolts at the end of the crown sheet are in tension. I think the staybolts do not expand, in the sense of elongation, but rotate and allow a movement with reference to the box and outside shell which allows the box to adjust itself to the different conditions going on in the sheet and steam space.

Mr. Fowler—I want to call attention to some experiments made in the past and reported to this association a great many years ago, I think, by Mr. Eddy, who was connected with the Fitchburg Railway. He put a gage on the top of the crown sheet at the front end near the top sheet, and set it back at intervals, and immediately noticed the movement of the sheet when he was getting up steam. He found that before there was any steam generation in the boiler whatever, the front of the firebox expanded the front sheet, expanded the crown sheet, and actally lifted the crown sheet and placed it near the roof sheet, so that the gauge rose through the stuffing box and showed there was a perceptible decrease between the two sheets. As the steam pressure was generated and applied to the top of the boiler the gauge dropped back to its natural position again and showed that the stays at the front end of the boiler were in tension. If they are slack at the front end, it allows for the rise of the sheet when the boiler is being heated, and they then go back in tension, and do their work when steam is placed on the boiler.

Mr. De Voy—I wish to correct the statement in one regard and pay a tribute to a man of the old school, who was conversant with every detail of the locomotive boiler. I refer to J. M. Boom, who was chairman of your boiler committee and conducted tests for three months during the time that I was the office boy at Frankfort, N. Y., on the old West Shore road about 18 years ago, so that if you will give credit to Mr. Boom, who presented to this convention a minority report in which he stated that the flexible sling stay at the front end of a boiler never did any good (and I never knew it to do any good), I think we will be only giving Mr. Boom just credit. I spent 2½ months on the proposition. When you first put fire in the firebox there is an expansion all around. We use the gauges you referred to. Our experiments were very elaborate. When you first put fire in the firebox there is an expansion of about 1-100 part of an inch on the whole thing, inside and all. We had gauges on the firebox outside crown sheet, and everything of that kind, and so while I have always been forced—wanted to be in style—to put three rows of sling stays in the front end of the boiler at the crown sheet, I want to tell you there is no more necessity for it than there is in wearing two hats. I want to take this opportunity to pay a tribute to Mr. Boom.

D. J. Redding (P. & L. E.)—These things we have just heard are facts. When you have a lot of rigid bolts in the front ends of your crown sheet, after the firebox has been in a year or two, you will find the crown sheet bottled down ¼ in., and the front end of the top sheet be up in the same way. I know, from personal observation, of the introduction of sling stays which do not corrode, which overcome that trouble.

C. E. Fuller—There is more trouble caused by the boiler maker than in any other way. Keep the boiler maker out of the firebox. If you allow the boiler makers to work on your flue sheets, using different kinds of rollers and expanders, in that you will find the cause of the trouble with the flue sheets. If you see a flue sheet going up, and a crown sheet going up with it, it has been expanded and stretched by the constant rolling of the flues.

Mr. De Voy—If you expand the flue sheet do you expand the side sheet? Do they stretch and go up at the same time? I would suggest putting your staybolts 4 in. back of the row of rivets in the flue sheet and find out whether they expand. I think Mr. Fuller explained the whole thing.

The President—Topical discussion No. 1 on today's program is entitled "Vanadium Steel; have the advantages claimed and shown in laboratory tests been substantiated in practice, particularly as regards the strengthening of locomotive parts?" This subject is set down to be opened by W. C. A. Henry. Mr. Henry has not prepared the paper and we have not been able to get anybody else to do it. Unless someone wants to take up the discussion of that subject we will proceed to topical discussion No. 2, entitled "Are by-pass valves necessary on piston-valve locomotives?"

Are By-Pass Valves Necessary on Piston Valve Locomotives?

H. T. Bentley (C. & N. W.)—When piston valves were first used on locomotives it was very naturally supposed that, on account of the shape of valve and its inability to lift as a slide valve does, it was necessary to have some arrangement or by-pass that would take care of a higher pressure in the cylinder, due to compression, than the steam pressure carried in the boiler, and numerous devices were used, all having the same object in view, but each design differing somewhat in the manner operated.

In one of the valves tested it required over 200 lbs. above boiler pressure to operate, and therefore was practically useless. Others performed their function satisfactorily, while they remained intact, but the hammering they were subjected to caused them to break, which resulted in a bad steam leak that was often difficult to locate.

A double-seated valve gave considerable trouble on this account. The seat closing the steam from the atmosphere would be tight, while the other, separating steam chest and cylinder pressure, would not close, owing to the expansion of the metal, and a continuous blow would take place and much coal was wasted in this manner.

After using various types for several years, with unsatisfactory results, we made a series of tests in September, 1907, and found that under ordinary service conditions the by-pass valves were unnecessary and therefore took them off. After running the engines without them for nearly two years, but having suction valves of ample capacity, we do not find any bad effects, neither have we had any more cylinder heads broken than we did before.

Where by-pass valves are used simply to by-pass the air from one end of the cylinder to the other, when drifting, they may give satisfactory results, and probably will be better than the suction valve located outside, as the air will pass back and forth from one end of the cylinder to the other and not through the walls of cylinder to the extent it would do if drawn in through regular suction valves from outside.

With water in the cylinders the by-pass or cylinder relief valve might give some relief, but under ordinary running conditions we find no advantage.

While at a locomotive builder's recently, in talking about some proposed engines having 25-in. by 32-in. cylinders and a boiler pressure of 170 lbs. without a superheater, it was the opinion of their engineering department that a by-pass valve would be necessary, probably on account of the greater condensation that would occur in the cylinder of the sizes given, and using a comparatively low boiler pressure without a superheater. But for engines having ample steam space, using good water, and with cylinders suited for a boiler pressure of 190 to 225 lbs., we do not believe a by-pass valve necessary.

H. D. Brown (Erie)—What has your experience been in the loosening of valve heads before and after using the by-pass valves?

Mr. Bentley—We have not noticed any difference. We formerly used the rectangular ring which was continually giving trouble with the by-pass valve on. Since our T-shaped piston valve ring has been in use the breakage has been reduced to a minimum.

Mr. Brown—Have you any trouble with valve bushing breakage?

Mr. Bentley—No, we have discovered no trouble whatever as the result of taking the by-pass valve off.

Mr. Brown—About what is the average number of piston valve rings which were broken in a month?

Mr. Bentley—With the rectangular ring in one roundhouse we were probably breaking two or three a day, and with the T-shaped ring it is the exception and not the rule for one to break.

Mr. Brown—Inside admission or outside?

Mr. Bentley—Inside admission.

Mr. Brown—In that case which ring did you find failed?

Mr. Bentley—I cannot say. We have a Master Mechanic here who has a large number of piston valve engines operating, with and without by-pass valves, and you might call on Mr. Slater.

Frank Slater (C. & N. W.)—Where the rings were broken with the rectangular rings they broke anywhere in the valve. We use three rings on our road, and we find one broken as frequently as the other. My experience was they did not break until the bushing had become worn, and the constant vibration would break them. As soon as we bored out the bushings and put in new rings the breakage would stop. The T-rings did not wear so fast and did not break. We have very little trouble from broken T-rings. We find no trouble at all in dispensing with the by-pass valve, but I must say that the engines will not drift quite so freely, and when they do drift, if there is any lost motion in the rods or driving boxes, the engines will pound while drifting almost as badly as while working steam. In the engine, with the by-pass valve the piston can travel freely from one end of the cylinder to the other; the lost motion is not taken up in the working parts, and you do not hear the pounding.

The President—A few years ago we made some experiments on this subject with engines fitted with the valve I think you are all familiar with, the American Locomotive Company's combined by-pass and suction valve of the 2-in. size, and another engine with a 2-in. suction valve on each end of the steam chest, and another engine with a patented type of relief valve, using, I think, 4 lbs. of suction in the cylinders with the American Locomotive type and 8 lbs. with the 2-in. suction valves, or the other type of valve. Consequently we had to use very extensively the regular by-pass and relief valve which is pretty common.

But there is a very wide difference between putting that valve on and saying you are using it, and having it used, if you really go around and see so many of them all blanked and not in use. In our winter conditions our men object very much to the combined by-pass and suction valve. It throws out a little steam for probably a couple of hundred yards after the engine is shut off, and they object to it on that account. It comes just as they are running into the station, and in exceedingly cold weather prevents them from seeing. We have felt, therefore, that we would go to the 2-in. suction valve, one on each end of the valve chest, and give up the advantage of a reduced amount of suction.

Brick Arches and Water Tubes in Locomotive Fireboxes.

J. F. Walsh (C. & O.)—Not considering for the moment the many desirable features in the use of the brick arch in locomotive fireboxes, we will consider only water tubes, which are applied primarily for the purpose of carrying the arch bricks.

In the four 3-in. water tubes which are used in the fireboxes of our locomotives we have a total heating surface of about 26 sq. ft., which aids materially the steaming qualities of the engine, if considered alone.

Again, in the wide firebox locomotives, with a grate surface of practically 50 sq. ft., the rapid deterioration of side sheets has been the cause of complaint, due to the buckling and cracking of those sheets at a point close to the flue sheet and crown sheet.

With a total of 250 of that type of engine in service, some of them in service for the past six years, we have had little cause for complaint concerning defects in our side sheets as noted above. This we believe is due to the fact that our arch tubes assist very materially in the circulation of the water, and by that means avoid the overheating of the side sheets.

Therefore I believe that the arch tube itself, independent of any other feature connected with it, is a desirable addition. We provide ample means for keeping the tubes clean by placing hand hold plates in the boiler head, and in the throat sheet in front of the water tube openings. These are taken off each time the boiler is washed and the tubes are thoroughly cleaned.

As to the usefulness of the brick arches, in a test recently made on one of our divisions we proved that by the use of the brick arch we can save 20 pounds of coal per mile as compared with the operation of the engines without the brick arch.

Where the brick arch is used the locomotives steam much more freely than without the brick arch, and we are enabled to keep up full boiler pressure regularly.

The use of the brick arch enables the fireman to maintain the maximum boiler pressure regularly. Without the brick arch this cannot be done when the engines are worked to full capacity. Therefore, without the brick arch we cannot haul full tonnage; so by the use of the brick arch we increase the earning capacity of the locomotives and of the railway.

Our brick arches cost us on an average 30 cents per brick. Using 10 bricks in each engine means a total cost per engine for arch brick of about $3.

A saving of 20 pounds of coal per mile will mean a saving of 2,000 lbs. of coal per 100 miles, and with coal costing us approximately $1.50 per ton we can save the price of the brick arch in a round trip by the saving in coal, and not considering the increased efficiency of the engine.

It would seem quite superfluous to add that by the use of the brick arch we obtain very much better combustion of smoke gases and reduce the quantity of smoke emitted. The same is quite true of the quality of sparks emitted, as the brick arch serves as a baffle to the escape of the cinders, retaining them in the firebox until consumed. This results in better firebox efficiency, reducing also the danger from fires along the right of way.

Our transportation officials and our enginemen and firemen complain if our supply of arch brick becomes exhausted, or if for other reasons we have to operate our engines without arch brick.

Dependent on the quality of the brick and the frequency that it has to be removed for flue or other repairs, a set of brick in our heavy locomotives will last from two to six weeks. Where the quality of the brick is good it may be removed to permit of work being done and used again several times.

Prof. H. Wade Hibbard (Univ. of Mo.)—In connection with fire brick arches in locomotives, some information that I gained last summer, when I was connected with a railway making very extensive use of fire brick arches, may be of value to this association, and that is, with regard to the durability of the fire brick. I believe that sufficient attention has not been paid to the sort of fire brick which should be used for this purpose. Fire brick for locomotives should have a greater degree of toughness and less ability to stand high temperature. The temperature in a locomotive firebox is low as compared to the temperature in an open-hearth steel furnace for the manufacture of open-hearth steel, and if you desire to have fire brick which will stand mechanical abuse in a locomotive firebox, then you should get the tough fire brick rather than the high temperature fire brick.

George L. Fowler (Railroad Age Gazette)—I think it would be interesting if some members of the association would give data as to what results they are getting where they have poor water and bad coal. Mr. Walsh's road, as I understand it, is remarkably blessed in two particulars. They have wonderfully pure water and a superb quality of coal. Now, it is quite possible that entirely different results might be obtained where you have a bad scaling water in use. It would be very interesting to have some data in that particular.

The President—Our experience has been like most roads, I think, that it is largely a question of local conditions. We use brick arches in some districts and we find their use inadvisable in others. There is very little doubt about the saving of coal, but the question is whether the trouble makes it a paying proposition. I think the Lake Shore has been doing a great deal of work on brick arches lately, have you not, Mr. Parish?

LeGrand Parish, Lake Shore—We have practically all the engines on the Lake Shore equipped with brick arches, including switch engines. About two years ago in looking into the subject we found that we had perhaps 100 engines maintaining the fire brick and we had to fight every minute to maintain that in the 100 engines, on account of the difficulty we had in the engine houses. There was also one other difficulty which we overcame. The great trouble in maintaining the arch brick in locomotives has been on account of the fact that we all used a brick that was too long. They were broken in shipping, they were broken in handling in the engine house, and they were broken when they were removed, and all that sort of thing. We got entirely out of fire brick. I was having all kinds of trouble on account of the engines not steaming. We used a lot of old brick that we had on hand which we considered obsolete, and the men who had this work in charge, our supervisor of boilers, and supervisor of locomotive machinery, were told for heaven's sake to use that brick in some way so that they would have brick arches in the engines. The result was they designed a short brick which rested in between the arch tubes, and it more than doubled the life of our brick and got us practically out of all our troubles. The result of that experiment has been that we have equipped everything on the Lake Shore with arch brick, and the saving in cost of coal is something enormous. I cannot give you the figures, I am sorry I haven't got them. It has made a wonderful difference in our coal—that in connection perhaps 75 other things, a number of which were mentioned in a previous paper.

A. E. Manchester (C., M. & St. P.)—It has been the practice of the C., M. & St. P. for 20 years to use arch brick. We are so thoroughly and firmly convinced of the good of the arch brick, and our men are in the same position, and feel that they could hardly run the engines without it. Whenever a condition arises that on account of the shortage of stock or something of the kind the arch bricks are not maintained, reports are always coming in that the engines are not steaming, etc., and that is given as the cause. We believe that a great deal of good is done with the brick, and we get just as good results, if not better, in the bad water districts as we do in the good water districts.

"Is Previous Railway Experience of Advantage to Locomotive Firemen?"

D. R. MacBain (N. Y. C.)—This question is one that we believe worthy of debate, as there are many angles from which the matter ought to be viewed.

Ordinarily, there are very few applications from the ranks of the shopmen, the trainmen, the switchmen or the clerical force for positions as firemen, and it has been our experience that, in most cases where applications are received from these sources, the applicants have not been successful for one reason or another, and turn to the locomotive service as a last resort.

From the ranks of the section men, the bridge gangs, the car repair gangs and the freight house gangs, there are many very desirable applicants. These men, as a whole ,are used to rough heavy work at low wages, and they appreciate fully the advantages afforded by the locomotive service in the matter of better working conditions and increased remuneration.

While it has been our experience that not all of these men make good as locomotive men, the exceptions are, perhaps, less in proportion to number than of any other class of men hired, and some of the very best engineers in the service at the present time are men who began on the track, the repair yard, the bridge gang or the freight-house gang. In such cases, by reason of the fact that they, in most instances, do appreciate that the locomotive service is more desirable in all respects than the jobs they left, it would seem their previous experience was advantageous to themselves and the company alike.

Viewing the matter from a standpoint of the practical railway experience of such men, they, of course, cannot be classed with applicants who have had previous experience as trainmen or switchmen, especially when firemen are needed to keep the road open, but it has been our experience that the latter men will not remain in the locomotive service longer than is necessary to find a job in the service they came from.

To sum up:

1. Should it be the good fortune of a road to get men who have fired elsewhere and been laid off on account of reduction in force, the experience they have had ought to be of some value to the employing company. They have, as a rule, the advantage of being young men, which is a desirable feature.

2. If intelligent young men could be induced to enter the track, bridge, car repair and freight house gangs with a prospect of advancement to the locomotive service, if they can qualify, it would seem that the scheme ought to work out advantageously to the railway companies.

3. In our opinion the next best material from which to choose firemen is from the farm. The farmer's son, after he is broken in, is usually appreciative of his position and will develop into a good, reliable locomotive fireman.

Much can be accomplished toward improving efficiency among locomotive firemen by having good men as firemen's instructors who shall have no other duties to perform and who can apply their whole mental and physical energy toward instruction.

The grand total of Panama Canal excavation during the month of May was 2,896,095 cubic yards, which is 558,554 cubic yards less than the total for April and 1,166,537 less than the highest record, that of March, 1909. Of the 2,896,095 cubic yards, 2,837,893 were chargeable to "Work" construction and 58,202 to "Plant." The amount removed from the Canal prism was 2,575,917 cubic yards. There were taken out by steam shovels 1,732,077, and by dredges 1,105,816, cubic yards. There were 25 working days during the month, the same as in April. The mean rainfall for the month in the territory in which excavation was in progress was 9.82 inches as compared with 4.36 inches the previous month.

Railway Mechanical Work at the University of Illinois

Since 1900 the College of Engineering of the University of Illinois has offered a course in railway mechanical engineering, and has carried on experimental work relating to steam railway practice. In 1906, in fuller recognition of the needs of training for railway service, there was established a school of railway engineering and administration whose function it is to co-ordinate the various facilities of the university so as to provide specialized training for all branches of railway service and other wise to further this work.

It is the purpose of the School of Railway Engineering and administration to provide training which shall prepare men to become efficient workers in the financial, traffic, and operating departments as well as in the engineering departments of both steam and electric railways.

The main object of these courses is to provide thorough training in theory and general principles amply illustrated and fixed by practice. It is recognized that this preliminary training can be completed only in actual practice and that its chief service must be to develop the ability to economically acquire and classify information and to accurately apply it.

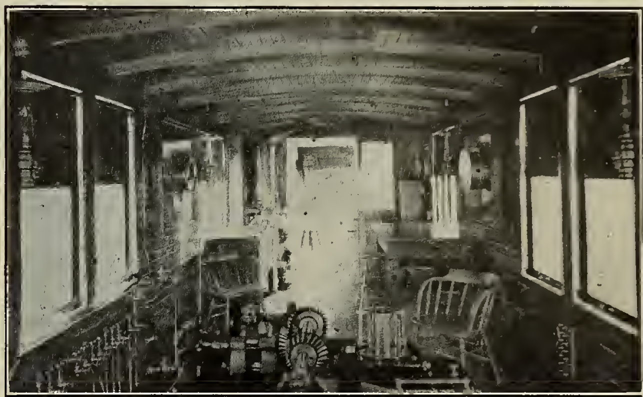
In railway work, as in other fields, one is seldom selected

Dynomometer Car, University of Illinois.

for an administrative position solely because of his technical professional attainments. His promotion depends rather upon his ability to grasp and properly evaluate all phases—financial, technical, and economic—of the problems presented for his solution. The effort is therefore made to emphasize this point of view and to stimulate interest in these directions, not only by the method of presenting the technical work but by the incorporation of other than purely technical subjects in these courses. Toward this end there is included, for example, among other general subjects in the engineering courses, such work as economics; and in the course in transportation there is enough of technical engineering work to give an understanding of the problems arising in the engineering departments.

The courses in railway civil engineering and railway mechanical engineering are intended primarily for those who expect to enter the service of steam roads in the departments of maintenance of way and of motive power; while the course in railway electrical engineering is arranged for those who will find employment in electric railways or in the service of steam roads with electrified lines. Each course occupies four years.

During the first two years the student in any of the three railway engineering courses studies principally the fundamental sciences which enable him to proceed with the technical subjects of the later years of the course. In mathematics he studies trigonometry, advanced algebra, analytical geometry and calculus; in physics, working in both the laboratory and lecture room, he obtains a grasp of the laws which underly all engineering practice. At the same time he is introduced to the study of the laws of mechanics. During these two years he spends about ten hours each week in the shops, becoming thereby familiar with the methods and processes of pattern-making and of the foundry and forge shop and finally of the machine shop. This shop experience forms the groundwork upon which the later instruction in machine design is based. Simultaneously with his shop practice the student spends an equal amount of time in drawing and in elementary design. Those taking the course in railway civil engineering receive shop instruction during the first year only, and in the second year they begin, in its stead, the study of surveying, spending each week about twelve hours in the field. Throughout these years of the course the work in science and shop practice is supplemented and balanced by the study of rhectoric and composition and of either English or French or German, which are required of all students in engineering. Military drill and work in the gymnasium are also required of all students during this stage of their course. Having the preliminary training here



Interior of Dynomometer Car, University of Illinois.

outlined, the students in these courses are now prepared to take up the more technical and specialized engineering subjects of the third and fourth years.

In the course in railway civil engineering the student proceeds with his study of mechanics in both the laboratory and lecture room during the third year. This work, which is common to all three courses, familiarizes him with the nature of engineering materials and with the fundamental laws controlling machines and structures. He begins here for the first time to study some of those subjects which are specifically related to his future work, such as railway yards and terminals and the design of railway structures; and he continues in the fourth year such subjects as the theory of railway location, masonry construction, bridge design, tunneling, and signal engineering. In all of this work the time is divided between classroom and laboratory, and field practice.

The student in railway mechanical engineering receives during the third year instruction in steam engineering in the mechanical engineering laboratories, which is supplemented by work along the same lines in the classroom, all of which familiarize him with the principles which apply to the design and operation of the steam engine, steam turbine, and other prime movers. At the same time he continues his study of machine design, and is given some training in the elements of electrical engineering and electric railway practice.

The fourth year is devoted largely to the special railway courses. Tere the student studies the mechanics of the locomotive and the problems of locomotive operation, while at the same time he is receiving instruction in locomotive and car design. Railway shop arrangements and shop equipment are also studied and a limited amount of time is devoted to the consideration of such auxiliary equipment as water pumping stations and purifying plants, and the air brake. During this fourth year the student takes part also in road tests, in which, by the use of the dynamometer car owned by the department, he makes in actual road service, tests of locomotives and of the resistance of trains; and studies in this connection the problems of tonnage rating.

The courses in railway civil engineering and railway mechanical engineering differ from the regular civil engineering and mechanical engineering courses only after the first semester of the third year, and the course in railway electrical engineering differs from the regular electrical engineering course in the fourth year only. In modifying the regular engineering courses to make the new railway engineering courses, care has been taken not to sacrifice any of the time devoted to the study of the fundamental sciences. Changes have been made simply by substituting for some of the special technical work of the last year other special railway subjects of equal educational value, but of such a nature as to introduce the student to some of the problems later to be encountered in practical railway work. The railway engineering courses are therefore but little more specialized than the regular engineering courses.

Three railroads enter Urbana and Champaign, the Illinois Central, the Wabash, and the Cleveland, Cincinnati, Chicago and St. Louis, the division shops of the last also being situated there.

Opportunities for shop and road tests have been freely given and throughout the year numerous locomotive and train resistance tests are made both for instructional purposes and for the information of the railroads. To facilitate this work there was designed and built in 1900 a dynamometer car which is owned jointly by the University and the Illinois Central Railroad. This car is equipped with all the apparatus necessary for carrying on train resistance experiments as well as with auxiliary apparatus used during locomotive tests. During the seven years, in which it has been in service this car has been operated over the entire Illinois Central R. R., in the establishment of tonnage ratings, as well as on the lines of the New Jersey Central, the Baltimore and Ohio, the Cleveland, Cincinnati, Chicago and St. Louis, and the New York Central. On this last road it was used in the preliminary train resistance tests made to provide information for the electrification of the New York City terminal, in which connection it was also used for competitive tests between steam locomotives and electric motor cars at the works of the General Electric Company at Schenectady, New York. In all this work the car has been operated by students of the Railway Engineering Department.

There has recently been added to the equipment of the Railway Engineering Department a standard drop testing machine which in its design conforms to the specifications of the Master Car Builders' Association. This apparatus is used in making impact tests of car couplers, wheels, axles and other material. In consists essentially of a hammer weighing one thousand six hundred and forty pounds, which runs in vertical guides fifty feet in height.

There is now under construction a brake shoe testing machine, which, when completed, will form a valuable addition to the equipment of the department for research and commercial experimental work. By the use of this machine it is possible to determine the co-efficient of friction and the wearing qualities of brake shoes upon which the efficiency of the braking devices used in railway trains must of course ultimately depend. This machine will be similar in construction to the original brake shoe testing machine built by the Master Car Builders' Association by means of which much valuable information concerning brake shoes has already been made available. Both the brake shoe testing machine and the drop testing machine will add greatly to the facilities enjoyed by the department for carrying on experimental work of interest and value to the railroads, and will provide unusual opportunities for the work of instruction.

The department owns also a complete New York air-brake equipment for engine, tender and five cars. In addition to the special apparatus here mentioned, the students of the railway course have open to them the advantages of the mechanical engineering laboratory in which they are given their preliminary instruction in experimental work.. The list of railway technical journals in the library is very complete.

Electric Locomotive with Side Rods

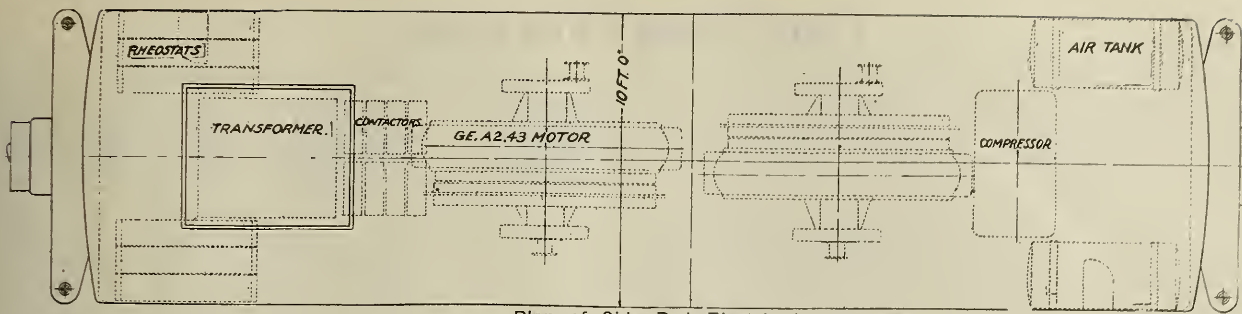
A somewhat novel electric locomotive has recently been built jointly by the General Electric Co. and the American Locomotive Co. The drawing herewith shows the principal features of the design, the most distinguishing of which is the location of the motors above the frames, rods and cranks being the driving medium in place of the usual gears.

The locomotive is designed to carry two 800-hp., single-phase, 15-cycle motors, and with this equipment will develop a tractive effort of 30,000 lbs. at a speed of 18 m.p.h. The motors are capable of driving the locomotive at a maximum speed of 50 m.p.h. and will operate equally well when running in either direction. The locomotive has been equipped temporarily with two 400-hp. motors for testing purposes, and it is the intention to build a cab over the entire length of the machine, as shown in the drawing.

The frame and running gear are very similar to those of steam locomotives. There are three pairs of coupled driving wheels 49 in. in diameter, a radial two-wheeled pony truck with wheels 36 in. in diameter at one end and a four-wheeled truck with 36-in. diameter wheels at the other end. The total wheel base of the locomotive is 36 ft. 3 in., but the rigid wheel base is only 10 ft., which will permit rounding the sharpest curves. This wheel arrangement corresponds to what is commonly known as the "Pacific" type in steam locomotive practice, and while it is unsymmetrical by reason of having a pony truck at one end and a bogie truck at the other, the locomotive is adapted for running in either direction. Preferably it would be run with the bogie truck in front.

The system of spring supports is equalized between all six wheels on each side and is also cross equalized. The pony truck at one end has a radial center bearing and is guided by two radius bars, which are pivoted at the center of a cross piece between the frames forward of the rear driving wheel. The total weight of the locomotive when equipped with two 800-hp. motors will be 250,000 lbs., of which 162,000 lbs. will be carried by the three driving axles. This gives a weight per driving axle of 54,000 lbs., which is slightly less than the maximum weights employed on high-speed locomotives, but is much higher than the weights on either the New York Central or New Haven electric locomotives.

The arrangement of connecting rods between the motors and the driving wheels is well illustrated in the drawing. Two jackshafts, 10 in. in diameter and supported in bearings rigidly fixed in the locomotive frames, extend across the frames outside of the end driving wheels. Quartered crank arms are shrunk and keyed on both ends of these



Plan of Side Rod Electric Locomotive.

jackshafts and similar crank arms are attached with flexible couplings to both ends of each motor armature shaft. Inclined connecting rods extend from each motor crank arm to the corresponding jackshaft crank. To the same crank pins on the jackshafts are connected the driving-wheel side rods. For each revolution of the motor armatures, therefore, the driving wheels make one complete revolution and the two motors revolve in exact unison, due to the mechanical connection through the driving-wheel side rods. The object of inserting the jackshaft as an intermediate connection between the motors on top of the frames and the wheels is to permit a horizontal drive between the spring-supported part of the locomotive and the driving wheels. This is necessary in order to provide for vertical play between the spring-supported part and the non-spring-supported wheels with a negligible variation in the distance between crank centers. Counterweights are cast in the driving-wheel centers radially opposite to the side-rod pins and the crank arms on the jackshafts are similarly counterweighted. The jackshaft counterweights, however, are of such mass and their center of gravity is so located as to counteract the resultant forces produced by the revolution of half the mass of the horizontal side rod between the jackshaft and the first driving wheel.

Expert's Report on the Wood Locomotive Firebox

An expert employed by the Wm. H. Wood Locomotive Firebox & Tube Plate Co., of Media, Pa., has for several weeks past made daily calculations on the amount of coal burned by engines of the same class on the New York Central with and without the Wood firebox. This man has very carefully watched the actions of the locomotives in service and has calculated the amount of coal burned each trip by measuring the contents of the tender before and after the run.

The locomotives in question fitted with the Wood firebox are numbers 2490, 2494 and 2481. Those of the same class running against them were numbered 2487, 2492 and 2499, the latter being equipped with the ordinary box.

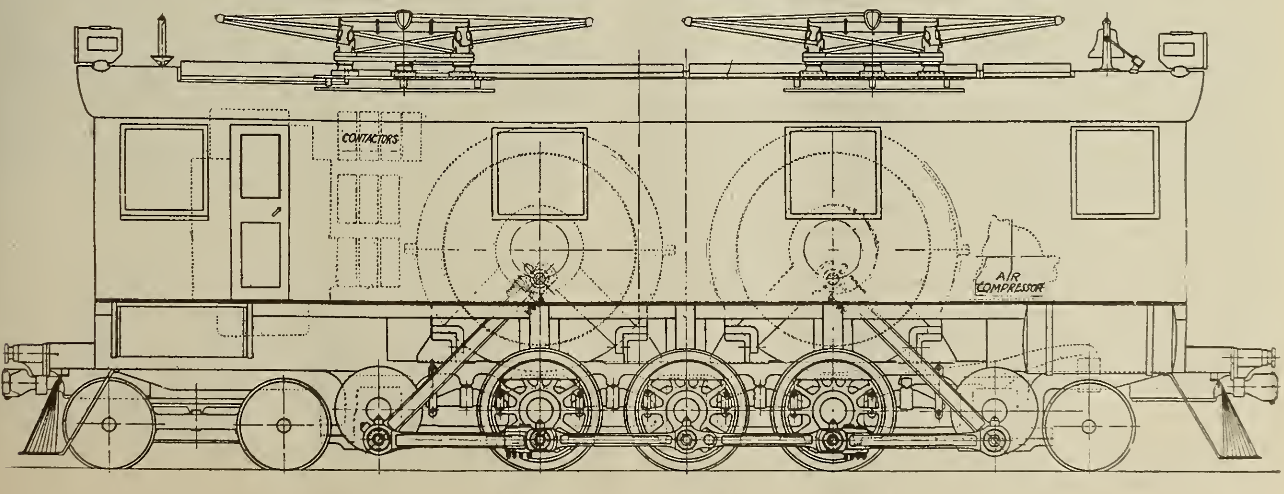
One of the reports follows:

Buffalo, N. Y., 24th May, 1909.

Eng. No.	Date.	Cu. Ft. Coal Left at End of Trip.	Coal Consumed Cu. Ft.	Consumed Tonnage.
2492	May 12	200	360	9
2481*	12	344	216	5 2-5
2487	13	227	333	8 7-20
2490*	13	254	306	7 13-20
2481*	14	335	225	5 5-8
2492	14	119	441	11
2487	15	254	306	7 13-20
2490*	15	335	225	5 5-8
2492	16	180	380	9 1-2
2481*	16	335	225	5 5-8
2490*	17	173	387	9 5-8
2487	17	227	333	8 7-20
2492	18	173	378	9 5-8
2481*	18	341	219	5 1-2
2490*	19	281	279	6 7-8
2487	19	173	387	9 5-8
2481*	20	308	252	6 3-10
2492	20	173	387	9 5-8
2487	21	227	333	8 7-20
2490*	21	173	387	9 5-8
2427	22	120	440	11
2481*	23	335	225	5 5-8
2490*	23	281	279	6 7-8
2487	24	254	306	7 13-20

* Indicates engines fitted with Wm. H. Wood's patent boiler.

This record is figured 50 pounds equal to one cubic foot. The engines hauled trains of approximately the same tonnage.



Elevation of Side Rod Electric Locomotive.

Car Wheel Forging*

From 600,000 to 1,000,000 tons of car wheels are made per year. A forged steel wheel era is commencing. I give you what I know and believe on this subject. I have no interest, nor have you, in anything but the truth, or at least the nearest approach to it that we can make..

Quality comes first; therefore, I take up the kind and condition of steel first, because this should be determined, and then suitable provision made for the most economical way of forging this steel. I do not take up alloy steels, as the makers of these are better qualified than I to do this. In an article running into such large tonnage as car wheels it is highly desirable that the lowest priced, in other words, regular commercial kinds of steel should be used. I believe that carefully made O. H. steel will answer every requirement if rightly forged and properly treated. I would rather trust this than higher priced steel which had not been put into proper condition. For instance the elastic tensile limit of a given steel suitable for wheels, can easily be doubled, and at the same time the steel made far more reliable against snapping. The question of steel treatment and how to apply it is very important. I know it is easy to make figures, and yet I trust that a rather long experience in forging and treating steel will be some reason for this paper.

As to the composition of steel for wheels, some were made at first of 0.60 to 0.70 carbon, later 0.60 to 0.80 was used and quite recently 0.65 to 0.85 with manganese about the same. We shall go still higher in hardness and strength. This can be done by higher carbon, and safety assured by toughening the steel after the wheel has been rolled, or by hardening and toughening steel of the present composition. It is foolishness to expect the best service without proper treatment of the steel after the mechanical work on it is done. I speak now of conditions in steel rather than of how to produce them. There is something to be learned regarding how far certain conditions are to be maintained in relation to other conditions, such, for instance, as ultimate stregth, elastic limit, reduction of area, hardness, size of grain, etc. There are many things in which we do not demand some of these qualifications, and the higher class of some articles the less attention we pay to some of these conditions, because the essential value is all, or nearly all, in other requisites. We hardly think of reduction of area and elongation in connection with the steel in a razor, but, on the other hand, we think a great deal of elongation in chains. The boy as you remember had many reasons to give why his father could not come to work. The first of these was that he was dead, and, of course, there was no use for any further reasons. So, with certain qualities in a given article assured, we need not trouble about others. What is the use of calling for 40 or 50 per cent reduction of area in steel for an article which is put out of service if bent the least bit. Far better to trade a portion of this quality for additional strength. In other articles the reverse of this is true. It is not how much steel will bend, or bend and rebend, but the real significance is in how long or how many times it will resist a given strain. In other cases, for instance, that of resistance to abrasion, we may largely center our attention on hardness and the size of crystals. Other things being equal, a different hardness of the surfaces working against each other seems desirable. I take it as indisputable that the central portion of ingots should never enter the rim or tread of the wheels, and I believe the years to come will bear me out.

*From a paper by James H. Baker, read before the Engineers' Society of Western Pennsylvania, March 16, 1909.

Coming now to making the wheels, perhaps I should undertake to tell what I consider the best method of forging wheels. But you may be pleased to have different methods described and the matter left for your consideration. Therefore, I take up the most important of these briefly. Since present manufacturers are free to make changes if desirable, there can be no harm in incidentally pointing out what I consider mistakes in present practice. All things must have their experimetal stages, owing partly to the fact that acquiring knowledge is progressive, and because the men best fitted by nature for pioneering stick closely to an idea which to them looks good. Perhaps one reason why some men have made much money is that they were not inventors and were, therefore, mentally free to chose among all plans. I do not mention many abortive efforts proposed or tried, to forge car wheels, except to say that the most costly one in view of the expense and what it accomplished, was the attempt to use a steel casting wheel and roll the tread. I have been informed recently of a plan to cast wheels of steel ready for use. I doubt the value of this, both as to cost and quality. Three different works use as many different methods for forging wrot steel wheels, while there is another just being put into practice, and a still different method is proposed.

Considering first the cost of material for wheels. One works have been cutting a round blank from a square slab. Taking, for instance, a circle of 28 in. diameter, it will require a piece at least 28½ in. square and this weighs full 30 per cent more than the circle. Then, assuming that the blank is to weigh 750 lb., there is 225 lb. to be added, making 975 lb., which at $28.00 per gross ton amounts to $12.20. Deduct say 215 lb. recoverable scrap at 75 cents, or $1.60, leaving $10.60. But using the ingot shown in Fig. 9, weighing say 775 lb. at $22.40 per gross ton, makes $7.75, showing a difference of $2.75 per wheel, using prices of three months ago, not taking into account that the recoverable scrap from the last named would be more than from the first one. This heavy extra charge cannot be continued. Removing this burden will do a great deal to promote the sale of steel wheels. The wheel business needs an Andrew Carnegie behind it.

This 28 in. circular blank, about 4¾ in. thick, in one works, is placed between dies in a powerful press which thins the web portion and raises the hub part. The metal in the hub is thus forced to travel in a direction contrary to that of the dies and this takes a large and needless amount of power. After further press work the blank is finished in a rolling mill outlined in Fig. 1. This method results in placing the outside part of the ingot in two portions of the tread, and the central portion of the ingot in other two portions of the tread, these portions blending into each other. This works use a 7,000 ton press for the heaviest part of the forging. Another works use a circular blank about 36 by 2½ in. This blank is pressed into something like the shape shown in Fig. 2 (which is not to scale), the flanges formed around the rim and in the central part being forced down to make the tread and hub. This works I am informed use a 10,000 ton press. They do not roll the wheels, but depend upon the dies for finish. This plan should make the hub and rim concentric, and should make a nice hub which perhaps would not need rough boring. But it places the central part of the ingot in a rather peculiar position. In the blank shown in Fig. 2, the center of the ingot would likely run something like the dotted line A and in the completed rim, probably something like the dotted line B, thus bringing the central portion of the ingot close to the face of the tread at this point.

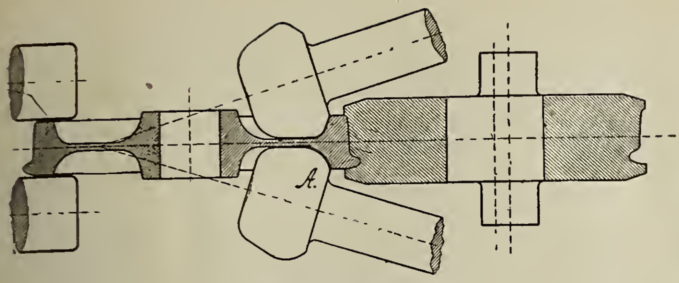


Fig. 1—Car Wheel Forging.

One works, during my last visit, were cutting the pieces from the ingot under a steam hammer. Another works have been trying a newly designed hydraulic machine with poor success. A different machine has been designed by their new engineer which I believe will answer. This is to do it by power in the way that a good blacksmith would do it by hand on a small piece.

There has been trouble with ragged edged flanges, also in trying to avoid eccentricity in the location of the hub, and in securing a true circle in the tread without lathe work. This is owing to a lack of forging knowledge. Please allow me to sharply criticise any methods of forging so plain a shape as a car wheel which leaves the truing to be done by machining. From my long experience in forging I can see no reason why a forged wheel cannot be forged as true to the circle as an iron one is cast.

As to rolling, the rim of a wheel is a continuous bar, and the utmost possible amount of work should be given it in the same way a bar or a wheel tire would receive it. The type of mill shown in Fig. 1 really does more effective work in the web than on the tread, as the rolls exert a grinding motion at A, on the inner side of the rim. The type shown in Fig. 6 is a better mill. It would leave a rougher surface on the web, but would do much better service on the tread, and like the show, the tread's the thing. Therefore, the blanks should be very heavy in the rim.

I was taught that steel articles should be finished at low temperatures, but in articles which are to be heated afterward this is not important. I have made carloads of good track chisels without paying any attention to the temperature at which the last forging was done. Of course I am not speaking of cold work, such as used to produce spring wire, etc. So far as I know none of the wheel treads now made are forged enough in the same direction. After sufficient work has been given to close the blow holes, kneading steel damages, while continued elongation helps it, owing to longitudinal seams often existing. In other words, working it crosswise and endwise is, as far as possible, to be avoided. This is the reason why the best car axles cannot be made by upsetting methods. Work for work's sake on steel is often worse than a waste of effort. We are told that seams do not exist in good steel, but in piercing a lot of selected 4 in. billets endwise with a pointed punch, thus making 5 in. rounds of them, I found longitudinal seams on nearly every side.

Correct weight is of importance. Even when starting with the proper amount of material quite a difference may be caused by scaling. In addition to scaling, the weight is apt to vary either in cutting the blank hot from an ingot, or in using individual ingots. By this method of forging, the ingot can be weighed on its way to the dies and by the simple operation of the first set of dies, and incidentally some variation of power, more or less metal can be let into the hub cavity. This cavity half filled would hold about 30 lb. of steel. The tread portion comes from the best portion of the ingot as shown in Fig. 3. For very fine work the ingot might be surfaced at its waist before forging. This general form of blank can be taken from a standard octagon ingot by forging. But if this is to be done this work should not be done by a press, but by a hammer of reasonable size, so that the work may mostly be given to the surface which is to form the tread.

In changing these dies the blank is automatically left on the bars, as the lower die descends, and the dies are changed automatically. This small sample was made by this method in which the inside dies were operated by springs, a poor way compared with controlling cylinders. But it shows to what extent a simple method of forging can be carried, though the blanks should be left much heavier in the rim before rolling. It is demonstrable that this method will not require over one-half the power used in present methods. And there is a vast difference between the cost and maintenance of a 3,500 ton press and a 7,000 ton machine, to say nothing of a 10,000 ton press.

The characteristic feature of this method is that it forges the blank for a wheel to a point ready for rolling to a finish by a series of successively acting dies of which each pair makes one impression, withdraws, and is followed by a pair next larger in diameter and so on, until all of them have been applied.

The principal involved in this process is that the metal is being gradually forced from the center, or hub, toward the periphery, by the successive action of this series of dies; beginning with the smallest diameter, near the hub, and ending with the largest, at the rim, but with the additional feature that whenever one pair of dies has performed its work the portion thus shaped is firmly held in that state by a pair of "holding down dies" automatically put in the place of the preceding ones, thus preventing any of the metal displaced by the succeeding dies to flow back into the part already reduced to the right thickness.

Comparing this feature with that characterizing the corresponding action in the operation of some other methods in which the entire mass of metal is displaced in the effort of producing the web, the metal being squeezed down in one operation from the thickness of the bloom to that of the web, in which case not only the whole of that work must be done by a single effort, but the resistance resulting from the clamping effect of the large die faces in action also must be met, which greatly increases the requirement of energy over what is needed to attain the same results by the process using successive dies.

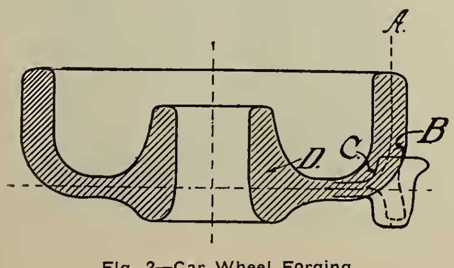


Fig. 2—Car Wheel Forging.

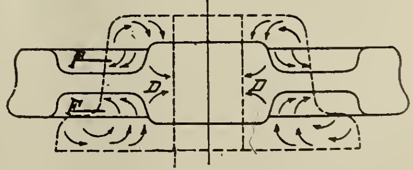


Fig. 3—Car Wheel Forging.

Were it only for the additional power required in the case of the single stroke forging, it would not signify much, because this would manifest itself chiefly in a somewhat larger fuel bill, but there is to be considered also the large bulk of the machine, its unwieldy details, the more frequent and longer interruptions of the operation due to repairs.

There are those who think that a forged wheel cannot be made to equal a steel tired wheel. I believe it entirely possible that a rim forged integral with the web can be made as good, and at less than half the cost. I feel confident that a good forged wheel, at a low cost, is certain to come.

Factors Influencing the Efficiency of Metal-Working Machine Tools*

The question of speeds, feeds and depths of cuts for all metal-working machine tools as lathes, drills, planers, grinding machines, etc, has been quite a vital one to the progressive manufacturer. This has become especially true since the introduction of high speed steel and the use of the grinding machine as a commercial tool. The efficiency of any metal-working machine is to be estimated by the amount of metal removed, and the accuracy and quality of finish.

The metal removed in a given time depends upon:

1. Quality of the material to be worked.
2. Grade and quality of the cutting tool.
3. Cutting speed, depth of cut and feed.
4. Volume and efficiency of the cooling agent or lubricant when one is used.
5. Strength and stiffness of the machine.

The quality of the material to be worked is the first thing to be studied, in order to obtain the highest efficiency out of a machine. Different metals have different characteristics. The characteristics of the metal determine the cutting tool's shape, clearance, rake, etc. There is no definite rule to be laid down by which we can be governed in deciding upon the angle of the cutting faces of the tools used, but experience has laid down certain rules that are universally followed. The quality of the material worked likewise influences the cutting speed; for certain metals there are certain limits for certain tool steels.

Likewise, the grade and quality of the cutting tool determine to a very great extent the amount of metal removed. With the metal a constant, more work can be gotten out of a "high speed" steel tool than out of the ordinary carbon steel tool. However, when one studies the question of grinding to obtain the highest efficiency the problem does not follow the general rule. The hard wheel will not necessarily remove more metal than the soft wheel. This might be the conclusion we would naturally arrive at, but the abrasive wheel question introduces some features not common to the metal tool.

Several years ago, there were several concerns looking about for a method of finishing tin-plate rolls. The old method of turning in a lathe was quite a long and tedious one, involving quite an expense. The rolls were made of chilled iron and quite difficult to machine. Several of these rolls were sent to a manufacturer of grinding machines and they were to grind them to compete with the lathe, pending an order for a grinding machine. The rolls were quite heavy, weighing about 5 tons each, being approximately 10 inches long by 20 inches diameter. The manufacturers of the grinding machine had just put out a large size machine and they were eager to test the machine out on work of this class. They made a series of experiments using hard and soft wheels, varying the wheel speed, work speed, depth of cut and feed. On the higher wheel speeds and the higher work speeds, there was a great tendency for the work to chatter, the wheel would bite the metal out of the roll regardless of the quality of the wheel used. Under these conditions, the hard wheel glazed and the soft wheel wore away too rapidly There were a great many variables that had to be considered to determine the best efficiency of the machin. The tests showed best results using a soft wheel, coarse feed, heavy cut, medium wheel speed and very slow work speed. With this condition they were actually able to produce chips from the roll, reducing the diameter about $\frac{1}{8}$ inch at a cut. Only a reasonable amount of wear was noticed in the wheel used which had a 3 inch face. There was no tendency to glaze, the wheel always being free of metal, so the abrasive material was given a chance to work to its fullest capacity.

*By M. H. Landis in the Sibley Journal of Engineering.

The cutting speed, depth of cut and feed used, determine the amount of metal removed to a very great extent. Various tests on this question go to show that the most metal can be removed in a given time by using a coarse feed, heavy cut and low cutting speed. However, the practise is different with drilling. The tendency is toward high speeds of the drill with light feeds, giving the drill a chance to clear itself of its cuttings.

The question of the volume and efficiency of lubrication is a very important one. Work produces heat and vice versa. With the removal of metal, there is a generation of heat. The heat may affect the cutting tool and likewise the material worked. Oil is used to reduce the co-efficient of friction between the tool and the metal, and at the same time carry the generated heat away. With the grind-machine, water is used to carry the heat away and to relieve the work ground of all temperature stresses, tending to distort the work. The effect of temperature stresses, is quite pronounced in the production of accurate work. In order to grind a shaft to an accurate size and keep it round, plenty of water must be used.

To take care of all stresses set up in turning and grinding it becomes quite necessary to insure stiffness and rigidity in the machine. The manufacturing public has seen a pronounced change in the design of machine tools, in the last few years. The design of the beds of lathes, frames for drills and planers was at one time the result of evolution alone. But conditions changed so very radically in the past few years that the designer has had to pay more attention to the actual stresses existing.

The accuracy and quality of finish are very important factors in rating a machine's efficiency, especially in cases where the finished product of the machine must be used as a part of another machine, where accuracy of operation is desired. For example, the high speed of a steam turbine shaft demands it to be finished to size, round and straight. A machine that cannot fulfil these requirements for you, must have its efficiency reduced as a high class machine tool.

So there are many factors influencing a machine's efficiency, that are well worthy of study. Due distinction should be made in all cases between rough and accurate work and due allowance made. This is quite hard for many people to do, as some people do not find themselves able to weigh the conditions accurately. These facts are not appreciated by a great many would-be progressive manufacturers, so time alone must rouse the conservatives out of their sleep. The time has come when efficiencies must be made a study, in order for us to compete successfully with our rivals in business

Starting Panels for Direct Current Service

The use of starting panels for direct current motors instead of a starting rheostat with separate switch and fuses, is becoming quite universal in a large number of industries, largely because the panel insures a more satisfactory location for rheostat, fuses, switch or circuit breaker, than is often accorded to some of these parts when mounted separately.

A line of starting panels has recently been placed on the market by the Westinghouse Electric and Manufacturing Co., ranging in capacity from a starter for a 1-4 h. p. motor at 110 volts to one for a 120 h. p. motor at 220 volts, including panels for 500 volt circuits. These panels are made up in several different styles and can be mounted with wall brackets or on tubular supports resting on the floor. Each panel consists of a slate slab on which are mounted the rheostat contacts and contact arm, the main switch and fuses or the circuit breaker. In the smaller sizes the resistance is mounted on the back of the panel, but in the larger sizes it is mounted separately. Five terminals are provided for connection to the line wires and the motor leads, and are plainly marked so that it is difficult for a man, even if unfamiliar with starting apparatus, to make a mistake in connecting, especially as a diagram is sent with the starting panels.

Figure 1 shows starting panel with a carbon break circuit-breaker, and Figure 2 shows a panel which has the same arrangement of face plate contacts, etc., but has a main switch and fuses instead of a circuit breaker. All sizes are provided with low voltage release devices which automatically return the contact arms to the starting position on interruption of the power.

All contacts on sizes over 1 1-4 h. p. either 110 or 220 volts are renewable from the front without disturbing any connection. In all sizes the initial contacts are protected from burning by a quick break arcing tip on the front of the panel or by a blow out coil on the rear, which prevents burning the contact on opening the circuit.

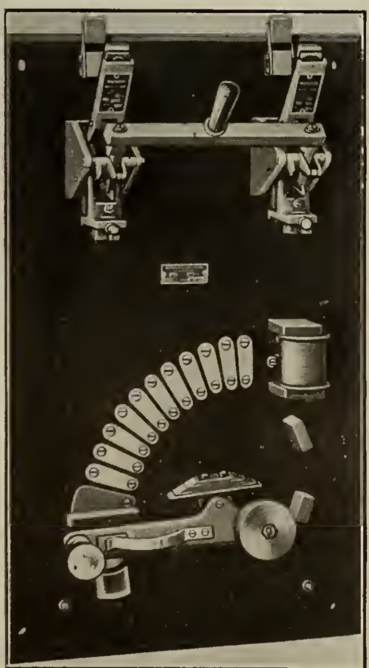


Fig. 1.

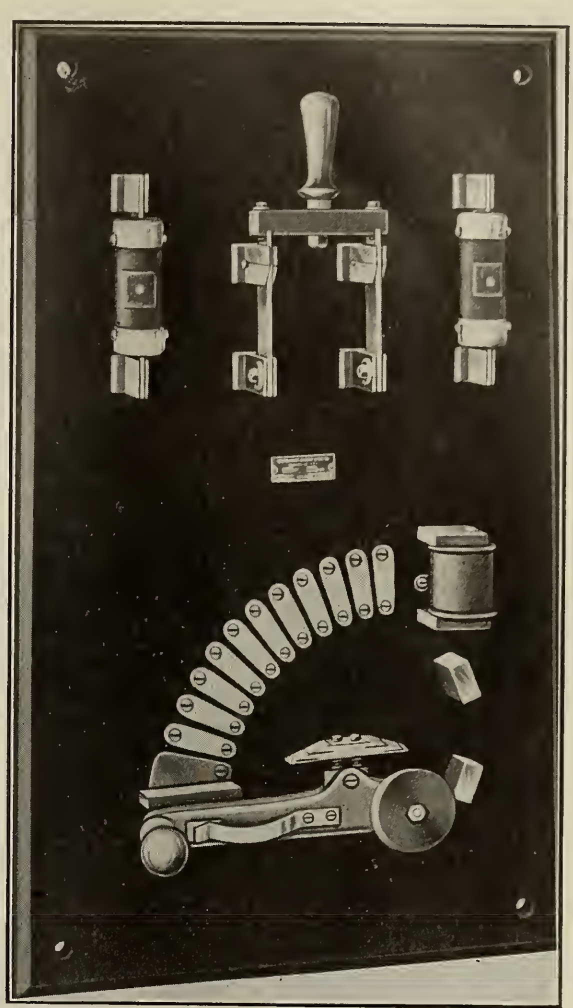


Fig. 2.

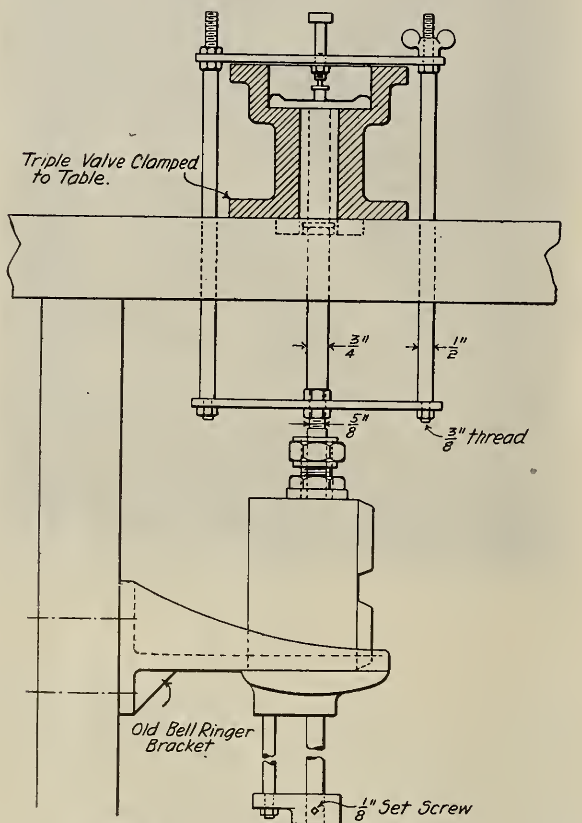
The question of whether a panel with circuit breaker or switch and fuse is preferable cannot be answered definitely to apply to all installations, each has its advantages and hence its own particular field. Fuses have a time element that circuit-breakers do not have,that is if fuses and circuit-breakers are rated to open the circuit at a certain current, a breaker will positively open the circuit as soon as the current reaches that value, even though the current remains at this high point only a very short time, while the fuse will carry currents in excess of its capacity for brief intervals. For this reason fuses may be preferable for motors that are liable to very brief overloads, especially where expert supervision of the electrical apparatus is maintained, such as in large mills and factories. A supply of extra fuses must be kept available.

As circuit--breakers can be reset in less time and with less trouble than is required to replace blown fuses, it is often preferable to use circuit-breakers where time saving is an important consideration. It is also unnecessary to carry a supply of extra parts.

On July 27, S. T. Park, superintendent of motive power of the Chicago & Eastern Illinois, conducted the first public test of his invention, the Ashton locomotive recording dynamometer, with a 3,000-ton coal train on the C. & E. I. at Danville, Ill. Officers of the Wabash, Kansas City Southern, Vandalia, Chicago & Northwestern, Rock Island and Northwestern Elevated were present. The party was taken from Chicago in the private cars of President Miller and General Manager Jackson of the C. & E. I.

Triple Valve Regrinder

The illustration clearly shows a homemade device for regrinding triple valves. The machine is the materialization of one of the ideas so often evidenced in the Aurora shops of the Chicago, Burlington & Quincy R. R. Mr. F. Zeleny, chief draftsman at this shop, is the man directly responsible for getting such ideas as this into tangible form. A locomotive bell ringer, which had been scrapped furnished nearly all of the material used in the construction. The work of the machine is surprisingly efficient and satisfactory.



Machine for Regrinding Triple Valves.

Use of Steel in Passengar Car Construction*

The steel passenger car is going through the process that the freight car went through many years ago. We looked upon the innovation, as it may be said to have been at that time, of the introduction of the freight car, with some degree of doubt. That doubt has been entirely removed and today no one, in modern railroad practice, would think of constructing any other design. From the best information I am able to gather, up to the year 1908 there were only about 100 steel passenger train cars in service in this country, and during the year 1908 about 400 were either constructed or contracted for, showing an increase of about 400 per cent. I may be slightly in error in these figures and the gentlemen will correct me if I am. This in itself speaks for the growing popularity of the all-steel passenger car and my personal opinion is that there is not the least doubt that within a very short time, either from choice or otherwise, the steel passenger car will be the only type of car constructed. If we are going into steel passenger cars I believe in the all-steel car. Don't make any composite construction of it. Be either on one side or the other. And I will carry it to the limit of the seat arms and your sash table and all other parts. The matter of the steel being cold to the touch is simply a matter of sentiment. It is new and people have got to get used to it. After a little while they won't pay any attention to it. These things are given more attention by the traveling public when they are first introduced than they are a little later. Reference has been made in the paper, and commented upon by some of the gentlemen who preceded me, to the question of cost of maintenance of these cars. We know that at the present time the ordinary passenger coach costs to maintain per car per year approximately $600. There is nothing here shown to prove that this maintenance is going to be any less. It is simply a matter of deduction. It is reasonable to assume that, the element of decay being eliminated, it will naturally follow this cost will be reduced. But we do not know at this time whether there are going to be other things develop in connection with this type of construction that are going, in a measure, to offset those parts in the wodeen car that are subject to decay. Reference has been made to the inflammable character of the material used in the interior finish of the car. I believe that, as is always found to be the case in matters of this kind, something—I don't know what—will be developed of an uncombustible character which can be applied to the interior of these cars, which presents a reasonable good appearance, and still not contain the element of inflammability. There is one matter that has been touched on in the paper relative to the large expense incurred in the change of design of various cars to suit different railroad people's ideas, and the tremendous expense incurred in manufacturing dies, templets, etc., required in the construction of this work. There is no doubt that that is a fact and anybody who has gone through any of the shops and watched the erection of these cars must be impressed with that fact. This leads to the question that the railroad people should get together on a more uniform design and sink some of their own personal ideas relative to little changes which may be a notion on their part. The steel car, to the best of my knowledge, up to this time has largely been developed not by the railroad companies—possibly with one exception —but by the steel car builders. The railroads should take this into consideration and, at least for the present, until reasonable returns have been secured on the investment, in the templets, dies, etc., try as near as possible to hold to uniform construction, accepting in a great measure, the designs of the car builders—I think that is justly due them in return for the money expended on their experimental work. It will necessarily follow that weaknesses in design will creep into these first cars, the same as was found in the beginning of building of the freight cars,—propable not to any such marked degree, as they have undoubtedly profited to a great extent by their past experience. I think this question of uniformity of design is a very important one and the railroads ought to give it due consideration in connection with the car builders. As a matter of information I should be very glad to learn any figures or have some figures presented, if such are at hand, on this cost of maintenance, by any of the gentlemen who may have same in their possession. I doubt very much personally whether such figures can be presented at this time. We are all rather at sea in that respect. Your terminal expense on a steel car, as I view it, would be as great as on the wooden car. I fail to see where there can be any saving in that direction. That brings it all up to the shop expense.

*A discussion by R. F. McKenna before the Central Railway Club.

25-Passenger Motor Car, C., R. I. & P. Ry.

There are a great many small railroads, primarily built for hauling freight, which have a light passenger traffic, that cannot be handled at a profit in the usual manner with a steam locomotive and coach. As a consequence, a mixed train service is inaugurated, which is altogether unsatisfactory, both to the railroads and their patrons. Much unfavorable criticism is excited through the local papers, by people who object to paying their money for the privilege of riding in a caboose, or coach sandwiched in between a lot of live stock. Besides, the slow schedule maintained, with the attendant long delays at wayside stations, waiting for merchandise to be loaded and unloaded, becomes monotonous.

The people demand better service, in the way of faster and more frequent trains, and the steam roads are not able to provide it with their locomotives, as the cost of operation would far exceed the gross receipts on many such branches.

Perhaps the most attractive feature of the motor car proposition is the low cost for operating these cars. Records of performance show that the average consumption of gasoline is approximately eight to ten miles per gallon with the Stover six cylinder car of sixty horse power. This means that a twenty-five passenger car can actually be operated for less than two cents per mile for fuel and lubricating oil, figuring gasoline at eleven cents per gallon. This means a car running 100 miles per day, can be operated at a cost of approximately $2.00 for fuel and oil.

The entire operating cost per mile of course depends on the amount of wages paid to the motorman and conductor, and mileage made per day. There are cars in service making as many as 110 miles per day, and the total operating cost, including gasoline, lubricating oil, repairs, wages and maintenance charges, everything on a mileage of over 2,500 miles per month, is less than seven cents per mile.

The car here illustrated was recently built in accordance with the following specifications for the Chicago, Rock Island & Pacific Ry for branch line passenger service by the Stover Motor Car Co., Freeport, Ill.:

Seating Capacity—In front compartment, when all seats can be occupied, nine to ten passengers. In main compartment sixteen passengers can be seated. Total seating capacity, twenty-five. Ten to fifteen more can be accommodated standing.

Body—Wood frame construction, built in substantial manner, yet of the requisite lightness in weight for equipment of this class. Main pillars and joists of oak or good grade of ash. Outside wainscoting of poplar. Doors and inside panels of California redwood.

Heating—Radiator coils are placed underneath seats in main compartment, which are connected to the water circulating system of the motor, and the piping is so arranged that the hot water from the engine cylinder jackets can be run directly first through the car, and the heat utilized in this manner, has proven adequate for the purpose intended. When the heat is not needed, it can be turned off.

Illumination—There are two side bracket lamps furnished in the main compartment, and one in the forward compartment, which are ample for properly lighting the car. These lamps burn acteylene gas, being connected to the storage tank, which also furnishes light for the headlight.

New Motor Car, C. R. I. & P.

Motor—Six-cylinder type. Cylinders cast in pairs. Bore 5½ in. diameter. Stroke 6 in. long. Normal speed 600 revolutions per minute. Horse-power rating 60. Valves, both intake and exhaust mechanically operated on separate cam shafts. Connecting rod bearings are of the removable and interchangeable type, the bushings being die cast within .001 of an inch under hydraulic pressure. This feature is valuable in case of repairs, as the worn bearing can be slipped out and a new one slipped in to take its place. All parts of this motor are made on jigs or templates, and thus any worn parts requiring renewal, can be easily and quickly duplicated.

Lubrication—Mechanical drive, positive feed with oil tubes running to each cylinder, and all bearings of the crank shaft.

Cooling—Motor is water cooled, and ample space is provided in the jackets, and all piping is of liberal diameter. Special radiators made of spiral tubing are carried underneath the motor, immediately back of the pilot where there is a good exposure to the wind, and the water tank carries 50 gallons of water, so that provision against overheating is entirely adequate even in the most severe service.

Carburetor—Automatic in its operation, so designed that engine can be handled with economy in the use of fuel under varying loads. Gasoline tank to which it is connected and from which the gasoline flows by gravity, contains about 45 gallons, which ordinarily is sufficient for running car between 300 and 400 miles, according to the care and skill of the operator in the use of fuel.

Transmission—Double drive friction type—so designed that car can be driven forward or backward at any speed up to the maximum. Three-point suspension frame, eliminating all possibility of disalignment of mechanism and vibration in car.

Drive—Morse silent chain 2-in. face. Double side chains are used. Noiseless in its action, it consequently runs with the minimum of friction.

Control—The car is driven either direction with simply one lever. There is also a lever for effecting the shifting of the friction wheels, from low to high gear. The speed of the motor is controlled by levers governing the amount of gasoline entering the engine cylinders, and the timing of the ignitions, as is the usual system in gasoline motors.

Speed—Ordinarily we gear these cars for speed of 30 miles per hour on level track, with full load, with the motor running at a normal engine speed. Where grades are to be overcome, gearing should be correspondingly lower.

Frame—All steel construction. Main sills heavy channel sections securely braced with cross sections, and all securely hot riveted.

Wheels—28 in. in diameter of high grade steel, strong, light and durable. Standard M. C. B. flange and tread.

Wheel Base—8 ft. 6 in., unless otherwise specified.

Axles—High grade steel 3-in. round stock.

Axle Bearings—Roller type, liberal in diameter and ample in length so as to make a good durable bearing, which permits rotation of axles with minimum of friction. Each bearing is fitted with good sized grease cup.

Brakes — Mechanically operated from engineer's cab through a system of levers which throw the shoes in and out of contact with all four wheels. This operation can be accomplished quickly and effectively. Reverse lever controlling transmission can also be used as a brake in case of an emergency.

Signal—A whistle is fitted to the exhaust pipe of the motor, and can be operated by foot pedal from engineer's cab. Car is also fitted with a suitable gong of large diameter.

The English railroads have magnificent roadbeds and light cars. The American railroads have magnificent cars and light roadbeds. In both cases the jolting is the same. English cars are divided into first and third class compartments, the difference being that the first-class seats have doilies on the backs. They abandoned the second class because they couldn't find a half-way place between doilies and no doilies. I would ride first class if they would make it ice water instead of doilies. I don't think doilies are worth a cent a mile, and apparently no one else does either.—Ladies' Home Journal.

Combined Mortiser and Gainer

In order to furnish a machine which will do heavy mortising and gaining on a piece of material without the necessity of moving the latter about from one machine to another, the J. A. Fay & Egan Co., Cincinnati, has combined a mortiser and gainer with one table to serve both.

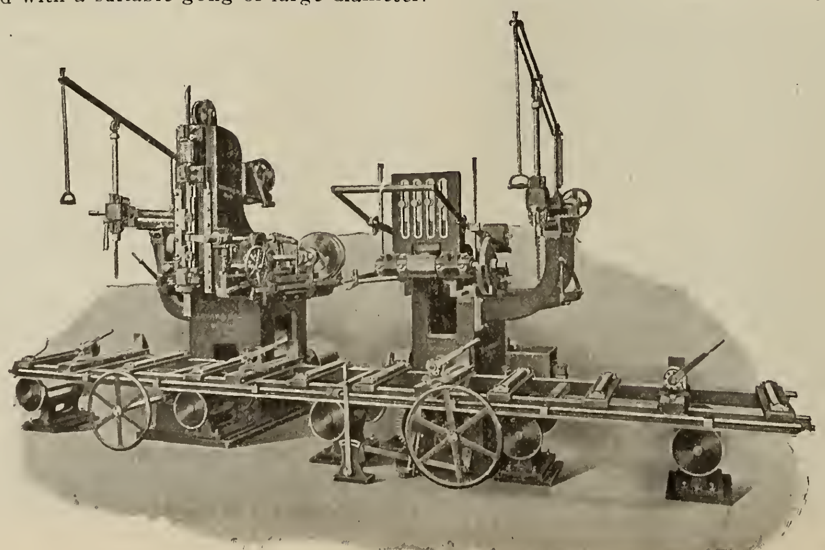
In constructing this machine the manufacturers have placed their No. 214 vertical hollow chisel mortiser and No. 150 automatic car gainer side by side with a single traveling carriage. The machine has capacity for timbers up to 20 inches thick and 24 inches wide. The two heavy auxiliary boring attachments angle to 30 degrees in either direction. They have transverse movement to the full width of the table and a stroke of 18 inches.

Box-Car Doors and Fixtures

A committee, consisting of C. S. Morse (chairman), J. P. Young, G. N. Dow, J. A. McRae and C. F. Thiele, reported to the Master Car Builders' convention on the subject of "Box-Car Doors and Fixtures" as follows:

It will be noted that the door-hanger holes have been given definite location and the door-hanger bolts have been increased from ⅜ inch to ½ inch in diameter. In place of the door guide plate there has been substituted a Z-bar which stiffens the lower part of the door and renders unnecessary the use of the lower angle-iron stiffener recommended last year. By the use of this Z-bar (Fig. 1) a shorter door-guide bracket is obtained. The bolts securing the door handle have been increased from ⅜ inch to ½ inch and lugs have been added, rendering the two screws unnecessary. The door hasp staple bolts have been increased in size from ⅜ inch to ½ inch, but the committee did not consider it advisable to increase the number of bolts.

Since the last convention the executive committee has requested this committee to consider also the subject of grain doors for box cars. Replies to the circular of inquiry indicate that the members are almost unanimously in favor of



Combination Mortiser and Gainer.

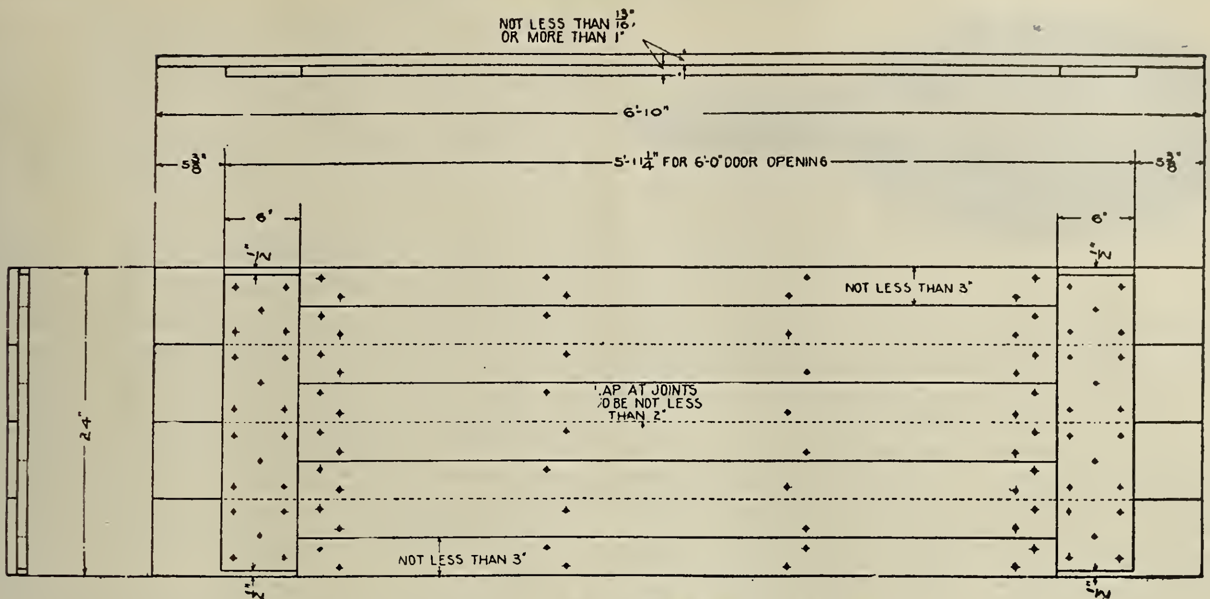


Fig. 2—Temporary Grain Door.

temporary grain doors. The committee has made a careful study of the various designs of temporary grain doors submitted and has prepared a drawing (Fig. 2) which would seem to be satisfactory from standpoints of price and efficiency. It would recommend specifications for grain doors as follows:

Temporary grain doors for box cars shall be made of two courses of lumber laid lengthwise with two end strips 23 inches long and 6 inches wide, one strip at each end of the short course. Lumber of any suitable wood may be used. The lumber may have loose or unsound knots, except at the ends of the long course, but it must be free from rot or shakes that would prevent the nails from holding securely. The lumber in each door must be of uniform thickness and

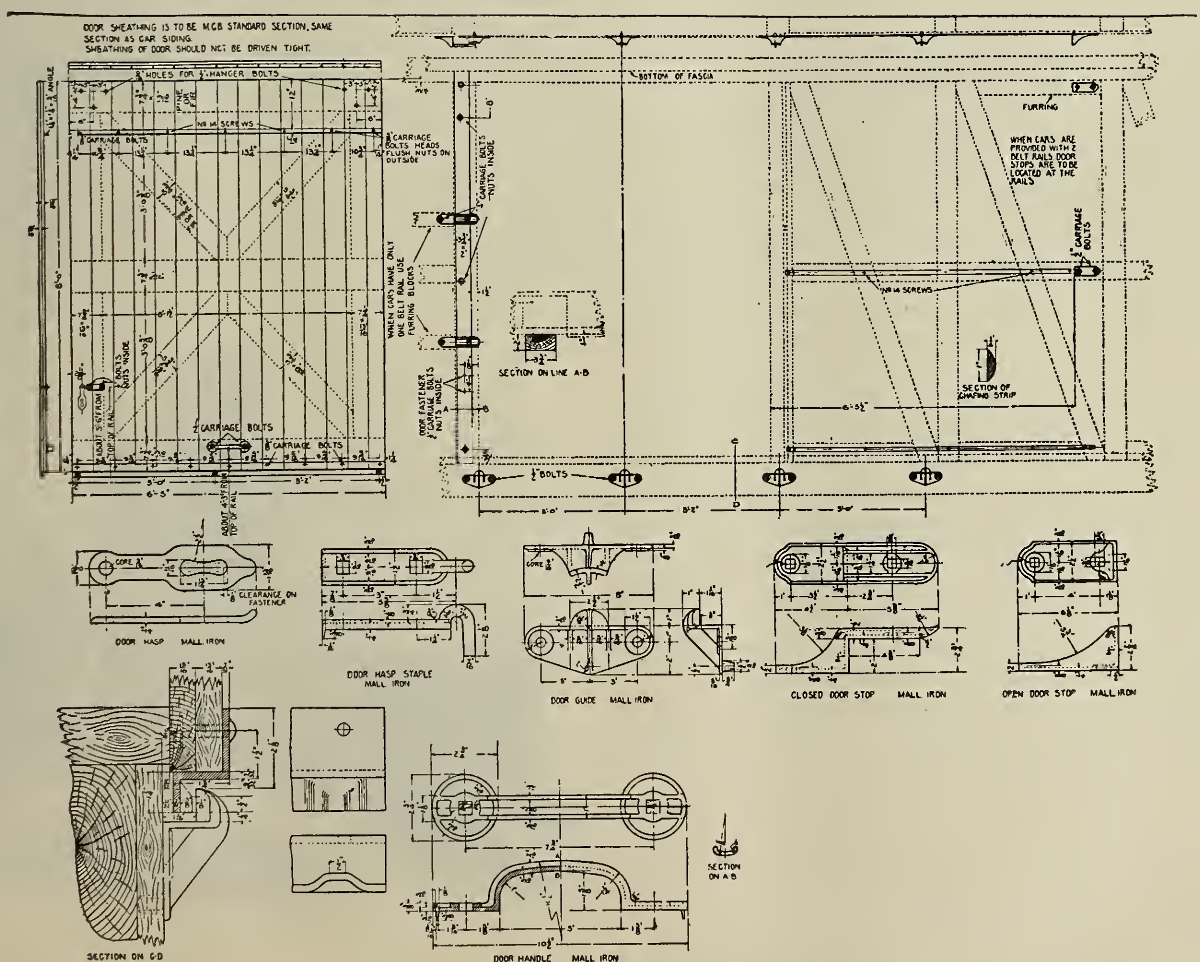
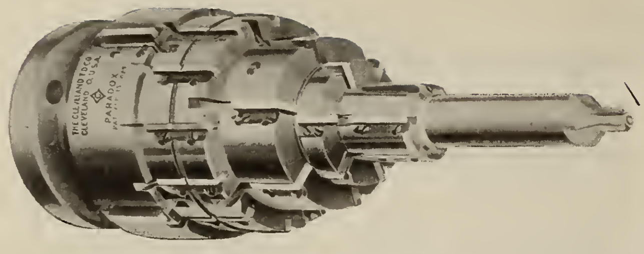


Fig. 1 Box-Car Door and Fastenings.



Tool for Many Purposes.

must be not more than one (1) inch or less than thirteen-sixteenths (13-16) inch thick and may be of any width—three inches or over—but each longitudinal joint shall be covered by a board that extends not less than two inches on each side of the joint. The short course must be nailed to the long course with four rows of clinch nails in a row and each end strip with twenty nails, all staggered and spaced as shown on drawing, driven home and properly clinched; where the width of the lumber used makes them necessary, a greater number of nails must be used to secure a strong and workmanlike job. The door, when completed, must be grain tight, with no holes or cracks extending through the door; also top and bottom edges of the door must be straight. Clinch nails must not be less than 2½ inches in length.

In order to identify the ownership of temporary grain doors and to aid in their return, the doors should be stenciled with the owners' initials. The present cost of grain doors is a very considerable item and a large saving would be made if the doors were returned to the owners.

An Interesting Tool

The illustration shows a special tool recently made by the Cleveland Twist Drill Co. for a concern in Cleveland. The tool was designed to rough-finish, ream and face all the holes in a certain class of castings, there being no less than eight cutting diameters necessary. It is 6½ in. in diameter and 21 in. long, weighing close to 100 lbs., and consists of a countersink, five reamers of different diameters, each made of inserted adjustable high speed steel blades, and finally a formed facing tool for facing and rounding the top rim. In all there are 34 inserted blades, 12 of them being of a combination double cutting type, making with the four countersink lips a total of 50 cutting edges.

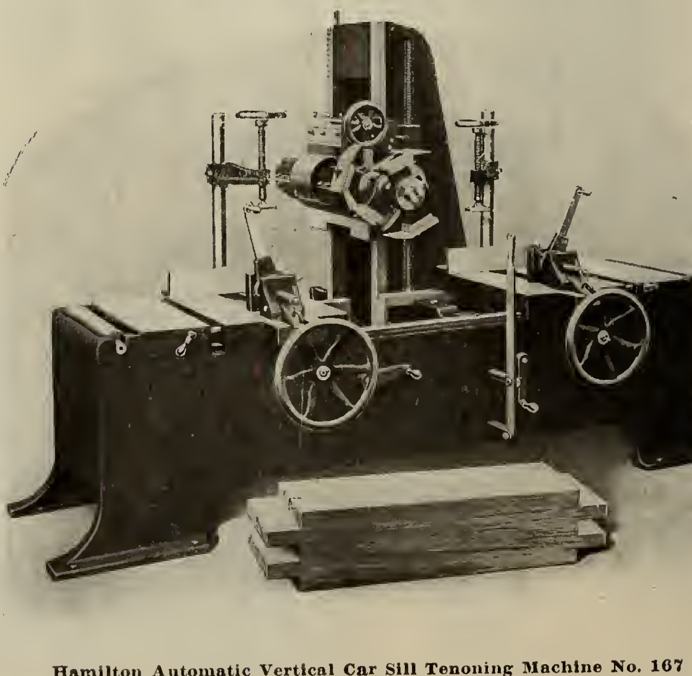
The body is made up of a cylindrical casting, holding the upper two sets of blades, into which is fitted a second and smaller body of machinery steel, turned and slotted to hold the next three sets of blades, and this body in turn holds the countersink which is made of hardened tool steel. The tool is bolted on the boring head of a large horizontal boring machine. The multiplicity of operations accomplished by this tool makes it a great labor and time saver; the high speed steel blades reduce the regrinding necessary to a minimum; but in the long run the chief economy of the tool is found in the adustable blade feature. A built up tool of like character with solid reamers would scarcely pay in service for the large initial cost involved, for when one of the reamers was worn below size the usefulness of the tool, as a whole would be destroyed. The blades, on the other hand, can be adjusted at small cost with new blades while the reamer body remains as good as ever.

Thirty-two feet below sea level is the elevation at which one of the steam shovels are excavating in the Mindi Hills, between Gatun and Limon Bay, Panama. This is only nine feet above the bottom of the channel, which is to be forty-one feet below sea level from deep water in the Carribean to Gatun Locks. The pit in which the shovels work is kept dry by four eight-inch pumps, and ordinarily these pumps are not run at their capacity. There has been surprisingly little seepage into the excavation since the work below sea level was begun, when it is considered that only a dike a few feet thick keeps the water in the old French canal from flowing into the trench, and that the bay of Limon is within two miles, and the Mindi river within a few hundred yards of the pit. During the latter part of June the shovel on the lowest level was obliged to suspend for a few days on account of the inability of the pumps to throw out the water that was coming in, but this proved to be only a temporary condition and the shovels are again at work.

Heavy Car Tenoning Machine

The illustration shows a new car tenoning machine of the vertical class recently placed on the market by the Bentel & Marqedant Co., Hamilton, Ohio. The machine is an improved car tenoner for making single, double or triple tenons on heavy material without reversing. It is useful also for cornering, beveling, smoothing, rabbetting or cutting down the sides of timbers by fixing the head and using as a planer, and is capable of rounding, moulding or tenoning ends of timbers to any desired shape by using special knives interchangeable with the regular straight knives.

The column and base are cast in one piece carrying the heavy housing in which the mandrel slides, this being adjustable from the front by hand wheel and screw within easy reach and instantly raised and lowered by the vertical hand lever. The steel mandrel is 2 7-16 ins. diameter with driving pulley between bearings, the power feed consisting of two vertical screws geared together with miter gearing, power applied by friction wheels all under full control of operator from position in front and center of machine. Steel cutterheads 13 ins. diameter have quick adjustment for different thicknesses of tenons and are quickly removable for



Hamilton Automatic Vertical Car Sill Tenoning Machine No. 167

changes. The table is 8 ft. 5 ins. long with dividing gap for passage of cutterheads and is strongly bolted to the upright column thus retaining perfect alignment. Idler rolls are provided at each end for easy movement of material. The countershaft is placed over the machine for straight belt drive to head with lower idler pulley on heavy arms for uniform tension of belt.

New Literature

CONFESSIONS OF A RAILROAD SIGNALMAN. By James O. Fagan; 181 pages, cloth, 7½ by 5 inches; published by Houghton, Mifflin Company, Boston and New York.

This book has perhaps created more comment since it appeared in October, 1908, than any publication of the kind in the railroad field. Coming from the pen of a man who holds a position in the ranks of a class of railroad employes not usually addicted to this line of endeavor, the work carries more interest than would otherwise be the case. One is inclined to wonder what furnished the incentive for the long study and hard work which this man must have imposed upon himself while still performing his routine duties as a towerman and telegraph operator. The foreword, styled "A Railroad Man to Railroad Men," contains only a partial explanation. The illustrations are all photographic reproductions of wreck scenes, each typical of a certain class of disaster. The book is a well written rebuke to the methods of the railroad employes of the United States as practiced through organization and the system of limiting the proper administration of discipline.

* * *

The American Locomotive Co., of New York City, has issued pamphlet number 10,034, entitled "Articulated Compound Locomotives." This is a reprint of a paper read before the American Society of Mechanical Engineers by C. J. Mellin, consulting engineer with the American Locomotive Co., and is a very instructive pamphlet on the subject. Following the paper are extracts from the discussion and illustrations of various type of articulated locomotives.

* * *

The Rockwell Furnace Co., New York City, has issued a large folder containing photographs illustrating its many types of coal, oil and gas furnaces and burning appliances in actual use.

* * *

Gasoline traction is becoming an important feature in certain phases of railroad work and the gasoline-driven locomotive is one of the newer developments. The Milwaukee Locomotive Manufacturing Co., of Milwaukee, Wis., in "Publication 100" gives description of the different gasoline locomotives made by this company.

* * *

"Above Board Methods in Box Boards" is a booklet in which the C. L. La Boiteaux Co. of Chicago describes very entertainingly its history and its modern strawboard mill at La Fayette. The booklet is illustrated with a number of photographs of the mill.

* * *

The railroad department of the Storrs Mica Co. of Owego, N. Y., has issued a new catalogue of the "Never Break" mica chimneys and globes manufactured by this company.

* * *

Catalogue 58 of the Wolfe Brush Co. of Pittsburg gives descriptions and price lists of the many types of brushes which this company manufactures.

* * *

"No. 930" is a leaflet issued by The Cleveland Twist Drill Co., descriptive of its high speed "Flatwist" drill.

* * *

"The Riggin blow-off valve is a winner." So says the Monarch Machine Works of Altoona, Pa., in the foreword of a booklet dealing with this valve.

* * *

The Watson-Stillman Co., of New York, has issued catalog No. 74, which takes up its hydraulic beam shear and hydraulic coping machine.

* * *

The Detroit Lubricator Co., of Detroit, Mich., has issued a small book which gives full description of the various types and sizes of the Detroit Bullseye Locomotive Lubricator, together with information relative to its installation, care and operation.

* * *

The American Blower Co. has issued three small pamphlets dealing with its "Sirocco" fans, its "A. B. C." fans and blowers and methods of ventilating by means of the same.

The Selling Side

Mr. A. Munch, manager of the railway department of The North-Western Metal Mfg. Co., of Minneapolis, Minn., has also been appointed a director and secretary of that company.

The Wolfe Brush Co., of Pittsburg, has acquired the services of Mr. I. R. L. Wiles as second vice president, in charge of railroad sales. Mr. Wiles left a position as supply agent of the Missouri Pacific System, with headquarters in St. Louis, where he had been for two years.

E. Waterman Dwight and William T. Dunning of Philadelphia have made application to the Governor for articles of incorporation for the Industrial Supply and Equipment Co., the object of which is to manufacture, construct, erect, repair, buy and sell machinery, tools, shop equipment, railroad supplies and mechanical devices of various kinds. Mr. Dwight is president and treasurer of the Chester Steel Castings Co., and Mr. Dunning is secretary of the former corporation. The company has been appointed sales agent for Pennsylvania, Delaware, Maryland, Virginia and Southern New Jersey for Thwing's Electrical Pyrometers, the Davis-Bournonville Oxyacetylene Cutting and Welding Apparatus and Newstetter's Automatic Electric Generating System for independent house lighting, in addition to a complete line of supplies for railroads, factories, contractors and coal yards, which will form an important branch of their business, under the personal directon of Mr. Frank E. Sutch.

The U. S. Metal & Manufacturing Co., New York, has taken the eastern agency for the Hutchins Car Roofing Co., Detroit, Mch.

The American Locomotive Co., New York, has let the contract for an addition to its Brooks plant, Dunkirk, N. Y., to the American Bridge Co.

The Pittsburgh-Buffalo Co., Pittsburgh, Pa., has ordered 20 seven-ton compressed air locomotives from the H. K. Porter Locomotive Co., Pittsburgh, Pa., for use in its coal mines at Marianna, Pa.

The McKeen Motor Car Co., Omaha, Neb., is endeavoring to double its output of motor cars, the present supply being inadequate. Large orders for machinery have been placed and additional floor space is seriously needed in the erecting department.

Dr. J. E. Widner, who has been connected with the Gould Coupler Co., New York, and the Gould Storage Battery Co., New York, for the past 17 years, will open an office in Chicago as western representative of the Trenton Malleable Iron Works, Trenton, N. J., for the sale of this concern's car doors, hopper bottom doors and gas engines.

The plant and properties of the South Baltimore Steel Car & Foundry Co., located at Curtis Bay, Md., just outside of Baltimore, was sold at public auction July 29. The plant has a normal capacity of 40 cars per day. It has been operated by Jos. R. Foard, Arthur G. Wellington and Howard Carlton as receivers for a considerable time.

The Carnegie Steel Co. will put the new Slick pressed steel car wheel on the market, and will manufacture it in the shops at Homestead, getting the steel from those mills. The Pittsburg & Lake Erie has been using the wheel nearly two years, and other roads have been testing it with satisfactory results. The company will continue to operate the Schoen car wheel plant at McKees Rocks, Pa.

Mr. W. A. Hopkins, formerly electrical engineer of the Wabash R. R., has been appointed electrical engineer for the southwestern district, Safety Car Heating & Light Co., with headquarters in St. Louis, Mo.

Charles R. Crane, first vice-presdent of the Crane Company, Chicago, has accepted the position of Minister to China, and the Chinese government has announced that the appointment is satisfactory to it. Mr. Crane is the eldest son of R. T. Crane, president and founder of the Crane Company. He was educated in the public schools of Chicago, and, after graduating, began work in his father's company. He began at the bottom, in the shops, and worked up until he became first vice-president in 1894, being given charge of the foreign business of the company. He has traveled widely since that time, particularly in Russia and China. The appointment of Mr. Crane is in line with the policy of the state department to try to get more commercial opportunites in China for this country, and Mr. Crane, as a manufacturer who has particular knowledge of conditions in China, was therefore selected. It is expected that he will take up his duties within a few weeks.

The National Malleable Castings Co., Cleveland, Ohio, has bought the property and assets of the Latrobe Steel & Coupler Co., Chicago, and the plant at Melrose Park, Ill., will hereafter be operated by the National company. In addition to making the Sharon, Climax and Tower couplers, it is prepared to furnish the Latrobe, Melrose, Munton and Chicago couplers, also repair parts for them all. The company, through this purchase, now has two large, completely equipped plants for the manufacture of steel couplers at Sharon, Pa., and Melrose Park, Ill.

Ball and socket joints are coming into very general use in all lines of railroad work where rubber hose is ordinarily used. The short life of the rubber hose, both armored and plain, and the great expense and annoyance caused in replacing this hose has made the flexible joint a live proposition among railroad men. The Barco Brass & Joint Co., of Chicago, has applied its patented joint to this class of work with great success. The joint itself is very ingenious in construction, the ball being surrounded entirely by hard and durable non-metallic gaskets. These gaskets conform at all times to the surface of the ball, and make a tight joint, both for steam, air, water and oils. They are made of either brass or malleable iron. The wear in this joint is all in the gaskets, the ball remaining perfectly round and true at all times. The life of the gasket is over two years, when the top gasket can be replaced by the bottom gasket of the joint, giving another long period of usage before the gaskets finally have to be replaced.

The Pittsburgh Pole and Forge Co. announces that it has sold to the Forsyth Steel Tie Co. its entire business, including works at Verona, Pa., stock on hand and good will. The new owners will continue to manufacture the same line of forgings and railway specialties heretofore made by the Pittsburgh Pole and Forge Co., but on a larger scale, and to these will be added the Forsyth steel cross tie, brake shoe key, tie plates, follower plate, brake lever and other patented devices for which the new company owns the exclusive right of manufacture.

The Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, report the receipt of an order for a carload of staybolt iron bars from the Great Southern Ry., of Spain, the second order within the year from this railroad. This company also reports that the Great Northern Ry. has specified its iron on five new locomotives and that an order has just been received for a large quantity of iron bars to be shipped to the Northern Ry. of Costa Rica.

B. V. H. Johnson, representing the Scullin-Gallagher Iron and Steel Co. in St. Louis for two years, has resigned to accept a vice presidency with the Commonwealth Steel Co. His resignation will take effect Aug. 1. Mr. Johnson is a graduate of the Manual Training School of Washington University, and is a native of St. Louis. He was for several years with the Pullman Co., afterward with the N. Y., N. H. & H. R. R., and in 1898 became assistant to Clarence H. Howard, who was secretary and Western manager of the Safety Car Heating and Lighting Co., with which company he remained until he accepted a position with Scullin-Gallagher Iron and Steel Co.

The directors of the United States Steel Corporation have declared a quarterly dividend of ¾ per cent on the common stock, thus placing this stock on a 3 per cent annual basis. One per cent was paid quarterly from September, 1901, to September, 1903, inclusive. The December, 1903, dividend was ½ per cent, and after that no dividends were paid on the common stock until 1906, when 1 per cent was paid in October from earnings of the previous half year, and since then quarterly dividends of ½ per cent have been paid. The last annual report shows $508,302,500 common stock outstanding and $360,281,100 preferred stock. The preferred stock is 7 per cent cumulative and dividends of 7 per cent have been paid since the organization of the Steel Corporation.

Universal Window Fixtures, manufactured by Grip Nut Company, Old Colony Bldg., Chicago, will be used on the following new passenger equipment to be built by the American Car & Foundry Company for the Rock Island-Frisco Lines: Sixteen chair cars, twenty-five coaches and six 70-ft. all steel dining cars.

Personals

C. W. Dieman has been appointed master mechanic of the Boyne City, Gaylord & Alpena R. R., with office at Boyne City, Mich., vice Mr. C. F. Gregory.

W. Northgraves has been appointed a roundhouse foreman of the Central Vermont Ry., with office at Brattleboro, Vt., vice J. Pitt.

L. Bragossa has been appointed master mechanic of the Charlotte Harbor & Northern Ry., with office at Hull, Fla., vice G. S. Bruce.

Jas. Kennedy and G. T. Neubert have been appointed division master mechanics on the Chicago Great Western Ry.

J. F. Killeen has been appointed a locomotive foreman and E. F. Palmer and W. S. Schlotfeldt have been appointed car foremen on the Chicago Great Western Ry.

N. M. Maine has been promoted to general master mechanic of the Chicago, Milwaukee & Puget Sound Ry.

S. S. Koehler and Geo. McMillan have been appointed shop foremen on the Chicago, Milwaukee & Puget Sound Ry.

C. J. Kennedy has been appointed master mechanic of the Denver, Boulder & Northwestern R. R., with office at Boulder, Col., vice J. C. Sauer.

J. A. Bell succeeds R. J. Turnbull as a master mechanic of the Illinois Central R. R., with office at Waterloo, Ia.

Sam'l. F. Grey has been appointed a road foreman of engines on the Peoria & Pekin Ry.

M. Abernathy succeeds Wm. P. Johnson as master mechanic of the Potomac, Fredericksburg & Piedmont R. R., with office at Fredericksburg, Va.

A. C. West succeeds D. L. Jones as master mechanic of the Quebec, Montreal & Southern Ry., with office at Sorel, Que.

P. P. Brooks has been appointed master mechanic of the Tombigbee Valley Ry., vice C. F. Smith.

Wm. McC. Grafton hasbeen appointed signal engineer of the Vandalia R. R., with office at Pittsburg.

The Pennsylvania R. R. has appointed the following section maintainers for both mechanical and electrical repairs:

Mr. I. F. Shade, Altoona; Mr. H. F. Detwill, Altoona yard; Mr. O. J. Graffius, Bellwood to Spruce creek; Mr. Blair Stouffer, Spruce creek to Huntingdon; Mr. Charles Bowers, Huntingdon to McVeytown; Mr. H. M. Flickinger, Longfellow to Denholm; Mr. W. T. Hainey, Denholm to Newport, and Mr. G. I. Leedy, Newport to Maysville.

S. S. Shields has been appointed the general air-brake inspector of the Atlantic Coast Line, with office at Wilmington, N. C., reporting to the general superintendent of motive power.

Thomas J. Burns, chief clerk, motive power department of the Michigan Central, has been appointed assistant to E. D. Bronner, superintendent of motive power, with office at Detroit, Mich.

A. V. Manchester, assistant district master mechanic of the Chicago, Milwaukee & St. Paul at Minneapolis, Minn., has been appointed master mechanic of the Chicago, Milwaukee & Puget Sound at Miles City, Mont.

C. W. Van Buren, division car foreman of the Canadian Pacific at Montreal, Que., has been appointed master car builder of the eastern lines, with headquarters at the same place.

C. Setzkorn, district car inspector of the Chicago, Rock Island & Gulf, at Delhart, Texas, has been appointed general car foreman of the Chicago, Rock Island & Pacific at Cedar Rapids, Ia.

A. W. Whiteford, shop superintendent of the Lehigh Valley at Sayre, Pa., has been appointed to the new position of assistant to the superintendent of motive power at South Bethlehem, Pa. Mr. A. M. McGill, general inspector of motive power and rolling stock, succeeds Mr. Whiteford.

R. W. Burnett, assistant master car builder of the Canadian Pacific, has been appointed master car builder to succeed Mr. W. E. Fowler, who has resigned on account of ill health.

J. F. Casey, formerly foreman of the car department of the St. Louis, Brownsville & Mexico, has been appointed to a similar position with the Fort Worth & Rio Grande.

M. F. McCarra has been appointed general foreman of the Kingsville shops of the St. Louis, Brownsville & Mexico, to succeed Mr. A. J. Conrad, who has resigned.

W. L. Allison, mechanical engineer of the Atchison, Topeka & Santa Fe., has resigned to accept a position with the Franklin Railway Supply Co., of New York. Mr. Allison was born in Salisbury, N. C., March 20, 1876, and educated at the Davis Military School in Winston-Salem, N. C. After five years of work in the internal revenue service of the United States Government, he went to the Baldwin Locomotive Works, Philadelphia, where he served in various capacities from March, 1898, to January, 1904. His service with the Santa Fe commenced at the latter date in the capacity of assistant to the superintendent of motive power. From May, 1905, to the present he has very successfully filled the office of mechanical engineer at Chicago.

J. G. Neuffer, superintendent of machinery of the Illinois Central R. R., has resigned to take effect July 31. The authority of this office is now divided between former assistants J. E. Buker, superintendent of cars, and R. W. Bell, superintendent of locomotives.

Mr. Neuffer began railroad work as a machinist apprentice at Chillicothe, Ohio, on the Marietta & Cincinnati R. R., now a part of the Baltimore & Ohio Southwestern. He served this road in the capacities of machinist, fireman, engineer and shop foreman. He entered the ranks of the officials in March, 1890, as road foreman of engines and was made a master mechanic in May, 1892. He became superintendent of motive power of the same road in December, 1893, serving in this capacity until November, 1903, when he was appointed assistant superintendent of machinery of the Illinois Central. His service as superintendent of machinery which ended July 31, dates from May, 1908.


W. L. Allison.


J. G. Neuffer.


N. P. Fenner.

To Die No More

N. Paul Fenner, president of the American Valve & Meter Co., Cincinnati, Ohio, died at his home July 19.

Mr. Fenner has long been closely associated with the railroad supply trade and his death comes as a surprise to his many friends in this field of endeavor. He was born Nov. 8, 1862, in Gallipolis, Ohio, and his early life was passed in the service of several Cincinnati retail concerns. He entered politics in that city at the age of 28, returning to commercialism at the age of 36, when he formed a company called the Washington-Goodwin Meter Co., which later changed its name to the Cincinnati Meter Co. Mr. Fenner held the position of president and general manager with both of these companies. In 1900 he organized a concern to manufacture railroad standpipes, called the Jno. M. Poage Mfg. Co., and became its vice-president. In 1902 the Cincinnati Meter Co. and the Jno. A. Poage Mfg. Co. were merged and called the American Valve & Meter Co., with Mr. Fenner as president and general manager. He held this position until June 4 of the present year, when he was compelled by ill health to resign. He grew steadily worse until his death in July. A devoted husband and father, a true friend, a kind employer, a generous, charitable, manly character, Paul Fenner will long be missed by those who knew him best.

Railway MechanicalPatents Issued During July

Device for raising car steps, 925,453—William W. Brown, Fort Smith, Ark.
Mechanism for operating car brakes, 925,466—Henry Dixon, Balmy Beach, Ontario, Canada.
Extension step, 925,476—Edward F. Howell, Wapanucka, Okla.
Carry iron for car couplings, 925,477—Charles A. Humphreys, Chico, Cal.
Car coupling, 925,544—Mike Westra, Orange City, Iowa.
Automatic air brake apparatus, 925,566—James O. Dodge, Los Angeles, Cal.
Car brake, 925,640—James W. Lamoreaux, Massillon, Ohio.
Motor truck, 925,682—Andrew Christianson, Butler, Pa.
Planer for locomotive cylinders, 925,696—William J. Hagman, Philadelphia, Pa.
Train stopping mechanism, 925,733—Jean F. Webb, Jr., New York City.
Passenger car, 925,786—Charles K. Pickles, St. Louis, Mo.
Dumping car, 925,792—Carl P. Astrom, East Orange, N. J.
Brake shoe, 925,837—Clifton D. Pettis, Chicago, Ill.
Car stop, 925,875—Robert E. Davies, St. Joseph, Mo.
Emergency brake for street cars, 925,904—Jacob Hauser, Scottdale, Pa.
Nut lock, 925,927—Edwin M. Lovell, Stanberry, Mo.
Concrete car, 925,964—Joseph B. Strauss, Chicago, Ill.
Car stake, 926,045—Robert J. Braun, Berkeley, Cal.
Box freight car door, 926,067—George W. Lohman, Berwick, Pa.
Car underframe, 926,074—Harry M. Pflager, St. Louis, Mo.
Pneumatic mail handling apparatus, 926,078—Thomas M. Riggle and William M. Baker, Tucson, Ariz.
Draft and buffing gear for cars, 926,110—Myers A. Garrett, Chicago, Ill.
Tipple for coal cars, 926,116—William L. Hansen and Alfred Hayes, Coalville, Utah.
Railroad motor car truck, 926,189—Clarence H. Howard, St. Louis, Mo.
Car stake, 926,203—Taylor H. McLafferty, Tenino, Wash.
Freight transfer device, 926,227—John L. Adam, New Orleans, La.
Draft rigging, 926,279—Walter S. Miller, St. Louis, Mo.
Car coupling, 926,295—Charles A. Schroyer, Oak Park, Ill.
Brake head, 926,299—Sven J. Strid, Chicago, Ill.
Extensible leg rest for car seats, 926,039—Hubert Witte, St. Louis, Mo.
Draft rigging, 926,351—William H. Mussey, Long Island, N. Y.
Brake beam, 926,395—Ethan I. Dodds, Central Valley, N. Y.
Car construction, 926,396—Thomas Dunbar and Lars J. Berg, Chicago, Ill.
Hose pipe coupling, 926,415—John C. Hopper and Arthur W. Bratt, Brunswick, Md.
Car body, 926,416—James M. Hopkins, Chicago, Ill.
Bolster for cars or other vehicles, 926,432—William H. Miner, Chicago, Ill.
Mine car, 926,446—Thomas W. Weaver and Clyde B. Weaver, Tunnelton, W. Va.
Railway frog, 926,488—Thomas M. Hopper, Suffern, N. Y.
Grain door, 926,494—William Jordan, Minneapolis, Minn.
Support for hand rails for locomotives, 926,506—Christian L. Nagel, Cheyenne, Wyo.
Running gear mechanism and brake apparatus for tramway cars, 926,534—Victor Zdziarski, New York, N. Y.
Brake mechanism, 926,578—Andrew Larsen, New Iberia, La.
Tender loading device, 926,619—Taylor F. Summers, Tyler, Tex.
Coupling pin lifter, 926,636—Jesse M. Arthur and John P. Birmingham, Lexington, Va.
Car construction, 926,645—Thomas Dunbar and Lars J. Berg, Chicago, Ill.
Emergency draft gear attachment for railroad cars, 926,733—George H. Gilman, St. Paul, Minn.
Car bolster, 926,752—John A. Lamont, Montreal, Quebec, Can.
Transom draft gear, 926,812—Edmund P. Kinne, Alliance, Ohio.
Car truck, 926,838—Walter S. Adams, Philadelphia, Pa.
Axle box for locomotive drivers, 926,862—Ed Fuller, Elmer, Okla.
Method of forming steel backs for brake shoes, 926,875—Harry Jones, Suffern, N. Y.
Steel underframe for railway cars, 926,897—George B. Robbins, Hinsdale, and William E. Sharp, Chicago, Ill.
Brake, 926,920—Walter S. Adams, Philadelphia, Pa.
Combined mailbag catcher and deliverer, 926,928—Jacob E. Diefenderfer, Williamsfield, Ill.
Means for reducing air resistance on vehicles, 926,971—George A. Ahrens, Mukwonago, Wis.
Car truck, 926,984—Oscar Hochberg, St. Louis, Mo.
Air brake, 927,016—Andrew J. Wisner, Philadelphia, Pa.
Car coupling, 927,138—Richard D. Gallagher, Jr., New York, N. Y.
Car stanchion, 927,288—Walter P. Scofield, Tampa, Fla.
Boiler for locomotives, 927,299—Samuel M. Vauclain, Philadelphia, Pa.
Car door, 927,332—Almerian A. Davis, Hammond, Ind.
Draft rigging, 927,333—John J. Dippel, Evansville, Ind.
Car coupling, 927,334—Charles Dobbs, Dallas, Tex.
Grain car door, 927,335—William G. Douglas, Winnipeg, and William Robinson, Selkirk, Manitoba, Can.
Draft gear, 927,382 and 927,383—Arthur L. Stanford, Chicago, Ill.
Locomotive, 927,386—Samuel M. Vauclain, Philadelphia, Pa.
Car coupling, 927,423—Adolph Moritz, Montgomery, Ala.
Car coupling, 927,453—Henry C. Crigger, Memphis, Tenn.
Track sanding apparatus, 927,459—Isaac A. Gibbs, Roanoke, Va.
Safety apparatus for motor cars, 927,475—John Barberie and Thomas J. Walsh, Brooklyn, N. Y.
Brake beam for railway cars, 927,645—William I. Eckert, South Bethlehem, Pa.
Angle cock support and lock for air brake systems, 927,686—William E. Sharp, Chicago, Ill.
Grain door for cars, 927,700—Walter S. Williams, Clinton, Ill.
Draft rigging for railway cars, 927,737—William J. Mack, Buffalo, N. Y.
Bail holder for lanterns, 927,760—Frederick K. Wright, Syracuse, N. Y.
Acetylene gas generator, 927,780—George H. Emerson, Robert D. Hawkins and Frederick T. Kitchen, St. Paul, Minn.
Shock absorber, 927,810—George C. Murray, New York.
Car refrigerator, 927,820—Wells R. Stokely, St. Augustine, Fla.
Safety device for car brakes, 927,847—Howard S. Foster, Philadelphia, Pa.
Rigger's truck, 927,879—John Ross, Philadelphia, Pa.
Brake mechanism, 927,941—Charles A. Burke, Philadelphia, Pa.
Combined emergency and throttle valve, 927,943—John G. Callan, Nahant, and Werner Johnson, Lynn, Mass.
Car truck, 927,962—Fredrich Gebhardt, Alliance, Ohio.
Knuckle joint connection, 927,978—Michael Kelly, Bloomington, Ill.
Car door construction, 927,992—Lansing Mills, Chicago, Ill.
Grain door for cars, 928,005—Lee P. Roberts, Minneapolis, Minn.
Attachment for locomotives, 928,093—Charles E. West, Little Rock, Ark.
Fire-door lock, 928,142—Richard M. McCoy, Terre Haute, Ind.
Pilot beam, 928,200—Charles C Hogen, Cleveland, Ohio.

RAILWAY MASTER MECHANIC

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CONTENTS.

Springfield Shops of the Frisco System.

Generally speaking there will be found little to criticize in the layout or equipment of the Springfield shops of the St. Louis & San Francisco R. R. as described and illustrated on other pages of this issue. The first engine was turned out after general repairs on July 18, and since that time the shops have been operating smoothly, with a few exceptions due to the stiffness of an entirely new equipment of machine tools.

There are a number of natural advantages which decided the location of the shops, chief among which, perhaps, is the quality of the soil. A pond which serves nicely as a kind of open hot well for the lower plant condensers, of the jet type, also supplies the boilers with a first class soft water feed. The pond is supplied with water from the drainage system, a good part of the water coming from the great expanse of building roofs. There is practically no seeping away of the water into the ground as the soil is almost impervious. A point in tool room and store room arrangement is the construction of the shelving in these departments. The general contractors put a great deal of thought into this feature and the result is a uniform, practical, accessible and, above all, neat arrangement of shelves and benches for all small tools. The shelving is made in standard sections or panels which permit of extension or vice versa without the necessity of any reconstruction. Temporary or partial partitions are made in the same way, the effect, after the sheet steel is painted a conservative color, is pleasing.

While locomotive and car parts undergoing repairs proceed through the shops with a minimum of travel, still there is no crowding either in machinery or in buildings and the ultimate increase in capacity will not effect this arrangement.

Self Cleaning Ash Pans.

One of the reports before the Traveling Engineers' Convention at Denver, Sept. 7 to 11, deals with the automatic ash-pan difficulty. Mr. W. C. Hayes has taken up the matter very thoroughly with the members of the association with gratifying results from those who entered the discussion at all, and only eighteen out of six hundred did. The replies indicate that the hopper bottom ash pan is becoming standard on most roads. These pans are usually operated either from the cab or from the running board and comply with the law which goes into effect next year. In some cases the pans are cleaned by means of a hot water blow off, but this method is apt to scatter cinders and grit into the bearings and is not always satisfactory. Power operated ash pan cleaners have shown good results and are in service on several roads. None of the designs taken into consideration are impeded by climatic conditions and it looks as though there would be several designs of successful self-cleaning pans to be selected from within the few months left before the law goes into effect.

For some time, it is needless to state, there has been little difficulty experienced in equipping new wide firebox locomotives with self-cleaning pans. None of these designs which gave good success in this application could, however, be applied with like success to narrow firebox engines already in service. The activity of the traveling engineers in this direction, therefore, will be appreciated. Narrow firebox locomotives will be performing service for many years yet and authorities cannot allow them to be laid up, even temporarily, on account of an unjust and prejudiced law.

The Special Apprentice.

The apprenticeship system has been a much discussed subject during the last few years and during such discussion, the question of employing the so called "special apprentice" has often come up; the term "special" being aplied to those who have had a technical or college training. Many claim that the special apprentice expects and generally receives preferences which tend to discourage the regular apprentice and that all apprentices should be started on the same footing. It is said too, that very few at the conclusion of their course care to, or are fitted to take positions in the shop.

It is a fact that the technical man is older than the regular apprentice and in as much as he has spent four years and some money in getting his training, he feels that he is entitled to preferences. And he is—when he has earned them. While he has been getting his theoretical training, the regular apprentice has been getting a practical mechanical training, also coming in contact with practical men and learning to understand the relative value of things. This last is lacking in many a graduate and from the nature and length of his training it is perhaps but natural that it should be so. Furthermore many a young man enters college or technical school, and some graduate, with a very bare conception of what sort of work he is prepared for. Consequently during the first portion of his apprenticeship, he is liable to get some hard bumps.

It has been said that the proper selection of a man to take charge of apprentices is one of the most important matters connected with the establishment of a course and it is undoubtedly true. The right man in such a position can bring his apprentices together, can advise and help them and can make each man feel that the employing company is interested in him. When such has been the case, it has been found that there is little difficulty in handling regular and special apprentices. But let that man be one who uses poor judgment in his selection of apprentices, who is not himself a practical man and who does not command the respect of the apprentices, then dissatisfaction is sure to result. An instance comes to mind of a man who has charge of thirty or forty special apprentices. He had formerly been instructor in a technical school, had little knowledge of shop work and less of men. He was unable to advise his apprentices, did not get along with the shop men and did not command respect. As a result, there was much dissatisfaction on the part of the company and the apprentices.

It seems to be true that few technical men care to take the minor shop positions at the end of their course. They regard it as a training for something higher and at the end of their time, a great many find positions in other departments of the service or in other lines of activity. As a railroad man said at one of the Master Mechanics' conventions: "The technical boy is the most desirable boy and there is room for a great many of them as apprentices, but not room for so many of them after they get through with their apprenticeship. Their attainments and ability are such that they are quickly called to higher places." The technical man, if he has that strength of character which makes a man in any walk of life, should with his special training become a valuable man to the company which employs him.

Death of Harriman.

The death of Edward H. Harriman at 1:30 p. m., Sept. 9, came as a shock to the railroad financial world, despite the fact that the end was expected for days and even weeks. Mr. Harriman was born on February 5, 1848, in a rectory at Hempstead, L. I., one of a family of six children. His education was gained in a somewhat fitful manner, two years spent at a small college, which he entered at the age of sixteen, completing his school work. At the age of eighteen, he entered a broker's office on Wall street, and was able to buy a seat on the stock exchange in 1870. By judicious trading he had accumulated a fortune of $1,000,000 at the end of ten years. He secured an interest in the Illinois Central R. R. in 1883, and, realizing the future prosperity which has since been the lot of American

E. H. HARRIMAN.

railroads, he made a specialty of railroad finances from that time to the end. Mr. Harriman's death ends the career of probably the most wonderfully active, and the best mentally endowed man the financial and industrial world has ever known.

Motor Cars.

By Francis W. Lane.

Thought the report of the committee of the Master Mechanics' Association on "Motor Cars" left much to be desired in that it was a "one-man" report and concerned itself with only one type of motor car, it nevertheless formed the basis of an interesting and valuable discussion. But its chief value as a report is the promise it gives as to what may be expected next year in the report of the same committee, taken in connection with the remarkable degree of interest that is now being displayed on so many roads in testing this adjunct to passenger equipment. Some 14 different types of motor cars are now in existence in this country and Canada and the numbers in service range from one, two or three of each type up to 47. The number of roads represented is slightly greater than the number of types of cars. The roads represented in these individual tests—though in many instances the service has passed far beyond the bounds of experiment—include the Union Pacific, Southern Pacific, Illinois Central, Erie, Chicago & Northwestern, Rock Island, Santa Fe, Great Northern, Northern Pacific, Chicago & Alton, St. Joseph & Grand Island, Intercolonial and Canadian Pacific and several others. There are 23 motor cars of the McKeen type on the Pacific Coast alone.

For the sake of clearness and at the risk of a slight repetition, the classification followed by the committee referred to may be reproduced. It divides motor cars into three classes, viz.: 1, steam motor cars; 2, internal combustion motor cars; 3, electric cars in combination with storage battery, or with steam or internal combustion motor.

Notwithstanding the fact that all of the steam motor cars that were tried about ten years ago were pronounced failures and, so far as we are informed, all of them have been withdrawn from service, and that of the two of a recent type that have been in experimental service for the last year or two one has has been returned to the manufacturers as unsatisfactory, and that the designer of another type himself condemns the combination of a steam engine and a passenger coach as radically wrong—notwithstanding this, three new types of steam motor car have recently appeared and two of them are now in experimental service. The other will be put in service shortly. But unquestionably the trend of opinion among railroad men is in the direction of favoring the gasoline engine with either direct mechanical transmission or with the intervention of the electric generator and system of control.

Th questions which the Master Mechanics' committee has formulated and upon the answers to which its report next year will be based cover the necessary ground in an admirable manner. They cover the subject from three principal points of view: First, the economic side—whether the independent motor car is a feasible and desirable proposition, whether its field of usefulness is enlarging, and whether by its means steam roads can compete successfully with electric lines in interurban business. Under this general head also belong the questions as to the probable outcome of a general adoption of gasoline-propelled motor cars relative to the available gasoline supply, the trend of the internal combustion motor of the future with reference to fuel subscribers for gasoline, and the commercial and mechanical possibilities of the use of producer gas for this system of propulsion. Second, the mechanical side—the relative practicability of steam, electricity or gasoline, and in respect to the latter the desirability of gasoline-electric motors with storage batteries, gasoline-electric without storage batteries, or gasoline with direct mechanical drive; and as to the location of the motor on the body, on the truck or on a separate removable power unit. Third, the operating side—whether an independent motor carrying passengers, or a front motor car carrying baggage, mail and express and pulling a passenger trailer in the better practice and the matter of weight as affected by the frequent accelerations and retardations incident to numerous stops.

That the motor car is a feasible and desirable proposition, or that it is thought to be, appears to be answered by what has been said before as to the numbers already in service, their distribution over the greater part of the country and the wide-spread interest in finding out exactly the service to which they are best adapted, whether their field of usefulness is enlarging is also answered to some extent by the creation of previously non-existent traffic in many if not most of the places where such cars have been placed in regular service. There has recently been published in several of the railway journals an interesting statement in reference to the local and suburban business of the St. Joseph & Grand Island in which it was stated that a motor car between St. Joseph and Highland, Kans., had averaged 75 passengers on each trip of 29 miles, mostly new business, and the results have been so satisfactory that three more larger cars have been ordered for similar service in other places in addition to regular trains.

But what appears to be one of the most satisfactory kinds of service for these cars, especially in the west, and which so far as we are informed has received little if any attention, is that which is proposed to be undertaken on the Santa Fe. As is well known, this road runs through long stretches of sparsely-populated country producing little local traffic. On this account it has been an operating necessity to perform its local business with its through trains to the great detriment of its through service and the annoyance of its long-distance passengers. Any attempt to cut down the number of stops has been promptly opposed by local interests amply supported by a railroad commission. The plan which it is proposed to put into effect in the near future is to run a motor car over a division or between important stations an hour or so in advance of its through trains between Chicago and California, clearing up all local business and transferring it, if required, to the through train at the next important or divison point. The through trains will then be required to stop only at principal stations, the local public will be better served, through passengers will be saved the annoyance of constantly entering and leaving local passengers and the road will be enabled to shorten its schedule and save the expense of frequent stops. It is calculated that a single motor car will be able to serve one division daily for trains in each direction.

Whether by means of motor cars steam roads can expect to compete with electric lines in interurban business seems to depend largely upon which of the two first occupies the field, though it is questioned if this is the best field of usefulness for the motor car. It would seem on the surface that a steam road with tracks already built might successfully discourage the competition of a parallel electric line which would be put to the additional expense of building a road. In fact, history in so far as there is any, bears out this supposition. It will have been noticed that most of the motor cars are located in the west and that though they seem to have built up a satisfactory service, there has been no serious electric competition developed and what little evidence there is is to the effect that it has been discouraged by the previous occupancy of the field by the steam roads with their motor cars. On the other hand, in the course of the discussion by the Master Mechanics' Association, the representative of the Boston & Maine reported that while it was originally supposed that the motor car should have a field on such a road, the result of an investigation indicated that there would be no economy in the inauguration of motor service on account of trolley competition. On the face of the matter the conditions on New England roads appear ideal for this kind of service—numerous short lines and branches serving a dense population and numerous large towns in which manufacturing is the principal interest; but the country served by the Boston & Maine was covered with a net-work of trolley lines before the advent of the motor car, and the New York, New Haven & Hartford operates the trolley lines which would otherwise be sharp competitors for its local business.

It has been stated that the success of the steam motor car or of the gasoline motor car depends upon operating conditions rather than on mechanical features. It is probably true, however, that the question of fuel supply will in many cases form the deciding element as between the two. In localities where a supply of oil for fuel is available at low cost, there should be less objection to the steam motor than in localities where the only available fuel is coal. This does not remove the objection raised by Mr. Vaughan, and doubtless his position will be taken by many motive power officers to the benefit of the promoters of the gasolene engine, with or without electric control; and if the development earnestly desired in some sections—a car that will work equally well in either direction, avoiding frequent Y's and turntables—shall ever be realized, it seems probable that it may come through the use of electric control.

Piping Arrangement for Steam, Air and Water Between the Locomotive and Tender.*

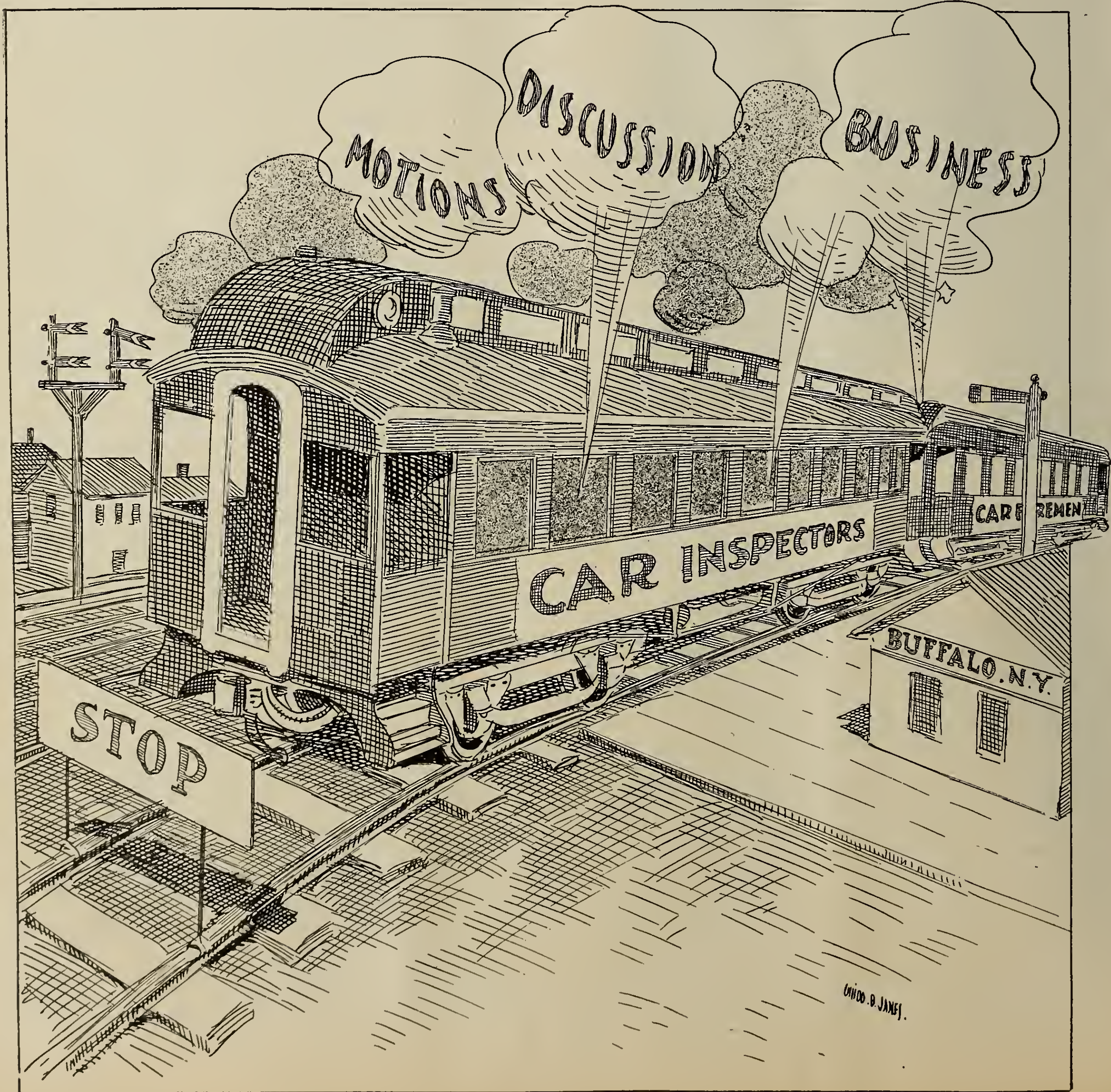
I believe that it has long been the rule that the adoption of new and useful inventions to general use took place slowly and gradually, and in the present case there is no exception to the rule, or perhaps we would not today be considering the subject of "Rubber Hose versus Metallic Connections," as that subject, no doubt, would have been disposed of ere this time. However, as it is not the aim of this association to try to determine the relative merits of the different devices alone, but to become better acquainted with the manner in which they can be operated—"To Improve the Locomotive Engine Service of American Railroads"—therefore I shall endeavor to give to you an outline, at least, of the different devices for conveying water, steam, air and oil between the engine and tender of locomotives, as well as to present some facts in regard to the success, or otherwise, that has been demonstrated in practice while operating the locomotives.

In regard to the use of rubber hose it is hardly necessary to go into details, as rubber has been the standard for many years, even before our experience in locomotive service. I will say, however, that the use of rubber steam hose between the engine and tender is open to serious objection, due to the rapid vulcanization from the heat of the steam, especially where high pressures are conveyed. The life of rubber hose, when subjected to high pressures, is limited on account of the constant expansion and contraction, which tends to work rapid deterioration.

Rubber will vulcanize and become worthless at about 250 degrees of heat.

With 50 pounds of steam the temperature is 280 degrees.
With 70 pounds of steam the temperature is 302 degrees.
With 100 pounds of steam the temperature is 327 degrees.
With 125 pounds of steam the temperature is 344 degrees.
With 135 pounds of steam the aemperature is 350 degrees.
With 150 pounds of steam the temperature is 358 degrees.

*From a report by L. B. Hart read before the Traveling Engineers' Convention, Sept. 7, 1908.



Added to the effect of steam pressures, which frequently run to 140 or 150 pounds or occasionally to 210 pounds, this brings a strain upon the hose which it cannot long sustain.

The alternative, then, is metallic flexible hose or piping. It is a well-known fact that engine failures are not only annoying to all concerned, but are also very expensive, and more so on account of the sharp competition and the density of traffic of late years upon the trunk lines of the country, which makes it desirable that they should be eliminated, if possible. There are also many more important functions performed by conveying steam, air, oil and water through the arteries between the engine and tender of locomotives, such as supplying steam for running dynamos to light the trains, as well as steam for heating them, which require high pressures, and the air pressures which formerly were 60 to 70 pounds, are now 90 to 110 pounds, all of which requires something that will not fail under normal conditions.

There is also the cost of appliances themselves, when purchasing, to be taken into consideration, but it is the belief of the writer that the saying is true, "The first cost is not the cost of an appliance for locomotives, but the first cost plus the cost of maintenance and operation is the real cost." Thus I believe that the use of metallic flexible swing joints or conduits is proving economical, although the first cost might appear comparatively high. The use of flexible metallic piping is not altogether new, as it is now in operation on many of the principal railroads to a great extent, and other roads are making tests which, I understand, are proving satisfactory.

The conduits are usually made with standard iron pipe of sizes varying from ¾ to 2½ inches, and of any length required. The sections are connected by four or five flexible joints, which will adjust themselves to every oscillation of the engine and tender, and, needless to say, are guaranteed tight by the manufacturer.

The use of metallic piping is not confined to American railroads alone, but it is used to some extent in foreign countries. In a French make there is a globe or cylinder permanently located on front of tender and rear of engine which is considerably larger inside than the straight pipe forming the connection between the two. At the opening of these cylingers there is a globular recess that contains a ball ring fitted to the outside of the connecting pipe and held in place by a gland being tapered to conform to and complete the seat for the ball ring.

Some of the railroads of England use the Westinghouse metallic couplings. I understand that these couplings are used regularly on the Baden State Railways.

In addition to the all-metallic connections there is the flexible steel-armored hose, which is worthy of mention at this time, as this has the two essentials, durability and flexibility. This steel-armored hose consists of the best quality of rubber hose closely covered with a metal armor, composed of a single strip of highly galvanized steel, wound spirally and interlocking, as shown in cut.

The armor protecting the hose externally from the elements also takes up the strain from the internal pressures that would otherwise have to be sustained by the hose itself, and the armor is so closely wound that in case of the rubber becoming porous or rotten it would maintain the hose in such a manner as would not allow it to burst, causing a complete failure, as would be the case with rubber hose.

It seems that metallic connections are inevitable. The troubles which have been experienced in the past in getting joints both flexible and tight are now being eliminated by the use of suitable gaskets. One concern uses graphite hard rubber for this purpose.

It seems that there has not been much of an attempt made to use the metal conduit for the purpose of supplying water to injectors, due possibly to the fact that there has not been so much trouble experienced with these connections, because they have to withstand only the pressure of the column of water, and no heat except while working heaters in cold weather; but I believe that they could be used, providing they were of sufficient size to insure an ample supply of water.

It is said that the metallic connections with a change of packing, say every six months, will wear indefinitely, their life being identical with that of the locomotive. The cost of the packing and the labor of installing the same is nominal.

There are other things, such as fitting the connections with automatic drain valves, especially in the steam pipe, but this is only a matter of opinion with the mechanical people.

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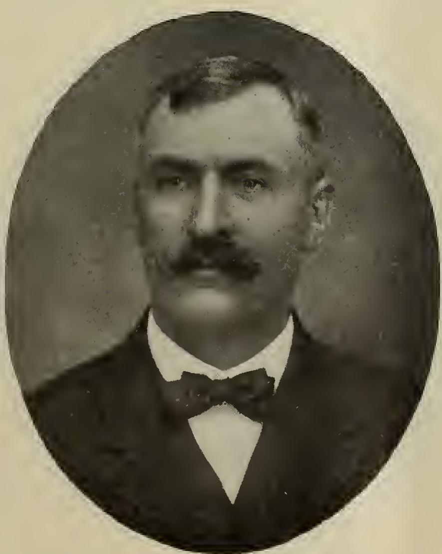

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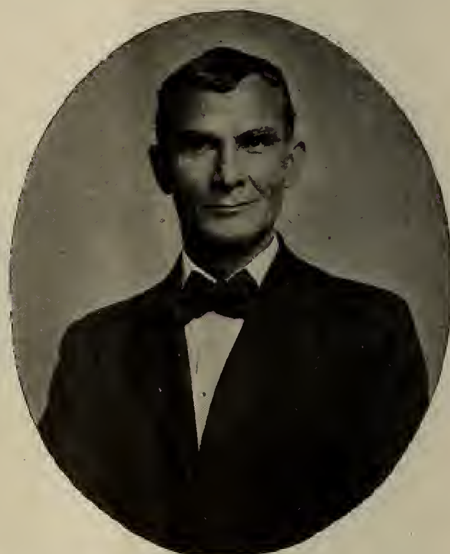

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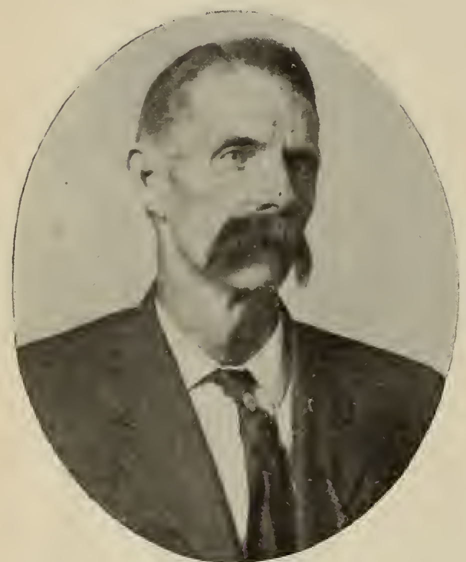

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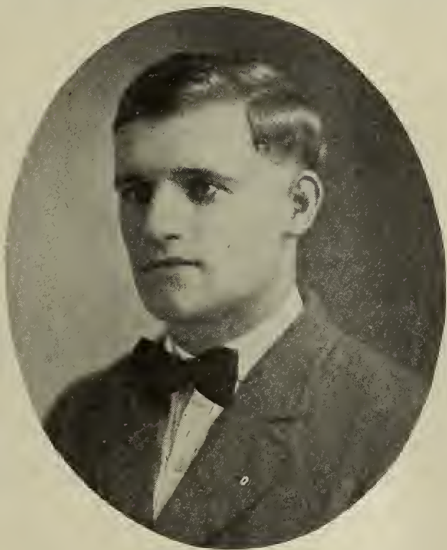

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Springfield Shops of the Frisco System.

The car and locomotive shops of the St. Louis & San Francisco R. R. at Springfield, Missouri, the plans and specifications for which were very fully discussed in the October, 1907, issue of the Railway Master Mechanic, were recently completed and opened for service. There have been some changes in the plans since the layout was designed, two years ago, as is natural, but the photographs, published herewith, show that the buildings generally are constructed according to the ideas expressed in the plans as described in the above mentioned issue of this paper. The original layout is reprinted in order that an idea may be gained of the magnitude of the work.

The Arnold Company of Chicago were the engineers and constructors of the complete shops; Mr. P. L. Battey, chief engineer of the Railway Shops Department of this firm, having personal supervision of both design and construction. The plans were worked up in co-operation with Mr. W. A. Nettleton, who was at that time general superintendent of motive power, Mr. George A. Hancock, superintendent of motive power, and Mr. M. C. Byers, chief engineer of the St. Louis and San Francisco R. R. Mr. C. R. Gray, vice-president, has taken personal interest in the work throughout and to him all plans were submitted for final approval.

requirements, being close to the machine and erecting shop, boiler and tank shop, and adjacent to the future planing mill, from which waste material may be delivered direct to the boilers. The blacksmith shop is close to the machine and erecting shop, scrap bins and future round houses, and by means of the yard crane, close to the future freight car department, via the transfer table, or by industrial tracks, it is accessible to the coach department, where the least output is required.

The tracks on the shop site are conveniently arranged for the receiving of all material, intercommunication of different departments, and for the removal of the output. A "Y" track is provided close to the machine and erecting shop, leading from one serving track on to the transfer table, for the purpose of turning engines.

The present machine and erecting shop and boiler and tank shop are served by the transfer table, which is common both to the locomotive and coach departments. This makes a very economical design up to the limit provided in the layout; future extensions being accomplished without material increase in the length of the transfer table pit.

The coach repair shop is convenient to the coach paint shop, and by means of the transfer table and industrial tracks, sufficiently convenient to the locomotive department for such material as will be furnished from this source.

General View of the Springfield Shops, Cooling Pond in the Foreground.

Arrangement of Present and Ultimate Plant.

The arrangement of the plant provides convenient grouping of the buildings included in the present construction. The growth of these and the addition of future departments will not in any way detract from its arrangements and such additions will be built as economically located from every operating standpoint as in the original plan. The buildings common to each department are located in the heart of the plant. These consist of the store house, power house and blacksmith shop.

The store house is convenient to the locomotive department, future round houses and future freight car department, and by means of the transfer table, easy access to the coach department is provided. It is immediately opposite one end of the transfer table and near the center of the yard crane runway so that material can be conveniently collected from or delivered to any building on the ground.

One of the striking features is well worth noting here: Every department can be increased about 300 per cent without unduly extending the lines of travel for men and material. This result was obtained only by a very careful study of the problem. Three hundred per cent extension is an unusual feature but is necessary in this instance owing to the combining of the two old plants now being operated, with the new one, and in addition allowing for a possible further extension of 100 per cent of the present plant before this consolidation of the plants is accomplished.

The power house is in the center of gravity of the power

The future freight car department is conveniently grouped in that the freight car repair shop and new freight car shop are both convenient to the planing mill and lumber yard; material entering yard from the east, passing through the dry kiln, dry lumber storage planing mill, new freight car shop and new freight car paint shop, in continuous unidirectional movement to completion.

The future steel car shop is adjacent to the new freight car shop, making it convenient to composite cars, and is also close to the present boiler and tank shop, thus bringing this class of work close together, the area between the latter two buildings serving as a general material yard for both departments. The steel cars will pass directly through the new freight car paint shop on the way out. The future car wheel shop is located as nearly central as possible to the freight car and coach shops by means of the transfer table and industrial tracks, providing for the handling of wheels to and from these shops and which can be efficiently accomplished. The future pattern shop is located close to the future planing mill and lumber yard, also adjacent to the future foundry, which is so located that raw material will enter from the east and pass through the departments in continuous movement. Provision is made for a future crane between the foundry and store house platform, which will provide an economical means of handling foundry supplies and finished castings.

The future oil house will be convenient to the store de-

Boiler and Tank Shop, Springfield Shops.

partment and the future roundhouse, to which it is most closely related. Other departments are not inconveniently far removed from it. The future roundhouses are located convenient to the road and also to the shop, and the future engine handling facilities will be conveniently grouped for rapid and economical handling of locomotives. Areaways are provided between tracks and buildings for the storing of material and for general accessibility about the plant, particular attention being given to the elimination of all possible fire hazard.

Capacity of Present Plant.

The normal capacity of the present locomotive department is 35 to 40 engines per month. The erecting shop contains 25 working pits. Tributary departments are in proportion. The possible ultimate capacity which can be conveniently provided is 90 pits. The present coach repair shop has a capacity of about 35 coaches per month, being provided with floor space for 22 coaches.

The coach paint shop and other tributary departments are provided in proportional capacity. Three hundred per cent future extension of this department is provided and even more can be obtained if ever desired, although the possibility of the latter is questionable. Under normal operating conditions the two departments will employ about 800 or 900 workmen.

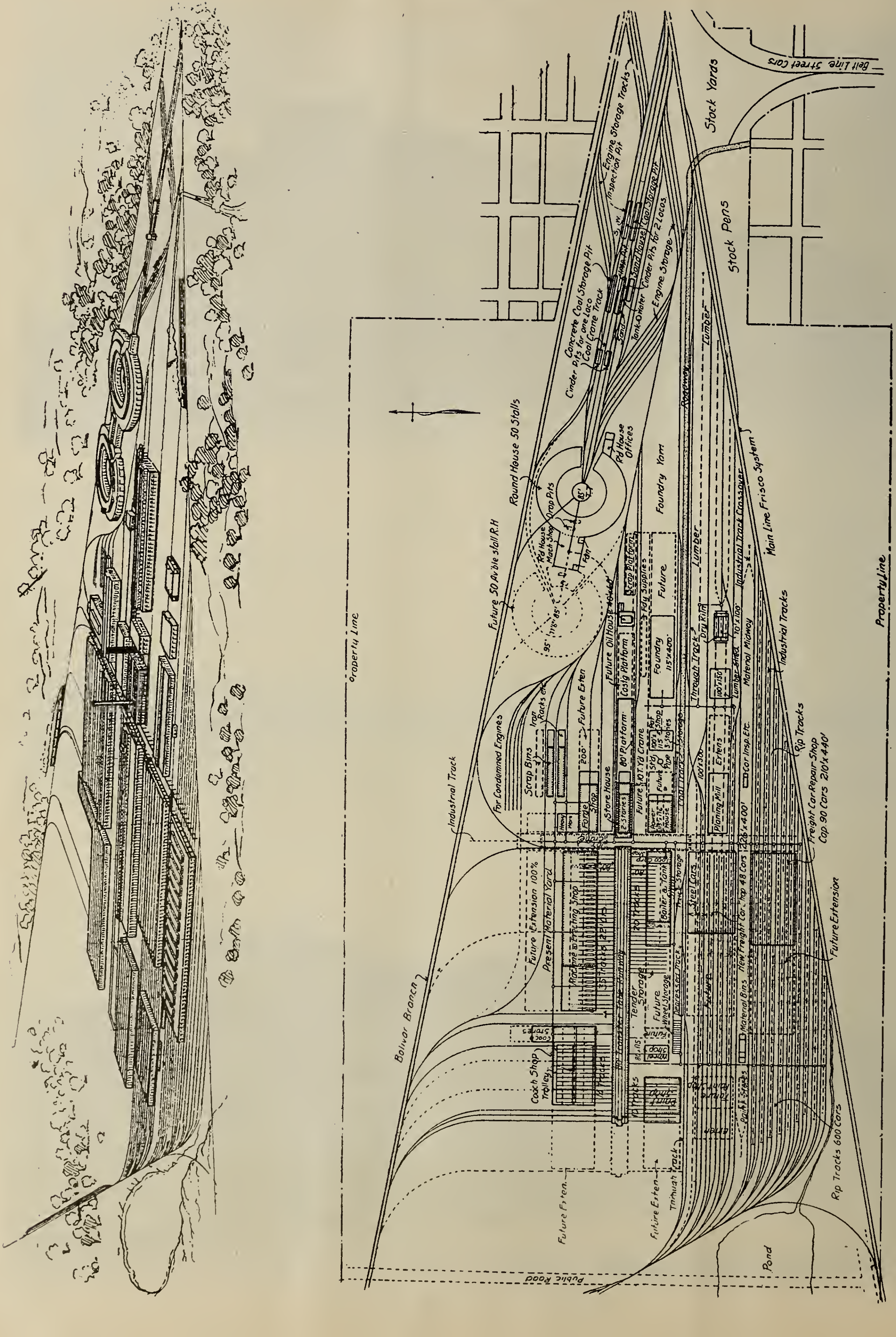
General Description of Buildings.

The buildings throughout are of brick, steel and re-inforced concrete. The only inflammable material used is heavy three-inch plank on the ground floors; heavy roof sheathing on the shop buildings, and the window frames and doors. The store house and platform, oil tanks and pump houses are of re-inforced concrete throughout, and the power house has re-inforced floors and roof.

All buildings, except the storehouse, have self-supporting structural steel frames, with hard brick curtain walls, and all window openings are glazed with one-eighth inch factory ribbed glass. Particular study has been made of the lighting of all the buildings and the result is immediately evident to all observers. An average of one-third of a square foot of window area is provided for every square foot of floor space. All buildings have parapet walls three feet high above roofs, and the roofs throughout are of 5-ply tar and gravel composition. This design materially reduces the fire risk.

The coach repair and coach paint shops have roofs of

Blacksmith Shop Exterior, Springfield Shops.



Block Plan and Bird's-Eye View of Ultimate Shop Buildings.

Locomotive Machine and Erecting Shop, Springfield Shops.

sawtooth construction, providing north light over the entire area of the buildings. Sawtooth glazing is of one-fourth inch ribbed wire glass. Cast iron ventilators with adjustable dampers are provided in sufficient numbers to insure the proper ventilation of these buildings. The machine and erecting shop, boiler and tank shop, blacksmith shop and power house, are well provided with roof monitors of ample dimensions, giving both excellent interior lighting and good ventilation.

The Store House and Office Building.

This building is in the exact center of the entire plant. It is 61 feet wide and 162 feet long; it is two stories high, the ceilings being very high to provide for the storing of materials in as economical a manner as possible.

A concrete platform extends entirely around the building for outside storage of heavy supplies and as a means of handling materials. This platform is 90 feet wide by 248 feet long and is raised 4 feet above the ground so that cars will open directly upon it. The floor space within the building is 18,500 square feet; on the platform 12,600 square feet. The cubical contents of the structure is 286,000 feet.

The first floor is largely divided for store house purposes, but it also contains a centrally located office for the storekeeper, and in the west end of the building is the general timekeeper's office for the plant.

The second floor is divided into two sections for offices and store rooms. The office section is in the west end of the building overlooking the main areaways between the shop buildings. The office for the superintendent of shops is so located as to command a view of almost the entire plant. Adjacent to his private office are located the conference room and the general office for the clerks of this department. Conveniently located is the well lighted drafting room, which connects with the blueprint room where there is apparatus for making blueprints almost instantly at any time of the day or night. A large room, connecting with the drafting room by large sliding doors, is provided for the shop apprentice classes. The partition between the rooms is entirely of glass and doors, so that the two rooms can practically be thrown together for night classes. Commodious toilet rooms are provided on this floor. All the offices are finished in natural southern pine and have floors of white maple.

The store room on the second floor is served with a hydraulic plunger elevator of 3,000 lbs. capacity, having a

The Great White Way—Transfer Table and its Pit, Springfield Shops.

large platform so as to handle bulky material. There are also two large outside doors on the second floor opening out upon concrete bracket platforms large enough to receive material from the yard locomotive crane, operating on track adjacent to the building.

The store department is equipped throughout with steel shelving and racks of a new "universal" design, made by the Lyon Metallic Manufacturing Co. of Aurora Ill, All racks are designed to suit the requirements of the different classes of materials carried and the stock is departmentized in accordance with the "Frisco" standard classification, as developed by Mr. J. R. Mulroy, general storekeeper.

The building is of reinforced concrete construction throughout. There is no wood used except in windows, and a small amount of trim. All racks and shelving being of steel, and fire hose outlets being provided at frequent intervals, practically all danger of damage by fire is eliminated.

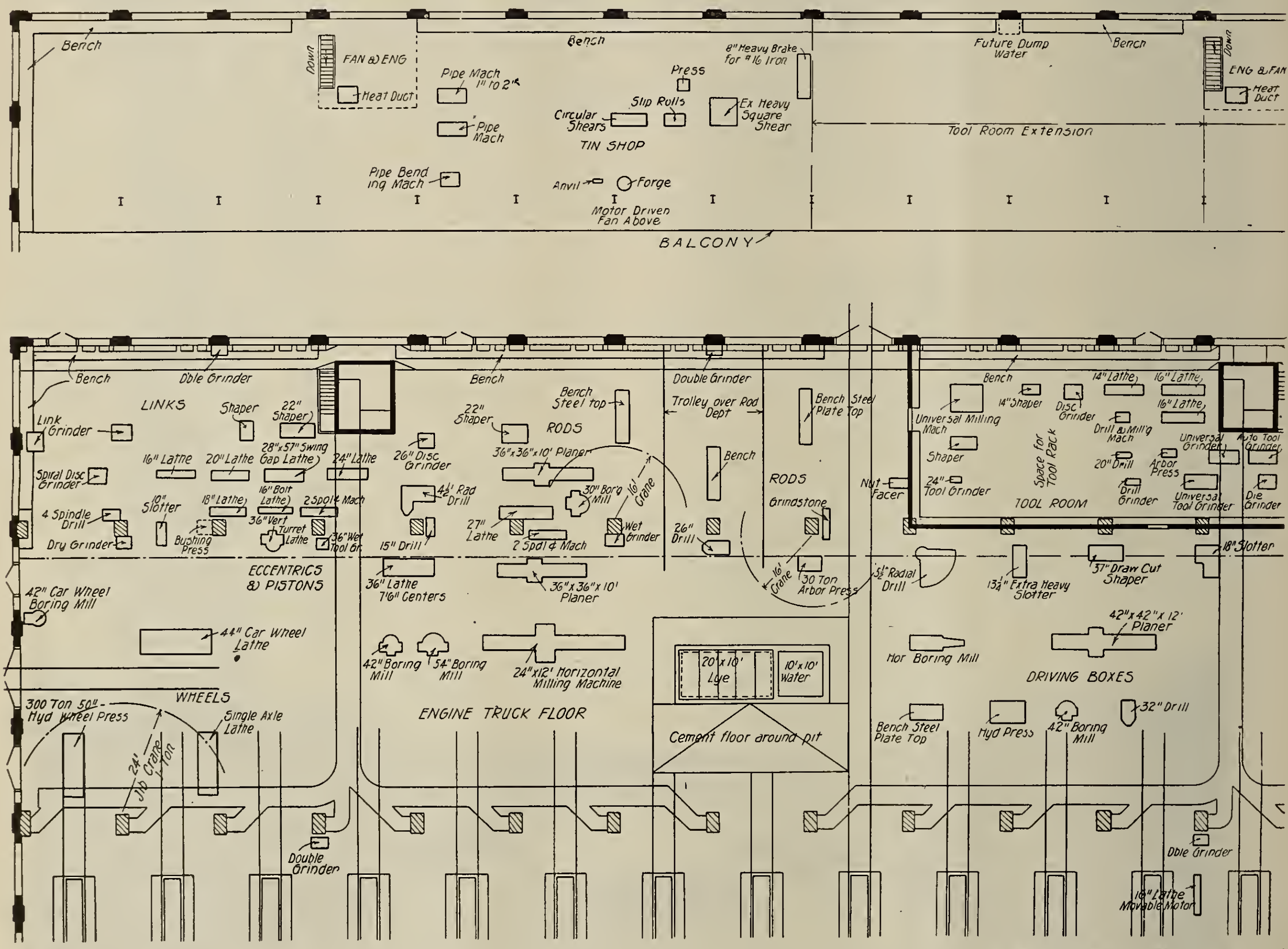
The oil carried in stock is stored in reinforced concrete tanks outside of the building and under the adjoining platform. It is drawn from the tanks by a battery of pumps, located in a room in the east end of the building, which is sealed off from the rest of the building by a blind wall, only one outside entrance being provided. This opening is covered by a steel shutter, the same as is used on all other outside doors of the store building. Storage space is provided in the fire-proof, oil drawing room for waste and other inflammable supplies.

The Transfer Table and Traveling Yard Crane.

The electric transfer table serves directly the machine and erecting shop; the boiler and tank shop; the coach repair shop, and the coach paint shop; also the future wheel shop and extensions for all departments. The table is 80 feet long, has a live load capacity of 180 tons and runs at a speed of 300 feet per minute. The pit in which it travels is 1338 feet long, or a little over a quarter of a mile. The table is operated by two electric motors, in the same manner as a double truck electric car. Current is supplied to the motors by means of a third rail system, the current-conducting rails being located on each side of the pit under a protecting ledge of the concrete retaining wall.

In order that the presence of the pit between the buildings may not interfere with the cross traffic between the various departments, concrete walkways five feet wide are located 100 feet apart along the pit. The bottom of the pit is 18 inches below the yard grade, and in order that the trucks may cross the pit easily on these walkways, an incline, or romp, 20 feet long, is provided on each side of the pit, thus eliminating any retarding of material handling due to the presence of the pit.

The electrical third rail system for conducting current to the motors on the table was developed to meet the requirements of these necessary walkways. Owing to the incline into the pit on each side cutting through the wall, it was, of course, impossible to string trolley wires continuously from end to end, and to get around this difficulty the third rail conductors were installed in sections between the walkways and connected together at these points by means of copper cables inserted in tile ducts, laid in the concrete wall under the walkways. This, of course, leaves gaps about five feet wide every hundred feet in the conductor rail, but current is supplied to the table continuously by having a pair of contacts, or "shoes," on each end of the table, which



Block Plan of Machinery in the

span these gaps, the forward shoe always making contact on the next section before the rear shoe leaves the last section of conductor rail.

This arrangement of transfer table and pit was the first of its kind ever installed, and appreciation of its many advantages is evidenced by the several similar tables which have been installed since the details of this one were first published.

A signal system is provided for the protection of workmen crossing the pit on the walkways during hours the transfer table is in operation.

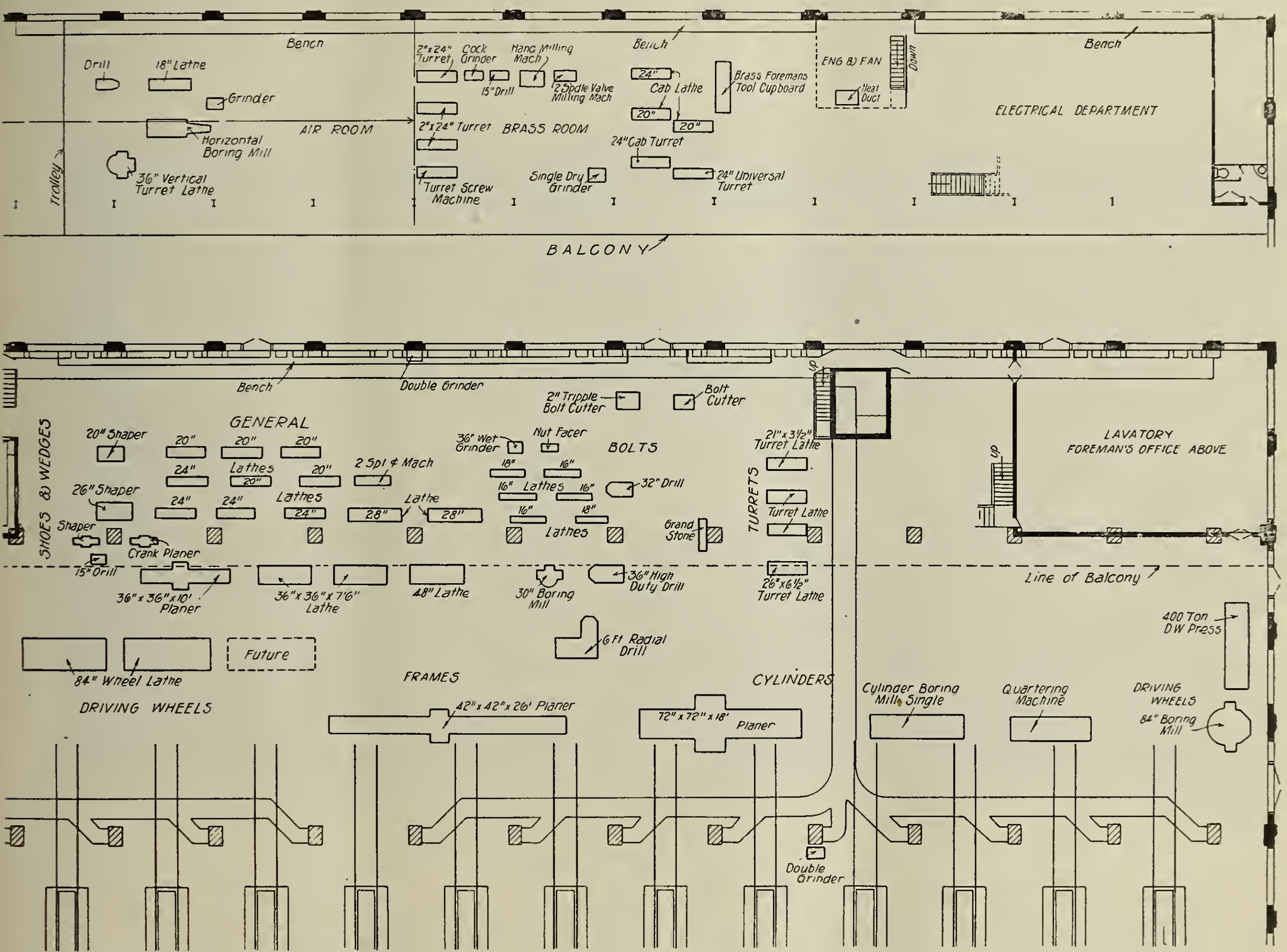
The pit rails, upon which the transfer table runs, are of 85-lb. steel, resting on steel tie plates and creosoted wood ties, 16 feet long, which are embedded at intervals of 18 inches in the concrete supporting walls. This provides heavy and permanent construction, suitable for the most exacting service.

mon carriers of primary importance in the handling of material for all departments.

The yard crane runway is of structural steel; extends north and south across the shop site a distance of 800 feet, with provision for ultimate extension to the property lines. The crane rails are located 23 feet above the yard grade, and the span of the crane is 75 feet. This provides a large material yard where heavy material of all kinds can be stored and efficiently handled.

The normal capacity of the crane is 10 tons, and it will safely carry a load of 12½ tons. It has a traveling speed of 450 feet per minute and a hoisting speed of 60 feet per minute under light load conditions. The speed is somewhat less under heavy loads.

The store house platform, which is located immediately opposite the end of the transfer table pit, extending under the yard crane runway a distance of 25 feet, allows of material



Machine and Erecting Shop, St. L. & S. F. Ry.

Owing to the length of the concrete walls, expansion joints are provided every forty feet, and to prevent any possible uneven settlement of adjacent sections at these joints, a heavy reinforced concrete mat has been placed immediately under the joint. These were placed in advance of the walls and finished on top, so that walls do not bend with the mats and are thus free to move.

The east end of the transfer table pit extends under the yard crane runway, which is located at right angles to it, a distance of 25 feet, so that material can be readily placed upon the transfer table from the electric yard crane. The transfer table and yard crane runway thus become two com-

being readily handled from the store department via the yard crane to any department north or south, and, by placing on the transfer table, to departments west.

The industrial track system, which is of standard gauge, with few minor exceptions, is so inter-connected by means of turn-tables that free movement of materials is possible to and from all departments independent of the mechanical material handling devices above outlined. The system thus serves as an additional means of material handling, as well as for emergencies. All industrial turntables are of very heavy design, mounted on roller bearings, the tables being set on concrete foundations, thus insuring permanent alignment with tracks.

The Blacksmith Shop.

The building is 102 feet wide by 245 feet long, and has a clear height under the roof trusses of 24 feet. The trusses span the entire width of the building, so that there is not a column in the building. The floor space is 24,400 square feet, and the total content of the building is 846,000 cubic feet.

Just north of the building are located the storage compartments, 30 by 150 feet, for iron, heavy forming tools, blacksmith coal, coke and charcoal. Materials into storage can be handled directly from cars on convenient tracks by hand or by the traveling crane. Hatches, mounted on wheels, are provided on the roof of the bins so that coal, coke, and charcoal can be unloaded by means of a clam shell bucket. Materials enter the blacksmith shop from the north via the industrial track system, and are worked through the various stages to completion, leaving the building at the west end en route to the locomotive shop, coach shop, or to the storehouse, immediately adjacent on the south.

The equipment consists of well selected and arranged modern tools, such as forges, furnaces, steam and power hammers, forging machines, revolving jib cranes for handling heavy materials from furnaces, and tools, large punches and shears, a very complete outfit of bolt and nut machinery, spring department, open fires and cranes for locomotive frame work, etc. All machinery is operated by electric motors, except steam hammers. The building is piped for water, steam, compressed air, fuel oil supply, air blast for forges and furnaces, and for heating. The blast system is supplied by two large Sturtevant 10-ounce pressure blowers, driven by electric motors. These blowers are connected so they may be used singly or together. The blast system is supplied throughout with automatic dampers to prevent back firing.

All forges and fires have hoods over them, with stacks carried out through the roof, so as to minimize all smoke and gases. The building is lighted throughout by electric mercury vapor lamps. The foreman has a neat office centrally located where he has an unobstructed view over the entire shop. The floor throughout is of screened cinders, well compacted, which makes it almost like an asphalt pavement.

Locomotive Machine and Erecting Shop.

This building, which is the principal one of the group, is 173 feet wide by 566 feet long, and has a total floor space of 123,000 square feet, or nearly three acres. It is divided into three bays, the erecting bay, 65 feet wide and 35 feet under the roof trusses, and the light machinery, or balcony, bay, 40 feet wide, 20 feet from the ground floor to balcony, and 15 feet from this floor to the under side of roof trusses. All of these bays extend the full length of the building, 566 feet.

The erecting bay is provided with 25 concrete engine pits, located on 22-ft. centers, each pit being 45 feet long. The pits are of massive construction, capped with heavy white oak timbers, upon which the engines are blocked when shopped. Over these pits, and carried by the heavy steel framework of the building, is a crane runway and a 100-ton (maximum capacity, 125 tons), double trolley, electric traveling crane for hoisting locomotives. There is also a 10-ton auxiliary hoist provided on this crane, and a separate 15-ton, high speed, electric crane for light work and general construction purposes. The span of these cranes is 61 feet, 3 inches. The large crane travels at 250 feet per minute and hoists at 20 feet per minute, while the 15-ton crane travels at 400 feet and hoists at 60 feet per minute.

At the east end of the building a half panel is provided in the structure, which serves to allow the 15-ton crane to run beyond the last engine pit, so that the lifting crane can be located over it. In this half panel is also located the facilities for the storing of cabs.

A series of double-decked steel racks is provided with capacity for nine cabs, any of which can be reached directly with the 15-ton crane for movement to and from any of the pits.

The locomotive carpenter shop, in which all woodwork for cabs will be done, is located immediately across the transfer table from this end of the erecting shop, so that it is very convenient to the storage racks.

Between the pits throughout the length of the erecting bay are located heavy steel-top vise benches, and steel racks for storage of pipe and other miscellaneous equipment removed from locomotives undergoing repairs. There is provided in each building column a steel compartment for the storage of heavy tools used in the erecting bay, which can be locked, tools being charged out to the several gangs. At frequent intervals electric tool grinders are located for handy use of the workmen on the erecting floor.

When locomotives are placed in the erecting shop they are set with front, or pilot, toward the outside wall and transfer table. The boiler flues, which are taken from the front end, are loaded on push cars and taken across the transfer table and into the boiler shop. After being repaired they are returned by the same route. After the shoes and wedges have been loosened up, the locomotive is picked up by the large electric crane and hoisted to clear the wheel equipment. The wheels are then rolled back on the pit track, which extends a distance of 25 feet into the central or heavy machine bay, where they are stored until removal by a 10-ton electric crane, and over this to the wheel department for repairs. Massive machine tools, each driven by individual electric motors, some tools having two or three motors, are located in this bay for work on engine cylinders, frames, wheels, tires, driving boxes and other heavy parts. All of the tools are served by the electric cranes so as to facilitate the work as much as possible.

A feature of this section of the shop is the large concrete lye vat and washing pit. An entire engine truck can be placed by the overhead crane directly into the lye vat to pickle and remove the accumulated grease and dirt, when it is removed to the adjacent washing pit and flushed off with hose and clear water. In order to prevent any possible fumes of the lye vat from contaminating the air of the shop, a sectional steel cover is provided, handled by the crane, together with an electric driven exhaust, which sucks all the fumes out through a duct leading through the roof. A concrete floor surrounds the vat, which drains into the sewer, thus insuring the utmost cleanliness.

The light machinery bay, over which the balcony is located, contains many tools for the lighter classes of locomotive parts, such as pistons, valves, valve motion, links, rods, etc. These tools are in most instances driven by bolts from a lineshaft, which is divided into short sections, or groups, each group driven by an electric motor. The shaft is so aligned, however, and provided with flanged couplings, that in case of a motor becoming disabled, the inserting of a few bolts will connect two or more sections together for such emergencies. The tool room is located near the center of the building in this bay. This department is separated from the rest of the shop by woven steel wire partitions and contains fine tool making machinery, as well as a complete equipment of steel racks and shelving for the storing of tools. Along the outer wall, where the best north light is available, almost a continuous line of work benches is located. These benches are covered with steel tops and provided with vises and many lock drawers for keeping the tools of the workmen who are on this class of work.

On the balcony floor, which is of reinforced concrete, capped with hard pine, so as to make it easy on the feet of the workmen, is located the tin and copper shops, the pipe shop, the air brake, injector, electric headlight, and boiled lagging departments, as well as other classes of light work. A balcony floor ledge, extending out under the crane of the heavy machine bay a distance of seven feet, makes it possible to pick up an article anywhere on the floor of the heavy machine bay and place it on the balcony at any point in the shop. In the balcony are also located the large blast fans for the heating system. There is considerable machinery located in the balcony in the brass working and pipe departments, all operated by electric drives, either in groups or with separate motors. Work benches extend the full length of the building along the north wall.

The building is piped throughout for water, steam, compressed air and heating. It is lighted artificially by means of electric mercury vapor lamps, while the natural lighting is unusual for a building of its size. Windows are largely pivoted or hung so as to provide the best of ventilation. Mechanical assistance in the ventilation is also provided in the three large blast fans which change the air once every thirty minutes. Air chambers and flues are arranged so as to receive fresh air from the outside, as well as the recirculated air of the room, mix in the proper proportion and then distribute over the entire building through underground concrete ducts. Both suction and discharge ducts are provided so as to control the movement of the air to a nicety and thus prevent local drafts and dead air pockets, which are objectionable to the workmen.

The boiler and tank shop proper, consisting of two bays 280 feet long, is served over the entire area by electric traveling cranes. The main bay, 65 feet wide and 38 feet under the roof trusses, contains 14 tracks on 20 ft. centers for assembling work on boilers and tanks. Over these tracks is located a double trolley crane of 30 tons capacity. At the east end of the bay next to the fire wall is located the riveting tower, designed for installation of future hydraulic riveting stake of large size, to do the heaviest class of work.

The machine bay, immediately adjacent to the assembly bay, contains many powerful tools for forming and finishing of boilers and tanks, such as annealing furnaces (one being large enough to heat heavy plates 12 feet square), bending rolls, rotary bevel shears, splitting shears, plate punches, flange punches, riveters, radial drills, etc. Nearly all are driven by individual electric motors; the remainder are arranged in convenient groups.

In the center of the shop, and on the machine-bay side, is located the large blast fan of the heating system, purposing the same function as those described under the "machine and erecting shop."

General Interior View of Blacksmith Shop, Springfield Shops.

All of the electric mains supplying motors and lights are located underground in tile and concrete ducts, easy of access for the present and the future, and greatly reducing the amount of exposed wiring to collect dust.

Locomotive Boiler and Tank Shop.

This shop, which is tributary to the erecting shop, is located in a building immediately across the transfer table from it. It dimensions are 118 feet by 347 feet, with a floor space of 39,000 square feet, and a total content of 1,742,000 cubic feet. At the east end of the building, 60 feet, extending the full width, is partitioned off by a heavy fire wall to provide space for the locomotive carpenter shop. In this department is done all wood work upon engine pilots, bumper beams, cabs and tank frames. Electric motor-driven groups of woodworking machinery are located on one side of the shops, and the other is devoted to floor work and assembling.

The building is piped for water; high pressure steam testing lines; an abundance of compressed air; fuel oil supply for furnaces; air blast system for forges and furnaces, and for heating. It is ligbted artificially by electric mercury vapor lamps, and numerous receptacles are also provided for portable incandescent lamps for use inside of the boilers. etc.

Coach Repair Shop.

This building contains 22 stalls for coach repairs; cabinet shop and upholstery department. It is 209 feet wide by 304 feet long, with 20 feet of clear height under the roof trusses, and a total floor space of 52,000 square feet. The roof is of sawtooth construction, all glass facing the north. so as to secure absolutely unifrom lighting over the entire building.

The cabinet shop and upholstery room are located in the east end of the building. The cabinet shop is equipped with a full complement of workworking tools, and in addition, numerous cabinet makers' benches of spacious dimensions. A long glue drying room is provided with special steam coils arranged to secure any desired temperature. The upholstery department is adjacent to the cabinet shop, and is provided with upholsters' benches; separate rooms for cleaning and renovating work, and a balcony for sewing machines and finishing work. The general foreman's office is located at the east end of the building connecting with both of the above mentioned departments.

The coach repair shop proper is arranged for two coaches on each track with a common bay between them in the center of the building. Over this bay is located a 10-ton electric traveling crane operated from pendant control cords at the floor. Under this crane runway all truck work will be done, the trucks being pushed forward under the crane after a coach is raised on blocks.

A complete system of permanent steel scaffolds for all coach stalls is provided. All scaffolds are adjustable for any height and distance from the car desired, and when the scaffolds are not in use, they may be quickly pushed up out of the way, clearing the floor seven feet, all vertical supports being counterweighted.

The building is piped for water, compressed air and steam, where is is needed, as well as for heating. It is lighted by incandescent lamps, with the exception of the truck bay and cabinet shop, where machinery is located, these being lighted by mercury vapor lamps. All machinery is driven by electric motors, those in the cabinet shop being arranged in groups, and all others are provided wtih separate motors.

Coach Paint Shop.

After the coaches have been put into shape for final painting, varnishing and refitting, they are transferred by the transfer table immediately across from the coach repair shop to the coach paint shop. This building is 183 feet by 184 feet, with a floor space of 32,600 square feet. It ocntains 16 stalls, each stall being provided with a concrete pit, 81 feet long and 8 inches deep. The heating pipes are arranged in these pits as they will assist in the drying of the varnish. The building also contains separate corners for paint mixing, brass cleaning, plating and polishing. These rooms are cut off from the main portion of the building by fire walls.

At the east end of the building a large space is also set aside for sash work, where very complete facilities are provided in this class of work.

The paints and varnishes used in this building are stored in underground tanks, from which pipe lines lead to a battery of measuring pumps, located in the mixing room, where supplies are delivered to the painters.

The same system of counterweighted adjustable adjustable steel scaffolds is provided in this building as in the coach repair shop.

Pit Bay of Erecting Shop, Springfield Shops.

The natural lighting of this building is a notable feature due to its uniformity of distributon, saw-tooth constructon being used over the entire area. The floor throughout is of finished concrete and well drained to bell traps located at intervals both in and between the pits.

The artificial lighting consists of incandescent electric light located between the tracks and provided with long cords for interior work on coaches. The brass polishing machinery is driven by electric motors, and the building is piped throughout for compressed air for paint burners, frequent hose valves for water service, and steam heating.

Power House.

The power house contains the complete central power station for the new shops and also furnishes power to the old north shops. The building at present contains 2,000 horse power in boilers, but it is designed to house 3,200 horse power and provision is made for further development when it becomes necessary. The building is 118 feet by 145 feet, with a total floor area of 30,000 square feet; it is fireproof, being constructed throughout of non-inflammable materials, with the exception of the window frames and doors.

It is subdivided into three rooms by brick fire walls, the turbine and boiler rooms being on the same level and each being provided with a 10-ft. basement well lighted and ventilated. The chimney is of reinforced concrete, 10 feet in diameter by 205 feet high. It is provided with high-class lightning rods and conductors. The smoke flues connecting the boilers with the chimney are of concrete and located in the basement of the building.

The five boilers are each 400 horse power of Babcock & Wilcox water tube type. Space is provided for additional 400 horse power boiler. The boilers are provided with superheaters of the same make. The boilers carry a steam pressure of 150 lbs., and the superheaters raise the temperature of the steam an additional 100 degrees. Each boiler is provided with a Green traveling link grate. These grates, or stokers, are operated by lineshaft in the basement, which is driven in turn by duplicate auxiliary engines. A system of narrow gauge tracks and turntables, an electric elevator, and manually-operated bottom dump coal and ash cars, have been installed. This equipment is so arranged that the coal and ashes can be handled by one man at a low expense. There is little about the equipment to deteriorate, as all storage pockets are of reinforced concrete. All coal and ashes are handled by gravity, with the exception of the movement over the electric elevator, which raises both coal and ash cars to the overhead bunkers. The storage capacity for coal in the main bunkers is 350 tons. Coal may be unloaded into these bunkers directly from bottom or side dump standard coal cars, or may be unloaded from gondola cars either directly by hand, or by means of clam shell bucket and locomotive crane on adjacent track. The storage capacity in the overhead bunkers is 320 tons, from which point coal flows by gravity directly into the hoppers on the stokers.

These bunkers are of a new and novel design patented by the Brown Hoisting Machinery Co. of Cleveland, Ohio. They are of the suspension type, the material, which is of steel and concrete, hanging from the supports in the shape of a parabola; thus placing the materials so as to throw practically all the steel in tension, and in this way take advantage of the maximum strength of the material. The shape of the bunker is particularly advantageous from the standpoint of discharging all the material in the bunker through the outlets by gravity; that is, there are no pockets from which the coal cannot easily flow.

There is also provided beneath the main bunkers emergency coal pockets, in which can be stored an additional 400 tons of coal, which can be handled almost as economically to the boilers as in the regular storage compartments. This coal, however, must be unloaded from gondola cars by hand through convenient steel coal doors. It is not intended to use the lower pockets for regular coal storage, and the space is therefore available for general storage of miscellaneous materials such as are used about the plant. The overhead ash bunker has a storage capacity of a carload of ashes. The ashes are delivered directly to this bunker by the electric elevator, from which they are discharged by gravity directly into a car on the coal storage track below. The small coal cars which are used for transporting coal from the lower storage to the overhead storage each have a capacity of one ton of coal.

A pump and piping room, in which particular attention has been paid to the ventilation, is provided between the boiler room and the turbine room of the plant. This room

Interior View of Storehouse (Note the Shelving).

contains a 2,000 horse power Webster open type feed water heater; two American Steam Pump Company's boiler feed pumps of 2,000 boiler horse power each; two large vacuum pumps, which return the water of condensation from the general heating system to the feed water heater, and thus return the condenser water to service. There are two engine-driven centrifugal circulating pumps of 2,440 gallons capacity per minute, which furnish cooling water for the condensing equipment, and two compound fire and service pumps, each of 1,000 gallons per minute capacity, which provide general water service at a pressure of 65 lbs. per square inch, and, in case of fire, 100 lbs. per square inch. This room contains practically all steam, exhaust and water piping for the entire plant. It is arranged for easy access to all valves and other parts by means of steel runways.

ducts in the basement, which connect with a protected opening to the exterior of the building.

The turbo-generators, which are of the Westinghouse-Parsons type, are of interest, due to certain features of design, which are along very modern lines. Each unit has a capacity of 500 kilowatts, delivering three-phase, sixty cycle current at 480 volts. Generators are of the revolving field type, speed being 3,600 revolutions per minute. In this type of apparatus the energy is derived by allowing steam to expand from high pressure and temperature to low pressure and temperature through a series of alternately moving and stationay blades, or vanes, termed respectively the rotor and stator. The rotor vanes are carried on a series of drums of different diameters mounted on steel shaft. Stator, or stationary blades, are placed inside the

Tool Bay of Boiler and Tank Shop, Springfield Shops.

The turbine room contains two 500 kilowatt Westinghouse turbo-generators; one 300 kilowatt rotary converter; one 30 kilowatt Westinghouse engine-driven exciter; one 30 kilowatt motor-driven exciter; one 13-panel switchboard about 40 feet long; three 150 kilowatt transformers for transmission line to North Shops; one 2,000 cu. ft. Laidlaw-Dunn-Gordon compound, two-staged air compressor. The room is also designed to provide for another 2,000 cu. ft. air compressor and two more turbo-generators, one 500 and one 1,000 k. w.

Each of the turbo-generators and the air compressor is provided with a barometric condenser, which gies a vacuum of 28 inches. All pipe and electrical connections to the apparatus are below the floor, where an ample basement is provided. In addition to other auxiliary apparatus, located in the basement, is the oiling system for machinery room. Fresh air for the air compressor and for the ventilation of the turbo-generators is provided in the shape of suitable

casing, fitting closely around the drum; the steam, being admitted through a suitable governor at the small end of the casing, increases in volume progressively through the stages to the large drum, where it is exhausted into the condenser. The successive impact of the steam on moving and stationary blades imparts a rotary motion to the shaft, which entends through the casing to drive the generator. The relation between moving and stationary blades is such as to produce an effect similar to a simple steam nozzle and a wheel carrying a series of vanes.

Water System.

Water for the plant is obtained from two sources and provision is made for a third. First, three 8¼ inch deep wells, 900 feet deep, delivering 150 gallons per minute, by means of motor-driven "Downie," double-acting, deep well pumps. These pumps discharge into a gravity pipe line leading to a cistern in the pump room of the power house, called the "well water cistern." The second source of water supply is a pond covering 15 acres, with a capacity of 20,000,000 gallons. This water is impounded in an area arranged for the purpose on the shop property.

The rainfall from over 200 acres of ground on the site, including 7 acres of roof area, is drained into the pond by means of a storm sewer system. An 18-inch tile gravity pipe line conducts water from the pond to a cistern in the power house, adjacent to the well water cistern. A pipe connection is provided between the well water cistern and the pond water cistern, which can be regulated to suit requirements.

The water used for general service and for fire purposes is pumped from the pond water cistern by means of two compound, steam pumps of 1,000 gallons per minute capacity each, into a 100,000 gallon, elevated, steel water tank on a steel tower. The top of the tank is 160 feet above the ground. Water is distributed from this tank by means of a network of cast iron underground mains, covering the entire shop site, and serving all departments. The gravity pressure on water system with tank about full is 65 lbs. per square inch.

There is a separate underground distributing system for drinking and lavatory purposes, serving all departments, water for which is taken directly from the cold well water cistern. Condensing water for the steam turbines and air compressor is taken from the pond water cistern by means of two centrifugal circulating pumps of 2,440 gallons per minute capacity each. Water discharged from the hot wells of the condensers flows by gravity into the main trunk line storm sewer, thence back into the pond, which, due to its large surface exposure, cools by evaporation ready for recirculation.

It has been found by experience in this district that the normal evaporation from a pond of this character just about equals the rainfall, but while the exposed surface of the pond is about 15 acres, the rainfall from over 200 acres is saved. It is estimated that the rain water thus provided will furnish a large part of the requirements of the plant for steam and general purposes, thus reducing the pumping from the deep wells to a minimum. The pumps in the power house are so cross-connected and provided with valves that, in case of emergency, service can be interchanged on circulating, general service and drinking water pumps. In case of fire the two 1,000-gallon per minute pumps can take water direct from the 20,000,000-gallon pond, or from the 100,000-gallon elevated tank by a system of valved cross connections, the pressure being raised to 100 lbs.

There are 25 outside fire hydrants located on the shop site at suitable distances from the buildings, each hydrant being provided with two 2½-inch hose connections. Inside of the buildings is provided a total of 97 2½-inch hose valves, 52 of which are provided with hose rack and 50 feet of Underwriters' fire hose and nozzle.

Cold water direct from the deep wells is piped underground throughout the various departments, and numerous sanitary drinking fountains are located in all the buildings, so that the workmen anywhere have only to go a few steps for water.

Interior of Coach Paint Shop, Springfield Shops.

Heating System.

All the buildings are heated by means of the exhaust steam vacuum system, utilizing exhaust steam from the power plant units (in the winter time running non-condensing). The exhaust steam is conducted from the connection at the power plant by means of a large pipe line located in a concrete tunnel connecting with the various buildings. This tunnel is 7 feet wide by 5 feet high. In addition to the heating pipes, lines for high pressure steam, compressed air, and condensed water returns are placed in this tunnel. All of the pipe lines are arranged for easy access and inspection.

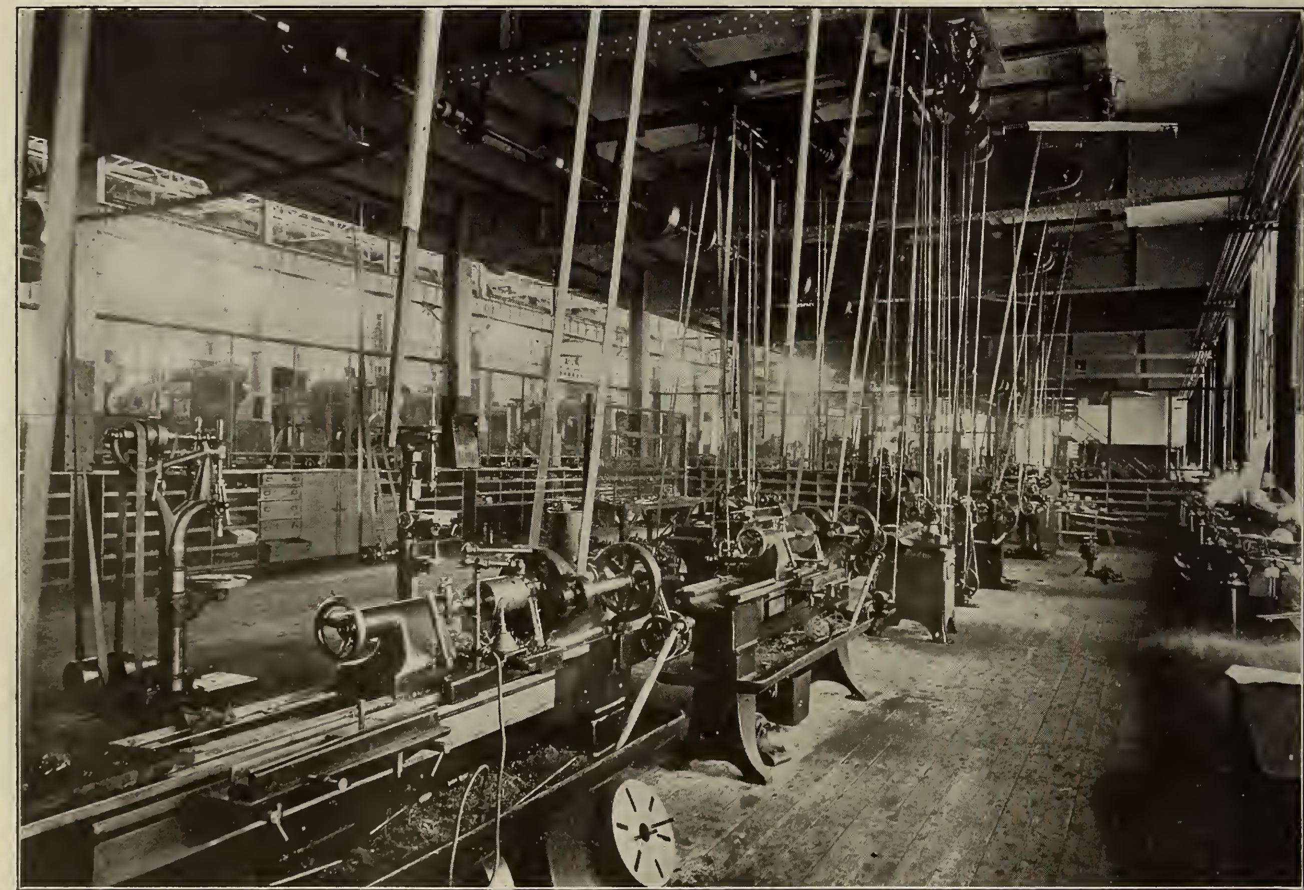
The machine and erecting shop and the boiler and tank shop are each heated by means of a combined hot blast and direct radiation system. Two-thirds of the heating capacity in these buildings is in the hot blast, or indirect section, the remaining one-third consisting of direct radiation, which takes care of wall exposure and openings. Either or both of these systems can be operated in various degrees to suit requirements of the weather. The blast fans in these buildings make a complete air change every 30 minutes, which materially benefits the ventilation of the buildings.

The coach repair shop, coach paint shop, blacksmith shop and storehouse are heated by means of direct radiation only. This radiation is so disposed as to take care of the exposures in the most economical way, at the same time placing radiation so that it will not in any way reduce the available working space within the buildings. All condensation from the radiation in the various buildings is returned through a pipe line to the power house, in which is located vacuum pumps in duplicate, which discharge the hot water into the feed water heater, from which point, after further heating, it is delivered to the boilers. The saving of this hot water is an item of considerable importance.

During the heating season the latter engines exhaust into the heating system mains, as well as all of the steam hammers, so that all waste steam is saved and utilized as far as possible. The distributing pipe lines are carried underground in tunnels and are all well insulated from heat losses.

Compressed Air System.

Compressed air at 100 lbs. pressure is supplied by the 2,000 cubic foot, compound air compressor located in the power house. Two large steel reservoirs are located just outside the power house, which receive the air and cool it. From there it is distributed by means of a system of underground pipe lines to all buildings and departments. Numerous outlets are located at frequent intervals, provided with hose connections, so that air for the operation of drills, reamers, riveters, clippers, caulkers, expanders, and a great many other purposes is always at hand.



Tool Room, Springfield Shops (Note Shelving).

The vacuum system on the radiation is what is known as the "Van Auken" type, by means of which the steam pressure on the heating mains is kept down to atmospheric pressure at the exhaust connections from the steam turbines and air compressor, and under many conditions a considerable vacuum is obtained at this point, thus relieving the power plant units of any back pressure. The full capacity is available both summer and winter.

High Pressure Steam System.

Dry steam at 100 lbs. pressure is furnished from the power house through a regulating valve, and is piped to all buildings requiring it; for the steam hammers in the blacksmith shop, the testing lines in the locomotive erecting and boiler shops, the glue room in the cabinet shop, the brass cleaning rooms in the coach paint shop, and for the engines driving blast fans for heating and ventilating system.

Fuel Oil System.

Fuel oil is received in tank cars on a track just east of the storehouse. Hose connections are made between the tank cars and inlet pipes leading to underground concrete storage tanks, which have a total capacity of about 40,000 gallons, or five carloads. From these reservoirs the oil flows by gravity, as required, to an auxiliary underground tank, from which it is pumped by electric motor-driven centrifugal pumps, up into an overhead tank located in the blacksmith shop, from whence the oil is distributed by gravity pipe lines to all furnaces in the blacksmith shop and boiler shop.

The electric pumps are automatically controlled by an electric device, which start either or both of the pumps when the oil falls below a certain level in the overhead tank, and stops them when the tank is full. The supply line is metered to measure the oil used in the shops.

Lighting and Power Systems.

Three-phase alternating current of 60 cycles at 440 volts is generated by two 500 kilowatt turbo-generators in the power house. These machines deliver the current to the controlling and distributing switchboard, from which a portion of the power is delivered to a 300 kilowatt rotary converter, which in turn delivers direct current at 220 volts. A direct current switchboard is provided for this section of the power supply.

Alternating current is used for all lighting, and for all constant speed motors. Direct current is supplied to all electric cranes, transfer table, and variable speed motors on machine tool drivers.

The 150 kilowatt transformers, located in the power house, receive alternating current at 440 volts and step up to 6,600 volts for the transmission line to the old North Shops, where the voltage is again stepped down to 440 volts for the power supply to the plant. Controlling apparatus is provided so that the new plant and the old one may be operated together, or separately, and power can be supplied to the capacity of the line (450 kilowatts) to either of the shops from either of the power houses.

The feeders from the new power house for the new shops leave the building in underground conduits, from which some of them lead to overhead mains carried on the back of the yard crane runway girders to the various buildings. A portion of the feeders lead underground direct to the panels at centers of distribution. All distributing panels are enclosed in locked steel cabinets. The lighting in the various buildings is described elsewhere, but in general it consists of Cooper Hewitt mercury vapor lamps. Numerous plug receptacles of very heavy and serviceable design are provided on columns and walls for portable lights. All lighting circuits carry a potential of 220 volts, a balancing induction coil being located at each distributing center, which is connected to the 440-volt mains, thus converting into a 3-wire, 220-440 volts system. The different centers are balanced up on the phases so as to load the mains uniformly.

All A. C. (alternating current) motors are of the 440-volt, 3-phase type. These drive all groups of belt-driven tools and such individually-driven tools as can be operated by constant speed motors, such as punches, shears, grinders, presses, some drills, etc. Tools such as heavy lathes, boring mills, radial drills, shapers, millers, etc., which require a wide range of speed, are driven by direct current, 220-volt motors, with speed ranging 2 to 1, 3 to 1, or 4 to 1, as required for the service.

All alternating current motors are provided with auto-starters. All direct current motors have drum type controllers, all being protected with circuit breakers of standard types.

Telephone System.

A central telephone exchange is located in the office building, from which circuits run to the various departments, providing each foreman with telephone communication to any other department, either at the new shops or either of the old plants. Telephones are of the desk type and are as conveniently located as possible throughout. A total of 14 is provided in the local departments.

Fire Alarm System.

A "Gamewell" fire alarm system consisting of 12 stations is provided. The alarm boxes are located outside of the buildings near the doors, and boxes are so spread that one can be reached anywhere on the shop site within a radius of 200 feet. The boxes connect to the central station in the power house, where a switchboard and battery is located, as well as the alarm apparatus. This consists of a gong, whistle trip and recording device, all electrically operated. When a signal comes in the gong strikes the number; the recorder records the number, and the trip blows one blast on the whistle to attract the attention of the engineer, should he by chance not hear the gong strike.

List of Machine Tools Installed in Springfield Shops, St. L. & S. F. R. R.

MACHINE AND ERECTING SHOP.

No.	Machine.	Size	Drive	Manufacture
1	Driving wheel lathe	84 in.	motor	Niles
1	Driving wheel lathe	84 in.	motor	Pond
1	Quartering machine	85 in.	motor	Niles
1	Axle lathe	......	motor	Bridgeford
1	Car wheel boring machine	42 in.	motor	Putnam
1	Hydraulic wheel press	100 in.	motor	Putnam
1	Hydraulic wheel press	300 ton, 50 in.	motor	Putnam
1	Steel tired wheel lathe	......	motor	Putnam
3	Bolt lathes	16 in.	belt	F. E. Reed
4	Bolt and screw cutting lathes	16 in.	belt	F. E. Reed
4	Engine lathes	18 in.	belt	F. E. Reed
4	Engine lathes	20 in.	belt	Schumacher & Boye
4	Engine lathes	24 in.	belt	Schumacher & Boye
1	Engine lathe	28 in.	belt	Putnam
2	Engine lathes	27 in.	belt	Lodge & Shipley
1	Engine lathe	27 in.	motor	Lodge & Shipley
1	Engine lathe	36 in.	belt	Niles-Bement-Pond
1	Engine lathe	36 in.	motor	Niles-Bement-Pond
2	Vertical turret lathes	36 in.	belt	Bullard
1	Turret screw machine	......	......	Barden & Oliver
1	Forming lathe	16 in.	......	Barden & Oliver
1	Cabinet turret brass lathe	24 in.	belt	Barden & Oliver
2	Cabinet lathes	20 in.	belt	Springfield Mach Co.
1	Turret lathe	6¼x26 in.	motor	Gisholt
1	Turret lathe	21x3½ in.	belt	Gisholt
1	Boring and turning mill	86 in.	motor	Bullard
1	Boring mill	54 in.	motor	Bausch
1	Boring mill	42 in.	motor	Bullard
1	Boring mill	30 in.	motor	Bullard
1	Cock grinder	2½ in.	......	Warner & Swasey
1	Valve milling machine	2-spindle	......	Warner & Swasey

1	Planer	72x72 in.	motor	Putnam
1	Forge planer	42x42 in.	motor	Putnam
2	Planers	36x36 in.	belt	Putnam
1	Planer	42x42 in.	motor	Putnam
1	Crank planer	20x20x24 in.	belt	Putnam
1	Head shaping machine	26 in.	belt	Cincinnati
1	Double horizontal milling machine	36 in.	motor	Ingersoll
1	Slotting machine	18 in.	motor	Sellers
1	Heavy slotting machine	13¼ in.	motor	Betts
1	Radial drill	5½ ft.	motor	Niles-Bement-Pond
1	Radial drill	6½ ft.	motor	Bickford
1	Radial drill	4½ ft.	belt	Bickford
3	Vertical drills	32 in.	motor	Aurora
1	High duty drill	36 in.	belt	Foote-Burt
2	Sensitive drills with column	15 in.	belt	Slate
2	Four-Spindle drills	......	belt	Quint
1	Horizontal boring and drilling machine	......	motor	Lucas
1	Horizontal boring and drilling machine	......	belt	Lucas
1	Centering and cutting off machine	......	belt	Hurlburt
3	Centering machines	2-spindle.	......	Whiton
2	Nut facers	......	......	Putnam
1	Pipe machine	......	belt	Jaracki
1	Pipe machine	......	motor	Jaracki
1	Triple bolt cutter	2 in.	......	Acme
1	Triple bolt cutter	1½ in.	......	Acme

TOOL ROOM.

1	Engine lathe	14 in.	......	Pratt & Whitney
1	Shaping machine	14 in.	belt	Hendy & Norton
1	Hand milling machine	......	......	Pratt & Whitney
1	Drilling and milling machine	......	......	Knight
1	Vertical drill	20 in.	belt	Rockford
1	Universal milling machine	......	belt	Hendy & Norton
1	Shaper	15x30 in.	belt	Cincinnati
1	Tool Grinder	24 in.	belt	Safety Emery Wheel Co.
1	Automatic tool grinder	......	belt	Walker Grinder Co.
1	Universal tool grinder	No. 1.	belt	Sellers
1	Universal grinding machine	12x40 in.	belt	Landis Tool Co.
1	Die grinder for bolt dies	......	belt	Modern Tool Co.
1	Disc grinder	......	belt	Besley
1	Twist drill grinder	3½ in.	belt	Yankee
2	Pipe bending machines	......	......	Pedricks & Smith
1	Arbor press	30 ton.	......	Lucas
1	Arbor press	......	......	Greenard
1	Hydraulic forcing press	100 ton	motor	Chambersburg
2	Rotary valve seat planers	26 in.	......	Underwood
2	Portable cylinder boring bars	4½ in.	......	Underwood
1	Radius link planer attachment	......	......	Underwood
1	Link grinder	......	......	H. G. Hammett
1	Walschaert link grinder	......	......	H. G. Hammett
3	Double spindle floor grinders	......	......	Safety Emery Wheel Co.
3	Cast iron grindstone boxes	8x60 in.	......	....
3	Double emery wheel grinders	......	motor	Safety Emery Wheel Co.
3	Double emery wheel grinders	......	motor	Northern
1	Planer surfacer	18x72 in.	belt	Safety Emery Wheel Co.
1	Spiral disc grinder	......	motor	Besley
1	Spiral disc grinder	26 in.	motor	Besley

BOILER SHOP.

1	Bending rolls	......	motor	Niles-Bement-Pond
1	Rotary bevel shears	......	belt	Scully Steel & Iron Co.
1	Rotary splitting shears	......	belt	Scully
1	Horizontal punch	......	motor	Hilles & Jones
1	Single punch	30 in.	belt	Hilles & Jones
1	Rapid action punch	......	belt	Hilles & Jones
1	Angle shears	......	......	Ryerson
1	Flue cleaning machine	......	......	Ryerson
2	Flue welders	......	belt	Hartz
2	Flue welding furnaces	......	......	Ferguson
1	Plain radial drill	66 in.	motor	Bickford

1	Vertical drill	32 in.	motor	Aurora
1	Single emery wheel grinder	......	......	Safety Emery Wheel Co.
1	Pressure blower	8⅞ in.	belt	Sturtevant
2	Pressure blowers	12 in.	belt	Sturtevant
2	Wheel grinders	......	......	Safety Emery Wheel Co.
2	Cast iron grind stone boxes	2x60 in.	......	Pond
1	Pneumatic staybolt nipper	......	......	Helwig
1	Large plate annealing furnace	......	......	Ferguson
1	Pneumatic rivet forge	......	......	Gunnell
1	Portable oil rivet furnace	......	......	....
3	Ball bearing rivet forges	......	......	Ryerson
1	Hydraulic test pump	......	......	Ashcroft
		BLACKSMITH SHOP.		
1	Steam hammer, single frame	3000 lb.	......	Chambersburg
1	Steam hammer, single frame	1500 lb.	......	Chambersburg
1	Steam hammer, single frame	1100 lb.	......	Chambersburg
1	Steam hammer, single frame	600 lb.	......	Chambersburg
1	Tool maker steam hammer	150 lb.	......	Chambersburg
1	Steam hammer	200 lb.	motor	Bradley
1	Punch and shear	25 in.	motor	Hilles & Jones
1	Open bar shear	16 in.	......	Hilles & Jones
1	Forging machine	2 in.	......	Ajax
1	Combined punch and shear	......	......	Coulter & McKenzie
1	Hammer bolt header	......	......	National
1	Eye bender	......	......	Williams & White
1	Iron bender	......	......	Pennock
1	Bolt cutter, single head	3½ in.	......	National
1	Bolt cutter, double head	2 in.	......	National
1	Geared nut tapper	4-spindle	......	National
1	Upright drill	32 in.	......	Aurora
2	Upright drills	26 in.	......	Aurora
		CAR SHOP.		
1	Combined universal woodworker	......	......	Fay & Egan
1	Patent universal woodworker	......	......	Fay & Egan
1	Scroll saw	......	......	Fay & Egan
1	Band scroll saw	......	......	Fay & Egan
1	Vertical cut off saw	36 in.	......	Greenlee
1	Tenoning machine	......	......	Fay & Egan
1	Foot power miterer	......	......	Fay & Egan
1	Automatic knife grinder	......	......	Fay & Egan
1	Saw bench triple arbor	......	......	Greenlee
1	Heavy vertical mortiser	......	......	Greenlee
1	Mortiser and boring machine	......	......	Greenlee
1	Double surfacer	30 in.	......	Berlin Mach. Wks.
1	Edge moulding machine	......	......	S. A. Woods
1	Band saw	......	......	Fay & Egan
1	Triple arbor saw bench	......	......	Fay & Egan
1	Lathe	30 in.	......	Fay & Egan
1	Spiral disc grinder	......	......	Besley
1	Power and hand pipe machine	......	......	Jaricke
1	Automatic hollow chisel mortiser	......	......	Greenlee

RAILROAD CO-OPERATES WITH FOREST SERVICE

For the purpose of reducing the number of fires along the right of way in the Arkansas national forest the Forest Service has recently entered into a co-operative agreement with the Kansas City Southern R. R. It is a well-known fact that coal burning locomotives are a prolific source of forest fires, particularly on heavy grades where a dozen or more fires may be started within a distance of a mile. Many of the most destructive fires have been caused in this manner and incalculable damage done.

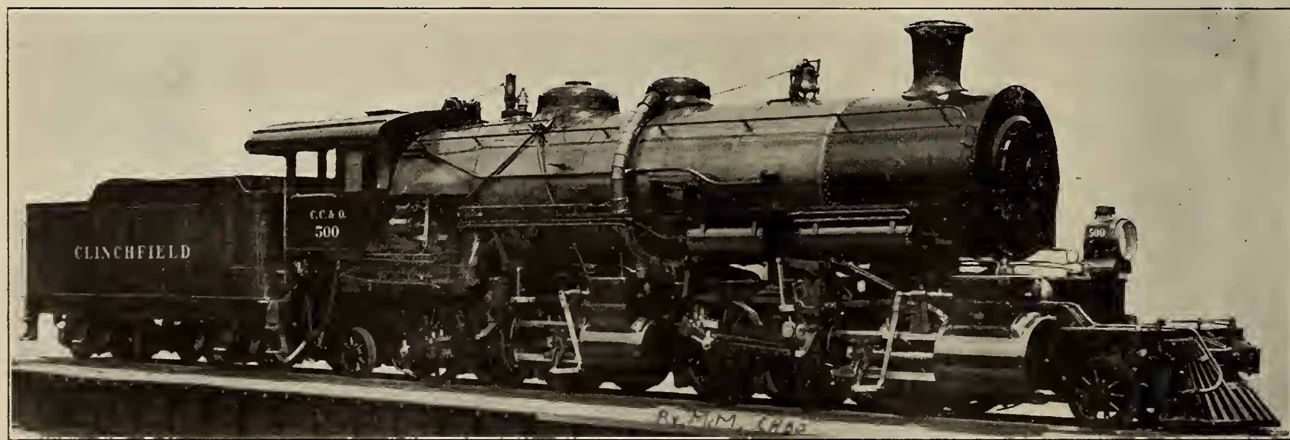
The agreement between the Forest Service and the Kansas City Southern R. R. provides that the railroad shall clear its right of way of all inflammable material for a distance of fifty feet on each side of the track and burn over an additional 100 feet wherever necessary. A provision is made for the use of efficient spark arresters, and that fires shall be reported to the nearest station agent, who will notify Forest officers and section crews. The maintenance of a Forest Service telephone line along the right of way will also be allowed. On its side, the Forest Service will patrol and supervise the clearing of the right of way, supply tools, and maintain and operate sufficient telephones as well as grant the railroad the timber free of charge, where it is necessary to clear the right of way. This agreement is for a period of ten years and has already been put into effect. Six telephones have been established along the line and excellent results are being obtained. Inasmuch as a great majority of the fires on the Arkansas National Forest can be laid to this source, it is thought that a great reduction in the area of burned over land will be made during the coming season.

Mallet Articulated Locomotives, Carolina, Clinchfield and Ohio Railway.

The Baldwin Locomotive Works has recently completed a Mallet articulated compound locomotive for the Carolina, Clinchfield & Ohio Ry. The maximum grade on this line, against loaded traffic, is one-half of one per cent, compensated for curvature; and an excellent opportunity is thus presented for handling heavy tonnage trains. The engine under notice has been ordered with a view to testing the suitability of the Mallet type in road service. The tractive force exerted by this design is 79,000 pounds.

In its general features, this locomotive is similar to the Mallet engines in service on the Great Northern Ry., which have proved highly successful, not only as pushers but also as road engines. The cylinders of the Clinchfield engine, however, are larger in diameter, thus increasing the tractive force, and the boiler is of the radial stay type, designed in accordance with the railway company's practice. The boiler barrel is composed of three courses, and the circumferential seam at the junction of the first and second rings is triple riveted. The firebox crown is supported at the front end, on two T-bars, and the crown and side sheets are in one piece.

The steam distribution is controlled by balanced slide valves, driven by Walschaerts motion. Reversing is effected by the Ragonnet power gear, and the high and low pressure reverse shafts are connected through a bell crank, which is fulcrumed to the boiler shell on the right side, immediately ahead of the articulated connection. When the engine is curving, the side swing of the lifting links is thus reduced to a minimum.



Baldwin Articulated Compound, C. C. & O. Ry.

The arrangement of the throttle valve and steam piping is similar to that previously used by the builders, and calls for no special comment.

The frames are of cast steel, and the articulated connection is effected by two radius bars. The upper bar is pinned to the high pressure cylinder saddle, and the lower bar to a cross-tie which spans the bottom rails of the rear frames. Hanger bolts are used to equalize the weights carried by the front and back frames.

The boiler is supported on the front frame by a waist bearer placed back of the smokebox. The centering device is placed under the smokebox, and normally carries no load, as ½ inch clearance is provided between the upper and lower castings.

The tender frame is composed of 12-inch steel channels, with oak bumpers front and back. The tank has a water bottom, and the trucks are of the arch-bar type, with "Standard" solid forged and rolled steel wheels.

The wide experience already gained with locomotives of this type, in heavy service under various conditions, indicates that this engine will prove highly successful.

The principal dimensions, weights, etc., are as follows:

Gauge	4 ft. 8½ ins.
Cylinders	23 ins. and 35 ins. x 32 ins.
Valves	Balanced
Boiler.	
Type	Straight
Material	Steel
Diameter	84 ins.
Thickness of sheets	⅞ in.
Working Pressure	200 lbs.
Fuel	Soft coal
Staying	Radial
Firebox.	
Material	Steel
Length	117 ins.
Width	96 ins.
Depth, front	78½ ins.
Depth, back	75 ins.
Thickness of sheets, sides	⅜ in.
Thickness of sheets, back	⅜ in.
Thickness of sheets, crown	⅜ in.
Thickness of sheets ,tube	½ in.
Water Space.	
Front	6 ins.
Sides	5 ins.
Back	5 ins.
Tubes.	
Material	Steel
Thickness	No. 11 W. G.
Number	437
Diameter	2¼ ins.
Length	21 ft.
Heating Surface.	
Firebox	223 sq. ft.
Tubes	5,384 sq. ft.
Total	5,607 sq. ft.
Grate area	78 sq. ft.
Driving Wheels.	
Diameter, outside	57 ins.
Diameter, center	50 ins.
Journals	10x12 ins.
Engine Truck Wheels.	
Diameter, front	33 ins.
Journals	6½x12 ins.
Diameter, back	33 ins.
Journals	6½x12 ins.

Wheel Base.

Driving	29 ft. 8 ins.
Rigid	10 ft. 0 ins.
Total engine	44 ft. 10 ins.
Total engine and tender	73 ft. 8 ins.

Weight.

On driving wheels	299,250 lbs.
On truck, front	20,500 lbs.
On truck, back	22,900 lbs.
Total engine	342,650 lbs.
Total engine and tender, about	500,000 lbs.

Tender.

Wheels, number	8
Wheels, diameter	33 ins.
Journals	5½x10 ins.
Tank capacity	8,000 gals.
Fuel capacity	14 tons
Service	Freight

Most Economical Method of Maintaining Tool Equipment on Locomotives in Service.*

In preparing this paper we have taken into consideration the fact that many railroads have adopted what is known as the pooling system with the engines, and as a consequence we have endeavored to deal with that particular condition only.

In order to recommend the most economical method of maintaining the tool equipment on locomotives in service, we deem is necessary first to call your attention to a number of tool equipment forms of various railroads.

In looking over the various forms you will note a number of articles on the list or form which might be dispensed with for the purpose of economy and an easier way to care for and to maintain tool equipment. A number of articles mentioned on the tool equipment list of former years, such as jacks, brasses, hose, etc., deteriorate very fast, and in times of trouble are not fit to be used or operated.

On account of the various makes of engines and tenders, we cannot designate the particular box or place for each article.

It is our belief that every engine should have a full set of fire tools, also one scoop shovel, and to be stamped with the engine number for each engine. A suitable rack should be on each tender to hold the fire tools; also an ash-pan slide hook should be on this rack on engines that require it.

We believe it is impossible for us to go on record with a list of fire tools to suit all engines and in all branches of service. But we believe all fire tools should be left on each engine—not taken off at the end of each trip, as is the practice at some important railroad terminals or roundhouses where the pooling of engines is in existence. This causes a delay to power in getting out of the house or terminal on time or at the time boarded, as every minute counts both to the crew and to the company, particularly on some runs on certain railroads, with the new sixteen-hour law. We believe there should be a close check on fire tools (also on wooden coal boards when in use), at the completion of each trip or when turning the engine over to the roundhouse force, by the hostler-foreman or some person who will act in this capacity. The check on the fire tools should be turned over to the roundhouse foreman. This check should bear the names of the crew which last brought in the engine. In this way the roundhouse foreman will be able to replace any missing article in the proper manner, and not cause other engines to be disarranged. It also gives the foreman a chance to hold the proper person to account for the irregularity of caring for the tools.

*Report of a committee consisting of A. G. Turlay (chairman), Jos. Keller, W. H. Corbett, J. J. Gill, E. Salley, before the Traveling Engineers' Association.

As a general rule, fire tools consist of:

1. Fire hook or poker (for large fire-boxes, one long and one short hook.
2. One ash hoe.
3. Ash-pan slide hook.
4. One grate shaking wrench.
5. One scoop shovel.
6. One coal pick.

We believe that other tools (besides fire tools) should be arranged and listed for engines in different service, such as passenger, freight, freight helper and work trains, local freight, and switching engines. These tools and supplies, when in the boxes properly provided for, should be under seal, and when necessary for the enginemen to use any of them the seal can easily be broken and a report made at the end of the trip, in addition to the inspection, and this will easily provide for the opening of the seat. We prefer a seal in preference to a lock.

Following is a list of tools for passenger engines:

1. Two hard-wood wedges, iron bound.
2. One pinch bar.
3. One twenty-ton jack and lever.
4. One fender brass.
5. One pin block.
6. Two guide blocks.
7. One brake pipe hose.
8. One signal pipe hose.
9. One steam pipe hose.
10. Two double end wrenches suitable for taking down rods.
11. One pipe wrench (18-inch Stillison or Alligator).
12. One set of car replacers.
13. One extra knuckle.
14. One pail and dope.
15. One set of packing irons.

List of tools for freight, freight helper and work train engines:

1. Two hard-wood wedges, iron bound.
2. One crank pin block.
3. Two guide blocks.
4. Two double end wrenches suitable for taking down rods.

List of tools for local freight engines:

1. Two hard-wood wedges, iron bound.
2. One crank pin block.
3. Two guide blocks.
4. Two double end wrenches suitable for taking down rods.
5. One switch rope or chain.
6. One push pole.

List of tools for switching engines:

1. One crank pin block.
2. Two guide blocks.
3. Two double end wrenches suitable for taking down road.
4. Set of car replacers.

You will note that the above lists of tools, except for passenger engines, do not mention car replacers, jacks, pinch bars, extra tender and car brasses, air hose, pipe wrenches, emergency knuckle, dope pail, packing tools, etc. We believe these articles can be better cared for in cabooses, as all railroads, especially the trunk lines, have cabooses, and on some divisions two, three and four engines are on one train. Furthermore, a caboose is a clean place and can have large boxes to suit the conditions. Cabooses are also more regularly crewed and are inspected at the end of the trip. The conductor and flagman should be held responsible for the full equipment of such tools with others that are required to be carried in the caboose. Cabooses and engines, as a general rule, come under the same department.

The committee was somewhat divided as to whether our best policy would be to recommend brasses and jacks in cabooses or to have stations along the line of road where this material might be taken care of. This would, of course, eliminate the large stock which was carried in cabooses. There would be great objections to having supply equipment stations along a line of railroad on account of the stations selected being water station junctions, which are not safe places to expect to have brasses in store and in readiness for an emergency, as railroad companies are greatly hampered by thieves of brasses of this description.

There should be a number of small tools, which, we believe, can best be taken care of by having a metal box, size about 7x8x24 inches, with lock and key. The most needed small tools for an engineman's list are:

1. A hard hammer.
2. One cold chisel.
3. One air pump spanner.
4. One 15-inch monkey wrench.
5. One sander device wrench.
6. One set screw wrench.
7. One 15-inch Alligator or Stillson wrench.
8. Extra lubricator glass and gasket (with old-style lubricator only).
9. Extra gauge cock gasket (when used).
10. About twelve inches of asbestos wick.
11. A few small cotters.
12. Two extra pipe gaskets.
13. A few rings of air pump packing.

These tools will best be taken care of when a box with a key is assigned to each engineman. In this manner the majority of enginemen become interested in their tool equipment as the engineman did with his regular engine in former years. It also gives an engineman a chance to take care of some small tools which he was obliged to carry around in his pocket. Enginemen's tool boxes should have a place provided and be stored away when not in use. This cupboard should be under lock and key, and the roundhouse foreman and tool inspectors should have a key. It should be arranged so that the tool inspector is advised which crew is next boarded, time and engine number. The inspectors should place the tool box on each engine at least thirty minutes before arrival of the enginemen, or time boarded. We believe that after completion of the trip or day's work, when the engine arrives at the terminal, the tool boxes should be removed and taken care of by the tool inspector. He should inspect all tools and keep a record of them, and also report missing articles to the roundhouse foreman, who should see that the missing article is restored, and, if it requires further action as to the cause of the article missing, take steps toward investigating the cause. In this way it will give the Master Mechanic control of the tools; he will also be able to apply discipline when and where needed.

We do not feel satisfied that we should designate a place where the tool box cupboard should be located, on account of the various conditions, location of ash tracks, and the various manners in which engines are handled. But it is our belief that this box should be removed on arrival and when the engineman is about to leave the engine in charge of the roundhouse force. It can sometimes be so arranged that the engineman in coming into the terminal might set the tool box off at a designated station for the tool inspector. This avoids the tool boxes being without care for a number of hours.

Supplies.

We believe that supplies should consist of:

1. One four-quart can for engine oil.
2. One two-quart tallow pot.
3. One one-quart spring can engine oiler.
4. Supply of waste.

These cans, with the proper oil allowance for the trip or day's work which the engine is boarded for, should be in readiness in the oil room to be taken out by the crew or party designated to perform that duty. The oil room should be provided with a suitable place, such as a metal shelf, and also be capable of being kept at the proper temperature to suit the weather conditions. We believe that it would be a good plan to have these cans assigned to each engine, and if on some day, when a lighter day's work or trip is performed, the crew saves some oil, do not take it from them, but give the engineer the benefit of his good judgment, and help him along with it when he is practicing economy. We further believe that the man in the oil room should be held responsiblt for the defective cans going out, or those without tops. Cans with open tops will allow sand and cinders to enter. At the present time there is little free oil used on driving boxes, due to the improved grease cellars, therefore the oil is more exclusively used for machinery parts and one grain of hard sand is the ruination of a good fit bearing. The tender or engine should be provided with a box where a machine oil can may be kept. The tallow pot and engine oiler are placed on the boiler or boiler-head shelf provided for the same. At the end of each trip those cans should be taken to the oil room and cared for until needed again, and then replenished with the proper allowance for the trip which the engine is intended to make.

Each road engine should be provided with classification lights complete, markers and gauge lights, with a fount which will hold sufficient oil to furnish light for sixteen hours. These lights, including the headlight, can best be taken care of by the roundhouse force, which is the practice in pooling engines. They should be removed from the engine, but should be stamped or marked with the engine number.

Each engine should be provided with the proper classification and marker signals for day, viz.:

1. Two white flags.
2. Four green flags.
3. One red lantern.
5. Six torpedoes.

A suitable box to take care of the flags can be located on the left side of the cab—attached to either the side of back of the cab, as conditions best permit. This box may be open in the top and be made of heavy tin, with a few one-half-inch holes in the bottom so that fine dirt will fall through. This will give an easy access for inspection of flags and be handy for the fireman. The red lantern when not in use can well be taken care of by providing a place in the same box in which the machine oil can be kept. In this box a small rack might be provided to clinch the torpedoes.

On the right side of the cab, either on the ceiling, side or back, in the place best suited for the style of cab, a cylinder-shaped box made of heavy tin should be located by being fastened to the cab and to hold about two pounds of crank pin grease. On roads where the grease is replenished by one man the same man can replenish the grease in the cab box and charge or record the amount of grease given to the engineman who uses it, or to the crew which brought the engine in with the extra grease missing.

We further believe that each crew should have in the roundhouse a locker with lock and key to take care of the overclothes, torches and drinking water can; each man should have his own torch and a record of the same in the oil house. Enginemen and firemen in all cases should take care of their torches and drinking water cans when in use. A locker, such as generally used, is provided for two men and should be numbered. The roundhouse foreman is to have a record of all locker numbers and the names of those who occupy them, so he will know just when there is a vacant place in any of the lockers, and not have more lockers than required.

We believe that in the above manner the "pooled" or "two or three crewed" engine will be well taken care of, and that the total stock carried on engines will be reduced.

The tool boxes should be so arranged that they can be sealed, the seal to be applied by the roundhouse inspector and to be broken by the crew when the tools are required. On completion of the day's work or trip and on arriving at the terminal the circumstances requiring the removal of the seal should be reported.

The question may arise why yard engines should have car replacers, while none are provided for freight engines. Yard engines have no cabooses. There are more cars derailed in a yard than on a main line, and as yards are from one to three miles long there would be considerable delay in going after car replacers. Sometimes only one pair of wheels are off the track.

Excellent results are being obtained on one of the leading railroad's by use of the following system:

A list of tool equipments, as detailed in the book of rules, is drawn up and the price of each item shown, which is posted on the various bulletin boards. An individual record is kept of all tools drawn, showing the name of employee, date, engine number, article drawn and price thereof. Each month this is drawn off in alphabetical order, according to names, and posted; thereby showing the expense each employee has incurred during the month.

Very little detail is involved in this system, although at first thought it might seem a great amount of clerical work would be necessary. On one division they have between 900 and 950 enginemen, 365 engines, and average between 9,800 and 10,000 engines handled per month.

As an illustration, the following will be interesting: Six months prior to the installation of the present system, they averaged $832.65 for engine tools . An average taken for ten months under the present system shows a cost of $393.07. This, you understand, is for locomotives only, and a corresponding saving was also made in trainmen's supplies.

Further, the men are all interested and are constantly turning in tools and other material picked up or found in excess, for which we give them an itemized list showing amount of saving, along with a letter of commendation.

All the former troubles with engines having no tools are done away with. While it used to be an impossibility to keep a supply of lanterns, wrenches, etc., on hand, even with increased requisitions, they now claim to have a surplus stock in the store room, which, when taken in consideration with the savings mentioned above, means considerable money to the company. This paragraph simply shows that close supervision is necessary to maintain tool equipment.

Lehigh Valley R. R.

Tool Equipment for Locomotives	Passenger	Freight	Yard
Four green flags	X	X	
Two white flags	X	X	
One red flag	X	X	X
Six torpedoes	X	X	
Two blizzard lamps	X	X	
Two marker lamps	X	X	
One cab lamp	X	X	X
One st'd gauge lamp (wide fire-box eng's only)	X	X	
One red lantern	X	X	X
Two torches	X	X	
One torch			X
One 1-gallon can for engine oil	X	X	X
One 1-gallon can for kerosene oil	X	X	X
One ½-gallon can for signal oil	X	X	
One 1-quart spring oiler	X	X	X
One 5-pint valve oil can	X	X	X
One iron pail for water	X	X	
One long rake (soft coal)	X	X	
One short rake (soft coal)	X	X	
One scoop shovel	X	X	X
One coal pick	X	X	X
One ash-pan slide hook	X	X	X
One hard hammer	X	X	X
One 15-inch screw wrench	X	X	X
One air pump spanner	X	X	X
One 12-inch flat chisel	X	X	X
One broom	X	X	X
One shaker wrench, for grates	X	X	X

X indicates the articles is to be furnished. No equipment is to be issued to locomotives except in exchange for old equipment.

The motive power department of the New York Central & Hudson River R. R. issues the following standard list of tools and appliances to be carried on locomotives: One broom, one coal pick, two white flags, one red flag, four green flags, one flat chisel, one hard hammer, one white lantern, one red lantern with six torpedoes, one long oiler, one engine oil can, one valve oil can, one kerosene oil can, one packing hook, one scoop shovel, one torch, one 18-inch monkey wrench, one No. 4 alligator wrench, one water bucket, valve stem clamp, one fire rake, one signal oil can.

In the first part of this paper we stated that the pooling system would be considered in his connection as well as economy, as it is this system that has brought out the question of late years, how to maintain and take care of supplies and tools. On a line of road where there is still a regular engine for each crew it would be of no use to frame up a long letter, as it is easy to let all things remain on each engine and avoid such close check of tools and supplies. Enginemen in the past have taken care of their tools and supplies and would soon make a complaint if they were disturbed. They also gave more of their personal attention to these things on a regular engine, if business and conditions would permit.

Boiler Check Valves and Feed Water Delivery Pipes.*

The subject of check valves and feed water delivery seems to be one to which very little thought has been given by the majority of the mechanical people; the established custom of placing the check valve on the side of the boiler, close to the flue-sheet and below the water line, being accepted as the proper location. This holds true with most all mechanical people we have referred to, they accepting the fact that there will be more or less precipitation and scale deposit anyway with the different kinds of water, and that checks should be placed at the coolest part of the boiler, thereby getting a better circulation and leaving such scale deposits as may be formed as far away from the fire-box as possible. However, we have information from mechanical people who claim they have made tests of the checks above the water line, and that the results were most satisfactory. They contend that by placing the checks above the water line, they have materially decreased flue failures. Mr. C. W. Seddon, superintendent of motive power of the Duluth, Missabe & Northern Railway, contends that on his road they had a number of engines, new from the locomotive works, that they were unable to get over the road satisfactorily, due to the engines not steaming and having considerable

*Report of Committee (J. D. Emerson, Chairman), before the Traveling Engineers' Assn., Denver, Sept. 7.

trouble with flues; also, that they were unable to keep certain classes of engines away from the shops on account of flues failing; and that after placing the check above the water line the flue failures stopped and he was able to keep his engines away from the shop, getting them over the road satisfactorily from every standpoint.

The following is a brief from Mr. Seddon, explaining his check, which is shown on the attached sketch:

By the Seddon boiler feed device the feed water is discharged from a perforated copper pipe in a spray, which, absorbing heat from the steam space of the boiler, strikes the surface at the temperature of boiling water. The result is to produce better circulation; eliminate leakage of tubes and locomotive failures resulting from the same; lost time and expense in the roundhouse incidental to calking of tubes and fire-box seams; overcome the breakage of staybolts due to fluctuating temperature of water, and, further, to effect a visible saving of fuel.

These statements are not theoretical, but rather are the result of long, practical and exhaustive tests on lines where the conditions are very severe. After being in service for two years and today being applied to all their power, the records on one line show the following very remarkable results:

1. No boiler failures chargeable to leaky tubes.
2. 75 per cent. less work for boilermakers in the roundhouse on running repairs.
3. An increase in train tonnage of 10 per cent.
4. A saving of fuel of 10 per cent.

There can be no question but what if the check is located on top of the boiler or above the water line we at least do away with the sticking of checks, and to a great extent to away with the grinding of checks. Your chairman has had considerable experience with Philips checks and cannot recall a single failure or check being destroyed from grinding. However, since the subject came up your chairman has had to apply a great many flues to different classes and sizes of boilers, and, considering the length of time that flues were in boiler, could see no noticeable difference with the checks and different locations.

If what Mr. Seddon and Mr. Philips state about their checks holds true, it is worthy of further consideration and, in our opinion, a thorough test, as compared with other checks located on the side of the boiler. Both of these gentlemen's claims for their check are very interesting, but, in our opinion, unless a test is made to convince the mechanical people that the general practice of placing the check valve on the side of the boiler is wrong, the established custom of so doing will still remain as right. We do not think, however, that the subject should be passed by without going into the matter more thoroughly. Practically all of the devices pertaining to the locomotive have been improved and we cannot say without testing the matter but what a different location of the check and the water being deposited above the water line would be better than below the water line. Most likely this test could be brought about by our representatives to the Master Mechanics' Convention, who, in our opinion, are the proper people to have this test made.

As to the steaming of engine and working of injector, your committee fully agrees with all the mechanical advice it has that there is no noticeable difference in any location that should be made; however, the checks and injectors should be placed so as to allow slow, easy bends in the branch pipe.

The following is from the personal experience of your chairman: With the operation of the checks above the water line the committee would recommend that all checks be placed as far from the throttle-box as possible, due to the fact that with a check above the water line close to the throttle-box, the throttle siphons the water very noticeably when the injector is working, which is bad on the valves and packing. We have, however, handled engines with the checks located on top of boiler and on front sheet next to smokebox, and noticed no bad results whatever along this line when the injectors were working. We would also suggest that no iron pipes be used with such location of checks, due to the fact that the bend that is necessary to be made to the check on top of boiler makes it next to impossible to keep the joints tight, due to expansion.

The following remarks are concerning the application and practices that should be followed in applying feed pipes, check valves, etc.:

The free and unrestricted passage of the water from the tank to the injector of a locomotive is of the utmost importance, and to attain this object it is necessary that all auxiliaries in connection with the water-feeding apparatus should be of proper construction, location and size.

One of the most important parts of the water-feeding system is the boiler check valve, and, in connection with it, the feed-water delivery pipe.

The pipe should be as short as circumstances and a well-established practice allow, and as straight as possible. In locomotive practice, the feed water delivery pipes are usually bent, but these bends should not contain sharp elbows, but should be made in easy curves, so as to avoid abrupt changes in the current of the water and resulting frictional resistance, which may affect the general performance of the injector. For the same reason the pipe should be of proper size and free of obstructions of any kind, as obstructions in the delivery pipes will create a back pressure against the injector, which may not only affect its general efficiency, but may cause the water to be thrown out through the overflow, resulting in considerable waste of water if the injector is provided with an open overflow; or, in case of a closed overflow, injector obstructions may cause the injector to fly off, with the result that live steam will blow back into the tank, eventually heating the water to an extent that will make it difficult to again start the injector until opportunity is found to cool off the water.

As to the size of the delivery pipe, it is safe practice to follow the recommendations of the manufacturers of injectors and to make the pipe of the size called for by the connections at the delivery end of the injector.

Concerning the boiler check the first requisite is that it should be of ample size. In their connection the size of the pipe connections provided for the injectors by their makers give a safe directive.

All passages in the boiler check should be of the full size called for by these connections.

The check valve should have a sufficient lift as to avoid crowding and stowing of the water, which should result in back pressure and may be followed by consequences as related above. A lift of one-quarter to one-third of the clear opening covered by the check valve will be found serviceable, provided the clear opening is of the proper size. Preferably the boiler check should be of the "straight" type; that is, the water from the delivery pipe should enter the check body underneath the check valve, passing through it in a straight line, so as to avoid "turns" in the direction of the flow of water as much as possible.

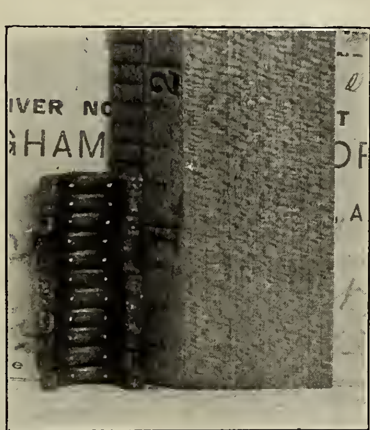
The boiler check should be provided with a removable seat, as thereby the body of the valve is made practicably indestructible, and in case the seat gets worn out, only the seat is to be replaced. The check valve itself and its seat should be accessible for inspection and re-grinding or reseating—with pressure in the boiler. For this purpose, the boiler check should be provided with a stop valve; that is, a valve which, when shut, cuts off communication between the boiler and the check chamber, permitting the opening of the check chamber by removing the caps usually provided for this purpose. In case of double boiler checks, the two check chambers should be independent and separate from each other, and each chamber should be provided with its own stop valve, so that in case one side should become inoperative from any reason it could be cut off without interfering with the proper operation of the other side.

The stop valve should preferably be placed in a valve chamber of its own, independent of the check chamber, so that the stop valve could not possibly interfere with the proper operation of the check valve or prevent access to the check valve. If the stop valve is located in a chamber common to it and the check valve, the latter is not accessible, except after removal of the stop valve or after disconnecting the pipe attached to the boiler check, either of which necessities nullify the true purpose and usefulness of a stop valve.

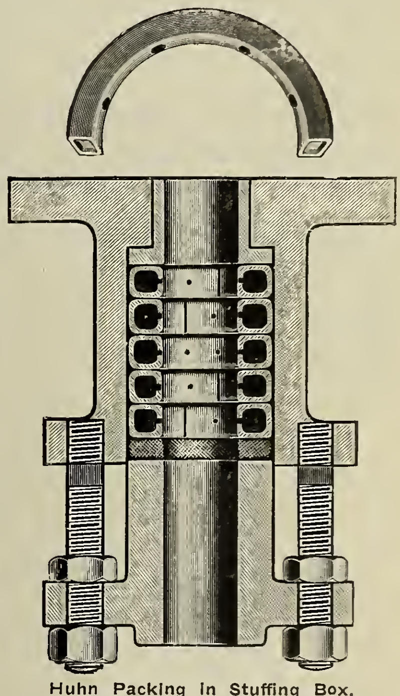
A New Metallic Packing.

For some years there has been in use on locomotives of Austrian railroads, a metallic packing which has produced excellent results. The packing has recently been placed on sale in the United States by the American Huhn Metallic Packing Co., of New York. The accompanying photographic reproductions illustrate the application and appearance of the packing in different classes of service. The White Mfg. Co., of Cleveland, has, it is stated, secured very satisfactory results from a six months test run with the idea of applying the packing to its steam automobile.

Large Sized Packing for Hydraulic Work.



Huhn Packing H. P. Rods of White Steamer.



Huhn Packing in Stuffing Box.

The Government Railways of Austria have found the packing particularly well adapted to the low pressure sides of superheater compound locomotives and use it exclusively in this capacity as well as in all the boxes of the saturated steam locomotives. It is stated that in this service the life of one set of packing is about one and a half years and that it will serve three to four months without being taken up. A drawing of the packing gland of an Austrian superheater express locomotive constitutes one of the illustrations.

Safety Breke Rigging.

Waterville, Me., July 31, 1909.

Editor Railway Master Mechanic:

The large number of wrecks that are traced directly to failure of brake hangers and broken brake-beam fulcrums with the still greater number of wrecks that are constantly occuring for which the cause is not made clear on account of the condition of the wreckage after it has happened, can, it seems to me, leave no doubt that safety appliances are very much needed in the foundation brake rigging of engine tenders and cars. The condition of these parts of our railroad equipment after being in continual service for months and sometimes years make it impossible for the inspector of brakes to tell if a brake is worn or cracked or if the brake-pin has worn below a safe point of resistance. This is so because these parts of the rigging are covered by other parts, also the fulcrum of a brake-beam is liable to yield and give way from the continuous strains. Therefore, it is a question for the management of our railroads to settle, if they can afford to allow these parts to go without any protection. There are many reasons why a strong safety loop should be carried by the brake-beam and deposed under the connecting-rod of brake-levers. Many times in taking up the slack the man who does this work must do so by going to and from the engine and brake-rigging. If after he gets the required piston-travel, his attention, is called to some other repairs, he may forget the fact that the cotter-pin has not been put in or split. The engine goes out, the pin works out from the lever, and a wreck occurs.

The writer has been informed of a number of very costly wrecks that could without doubt have been prevented if safety hoops and safety chains of sufficient strength had been used in the brake-rigging to catch and hold the rods and beams when the usual parts fail. Another cause of failure of brake-beams is the lever wearing down at the fulcrum weakening the parts so that they will fail in due time. To prevent this, a lever-support, attached to the brake-beam and placed under the lever, holds the lever up in the position it is designed to work. Thus the fulcrum of both lever and brake-beam and saved by keeping the lever and rods in line by the use of a lever support fastened as described. The brake-beam has a lateral motion with the wheels thus saving the wheels from the wear of the brake-shoe occasioned by the usual condition, where the supports for the brake-lever is fastened to the car-body or truck-frame. This latter condition has a tendency to keep the rigging always to one side, causing a large percentage of flanged wheels. This can be very surely proven by noting that the flanged wheels are usually on the side the lever is supported from.

The devices I have spoken of for the protection of brake-rigging have been in general use with good results on one large system for a number of years. The following data is compiled from the records on file at one of the shops, showing the number of tender wheels applied during a period of years and illustrates the great saving to the wheels occasioned by the use of the lever support applied to the brake-beam.

Year.	Tender wheels applied.	Flanged.	Other causes.	Percentage of flanged wheels.
1903-1904	465	218	247	.47
1907-1908	245	26	219	.11

It will be noticed that the numbers of wheels changed during the latter period was about one-half the number changed during the first period, even though the weight of the tenders in 1907 and 1908 was increased about 25%. The number of flanged wheels reported for the years 1907-1908 during which time the Lightbody Brake Lever Support was in general use upon the system was reduced by more than 75% over the number of flanged wheels reported in 1903 and 1904, before the support was applied.

James A. Lightbody.

Papers to be Read Before the Western Society of Engineers, Fall and Winter 1909-1910.

The Rolling of Some Special Sections in Iron and Steel, by Willis McKee, Elyria, Ohio.

Some Engineering Features of the Chicago Harbor, by John M. Ewen, Chicago.

Wood Preservation, from an Engineering Point of View, by a representative of the U. S. Forest Service.

Hydraulic Mining of Auriferous Gravels, by J. W. Phillips, Lewiston, Cal.

The Loss of Heat Through Furnace Walls, by W. T. Ray and Henry Kreisinger, Pittsburg, Pa.

The Panama Railroad and Its Relation to the Panama Canal, by Ralph Bcdd, Cristobal, C. Z.

Progress of the Coal Mine Investigations by the U. S. Geological Survey, by George S. Rice, Pittsburg, Pa.

River and Harbor Improvements at Chicago and the Calumet, by Thomas H. Rees, Chicago.

Compressed Air in Contract Work, by M. W. Priseler, Chicago, Ill.

The Corrosion of Steel in Concrete, by R. P. Melendy, Boston, Mass.

Reinforced Concrete Trestles, by C. H. Cartlidge, Chicago, Ill.

The Kilbourne Plant of the Southern Wisconsin Power Co., by D. W. Mead, Madison, Wis.

Economies in Central Station Management, by W. L. Abbott, Chicago, Ill.

Depreciation and Reserve Fund for Electric Properties, by Wm. B. Jackson, Chicago, Ill.

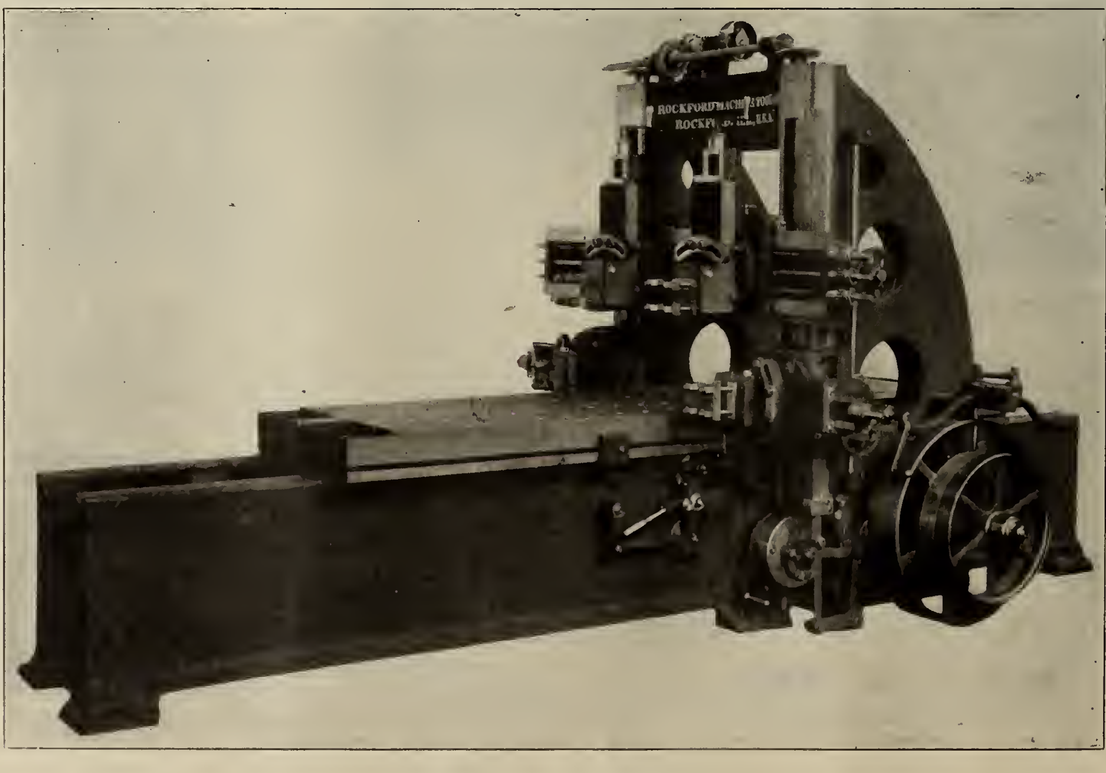
New Illuminants, by Carl Wiler, Chicago, Ill.

The following is a list of the regular meetings for 1909-10: Wednesday, Sept. 1, 1909; Wednesday, Oct. 6, 1909; Wednesday, Nov. 3, 1909; Wednesday, Dec. 1, 1909; Tuesday, Jan. 4, 1910, annual meeting; Wednesday, Feb. 2, 1910.

HEAVY DUTY PLANER.

The accompanying illustration shows a new 32 in. x 32 in. x 8 ft. heavy duty planer manufactured by the Rockford Machine Tool Co., of Rockford, Ill. This firm, which builds "Rockford" shapers, has for some years been turning out planers in the smaller sizes and now is making rapid progress in developing a full line of planers, its aim being to build a rigid and powerful machine, at the same time maintaining the smooth running qualities and the ease of operation that have characterized the other tools.

The gearing in the drive of the new planer is located inside the bed between the bearings, which are long straight



Rockford Railroad Shop Planer.

bushings accurately fitted into holes bored directly in the bed castings. Ample means are provided for perfect lubrication. The belt shafting device is very simple and reverses the table without shock or jar. The heads on cross-rail as well as the side heads have both horizontal, vertical and angular feeds. The down feed to the heads on rail is 12 in., while the feed friction is of the combination releasing type. It will carry the heaviest feeds without slipping and will not run hot. The feeds are changed by the knob shown on the front friction. a pointer indicating the feed obtained at the different settings. With this device, the feed can be changed for the finishing cut after roughing a piece of work and returned for the next casting and the operator will know exactly what feed he is going to get without making several adjustments, or counting the clicks of the ratchet. The different parts of the machine are very accurately fitted and are interchangeable. Ample means are provided on all bearings for adjustment for wear, taper gibs being used throughout.

New Literature.

John F. Allen ,of New York, has issued a leaflet descriptive of the portable, pneumatic riveting machines manufactured by this concern.

* * *

The safety of employees is always a matter of importance. A circular cylinder for hand jointers, which greatly minimizes the danger of the loss of fingers is described and illustrated in a booklet recently gotten out by the Oliver Machinery Co., of Grand Rapids, Mich.

* * *

Form No. 4001, issued by the Ingersoll-Rand Co., of New York, gives complete descriptions of the manufacture of their rock drills. Also tables and information for intending purchasers.

* * *

"Railroad Hydraulic Tools" is the title of a 120 page catalog just issued by the Watson-Stillman Co., of New York. This catalog describes a line of hydraulic tools for steam and electric railway service, and there are listed numerous tools that have not previously been described in print. Among the noticeable additions to the Watson-Stillman line during the last year as described in this catalog are several new types of jacks, a motor-driven rail bender for handling large pneumatic wheel presses, a motor-driven forcing press with detachable shelves on the base and an overhead crane, a hydraulic gauge calibrating apparatus, a new hydraulic coping machine and a new hydraulic beam shear.

The Selling Side.

Renewed experiments are to be undertaken in order to investigate the question of coal and peat used as fuel on Swedish railways. Between Elmhult and Alfvesta there will be run a special train, consisting of fifty cars, loaded with coal and peat. This train will be running for a fortnight between the two places, using alternately as fuel English steam coal, peat, and steam coal in different proportions, and peat only. There will also be used different types of locomotives.

Mr. J. B. Rider, formerly general superintendent and assistant to the vice-president of the Pressed Steel Car Co., Pittsburg, Pa., has been appointed general manager, and Mr. J. B. Maher has been appointed general agent in charge of the sales department of the company.

In the construction of the foundations for the railroad terminal that is being built by S. Pearson & Son, Ltd., at Vera Cruz, Mexico, approximately 3000 Raymond concrete piles will be employed.

Preliminary returns of the Western Electric Co., Chicago, for July show that the company's business for that month ran approximately 46 per cent ahead of July, 1908. The eigth months' returns indicate a gross business for the year of about $47,000,0000, but it is expected that improvement in industrial conditions will enable the company to show nearer $50,000,000 in round figures. For the year ending November 30 last, gross sales of the Western Electric totaled $33,000,000. In 1907 the total was $52,000,000 and in 1906, $69,000,000, the last-named figure being the high record for the company. In electric lighting supplies and electrical machinery, last month was the largest in the Western Electric's history. The eight months also were the largest eight months on record in these two lines. Of late there has been considerable activity in the foreign departments.

The Joliet Steel Car Company, Joilet, Ill., has purchased 60 acres of land in the town of Channahon, Ill., on which it expects to build a large plant for the manufacture of steel cars.

Contracts are said to have been awarded by the Carnegie Steel Company for the new steel car wheel plant to be erected at Homestead, plans for which were announced by President W. E. Corey, of the United States Steel Corporation. Approximately $3,000,000 has been appropriated for the new "Slick" car wheel plant, but it has not been determined just what portion of this sum is to be expended at this time. For the last two years the Carnegie Steel Company has been experimenting with a new process of manufacturing car wheels, by which the wheels are cold rolled. Managers of several of the large railroads have approved of this process, but until the new wheels are given a thorough test on some of the big trunk lines, the steel company will not expend the entire appropriation for a new plant.

Mr. Ralph W. Benson, formerly an engineer of the Pullman Co., has been appointed an assistant manager in the sales department, with office at Chicago. Mr. Benson succeeds Mr. A. Twyman, who has retired.

P. A. McCarthy & Sons, consulting civil engineers, will move their offices from Lufkin, Tex., and El Paso, to Houston, about September 15.

Mr. F. C. Armstead, supervising engineer of the stoker department of the Westinghouse Machine Co., who, for a number of years, has been located at East Pittsburg, Pa., has moved his headquarters to the Westinghouse works, Attica, N. Y., where the stokers are manufactured.

The Seabrook Differential Axle Co. (Colton, Cal.), has given its differential axle a practical trial by equipping a car of the San Bernardino Valley Traction Co. with the device, and trial trips made recently are stated to have been very successful. The differential axle is an axle in two sections, fastened in the center by a mechanism that keeps it rigid as to position under the car but allowing each wheel to move independent of the other. The parts are held in a hermetically sealed boxing in which certain spaces are filled with graphite lubricant. They are thus dirt proof and seldom need more lubricating. It is claimed that the device gives important advantage in improving the action of wheels around curves, or on inequalities of the track. The company states that it has had, since March 12, last, a tank car on the Atchison, Topeka & Santa Fe Ry. equipped with a full set of the differential axles. It is claimed that the engine can haul a heavier load by some 25 per cent than can be done on cars equipped with the present axle, also that cars thus equipped will not derail so readily, and further, that this tank car has shown that the life of a car wheel it at least doubled by the use of this invention.

The Nevada Northern will ask bids about December 1 for the following individual drive machine tools: One punch and shear, one 12-in. slotter, one set of rolls, one 10-ton crane and one bolt machine.

The Northern Pacific has announced that its new equipment, upon which the builders have been exerting every effort toward quick delivery, will be received in the near future; the first consignment of cars starting on August 24 from the Pullman shops. There will be 16 standard sleeping cars delivered in the next few days, and these will immidiately be placed in service on the North Coast Limited trains. Of this equipment eight of the cars will contain 14 sections and one drawing room, and eight cars will contain 10 sections, two state rooms and one drawing room. Every device for the comfort and convenience of passengers will be provided in these sleeping cars, including electric lights, fans, patent ventilators, dental lavoratories and large andc ocmmodious toilet rooms. The Northern Pacific recently received 13 new locomotives from the Baldwin Locomotive Works and 17 more are ordered. They are all of the Pacific passenger type and those received have been assigned to passenger service on the various divisions. The combined weight of each engine, with its loaded tender, is 376.900., the tenders having a capacity of 12 tons of coal and 7000 gals. of water. The engines have 22x26 in. cylinders and 69 in. drivers, and they carry 200 lbs. working pressure of steam. They are equipped with the latest improved Westinghouse high speed brakes. They are capable of an avrage speed of 60 miles per hour with a train of eight cars.

The construction of the first steel plant is progressing at Corrall, South Mexico, and the works are expected to be in going order early in 1910. The plant will cost $2,000,000, and will have a daily capacity of 200 tons. The undertaking is financed by French capital, and the machinery will be principally of French manufacture. Excellent ore is found in large quantities within five miles of the new works.

The annual report of the U. S. commissioner of navigation shows the output of the shipbhilding yards in the fiscal year ending June 30, 1909, to be the smallest since 1898, the total being 1362 merchant vessels of 238,816 gross tons, as compared with 588,627 gross tons in the fiscal year of 1898, which was the record year of American shipbuilding. Since the beginning of the new fiscal year, however, shipbuilding contracts indicate material increase. Last year only two ocean steamships were built in American yards, and no vessels for foreign trade.

The Hudson's Consolidated Co., England, have leased from the Burntisland Harbor Commissioners and the North British Railway Co. a plot of ground on which they propose to construct a dry dock of 660 fe. in length, with a depth of 24 ft. over sill, and a width at entrance of 65 ft. The dock will be capable of accomodating vessels of 8000 tons burden. The pumping machinery to be provided is to be capable of pumping water out of the dock at the rate of 6000,000 cubic feet per hour. The dock is to be fitted with electric traveling cranes, and with sheer legs for lifting loads up to 50 tons, and plant is to be provided for the repair of both ships and machinery.

Erickson & Peterson, San Francisco, Cal., recently ordered six 11-in.x16-in. four-driver saddle tank locomotives equipped for oil burning from the Vulcan Iron Works, Wilkesbarre, Pa. Two of these locomotives have already been delivered.

During the business depression the American Locomotive Co., New York, made contracts for extensive improvements to the shops at Schenectady, Dunkirk, Richmond and Pittsburg, to cost about $3,500,000. To reimburse the company for money spent and to be spent on these improvements, and to provide additional working capital which will be needed because of the increased capacity, a $5,000,000 note issue has been authorized.

The Crocker-Wheeler Co., Ampere, N. J., recently booked several large orders for direct current apparatus. One from the Indiana Steel Co. calls for 70 mill motors, totaling about 2,400 h. p. This order is an addition to the 11,000 h. p. of Crocker-Wheeler motors, employed at present by this company. The King Bridge Co., Cleveland, Ohio, recently placed an order for one 150 kw., compound-wound, 250-volt generator, to be used for supplying light and power. The Bethlehem Steel Co. recently added to its 8,800 h. p. of Crocker-Wheeler motors by an order for a 225 h. p. compound-wound motor, to be installed at the Saucon plant.

The Association of Car Lighting Supply Manufacturers was organized at a recent meeting in Chicago to furnish entertainment and to give exhibitions of car lighting supplies in connection with the meetings of the Association of Car Lighting Engineers, whose next meeting will be held at the La Salle hotel in Chicago, on October 4, 5, 6 and 7. The following officers of the Association of Car Lighting Supply Manufacturers have been elected: President, W. L. Bliss, United States Light & Heating Co.; eastern vice-president, C. W. Bender National Electric Lamp Association; western vice-president, W. E. Ballentine, Willard Storage Battery Co.; secretary, J. Scribner, General Electric Co.; treasurer, Edward Wray, Railway Electrical Engineer. A committee on arrangements has been appointed, of which J. M. Schilling, of the Westinghouse Electric & Manufacturing Co., is chairman. A committee on dues and finances has been appointed, of which Charles Talbott, of the Westinghouse Electric & Manufacturing Co., is chairman. A committee on membership has been appointed, of which Edward Wray is chairman. The membership fee for companies is $25 and for individuals, $5. The Association of Car Lighting Engineers is composed of officers of the railways having charge of car lighting and also of representatives of supply concerns. The latter will continue to belong to the Association of Car Lighting Engineers.

Captain Herman P. Schuyler, assistant treasurer of the General Electric Co., Schenectady, N. Y., died on August 14 at his home in Albany, N. Y. He was born in Albany county in 1842, and was a direct descendant of Gen. Philip Schuyler. With the beginning of the Civil War Mr. Schuyler went west and enlisted in the First Wisconsin Regiment, where he remained until the end of the war, being promoted to first lieutenant. In 1864 he was appointed head of the ordinance department of the army corps, with headquarters at the Watervliet arsenal. Resigning this position in 1870, he became the head of the sales department of the Troy Steel & Iron Co., Troy, N. Y. In 1887 Captain Schuyler went to Rogers, of the Standard Oil Co. Three years later he was called to Philadelphia to become head of the sales department of the Wellman Steel & Iron Co. at Thurlow, Pa. From this position his marked ability won for him the position of assistant treasurer, in charge of credits, of the General Electric Co., in 1893, which position he retained until the day of his death. He was especially well known in New York, Troy, Schnectady and Albany, being a member of the Fort Orange Club of Albany, Troy Club of Troy, and the Army and Navy Club, the Loyal Legion and the Holland Society of New York City. He is survived by a daughter, Mrs. R. C. Yates, and a son, Herman P. Schuyler, Jr., both of Chicago.

Grip Nuts, manufactured by the Grip Nuts Co., are to be applied on eighteen hundred box cars for the Northern Pacific Ry., which are to be built by the Pullman Co. Universal window fixtures and Universal deck sash rachets, manufactured by the same company, will be used on the fifty new cars to be built by the American Car & Foundry Co., and the Barney & Smith Car Co., for the Baltimore & Ohio R. R. The Grip Nut Co. has moved its offices from 1590 Old Colony Bldg., to 575 Old Colony Bldg., Chicago. The change was necessitated by the increase in the officc force.

The Westinghouse Storage Battery Company, which was incorporated July 12th, has acquired all of the plant, patents, and equipment of the storage battery department of the Westinghouse Machine Company and of the General Storage Battery Company, and will manufacture, at Boonton, N. J., both the Westinghouse and Bijur types of storage battery for those classes of service in which each has proven superior. The Westinghouse Storage Battery Company enters the field with greatly increased manufacturing facilities and the best engineering talent obtinable, and will maintain thoroughly equipped testing and commercial laboratories, insuring uniformity of both materials and product. The general offices of the company will be located at Boonton, N. J., with sales offices in the principal cities of the country.

Mr. L. H. Raymond, formerly master mechanic on the New York Central, has accepted a position as Eastern representative of the Grip Nut Co., of Chicago and New York.

The contract for building 1,000 feet of reinforced concrete docks for the Deering works of the International Harvester Co., Chicago, has been awarded to the Raymond Concrete Pile Co. of New York and Chicago. W. D. Price, engineer. The docks are located along the north branch of the Chicago River.

Personals.

E. Heugst has been appointed master mechanic of the Cleveland, Painsville & Eastern R. R., with office at Willoughby.

car shops, general foreman Eastern division, general foreman Scranton division, superintendent car shops, master car builder.

H. C. Eich, master mechanic of the Illinois Central, has been transferred from Memphis, Tenn., to the Burnside shops at Chicago, Ill.

T. F. Quinn has been appointed division master mechanic of the Oregon Railroad & Navigation Co. and the Oregon, Washington & Idaho, with office at Starbuck, Wash. He succeeds Mr. W. H. Dressel, who has resigned.

F. J. Barry has been appointed general inspector of air brakes, steam heat and lighting for the New York, Ontario & Western.

C. L. Dougherty has been appointed acting mechanical engineer of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Indianapolis, Ind. He succeeds Mr. B. D. Lockwood, who resigned recently to take a position with the Pressed Steel Car Co.

W. M. Scroggins has been appointed general car foreman of the Texas & Pacific at Longview Junction, Tex., in place of Mr. Thomas Welch, who has resigned.

W. Sinnot, foreman on the Baltimore & Ohio at Philadelphia, has been promoted to the position of master mechanic.


C. E. Chambers.


R. F. McKenna.


H. C. Eich.

T. Kilpatrick has been appointed a master mechanic on the Denver & Rio Grande R. R.

P. J. Ryan has been appointed a road foreman of engines on the Lake Erie & Western R. R.

A. Campbell has been appointed a general foreman on the Orange & Northwestern R. R.

J. C. McNully succeeds F. F. Mitchell as master mechanic on the Salt Lake & Ogden Ry. His office is at Salt Lake City.

Robert F. McKenna, master car builder of the Delaware, Lackawanna & Western, at Scranton, Pa., has resigned, effective Sept. 1, and will retire entirely from railroad life. Mr. McKenna was born at Scranton, Pa., in 1868 and entered railway service as an apprentice on the Delaware, Lackawanna & Western in 1884. Since that time he has been continuously in the employ of the road, with the exception of a period of about a year, when he was manager of the Buffalo Car Wheel Co. During his service with the road he has held the following positions: Chief draftsman in the car department, general air brake inspector. foreman

A further reorganization of the mechanical department of the Illinois Central R. R. makes R. W. Bell superintendent of machinery and A. J. McKillop, who was a master mechanic at Burnside shops, becomes assistant superintendent of machinery. J. E. Buker is superintendent of the car department, as was stated in last month's "Master Mechanic," and J. M. Barrowdale becomes his assistant. This completes the arrangement which separates the locomotive and machinery department from the car department.

C. E. Chambers, who, as was stated in a recent number of the "Master Mechanic," was promoted to general master mechanic of the Central R. R. of New Jersey, was employed in the shops of the bridge and building department of the Chicago, Burlington & Quincy R. R. from July, 1883, to June, 1901. In June, 1901, he went to the Philadelphia & Reading R. R. as road foreman of engines and to the Central R. R. of New Jersey in June, 1902, as general road foreman of engines. He was promoted to master mechanic of the Central division in October of the same year, and has held this position until his recent promotion.

Railway Mechanical Patents, Issued During August

Stock Car, 928,269—Thomas J. McKay, Atlanta, Ga.

Cylinder Ring, 928,294—Wander A. Wehrman and Joel C. Truebold, Belle Plaine, Ia.

Floor construction for refrigerator cars, 928,406—John Strain, Chicago, Ill.

Lock nut, 928,436—James J. Fifield, Medford, Mass.

Car axle coupling, 928,445—Richard Hackbarth, Baumschulenweg, near Berlin, Germany.

Turntable, 928,675—Michael J. Leonard, Long Branch, N. J.

Dump car, 928,698—Herman Pries, Michigan City, Ind.

Dumping car, 928,837—Carl P. Astrom, Hasbrouck Heights, N. J.

Locomotive boiler, 928,880—Orel D. Orvis, Jersey City, N. J.

Draw bar carrier, 928,890—Charles H. Tomlinson, Mansfield, Ohio.

Underframe for tank cars, 928,924—John M. Ames, Dongan Hills, N. Y.

Car underframe, 928,925—John M. Ames, Dongan Hills, N. Y.

Separable cast bolster, 928,926—John M. Ames, Dongan Hills, N. Y.

Duplex pressure emergency brake, 928,970—Theodore A. Hedendahl, Denver, Colo.

Railroad motor car truck, 928,976—Clarence H. Howard, St. Louis, Mo.

Passenger car, 928,983—Peter M. Kling, Pittsburg, Pa.

Passenger car, 928,985—Felix Koch, Bellevue, Pa.

Pressure governing apparatus, 929,055—Walter V. Turner, Edgewood, Pa.

Coupling draw bar pocket for locomotive engines and the like, 929,062—Charles T. Westlake, St. Louis, Mo.

Car fender, 929,071—Nicholas F. Alston, Inez, N. C.

Dump car, 929,104—William Q. Olden, Chicago, Ill.

Slack adjuster for draw bars,.929,114—Edward Ryan, Clinton, Iowa.

Roof for train sheds and other buildings, 929,115—Henry J. Schlacks, Chicago, Ill.

Uncoupling lever, 929,188—John P. Birmingham, East Lexington, Va.

Car roof, 929,236—Peter H. Murphy, St. Louis, Mo.

Car body underframe construction, 929,245—Oswald S. Pulliam, Pittsburg, Pa.

Draft carrier and body bolster construction, 929,246—Oswald S. Pulliam, Pittsburg, Pa.

Car truck, 929,267—Ernest B. Allen, Louisville, Ky.

Car door gear, 929,268—Harvey Allen, Pittsburg, Pa.

Car truck frame, 929,300—Charles B. Goodspeed, Columbus, Ohio.

Car wheel, 929,320—William McConway, Pittsburg, Pa.

Car wheel, 929,321—William McConway, Pittsburg, Pa.

Car wheel, 929,347—Israel P. Todd, Middlesboro, Ky.

Car brake, 929,432—Henry Hoffman, New Rochelle, N. Y.

Car door, 929,453—Chester W. Leaning, Yankton, S. D.

Automatic air coupling, 929,511—Alexander E. Squyars, Laurinburg, N. C.

Underframe for railway cars, 929,630—Clifford F. Rice, Springfield, Mass.

Logging engine, 929,662—Alexander Dunbar, Woodstock, New Brunswick, Canada.

Nut lock, 929,673—Englebert R. Kern, Fairbault, Minn.

Car frame, 929,705—Harry M. Pflager, St. Louis, Mo.

Means for introducing feed water into steam boilers, 929,716—Charles W. Seddon, Proctor, Minn.

Fire brick arch, 929,724—Enoch P. Stevens, Chicago, Ill.

Cooling attachment for stock cars, 929,725—Benjamin L. Stimmel, Hennessey, Okla.

Snow remover, 929,737—Joseph W. Weismantel, Newark, N. J.

Trailer truck for locomotives, 929,768—William F. Kiesel, Jr., Altoona, Pa.

Reversible car axle coupling, 929,771—Melkon Markarian, Los Angeles, Cal.

Current leak indicator for electrical conductors, 929,773—Raymond S. Mason, Berkeley, Cal.

Roundhouse system, 929,857—Carl W. Johnson, Chicago, Ill.

Retainer for knuckle pivot pins 929,864—Robert P. Lamont, Chicago, Ill.

Car coupling, 929,879—Newall F. Resseguie, Frederick, S. D.

Track sanding apparatus, 930,008—Charles P. White, Greensboro, N. C.

Automatic train pipe coupling, 930,041—Lewis C. Cary, Los Angeles, Cal.

Exchanger in tablet systems of railway traffic control, 930,042—William Clark, Junee, New South Wales, Australia.

Bolster, 930,051—Frank H. Davol, Jr., Brooklyn, N. Y.

Car fender, 930,062—Paul A. Faust, St. Louis, Mo.

Tank car, 930,101—Chester N. Stevens, Chicago, Ill.

Nut lock, 930,148—Frederick J. Brown ,Scranton, Pa.

Car truck, 930, 216—Albert J. McCauley, St. Louis, Mo.

Controlling mechanism for locomotives, 930,225—Eugene L. Ragonnet, Bowdoinham, Me.

Metallic packing, 930,230—John M. Rhodes, Dallas, Tex.

Brake, 930,234—Robert E. Rudolph ,Paducah, Ky.

Dumping car, 930,335—George P. Ball, Gatun, Panama.

Car-door hanger, 930,348—Cyrus L. Bundy, Kingsland, N. J.

Logging locomotive, 930,354—Harry N. Covell, New York, N. Y.

Air-brake apparatus, 930,379—Lee H. Hosack, Youngstown, Albert H. Geltz, Alliance, and Walter W. McBane, Youngstown, Ohio.

Reinforcing plate for railway car center and end sills, 930,391—Felix Koch, Bellevue, Pa.

Door hanger, 930,393—James G. B. Lamb, Williamston, Mich.

Car door operating mechanism, 930,434—John F. Streib, Avalon, Pa.

Lubricator for locomotive, 930,525—Emanuel Blauhorn, Vienna, Austria-Hungary.

Car stake, 930,623—Frank Shillin, Sunby, Minn.

Car roof, 930,679—Walter P. Murphy, St. Louis, Mo.

Stay bolt, 930,805—William M. Smith, Turtle Creek, Pa.

Stay bolt, 930,807—William M. Smith, Turtle Creek, Pa.

Flexible stay bolt, 930,809—William M. Smith, Turtle Creek, Pa.

Stay bolt, 930,810—William M. Smith, Turtle Creek, Pa.

Tube expander, 930,820—Gustav Wiedeke, Sr., Dayton, O.

Tube expander, 930,821—Gustav Wiedeke, Sr., Dayton, O.

Locomotive ash pan, 930,866—John A. Kremser, Duquesne, Pa.

Steam pipe coupling for cars, 930,933—John E. Brodie, Rochester, N. Y.

Flush door hanger, 931,052—George Fristad, Garrington, Alberta, Canada.

Lubricating device for car axle, 931,053—Harry C. Gamage, New York City.

Friction block or shoe, 931,093—Charles C. W. Simpson, Wigan, England.

Bell ringer, 931,108—Edward Wilson, St. Louis, Mo.

Stay bolt drilling machine, 931,119—James Hocking, Norwood, Mass.

Draw bar and extension shank for cars, 931,193—Myers A. Garrett, Chicago, Ill.

Air brake system, 931,234—Edwin M. Swift, Ballard, Wash.

Air brake, 931,237—Walter V. Turner, Wilkinsburg, Pa.

Triple valve, 931,238—Walter V. Turner, Wilkinsburg, Pa.

Triple valve, 931,271—John W. Cloud, London, England.

Truck, 931,413—Harry C. Grant, Bayonne, N. J.

Truck, 931,414—Harry C. Grant, Bayonne, N. J.

Railway Master Mechanic

Established 1878

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CONTENTS.

Side Frames and Trucks

Considering the activity of its "knockers," it would seem that the days of the arch-bar truck should have been long since numbered. The newer devices in side frames and trucks are fast displacing it but not so fast as some persons would desire. There is no question but that the arch bar type has been improved upon, whether or not the improvement warrants the payment of increased initial cost with royalties, etc., is another question. In general, two classes of improved side frames have gained wide recognition; the type which combines in one piece all the parts of the arch bar frame, and the type which includes in one piece these parts as well as the journal boxes. The first of two improved frames seems to be a compromise between the arch bar and the all-in-one-piece designs, and an analysis of its advantages shows that many of its points are claimed for the strictly one-piece idea as well. Without exception the newer designs of trucks including the side frames are designed by structural engineers in much the same way as are modern bridges and buildings, the amount of metal is cut down to that absolutely required to give the necessary strength with a selected constant for safety. The metal that is used is so distributed mathematically as to resist the greatest strain. All this is not true of the arch bar type. The result of scientific design is usually a stronger truck in spite of the fact that it is in almost all cases a lighter one.

The elimination of numerous small parts is an item the value of which is not easily computed, it can at best only be estimated. One design (that which does not include the journal boxes), eliminates from forty to fifty pieces per car. The other improved type eliminates, of course, many more, but involves the difficulty of taking apart the entire truck in order to change a pair of wheels, and possibly involves also some uncertainty on account of the necessity for having a loose connection between the side frame and spring plank. The weakness at the junction of the top and bottom members of the arch bar frame can be held accountable for a great many avoidable hot boxes and a great deal of uneven wear on brasses. Structurally designed frames are especially strong at this point and the skewing to one side is thus avoided, an even weight on the brasses being the result.

A question, the solution of which seems still to be a matter of personal opinion, but which has been the object of many tests, arguments and much demonstration, is whether it is not possible to go too far in the idea of one-piece construction. Accidents are daily occurrences on large systems. The more complicated a member, the more liable it is to, at least, temporary disalignment. One of the prime arguments for avoidance of too many parts is the decrease in bad order cars. Therefore the question is one of extreme delicacy, but one which will surely solve itself.

Among the railroads whose mechanical men have experimented somewhat along this line and which have applied many of the newer trucks to car equipment are the following: Chicago, Lake Shore & Eastern, Chicago, Milwaukee & St. Paul, Central R. R. of New Jersey, Cleveland, Cincinnati, Chicago & St. Louis, Hocking Valley, Illinois Central, New York Central & Hudson River, Oregon & Washington, Pittsburg & Lake Erie, St. Louis Southwestern, Southern Pacific and Union Pacific.

The Winter Season.

We are entering the strenuous portion of the year; the season when days are short and evenings long. Clubs and associations which have been dormant for the past two months are again becoming active and preparing their plans for the winter season.

There are some who question the benefits derived from a railroad club and who say that they get little value from it. But the growth of railroad clubs and organizations during the past few years and the interest taken in them, seems to disprove this. The fundamental idea of a club is fellowship, and there is nothing which can broaden a man's scope of mind like meeting in a spirit of fellowship men who are working towards the same things which he is working towards. It has been said that a major part of the work of conducting a railroad club falls on the secretary, and this is too often the case. A man gets just as much out of the club as he puts in; if he enters into a discussion, he must get something out of it as he hears what others think of his ideas. A suggestion has been made that one club take up a topic at the same time with several other clubs, thus giving a chance for a comparison of ideas. To the man who resolves to make them so, the evenings spent at his railroad club should prove most profitable and pleasant to him. With the returning wave of prosperity the coming season should be one of great value to the members of railroad clubs.

Mr. George A. Hancock, S. M. P., St. Louis & San Francisco R. R., has arranged an injecter outside the erecting department of his new shops at Springfield, Mo., so that by means of hose connection, the dirty incoming locomotives can be cleaned up before entering the floor. One day one of the men was cleaning up an engine preparatory to running it onto the transfer table, and had proceeded as far as the firebox, into which he directed the stream, when a series of hoarse shouts coming from the interior begged him to desist. The hot water was shut off by the surprised pipeman and immediately a wild eyed drenched specimen of the species hoboe dragged himself through the firebox door and made off across the prairie. He had been asleep in the dead engine on a pile of waste and had not been made aware of the fact that his Pullman had reached its destination.

Santa Fe Locomotive Record.

The Atchison, Topeka & Santa Fe Ry. has a Baldwin Atlantic four-cylinder balanced compound locomotive which was recently shopped for the first time since delivery in August 1905 after having covered 227,902 miles. By means of the engine expense system used on this road, $5,700 is computed to this locomotive's credit.. This is probably the world's record in locomotive service and that being the case, the conditions which, working together, brought such favorable results, would be well worth study, the Santa Fe will soon be in possession of eighteen new locomotives of this same class now building at the Baldwin Locomotive Works. The most noteworthy difference is in the fact that the new engines are to be equipped with superheaters.

More Terminal Electrification Discussion.

This paper has, at least once, stated its position as to the problem of electrification of the Illinois Central R. R. terminals in Chicago. Recent developments seem to forebode something of a clash between would-be authorities in railroad problems and the officials of the Illinois Central. A certain public official of the city of Chicago, whose duties and efforts are supposedly along the line of maintaining or raising the standard of the public health, has broken into print and been credited with the statement that he may be able to induce President Harahan to reverse a decision recently expressed, to the effect that the latter will tell the stockholders of the road that electrification will result in a reduction of the dividend rate. In other words, the city official will pit his knowledge of the science and technic of railroad management and operation against not only the judgment of Mr. Harahan but against that of all of his advisors, including a board of engineers who have been working on the problem, as well as against that of the mechanical and executive officials of the road. We believe that the management of the railroad is open-minded and unprejudiced in the matter of electrification of its terminals. It may be true that electrification of the Chicago terminals would precipitate upon the Illinois Central the same problem in several other cities, as has been stated, but this fact is aside from the issue, because if such a change in the motive power is feasible from a financial standpoint in Chicago, the same would be true of the other terminals. In general, electrical motive power over certain zones of a steam railroad, is still a doubtful proposition. The methods of application are still in a crude state of development and indications are that a change in principles is not many years off. Therefore, let the tests be run on a smaller scale, until concrete data can be obtained and applied on the greater propositions such as this one.

In this connection it is interesting to note that efforts to obtain a basis for computing costs, feasibility, etc., of steam road zone electrification are now being made in several foreign countries. Notably the French railway, Paris-Lyons-Mediterannee, is at present carrying out experiments in conjunction with Messrs. Alioth, with a view to converting the Cannes-Vintimille section of its line from steam to electricity. The experiments are being made on the Grasse-Mons-Sartouse section, which is very convenient for the purpose, as it includes some of the steepest grades and sharpest curves, and is also not crowded with traffic. The overhead wire is suspended flexibly by means of a system patented by Messrs. Alioth, which does not involve the use of separate suspension wires. Wooden poles are used at present, but these are to be replaced by metal lattice work supports later on. The locomotive used weighs 140 tons, and is approximately the same length (65 ft.) as the normal steam locomotive in use on the road, including the tender. There are eight axles, of which the four central ones are driving axles with large wheels. The overhead line is supplied with single-phase alternating current at 12,500 volts, but this is converted on the locomotive into direct current at a voltage adjustable between 0 and 600 at will. The motors are of the ordinary direct-current type of 450 h. p. each, and there are four to each locomotive. They are flexibly geared by means of spur gear to the four driving axles. The total draw-bar pull exerted by the locomotive is 16,400 lbs. at a speed of 37 miles per hour, and 10,600 lbs. at a speed of 62 miles per hour.

Faster Times for Western Trains

According to the newspapers, the withdrawal of the Burlington road from the agreement among the western roads as to the running time to be maintained between Chicago and Denver and the Pacific Coast and the threat of inaugurating a speed war brought a definite reply from the Chicago & Northwestern Ry. recently, whereby that company announced a reduction of two hours in running time between Chicago and Denver on its fast trains. The new schedules became effective Sept. 12, and are as follows: The Oregon-Washington limited, which now leaves Chicago at 11:30 a. m., will leave at 10:00 a. m. and reach Portland at 8 o'clock the third morning; eastbound, this train will leave Portland at 6:35 p. m. and reach Chicago at 8:35 o'clock the third evening. The Colorado special, which now leaves Chicago at 10 a. m., and reaches Denver at 2 p. m., will leave Chicago at 1:30 p. m. and arrive at Denver at 4 p. m. the next day. Eastbound, the Colorado special, which now leaves Denver at 2:45 p. m. and arrives at Chicago at 9:15 p. m., will leave Denver at 12 o'clock noon and arrive Chicago at 4:30 the next afternoon. The Overland limited, which now leaves Chicago at 5 p. m. and arrives Denver at 9:30 p. m., will not leave Chicago until 7 p. m. and will reach Denver the same time as at present, and it will also reach San Francisco at 7:28 p. m., the same as now. Eastbound, the Overland limited, which now leaves San Francisco at noon, will leave there at 10:40 a. m., and it will leave Denver at 8:15 a. m., instead of at 7:20 a. m. as at present, and arrive Chicago at 12:45 p. m. instead of 1:45 p. m. as now.

Surprise Tests on the Pennsylvania Railroad

A report issued August 26 shows that over 156,000 efficiency tests were made by the Pennsylvania Railroad in the first six months of this year, and practically a perfect record was made by the employees. The average number of tests made each day was 862, and the total for the six months, 99.6 per cent were perfect. In the 0.4 per cent of failures are included the cases where enginemen passed signals by a few feet before stopping their trains, and similar cases, which, though technical violations, were not such as would make possible an accident to a train. Efficiency, or surprise tests, are conducted by officials of the Pennsylvania Railroad, who, at unusual times and places, set signals at caution or danger, extinguish signal lights, display fuses, or place torpedoes on the track, with a view to keeping enginemen constantly on the alert for any and all signals. In conducting surprise tests the officials sometimes extinguish signal lamps, and while enginemen may stop at the signal, failure to report the dark lamp at the next station lays them liable to suspension. Failure to observe any of the rules regarding the operation of trains is disciplined. The tests made this year were divided into four classes, in which the following records were made by the men: Block signal rules, 24,292 tects, of which 99.6 per cent showed perfect observance on the part of employees; rules governing flagmen, and the use of fusees, torpedoes and other signals, 23,042 tests, with 99.5 per cent perfect; trains ahead of schedule time, 53,503 tests, with 99.7 per cent perfect; signalmen relieving each other, 99.9 per cent perfect out of 56,112 tests. The New York division, the line between New York and Philadelphia, showed a perfect record in all signal tests, as did the Cresson and the Central divisions. On the Sunbury and Shamokin divisions a total of 8,732 signal rule tests were made and in only nine cases was the observance imperfect. Nine of the 26 divisions reported perfect observance of all block signal rules; five were perfect in other signals, twenty-one in trains running ahead of schedule time, and ten in signalmen relieving each other.

The Chicago, Burlington & Quincy R. R. has had constructed four coaches termed "lounging cars," for use on four of its through trains, a particular feature of which will be the installation in each of a small library to include Dr. Eliot's famous "five feet of books." The cars embody the idea of a lounging room on wheels and are intended for the use of both men and women passengers. One end of the car is devoted to a new style of observation platform, entirely enclosed by glass doors and windows. The car is 78 ft. in length, a little longer than the average coach, and so allows for more conveniences in the interior. One end is given up to a buffet-smoking room seating nineteen passengers. The ladies' parlor at the other end accommodates twenty-five. At the center is the writing room, with two desks, the library and a telephone for use at the stations. The library will include, in addition to Dr. Eliot's collection, Shakespeare and the Bible, several of the current magazines and general statistical railway information.

The man with the glassy eye and preternaturally solemn demeanor put down a coin at the ticket office and demanded a ticket. "What station?" snapped the agent. The would-be traveler steadied himself. "What stations have you?" he asked, with quiet dignity.

Pneumatic Dispatch Tube

The pneumatic dispatch tubes used on the Pennsylvania railroad between the inspection pits and the roundhouse foreman's office, for the purpose of quickly forwarding inspection reports, were thus described by Mr. William Elmer, master mechanic on that road at Pittsburg.

The dispatch tube is made of 2-in. pipe laid in a box underground or carried on the ends of ties; corners are turned with easy curves. The fins are smoothed off the inside of the pipe and a simple carrier can be made of an old air brake hose. When the inspection reports are ready they are slipped into the carrier and the latter pushed into the open end of the tube. A hinged flap valve is then held against the tube and the air pressure turned on, a distance of several hundred feet can be traversed in a few seconds. As almost all our large engine houses are provided with air compressors, it is easy to secure the air pressure needed by using a reducing valve set to a few pounds. The carriers as they come out of the tube strike against a spring buffer a foot or so away and drop into a basket. The man at the receiving end then signals to the other end by means of a bell or incandescent lamp and the air is shut off and the flap valve allowed to fall.—Compressed Air Magazine.

This is a story told by a commercial traveler after a trip through southern Canada: "Being impatient to get out of a sleepy little town I hurried to the station. After a while an object slowly emerged from the distance and slunk up alongside. I boarded the solitary coach and, after a tedious wait, the engine began to gasp feebly, the old coach creaked a little, but the train did not move. I was about to get out to see what was the matter when the forward door of the coach was suddenly flung open and a head popped in. 'Hey, you,' said the engineer, leering at me, 'climb off till I get a start, will ye?' "

Plaster-of-paris is a good flux for use in melting scrap brass, such as washings, grindings, etc. It melts at a red heat and dissolves the foreign matter in the metal, and at the same time does not attack the crucible.

A Successful Superheater, Canadian Pacific Ry.

The Vaughan-Horsey superheater, which has been giving excellent results in both passenger and freight locomotive service on the Canadian Pacific Railway, is fairly familiar to those who have attended the mechanical conventions at Atlantic City. Mr. H. H. Vaughan, assistant to the vice-president of this road has submitted very useful and interesting data on superheater works, and the appliance as shown in the accompanying drawings was designed jointly by Mr. Vaughan and Mr. Horsey, mechanical engineer.

The records made by locomotives equipped with this superheater have been published often and the fact that almost all Canadian Pacific engines either are already equipped, or are being equipped with it, is a strong point in its favor. The description as given by Mr. Vaughan is as follows:

The superheater consists of two headers as shown in Figure 1, the upper of which is known as the saturated and the lower as the superheated header. The steam from the throttle enters at "A" and passes downwards through the extensions on this header and is distributed through the two and four way fittings shown in Figure 2, to the bent pipes which connect to the headers by union nuts as shown, Figure 3, and extend backwards into the boiler flues which are 5 inches in diameter to a point about 20 inches from the back flue sheet. These tubes have return bends at the end near the firebox flue sheet and the steam, returning, enters the superheated steam header. The superheating is thus done by the passage of the steam against and with the flow of gases from the firebox.

On the design shown in Figure 1 there are ninty-six pipes or forty-eight superheating elements, the combined capacity of which is sufficient to superheat all of the steam admitted through the throttle and dry pipe. The steam after passing through the superheater pipes and entering the superheated header is carried through the two steam pipes at "B" to the cylinders.

The arrangement of the plating in the smokebox is such that the passage of hot gases from the firebox may be cut off through the 5-inch flues in which are located the superheater tubes. This is necessary when the throttle is closed as there being no steam in the pipes they would burn out, and the superheater damper cylinder, Figure 4, has been applied and connected to a damper in such a way that steam being admitted to it while the throttle is open, opens the damper, permitting the passage of gases through the 5-inch flues, but when the throttle is closed the counter weight at "C" (Fig. 1.) closes the damper and shuts off the draft, which is then necessary through only the lower flues.

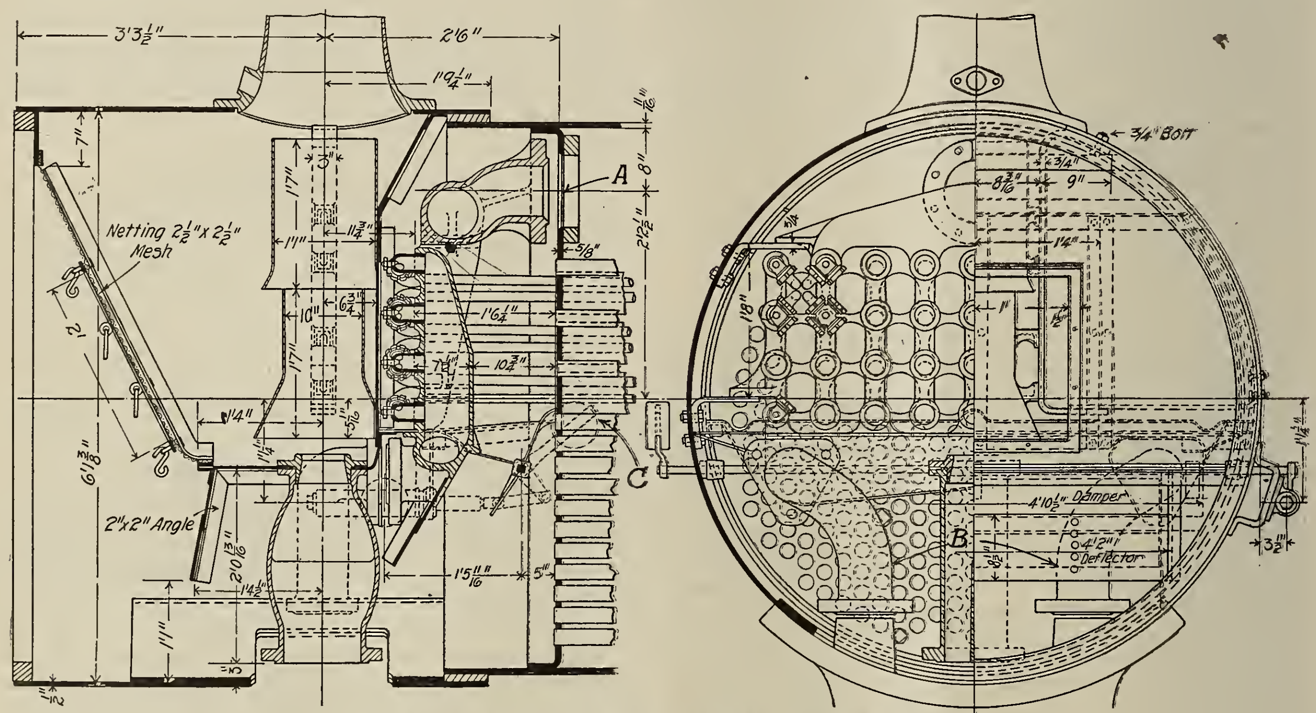


Fig. 1—Smoke Box Arrangement, Vaughan-Horsey Superheater.

Report of the Master Blacksmiths' Convention

The seventeenth annual convention of the International Railroad Master Blacksmiths' Association, at Niagara Falls, was opened August 17 by President Russell, who introduced Rev. Father Walsh, of Niagara Falls University, who made a short address of welcome. Rev. F. S. Parker, Ph. D., of the St. Paul's Methodist Episcopal Church, was then introduced, who in behalf of the Mayor of Niagara Falls, N. Y., delivered the address of welcome to the city. In behalf of the association, Mr. W. W. McLellan, of Denver, ex-president of the organization, delivered a response to the speakers. President Russell followed with his address.

The convention then went to work on the business program, taking up the reports of the committees, topics, discussions, etc. J. S. Sullivan read the resolutions on the death of John McNally, ex-president of the association. After the report of the hotel committee the convention took up the topic reports. The topics were all freely discussed after the reports were read. The last business transacted was the election of officers and selection of meeting place for 1910. Detroit, Mich., was chosen as next meeting place.

The report of Secretary A. L. Woodworth showed that the association had taken in thirty-three new members and had lost three by death. Those who had died were John McNally and John Kuhn, of Chicago, and James Fenwick, of Montreal. The membership now consists of 309 active, 35 associate and 7 honorary, making 351 in all. The financial report showed there

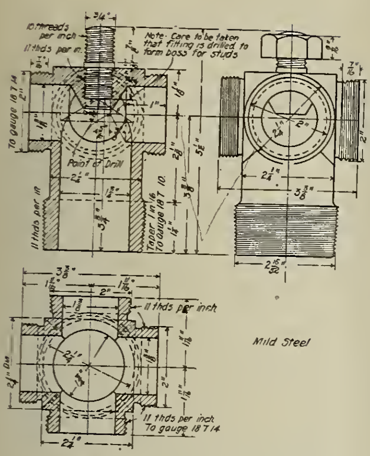


Fig. 2—Four Way Fitting.

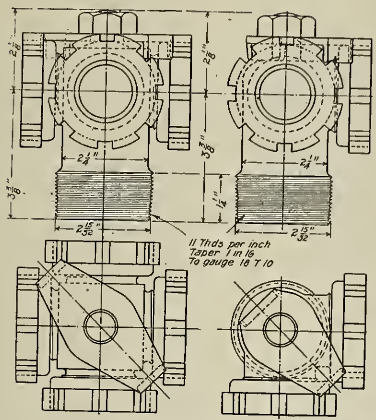


Fig. 5—Two and Four Way Fittings.

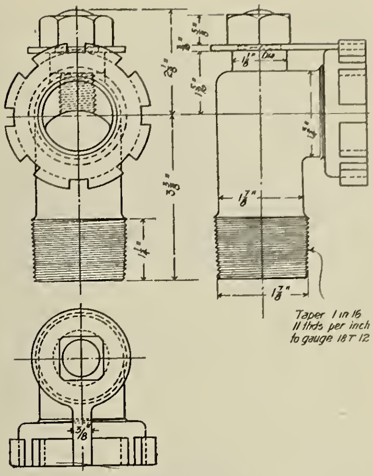


Fig. 6—Arrangement of Elbow Fitting.

were $304.03 on hand. These facts indicate that the organization is in a flourishing condition in every way, the success of which is largely due the officers in charge.

The following are the officers chosen for the coming year: President, G. W. Kelly, Central Railroad of New Jersey, Elizabeth, N. J.; first vice-president, John Connors, A. & W. P. Ry., Montgomery, Ala.; second vice-president, F. F. Hoeffle, Louisville & Nashville, Louisville, Ky.; secretary-treasurer, A. L. A. L. Woodworth, C., H. & D., Lima, O.; chemist, George H. Williams, B. M. Jones & Co., Boston, Mass. President Kelly selected the following as the executive committee: J. T. McSweeney, chairman, Baltimore & Ohio, Baltimore, Md.; J. E. Carrigan, Rutland Ry., Rutland, Vt.; J. H. Hughes, Kansas City Southern, Pittsburg, Kan.; John Caruthers, D., M. & N. Ry., Proctor, Minn.; C. A. Sensenbach, P. R. R., Sunbury, Pa.

Report of the Traveling Engineers' Convention

The seventeenth annual convention of the Traveling Engineers' Association at the Albany Hotel, Denver, was opened at 9:30 a. m., Sept. 7, 1909. An address of congratulation by Angus Sinclair, followed the opening prayer by Reverend Fish. Mr. Sinclair predicted a brighter future for the members of the mechanical departments of railroads than they have realized in the past. The changes in the organization of some of the railways, principally the Harriman lines organization, will bring the mechanical departments into closer touch with the managing officials of the railway. The result of this closer relationship will be the selection of men from the mechanical ranks to fill positions that are now chosen from the ranks of operating departments.

President J. A. Talty then presented his opening address, which, briefly, was as follows:

"Sixteen years ago this association, then in its infancy, held its second annual convention at Denver. When we look back and consider that at that time there were only 106 members, and that there were as many different opinions as to the wisdom of the organization of such an association, not only among the members themselves, but also among the higher mechanical officials of the railroads, I think that you will agree with me that this assembly fully demonstrates that the charter members, a few of whom we are happy to have with us to-day, set this association on a stronger foundation than was anticipated at that time. At the opening of this convention there are enrolled upon the membership list nearly 700 members. This membership, in view of the fact that it represents a healthy growth, with no setbacks in the seventeen years, is a testimonial of its value and popularity among other railway mechanical associations.

"When this association was started the position of the traveling engineer was not looked upon as being of great importance, but to-day it is considered one of the most important on American railroads. This condition has been largely brought about through this association by improving the locomotive service and by investigating and discussing in common the problems peculiar to the position.

"A good live traveling engineer, who is able and willing to

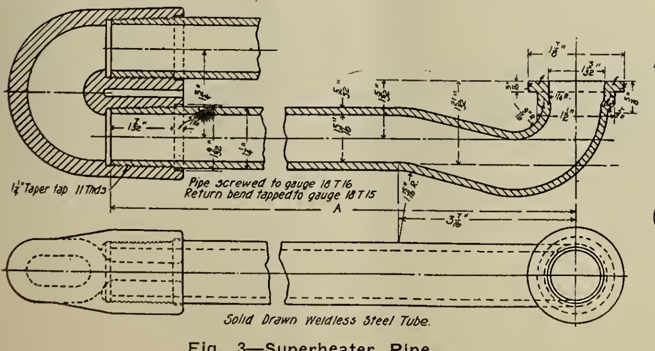


Fig. 3—Superheater Pipe.

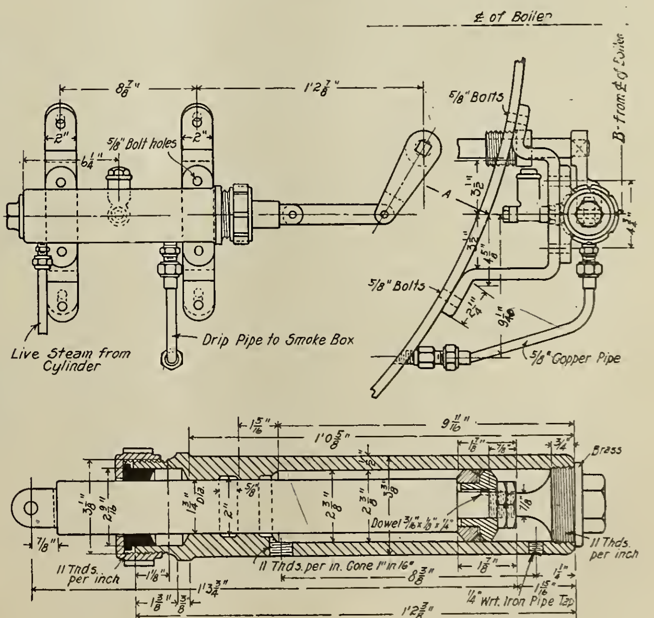


Fig. 4—Arrangement of Damper Cylinder.

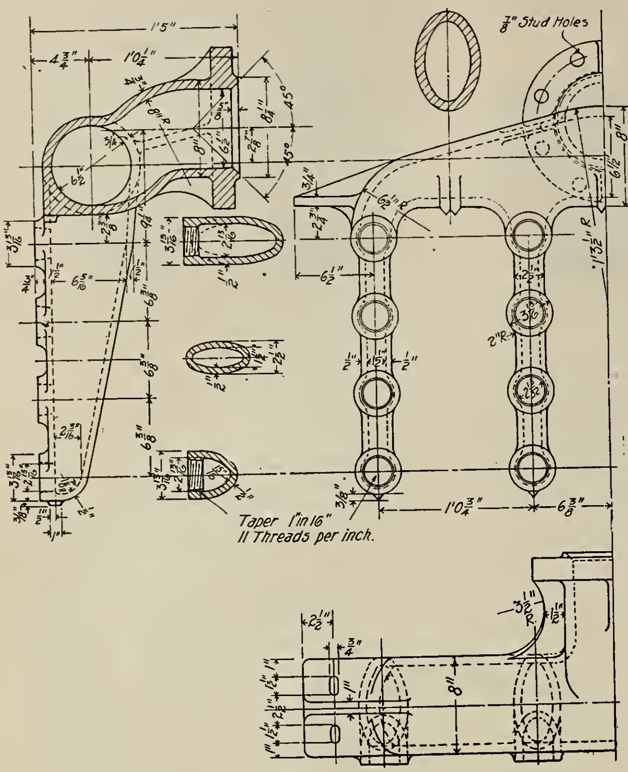


Fig. 7—Top Header.

give his time and attention to the men under his charge, as well as the locomotives, is doing a great deal toward building up an organization which assists in rendering valuable service to both the transportation and mechanical departments. To do this he must be fair in his dealings with the men under him as well as with his company. He must conduct himself in a manner which will win respect from his officials as well as others with whom he comes in daily contact. This condition established is appreciated by his superiors, who are always willing and anxious to recognize the ability with larger duties in more responsible positions.

I wish to call your attention to the important subjects which are to be discussed at this meeting, as they are of more than ordinary interest to our progressive American railroads. Particular attention is called to the close investigations which are being made together with the improvements in the development of the automatic stoker. The men who are devoting their time and money toward perfecting this much-needed device are public benefactors indeed, for the time has long since arrived when the number of cars or tons of freight that make up our freight trains are not measured by the tractive effort available in the locomotive, but by the ability of the fireman to maintain the maximum steam pressure, which is very nearly impossible, even with the best of fuel and the highest standard of locomotives.

"We can all remember the remarks of one of the brightest lights in the railroad world who said, on the floor of our convention, a few years ago, that none of us would live to see electricity used for motive power, except on street railroads less than three miles long. Several of my predecessors have given you a word of caution about the prominence of the electric locomotive, which is manifesting itself in railroading today, and I cannot refrain from again calling your attention to the necessity of posting yourselves on this subject. The substitution of electricity for steam has thus far been rather slow, but improvements are constantly being made in electric power which should not be underestimated, and it therefore behooves us to give the subject careful consideration to the end of being able to handle electric power as efficiently as steam."

After an intermission in which the guests were permitted to retire, the secretary gave his report, which showed that the organization was in good condition, both in regard to membership, which is now 694, and in its finances.

The first paper to be considered was that of locomotive equipment. This paper was published on page 379 of the September issue of Master Mechanic. The discussion of this paper centered upon the question as to whether or not derailers should be carried on tenders of all engines or just upon engines in classified service and in switching service. Several points were brought out on both sides of the question. The fact that trains are of considerable length, and it being necessary to carry the frogs from one end of the train to the other when the frogs are kept in the caboose, many times causes considerable delay that could possibly be avoided by equipping the engines with frogs. Again, in cases of derailments of cars that occur in the first section of a train, doubling on a grade leaves the engine entirely helpless, while had the engine been equipped with derailers the wheels might have been replaced with very little delay. The question of leaving derailers off from all locomotives met with some favor. On the other hand, their universal adoption, considered from an economical angle, was discussed, and in view of the fact that the first cost would be so great it was considered an uneconomical investment.

In the consideration of the question of small tool equipment it was generally agreed that such an equipment should be maintained. But the method of maintaining it was divided between that of individual tool boxes and oilers for each engineer, holding him responsible for the contents and that of equipment being placed on the engine, the latter system necessitating a system of checking. A very good means of maintaining a check suggested was to check the tools in against the engineer at the end of his run and out against the tool inspector when the engine was ready to leave. This system would hold the engineer responsible for the tools at the end of his trip and the inspector would have to replace any shortages at the beginning of the trip.

In reference to the tendency which exists among engineers to draw too many tools and supplies, a suggestion was made that the record of such enginemen should be posted so that the remaining enginemen might know who the offenders were.

A motion was made that the report of the committee be received and approved. Motion carried and the discussion closed.

The paper next to be considered was that upon the subject of fuel economy. The paper was most thorough and covered many of the points upon the subject interesting to higher mechanical officials as well as traveling engineers.

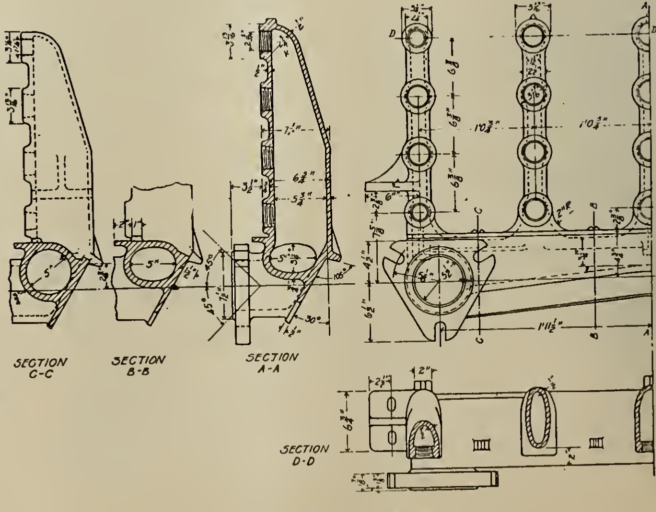


Fig. 8—Bottom Header.

In the discussion it was stated that the railroad companies were confronted with problems from both the public and the employees, which made it difficult at times to make both ends meet. The public demands were for lower rates and the employees' for increased remuneration. There are two ways for the railroad companies to meet the demands and still pay dividends, i. e., effect a reduction in the cost of transportation or by increasing the tonnage per unit of power. Cost of transportation can be effected by a campaign of education of the "man at the wooden end of the shovel" and by the purchasing department in supplying the mechanical department with coal of a uniform quality. A great deal of cost results from supplying several kinds of coal to locomotives, not only from the fact that coal of one kind will not burn successfully upon a grate designed for another coal, but in the expense necessary to change the draft and grates to accommodate various kinds of coal.

Among other methods of saving coal it was recommended that the slack be kept up between the engine and tender to reduce the vibration that occurs in descending heavy grades, causing the coal to be shaken off; more care be taken in loading tenders to not heap the coal too high; the firing should be done smokelessly. Finally the co-operation of all the departments, whether in the departments supplying or using fuel, would be of great assistance in efforts to save the coal supply.

The second session of the Traveling Engineers' Association convention was called to order at 9:00, Sept. 8, and after a short discussion on the subject of fuel economy, which was left over from the first session, the members of the association listened to an address by Hon. John F. Shafroth, governor of the state of Colorado. His address consisted of a welcome to Denver, commenting upon the beautiful scenery of the state. He spoke also of the water power that existed in Colorado which could be harnessed. He forecasted the view that in years to come railroad trains would be hauled over the mountains by current generated by the mountain streams.

The next paper to be read was "Proper Method of Handling Air Brakes on Long Trains to Insure Smooth Service." Several interesting points were brought out in the discussion, i. e., the holding feature of the equipment should not be used except where there is danger of breaking in two by letting it off, when there is any probability of slipping or heating tires. Considerable controversy arose over the portion of the paper which read as follows: "With short trains of thirty-five cars or less equipped with H valves, and all trains, regardless of their length, equipped largely or wholly with K valves, make initial reduction of 4 to 6 lbs. and hold for a sufficient length of time to allow the coupler slack to become adjusted, after which increase braking power from time to time by making 4 to 6-lb. reductions until the desired reduction is obtained." It was contended that 4-lb. reduction would not effect the triple valves at all, or if it did it would only get those in the best condition, leaving the sticking triple valve unaffected, which would probably go into emergency at the next reduction. Mr. Turner of the Westinghouse Air Brake Co. produced the results of some tests that he had made previously with the idea of showing that all the brakes had been set on a 150-car train with a 5-lb. reduction. Mr. Turner also said that the H triple was entirely independable in individual tests and that its value could only be determined by an average of a large number of tests.

Following the paper on air brakes was read a paper entitled "Boiler Check Valves and Feed Water Delivery Pipes. Does their location and arrangement affect the Working of the Injector, Steam of the Boiler and the Formation of Scale?" This paper was printed on page 381 of the September issue of the Master Mechanic.

One system of putting the water in at the side of the boiler just above the water line and directing it upward by means of an elbow had the advantage of working fairly well when it is new and the disadvantage of scale forming in the elbow reducing the size of the opening. Claims were also made that with check valves located on top of the boiler similar to the Phillips valve, a saving of 75 to 80 per cent had been saved in leaky flues. It is interesting to note the figures representing the temperature in several parts of the boiler. One of the members of the association stated that when water was delivered to the boiler at the top the difference in temperature between the top and the bottom of the boiler was 10°; when delivered at the bottom the difference was 90°, while with the side delivery the difference between the water at the check and at the mud ring was 45°. Objections were then made to the check in the top of the boiler on the ground that the cold water would either come in contact with the steam pipe or would be retarded by deflections necessary to keep it from the steam pipe.

The last paper considered in the second session was "Piping Arrangement for Steam, Air and Water Between the Locomotive and Tender—Rubber Hose Versus Metallic Connections." This report was accepted for the information that it contained. It was published in full in the Master Mechanic issue for September. The only questions that were raised were the claims that the grit in water often cut out the seat of the joints and that occasionally on rough track metallic signal connections were jarred loose causing the signal to blow.

The third session of the convention considered the report of Mr. W. C. Hayes on "Modern Methods of Cleaning Ash Pans." This report covered a description of several types of ash pans in use on various roads including the display of models of some of them.

In discussing the paper the opinion of many of the members favored the steam or water blower in the ash pan. This method serves the double purpose of removing the ashes from the pan and at the same time extinguishing all the live coals which might set fires. It was suggested that in piping to the ash pan blower the supply pipe be connected with the boiler at a height corresponding to the second or third gauge-cock. In this location the event of cleaning the pan the blower will also act as a skimmer. The blower in the ash pan is considered by many roads operating in localities, where the winter seasons are severe, as valuable as a means of keeping the pan free from snow and ice. In the case of slide bottom and drop bottom pans it was suggested that the air pump exhaust be utilized to heat the pan in very cold weather.

The next paper to be considered was the report of the committee on Walshaert valve gear and "Methods of Procedure in Failures or Breakdowns on Simple or Compound Locomotives Including Simple, Compound and Mallet Type." This report was accepted by the convention. The last session of the convention was given up to the reading of a paper on "Tender Derailments," and one on the "Development of the Electric Locomotive," together with the business session, at which the following officers were elected for the year 1909-10:

C. F. Richardson, president; F. C. Thayer, first vice-president; W. C. Hayes, second vice-president; W. H. Corbett, third vice-president; O. W. Thompson, secretary, and C. B. Conger, treasurer. The members of the executive committee were elected as follows: S. D. Wright, D. L. Eubanks, Chas. Cottr, John McManamy, F. D. Roesch and W. H. Corbett.

The following railway supply companies were represented at the convention: American Locomotive Co., New York, by W. P. Steele; American Locomotive Equipment Co., Chicago, by C. B. Moore, L. S. Allen and F. G. Boomer; American Steam Gauge & Valve Co., Boston, by C. H. Smith; American Steel foundries, St. Louis, Mo., by W. G. Wallace; Ashton Valve Co., Boston, Mass., by J. W. Motherwell; Crane Co., Chicago, by F. D. Fenn; Dearborn Drug & Chemical Co., Chicago, by J. D. Purcell, D. E. Cain, J. H. Brown, W. S. Reid and J. F. Roddy; Detroit Lubricator Co., Detroit, Mich., by A. D. Howard;

Galena Signal Oil Co., Franklin, Pa., by W. J. Vance, W. O. Taylor and J. A. Roosevelt; Garlock Packing Co., by Fred W. Wells and J. E. Hillerman; The Leslie Co., Lyndhurst, N. J., by J. J. Cizek; Railway and Locomotive Engineering, New York, by Angus Sinclair; Mason Regulator Co., Boston, Mass., by Frank C. Morrison; Nathan Mfg. Co., New York, by Geo. Royal; National Boiler Washing Co., Chicago, by W. White; New York Air Brake Co., New York, by B. Pratt and William Owens; Ohio Injector Co., Chicago, by Wm. S. Furry, F. W. Edwards and Frank Furry; Pyle National Electric Headlight Co., Chicago, by J. Will Johnson; Wm. Sellers Mfg. Co., Philadelphia, Pa., by C. B. Conger and S. L. Kuros; Storrs' Mica Co., Owego, N. Y., by Chas. P. Storrs; Westinghouse Air Brake Co., by T. G. Hedendahl, E. H. Beck and S. D. Hutchins.

It has been the fashion of many roads for a number of years past to economize on the oil supply for locomotievs to such an extent as to create more friction between moving surfaces in contact than there would be if proper amount of lubricants were used, also cutting frictional surfaces. This has resulted in locomotives burning more coal than they would otherwise, and lying down with their tonnage rating at times, when, if properly lubricated, they would have handled same. This is a case of spending dollars in trying to save cents. The matter of oil allowance should be left entirely to a practical man, who is directly in charge of men and engines to be handled by him regardless of the prevailing fashion.—C. F. Smith, R. F. E., T. R. R. of St. L., before the St. Louis Ry. Club.

English Locomotive Boilers*

By GEORGE HUGHES, Mech. Eng'r., Lancashire & Yorkshire Railway

The Lancashire & Yorkshire Railway possesses 1,517 locomotives, 1,052 of which have been constructed at the Horwich works. Approximately, 1,100 engines are in use daily, the number varying, of course, with the demands of traffic. When the works at Horwich were opened the company had 1,000 engines, 353 of which were passenger engines and the rest freight engines. There were twenty-nine different types of passenger engines and twenty-six types of freight engines. An attempt was made at that time to reduce the number of types to as few classes as possible and to introduce standardization, and, wherever possible, interchangeability.

As a result of this policy for a number of years, until the introduction of larger types of locomotives, the flanged plates were common to each class of boilers, with only a slight difference in the length of the barrels. When the larger types were introduced, however, this uniformity disappeared, and Figs. 1 to 10 illustrate the different boilers for various classes of engines.

In the first boilers with round top fire-boxes, experience proved that the tubes were placed too near the bottom and sides of the barrels, as pitting soon developed, especially in the neighborhood of the smoke-box tube plate. Subsequent boilers were built with a fewer number of tubes, so as to give greater distance between the tube and barrel, and more recently the distance between the tubes has been increased from 9/16 inch to 11/16 inch. In 1896 the Belpaire type of fire-box was introduced into a number of shunting tank engines. This type of box had advantages in the way of increased steam and water space, additional surface on the back plate for mountings, and direct staying of the crown. A similar design, of suitable proportions, was adopted for the large engines. With these boilers it was impossible to introduce the inside box from the bottom, and Mr. Aspinall decided to pass it in from the back, and flange the back plate outward, for convenience of riveting up by machine. This method of flanging cured more than one evil, but resulted in setting up severe stresses in the crown sheet along the line of rivet holes which join the back plate to the wrapper. There has also been much grooving down each side of the plate along the waist. To relieve the crown plate of these stresses some engines have been fitted with a row of flexible stays at the back end. The later boilers are now being made with the back plate flanged inwards, the final operation of riveting up this plate to the wrapper being done by hand. All new fire-boxes of the larger classes since January, 1904, have had wider water spaces, which have resulted in increased mileage and fewer repairs, particularly in the renewal of stays. The reduction of grate surface, caused by increasing the spaces, has not interfered with the steaming qualities of the engines.

In the ten-wheeled passenger and coal engines the original boilers had 239 tubes, 2 inches diameter, and the more recent boilers with wide water spaces have only 225 tubes. In each top corner a group of tubes, fifteen in number, are reduced in diameter at the fire-box end to minimize the fracturing between the tube holes at these corners.

Copper and steel tubes are used, and their life, as in the case of boilers, is influenced by several circumstances, but over a period of eight years the average mileage works out as below:

	Miles.
Copper, first period (new)	110,000
Copper, second period (stretched)	80,000
Copper, third period (pieced)	50,000
Total	240,000

and subsequently 30 to 40 per cent of those pieced are treated so again.

	—Miles—
Steel, first period (new)	70,000 to 80,000
Steel, second period (pieced)	30,000 to 40,000

Previous to year 1888 the boiler pressures did not exceed 140 pounds per square inch.

Previous to year 1899 the boiler pressures did not exceed 160 pounds per square inch.

Previous to year 1901 the boiler pressures did not exceed 175 pounds per square inch.

Present practice 180 pounds per square inch.

Copper fire-boxes run from 150,000 to 275,000 miles, and copper tube plates last three and three-fourths to seven years.

In all cases the life of the boiler is dependent upon the amount of patching and renewals of wrapper and mouthpiece plates, and restoring of tube, throat and barrel plates.

Wear and tear may be divided under two headings, namely, grooving and cracking, by reason of expansion and contraction; and pitting, brought about by deposits which are carried in solution and suspension in the water. The pitting at the smoke-box end is produced by chemical reactions going on in the mud which is deposited, and pitting round the stays and sides of wrapper plates, probably by chemical and electrical actions. The diagram, Fig. 11, shows the pitting and grooving of boilers and fire-boxes. So serious a

*From a paper read before the Institute of Mechancial Engineers.

Fig.1

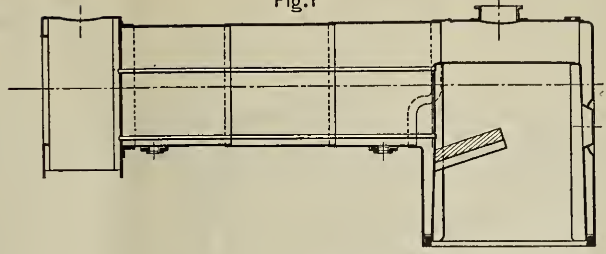


Fig.2

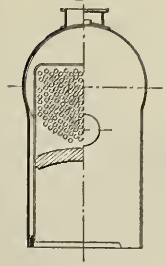


Fig.3

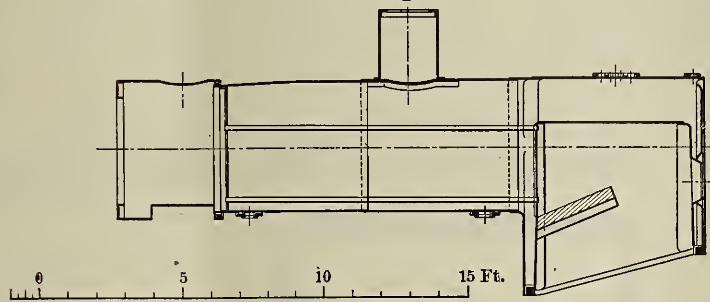


Fig.4

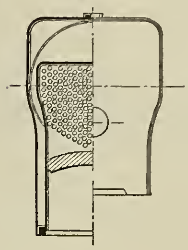


Fig.5

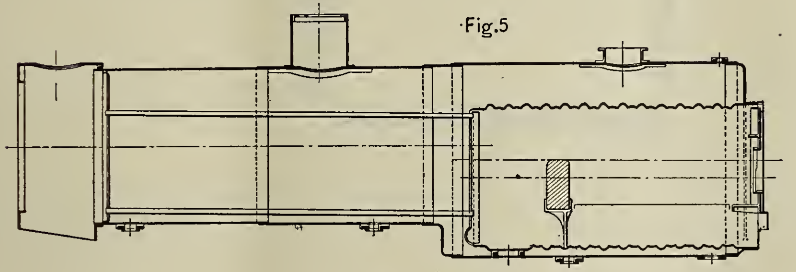


Fig.6

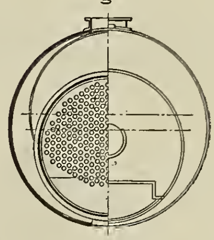


Fig.7

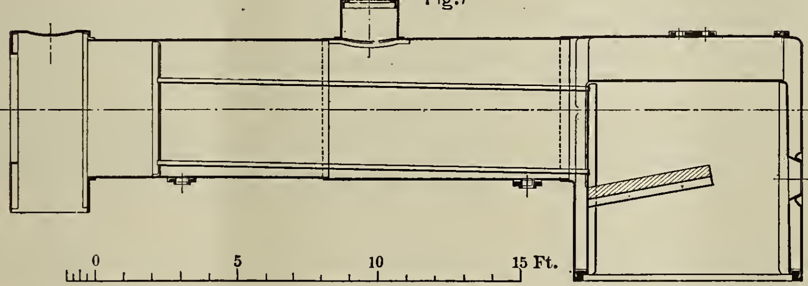


Fig.8

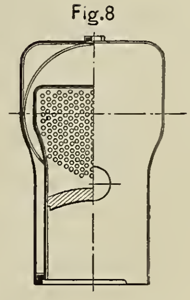


Fig.9

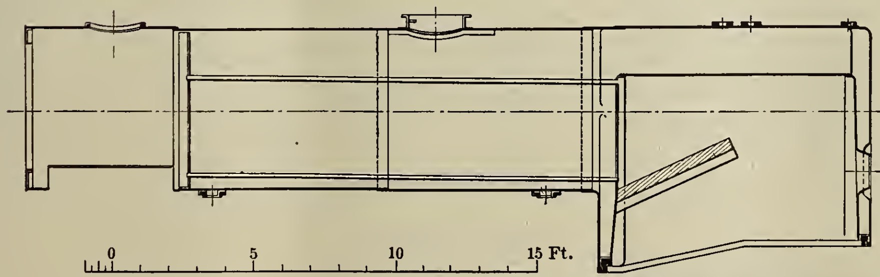
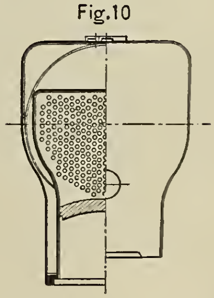


Fig.10



BOILERS FOR VARIOUS CLASSES OF ENGINES.

Figures.	Boiler.			Firebox Shell.		Copperbox.		Tubes.		Heating Surface.		Firegrate.
	Diam	Length.	Pressure.	Long.	Wide.	Long.	High.	Number.	Out. Dia.	Tubes.	Firebox.	
	Ft. In.	Ft. In.	Lbs.	Ft. In.	Ft. In.	Ft. In.	Ft. In.		Ins.	Super.	Feet.	Feet.
1.......... 2..........	4 2	10 7[illegible]	180	6 0	4 1	5 4⅝	5 10	220	1¾	1108.73	107 68	18¾
3.......... 4..........	4 6	10 [illegible]	180	6 4	4 7	5 6⅜	F 5 11¾ B 4 8¾	220	1¾	1086	107	18¾
5.......... 6..........	5 5½	12[illegible]	180	Shell 6–8⅛ dia., Flue 9.6 long, dia. over corrugations 5–1½".				280	2	1775	125	20
7.......... 8..........	4 10	1[illegible] 0	180	8 1	4 1	7 5⅝	6 11½	225	2	1767	161	23
9.......... 10..........	5 8¼	15 0	180	9 6	4 1	8 7	F 7 0 B 6 1	295	2	2317	190	27

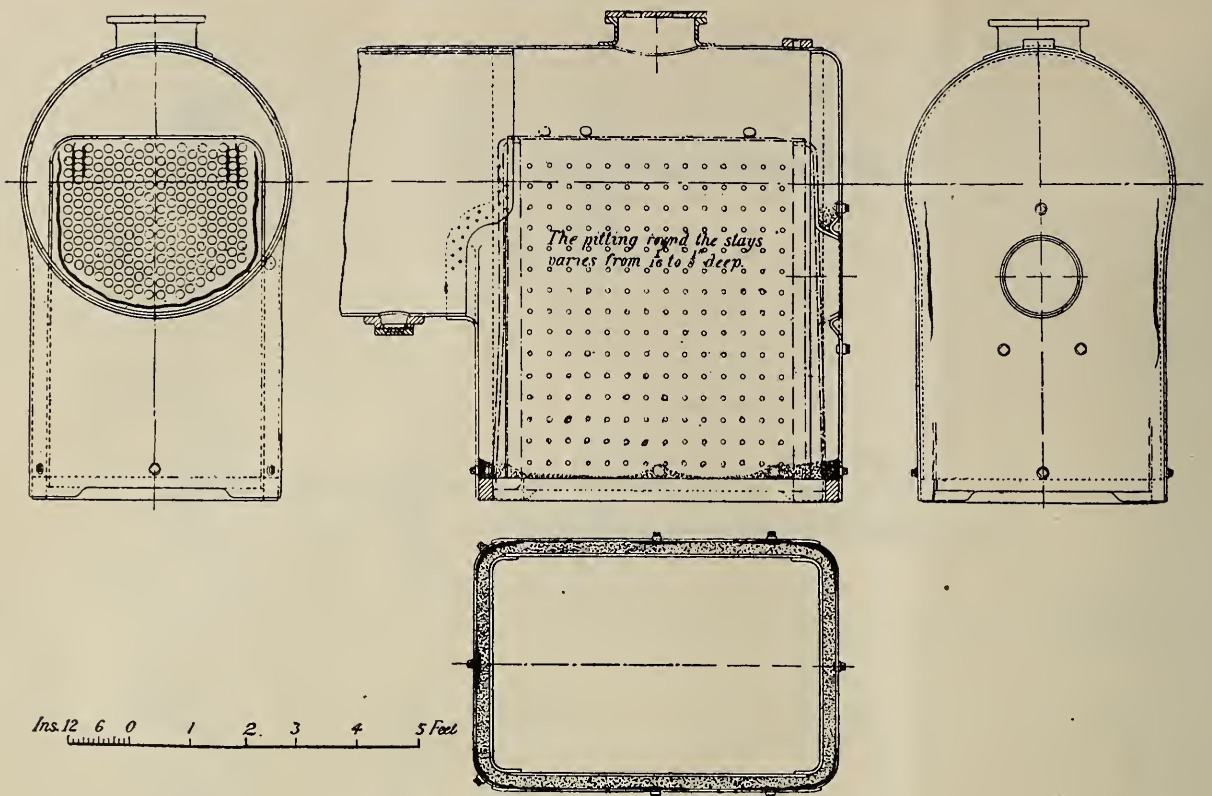
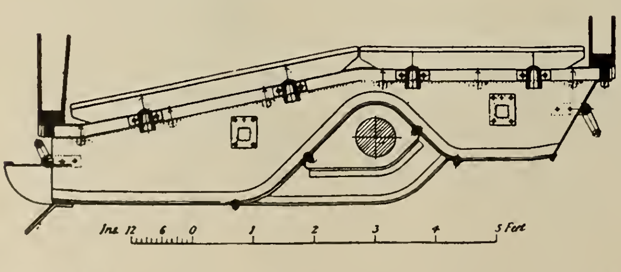


Diagram Showing Pitting of Boilers and Fire Boxes.

few years ago was pitting in the bottoms of boiler barrels that the author decided to carry out a number of experiments with a view to eliminating the same. For example, cementing the bottoms of the barrels, using nickel steel plates, inserting steel and copper tubes mixed, and also suspending zinc blocks, but without any material improvement. Subsequently, he then selected a number of boilers, and lined the barrel bottoms with thin Low Moor iron sheeting, also old copper plates and lead sheeting. In three years the Low Moor iron sheeting was completely eaten through, and when examined resembled a riddle. The old copper plate, of course, remained intact, but the lead sheeting in twelve months' time had entirely disappeared. Before this disappearance, however, complaints were made to the author that the gage glasses were being coated with a white film, which obscured the water levels, and upon scraping sufficient from the inside of the gage glasses, in order to make a qualitative analysis, it was discovered to be lead carbonate. The author was induced to try lead on account of his knowledge of its acid-resisting properties; as traces of acid had been found in some of the water used, he did not anticipate that carbonic-acid gas would be generated in the bottoms of the boiler barrels to such an extent as to combine with the whole of the lead. From this discovery, a cycle of



Ash Pan and Grate Arrangement, Four Cylinder Locomotive.

chemical reactions was formulated, and recognized as a reasonable explanation of the immense amount of pitting that goes on in locomotive and other boiler barrels. Table 1 gives the analysis of deposit from six different positions of the boiler barrel.

To ascertain the real cause of priming, the author has carried out investigations which may be of interest.

Observations were made on several boilers of different designs, when it was found that design had little effect on priming, and that the real cause (provided that care was exercised in handling the engine, and the water level in boiler not exceeded) depended on the quality and quantity of water evaporated.

A chemical analysis of two waters experimented upon is given below:

	—Grains Per Gallon—	
	No. 1.	No. 2.
Carbonate of lime	4.9	3.8
Carbonate of magnesia	0.5	0.5
Sulphate of lime	3.7	3.2
Sulphate of magnesia	2.5	2.0
Oxides of iron and alumina	0.1	nil
Scale-forming matter	11.7	9.5
Sodium chloride	5.7	2.8
Total dissolved solids	28.0	16.0

It will be noticed that, so far as scale-forming matter is concerned, there is not a great variation in the two waters, But No. 1 caused priming much sooner than No. 2. The boiler fed by the former primed badly at the end of four days' work, whereas with the latter the engine ran six days before priming occurred. In both cases the daily evaporation was much the same. Seeing that priming occurred much sooner in the case of No. 1 than No. 2, and that the proportion of scale-forming matter was nearly the same in the two

TABLE 1.

Substance.	Bottom of Barrel.			Side of Barrel.			Crown of Locomotive Fire-box.
	Smoke-box Plate.	Center Plate.	Fire-box Plate.	Smoke-box Plate.	Center Plate.	Fire-box Plate.	
	%	%	%	%	%	%	%
Silica..................	3.9	4.5	6.0	21.6	19.1	18.6	5.5
Oxides of iron and alumina............	71.5	60.0	26.5	9.9	24.9	6.9	3.0
Sulphate of lime......	2.1	5.8	48.8	1.9	4.8	2.2	68.0
Carbonate of lime.....	16.0	18.3	4.2	21.5	15.3	10.7	0.4
Lime, other than carbonate or sulphate, calculated as hydrate	.....	.....	.....	29.9	10.1	34.1	.....
Carbonate of magnesia.	7.0	5.6	7.4	.....	.....	.....	9.0
Hydrate of magnesia..	.....	5.7	7.1	12.5	26.0	21.1	14.0
Total............	100.5	99.9	100.0	97.3	100.2	93.7	99.9

waters, the conclusions drawn were that these scale-forming constituents did not produce priming.

The subject was next investigated in the light of salts other than scale-forming. These are best described as soda (or soluble salts), the predominating constituents being the sulphate. In order to ascertain to what extent these particular salts influenced priming, very accurate measurements were made of the water collected and evaporated. It was also analyzed for the quantity of solids carried into the boiler.

All engines are fitted with brick arches. These extend from the tube plate to about half the length of the fire-box. The rake of the arch is governed to some extent by the position of the fire-hole above the grate. When this distance is small and the fire-box long it is necessary to incline the arch, so that there is no chance of throwing the fuel upon it. With the fire-boxes which have horizontal grates the arch slopes upwards, pointing to the top side of the fire-hole. In the four-cylinder engine the slope points to the top

TABLE 2.—SHOWING THE GRADUAL CONCENTRATION OF SOLUBLE SALTS UP TO THE POINT OF PRIMING.

Engine No.	Class of Engine.	Day.	Grains of Soluble Salts per Gallon of Water in Boiler.	Remarks.
1402	10-wheel bogie passenger	1st	46	No priming.
1402	10-wheel bogie passenger	2d	117	No priming.
1402	10-wheel bogie passenger	3d	164	No priming.
1402	10-wheel bogie passenger	4th	210	No priming.
After 4th Day Boiler Washed Out to Prevent Priming.				
281	Radial passenger tank...	1st	127	No priming.
281	Radial passenger tank...	2d	194	No priming.
281	Radial passenger tank...	3d	269	Primed badly.
262	Radial passenger tank...	1st	184	No priming.
262	Radial passenger tank...	2d	266	Primed badly.
906	Radial passenger tank...	1st	132	No priming.
906	Radial passenger tank...	2d	230	Primed badly.

corner of the back plate. The function of the arch is to assist combustion by maintaining a high temperature, and to direct the gases round the fire-box, especially so that they impinge against the top and back plates. The fire-hole deflector is used to prevent the air passing direct to the tubes.

All ashpans are made of ample dimensions, so that the accumulated ashes do not hinder air supply. The damper doors open as wide as possible to allow a maximum air supply and for convenience of raking. The bottom is made to retain water for quenching the ashes, a small pipe being connected to the injector feed pipe and led to the ashpan for that purpose. The damper door handles are fixed on the fireman's side of the engine, and have a screw arrangement for adjusting the amount of air and for closing the door practically air-tight.

There is ample room for discussion and experiment on the subject just mentioned. It is remarkable what a small amount of information is available.

Choice of a System of Electrification for Trunk Lines

By C. L. DeMuralt

Trunk lines handle two distinct kinds of traffic-passengers and freight. Each kind can again be subdivided into through and local traffic. It is quite probable that in the final outcome we will try to eliminate the subdivisions more or less. If we take, for instance, the various lines connecting Chicago with New York, it is possible that eventually there will be no great difference between the fine through trains and the poor local trains. The ideal would be to have a series of trains, each made up of, say, four or five cars, leaving New York at stated intervals and reaching Chicago at a definite time. These trains would stop only at a few intermediate stations such as Albany, Syracuse, Buffalo, Detroit, etc. Between these trains other trains would be made up in similar manner, but stopping at all the stations between the points just mentioned. Similarly in freight traffic; some freight trains would make few stops while others would make all stops. All passenger trains would be running at the same speed and all freight trains likewise. An interchange of passenger and freight would take place at the intermediate main stations. Think of the New York subway service and extend it to cover the distance between New York and Chicago, and to take in freight as well as passenger traffic, and you have what I have in mind as a possible final solution.

In the meantime, any electrification to be done in the next five years or so will probably be carried out on the plan of present steam service. There is no particular reason for revolutionizing trunk-line operation at this time. It will therefore be best simply to substitute electric locomotives for the present steam locomotives and operate all trains substantially as is done now. Suburban traffic in the large cities should preferably be handled by motor car trains. This is a special kind of service, of relatively small importance when complete trunk-line electrification is considered, and therefore it may well be solved by a special method. The advantage of using motor cars for this kind of service lies principally in the high rate of acceleration made possible. By this method suburban trains can be run on the same schedule speed as through trains, even though they make many more stops than the latter.

Any electric trunk-line equipment has three essential parts: power house, line equipment, and electric rolling stock. The last is of course the counterpart of the steam locomotives. The other two are not present with steam operation.

In the present state of the art four electric systems are suitable for electric trunk line purposes: 1. The direct-current system. 2. The single-phase alternating-current system. 3. The three-phase alternating-current system. 4. The combination system which uses single-phase alternating current on the line, converting on the locomotive into direct current for use in the motors.

It is probably easiest to compare the systems after investigating the relative merits of their separate parts. Starting with the power house, we find that all four systems use three-phase alternating-current generators. For the direct-current and the three-phase alternating-current systems this is literally true. The two single-phase alternating-current systems could use single-phase generators, but even they operate best if three-phase alternating current is generated in the power house and the three phases are used separately.

There is thus no real difference in the type of generator usd, nor need there be any difference in the cost per kilowatt of power-house capacity. The difference lies in the size of the power house required. All four systems will have to exert substantially the same power at the driving axles of the trains, but the losses between driving axles and power house vary with the different systems. The single-phase systems have the greatest losses and therefore require the largest power house capacity for the same service. The three-phase system is the most efficient and therefore requires the least power-house capacity. Roughly speaking, for each 100 kw. in power house capacity which the direct-current system requires, the single-phase systems require about 180 kw. and the three-phase system about 70 kw.

As to the line equipment: we would better distinguish between the transmission line which carries the high-pressure current along the right-of-way; the sub-stations which transform the high pressure to medium pressure; and the contact line by means of which the medium-pressure current is transmitted to the locomotives. It is of course possible to combine all these three items into one by using the transmission line directly as a contact line, provided distances are not too great and traffic is not too heavy. With 10,000 volts, distances of 40 miles and even greater may thus be covered. The more locomotives on the road at the same time, the shorter would be this distance, due to the increased line drop.

But even with light traffic I see no advantage in feeding the contact line direct from the power house, as it necessarily multiplies power houses. On a 150-mile division there would be at least two or three power houses, all of medium size and therefore of low efficiency if compared with a single power house of a size suitable to feed the entire 150-mile division. There would also be more men required for the three small power houses than for the one large power house. Furthermore, it does not seem good practice to use the transmission line as a contact line, because the security of the service is thus undoubtedly lower than if separate contact and transmission lines were used, both being thoroughly sectionalized so that even in case of a breakdown current may be fed around the break and interruption thus avoided. Everything considered, I believe that the use of an independent transmission line, with transformer sub-stations and an independent contact line, is by far the best arrangement.

With the transmission line we find essentially the same practice in all four systems. Here again, all preferably use three-phase alternating current, although for the two single-phase systems the three phases are used separately.

In the sub-stations the two single-phase systems and the three-phase system use transformers for reducing the high pressure of, say, 60,000 volts, to the medium contact-line pressure of, say, 3,000 to 15,000 volts. The direct-current system has to transform the high-pressure alternating current into medium-pressure direct current. This means that in addition to the transformers the direct-current system must use either synchronous converters or motor-generators, entailing an incease in first cost of installation as well as in cost of operation.

For the contact line we find that the most important point to be considered is the question of amount of current to be carried. An overhead contact line can be made to give off only limited amounts of current. Depending on the speed of the locomotives, the amounts may be said to range somewhere between about 300 amperes and 600 amperes. A third rail can be used without difficulty for very much larger amounts of current. The locomotive power available is directly proportional to the product of amperes and volts. The higher the line pressure the lower the current for the same power. Whether or not an overhead contact-line can be used thus depends directly on the line pressure.

The alternating-current systems with pressures of 3,000 volts and more have no difficulty in collecting the current by means of an overhead line. The direct-current system, which thus far has used 600 to 700 volts and is now using 1,200 volts, is practically forced to use the third rail. If we go higher in direct-current pressure and use 2,000 volts or more, as is now customary in Europe, we may come back to the overhead line. There has been a great deal of discussion as to which type of contact line is better from the general operating standpoint, considering accidents, work of track gangs, etc. In actual practice it has been demonstrated clearly that there is little difference between the two types of contact lines from these viewpoints.

Let us finally investigate the question of electric rolling stock. We find that the direct-current motor was formerly considered to be the most desirable for trunk-line purposes. The principal reason for this belief was the fact that direct-current apparatus had been thoroughly developed and standardized in street railway service and it was thus undoubtedly the most available when the first trunk-line electrifications were considered. Direct-current motors are mostly of the series type. Quite early in the art, shunt-type direct-current motors were experimented with. It was found, however, that for street railway service—then the only kind of service considered—the shunt type was not advantageous. If direct current should be used extensively in trunk-line work, whether or not we may come back to the shunt type on account of its speed characteristics I do not know, but it is a possibility.

The single-phase alternating-current motor is really a direct-current motor which by certain refinements of construction has been made suitable for operation on alternating-current circuits. It is admittedly a makeshift, that is employed for the sole purpose of being able to use alternating currents in the contact line. Being a makeshift it naturally possesses a good many faults. For instance, the single-phase motor must use a much smaller flux density; hence its speed characteristics are very unstable. If single-phase and direct-current motors have the same current input for a certain speed, any increase in current due to greater power output will produce considerably more drop in speed in the single-phase motor than in the direct-current motor.

Furthermore, the single-phase motor has much larger copper losses; hence with a good starting torque a large amount of heat is produced. This is the explanation of the fact that single-phase motors cannot be used for starting heavy loads nor for starting light loads at frequent intervals. The single-phase motor is essentially a high-speed motor and is not suitable for frequent stop service nor for heavy freight service. It can consistently be used for express work, since in this kind of service the trains can be started slowly and will run long distances at high speed.

The three-phase alternating-current motor is of a type quite different from either the direct-current or the single-phase motor. It is a constant-speed motor and has all the characteristics of the shunt type. The field strength is independent of the current flowing through the armature, and therefore the motor will maintain practically constant speed no matter what output it is called upon to give. This may be an advantage or a disadvantage according to circumstances. Not only will the motor run at practically constant speed, but from zero to full speed the rate of acceleration will be practically constant. The three-phase motor is thus able to accelerate much faster than either the direct-current or the single-phase alternating-current motor. Now, this may be considered a disadvantage where the stops are frequent, as in street railway service, because the high rate of acceleration means a high peak. It is an advantage wherever runs between stops are comparatively long, and, furthermore, where the highest schedule speed is desired. Constant speed in itself is an advantage because it insures maintenance of train schedule independently of the motorman's action, of train weights, and of grades.

Perhaps the most important difference between the three types of motors lies in the east with which they can get rid of the heat losses. The three-phase motor produces the greater part of its losses in the stationary or outside part of the motor. The losses in the direct-current and the single-phase motor are produced chiefly in the armature or rotating part and the heat must pass first through the field structure before it reaches the outside radiating surface of the motor. The winding of the three-phase motor, being evenly distributed, is much thinner than the winding of the direct-current motor or the single-phase motor. Therefore, the heat from the losses in the three-phase motor will reach the outside surface more easily. Moreover, the losses in the three-phase motor are smaller. It is not difficult to obtain 90 per cent efficiency in three-phase motors, while the efficiency of direct-current motors is somewhere between 75 and 85 per cent and that of single-phase motors is hardly better than 60 to 70 per cent.

For the foregoing reasons, if the motors are of the same size, the three-phase motor will run much cooler than the direct-current motor, and the latter much cooler than the single-phase motor; or if the same amount of heating is allowed for the three types, the three-phase motor will be much smaller than the direct-current motor and the latter much smaller than the single-phase motor for any given output. Of course this is a well-known fact thoroughly exemplified by stationary motor practice.

The difference in motor weight introduces differences in locomotive weights all the way through. To support a heavier motor requires a heavier frame. Actual locomotives plainly show this. The New Haven single-phase locomotive weighs 102.5 tons and produces 1,000 h. p. at the usual 1-hr. rating. The New York Central direct-current locomotive weighs about 95 tons and produces 2,200 h. p. on the 1-hr. rating. The Simplon three-phase locomotive weighs about 70 tons and produces 2,700 h. p. on the 1-hr. rating. These figures correspond to about 200, 90, and 50 lb. per h. p. respectively.

It is the weight question that principally acts against the use of the fourth kind of electric system above referred to; namely, the converter locomotive. If single-phase alternating-current is converted on the locomotive into direct-current, the weight of the locomotive is increased by the weight of the converter and by the extra weight of mechanical parts to support the converter. Whether or not these converter locomotives weigh much more than single-phase locomotives remains an open question. It is a fact, however, that only a very limited number of converter locomotives—I believe not more than three—have thus far been built and all are used for experimental work.

After thus considering the three parts of electric trunk-line equipment—the power house, the line equipment, and the rolling stock—we can put the three parts together and determine the comparative advantages and disadvantages of the various systems taken as a whole. First let us establish the over-all efficiency for each system from power house to driving axle. Starting at the driving axle we find that the amounts of power required for hauling any given trailing load are different, following the differences in locomotive weights. The three-phase system, having the lightest locomotive, will require the least total power, the direct-current system will require more power, and the single-phase systems still more. Due to its higher motor efficiency, we again find the three-phase locomotive in the lead, with the direct-current system second, and the single-phase system in third place.

From the contact device to the sub-station it is not quite so easy to draw direct comparisons among the systems, because a great deal depends upon the amount of metal placed in the contact line. In actual practice maximum losses in third rails for direct-current are generally limited to 50 per cent, and in three-phase and single-phase overhead contact lines to 15 per cent. Average losses will be smaller, but about in the same ratio. In the sub-stations we find that the efficiency of the transformers is considerably higher than the combined efficiency of the transformers and the converters. The main transmission lines being essentially the same in all cases, the transmission loss will be practically proportional to the amounts of power carried over the transmission line in each system. Combining all these efficiences, we find the approximate relation already mentioned; namely, that for the same trailing loads the power house output will be least for the three-phase system, more for the direct-current system, and most for the single-phase systems, about in the proportion of 70 to 100 to 180. These are of course approximate figures only, subject to changes according to train weights, speeds, and metal used in line equipment. The amounts of energy consumed throughout the year are approximately in the same ratio.

To produce figures for first cost of installation so that they will be applicable to any general case is almost impossible. It is essential that each case be studied on its own merits, and a comparison of costs should be based on actual figures obtained after designs for the three systems have been decided upon.

Nevertheless it is permissible to draw a few general conclusions. For instance, wherever traffic is dense and rolling stock plays a preponderant part as compared with line equipment, without question the single-phase system will be most expensive. Whether the direct-current or the three-phase system is more suitable in such a case is somewhat doubtful, with the odds in favor of the three-phase system. When a line is very long and the traffic light, rolling stock is less important compared with line equipment; in this case it is possible that the direct-current system will be out of the question, due to the great cost of converter sub-stations. Whether the three-phase system or the single-phase system should be used in such a case must be carefully investigated. The single-phase line equipment may be cheaper, but the differenee is small. The difference in rolling stock is always great. In most cases the three-phase system will be preferable. It requires a very long line combined with a very light traffic to show an advantage for the single-phase system. As a matter of fact, if the traffic dwindles to five or six trains a day, which is about the point where the single-phase system may show to advantage over the three-phase system, then it is generally found that steam operation is preferable to electric operation.

It is thus seen that for real trunk-line service the three-phase alternating-current system will be found best in almost all cases. But there are some disadvantages connected with the three-phase system, and it is well to have those in mind before making a definite decision. First, we have two overhead wires on any railroad equipped for the three-phase system. Two overhead wires are undoubtedly more complicated and less desirable than one overhead wire. The question is, will this show itself in cost of operation? Fortunately it does not. It is more difficult to install two overhead wires, because at the switches it is necessary to have a short insulated portion, so that the two wires, which have a difference of potential between them, can be safely brought past each other. But this does not mean that current must be interrupted at the switches. Three-phase locomotives are usually equipped with two contact devices, one at each end, and one of them will always be able to draw current from both phases of the line. Once a double overhead-line equipment is suitably installed, it operates more easily than a single line, as the roller runs more steadily on two wires than on one. In Europe three-phase lines have been in use for more than 15 years.

A second objection is the small air-gap used in three-phase motors. Years ago it was thought dangerous to use what is now considered quite standard in this respect. Air-gaps have been reduced in direct-current motors also, and designers of single-phase motors are certainly showing that they are not really afraid of small air-gaps. The point is this: If a small air-gap is used between stationary and revolving parts, it is necessary to be sure that the gap will remain constant regardless of wear or vibration. This is a question of size of bearings. In direct-current and single-phase motors the space available for bearings is limited and therefore small air-gaps might be dangerous. In three-phase induction motors there is ample room for sufficient bearings and with almost the entire length of the shaft available for bearing surface it would be easy to reduce the gap even below the 1/16 in. now used.

As a third disadvantage it is frequently claimed that the three-phase locomotive possesses only one efficient speed. Those who make this claim do not seem to realize that the direct-current locomotive acts exactly like the three-phase locomotive in this respect. If either of these two locomotives have only one motor, then there is only one speed at which it can run without using resistances. No one has ever thought of calling the direct-current locomotive ineffective on this account. Why then should the matter be counted against the three-phase locomotive? Most locomotives have two or more motors and in that event two, three, four and more speeds can be obtained at which the motors can run without resistance. The advantage of the three-phase motor lies in the fact that, whatever speed is chosen, it is a constant speed. The superintendent of motive power can decide at what speed he wants his locomotive to run and they will run at that speed no matter how heavy the train or how inexperienced the motorman.

We find, therefore, that the disadvantages claimed against the three-phase system are all negligible except that of two overhead wires. These remain a disadvantage from the designing engineer's standpoint because it is somewhat more difficult to lay out a complicated track system with two overhead wires. From the operating engineer's standpoint the three-phase system possesses no disadvantages. It is well to bear this clearly in mind.

For real trunk-line work we can choose the three-phase alternating-current system without hesitation. For the suburban traffic at the large city terminals of trunk lines we can use the three-phase system if we desire to do so, but the use of the direct-current system for this particular service presents the advantage that the multiple unit train control has undoubtedly been developed more for the direct-current system than for the three-phase system. Suburban traffic is generally so dense that rolling stock is by far the greater part of the equipment required and it is quite feasible to pay somewhat more for line equipment without seriously affecting the total first cost of installation. Suburban zones may therefore be well provided with direct-current equipment for multiple-unit train operation. Suburban trains will then draw their energy from a third rail, supplying direct-current while the through or main trains will use a three-phase overhead line equipment. Both the third rail and the overhead line will be fed by common three-phase power houses, three-phase transmission lines, and three-phase transformers, the direct-current for the third rail being obtained by adding converters to the sub-stations for this specific purpose. For the single-phase alternating-current system I can find no suitable place in trunk-line operation. It can of course be used as heretofore on long lines of the interurban railway character. But three of these, among them the first and most important lines, have just decided to go back to the direct-current system.

New Passenger Equipment, C. M. & St. P. Ry.

There have recently been delivered to the Chicago, Milwaukee & St. Paul Ry. some very handsome passenger cars which embody a number of interesting features. This equipment consists of 10 baggage, mail and express cars, 15 day coaches and 2 buffet library cars. All of these cars have steel frames and steel underframes. They are modern and up-to-date in every particular and the interior design and decorations are strikingly fine and original. In the structural features the three classes of cars are substantially the same so that the description of the buffet library car given below will give a good general idea of the whole lot.

These buffet library cars are 72 feet 6 inches long over end sills, 10 ft. wide over the frame and are constructed with complete self-supporting steel underframes and steel framework for the superstructure. The underframes are composed of built-up girder center sills and built-up side trusses in connection with the Commonwealth Steel Co.'s combined cast steel double body bolsters and platforms. The center construction consists of two 5/16-in. web plates 30 ins. deep at the central portion between the cross ties, tapering to 12 ins. at the point of juncture with the bolsters, with four 3½x3½x⅝-in. angles at the bottom of the webs, two 3½x3½x⅜-in. angles at the top and one 24x⅜-in. top cover plate. The side trusses consist of 24x5/16-in. web plates with one 3x4x⅝-in. angle at the top, one 3x4x⅜-in. and one 3x3x5/16-in. angle at the bottom. The top angle is placed outside of the web plate and carries the wood nailing strip to which the side sheathing is secured. The center construction is designed to resist the pulling and buffing shocks and to carry a proportion of the load, while the side trusses take care of the balance of the load.

There are four Commonwealth Steel Co.'s cast steel cross ties and center filler castings per car, all being 30 ins. deep, the object being to equalize and distribute the load between the center construction and the side trusses. The floor

Interior of Frame, C. M. & St. P. Buffet Car.

Exterior View of New Buffet Car, C. M. & St. P. Ry.

supports between the cross ties are 4-in. channels. The end framing and anti-telescoping device is composed of eight 4-in. "Z" bars at each end of the car, the lower ends extending down into pockets cast in the steel platform and riveted to the end sill sections. The upper end of each of these "Z" bars has the web cut out and the inner flange pressed back even with the outer flange, and both flanges are riveted to a pressed steel end plate, which in turn is securely connected to the side plates and roof framing of the car.

The side framing consists of 3/16-in. pressed steel channel-shaped posts running from the side plates to the bottom of the side trusses. Each of these posts extends the full depth of the side truss and has a large inner flange at this point, which provides an extremely large surface for securely riveting the post in position. The side girths are composed of 3x3x5/16-in. angles fitted and riveted between the pressed steel posts. The side plates, which are continuous, are of 3x3x⅜-in. angles. The deck sills are continuous steel angles 4x4x5/16-in. The deck plates are of 3/16-in. pressed steel channel-shaped sections. The rafters, for both the upper and lower decks, are of angle section 2x1⅛x3 1/16-in., bent to shape and riveted directly to the deck sills and the deck plates, and secured to the side plates by malleable iron castings riveted to the lower deck rafter and the side plates.

Nailing strips are bolted to the side posts and the rafters for securing the outside sheathing, the roof, the inside finish and the headlining. Wood nailing strips are placed in the bottom framing for securing the flooring, there being one deafening floor below the sills, and the two upper floors. The finished floor is of "Flexolith" composition material, manufactured by the General Railway Supply Co. This composition is laid over expanded metal, which is attached to the upper course of wood flooring. The lower floors are further insulated with a course of 1½-in. hair felt placed between the floor nailing strips.

The draft and buffer attachments are extremely heavy, Miner friction draft rigging and Forsyth friction buffers being used. The trucks used under the buffet library cars are the Commonwealth cast steel six-wheel truck frame, equipped with Paige 38-in. wheels, Franklin journal boxes and Diamond Special brake beams. The controlling factor in the floor plan is the fact that instead of being placed at the forward end of the train, as is usual with buffet library cars, this car is to be placed in the middle of the train or between sleeping cars so that sleeping car passengers may enter it from either end. This is likely to prove to be a most convenient and popular arrangement for passengers who want to use the car for reading or lounging.

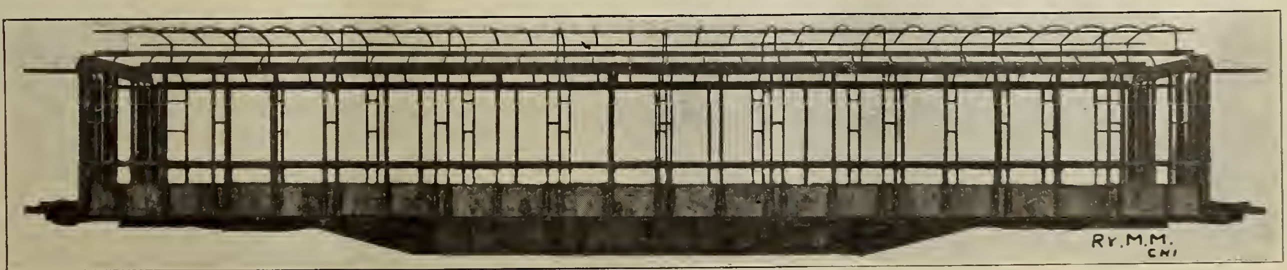
The car is divided into two rooms with the buffet between them. The smaller of the two rooms is the lounging room; the larger is the library or reading room. The former is finished in dark woods with subdued lighting and color effects; the latter in lighter tones with brilliant coloring.

The interior finish of the lounging room is done in a dark wood native to Peru where it is known as "Quitacalcon." The builders, who have used the wood for several years, have given it the name of "Peruvian Mahogany." It is finely figured and takes a perfect polish. The interior finish of the library end is in Cuban mahogany, exquisitely marked.

One of the noticeable features of the interior is the entire absence of square or angular corners in the library room. The bulkheads, side walls and partitions have round corners, forming a continuity of line which gives a pleasing relief from the usual box effect and thereby contributes to the general air of comfort and repose, which is the characteristic idea throughout. The idea of the curved lines is carried into both the lower and upper decks in the library room and appears both in the O G curve in the headlining and in the coloring of the headlining which gives an impression of height and roominess that is most attractive. This general effect of roominess is much enhanced by the height of the windows. All of the windows stop at the chair rail line and the result is an impression of bulk and strength on the exterior and altitude and space on the interior.

The inside windows are of leaded glass with a combination of polished French plate combined in designs of richly colored cathedral glass. The glass in the deck sash is of the same general character. In the lounging room, the ceiling is finished in canvas and is paneled with massive beams and painted a rich red slightly relieved with gold line ornamentation.

The Barney & Smith Car Co. of Dayton, Ohio, the designers, as well as the builders, claim that nothing finer or stronger in palace car construction has ever been built than these cars which are to be used on the "Pioneer Limited" of the Chicago, Milwaukee & St. Paul Ry.



Exterior of Steel Frame, C. M. & St. P. Buffet Car.

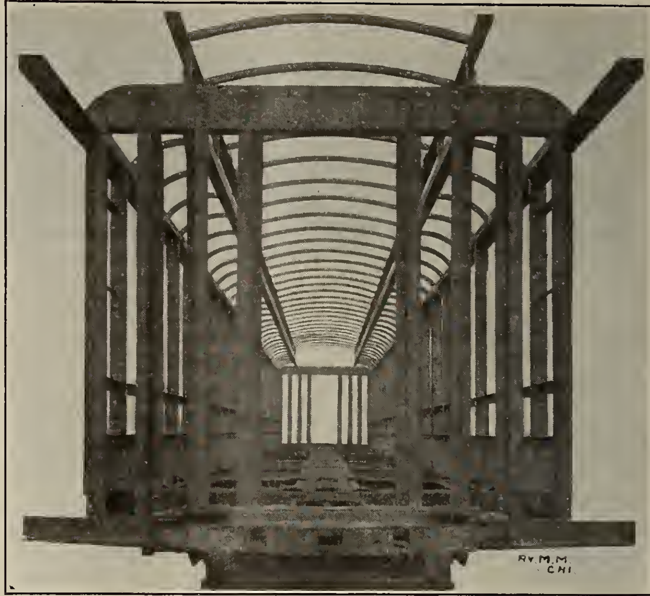
Notes on Brass Melting*

By Charles T. Bragg.

The gradually increasing demand for alloys of certain definite physical characteristice is bringing about the development of a great number of metals about which too little is known. Undoubtedly, in many cases, if instead of finding a new alloy to suit each new engineering condition that arises, we knew something of those we already have, we would find that another was not needed. In order to know our alloys in all their phases, and in order to be able to keep their constitutents always present in a constant proportion, the fewer we have the better. In order completely to standardise our alloys and keep them under control, unquestionably the fewer we have the easier will be the subsequent labor and the less intricate the system necessary.

Several factors are important to the successful standardisation of alloys. Good original alloys, complete knowledge of materials to be used in their manufacture, control of the furnaces in which they are made, knowledge of the changes and causes of the changes taking place in those furnaces, and complete knowledge of the composition of the resulting alloy, are the chief ones to consider. The choosing of suitable alloys is, of course, largely a matter of personal decision, but that decision is often influenced by factors unknown to the one making such decisions. In other words, in experimenting to find the most suitable alloy for a class of work, absolute knowledge of the quality of the materials used and results attained is essential. For this knowledge we must turn to the science of chemistry. It is not so much a question of whether we have produced what we want, as it is whether we have complete data on what we have produced, and whether we can repeat the production of that article. Let us say, for example, that we are developing an aluminium brass, and that copper, zinc, and aluminium have proved themselves the elements necessary. After repeated trials, using various proportions of these elements, we fail to get the desired physical characteristics. All conditions are equal, the analyses of the copper and aluminium show them to be pure, but the zinc contains iron, lead, and cadmium. Using the same grade copper and aluminium, but a zinc free from impurities, we find ourselves able to produce aluminium brass to our satisfaction. We have begun an important thing, that of using articles about which we are thoroughly informed, and have cleared the road to the reproduction of the alloy in question, without difficulty, at least, from the standpoint of the prime materials to be used. An analysis of the metal produced will show what our real alloy is, and what it is that we are trying to make. That is, if the metal as it leaves the furnace is the composition desired, then the material that goes into the furnace is only important in that it shows what changes have taken place, and what compensation must be made for those changes, if that metal is ever to be made from its own scrap, gates, sprues, etc.

*Abstract of a paper read before the American Brass Founders' Association.



Exterior End of Frame, C. M. & St. P. Buffet Car.

Interior of Library End, C. M. & St. P. Buffet Car

Considering now an alloy of ordinary constituents, variations of composition may be assigned to several causes, such as oxidation or volatilisation of one constituent to a larger degree than others present, loss by the same means of two or three constituents in varying proportions, or loss of one constituent by its reducing action on the oxides of another, as the loss of zinc due to its reduction of copper oxide, etc. In a forced-draught furnace other agencies have considerable bearing on the change of composition, chief of which is the action of gases, both unburned and products of combustion. The action of these gases—such as nitrogen, carbon monoxide, carbon dioxide, sulphur dioxide, etc.—on brass at high temperatures has been but imperfectly studied, although some of their general properties in other connections are well known. In a furnace which exposes an alloy to all these influences, certainly the best results are not possible, and the only road left open is to overcome the natural defects of the furnace by outside means.

Undoubtedly the greatest cause of variations in composition is due to oxidation and volatilisation. We will consider the loss of zinc in detail, inasmuch as it is both easily volatilized. It is easily understood that at 718° F., if exposed to air, zinc then in its melted condition begins to oxidise. 1652° F., the temperature at which zinc volatilises, is easily attained in brass melting. If sufficient time is given at 1652° F., or the temperature raised very high above this, in a short time all the zinc will volatise. We are considering now that the zinc has been melted alone. When melted in brass it behaves, as far as we know, as when melted alone. That may or may not be true, inasmuch as any definite chemical compounds formed between zinc and other constituents present, may have considerable influence, and doubtless do. The quantity of metal in a furnace has a certain influence over the time which must elapse to bring it to a required temperature. Therefore, since the melting point of the brass is above that of zinc should begin to oxidise as soon as its melting point is passed. This, again, is variable, due to the fact that the contained zinc cannot be attacked by oxygen until the brass itself begins to melt, as it is not exposed, and due also to the different proportions in the alloy in which the zinc may exist. Taking the other constituents of brass or bronze into consideration, they might be handled in much the same way, depending, of course, on what they are. It would seem that a fixed length of time for a given quantity of a given metal, with a fixed oil or gas flow and a fixed air pressure, would be all that is necessary to make a brass of given constituents leave the furnace each time practically of the same composition. As heats of various sizes of various compositions for different classes of work are usually made by most foundries, it is evident that any such procedure would involve considerable difficulty. However, it would be comparatively easy to establish a temperature at which these various compositions should be removed from the furnace, and at some future time this may be possible. When it is possible to equip a brass-melting furnace with a pyrometer which will at all times tell the temperature of the contained materials, the road to standardising alloys and stopping moulding troubles of many kinds will be clearer. Measuring temperatures in the crucible serves many good purposes, but does not eliminate the expense of varied compositions, nor does it eliminate the expense of furnace losses. Every composition has a definite melting point and a definite casting temperature, and the determination of just what these points are can be done only with a pyrometer. It is easily seen that if a brass or bronze of any composition be brought to a certain temperature in a definite length of time, its original and melted compositions could be made very nearly constant. It is worthy of note that very little attempt has been made, as far as the writer knows, at least, to bring this about.

We have seen that considerable variation is possibly due to many causes, and must admit that it is very difficult to overcome many of these with present means. In spite of all this, it is still possible to keep the compositions of our alloys very nearly standard ,if certain conditions are kept in mind. We have said before that if we know the purity of our virgin materials, and find the alloy which, when made from certain proportions of these materials, gives us the alloy with the properties and cost desired, we should endeavor to produce that composition constantly. There are two ways of doing this. First, the total loss of given original constituents in the furnace may be determined, and an analysis of the resulting material obtained, from which calculations back to the original composition may be made. Second,, the analyses may be made of the resulting material and calculation made back to the original composition without knowing the total loss. In order to use the first method, the total loss in the furnace may be obtained as follows:—Weigh the virgin metals in the proportions before found to produce the alloy needed. Place in the furnace and melt, bringing the alloy to the necessary temperature for pouring the castings for which the alloy is intended. Observe the temperature attained and the time elapsed during melting, and when repeating the experiment, which must be done several times to obtain a fair average, endeavor to have the time elapsed and temperature attained nearly the same as before. This is assuming that the oil or gas, and air pressures (in furnaces using them) are kept constant. Weigh the metals in the crucibles after melting. The weight of the metal after melting, plus the metal in the slag, substarcted from the weight before melting, will give the loss for the particular furnace in use under the particular conditions mentioned. After establishing the total loss, repeated analyses of the product will show the average change in composition from the original proportions put into the furnace. This average of results should be considered as the composition of the alloy it is desired to produce. Now, when the scrap, sprues, runners, etc., from the alloy produced are returned to the metal depository, they should be kept distinctly separate from that of any other alloy, and when again issued to the furnace should have added the metals lost during the former melting. The amount to be added may be calculated in the following way: Take 100 lbs. as the unit weight of the original alloy. Subtract from that the percentage in pounds total loss established for that alloy. From the resulting figure, using the average analysis of the produced alloy, calculate the actual weight in pounds of each constituent present in the produced alloy, and subtract the result from the number of pounds of each corresponding constituent in 100 lb. of the original alloy. The difference is the weight of each constituent lost per 100 lb. of metal melted—that is, 100 lb. minus the total loss per 100 lb. in pounds, plus the metals "burned out," should be the metals re-issued to the furnace. Let us say, for example, that the loss on original materials was 5 per cent., then 95 lb. of gates, sprues, etc., plus the amount of copper, zinc, lead, tin, etc., lost, in total 100 lb., would be the proper amounts to issue to the furnaces. In arriving at the quantities of each constituent lost, the reason for the apparent gain in some slightly volatile metals, such as copper, will be easily seen. The scheme as outlined above is open to the objection that the means of determining the total furnace loss is not to be compared for accuracy with the chemical laboratory process which determines the ratio of the constituents, although that depends, of course, on just how carefully both are carried out. In using this scheme, it must not be supposed that the losses for one alloy can be calculated to show the losses for others. The reason for this has been shown before.

In order to use the second method, the analyses of the produced alloy may be considered to represent the proportions of elements present per 100 lb. of metal produced. Then 100 lb. of scrap may be reverted to the original composition by adding 100 lb. of prime metal in the proportions necessary either to increase or decrease the various constituents. This is open to the objection that for each unit weight of scrap issued, an equal amount of new metal must be used. This does not use the scrap on hand rapidly, and too rapidly reduces the virgin material on hand. This may be avoided by adding to 100 lb. of scrap the materials lost in largest proportions, in quantity sufficient to reduce those present in largest proportions to the desired amounts. As this involves merely a problem in arithmetical proportion, it is easily worked out, and presents the best practical working method for ordinary alloys of using the scrap produced. This introduces an error in the rebuilding scheme, since scrap made from scrap, which was made from new material must be considered to be of the composition of scrap made from new materials. However, over a period of time this discrepancy corrects itself as the materials go back through the remelting cycle.

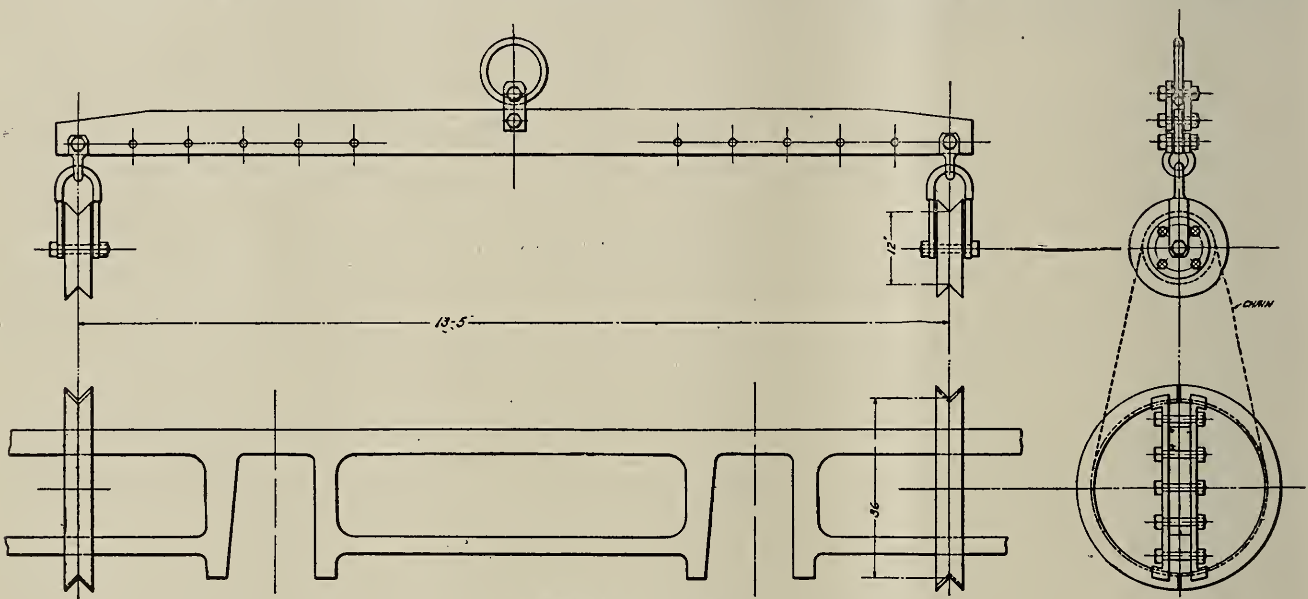
In using turnings from one's own alloys or scrap purchased outside, it is largely impracticable to determine furnace losses for each case, and inasmuch as it is likely to be of variable composition from lot to lot, it is not practicable to determine it for certain cases and calculate from that basis for others. In the case of turnings from one's own alloys, it is likely to be difficult to keep the turnings of one alloy from being contaminated with turnings from others. In addition, since the particles are small and more exposed to oxygen and heat, the loss is not to be considered as anything like that of the same alloy when made from either new or scrap materials. In general, if a sample of turnings is melted under the conditions that the alloy in which they are to be used is melted, and then analysed, they may be calculated into the alloy for which they are intended, using the alloy to be produced as the basis for calculation, as their loss has been already considered in the analysis.

Welding Locomotive Frames*

It is less than a year since the repairing of frames in the smith shop became an established practice on the Rutland railroad; power bought in 1902 is now coming in for new fireboxes, and about all of this class have one broken frame and most of them two, that have been repaired by patching and with the oil weld, and in two cases with the "Thermit" process. The oil welds and patches we expect to cut out of all of them as they come; the Thermit we will have to hold a council on, as some of us think that a frame repaired by the "Thermit" process is somewhat of an invalid still, unless the point of repairs is brought up to a welding heat inside the mold, before the Thermit is poured, and we do not think our frames were hot enough when we tapped the crucible and let the Thermit in, consequently there is no fusion between the two metals, excepting perhaps a spot just where the Thermit first struck the frame. However, we are in the business of "frame repairing" to stay, and, as such is the case, we have looked the field over pretty closely for points, and have listened to some good arguments made before our different conventions, and I must admit that we have learned a great deal therefrom; but instead of using the regulation "V" weld in making repairs, we have gone one better and adopted the plan of using one "V" and two binders, as shown in the illustration, being particular to select the best stock at hand for "V" and binders, and have the grain in same run in the same direction with that of the section to be repaired. We are obliged to do this work with sledges, not having any steam hammer, and we contend that it is the best and strongest weld possible to be done with sledges, and think a man with a steam hammer might consider it profitable to himself and his company.

I wish to add a few words in description of the tools we use in handling our frames. We use an adjustable equalizer, suspended from a quick-acting chain-falls, which allows us to raise or lower it easily; the equalizer is made 1½x8 inches by 14 feet long, as shown in print. We have no trouble in striking a balance on the length of any frame—with an equalizer made in this way. The frame wheels are thirty-six (36") inches in diameter on the bearings, and it is an easy matter to get a balance crossways of the frame, by placing the heavy section of frame nearest the center of wheel. With a wheel of this size, there is no record of using scrap iron for counterbalancing.

*From a report by J. E. Carrigan of the Rutland Ry., before the Master Blacksmiths' Convention.



Frame Sling, Rutland Ry.

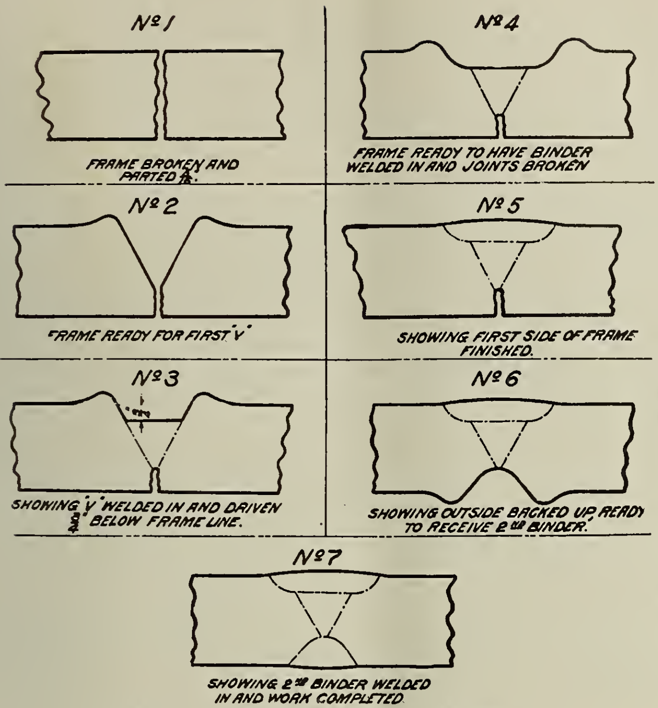
Lighting of Erecting Shops and Heavy Machine Shops

By S. H. Knapp.

The artificial lighting of the work in erecting shops and heavy machine shops such that the employes can have working conditions equal to daylight, has, in the past, been a difficult problem. The considerable height of the heavy cranes has made it necessary to place most, if not all, of the lighting units underneath the cranes. In many instances it has been impossible to install lamps anywhere except on the side walls, although it is readily apparent that with an arc or incandescent cluster in that position much of the light is absorbed by the dark walls, and consequently in the center of the room the lighting is most unsatisfactory. Again with low lighting from the side walls, locomotives or high machines may hide the source of light, producing large shadows in the center of the floor. Were it possible to obtain from skylights all the daylight required for satisfactory lighting, this arrangement would unquestionably give the best distribution and diffusion. Accordingly if these satisfactory conditions can be artificially duplicated by placing the light source directly over the machines and workmen a better distribution and the avoidance of eclipsing shadows will be obtained.

The Cooper Hewitt Lamp, with its diffusion resulting from a large luminous surface, makes possible the satisfactory illumination of a floor surface from a much greater height than was formerly considered possible. At the same time the comparative length of light source in the 50-inch tubes makes it possible for heavy cranes to pass underneath without causing any sharply defined shadows. This, with the absence of glare, as obtained from other illuminants, makes it possible for the mechanic to distinguish detail in his work with accuracy.

The accompanying photograph shows an erecting shop lighted by 34 type F Cooper Hewitt lamps, giving 28,900 candlepower at a current consumption of 13.6 kilowatts. The dimensions of this building are 442 by 94 feet, or 41,550 square feet. The height of the lamps from the floor is 50



Method of Welding Frames, Rutland Ry.

feet, and 1225 square feet of floor surface is allowed per lamp. In an adjoining erecting shop of three-fourths the size. two and one-half times as much power is being used to furnish arc lighting from the side walls, with most unsatisfactory results.

Results show that the manufacturer can obtain a great volume of serviceable light at a minimum expenditure of electrical energy; that the source of light may be installed at a great height, and still give satisfactory floor illumination; that shadows can be almost wholly eliminated, and a perfect diffusion of pleasing light, the equal of daylight for manufacturing purposes can be obtained. The long life of the tubes,—numerous installations having averaged over seven thousand hours' burning,—assures a very economical maintenance, and the user is not subject to the annoyance and delay often caused where it is necessary to retrim arc lamps during working hours.

How Boilers are Ruined*

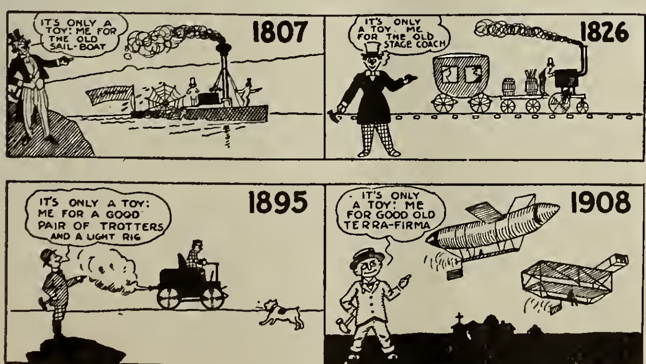
Chemically pure water is unknown in its natural state. Water is a fluid composed of oxygen and hydrogen, in the proportions by weight of one part hydrogen and eight parts oxygen; it is a very powerful solvent, and in its course as a river, a brook or a spring it takes up and holds in solution more or less of the various minerals with which it comes in contact. Lakes and ponds that are fed by surface streams are likewise impregnated with impurities. The amount of these impurities varies according to the underlying strata of rocks on or through which the water passes on its way to the surface. Hence, in a section of the country where the rock foundation is of a limestone formation, the water in all wells, springs and streams will be heavily impregnated with sulphate and carbonate of lime.

Nearly all the minerals found in boiler feed-waters become sediment, due to the fact that these minerals cannot be evaporated. The most common of these impurities are lime and magnesia, in the form of a carbonate or sulphate; and, in brackish or salt water, chloride of sodium. Carbonates of lime and magnesia are soluble only when the water contains free carbonic acid. Well water contains more of these than river water. At 212 degrees the carbonic acid is set free, and the lime and magnesia, which were in solution as bicarbonates, being deprived of their solvency, become insoluble carbonates, floating around and through the water which is in agitation. Chloride of sodium, sulphate of lime, and the other salts held in solution are precipitated by the same process; but, owing to their greater solubility, much more evaporation is required.

Now, all these impurities are deposited on the lower sheets and tubes, mainly when the boiler is not used very hard, or when there is no steam going from the boiler when circulation has ceased. The moment these mineral particles touch the iron the heat bakes them; the carbonates forming a soft, granular and the sulphates a hard and crystalline scale. This settles to the bottom when everything becomes quiet in the boiler, and, as one can readily understand, displaces the water from the iron, and naturally receives the first heat when fire is again started. The scale immediately in contact is baked on the iron, while the remainder, by the agitation of the water, will be held in suspension and again be ready to settle when circulation ceases.

Now, it will be readily understood that the thickness of the scale increases day by day by the same process as at first until it becames so thick and hard that, in order to generate steam, the fire must be forced, which results in a greatly increased fuel consumption and the ruinous overheating of the iron. We all know that incrustation and scale are very poor conductors of heat. Various estimates have been made of the loss of fuel due to the presence of scale in the boiler, the lowest of which is as follows:

*By William Olsen, supervisor of boiler cleaning, Motive Power Department, New York Central Railroad.



From the New York Journal.

Cooper-Hewitt Illumination of Erecting Shop.

	Percent.
For 1/16 inch	15
For ¼ inch	50
For ½ inch	120

and so on.

Still another matter of cost, resulting directly from the presence of scale, is that of repairs. When all these expenses are combined the amount chargeable to scale in the boiler is appalling. And it is not alone the additional expense for fuel and repairs that results from scale but the boiler is rapidly weakened.

Another serious cause of trouble in steam boilers is internal corrosion. This is not as common as incrustation, but, when it occurs, it is one of the most dangerous evils with which boiler owners and engineers have to contend. Its cause is now generally understood, and is looked upon by engineers, or the men in charge, as a matter of course; that is, that it must exist to a greater or less extent, on the theory that corrosion is rust, and that it is but natural for water to cause rust by coming in contact with iron in the presence of air.

Investigation, however, discloses some facts in connection with corrosion which will show that the evil is due to some other cause than the ordinary effect of water on iron. Internal corrosion is the most dangerous, for the reason that is presence is oftentimes not readily detected, the ordinary types of boilers being so constructed as to be difficult to properly examine internally. Internal corrosion is due to the presence of acids contained in the water or set free in the process of evaporation.

The proper care of steam boilers should be thoroughly understood by owners as well as by engineers, for it is only by observation and close attention that economy of fuel and the durability and safety of the boiler are attained. Its neglect will mean poor steaming boilers, leaky flues and mudrings, and when it comes to washing the boilers the scale will be found to have baked with one layer on top of the other.

In districts where the feed-water contains large quantities of carbonate of lime the very best remedy is to wash the boiler often. If dealing with a locomotive boiler, it is very important to remove all the wash-out plugs in order to get a stream of water inside and around the flues.

The greatest enemy that confronts all users of steam power is crust or scale in boilers. The manner in which incrustation or scale forms is commonly known. As has been explained in the beginning of this article the feed-water which must evaporate is not chemically pure, but contains elements, both in solution and suspension, that do not evaporate, but are left in the boiler, being deposited in the form of a hard crust or scale on the boiler plates. Incrustation is probably the greatest drawback in connection with the care and maintenance of boilers. It is a never-failing source of worrk and expense; the cause of costly stoppages for scaling, chipping, etc., to say nothing of the danger arising through the impossibility of making a thorough examination.

Remedies for this have been brought forward in profusion, but with little benefit to the boiler, due chiefly, to the fact that the start is invariably made from the attempted removal of the scale instead of preventing its formation. A partial removal of the scale is sometimes attained by the use of some of these remedies, but usually at the expense of the boiler—its life being shortened—and therefore the remedy is almost worse than the disease.

There is but one really safe method of eliminating this trouble, and that is, the boiler must be clean and retained so. This may seem almost impossible to those who are conversant with these difficulties, but prolonged practical tests have proved to the contrary; and by these tests the conclusion is reached that by the application, in proper quantities, of carbonate of soda—commonly known as "Soda Ash"—these difficulties can be overcome. But it must be remembered that in many cases, and for a long time, carbonate of soda has been used and incrustation still occurs. This must be admitted, but it is not sufficient merely to know a remedy; it is also necessary, in order to obtain satisfactory results, to know the proper proportion and the method of application, otherwise it is comparatively useless. Many are unaware of the proper function of soda ash in boiler water, but think only of its biting qualities as used in cleaning. To such an extent does this prevail that many engineers use even caustic soda. This is a serious error. Soda cannot bite off incrustation, but if it is added to the boiler water in proper quantities it will change what otherwise would become scale into a chalky mud, that will not deposit itself on the boiler plates, but will sink to the bottom of the boiler, where it can then easily be blown off or washed out.

Again, carbonate of soda has the useful property of neutralizing harmful acids that are present in most feed waters, and, consequently, prevents corrosion and pitting. It is, however, imperative to know the exact quantity of soda ash to add in order to obtain the desired results. There must be neither lack or excess of quantity, the latter causing priming and foaming. In stationary plants, where feed-water heaters are used, it has been found that oils, etc., used for lubricating purposes, enter into the boiler to some extent, and if soda ash is used in excess it saponifies (changes to soap) the oils, and again through galvanic action corrosion will set in.—The Boiler Maker.

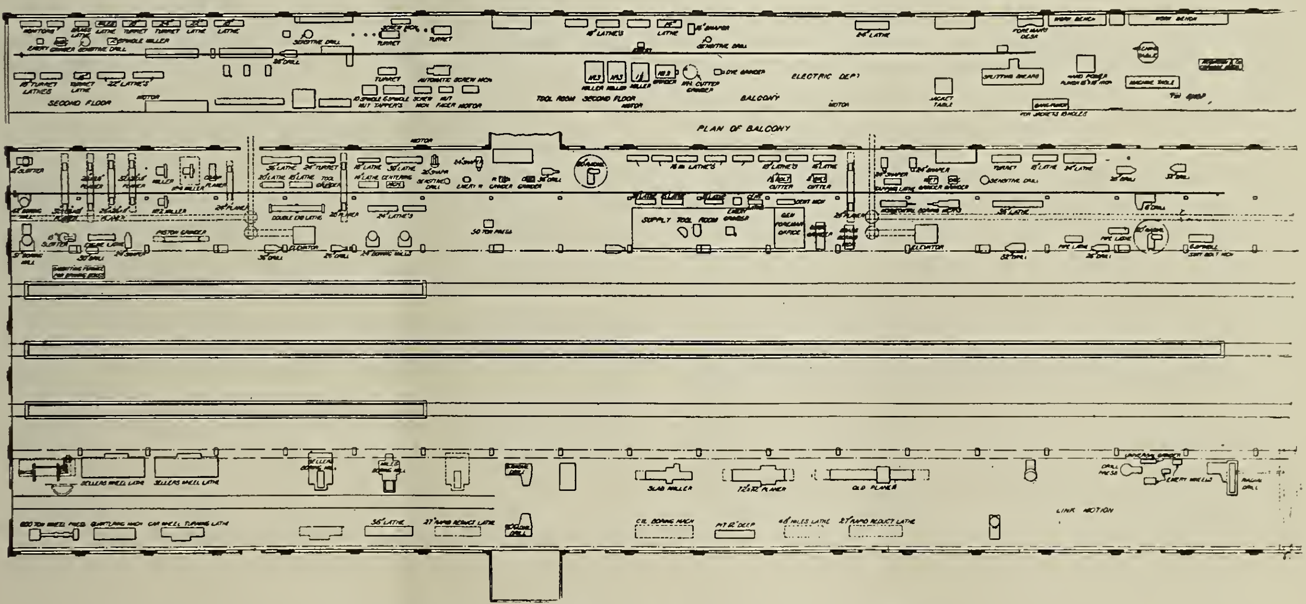
Parsons Machine and Erecting Shop, M. K. & T. System

The longitudinal arrangement of a machine and erecting is so unusual as to attract much interest among mechanical men. The Parsons shops of the Missouri, Kansas & Texas have now been in operation two years and it is understood that as far as shop costs are concerned, this installation compares favorably with any in the country.

The boiler and tank shop at one end of the building is not shown in the accompanying illustration, which is limited to the locomotive erecting shop proper. The span of the erecting shop, center to center of columns, is 78 ft., and the height from the floor to the top of the rail on the crane runway is 27 ft. This shop is supplied with two 60-ton cranes. The columns supporting the crane runways are 26 ft. centers, which allows two tenders to be placed on the parallel track side by side between columns. The space provided for the repair of tenders is covered by a 25-ton crane.

Referring to the machine layout, it will be noted that the driving wheel lathes are at the extreme end of the shop. Next to these is a lighter lathe for truing driving axles, and opposite, along the wall, are a 600-ton wheel press, the quartering machine and lathe for steel-tired truck wheels. Farther along in the same bay are the tire boring mills and driving axle lathes. Beyond these are the tools for frames, cylinders and rods, including a large Bement slab miller, a Sellers 72-in. planer, a 48-in. Niles-Bement-Pond lathe, and a Watson-Stillman 150-ton hydraulic press for rod bushings. Nearby is the rod gang and tools for finishing the link motion, and here are located radial drills and four grinding machines. The next section in this bay is occupied with the repairs to engine trucks, and the balance of the bay contains a small tool-room, foreman's office and machinery for boiler repairs. There is a large supply tool room and foreman's office at the center of the shop, and above it on the balcony a manufacturing tool room, where cutting tools, special taps and reamers are finished. The floor on the opposite side under the balcony, at the extreme end, contains planers and boring mills for driving boxes, and next to this is a group of tools for pistons, including a large

Norton grinder, and farther on are miscellaneous small tools. On the second floor there is a department for air brake repairs, an electrical department, principally for repairing generators for electric headlights, the tin shop, and benches for sheet iron and jacket work. The space occupied by tools as indicated by the plan does not nearly fill the shop, and ample room remains for additional tools, so that the capacity of the erecting shop may be further increased in this way.



Parsons Machine and Erecting Shop, M. K. & T. System.

The Relation of the Character of Coals to the Prevention of Smoke*

The semi-bituminous and bituminous coals are the most extensively used of all the fuels which are available for generating steam. Containing as they do a considerable quantity of volatile matter which is given off when the coals are heated in the furnace, it is difficult to burn them under boilers so as to secure perfect combustion and freedom from smoke. Specially designed furnaces and careful operation are required to get good results.

The difference in the character of coals is only partly shown by the approximate analyses which are commonly used, but to one familiar with coals these analyses indicate in a general way the leading characteristics of the coals.

TABLE 1 ANALYSES OF FUELS AS DELIVERED AND USED.

	Coke.	Anthracite Pea Coal.	Pocahontas Coal.	Pittsburg Coal.	Indiana Coal.
Moisture	4.67	4.75	1.12	2.48	9.62
Volatile matter	2.82	2.90	17.24	38.74	36.14
Fixed carbon	82.61	77.15	74.84	49.18	41.22
Ash	9.90	15.20	6.80	9.60	13.02
	100.00	100.00	100.00	100.00	100.00
Sulphur	....	0.80	0.71	1.85	4.43
B.t.u.	12,206	11,886	14,530	13,172	11,122

To show the difference in fuels, Table 1 has been prepared.

It will be noted that coals vary both in their composition and in their heating values (B.t.u.), and in consequence they are more or less valuable as fuel, depending on these variations.

Other things being equal, a fuel high in fixed carbon is more easily burned in a common furnace without loss of heat and without smoke than those of lower percentages. Coke and anthracite coals are examples of this class of fuels.

The percentage of moisture is not of great importance except in cases in which the coal is naturally high in moisture, or in which the coal is very wet as a result of washing or exposure to storms. Moisture in small percentages seems to aid combustion, but in larger amounts it retards the ignition of the gases and lowers the furnace temperature. It may or may not increase the smoke, depending on the character of the fuel.

The percentage of ash, and especially the character of the ash, is of importance in connection with the smoke problem. Ash which is fusible and runs down onto the grate bars may cause smoke by shutting off the flow of air through the fuel, and by increasing the poking which is necessary to keep the grates free. Coals which clinker badly require more attention from the firemen and poking the fire is a common cause of smoke.

There is a great difference in the behavior of the same coals when burned under different furnace conditions and in different furnaces. Some grates and stokers are adapted to handle coals which are burned with great difficulty on other equipment.

The rate of burning per square foot of grate is often the deciding factor as to whether a given coal may be used or not. This is principally due to the higher temperatures which are obtained with high rates of combustion, and the effect on the fusible portion of the ash of the coal. Investigations are now being made to determine the char-

TABLE 2. ABSOLUTE QUANTITIES OF SMOKING PRODUCTS IN TEN MINUTES' HEATING AT DIFFERENT TEMPERATURES.

Coal.	Temperature, Degrees C.		Smoking Products.	
	Furnace.	Coal.	Tar, Per Cent.	C_6H_6—c.c.
3 Connellsville	600	441	4.9	1
1 Ziegler	600	440	6.8	51
3 Connellsville	700	562	11.0	145
1 Ziegler	700	545	7.8	24
16 Pocahontas	700	599	4.2	138

*See paper by Porter and Ovitz in *Journal* of American Chemical Society, Vol. XXX.

*From a paper by D. T. Randall, read at the Syracuse meeting of the International Association for the Prevention of Smoke, June 24 to 26, 1909.

TABLE 3. SHOWING RELATION OF SMOKE TO CO IN FLUE GASES.

Average per cent. of black smoke......	0	7.1	15.5	24.7	34.7	43.1	52.9
Average per cent. CO in flue gases......	0.05	0.11	0.11	0.14	0.21	0.33	0 35
Number of tests averaged............	37	18	56	51	36	17	4

*See United States Geological Survey Bulletin 325, pages 101 and 167.

acteristics of the ash of representative coals as related to the clinker formed at various temperatures.

As far as smoke is concerned the volatile matter is of the greatest importance. The quantity of volatile matter is not a true measure of the difficulty of burning a coal, but to one familiar with the various coal fields it is of great assistance in choosing a suitable coal or in designing a furnace suited to the given coal.

Investigation relating to the nature of volatile matter in representative coals have been carried on at the Government fuel-testing plant at the University of Ohio, and at the University of Illinois.

The results show that the differences in the gases given off from coal may be due to the composition of the coal and to the temperature to which the coal is subjected when placed in the furnace. The higher temperatures tend to distil the volatile matter more rapidly and drive off the heavy hydrocarbon in forms which are difficult to burn without smoke.

Table 2 gives some idea of the complicated relation between the temperature of the coals in the furnace and the compositions of the various gases to be burned. Investigations of this character are necessary to determine the characteristics of coals from each of the representative beds.

The combustion of coke or other fuels high in fixed carbon is comparatively simple. The greater portion of the fuel is burned on the grate; the remainder in the form of gas burns at a short distance above the bed of fuel. This may readily be observed on a fire of anthracite coal in which there is only a small percentage of volatile matter.

In burning bituminous coals, however, the difficulties are much greater and for the reasons given. The volatile matter from some coals is set free more readily than from others and with some coals the nature of the volatile matter given off is such as to make it very difficult to secure complete combustion. Smoke is an indication of incomplete combustion and the problem of reducing the amount of smoke is important, not only from the standpoint of the smoke inspector, but also because of the losses in combustible gases such as carbon monoxide (CO) and hydrogen which escape with the smoke.

Experiments by several investigators have shown that whenever smoke is given off there is also a considerable quantity of carbon monoxide gas and that as a rule this gas is accompanied by small percentages of hydrogen and hydrocarbon compounds. The losses due to these combustible gases which are found in connection with a smoky stack may vary between 1 and 10 per cent of the fuel.

When burning a bituminous coal, the volatile matter must be raised to a high temperature while mixed with a sufficient quantity of air and burned on its passage from the fuel bed to the surfaces of the boiler. In most boiler settings this distance for combustion is very short and

TABLE 4. SHOWING RELATION BETWEEN CO IN FLUE GASES AND OTHER COMBUSTIBLE GASES.*

	SMOKY				CLEAR.			
Boiler..... .... Furnace............... Hand fired............	CO_2	CO	CH_4	H_2	CO_2	CO	CH_4	H_2
	10.95	3.00	0.70	3.23	.8.15	0.0	0.0	0.0

*See Manchester (England) Smoke Abatement Report.

when the gases strike the cold surfaces of the boiler shell or tubes they cool below the temperature at which they will burn rapidly and as a result some escape unburned and others are only partially burned, as shown by the heavy deposits of soot. In properly designed furnaces the space provided for combustion is large for coals giving off high percentages of volatile combustible. Even in such furnaces the firing must be carefully done or at times enough air cannot be supplied to the gas, and smoke results for short periods. In most plants the time required for the gases to pass from the fuel bed to the top of the stack is between 10 and 15 seconds. Assuming the velocity to be reasonably uniform at different sections, it will be seen that the gases pass from the fuel bed to a distance of, say 12 feet in one second. At the end of this period there is but little opportunity for the gases to burn. This will make clear the great importance of a sufficient air supply, properly distributed, and an ample space above or back of the grates in which the gases may thoroughly mix and burn within considerably less than one second of time.

That there is a loss due to the volatile gases escaping by the results of tests on house-heating boilers. Table 5 gives figures obtained on two series of tests for the purpose of determining the fuel values of several coals and briquets when burned in a house-heating boiler.

The furnace in which the results shown in Table 5 were obtained is best suited to coke, anthracite, or low-volatile coals, and, as will be seen, is not adapted for

TABLE 5. THE RELATION OF VOLATILE MATTER OF SMOKE AND UNCONSUMED GASES.

Number of Tests Averaged.	Volatile Matter in the Combustible.	Ash in Dry Coal.	Efficiency	Black Smoke.	CO in Dry Flue Gases.
4	18.30	8.00	60.56	18.2	0.44
12	22.71	8.94	56.33	18.0	0.50
7	34.70	11.27	54.11	22.1	0.55
11	38.79	15.02	47.19	30.8	0.62
16	44.46	14 57	47.19	32.9	0.74

burning bituminous coals with good efficiency, yet many furnaces having practically the same features, such as a grate surrounded by heating surface, and a small combustion chamber, are used in power plants for burning high-volatile coals.

Even with furnaces of improved design it is difficult to charge the coal by hand-firing and secure smokeless combustion. This is due to the fact that a comparatively large quantity of gas is liberated immediately after firing. At the same time the fuel bed has been thickened and the air enters with more difficulty and without being well distributed with respect to the gases rising from the bed. With such a furnace the loss of combustible gases may be reduced to 5 per cent, or less, depending on the coal and the operation.

It is because of the advantage in having the coal gradually heated and the gases distilled from it at a low temperature that a mechanical means of feeding the coal to the furnace is usually more successful in the prevention of smoke.

A good furnace should permit the burning of bituminous coal in sufficient quantities without loss of escaping gases or the formation of smoke when the air supply is about 50 per cent in excess of the theoretical amount.

Some of the conditions under which smoke will be evolved even with the best coal and properly designed furnaces are as follows:

When a fire is built in a cold furnace.

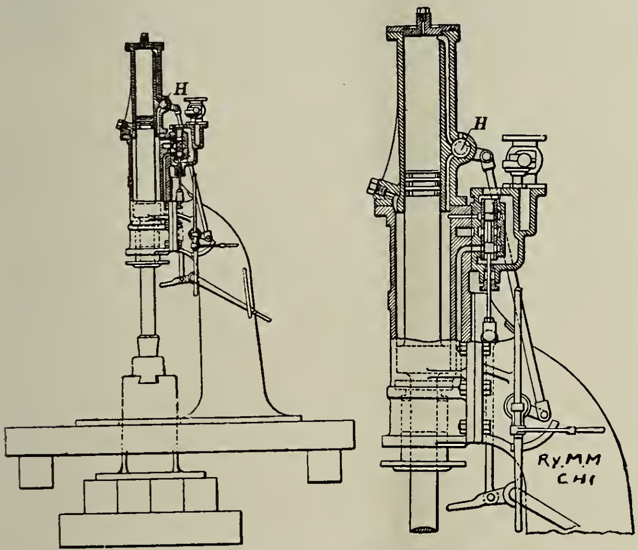
When an excessive amount of coal is burned on the grates, making it difficult or impossible to properly mix air with the gases to the necessary extent.

When the rate of combustion is suddenly changed, due to a change in the demand for steam.

Compressed Air Hammer

In some railroad shops the introduction of gas engines and motor drive has been considered practically impossible on account of the necessity for steam in the forge shop department. It not being considered economical to install both a steam and gas plant. Where heating is not necessary steam boilers can be displaced entirely when the machinery is either motor or air driven. The accompanying drawings illustrate an air-driven power hammer which has been designed and placed in service in England.

The essential feature of this hammer is the use of double cylinders placed one above the other, and so proportioned that by a simple change of position of the plug-cock H compressed air can be admitted to one or both cylinders, thus producing, at the will of the operator, a half-weight or full-weight blow, with a proportionate consumption of compressed air. From an examination of our drawings, it will be seen that an existing single-cylinder steam hammer can be easily transformed into an



Two Drawings of Compressed Air Hammer.

economical compressed air hammer by bolting an upper small-diameter cylinder to the top flange of the existing cylinder, and fitting therein a trunk piston as shown. This piston can either be forged as part of the lower piston and rod, or fixed to an existing piston and rod.

Compressed air is conveyed to, and exhausted from, the upper side of the trunk piston of the small cylinder by a port, communicating with the port usually performing these functions for the lower cylinder. In the former port is placed the plug cock H, by means of which the space above the trunk piston may be put either in communication with the lower cylinder port, or with the atmosphere, as desired. Apart from this addition, there is no alteration in the existing valve-gear of the ordinary single-cylinder hammer.

New Literature

MODERN LOCOMOTIVE ENGINEERING HAND-BOOK. By Calvin F. Swingle, M. E.; 800 pages, leather, 5½ by 6¾; published by Frederick J. Drake & Co., Chicago. Price, $3.00.

This book, which has been enlarged and revised in each of several editions, is a most convenient and authoritative treatise on the modern locomotive. While elementary in its treatment of constructive details, it contains reports of tests, tables, diagrams and efficiency studies of great value to the technically educated man. The book is profusely illustrated with both photographic reproductions and line drawings, several of the latter being printed on folded inserts. The author's comprehensive treatment of valve gears, the indicator applied to the locomotive, electric headlights, stokers and the air brake, make the book of great value to shop men as well as enginemen. The aim of the author in compiling this work, however, was to furnish to locomotive engineers and firemen, in a clear and concise manner, such information as will thoroughly equip them for the responsibilities of their calling. The subject-matter is arranged in such a manner that the fireman just entering upon his apprenticeship may, by beginning with chapter I, learn of his duties as a fireman and then, by closely following the makeup of the book in the succeeding pages, will be able to gain a thorough knowledge of the construction, maintenance and operation of all types of engines.

* * *

MODERN AIR BRAKE PRACTICE—ITS USE AND ABUSE. By Frank H. Dukesmith, M. E.; 450 pages, cloth, 8 x 5½; published by Frederick J. Drake & Co., Chicago.

The author, in this book, now in its fifth edition, has endeavored successfully to illustrate the fundamental principles upon which all air brake systems are operated by drawing comparisons with problems met in, and understood from, daily contact. The subject matter is divided into eight sections in order to still further simplify the study. These sections are devoted successively to an elementary explanation; studies of the Westinghouse, New York, and Dukesmith air brake equipments; the philosophy of air brake handling; and a study of the straight air brake equipment. The book is very attractively bound in ornamental cloth and is a valuable addition to the library of anyone desiring a complete knowledge of the air brake.

* * *

OPERATOR'S WIRELESS TELEGRAPH AND TELEPHONE HAND-BOOK. By Victor H. Laughter; 180 pages, cloth, 5 by 7½; published by Frederick J. Drake & Co., Chicago.

A complete treatise on the construction and operation of wireless telegraph and telephone systems, including the rules of naval stations, with an exposition of the codes and abbreviations. The author is the technical director of the American Wireless Institute at Detroit, Mich., which has been organized since the writing of his book. The idea which has been carried out in the publication of this work is that of supplying the student or investigator with both an elementary and an advanced treatment of the subject in the one volume. The reader is carried from a rudimentary explanation of principle in the first chapter to detailed technical descriptions of methods and systems in the later chapters. The book is profusely illustrated with half tones and line drawings, with a large number of circuit and wave diagrams.

* * *

TRANSMISSION LINE CROSSINGS. By Frank F. Fowle; 70 pages, cloth, 5½ x 7½; published by the D. Van Nostrand Company, New York City.

This book is the outcome of a paper prepared by the author for the 27th annual convention of the Association of Railway Telegraph Superintendents, and treats particularly with the protection of life and property on railroads from overhead crossings of high-tension power transmission lines. With the increase of hydro-electric installations and power transmission the number of high tension lines has greatly increased and many of these crossings are recognized as highly dangerous. The writer brings out the disastrous effects of failures of high tension lines at railroad crossings and the causes of such failures. Screen protection, bridge and catenary types of reinforced crossings and underground crossings are taken up in successive chapters and the latter part of the book is devoted to a discussion of a proposed type of crossing which reduces the danger to a minimum.

THE BOILER. By Stephen Christie; 264 pages; cloth, 6 by 9; published by Christie Publishing Co., Chicago. Price, $1.00.

The author has compiled, in this book, the information gained from years of personal experience and study, and has tabulated rules, formulae and data which have proved useful to himself as a master boilermaker and boiler inspector, in such a way as to place them within the reach of the man who has been handicapped by a limited amount of mathematical study. The subjects treated are material, selection of boilers, boiler and engine power measurements, boiler construction, braces and reinforcements, rules for lap and butt joints, excerpts from Government rules, tests, inspections and safe working pressures. Flues and furnaces, chimneys and stacks are taken up, also lap and butt joints, boiler settings, tests and inspections, pumps, tanks and feed water purification. The book is replete with valuable tables, covering most of the data which a designer will need for daily use.

* * *

WHEN RAILROADS WERE NEW. By Chas. F. Carter; 324 pages, cloth, 5½ by 8½; Introductory note by Logan G. McPherson; published by Henry Holt & Co., New York.

One of the most interesting of the works on the development of American railroads, this book is at the same time a useful history on the subject. Concerning the dates of certain occurrences of more than passing interest, we quote from the introduction as follows: "Dates that vary a whole year are given for so recent an event as the running of the first through passenger train over the Canadian Pacific Ry. A former auditor of the Lake Shore, in attempting to give the date of the Ashtabula wreck, in a historical paper presumably prepared with care, errs regarding the day of the month, the month, and the year. In this volume an attempt has been made to gather the floating fragments of railroad history having a human interest into a coherent narrative of the work-a-day trials and triumphs of the pioneers in the planning and the building of the railroad that would be neither a dry historical treatise nor a collection of anecdotes." The book is divided into chapters, each treating of the development of one of our great systems from its earliest origin. It is well illustrated with photographic reproductions, the subjects of which are closely related to the historical accounts.

* * *

DESCRIPTIVE GEOMETRY. By Gardner C. Anthony and George F. Ashley; 160 pages, cloth, 6 by 7½; published by D. C. Heath & Co., Boston, Mass.

The authors have made use of notes and data collected from their experience in the instruction of engineering students and have gradually developed the subject into the present form of the book. The value of a publication which has been worked up in this manner is at once evident, for all of the problems incorporated therein have stood the tests of the class room. Although the student who hopes to get the most out of a study of this book should first take up an elementary course in simple drawing, such a previous knowledge of the subject is not absolutely necessary.

* * *

POCKET BOOK OF MECHANICAL ENGINEERING. By Chas. M. Sames, B. Sc.; 203 pages, flexible leather, 4 by 6⅝; published by Chas. M. Sames, Jersey City, N. J. Third edition. Price, $2.00.

This book is a digest of mechanical engineering science. Although treating a wide range of subjects, the data and formulae are so condensed as to make the book thin enough to be carried in the pocket without inconvenience. It is a real pocket book and this fact should be kept in mind by the purchaser. A very large amount of the information in this book is not otherwise available in convenient reference form, and this fact renders it valuable to mechanical engineers, draftsmen, and students. In the present edition several sections have been rewritten; others have been furnished with fresh data, including a number of important additions. Eight pages of cross-section paper are bound in each copy, permitting the entry of notes which individual requirements may suggest.

* * *

THE ENGINEERING INDEX ANNUAL FOR 1908. Compiled from the Engineering Index published monthly in the Engineering Magazine; 437 pages, cloth.

This index in annual form contains in compact and permanent binding, data which, more than a luxury, is almost a necessity in every engineering library, no matter how small or large. The book is doing praiseworthy work in saving from practical oblivion and placing at the disposal of the searcher large amounts of technical literature which appear weekly and monthly in the periodicals of the world. The comprehensive method of indexing which has been used in the last two Annuals will be appreciated by those who make use of the book. The ease with which an article may be found is remarkable considering scope of the book. To those who are not familiar with the book in previous editions we quote from the preface as follows: "The work as a whole represents the continuation of that originally stated by the late Prof. J. B. Johnson in the Journal of the Association of Engineering Societies in 1884 and turned over by that association to the Engineering Magazine at the close of 1895. The previous volumes, published in 1892, 1896, 1901, 1906, 1907 and 1908, covered with increasing fullness and thoroughness, the field of periodical literature in engineering and closely related applied sciences. The latest volume brings the investigator down to the close of 1908, while the earlier parts enable searchers such as occur in patent cases and the like to be prosecuted with a minimum of cost and delay."

* * *

HYDROELECTRIC DEVELOPMENTS AND ENGINEERING. By Frank Koester; 454 pages, cloth, 7¼ by 10¼; published by the D. Van Nostrand Co., 23 Murray St., New York. Price, $5.00.

In view of the fact that water power resource development has taken a stimulus in all parts of the world, the literature of the subject has been somewhat stale. The publication of this book has gone a long way toward placing knowledge of recently gained experience in this branch of engineering to the seeker for this kind of knowledge. The author has compiled an immense amount of information into one of the most exhaustive treatises on the subject the reviewer has ever had the benefit of reading. The book is divided into three parts and subdivided into ten chapters. Part I treats of the transformation of water power into electrical energy; Part II treats of the transmission of high tension electrical currents, and Part III gives an exposition of modern American and European hydroelectric developments. The book is illustrated with over five hundred photographic reproductions, maps, and line drawings.

* * *

The General Railway Supply Co. of Chicago has issued a very attractive booklet of the railway specialties handled by this company. Among these are metallic sheathing, trap door and lifting device, curtain rollers, flooring and ventilators.

* * *

"Forsyth Products" is issued by the Forsyth Steel Tie Co. of Pittsburg, Pa., and contains descriptions and illustrations of steel ties and other accessories manufactured by this concern.

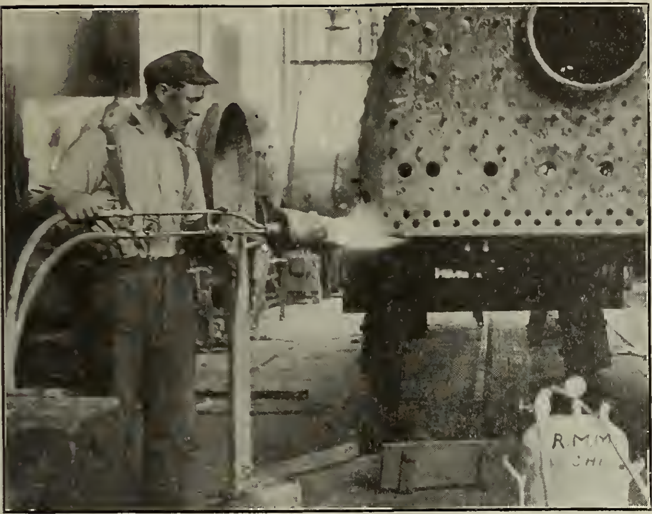


Fig. 1.

Punching and shearing machines, boilermakers' tools, rolls, etc., are described in a recent catalogue issued by the Covington Machine Co. of Covington, Va.

* * *

A twelve-page booklet of envelope size has just been issued by the Joseph Dixon Crucible Company, describing their facings for various kinds of work. The purchasing agent will be glad to know that the listings include prices.

* * *

The Cleveland Twist Drill Co. of Cleveland, O., has issued a little leaflet on "Drill Grinding," which contains a bit of useful information on this too much neglected subject.

* * *

Keuffel & Esser Co. of New York has issued a new leaflet descriptive of the blue print papers manufactured by this company.

Case Hardening*

Case hardening is a process of converting wrought iron into hardened steel and still retain a fibrous iron center to keep same from breaking. The practice at our shop is this: We use cast iron boxes of different sizes to suit the different pieces to be case hardened. We have one box 12 x 24 inches, one 12 x 36 inches, and one 12 x 48 inches; the last-named is used only for quadrants, or in annealing cast tool steel.

At present we case harden with bone black, which costs about 6 cents a pound. We first put bone black in the bottom of the box, then a layer of the articles to be case hardened, then another layer of bone black, and so on until the box is full. We are careful that the different parts to be hardened do not come in contact with the box. When the box is full and well protected with bone black, we put on a sheet iron cover, and put clay on top of cover to make it as near air tight as possible, we then put the box in a furnace built for this purpose.

We use an oil furnace for this work, and I think it is the best, as the heat can be better regulated. We keep the heat up to 1450 to 1500 degrees, and get very good results. We case harden ⅛ of an inch deep in 18 hours, and 1-16 of an inch in 12 hours. For a bath we use cold water, and keep it as cold as we can by letting the hot water run out and the cold water run in. By this process we make a good clean job that is very readily cleaned and made bright in the machine shop.

There is another way of case hardening that we have practiced for several years. This is with common salt and potash, packed the same as with bone black. We use about 6 pounds of potash to a box 12 x 36 inches, the balance salt. The salt and potash will melt and form a fluid that will boil. A cover is put on the box loose so the steam can escape while fluid is boiling. You can case harden ⅛ of an inch in 8 hours by this process. A small box can be put in spring furnace when making springs. It will not interfere with making springs, and will save the extra expense of operating case hardening furnace.

I remember when I first started case hardening with salt. I was helping to take the different pieces out and put them in cooling vat. One of the helpers took a pair of wet tongs and put them in the box of salt and potash fluid, and in less time than it takes to tell it the box was empty, and I was full of hot salt and potash. I was burned all over from the stuff. Care must be taken to keep everything wet away from the box. Our people do not like the case hardening with salt and potash on account of its being harder to clean than when the bone black is used.

For a hurry job for the roundhouse when the engine is needed, we simply use cyanide of potassium or prussiate of potash. We heat the article to be case hardened to a bright cherry red, put the potash on with a spoon, or rub the cyanide of potassium on with a pair of pick-ups; reheat the piece so treated, and then cool it in cold water. This will go in only about 1-64 of an inch, but we have to case harden this way occasionally when the engine is needed.

*From a report by J. G. Jordan of the T. & N. O. R. R. before the International Railroad Master Blacksmiths' Association.

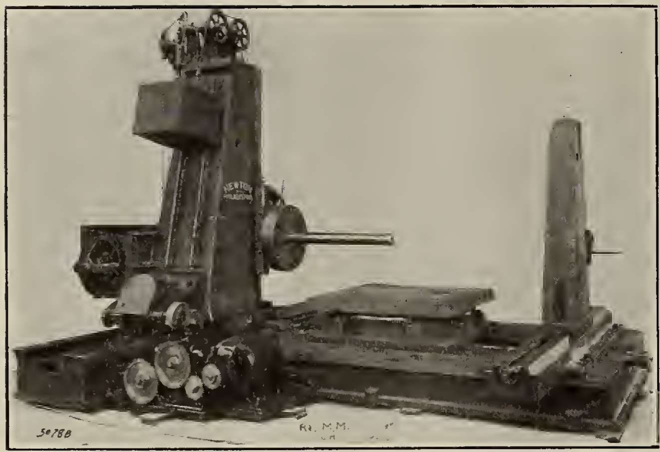
New Hydro Carbon Burner

Whenever Pintsch gas is manufactured there is considerable refuse, commercially called hydro carbon, which it is not impossible to use economically in certain shop repair operations.

The Hauck Mfg. Co. of New York City has placed on the market a burner which successfully uses this gas residue for certain ordinary locomotive repair operations such as those illustrated in figure 1 and figure 2 herewith. Figure 1 shows the method of using the burner in the process of heating the corner of a firebox, while figure 2 illustrates the process applied to a locomotive frame.

The construction of the machine is simple and an important feature is the possibility of its use with liquid fuel with slight alterations. One of the burner's uses is the preheating of parts for thermit welds.

Fig. 2.



New Horizontal Floor Boring Machine.

Horizontal Floor Boring Machine

A new horizontal floor boring, drilling and milling machine, which has now been adopted as standard by the Newton Machine Tool Works of Philadelphia, is illustrated herewith. The spindle of this machine is driven through intermediate gearing by a 10 H. P. motor of variable speed. The gearing consists of a train of clutched bevel gears thus allowing for reversing the rotation of the spindle. The traversing apparatus is arranged to give six speeds, ranging from 0.005 inch to 0.0124 inch, with the high speed gear in mesh, and from 0.0178 inch to 0.0124 inch per spindle revolutions with the face plate gear in mesh.

The spindle is arranged to drive the cutters by means of a broad face key and is fitted with a No. 6 Morse taper. All levers controlling the different feeds, the rate of same and the different movement are located on the front of the saddle within convenient reach of the operator. As shown on photograph, the outboard bearing of this machine is mounted on an auxiliary base, permitting of hand adjustment across the entire width of the bed. This auxiliary slide has a central bearing on the bed, adjustments being made by means of bronze taper shoe. There is also furnished a rotating work table 48 inches in diameter, the circular adjustment being controlled by hand.

As shown, there is provided a separate motor for feeding or rapidly adjusting this rotating table in a direction parallel with the travel of the spindle.

Some of the specifications are as follows: Diameter of spindle, 5 inches; length of spindle feed with single grip 48 inches, and with double grip 9 inches; vertical motion of spindle saddle on upright 60 inches; horizontal motion of upright on base 96 inches.

High Speed Sensitive Drill

The American Tool Works Co., of Cincinnati, Ohio, has recently brought out a special design of high-speed drill, with motor drive and tapping attachment. This machine, equipped with a two-foot arm, is shown in the accompanying illustration. The bearings are of the ball type and the spindle can be operated at 2,000 R. P. M. if desired.

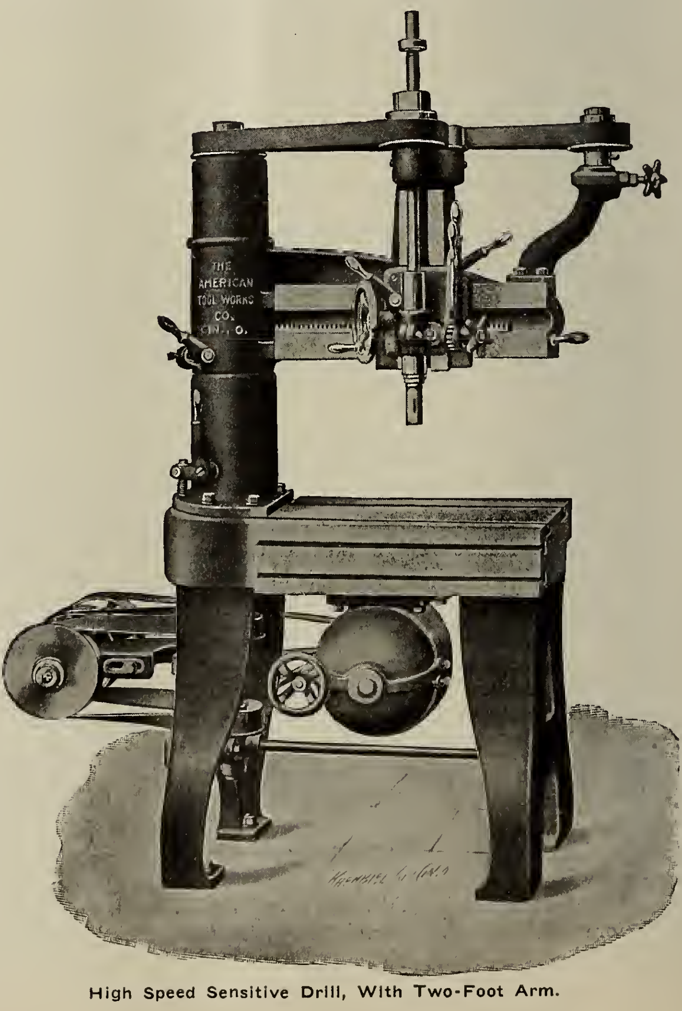
The tapping attachment on this machine is under good control in spite of the high speed of the spindle, by the lever shown at the base of column. There are no gears in the drive of this machine, as the power is transmitted throughout by belts. Adjustment for regulating the tension of the belts is arranged for both of the overhead belts and those of the tapping attachment and motor. The frictions in the tapping attachment are of a type which cannot become disengaged of themselves, after once thrown in. They are of such large proportions as to transmit the maximum of power intended for the machine. It is stated that this machine will handle high speed twist drills up to 1 in. diameter and will take care of 1-in. standard taps. When fitted with a tapping chuck it is particularly adapted for tapping of small holes. The available high spindle speeds have in a few instances enabled this machine to be used as a router.

Manufacture of Sand Paper

The use of sand paper, emery paper and emery cloth is so general that a short description of the process of manufacturing these useful articles should be of some interest.

The processes of sandpaper manufacture are largely mechanical. The raw material is dumped into a hopper and run through rolls for reduction by grinding, and the milled product is then elevated into a series of bins and sent by gravity to an elaborate bolting plant, where it is sifted with the same care that is given to the sifting of flour. This plant consists of a series of bolting machines, each equipped with a screen of a different texture. Bolting silk of every size of mesh used in a flour mill is used in the various bolting machines, and the ground material is sifted through into hoppers, the contents of each being nicely exact in the size of the grains to which the material has been reduced. The product, ready for the sandpaper, varies in degree of fineness from the coarse article that is used on the heaviest sandpaper to an impalpable dust that leaves no suggestion of grit when rubbed between the fingers, but which retains the cutting qualities intact. The bolted material is stored in bins until required in the next process.

The glue comes in big barrels, and is so important a factor in the making of sandpaper that there have been 1,800 barrels used annually for this purpose. The dry glue is fed through a hopper in the floor into a boiler in which it is cooked, and the hot material is again conducted, on the floor below, to the machines, the abrasive being fed to the proper machines from



High Speed Sensitive Drill, With Two-Foot Arm.

the same floor. The fourth floor, where the sandpaper is actually made, looks at first glance like the drying room of a laundry, folds of paper being suspended from racks that move automatically, the paper being carried in a waving line through hundreds of yards of space, weaving its way back and forth on the drying racks.

The machinery with which the paper, glue and mineral are brought together is intricate, but looks simple enough. The light brown paper of various weights comes in rolls up to 48 inches wide. This is run into a machine, the first function of which is that of a printing press.

As the paper is printed, it is carried on through another set of rolls and receives its coating of glue. Turning over, above, to another machine, it passes through controlling rollers and receives its deposit of mineral of the size proper to the texture of the paper, then is subjected to another coating of thin glue, which acts as sizing and serves to set the mineral firmly on the base. Then it is picked up automatically and carried up to the drying racks. As the paper comes out of the machine it is caught up from beneath, so that it is attached to and suspended from the rack in folds about 10 feet in length. By a halting motion, the racks move on to the end of the building just as fast as the paper comes through the machine. Just before it reaches the wall it automatically rounds a curve and comes back in a line parallel with its first course, to repeat the process at the end of the line and turn again. The distance traversed to the far side of the room, where the paper is taken from the racks, is quite sufficient to permit the drying of the very heaviest paper, and, as that of lighter weight has to travel the same distance, provision is made for slightly moistening the hanging fold of this latter, so that it shall not break because of its brittleness. From the racks the paper is carried to a shaft and rolled into large rolls, and the process of manufacture is complete, but the cutting and packing.

On the floor below are the cutting machines. The roll of sandpaper is fed into a machine that cuts it longitudinally into desired width, and, as it is run off, it is cut into lengths by a steel bar that strikes it against another revolving bar. Men and girls stand about the sorting table and pack the sheets into quires and reams to be put into various sized packages, according to the purposes of distribution. That destined for export is wrapped, after being compressed into four-ream packages by hydraulic power, in tar paper. That which is to be supplied to the trade is put up in more elaborate packages of assorted sizes, and wrapped like stationery, in bundles, each of which bears the trade-mark and place of manufacture.

The Selling Side

Percival Manchester, president of the Railway Appliances Co., Old Colony Bldg., Chicago, is in Wyoming for a couple of months' rest and recreation.

The Chicago, Milwaukee & Puget Sound has ordered two rotary snow plows from the American Locomotive Co.

M. H. Hovey, formerly signal engineer of the Illinois Central, is now signal engineer for the American Railway Signal Co., Cleveland, Ohio.

The Isthmian Canal Commission asks bids up to October 4 on locomotive tires, sheaves, ratchet wheels, pinions, wire netting, canvas belting, lumber piles, etc. (Circular No. 537.) Bids are asked up to October 1 on crucible steel, wire rope and friction clutch couplers. (Circular No. 537-B.)

In review of the application for a receiver for the Chicago Railway Equipment Co. by a holder of 5 shares of stock in the company, valued at $500, this stockholder having been at odds with the management for nearly ten years, charging mismanagement, it is interesting to note that on Saturday last the company declared its fifty-second regular quarterly dividend. This was a dividend of 1¾ per cent, amounting to $43,000.

The Vandalia R. R. has recently purchased a large water softening plant of the L. M. Booth Co., Chicago. This plant, which has a capacity of 40,000 gallons per hour in treated water, includes a 350,000 gallon steel storage tank. The plant is to be installed in connection with the new shops of the road at Terre Haute, Ind. The Booth company has under construction a large water treating plant for the Chicago, Rock Island & Pacific Ry. to be installed at Sayre, Okla. This plant will be completed and placed in service at a very early date. The sale of these two plants was arranged by W. R. Toppan, vice-president and general manager of the L. M. Booth Co.

W. R. Toppan, who last year was made vice-president and general manager of the L. M. Booth Co., has a remarkable record as a railroad supply man. Entering the field as mechanical expert for the Galena Signal Oil Co., he passed several years

W. R. Toppan.

in the employ of this concern. He became general manager of the Kennicott Water Softener Co. in January, 1905, and held this position until he resigned to accept his present position with the L. M. Booth Co. in May, 1908.

L. C. Thompson, manager of the railroad department of the Alamo Manufacturing Co., of Hillsdale, Mich., manufacturer of gasoline engines for railroad service, has affiliated himself with the Duntley Manufacturing Co., and will have charge of the railroad department for this concern. Mr. Thompson will retain his position with the Alamo Manufacturing Co., with headquarters in the Harvester Bldg., 234 Michigan Blvd., Chicago, Ill.

Prof. Morgan Brooks, of the Department of Electrical Engineering, University of Illinois, who is absent from the University during the present school year on leave, sails from San Francisco on October 12 on a trip which ultimately will take him around the world.

James H. Norris, for the past nine years business manager of the John F. Allen Riveting Machine Co., New York City, has resigned that position, his resignation taking effect September 1. It is Mr. Norris' intention to take a rest of about two months, part of which is to be spent on an extended trip. He has not yet formed any definite future connection but has several under consideration.

The McKeen Motor Car Co., Omaha, Neb., recently shipped three gasoline motor cars to the Pacific Coast. The cars were coupled together and made the trip under their own power. Two of the cars are for the Southern Pacific, and will be used in California, while the third car is for the Oregon Short Line, and will be used in the vicinity of Salt Lake City. This makes a total of 52 McKeen gasoline motor cars in service in various parts of the country, one of which is operating in Mexico.

The following is a letter from the Pressed Steel Car Co., McKees Rocks, Pa., calling attention to errors in an item published last month: "Referring to the September issue of the 'Railway Master Mechanic,' Mr. Rider was not formerly general superintendent. His title prior to having been appointed general manager being that of assistant to vice-president, located in the Farmers' Bank Bldg., Pittsburg, Pa. Mr. J. V. Maher, who has been appointed general agent, with headquarters at Pittsburg, is not in charge of the sales department, this department being in charge of Mr. O. C. Gayley, second vice-president."

A uniform grade of metal with a uniform color, strength and good casting qualities is the desideratum of every brass or bronze founder. The necessity of using up the borings, gates and scrap of previous melts introduces an element of uncertainty into the mix, to overcome which purifiers have to be added and corrections made. The United States Alloys Co., of Baltimore, manufacture fluxes which furnish a means of cleansing the metal bath of impurities by converting the latter into a fusible slag which rises to the surface and can then be skimmed off. This company manufactures a large number of standard alloys and fluxes for the brass and iron founder.

The Raymond Concrete Pile Co., of New York and Chicago, has been awarded the contract for the concrete pile foundations of a building to be erected on Seventh street, Milwaukee, for the George Seelman & Sons Co.

H. H. Stock, for many years editor of "Mines and Minerals," has been appointed professor of mining engineering at the University of Illinois. This announcement is made under the authority of Dean Goss and it is to be accepted as evidence that the new department of mining engineering of the University of Illinois is to be as efficiently manned as are its other departments of engineering.

The Chicago, Burlington & Quincy R. R. has ordered the body and truck bolsters for the 3,000 box cars which the American Car & Foundry Co. is building for the road from the Scullin-Gallagher Iron & Steel Co., of St. Louis, Mo. This company plans to erect a pattern shop, 75x200 ft., at St. Louis at a cost of about $10,000. The shop will be used for making patterns for its customers and when completed the company will be in a position to quote from blue prints, furnishing both patterns and castings. Heretofore the company has not had facilities for making patterns for all its customers.

The O. M. Edwards Co., Syracuse, N. Y., has orders for trap-doors and window fixtures for the 100 Long Island passenger cars, to be built at the American Car & Foundry Co. The Edwards' steel trap-door is also to be used on the 55 new coaches for the Baltimore & Ohio. Steel trap-doors and window fixtures will also be used on the five new cars for the Chicago & Alton. Several large orders for window fixtures have been received for export trade. The factory force has been doubled within the last two weeks, and the plant is also working overtime to meet the large number of rush orders which it now has on hand.

The Westinghouse Air Brake Co., Pittsburg, Pa., has declared the regular quarterly dividend of 2½ per cent and an extra dividend of 1½ per cent. This is the first extra dividend paid in the calendar year 1909. The total dividends paid in 1908 were 12½ per cent, and in 1907, 20 per cent.

Roswell P. Cooley, formerly mechanical inspector for the Pullman Co., Chicago, has resigned, to take a position with the Chicago Car Heating Co., Railway Exchange Bldg., Chicago, Ill.

The Standard Steel Car Co. is reported to be planning to take over the plant of the Middletown Car Co., at Middletown, Pa. The company will improve the plant and plans to be able to build 20 steel cars a day at the plant. This acquisition would give the company control of four plants, which are located at Butler, New Castle, Middletown and Hammond, Ind., having a total capacity of about 250 steel cars a day.

The Lutz-Lockwood Mfg. Co., manufacturers of the Gordon primary batteries, announce a removal of their offices from 39 Cortlandt street, New York, to Aldene, Union county, New Jersey (postoffice, Roselle, N. J.).

Announcement has been made of the appointment of Charles D. Jenks as western sales manager of the Standard Coupler Co., by George A. Post, president of that company. The western sales office of the company is at 1207 Fisher Bldg., Chicago. Mr. Jenks has been connected with the Pressed Steel Car Co. for the past seven years, two years in the operating department as assistant to the vice-president in Pittsburg, and five years in the sales department in Chicago. Prior to his connection with the Pressed Steel Car Co., Mr. Jenks was for eight years employed in the traffic department of the Pennsylvania R. R. and for six years he was with the engineering and construction department of the Atlantic Refining Co. in Philadelphia.

Severn P. Ker, vice-president and general manager of sales of the Republic Iron & Steel Co., has resigned, to take effect on Oct. 1. Chas. T. Johnson, assistant general manager of sales, will succeed Mr. Ker as general manager of sales, George L. Claypool, at present manager of sales of the Pittsburg district, succeeding Mr. Johnston. Walter W. Hall, assistant in the general sales office, will become manager of sales of the Pittsburg district.

The Great Northern has recently completed some very successful tests of the Strouse automatic stokers on its line between Clancy and Woodville, Mont. The line at this point has a grade of 2.2 per cent. G. H. Emerson, superintendent of motive power, conducted the tests.

The Pilliod Company, Chicago, has orders for equipping the following engines with the Baker-Pilliod valve gear: Six Pacific engines, Norfolk & Western; six consolidation engines, Monongahela R. R., and eight consolidation engines, Lake Superior & Ishpeming.

Joseph T. Ryerson & Son, Chicago, are now working on the order for punches and shears for the new Dunkirk shops of the American Locomotive Co. The same firm secured the order for the majority of the machines in the boiler shop and blacksmith shop of the new Macon shops on the Central of Georgia. The order includes hydraulic wheel presses, flanging presses, accumulators, pumps, steam hammers, punches, shears and saws.

Personals

J. B. Moore, shop foreman of the Chicago & Northwestern Ry. at Missouri Valley, Ia., has been promoted to assistant division master mechanic at Chicago.

Geo. Logan succeeds J. B. Moore as shop foreman of the Chicago & Northwestern Ry. at Missouri Valley, Ia.

Geo. A. Morley has been appointed shop foreman of the Chicago & Northwestern Ry. at West Chicago.

David L. Bush, general superintendent of the Chicago, Milwaukee & St. Paul Ry., has been promoted to the office of general manager, Mr. Underwood having secured an extended leave of absence.

J. D. Cauley succeeds M. J. Connelly as master mechanic of the Georgia, Florida & Alabama Ry., with offices at Bainbridge, Ga.

John Hill has been appointed master mechanic and master car builder of the Minneapolis & St. Louis R. R., vice John Lange. His office is at Minneapolis.

F. E. Patten has been appointed road foreman of engines of the Mobile & Ohio R. R., with office at Mobile, Ala.

J. H. Myers has been appointed foreman of car shops on the Northern Central Ry. at Baltimore, Md.

J. G. Witt has been appointed master mechanic of the Washington, Idaho & Montana Ry., vice E. J. Davis. His office is at Potlatch, Idaho.

W. McIntosh has been appointed a master mechanic of the Yazoo & Mississippi Valley R. R., with office at Mem-


John Hill.

phis, Tenn. He succeeds H. C. Eich, who, as was stated in the September Railway Master Mechanic, was appointed master mechanic of the Illinois Central R. R. at Burnside shops, Chicago.

J. F. Murphy, master mechanic of the Houston & Texas Central R. R. shops at Ennis, Texas, died September 9. His position is still vacant.

J. E. Weatherford, a foreman in the car department of the Houston & Texas Central R. R. at Ennis, Texas, has been promoted to general foreman of the car department at Houston, Texas.

Robert S. Lovett, chief counsel of the Union Pacific, was elected chairman of the executive committee of the Union Pacific to succeed E. H. Harriman on September 13 and to a similar position with the Southern Pacific on September 14. At the same meetings Jacob H. Schiff and William Rockefeller were elected to board of directors and made members of the executive committee to succeed W. D. Cornish and E. H. Harriman.

A reorganization of the executive officers of the Atchison, Topeka & Santa Fe Ry. system has been determined upon by the directors and became effective on October 1. After that date two new vice-presidents will be added to the organization by the promotion of W. B. Storey, Jr., now chief engineer, and W. E. Hodges, general purchasing agent. The present system of designating vice-presidents as second, third and fourth will be discontinued. There has been no first vice-president for several years since the resignation of E. D. Kenna. Under the new plan of organization the various vice-presidents will be distinguished by the department over which they have jurisdiction. Mr. Storey will be in charge of construction and Mr. Hodges of purchasing and stores. Mr. Storey will thus have jurisdiction over some of the work previously handled by the general managers, while being relieved of some of the maintenance work. Mr. Storey began his railway service in 1877 at the age of 20 as axman for the Southern Pacific Ry., but after a year left to attend the University of California, where he was graduated in 1881. He then returned to the Southern Pacific and served as rodman, levelman, transitman and assistant engineer until 1893. For two years he was an assistant engineer with the United States Hydraulic Mining Commission and in 1895 became chief engineer and general superintendent of the San Francisco & San Joaquin Valley Ry. In 1900, after this road was acquired by the Atchison, Topeka & Santa Fe, he was appointed chief engineer of the Santa Fe Ry. at Topeka, and in 1906 was made chief engineer of the entire system, with headquarters in Chicago. Mr. Hodges began his railway service in 1881 as a clerk in the general superintendent's office of the Chicago, Burlington & Quincy, and in 1889 became assistant to the general manager. He was then for a year traffic manager for Fraser & Chalmers, Chicago, and in 1896 was appointed private secretary to President Ripley of the Santa Fe. He has held the position of general purchasing agent since 1897.

The Hine system of organization having been established on the Harriman Lines in Washington and Oregon, the following officers will hereafter be designated as assistant superintendents and their present titles are abolished: T. W. Younger, master mechanic; C. C. Blood, division engineer; C. H. Fox and E. B. Pengra, Southern Pacific Lines in Oregon. C. W. Martyn also continues with the title of assistant superintendent. J. T. Langley, master mechanic; A. F. Stotler, division engineer; A. Buckley, chief despatcher; J. F. Corbett, chief despatcher; W. E. Borden and J. C. Shea, Oregon division, Oregon Railroad & Navigation Company. J. D. Matheson also continues with the title of assistant superintendent. R. O. Cowling, trainmaster; J. H. Robb. divisoin engineer; T. F. Quinn, division master mechanic; H. L. Buchanan, chief despatcher; J. Beck, chief despatcher, Washington division, Oregon Railroad & Navigation Company. W. M. Gleason also continues with the title of assistant superintendent.

Papers read before the Chief Joint Car Inspectors' and Car Foremen's Association in Convention at Niagara Falls, Sept. 16-26

THE NIAGARA FRONTIER INSPECTION ASSOCIATION AND ITS ADVANTAGES.

By Frank Cleary.

This is the age of speed and rapid transit. It has been said that we reduce everything in the line of transportation to terms of distance and minutes. We want trains that will run still faster, and as a result of this ever-growing public demand we find our fast freight service, as far as speed is concerned, approaching the passenger schedule, and it is in marked contrast to the fifteen or twenty mile per hour movement of a few years ago. As car men, our interest is not centered in the actual train movement from one point to another, but we are vitally interested in the time occupied on terminals, to see that the work of inspection or repairs is reduced to a minimum. We see, therefore, that car inspection does enter into the question of fast freight movement and from a transportation standpoint, is considered good or faulty according as it interferes very little or very much with the movement of trains in interchange over large terminals, and this, of course, largely depends on the system under which the work is done.

We will suppose that a fast freight train arrives at Buffalo, destination Chicago. Under our present system this train will pass directly to the western connection forming the next part of its route, and the inspection and repairs will be made by the receiving line. Experience has shown that this is a very great advantage, and harmonizes more with the effort for fast train movement than under the former system of joint inspection, under which the cars were inspected in the delivering company's yard some distance from the connection, and were delivered after they had received the necessary attention in repairs, according to the judgment of the delivering line. This proved unsatisfactory and detrimental, as in many cases other defects were detected by the receiving company's inspector, or defects originated in the yard movement, and for these newly discovered defects, the cars would be returned to the delivering line for repairs, losing hours of valuable time in this useless return movement. This was particularly annoying in cases of cars being returned that were loaded with perishable freight, requiring special attention in movement.

Under the Niagara Frontier Inspection, there can be no return of the loaded car. It must be moved forward. The delivering line is through with it, and it is the duty of the receiving line to handle it as expeditiously as possible. In the disposition of the car he is his own master, his own servant, and in the broadest sense of the Master Car Builders' Association rules, he will be the judge as to what defects he shall allow to run, what he shall repair, and what he shall adjust or transfer according to the physical requirements of his own line. He does this with a certainty which the delivering company would not be able to do, and as he works in the exercise of his own good judgment, no criticism can come to him.

It has been said that the freight agent solicits freight and the unschooled car inspector diverts it, and that supervision is at fault. We have in mind the unschooled car inspector, the man who demanded "The Kard" at the expense of everything else, or the man with the "Get Even" policy. "You stopped certain defects on me, I'll see if I cannot get even by stopping some on you."

Now we are pleased to know that the unschooled car inspector is not in evidence on the Buffalo terminal. In the first place the system prevents arbitrary action on the part of individual inspectors, and the get around policy of the arbitrator induces unanimity of spirit in the work, and through the efforts of the arbitrator another feature has been added which still further tends to unanimous action. Reference is made to the meetings of the general foremen, foremen and others in touch with this important work. Here all questions of differences are submitted, and mutual benefits accrue from the deliberations of these representatives of the various interested lines. One result of this mutual education is to allow cars in dispute to go forward and settle the dispute afterwards. This is important on general principles and particularly on per diem charges. The inspectors are instructed to remember that it is the freight rather than the cars that is wanted at destination, and that while due consideration must be given existing defects, good judgment must enter into the work to the end that the freight is not needlessly delayed. So much for the transportation side.

I wish now to pay some attention to the mechanical side of the question, and will say that this is also most important, and one feature of it that requires the exercise of good judgment, is the determination of what shall be held to be owner's defects. Some may say that the Master Car Builders' Association rules provide for this. This is true, but we will do well to remember that it required the judicial ruling of the arbitration committee to decide some cases, and we are not justified in thinking that the work of car inspection is by any means an easy task in this respect, but under our Buffalo system as the defects for which cards are issued pass under the scrutinizing eye of the arbitrator's office, it is practically impossible to have defect cards improperly issued.

The schooling referred to in the above is also brought into effect in disposing of defects covered by defect card, and it is worthy of note that the defect carding as practiced by the Buffalo system is in harmony with the spirit of the Master Car Builders' rules of interchange, and that this distinction has been gradually reached by the careful supervision given this work. We will not offer the Niagara Frontier Inspection as a panacea for all the ills in connection with this work, nor can we say that it is the best system that can be put into effect, but we do find it superior to other systems tried in the same territory, and we note that at least at one or two other important terminals arrangements are being made to install a similar system.

INTERCHANGE OF TRAFFIC AS OBSERVED BETWEEN NUMEROUS RAILROADS.

By T. J. O'Donnell, Arbitrator Niagara Frontier Agreement.

The numerous changes in all branches of business at present and for some time past vitally enters into the inspection and repair departments of all railroads in so far as the rank and file of the force are concerned, due largely to the younger class or the rising generation taking to other duties in life which may appeal to them more fitting to earn a livelihood, thus making it more difficult to maintain the high standard of labor at all times to cover this important branch of the business without serious inconvenience or loss to the service.

This phase of the question places upon the official in charge be he a chief joint inspector, a car foreman or otherwise, the very delicate task of making the very best he possibly can out of the material on hand to fill the respective positions, and of necessity this must be kept up unceasingly to secure the desired results.

It therefore requires a systematic training to bring about perfection or at least honest results in this respect and to do this the first step in the estimation of the writer is to procure through honorable means the confidence of every employee under your direct jurisdiction by explaining patiently through personal conversation and otherwise, the responsibilities resting upon each individual from a monetary standpoint, and at all times to endeavor to have each employee realize that he himself is a component factor in working out the problem to such an extent that the higher part of man, the intellect, will go hand in hand with the muscular task. Another important factor to bring about good results in this respect is to have meetings of the rank and file to discuss subjects pertinent to the daily routine of work covered, at regular intervals. It should be the ambition of all departments to work hand in hand for the one common end—the betterment of the service for the road that maintains each one on their respective rolls.

It is understood by the writer and also, it is hoped, by those listening to these remarks, that no one is expected to be superior to his fellow workman, while of necessity many of us may hold positions of trust, in the natural course of events we are and should feel at all times that we are only a common unit or an integral part that go to make up the vast army that are carrying on the daily task of our respective assignments. It might be well to quote here the words of one of the great railroad generals, who at present is handling the affairs of the greatest combination of trunk lines in the world. The instructions are to each employee and are based on "Co-operation," a portion reading as follows:

"Co-operation between every department of this system is essential to its success. This means not only sincere, heartfelt interest in the welfare of the system as a whole, but personal friendship for the officers and employes of other departments, and an eagerness to assist all departments, so far as possible, in order that the best results for the entire system may be accomplished. It should be remembered, at all times, that the pay of every man in the employ of the company comes from the same source, and that only by serving the best interests of the whole system can any department serve its own best interests. The public judges the railroad very largely by the attitude of the representative with whom they come in immediate contact. Kindly courtesy upon the part of subordinate officials and employes costs nothing to the employes, but to the railroad it is an asset of very great value."

No comment appears necessary on such remarks; they emanate from a large broad-minded official who needs no eulogy and who has risen to the present position through the confidence of public and employee and is one of the many our country is proud of at this time.

In concluding these feeble remarks, Mr. President and gentlemen, may they not be summed up briefly as follows?

First: Be true to yourself and of necessity it must naturally follow that you must be true to all others.

Second: Always be on the alert to grasp a new idea; never feel that you have finished. Life is a warfare, and hesitation means a point lost which it is difficult to regain.

Third: Inculcate in the minds of those associated with you a common respect and a feeling of pride in the position that each may fill by considering the Golden Rule in letter as well as in spirit in your daily duties, thereby injecting, as far as possible, the milk of human kindness in our every-day duties.

Fourth: Bear in mind at all times we are associated with the railroad fraternity through our own free well and let us a'! strive to maintain the high standard railroad-men in general have to their credit the nation over.

Fifth: Last, and the most important, it is to be hoped we may never disregard or forget the All-seeing Power that guides our every act and that we all look forward to those words, that give us courage in this battle for decency, honesty and righteousness: "Well done, thou good and faithful servant."

PAPER PREPARED BY THE CINCINNATI CAR FOREMEN'S ASSOCIATION.

From all indications, this country is facing the greatest prosperity wave that was ever known, and the indications are that within the next few years the railroads will be called upon to handle a larger amount of business than ever handled before. That means that such associations as that of the chief joint car inspectors and car foremen should take steps at once to suggest the necessary changes in the M. C. B. rules to handle this anticipated business in interchange economically and with as little delay at interchange points as is consistent with safety.

This association, being composed of men who are on the ground and know from practical experience what is necessary to accomplish the desired results, should not hesitate to make whatever suggestions they deem proper to obtain the desired results. There is no reason why there could not be adopted uniform methods whereby cars in interchange between connecting lines could not be handled under the same rules and methods as are used between different divisions on trunk lines. If a car is in safe and serviceable condition to pass from one division of a trunk line to another division of the same line, why should it not pass to a foreign connecting line under the same conditions? I have no doubt but what you will agree with me that it should. If so, why not adopt rules that will insure its being accepted instead of being rejected on some technical point of the rules. Rules should be made from a practical standpoint as much as possible and not from theory.

There is a large amount of time and money spent in tracing cars received from connecting lines that is unnecessary, all on account of some rules, making the delivering line responsible for car own defects in interchange.

The members of this association should endeavor to show the benefits to be derived by cutting out rules that only delay business and cause unnecessary correspondence, also extra switching at terminals. The switching of cars is an expensive proposition and if this association can, by having rules adopted that are not only a benefit to the interchange of cars but also reduce switching, it would make a saving in both departments.

While the conditions are not the same at all interchange points, there is no reason why there should not be a more uniform interchange of cars at the different points. While it is true that this association through its annual meetings has brought about quite an improvement there is still more to be accomplished. Often cars are transferred on some technical point of the rules, simply because the delivering line is responsible for the cost of doing same.

If the delivering line has gone to the expense of building side tracks to industries to originate this business, why should the receiving line not be the proper one to stand the expense of transfer, when necessary? If such would be the case all this transferring of freight on some technical point would be discontinued and there would be less delays and better results would be obtained.

ADDRESS BY F. W. TRAPNELL, CHIEF INTERCHANGE INSPECTOR, KANSAS CITY, MO.

Another year has passed away and we are again assembled to discuss the changes in the rules governing the interchange of cars through our various great commercial gateways to expedite the movement of freight so that the railroad companies can have the benefit of the prompt movement of cars. Our session here is to get a uniform understanding of the rules and to interpret them all alike, so that the car leaving the eastern shore, can go through to the western shore with the same uniform understanding, and not cause any delay on account of the different interpretations of the M. C. B. rules of interchange.

At our last meeting the financial panic was loosening up, and to-day we are getting back to prosperous times, and with the good crops and the tariff bill settled, business will be good, and continue to be for a long time, and with prosperity means increased car movement, and the best and most economical method of handling same should be our watchword.

This, then, brings me up to the subject that I am to read before you, viz.:

"Joint Car Inspection,"

the most discussed proposition for the past year before all divisions of the Central Association of R. R. Officers. This subject has had considerable thought, and figures have been compiled to show the saving to be had from the sytsem of joint car inspection. There are only a few points that have joint car inspection, and Ft. Worth reports that business is handled very promptly at that point and at a reasonably low cost per car.

The other centers do not have joint inspection, while they call it joint, it is not, as each road employs their own inspectors on the various connections to receive the cars for their respective roads, and as a rule, while the inspectors of the road receiving the cars are working, the inspectors of the delivering line are idle. Now if joint inspection was being done, in place of inspectors being idle, they would all be working when any cars were placed on the delivering tracks for interchange, and in that there would be a saving to all lines, the inspectors would have to be competent and would hold their position from their ability to handle the business.

On the interchange tracks at Kansas City this matter was gone into very thoroughly by a special committee, who were to secure and present to the General Association of R. R. Officers, all the data for one month, to show the present cost of interchange car inspection and interchange yard clerks, and it developed that the cost for one month amounted to $9,698.17, and the work done by consolidating the inspector and interchange yard clerk duties, for $6,048.60, being a saving of $3,649.57.

Under the old plan it cost per car	.0965
Under the proposed plan	.0602
Saving under the proposed plan	.0363

This to be effected by grouping the inspectors at the central point of each interchange. In Kansas City we made seven groups, and recommended a captain for each group, so that there would be a head for each inspection point, the captains to receive additional pay, the day captains $10 per month, the night captains $15 per month, so that it at all times gave the inspectors an incentive to work faithfully, as there was promotion in their work, and a head to each group who would be responsible for the prompt handling of the business at that particular point, and at rush hours, if sufficient men were not there to handle without delay, call for additional force if needed, and report where men could be relieved and used at some other point. Through the captains the chief inspector may direct the men, and in that manner always have a flexible organization in handling the cars in interchange, and the inspectors furnished with a self-locking seal, should they find one broken, the seal to be furnished by the Joint Inspection Bureau.

The plan of joint inspection will do away with the friction that exists between the various lines inspectors, and in the place of strife, it will be harmony, which is the best recommendation, for with strife there is delay, while with harmony there is prompt movement. There is also a great benefit to be derived from joint inspection in the per diem reports, his report would be final, and the squabble between the delivering and receiving agent done away with, the reports in promptly and the car accountants able to make their statement promptly at the close of the month, and the same settled for, as the cause of the friction has been eliminated.

Some will raise objections to the car inspector acting as interchange clerk, claiming he has not sufficient time, but a careful review of the work will show very plainly, the additional work is so little, it will not amount to anything when the plan is in operation.

The inspector gets the following information: Initial, Kind, Number, Load or Empty, Time inspected, Nature of physical defects, also if any broken seals; this is virtually a repetition of the interchange clerk, he showing the same data except: Physical defects, and in lieu of that shows contents; seals and destination of car, which inspector can copy from switch card placed on the cars, so you can readily see that the additional work on the inspectors is a very small matter, as the interchange clerk's time to each car averages 1 minute and 9 seconds.

Now with joint inspection taking in both interchange clerk and inspector's work, a system would have to be adopted, to gather the inspection from the various points, to the central office, so that typewriting operators could take the data off and send it to the various car accountants promptly at the close of each day's work, this could be done by messenger boys, who would collect all the inspection sheets at stated times and leave them at the office to keep the operators busy getting out the per diem sheets, one copy to the car accountant, one copy to the delivering and one to the receiving line's agents, and one copy for file in office of chief interchange inspector.

As shown above it is proposed to divide the inspection points into seven groups and the figures show the number of cars inspected by each inspector in interchange.

	Day.		Night.	
Group	Present Plan.	Proposed Plan.	Present Plan.	Proposed Plan.
1	63	98		
2	63	72	36	51
3	55	121		
4	46	64	65	62
5	53	61	43	60
6	43	68	51	68
7	47	59	25	27
	—	—	—	—
Total aver.	49	68	49	61

In Group No. 3, this is all day work and there is not sufficient work for two men therefore one man will be at that point and work until he is through, receiving extra pay for overtime.

To put this plan in effect would mean the reorganization of the force in the chief inspector's office to meet the new conditions. I would also recommend that a system of numbering the defects be adopted which would help the inspector in getting his inspection, as follows, for example: "28.2 F," which would mean 2 draft timbers broken B. End.

A printed list of the numbers showing what defects they cover, could be printed and furnished each inspector, who would soon become familiar with the same, and in that manner greatly expedite the inspection of cars.

REORGANIZATION OF DUTIES OF INTERCHANGE OFFICIALS.

By L. D. Roberts.

Some four years ago it became apparent to our local railway officials that the mechanical department (through its inspectors) and the transportation department (through its interchange clerks) were duplicating, with slight exception, the data that each department required. With this one idea paramount, and with a full realization that if such was the case, an economical readjustment could and should be made, they undertook, at that time, to solve the problem. After fullest investigation on their part, it was determined that the real, logical solution was a consolidation, under one head, of the interchange work of the two departments, with a slight increase in the pay of the joint inspectors, having them essay to do the work of the interchange clerks, dispensing with the services of the latter.

Pueblo, at that time, was not fully equipped with interchange clerks, there being but four, two days and two nights, on two distinct points of interchange. These four clerks were paid by three different lines and received in compensation, in the aggregate, $250 per month, yet three separate points of interchange were unprotected and interchange data not gathered. These three unprotected points were a constant source of contention, arising from conflicting seal records and disputes as to the actual time of the delivery of cars. Under the then existing arrangement, had these three unprotected points been covered, furnishing the same service as at the other two, it would have entailed an additional cost to the railroad companies of, approximately, $400 per month, not including supervision, and considering this, the necessity for the consolidated plan became more apparent, for under its jurisdiction interchange data for car accountant, agent and yardmaster could be gathered at all interchange points for even less money than was being paid at that time for the two protected points.

As I have stated in the preceding paragraph that the cost would be less under the consolidated plan than under the individual plan, I would wish to emphasize that fact because, in the investigation of the consolidated plan, I had been requested to furnish an estimated cost of the additional labor, and I found that it could be maintained at the following expense, to offset which they had a saving of $250 from four relieved interchange clerks. My estimate of the expense was based upon a flat rate of increase of $5 per month for each inspector, of whom we have seventeen, equaling $85; one stenographer, $75; one messenger, $25; total, $185, plus whatever increase was considered equitable for the chief joint inspector. On April 17, 1909, this amount was determined at $25 per month, thus making the total labor cost $210 with all points protected, as against, under the old plan, $250 per month, with but two points protected.

This estimate, when first made, was treated as somewhat of a joke because a nearby city, with about the same conditions and a trifling less volume of business, was paying between $700 and $800 per month for interchange data alone. After many conferences and still more questions, I was able to convince them of the reasonableness of the estimate and the plan was locally approved, but it remained for May 1, 1909, to witness its adoption and, I may add, that subsequent operations under the consolidated plan have proven the accuracy of the estimate.

On April 17, 1900, at a joint meeting of the representatives, superintendents, master mechanics, agents, yardmasters, etc., of the various lines a permanent organization was effected and it was elected to commence operations on the first day of May. Whilst the minutes of this meeting might make interesting reading, I believe that their sense can be most clearly imparted by simply reading the rules and regulations as promulgated that date for the government of the consolidated bureau. Before, however, beginning the reading of these articles of agreement, which clearly define organization and conduct of the bureau, I would like to add that the representatives there assembled were clothed with authority by their respective managements to sign in the affirmative.

We, your committee, selected January 16, 1909, beg to submit to you the following rules and regulations pertaining to the Pueblo Joint Car Inspection and Interchange Bureau, organized December 16, 1908.

First: That the Pueblo Joint Car Inspection and Interchange Bureau be divided into a Car Inspection Division and an Interchange Division.

Second: That the executive body be known as the Board of Directors, said body to be composed of one representative from the transportation department and one representative from the mechanical department of each of the subscribers hereto and that this body select its chairman, vice chairman and secretary at each annual meeting, and these three officers shall hold office for one year or until their successor is chosen.

Third: That from the Board of Directors, three members be chosen from separate roads by a vote of the board at each annual meeting, who shall constitute an "Active Committee" (with a presiding officer selected by themselves) who shall have general charge of and supervision of the work of the Pueblo Joint Car Inspection and Interchange Bureau, subject, however, to ratification by the Board of Directors at any regular or called meeting. And further, that no member of the Active Committee shall have voice in controversy or action involving the line he represents except as attorney, his place on the Active Committee to be temporarily filled by appointment, by the Chairman of the Board of Directors, of a disinterested member of the Board of Directors pending adjustment of such controversy or action.

Fourth: That meetings by the Board of Directors shall be held semi-annually on the first Saturday in June and on the first Saturday in December and the meeting on the first Saturday in June of each year shall be designated as the regular annual meeting, due notice to be given in writing to each member of the Board of Directors, by its secretary, at least fifteen days in advance of the meeting. Upon written request signed by three members of the Board of Directors, setting forth the reason, the Chairman of the Board of Directors shall forthwith issue a call for a special meeting, notifying all members of the board in writing of same fifteen days before date of meeting.

Fifth: That the active committee are privileged to convene at any time or place for the transaction of any business that may properly come before it and a majority of said committee shall have power to act.

Sixth: That seven members of the Board of Directors shall constitute a quorum, except that a less number may adjourn from time to time.

Seventh: Any member of the Board of Directors and Active Committee shall appoint a substitute in his absence.

Eighth: That a manager for the Pueblo Joint Car Inspection and Interchange Bureau shall be chosen by the Board of Directors and it shall be his duty to supervise the immediate workings of the Bureau, reporting to the chairman of the active committee.

Ninth: The manager shall be governed by any special rule or interpretation of rules issued by any subscribers hereto, except that such rule or interpretation of rules shall be approved by the chairman of the active committee.

Tenth: That all expenses of this bureau shall be paid by the several subscribers thereto on a car basis, prorated upon the number of cars inspected for delivery and receipt by each line.

Eleventh: The manager shall have full charge of the inspection and interchange of all cars at Pueblo; he shall have full charge of his force, with power to hire and discharge, and with the chairman of the active committee shall regulate the number of clerks, inspectors and their respective salaries.

Twelfth: The manager shall keep a correct and accurate record of all his expenses and he will render monthly statements to each of the lines signatory hereto, covering incidental expenses and the wages of himself, clerks and inspectors together with the number of cars handled and the per cent of expense chargeable to each interested line and this monthly statement shall have the approval of the chairman of the active committee before being forwarded.

Thirteenth: The books and records of the manager shall be open at all times to the inspection thereof by any of the subscribers hereto.

Fourteenth: Any subscriber hereto, if wishing to withdraw from this agreement, must give, in writing, sixty days' notice to each subscriber.

Fifteenth: Acceptance of this agreement must be as a whole and no exception to any rule or rules shall be valid.

Sixteenth: This agreement entered into this .. day .... 1909 shall supercede all agreements as to inspection and interchange of cars, at Pueblo, in effect this date.

Inspection Division. Rules Governing.

First: It shall be the duty of the manager to see that all cars delivered or received by any of the subscribers hereto are carefully and impartially inspected and the decision of the manager shall be final except as hereinafter provided and he shall keep a correct and accurate record of the physical condition of all cars offered in interchange.

Second: Cars shall be inspected and claims made in accordance with the M. C. B. rules of interchange, except that all equipment foreign to the subscribers hereto may be run on book record unless defects exist for which the delivering lines are responsible and the repair of which is necessary for the safety of the lading, etc., when the delivering lines defect card shall issue.

Third: Questions as to the liability for repairs or for the fitness of a car for service shall be decided by the manager, subject to the following article: Any subscriber to this agreement may appeal from the decision of the manager to the active committee whose decision shall be final except a further appeal may be made to the Board of Directors.

Fourth: No cars shall be offered in interchange nor accepted bearing any defects that conflict with the requirements of the Federal Laws relating to the penalty safety appliance defects.

Fifth: All loaded cars will be interchanged at Pueblo which are exempt from penalty safety appliance defects in accordance with the Central Association of Superintendent's Agreement, which provides that cars must be safe to handle from the point of interchange, it being the intention of each subscriber hereto, to repair its own system cars and such foreign cars as it may offer in interchange, the manager to be the judge as to whether the car or cars are in condition to be moved, subject to appeal as provided in Article Third.

Sixth: Should additional damage accrue to said car while in possession of the receiving line, the manager shall place the responsibility and he may elect that the receiving line repair the additional damage before the return of the car, except when in his judgment the additional damage was contributed to by reason of the defective condition of the car on its initial movement.

Seventh: All switch cars except cars having penalty safety appliance defects, will be accepted to go to point of loading or unloading, the manager to be the judge of condition, said car to be returned in same general condition.

Eighth: All system cars will be received home in any condition provided they are properly carded when delivering lines defects exist, except that all penalty safety appliance defects must be repaired by the delivering line before car is offered in interchange.

Ninth: No cars shall be offered in interchange on which the draft gear is in such condition as to suggest possible loss of coupler or other damage but in case such car reaches the transfer it shall be treated in the same manner as a car bearing a penalty safety appliance defect.

Tenth: Cars carrying double loads shall be secured to one another by switch chains, except when said cars are equipped with end sill safety chains, the chains to be furnished and the chaining to be done by the delivering line.

Eleventh: Cars with contents leaking or partially lost in transit will not be accepted in interchange but will be set back to the delivering lines house to check contents or to delivering lines shop to be repaired.

Twelfth: Sfitch chains settlements shall be made monthly either by the return of an equal number of chains of the same dimensions or by the issuance of the receiving lines defect card, as per the statement of credit balance as rendered by the manager.

Thirteenth: Inspectors shall be paid 23½ cents per hour for each hour worked and shall be allowed eleven hours for each shift actually worked.

Fourteenth: These rules governing the inspection division shall apply in all cases except as per notice served by the Denver & Rio Grande Railroad Company, dated November 11, 1907.

Interchange Division, Rules Governing.

First: It shall be the duty of the manager to keep a correct and accurate record of all car numbers, initials, kind of car, loaded or empty, and if loaded, the contents and final destination or consignee. If load is in open or stock car, the condition of the load, if defective; the time of setting of car to transfer and the time inspected.

Second: He shall keep a correct and accurate record of all seals on loaded cars interchanged at Pueblo. On refrigerator cars, he shall keep a record of the amount of ice in bunkers, and if none he shall so show the condition of drain pipes and ventilator doors and plugs as well as temperature and weather conditions.

Third: He shall furnish daily to each of the subscribers hereto a complete report, and as many copies as may be required of all cars delivered and received by each line, to wit: an interchange report.

Fourth: Each subscriber hereto pledges himself to card or otherwise distinctly mark, all loaded cars with contents and final destination or consignee, also empty cars foreign to the receiving line, except that inspectors will card loaded cars destined for the Colorado & Wyoming, at Minnequa, arriving from the South via the Denver & Rio Grande and the Atchison, Topeka & Santa Fe. (Colorado and Southern).

Fifth: Each subscriber hereto pledges itself to furnish a switch list with all cars intended for delivery to a connecting line, said switch list to be left at the headquarters of the inspector or inspectors at point of interchange and said switch list to give the car number and initial and time of setting.

Sixth: The additional help of one stenographer and one messenger is allowed the manager in this division.

Seventh: The rate of pay for the stenographer shall be $75.00 for each calendar month and the rate of pay for the messenger shall be $25.00 for each calendar month. For additional work on the part of the inspectors they shall receive a flat rate of $5.00 per month for each inspector or as much thereof at 16 2/3 cents per day as said inspector has worked days in any calendar month. For additional duties imposed on the manager he shall receive as compensation the sum of $50.00 for each calendar month.

Eighth: If at any time conditions demand the placing of interchange clerks at any transfer point to collect interchange data, then the $5.00 per month allowed the inspector or inspectors at that point for the collection of interchange data, shall cease.

Ninth: The expense of the interchange division from its inception and inauguration, shall be kept and maintained separate and distinct from the inspection division expense and the interchange division expense shall be solely a transportation department charge and shall be shown on all pay rolls, expense statements and accounts emanating from the manager's office.

In connection with the inauguration of the Pueblo Joint Car Inspection and Interchange Bureau, we, your committee, beg to submit the following recommendations:

First: That the present joint office be declared the permanent headquarters of the bureau.

Second: That the west partition of the room be moved 8 to 10 feet farther west, to enclose the window fronting on "B" street and that a board floor be laid covering the entire office and that a committee, composed of the various superintendents whose lines are interested in the Pueblo Union Depot and railroad company, wait on Mr. Tate, superintendent, to that end.

Third: That an Oliver typewriter, with long carriage, be furnished the manager to the end that reports may be uniform and businesslike in appearance and that as many copies as are required may be made at one writing, for the interested lines.

Fifth: That a standard form of stationery be adopted that will conform to the requirements of all interested lines.

Sixth: That city phone connection be made with the inspectors covering operations between the A. T. & S. F., and Colo. & Wyo., at Minnequa.

Seventh: That the adoption of an automatic seal so marked as to identify it as having been applied by the Pueblo Joint Car Inspection and Interchange Bureau.

Eighth: That the manager be instructed to proceed at once upon the consolidated plans to the end that the Bureau may be ready for work on February 1, 1909.

(Signed) Geo. Van Brimer, L. D. Roberts, Committee.

To begin with actual operations, I will state that our men write all records in duplicate, retaining the carbon copy at their point of interchange for mechanical reference, and turning into the Bureau office the hard copy as the official record of the car. These records we gather, with messenger, three times daily, to wit: 7:00 a. m., 1:00 p. m. and 4:00 p. m. At other cities conditions might be so dissimilar to ours that this arrangement would not be satisfactory. Upon arrival of the records in the Bureau office they are checked as consistently as the previous movements of the car will allow, as will be explained further on, in order to verify numbers and initials. The stenographer then compiles, on his machine, at one writing, the interchange data required by the car accountant, agent, yardmaster, et al, of both the delivering and receiving line. These reports are completed on the previous day's business by 3:00 p. m. although local deliveries of the completed report begin as early as 9:00 a. m. We mail the reports to the car accountant direct, in some cases; while in others they pass through the local offices in order to check individual lines business when joint yard agreement exists. The accuracy of this report is not a responsibility that rests alone with the inspector and stenographer because in one instance we are compelled to get switch lists to determine the actual car delivered, there being no regular interchange track and the delivering line's engine handling the car after inspection. In another instance, on account of a joint yard agreement where each of two lines claim individual possession of its respective cars, we are compelled to check the receiving and forwarding books before we can render competent reports. We find, however, in neither case is there anything specially detrimental to the consolidated bureau nor is additional cost entailed.

The work on the part of the joint inspector, under the consolidated plan has not been materially increased. By close observation we have ascertained at Pueblo, that only about 30% of our loaded cars are under seal, the remaining 70% being either open cars or empties routing home.

It was a mechanical contention, at first, that the duties of the inspectors under the consolidation plan would be so materially increased that the mechanical inspection would suffer and that the mechanical department, by reason of their jurisdiction over us, would be called upon to explain why so much more time was consumed in inspection and they anticipated, as a consequence, that they would be held for delays which properly belonged to the transportation department. These delays have not developed in our experience. The condition was magnified because it was unknown and dreaded.

The major portion of our interchanges are made in the day time and as a consequence we have two men on each transfer. One of these men does the writing, one way and the other, whose hands are free, examines the car underneath, noting the condition on his side of the car and secures the end door seals. This same inspector retraces his steps via the roofs of the car while his companion follows along on the ground and checks, in order to verify, the car numbers and intials. Working in pairs in this manner has overcome every tendency to delay and as far as the mechanical inspection is concerned, with reference to neglect, I am glad to state that on the contrary it has improved. The habit of being accurate has been instilled into every one of our inspectors and, while it started with car numbers and initials, seals and ice boxes, under the consolidated plan, it now has been carried to the physical condition of the car.

The data that our men are gathering must be accurate to be of benefit and the taking of seals, etc., has been a school for the inspector that he long has needed to attract his attention to the various cases of apparent oversight. Many errors which he previously has made have never been called to his attention because of lack of checking facilities but with the responsibility for interchange data in his hands the errors stand out so prominently that habitual vigilance has become a second nature to him.

Of a daily interchange, under normal conditions, of between 800 and 1,000 individual cars, we will not average more than one bad order set back load for the delivering line to repair.

My observations have been, preceeding consolidation, that the line of demarkation as between the mechanical and transportation departments has been vividly drawn, the breach being as distinct as that between a divorced pair. Since consolidation a complete reconciliation has been effected and, now that a dual responsibility has manifested itself, a mutual interest has arisen in the two departments and more perfect harmony has reigned than ever before in my experience.

Numerous reasons have been advanced as to why consolidation should not obtain, most of them trivial in nature, or made through ignorance of conditions. It has been claimed that when inspectors have the authority to examine, remove and apply seals, from any cause, the opportunities for pilferage have been correspondingly increased.

This is going a long way to find an objection against consolidation. Railroad companies must trust some one and why not the inspector? In my experience with both the inspector and the cheap interchange clerk, I certainly must give my preference to the inspector, through no favoritism, though. He has worked every day in the year, for years, to qualify in his trade and, unlike the interchange clerk, cannot be made in a day under the most favorable of circumstances. The inspector passes upon the serviceability of equipment where the value is not reckoned in pounds and tons. He tells you that a coach is safe to carry you and if he can be entrusted with human lives can there be any valid reason for assuming that he cannot be entrusted with the safety of the commodities which the railroads carry. As long as some employee must be trusted, I believe you will not find the peer of the competent joint inspector.

Another theory (I will not dignify it by saying "reason") against the inspector undertaking the duties of the interchange clerk was because of the alleged illegibility of his writing. That could not be a serious objection even were the fact established as his records are handled exclusively by the bureau office, where the interchange data is compiled. I am pleased to say that, as far as Pueblo is concerned, the writing of its inspectors will compare favorably with that of any clerical force employed by any railroad department, except possibly that which executes vouchers and payrolls. Why, one of or local agents, when shown specimens of their writing, admitted that it was an improvement on the force under him.

Still another objection has come to our attention and it was the simple one that the inspector's hands were not clean enough to attempt the work. This, it occurs to me, is about as valid as any that have been made. Of course his hands are not suggestive of the manicurist but at that the objection will not stand because he does not compile the interchange report, he simply furnishes the data. As a parting shot at pilferage, illegibility and cleanliness arguments, I will state that they were made through absolute ignorance of conditions. I think you will find reference to clean hands in the April, 1909 report of the Central Association of Railroad Officers, Kansas City Division.

On the part of some mechanical officials there seemed to be a strong feeling against consolidation due to their lack of jurisdiction over the joint inspector and consequently their inability to discipline and they advance as a result "poor service." This, it occurs to me, is not a tenable objection. "Results" are all that any railroad corporation desires and the consolidated bureau is not dissimilar in its appointments to any other branch, whether it be mechanical or transportation; all are alike dependent upon proper supervision. If in a company's employ is a poor superintendent, you have poor service on his division; if there is poor talent in the roundhouse, you experience poor engine service; if a poor foreman is employed, you have poor local inspection and poor repair work. So, it applies alike to all branches of railroading; poor supervision is conducive to poor results. Another manifest objection is the time worn one of partiality. With this claim I have little patience. The entire tribunal of justice of these great United States exists because men can be trusted to act impartially. Can any dissenter from this consistently claim that just as much honor, just as much integrity, just as much loyalty, does not exist beneath the coat of blue denim as pulsates within the ermine clad justices of our courts. If any railroad company suffers by reason of partiality it is because of something wrong and if it is wrong there is a solution but I wish to impress upon you here that it is not always the inspector who is wrong. Many times, unjust and unreasonable demands are made.

A visitor at our particular point made the claim, not to me, however, that our inspectors did not take kindly to the work because of the slight increase in pay. If such is the case it has never manifested itself in my presence. Our inspectors are a unit, so far as I know, in favor of the additional work. As a rule the competent joint inspector is the progressive, energetic man of his class. He is a student to a certain extent. Give him a new edition of the M. C. B. rules or the pamphlet reporting the decision of the Arbitration Committee and you will find him burning the midnight oil to acquire the knowledge these publications impart. He wishes to make himself efficient in his work and worthy of his hire. He seeks promotion and bends every effort to that end.

Pertaining to seals in use by our Bureau, I will state that they are automatic, thus avoiding the use of the sealing iron. They are identified by the words "Pueblo Bureau" stamped thereon and are consecutively numbered. As we deliver them in bunches from 15 to 20 to our inspectors, we charge them to that particular transfer, showing the individual number of each seal so delivered. If a broken, or otherwise defective seal is encountered on a car, it is removed, the Pueblo Bureau seal applied and its number taken, together with the circumstances connected with the transaction. The broken or defective seal is turned into the bureau office with the record, and, by us, forwarded to the agent of the line in whose possession the car was at time of discovery of broken seal. The lading under protection of the Pueblo Bureau seal goes on to its destination unless conditions indicate that the load should be checked before being forwarded.

Regarding errors in car numbers and initials and interchange data, we have not found it serious. Our men make some errors and always will, but we have found the errors no more voluminous under consolidation than under transportation supervision alone. Probably three to five errors daily in car numbers and initials is all with which we have to contend. As time goes on and our inspectors get the benefit of schooling in accuracy that is demanded by the interchange data, I expect to see even this small average decreased.

We are using pool marks on all cars which we handle. These marks indicate the delivering and receiving line, together with the date of delivery. The pool mark is placed, with chalk, on the cross tie timber or intersill. Upon the return movement of the car this pool mark is furnished as a part of the inspector's record and it must corroborate the record in the office in car number and initial and previous movement. We maintain a location book and this ready reference factor, with the pool mark, enables us to locate errors, often before they become apparent to the car accountant. When discovered we immediately follow with corrections to both lines interested, unless, perchance, the discovery is made before the interchange report leaves the office. In that event the correction is made on the original report.

Our office force before consolidation consisted of one clerk whose whole time was given to the "location book." Since consolidation we have the increased force, stenographer and messenger, whose whole time is given to the interchange bureau end of the work.

The first month's operation under the consolidated plan was at an additional expense of $315.77. Of this sum nearly $100.00 was expended for permanent office fixtures, 15 inch carriage typewriter, etc. Subsequent months have cost in labor $205.00 and such sums in addition as have been expended for stationery and supplies, plus one half of various common expenses, i. e., rental, phone, etc., that had hitherto been borne by the mechanical department alone.

With the exception of the two instances, we do no carding of cars whatever, this being done by the delivering line as per agreement. These cards are supplied by them upon the arrival of their trains in their breaking up yards. This practice has been of inestimable benefit to switch crews and has resulted in almost entirely eliminating the wrongful delivery of cars, as was a common occurance under the old plan when switch lists were made out in the yard offices and given the crews.

In conclusion I feel free to say that in my opinion joint car inspection and interchange data should be consolidated. It is a fact that the mechanical department has always had the best car records and, that being admitted, why should not the other departments of the railroads avail themselves of this correct data rather than incur additional expense in gathering records for themselves that we know to be less accurate. It is also a fact that under joint inspection alone there are certain fixed charges borne by the mechanical department which, under consolidation, would be equally divided with the transportation department thus slightly reducing, per car, the cost of inspection.

Every undertaking has its drawbacks and it is manifestly unfair to condemn a plan because conditions at some one time or place have not proven absolutely successful in every particular. Errors are made in all the affairs of life; some, innocently enough; others, premeditatedly, I am willing to concede, but why condemn any until tried out under conditions that are favorable? In this particular departure from the old established ways it is not an expensive experiment. Whether successful or not, from all points of view, consolidation will save the railroad companies some money while they are experimenting with it.

ADDRESS BY MR. F. M. LUCORE.

Last year your president was good enough to invite me to address you and I prepared a paper treating of the relations between railroads and departments of railroads in conducting the transportation business of this country. This year I shall not ask for so much of your time, and I am sure you will not think it done in a flippant sense when I tell you that baseball is what I want to talk about today.

Yours is an association which undertakes at all times to perfect transportation, and I realize you would not sanction anything which did not have that for its purpose. Please bear with me, therefore, and see if a lesson can be drawn from the National game.

In probing for the heart of the game of baseball I learn that each player's action is made to fit the action of every other player—that the player himself is really not the unit, that the unit is the team. I see the man at bat make a sacrifice hit to advance, not his own score, but the standing of the team. I see the player who has reached second base purposely attract the ball to him and be put out that the runner on third may score, and then I remember that all the rules, and the whole spirit of the game are founded on the "team work" principle. I argue with myself that I would not be an automaton, guided by a lot of rules, with no initiative, that I would enter a business where I can think for myself, and then I look again. I see that individual effort, however great, would be thwarted with every player for himself, and then I wonder if one can do good work in the transportation field if he forgets for an instant the purpose of transportation or disregards his fellows. I look again and see that after all the player has a better standing at the season's close than if he had played for his own record alone, and, I am made to wonder if one's record in other lines will not also prove better if effort is directed likewise toward the general standing.

I note also that in spite of the team work principle, and the many rules of action to guide a player of baseball, there is still room for initiative; that his judgment must be quick and it must be sound, else the whole team is hampered; that when the game is over he must practice for tomorrow,—that when the season is finished, he must devise ways of making next year's work even better. I note the rules of baseball are not confined to state lines, but are alike throughout the nation. I note that the player with the physical strength, without the trained mind, the one having a clear head but lacking the physique, and the player possessed of both, but not realizing the advantage of team work, with his eye too much perhaps upon the grand stand, alike fail in the end to make good. I see that ridicule from the audience sometimes discourages the players; that a sympathetic note often puts new vigor into the team.

As a pastime, a diversion, I can imagine nothing better than America's national game. Its popularity reflects the Nation's high ideals. When a business or profession becomes as skillfully conducted as the game of ball, what pleasure work will be, and what startling results are sure to follow! You and I have engaged in the business (or shall I say the profession) of transportation. It is not play; it is work; but there is no higher calling. Like the game of ball, transportation is in various stages of development throughout the world. I shall not insist that the transportation system of this country excels that of other nations, but I do feel justified in laying stress upon the fact that with our 5% of all the people, a similar portion of all the land, this nation has almost one-half of the whole world's railroad mileage. I think the least that can be said is that this country in its ability to exchange products one section with another, is fortunate indeed. Transportation as it exists today is so important to the general welfare, and the need of more and better transportation is so urgent that it is not exaggerating to say that transportation overshadows other undertakings.

It should be, and I am sure it is, your ambition that transportation be conducted in perfect time and taste. But if imperfections are discovered here and there, no one need feel discouraged. Must not they be discovered before they can be corrected? Does not the very fact that defects are detected indicate a high conception of what transportation really stands for?

Correctly conducted, transportation in its every move, brings a benefit to mankind and every man assisting to that end its no less than a public benefactor. To catch the real spirit of it all, removes many otherwise unpleasant features, both to the transportation team and to the patrons for whose benefit the game goes on. Working to improve transportation, instead of a tedious task, becomes as play to a child—as music to a musician.

To the patrons of transportation I would say: "Cheer the transportation team a little." "Their playing may still be unscientific in some points, but please cheer a little anyhow." I would remind them that in the game of ball now played in such perfect time, hundreds of years were used in its evolution—that nine men constitute a team. I would bring to their attention that compared with most other undertakings, steam transportation is an infant; that one million five hundred thousand men make up the transportation team; that the coachers themselves do not always know the transportation game, and that they, the patrons, have not seen it long enough to always realize a good play when one is made; that there have been sacrifice hits in transportation and the audience, misunderstanding, ridiculed. I would bring to their attention that the rules of transportation cannot be changed between games or even between seasons, for transportation never ceases; they must be altered during its progress if at all; that instead of an audience, united on the rules, transportation must be conducted in as many ways as there are states in the Union and that even every city and village undertakes to formulate the transportation rules. Shall I say of the patrons that in approaching transportation's ticket window, the price of an amateur performance is reluctantly produced, but once inside the grounds, a scientific taste speedily develops?

To the players on the transportation team I would remind them that railroads were not constructed just to give men jobs; that it is well to keep in sympathy with those who pay the bills; that while the patrons may have sometimes cheered the wrong man on the team and hooted down the one who really deserved a little praise, they are becoming posted on the rules, and are encouraging these who do real live transportation team work.

We have not always changed the rules which we made for our own guidance even when it was found that transportation would thereby be improved. We perhaps thought we were too busy, and when our patrons ridiculed for the stupid results we talked back and said "What is it to you?" "This is my business." Our audience stood a good deal in the days now passed, but finally left their seats, swarmed into the field, and if what they did was a trifle rough, perhaps we deserved it after all. If we still remember that our patrons hinder and sometimes almost block the game by retaining the instruments of transportation which have been surrendered to them for loading and unloading, let us not forget that we in turn make a play equally unscientific, if by any of our rules we delay the tonnage that has been entrusted to us for transportation; that if we fail in our team work, we place a stigma on our game. Let us rather remember that our audience is becoming quick to note efforts put forth in its behalf, and is sure to admire the strength which the transportation team can exert by a steady and united pull. Already the patrons are nudging one another and whispering that we can "play ball" after all. If we keep practicing, it won't be very long until we can present a really scientific game. We fumble yet, and our team is so big and the interests of its members are so divergent (at least, we sometimes think they are) that we often lose the advantage of team work. We exert ourselves enough, but the exertion is not always in unison. Instead of complaining that our audience wants the game played its way, let us congratulate ourselves that in performing a public service we are allowed to shape our own policy as much as is now the case, and spend our energy in perfecting the rules of transportation and our skill in carrying them out. Let us encourage right relations all along the line, making sacrifices when they will advance the general standing, remembering that we are engaged not in a pastime, but in the world's work, and that every day history is made; that the welfare of a nation and of all its people depends on transportation.

The transportation team may have differences on many subjects, but however that may be, we must all agree that great improvement in transportation is possible, and if we would command the price must we not learn to play the game? This positively cannot be accomplished without team work; therefore whether we pitch or catch or are placed out in the field, let us always keep our eye upon the ball.

You who are members of this association, and are today in attendance at this its tenth annual meeting, can perform a part in the improvement of transportation and can do that part a little better than anybody else. You give working effect to some of the very important rules of transportation: indeed, you have a voice in shaping them. As you are called upon a little more year by year to help in making the machinery of transportation run smoothly and produce a perfect product. I am sure it will be discovered that you have become not only experts in your line but are preparing yourselves for whatever advancement time may bring, and that the science of transportation will be advanced by reason of your influence in it.

Railway Mechanical Patents Issued During September

Dumping car, 931,720—Anton Becker, Columbus, O.

Interior arrangement for smoke boxes of tubular boilers, 931,727—Frederich W. Born, Charlottenburg, Germany.

Car roof, 931,736—Emory V. Donelson, Baltimore, Md.

Grain car door, 931,739—Clark S. Eaton, Ott, N. D.

Automatic brake-applying mechanism, 931,798—Franklin A. Pierce, Wheeling, W. Va.

Car coupling device, 931,927—John W. Howard and William W. Howard, Westernport, Md.

Dumping car, 931,333—Thomas Lawson, New York.

Triple valve for air brakes, 931,942—William B. Mann, Baltimore, Md.

Friction draft rigging, 931,955—Charles J. Nash, Chicago, Ill.

Snow plow, 932,154—Jean B. Martin, St. Polycarpe, Quebec, Canada.

Seal for car doors, shipping receptacles, etc., 932,159—John J. A. Miller, Denver, Colo.

Combined spring and friction draft-gear, 932,215—Willis De Groff Wilcox, Chicago, Ill.

Grain car door, 932,335—Peter J. A. Schnoor, Holstein, Iowa.

Mail bag deliverer, 932,337—Obadiah J. Seymour, New York, N. Y.

Car seal, 932,351—William H. Sullivan, Denver, Colo.

Car sheathing, 932,367—Lowell C. Bassford, Chicago, Ill.

Dust guard for journal boxes, 932,484—George L. Mansfield, Chicago, Ill.

Folding turn-table for hand car, 932,496—Alexander Reitz, Bond, Md.

Car dumping apparatus, 932,529—Charles H. Wright and Harry E. Scott, Cleveland, Ohio.

Locomotive ash pan cleaner, 932,553—Takao Iwanami, Washington, D. C.

Dump car, 932,564—Thomas R. McKnight, Chicago, Ill.

Railway car side bearing and center bearing testing machine, 932,567—John F. O'Connor, Chicago, Ill.

Car wheel, 932,605—Robert J. Gardiner, Pittsburg, Pa.

Lock for freight car doors, 932,658—Leland Wadsworth, Troy, N. Y.

Car construction, 932,728—John E. Tesseyman, Columbus, Ohio.

Car ventilating system, 932,761—Dwight I. Cooke, Chicago, Ill.

Jacking apparatus for railway cars, 932,811—Carl Ruegg, New York, N. Y.

Car-door operator, 932,836—Ferdinand F. Unckrich and Charles L. Seeley, Galion, Ohio.

Rerailer, 932,985—Grant C. Headley, Hastings, Colo.

Car brake mechanism, 932,994—Cornelius M. McCarthy, Jersey City, N. J.

Car underframe, 932,005—John E. Tesseyman, Columbus, Ohio.

Bolster for hopper cars, 933,014—Anton Becker, Columbus, Ohio.

Friction draft and buffing mechanism, 933,046—Halfdan Asper, Butler, Pa.

Drawbar safety device, 933,078—Dixon G. Kitzmiller, Harrisburg, Pa.

Metal wheel, 933,102—Albert E. Noble, Anniston, Ala.

Draft and buffing gearing for railway cars, 933,201—Emanuel L. Philipp, Milwaukee, Wis.

Buffer for railroad cars, 933,204—Peter Recconi, San Francisco, Cal.

Car truck, 933,223—John C. Barber, Chicago, Ill.

Freight car and heating appliance, 933,241—Wm. E. Eastman, Boston, Mass.

Convertible car, 933,268—Myron Rounds, Boston, Mass.

Scale car, 933,452—Frank K. Hoover and Arthur J. Mason, Chicago, Ill.

Connecting hose for railway cars, 933,516—Emil Witzenmann, Pforzheim, Germany.

Device for preventing hold-ups on locomotives, 933,565—Charles J. Johnson, Denver, Colo.

Combined door and step operating means for railway cars, 933,574—Michael O'Brien, St. Louis, Mo.

Car truck, 933,579—Henry F. Pope, Cleveland, O.

Nut lock, 933,595—Charles Starzman, Pittsburg, Pa.

Frictional draft rigging, 933,601—Clinton A. Tower, Cleveland, Ohio.

Car coupling, 933,602—Clinton A. Tower, Cleveland, Ohio.

Wrecking car, 933,631—James W. Dasher, Glennville, Ga.

Fastening for freight train doors, 933,632—Michael C. Devine, Sedalia, Mo.

Turntable turner, 933,637—Richard R. Farrell, Sausalito, Cal.

Car body, 933,903—James M. Hopkins, Chicago, Ill.

Coupling, 933,924—George Sarrazin and Hector Perreault, South Holyoke, Mass.

System of washing and filling locomotive boilers, 933,937—William White, Chicago, Ill.

Car coupling, 933,941—William L. Wright, Newport News, Va.

Car coupling, 933,959—Robert B. Chalmers, Springfield, Mo.

Track sander for locomotives, 933,972—James E. Ganson, Columbus, O.

Reversible car axle coupling, 934,003—Melkon Markarian, Fresno, Cal.

Fluid-pressure brake system, 934,019—William H. Sauvage, New York, N. Y.

Car seat, 934,121—Hubert Witte, St. Louis, Mo.

Fluid pressure switching device, 934,138—Robert V. Cheatham, St. Mathews, Ky.

Passenger car, 934,142—Samuel M. Curwen, Haverford, and Warren M. Smith, Moores, Pa.

Locomotive boiler furnace, 934,157—Frederick F. Gaines, Savannah, Ga.

Dumping car, 934,267 and 934,268—Anton Becker, Columbus, Ohio.

Drop door operating mechanism for hopper bottom cars, 934,269—Anton Becker, Columbus, Ohio.

Drop bottom dump car, 934,279—Harry C. Brunker, Middleport, Ohio.

Supplemental air brake mechanism, 934,293—Arthur Doan, Oakland, Cal.

Drop door fastening for cars, 934,299—Peter Furgeson and Edwin L. Wheland, Youngstown, O.

Passenger car, 934,350—Charles K. Pickles, St. Louis, Mo.

Log and lumber car, 934,362—Milo M. Russell, Eau Claire, Wis.

Underframe for cars, 934,382 and 934,383—Anton Becker, Columbus, O.

Car, 934,398—George G. Fryer, Syracuse, N. Y.

Canary yellow has been adopted as the standard color for the coaches, refrigerator cars and all other cars used in the passenger service on the Panama R. R. Tests to ascertain the color best suited to withstand the local climatic conditions, which are usually hard on exterior paints, have been made with the result that yellow has demonstrated a superior lasting quality over the other colors tried.

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CONTENTS.

The Pennsylvania Tunnel & Terminal Company, operating the Pennsylvania railroad tunnels under New York City and the rivers, is installing in its Long Island City power house two Westinghouse turbine-alternator sets of 2,500 kw. capacity each, for lighting the tunnels and terminals. The dependability required in this service has demanded that every precaution be taken to insure absolute continuity of operation of the generating and distributing systems. The alternators will supply three-phase, 60-cycle current at 440 volts.

PREPARING MOTIVE POWER EQUIPMENT FOR WINTER SERVICE.

So many engine failures during the severe winter months can be attributed directly to lack of foresight in preparing motive power equipment for storm service that it would seem good policy to spend some time and thought on the subject during the fall. It is a notable fact that the engine failures referred to do not occur so frequently where conditions with respect to severe cold and storms, are naturally the worst. Northern and mountain railroads are usually properly prepared to cope with these conditions. The most serious of train delays caused by engine failures, snow-blocked tracks, etc., are frequently, reported on railroads in the middle west operating stretches of line through prairies and comparatively level country. Several winters in succession may pass with only one or two blizzards, and then a season of such severity follows that the road finds itself entirely unable to make its schedules. As stated, many of these delays can be avoided, even without better snow fighting equipment by properly preparing the locomotives for this class of service.

It is hardly necessary to say more than enough to call attention to the subject. Mechanical officials all have ideas which would avoid delays if only put into effect early enough in the season. A frequent source of trouble in cold weather is the hot box. It occurs most often, in snow bucking, in the engine truck journals. It is a cold weather complaint for the reason that the lubricants do not perform their intended duty at such times. A suggested remedy for this evil is a steam jet permanently piped to each journal. Frozen links and blocks could be cured in the same manner. Injecters should be connected in such a manner as to allow of blowing a small amount of steam back into the tank through the suctions, while the injectors are not in operation. The writer has seen trains delayed on account of large quantities of heavy wet snow blown across half empty tenders in such a way as to prevent its separation from the coal, resulting in killing the fire. A heavy canvas buttoned across the top of the tender would prevent this difficulty. Pilot plows and sheet steel wind guards under the boiler heads represent only slight expenditures, and render good service, not only in snow bucking, but in protecting the machinery between the frames from strong snow-laden head winds. There is some satisfaction left the engine men when the train stalls, while bucking a deep drifted cut, with everything about the engine working as it should, but there is small satisfaction to anybody in a series of delays resulting from minor discrepencies in equipment.

STUDY UP ON ELECTRIFICATION PROBLEMS.

The recent developments in railroad electrification have caused more or less uneasiness among the mechanical men of the old school. Many of these men are looking forward with apprehension to the incorporation of electrical zones of operation, believing that it will narrow their individual fields. Perhaps this apprehension is well founded, but whether so or not it is something of a blessing insofar as it will cause the mechanical men to "buck up" on things electrical There is no question but that on many miles of railroad now operated by steam, the electric locomotive will soon be hauling the trains. Conditions in some parts of the country are so manifestly favorable to electrical operation that it can be only a short time before long stretches of track, including division after division, will be equipped for the electric locomotive. It is not necessary to elaborate on the subject of what these conditions are. It suffices merely to call attention to the water power now being developed in the mountains of the East and West, and the lignite deposits of the northwest and southwest, leaving each to do his own reasoning as to how and when they will be used by the railroads, for used eventually they must be. Logical reasoning points only to high voltage generation of electricity at the points of natural supply, the length of the electric zones depending upon practicable transmission.

Unless, then, the master mechanic and his subordinates wish to have their range of usefulness limited in the future, they must be prepared to handle questions of electrical operation as readily as they now deal with problems arising in the operation of steam locomotives. The study necessary to gain this end is not so great as to be discouraging. The knowledge must, however, be gained without much practical experience, which has been of such advantage in the past. The man who has abvanced to the position of a mechanical official solely by benefit of knowledge gained through practical machine shop and road experience, and who has done little or no reading of technical periodicals and books will have a hard row to hoe unless he is willing to admit the value of this last mentioned method of education, and profit thereby.

EMERGENCY TREATMENT FOR INJURED.

In large shops employing hundreds and thousands of men it is inevitable that there shall be numerous injuries of a more or less serious nature. A great many of these injuries, such as particles in the eye, are not serious of course. But for the more serious injuries, many shops do not contain adequate provision for giving emergency treatment. If a man has his arm crushed, he has to wait fifteen of twenty minutes for an ambulance, and in the meanwhile he is attended by some man about the plant who has been delegated to take charge of the medicine box. And there are instances where the loss of life could have been prevented, had there been present the proper facilities for emergency treatment and a man with a knowledge of medicine.

Some railroad shops have equipped small rooms with the necessary material and apparatus for such treatment and have men at hand competent to handle cases. Where such a plan has been tried, the benefits derived have been found to more than compensate for the expense. It may be possible in some cases to have a doctor who can be partly in the company's employ and still devote some time to outside work. The plan employed in one large shop would seem to be best however; that of having a man with a few years' experience in medicine who will be in constant attendance and who can do some office work at odd times. For the minor injuries the men feel free to use the hospital, and often a man who otherwise would have gone home for the rest of the day, will be kept at work. A man with a particle in the eye, or a bad sliver in the hand, can step in and have it carefully and quickly removed, where otherwise he would have asked the assistance of a fellow employee, resulting in a loss of time to the company and also a chance of infection.

A plan which, so far as the writer knows, has never been tried out, but which seems feasible, is to equip an old coach as a hospital, placing it in a special siding near the shops. One end of the car could be fitted up as a doctor's office, and connections could be arranged for the shop water, lighting and steam heating systems. In case of a serious wreck, this car could be coupled to the relief train and hauled to the scene of the disaster where it should be of good service in saving the lives of the seriously injured. It might even be a paying proposition to haul the hospital car with the wrecking outfit when this train is made up at the shops, as it is at many terminals. The connections for water, steam, etc. at the shop side track should be of such a nature as to allow of quick uncoupling and the car should be kept in condition for road service. Notwithstanding the fact that the principal value of the hospital would be in its shop service, still it should give a good account of itself in wreck service.

A SUGGESTION.

The selection of the meeting place for the great mechanical conventions for June, 1910, will be made this month and it is assumed the locality offering the greatest advantages for the greatest number will be selected. Of equal importance, however, is the selection of the secretary of the Supply Men's Association. The man for this position should be chosen solely for his fitness for the office. His character and record should be such that his motives cannot be justly impugned. The use of this office for personal gain or for the display of petty spite for real or fancied wrongs should not be tolerated. This paper has no favors to ask. It has no candidate to put forth. It intends to pay its share of expenses in maintaining the organization, but it does want to see fair play and an honest and tactful administration of the office. We believe that we but voice the sentiments of every right-thinking man in demanding "a square deal for all" and the selection of a secretary who will meet the requirements. It is to be regretted that the retiring secretary, Mr. Earl G. F. Smith, whose splendid work contributed so largely to the success of the conventions, could not have been induced to remain in the office.

A rust-preventing coating for iron, used by a German manufacturing company, consists in coating iron and steelware first with lead, then electrolytically with zinc, and finally heating this coating, so as to obtain an alloy of the two metals which has the same potential as zinc.

I do not hesitate, therefore, to denounce the whole scheme of the Pennsylvania road as utterly stupid and unbusinesslike. If a person manufacturing something to sell on the market conducted his business in that way he would find himself bankrupt in no time.—R. T. Crane on the Pennsylvania Special Apprenticeship System..

Locomotive and Car Repair Shops, New Orleans Great Northern R. R., at Bogalusa, La.

The accompanying photographic reproductions and drawings illustrate, in an unusually comprehensive manner, one of the neatest of the smaller class of railroad repair shops of modern times.

The New Orleans Great Northern R. R. is a new Southern railroad, the main line of which extends from Jackson, Miss. to the city of New Orleans, La. The road passes through an extensive undeveloped section of pine forests in these states commonly known as the "Ozone Belt." The present operating mileage is about 273, including the branch lines over which passenger and freight service is being maintained. The rapid growth of the traffic developed immediately demanded adequate provision being made for proper maintenance of rolling stock. Mr. C. W. Goodyear, Buffalo, N. Y., president; Mr. A. C. Goodyear, Buffalo, N. Y., third vice-president; Mr. N. C. Pearsall, Bogalusa, La., general manager, and Mr. J. F. Coleman, New Orleans, La., chief engineer, were the officials of the railroad company directly interested in the development of shop facilities and who passed upon the plans and had general supervision over the construction work. Mr. H. W. Burkheimer has recently been appointed master mechanic and now has charge of the shops and equipment.

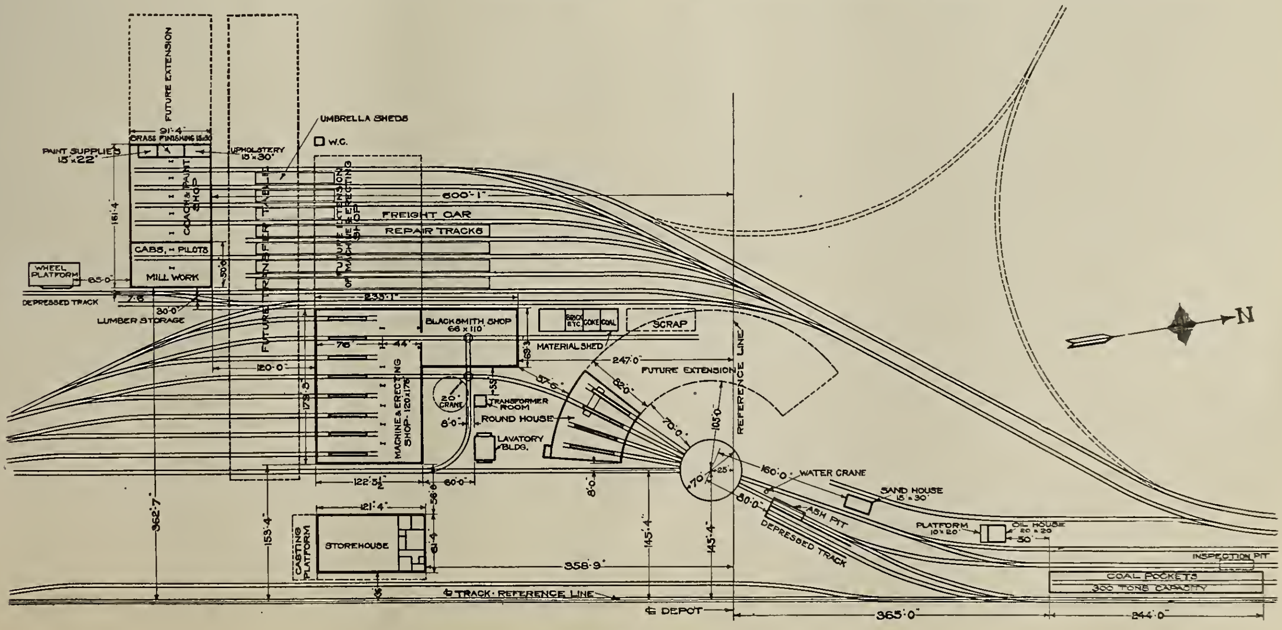
In February, 1907, The Arnold Company was requested to make a study of the conditions and requirements pertaining to locomotive, freight and passenger car repair shops. They were later retained as engineers to prepare plans and specifications for the buildings and equipment, and shortly after as constructors of the complete plant ready for service. Actual surveys and construction work on the shop buildings was begun in August, 1907, and actively progressed until December, 1907, when operations were suspended on account of the general depression in railroad business caused by the financial stringency throughout the country.

With the return of activity in the traffic department of the railroad the completion of the shops became necessary in order to meet the demands of increasing business and The Arnold Company was therefore instructed to resume work and push to as prompt completion of the shops as possible. The work was taken up in January and completed in June, 1909, the railroad company's respective departments occupying their new quarters during the same month.

View of the Bogalusa Shops, N. O. G. N. R. R.

The site chosen for the location of the shops at Bogalusa on the main line of the road, 70 miles north of Now Orleans, was deemed particularly suitable for the following reasons:

1. Its nearness to the center of gravity of the system.
2. The prospective development of the new city promising to attract a class of skilled and common labor well suited to the requirements of railroad work.
3. The available area of level ground adjacent to the main line, affording an ideal space for shop track system, with ample provision for future extension of each department.
4. The convenience and economy of purchasing electric power



General Layout of Bogalusa Shops, N. O. G. N. R. R.

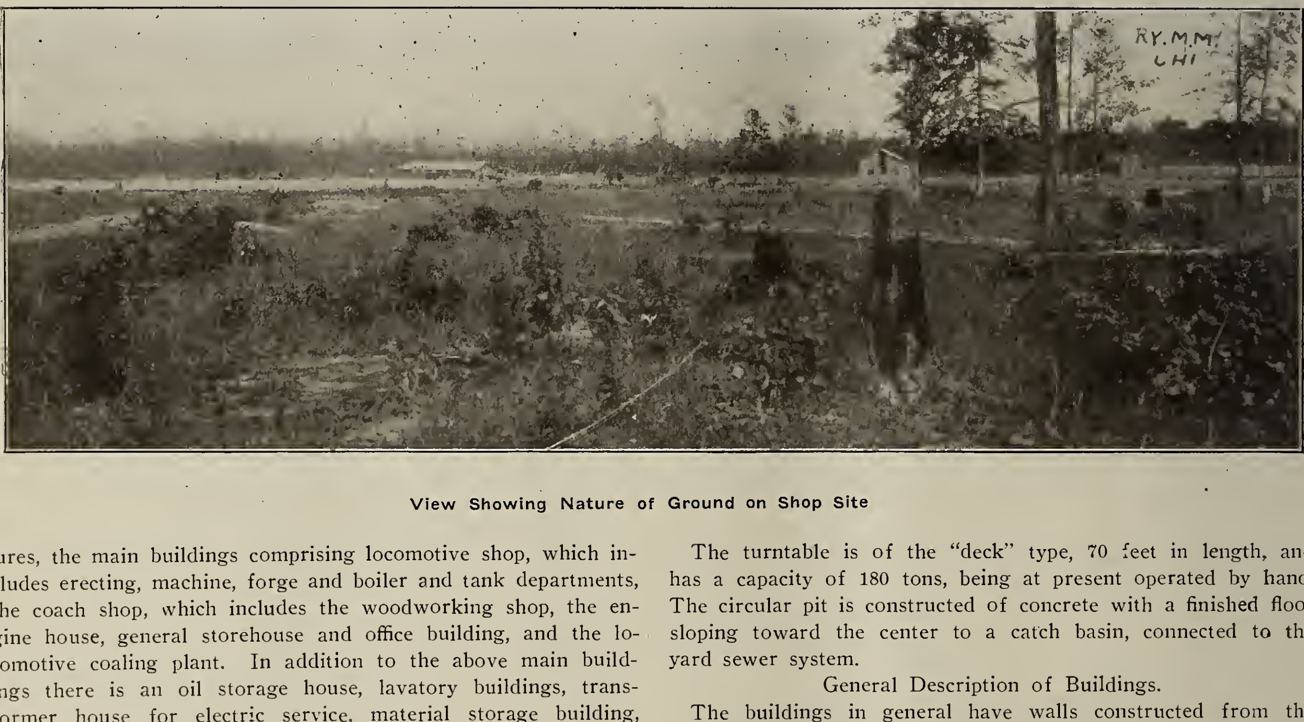
for the plant from the large plant of the Great Southern Lumber Co., adjacent to the shop site, thus saving the railroad company the expense of building and maintaining a plant of their own.

5. An abundant supply of pure artesian flowing well water and excellent natural drainage.

6. A healthful spot for the employes, due to its elevation and proximity to the forests.

The locomotive and car repair departments are designed not only to accommodate the locomotive passenger and freight car equipment of the New Orleans Great Northern R. R., but provision is made for repairing and maintaining a portion of the special logging machinery of The Great Southern Lumber Co., comprising locomotives, steam log rollers, steam skidding machines and cars. The plant is designed with present facilities for handling 50 locomotives of American standard type; 20 geared locomotives; 10 steam log loading and skidding machines, and 5 Barnhardt steam log loaders. In addition to the above there are provided repair facilities for taking care of approximately 3,000 freight and logging cars and 30 passengers cars.

For the accommodation of the several shop departments there are provided five main buildings and seven auxiliary structory intended for other uses. The locomotives and coach shops are at present approached by means of a system of ladder tracks, the plan being to remove these tracks whenever the shops are extended, and install a transfer table running between the two buildings. This table will serve for the transfer of material as well as for entrance purposes of engines and cars. The freight car repair shops are located north of the coach shop, convenient to the woodworking shop and lumber storage piles, and also well situated with reference to the forge and locomotive shops. A standard gauge track passes through the woodworking shop and runs parallel with the freight car repair tracks, which serves as an industrial track for transporting timber from the mill to the repair yard. A standard gauge industrial track is provided through the locomotive and forge shop, passing the material sheds and scrap storage yard, which greatly facilitates the handling of material between these departments. A track directly through the machine shop and engine house passes over the driving wheel drop pit and renders it possible to roll removed drivers directly from the pit into the machine shop, where they can be taken with an electric Telpher hoist from this track direct to the driving wheel lathe. A Y track is provided in the north end of the yard for turning coaches and cars which are too long to be turned on the turntable.



View Showing Nature of Ground on Shop Site

tures, the main buildings comprising locomotive shop, which includes erecting, machine, forge and boiler and tank departments, the coach shop, which includes the woodworking shop, the engine house, general storehouse and office building, and the locomotive coaling plant. In addition to the above main buildings there is an oil storage house, lavatory buildings, transformer house for electric service, material storage building, cinder and ash pit and depressed car wheel handling pit. By referring to the block plan, it will be noted that the layout is designed to provide for the necessary terminal facilities as well as those for general repairs.

The shops are located directly opposite the passenger station, which renders convenient the local inspection of through passenger equipment while such trains are stopping at the depot. The north end of the property is devoted to terminal purposes, locomotives coming onto the turntable pass directly over the cinder pit and leave the roundhouse by way of the water crane, sand house, oil house and coal pockets. The coal pockets are arranged with two aprons on each side, permitting locomotives to be coaled either on the main line or from the siding.

Shop Track System.

The yards and buildings are served with a convenient system of standard guage tracks, and each department is laid out to permit of 100 per cent extension without encroaching on terri-

The turntable is of the "deck" type, 70 feet in length, and has a capacity of 180 tons, being at present operated by hand. The circular pit is constructed of concrete with a finished floor sloping toward the center to a catch basin, connected to the yard sewer system.

General Description of Buildings.

The buildings in general have walls constructed from the foundation up of reinforced concrete, made from washed creek gravel. An abundant supply of gravel and sand extremely adaptable to concrete construction, was obtained from Bogue Luse creek, immediately adjacent to the building site. The gravel and sand, being clean and white, give a pleasing color to the concrete, the buildings presenting a very attractive appearance. All walls are carefully reinforced with steel bars, the walls in general being eight inches thick. The window and door frames were placed in the concrete forms and the walls cast around them, thus insuring a good anchorage and neat joints. An impression made upon the observer is the solidity and durability of the construction, which is semi-fireproof throughout. The substantial construction of the buildings and the ample provision for expansion, which is apparent in the layout, is indicative of the faith of the railroad company in the future growth, development and extension of the business, and of their foresight in outlining these details.

Locomotive Shop.

The locomotive shop is 176 feet long by 120 feet wide, with a wing at the west end of 66 feet by 110 feet, which is occupied by the forge shop. It is of the transverse type; the erecting bay is 75 feet wide, 37 feet clear under roof truss, and has eight concrete engine pits on 22-foot centers. The machine bay is 44 feet in width and extends the entire length of the building, adjacent to the erecting bay. The building superstructure is of reinforced concrete and steel construction and has a corrugated muck bar iron roof. The floor is of 3-inch yellow pine laid on 4x6 sleepers embedded in sand. The steel columns are designed to support a future 100-ton crane runway, with traveling crane over the erecting bay. For the present needs a 5-ton traveling hoist on bracket runway is provided on the north side of the bay.

Particular attention was given to the natural lighting of the building, and, in addition, to the side windows and transoms over the track doors. More than one-third the area of the doors is glass. The erecting bay has a wide monitor with windows on each side over its entire length, and the machine bay is lighted by three sawtooth skylights, which extend the length of the building, excepting the last bent on each end, and which furnish excellent north light for the operation of the machine tools.

On account of the heat and humidity of the climate, the windows are designed to provide for all possible ventilation and are equipped with mechanical operators. The majority of the side windows are hinged at the top, and arranged to swing outward by means of vertical gang operators, giving an opening of about 30 per cent of the window area.

The monitor windows of both the erecting and forge shop are also arranged to open, the sash sliding past each other and giving an opening of about 50 per cent of the window area. These windows are moved by a steel cable controlled by a geared operating device. As a still further means of ventilation over the machine bay the sawtooth monitors are provided with circular metal ventilators distributed throughout their length.

The tool room, 21 feet square, is in the wing occupied by the forge shop, and is separated from the forge shop by an eight-inch concrete wall, and connected with the machine shop by a double door and two windows fitted with diamond wire mesh panels.

The forge shop has concrete walls, steel columns and roof trusses and a corrugated iron roof; also a six-inch floor of tamped screened cinders, and is separated from the machine shop by an eight-inch concrete fire wall, having an automatic fire door.

Coach Shop.

The coach shop, 161 feet long by 91 feet wide, is of reinforced concrete construction, having wood roof framing covered with corrugated iron. As in the other buildings all possible natural lighting and ventilation are provided, the windows being operated in a manner similar to those in the locomotive shop.

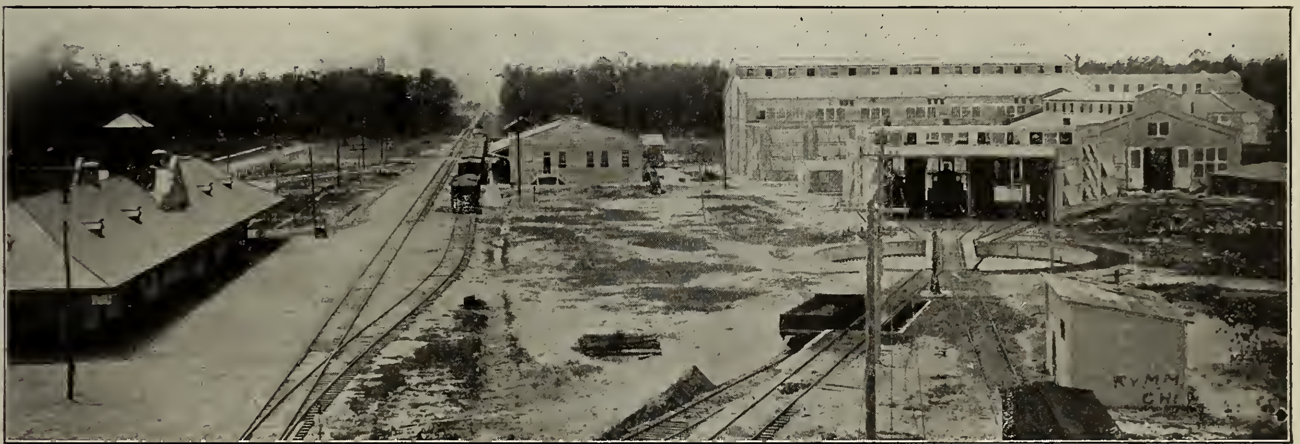
Track doors on both sides of the building provide for additional ventilation and render it possible to use all tracks as through tracks at some future date if desired. The section devoted to woodworking machinery is 50 feet wide by 91 feet long and is separated from the coach department by an eight-inch concrete fire wall and two double automatic fire doors. A full complement of woodworking tools are arranged on either side of the track leading to the freight car repair yards.

In the west 20 feet of the building are located the brass finishing, upholstering, paint storage and bench workrooms, separated from the main section of the building by an eight-inch fire wall and from each other by eight-inch walls 12 feet high. Each room has an outside door and a double automatic fire door leading into the coach room.

The main central portion of the building, 90 feet long by 90 feet wide, is used for coach repairs and painting, and is provided with four tracks on 20-foot centers. The floor in this building is of three-inch yellow pine laid on 4x6-inch sleepers embedded in sand.

The engine house is provided with four stalls and concrete engine pits, two of which are connected by a driving wheel drop pit, in which wheels are handled by means of a traveling pneumatic jack of the telescoping type. The building is of reinforced concrete construction, uniform with the shop buildings, and has wood roof framing and a tar and gravel composition roof. The sheathing is two-inch matched yellow pine and the purlins and framing are sufficiently heavy to provide a "slow-burning" type of construction. The smoke jacks are vitribestos, of ample dimensions, and are suspended from the purlins by means of heavy iron rods well painted with asphaltum paint. The usual track doors on the inner circle of the building are omitted, a three-foot wide canopy affording necessary protection from the weather. The floor is of three-inch yellow pine to the end of the engine pits, to which point the tamped cinder fill between the turntable and the engine house extends.

The ventilation and lighting of the house is well provided for in a wide central monitor, both exposures of which are arranged to be thrown open, and in large areas of rear and side wall windows, with all hinged sash operated mechanically; thus



Station and Roundhouse, Bogulusa

Lavatories, Bogalusa Shops

practically every foot of window and door area, under ordinary circumstances, aids in insuring free circulation of outside air throughout the building. An annex 12x16 feet is provided for the foreman's office in a convenient location.

Store House and Offices.

The storehouse and office building, 121 feet 4 inches long by 61 feet 4 inches wide, is of reinforced concrete and "slow burning" wood construction, with a corrugated iron roof. The north 30 feet of this building is divided into suitable rooms designed for the offices of master mechanic, clerks and storekeeper, and store rooms for stationery and supplies. The remainder of the building is used for the storage and handling of general supplies required in the operation and maintenance of the road. Storage bins, shelves and material racks are provided for this purpose. The store house floor is four feet above rails of serving track for convenience in loading and unloading cars. The floor, consisting of three-inch plank secured to 6x6-inch stringers embedded in cinders, rests on an earth fill within the foundation walls. A wooden platform, supported on concrete piers, extends the full length of the building on the east side, parallel to the side track, and has an incline or ramp to grade at each end for the purpose of trucking heavy material. A canopy over this platform affords protection from the weather for the men loading and unloading cars.

Coaling Plant.

The coaling plant is a wood structure with steel lined bunkers, having a storage capacity of 300 tons. Standard coal dump cars are pulled up a trestle, having a 20% grade, on to a track 36 feet above the main line, directly over the bunkers, by means of an electrically operated hoist, power being supplied by a 40 horse power induction motor. This hoist is of sufficient capacity to pull a loaded coal car weighing 150,000 lbs. up the 20%

Exterior of Erecting Shop

grade at a speed of 30 feet per minute. The bunkers are equipped with four steel aprons and gates, two on a side, permitting coal to be loaded by gravity directly into the locomotive tenders on either side. A wood canopy covers the bunkers and hoisting machinery, the latter being housed on three sides to give protection to the hoisting machinery.

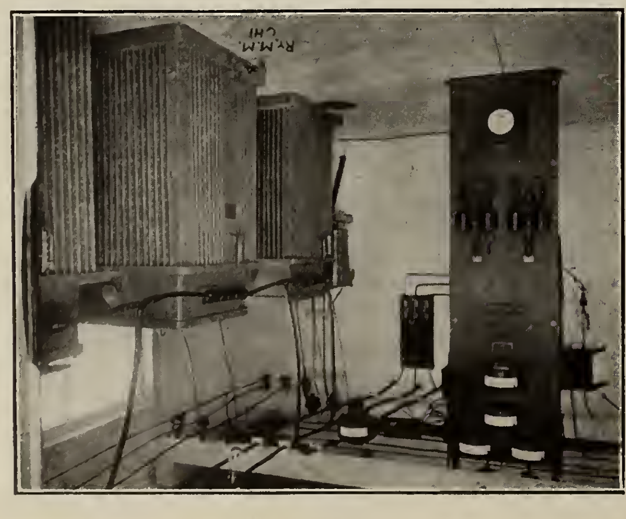
Auxiliary Building.

The oil house is located adjacent to the track used for outgoing locomotives and is 20 feet square, being built of corrugated iron on a wood frame work. The oil storage tanks are of reinforced concrete lined with sheet metal, the top of the tanks forming the floor of the delivery and waste storage room. The five tanks have a total capacity of 23,000 gallons, and each is provided with a rotary hand pump and galvanized iron sink. The tanks are filled through manholes in the concrete tops.

The sand house is a frame structure, 15 feet by 30 feet, sheathed with drop siding and covered with a composition roof. Wet and dry sand storage bins are provided, and also elevated platform and door, from which a man can step directly onto the running board of an engine.

The employes' lavatory, 24 feet by 32 feet, is a corrugated iron building located between the locomotive shop and the engine house, convenient to all departments. The lavatory building has a concrete floor sloping to a bell trap near the center of the room to permit flushing with a hose. The room is equipped with 100 perforated sheet steel clothes lockers; a 20 ft. automatic range closet; a 20 ft. porcelain enameled iron wash sink, and two 4 ft. enameled urinals.

The transformer house, 16 feet square inside by 9 feet high, is fireproof, having reinforced concrete walls, steel channel purlins and a corrugated iron roof. The concrete floor is raised 12 inches above grade to avoid dampness and is laid on a cinder



Transformer Room

H. W. Burkheimer, Master Mechanic, Bogalusa Shops

Coaling Station, Bogalusa Shops

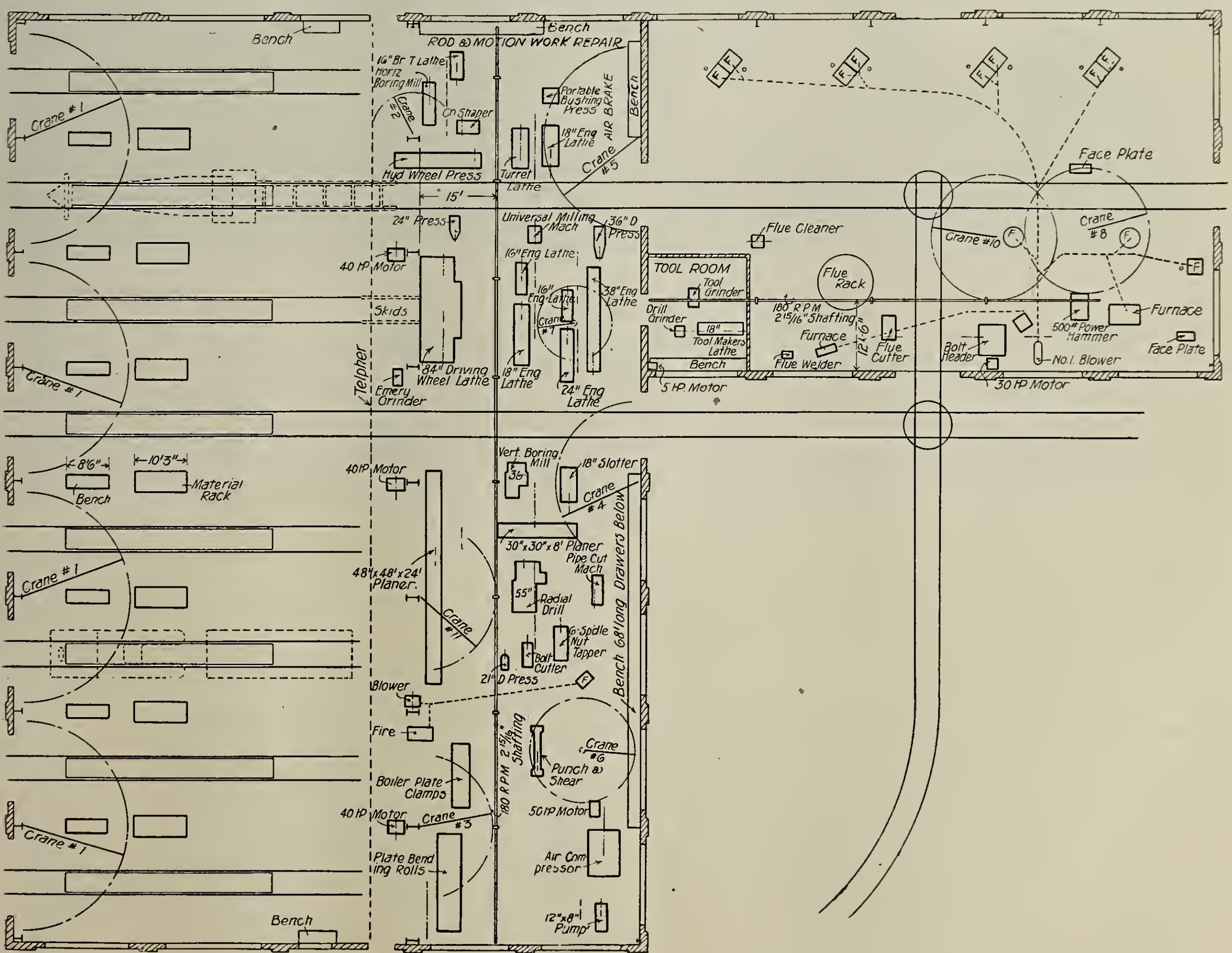
substructure. A wood frame work of seasoned yellow pine is set in the building walls for supporting the wires and cables.

Machine Tool Equipment.

The machine tool equipment is ample to meet all present requirements, as well as to provide for some future increase of business, the layout being so designed that work shall pass through the shops with a minimum of handling.

The machine and boiler shop tools are divided into three groups, each group being driven by a 40 horse power induction motor mounted on a steel bracket, supported by a building column. The main line shaft is so arranged that any motor may be out of service and yet the important tools may be operated by coupling its section of the main line shaft to adjacent sections driven by the other motors. The west group includes the lathes, driving wheel press, shaper, milling machine and drill presses. The middle group includes the planers, boring mill, slotter, grinders, etc., and the east group comprises boiler and tank shop machinery, including pressure pump for the water system.

The toolmaker's lathe and grinding machinery in the tool room are driven by a 5 horse power motor mounted on wall bracket, and, in case of necessity, the tool room lineshafting



Layout of Machinery in Erecting Shop

can be coupled to that in the forge shop and these tools driven by a forge shop motor. Jib cranes are liberally provided for use in stripping and assembling locomotives undergoing repairs. The heavier machine tools are likewise served by similar cranes, ranging in capacity from one to four tons. These cranes were furnished by the Whiting Foundry Equipment Co., each being fitted with a Yale & Towne chain hoist. Running lengthwise of the erecting bay and near the machine boy is located the floor-controlled electric traveling hoist of 5 tons capacity, equipped with three phase induction motors operating at 460 volts. This hoist handles principally the driving wheel work between the various pits and the wheel lathe, but, in addition, it serves for general transportation of heavy material.

In the southeast corner of the woodworking shop is located the tools required for car wheel work, such as hydraulic wheel press, double head axle lathe and car wheel borer, the wheel presses being directly opposite the wheel storage platform located just outside of the building. A depressed wheel pit for loading and unloading mounted wheels is located adjacent to the wheel platform.

One 24 in. Acme crank shaper.
One No. 2 LeBlond universal milling machine.
One 30 in. x 30 in. x 8 ft. planer.
One 48 in. x 48 in. x 24 ft. Pond three-head planer.
One 36 in. Aurora drill press.
One 24 in. Aurora drill press.
One 5 ft. Niles semi-universal radial drill.
One 20 in. "D" standard dry grinder.
One 84 in. Niles hydraulic wheel press.
One 18 in. Bement slotter.
One 23½ in. x 32 in. Bement No. 0 horizontal boring mill.
One 16 in. x 5 in. Universal turret lathe.
One 35-ton W. & S. portable hydraulic rod bushing press.
One 2 in. bolt cutter.
One 2 in. Acme 6-spindle nut tapper.
One 2 in. drill press.
One 225 cu. ft. Ingersoll-Rand Imperial type 10, power-driven air compressor.
One 8 in. x 10 in. Dean triplex power pump, 225 gallons at 100 lbs. pressure.

Locomotive Erecting Shop

The woodworking machinery is divided into two independent groups, each operated by a 40 horse power induction motor mounted on overhead platform. The shafting in this building is supported by 4 in. by 12 in. latticed wood struts fastened to the bottom chord of the roof trusses, and at the ends set into the concrete end and partition walls.

The forge shop tools consist of power hammer, bolt header and flue machinery, together with forge blower, driven by a 30 horse power induction motor mounted on a steel and concrete bracket. In addition to 11 forges, the blower furnishes heat for furnaces used with hammer, bolt header and flues. All blast ducts are laid underground in salt glazed sewer tile. Power hammer, furnaces and forges are served by two Whiting 4-ton post cranes conveniently located.

The following is a list of the principal tools installed in the various departments. The arrangement of the tools and equipment is shown in the machinery layout plans herewith.

Machine Shop.

One 84 in. Niles double driving wheel lathe.
One 38 in. x 16 ft. engine lathe.
One 24 in. x 16 ft. LeBlond engine lathe.
One 18 in. x 10 ft. LeBlond engine lathe.
One 18 in. x 10 ft. LeBlond engine lathe.
Two 16 in. x 8 ft. LeBlond engine lathes.
One 2 in. x 26 in. Pratt & Whitney turret lathe.
One 42 in. Niles vertical boring and turning mill.
One 48 in. x 6 in. Pond grindstone.
One 3¼ in. x 8 in. Underwood portable cylinder boring bar.
One 26 in. Underwood portable valve seating rotary planer.
One 12 in. Birdsboro-Jackson spiral belt lacing machine.

Boiler and Tank Shop.

One No. 2 Long & Allstater double punch and shear.
One No. 5 (¾x10 ft.) Niles plate bending rolls.
One 10 ft. Niles plate flanging clamp.
One 4 in. Cox pipe threading and cutting-off machine.
One blower (moved from Florinville).

Flue Shop.

One Otto flue cleaner.
One McGrath pneumatic flue welder and scarfer.
One 14 in. x 5 in. Gantt "B" coke furnace for flue welding.
One vertical revolving, ball bearing flue rack.
One No. 6 Fox flue cutter.

Forge Shop.

One 2 in. Acme bolt heading and forging machine.
One 24 in. x 5 in. Gantt "C" coke furnace for bolt header.
One No. 12, 500 lb. Beaudry power hammer.
One 30 in. x 7½ Gantt "D" coke furnace for Beaudry hammer.
One No. 11 Buffalo blower.
One 14 in. x 5 in. Gantt "B" coke furnace for case hardening.

Tool Room.

One 18-in. Pratt & Whitney improved tool room lathe.
One Yankee (Style "P. O.") twist drill grinder.
One Blount wet tool grinder.

Car Wheel Shop.

One No. 2 Niles double axle lathe.
One 42 in. Niles car wheel borer.
One 300-ton hydraulic wheel press.

Woodworking Shop.

One No. 3 (36 in.) Fay & Egan, car rip saw.
One 16 in. Greenlee, double arbor universal saw bench.
One 36 in. Greenlee automatic cut-off machine.
One No. 225 Greenlee vertical automatic hollow chisel mortising machine.
One No. 62 Fay & Egan variety wood worker.
One No. 85 Fay & Egan double spindle shaper.
One No. 108 (15x18 in.) Berlin open side moulder.
One No. 5 Greenlee horizontal car tenoning and gaining machine.
One No. 9 Fay & Egan planer and smoother.

arc lamps is transformed from 2300 volts to 460 volts by means of three 75 kilowatt Westinghouse single phase transformers connected in delta. A three phase, 2300-110 volt transformer provides for the incandescent lights.

From the transformers the low tension wires are carried overhead to the distributing panels, located in the tool room, on which switches are mounted for controlling the lighting and power circuits throughout the buildings. On this panel there are also located a voltmeter and an ammeter, together with multiple point voltmeter and ammeter switches so connected that voltage and current readings may be made at will on any individual power or lighting circuit.

Allis-Chalmers three phase induction motors are used throughout, nine motors being installed at present, with an aggregate horse power of 325. Each of these motors is capable of carrying 25% overload for one hour and 50% overload momentarily. They are each controlled by a starting compensator, and are protected when starting by fuses, and when running, by both fuses and automatic circuit breakers provided with no voltage release coils.

Machine Bay of Erecting Shop

One No. 50 (36 in.) Fay & Egan band saw.
One No. 4 (18 in.) Fay & Egan wood lathe.
One 48x6 in. Pond grindstone.
One No. 6A Fox bench wood trimmer.

Power and Lighting System.

Electric power is purchased from the Great Southern Lumber Co., whose plant is located about one-half mile distant. The current is brought to the shops over a 2300-volt, three-phase, transmission line, consisting of three No. 4 bare copper wires carried on wood pins and crossarms on 7 in. top 40 ft. yellow pine poles. The primary circuit at the receiving substation is provided with lightning arresters, hook switches and choke coils, and is controlled by two separate automatic, overload release, oil switches (one for power and one for light) mounted on a slate panel. This panel is further equipped with integrating and indicating wattmeters; ammeters for each phase; voltmeter and power factor meter. The portion of power used by the motors and

There are 28 Western Electric, 460 volt, arc lamps installed throughout the yards and buildings; 14 of these being in the locomotive shop, 3 in the engine house and 11 in the yards. This type of lamp is used because of its convenience for operation on power circuits, thus simplifying the wiring system, as in many instances the lamps are remote from any lighting mains. These lamps are protected from short circuits by double-pole cutouts at connection to mains.

The arc lamps installed in the engine house are fitted with special tapped tops and threaded to conduit used as a hanger. All wiring is in conduit, an effort being made to make the installation proof against corrosion by fuel gases.

The remainder of the artificial shop lighting is by means of incandescent lamps used on drop cords and adjustable bench fixtures, a total of about 200 lamps being installed. Plug receptacles for extension cord lights are provided at numerous places in the locomotive shop and engine house, allowing any point in either building to be easily reached.

Water System.

Water for shop purposes is piped from the plant of the Great Southern Lumber Co., where fire pumps are installed in conection with an elevated tank. The ordinary pressure on the water service mains is 45 lbs. but this can be increased to 100 lbs. pressure in case of fire.

The shops have good fire protection facilities, the yards being supplied with a network of water mains of ample size with well located fire hydrants and hose valves. Distributed throughout the buildings are hose racks, each containing 50 feet of Underwriters' linen fire hose permanently attached to hose valves and each provided with a hose nozzle. With water at 100 lbs. pressure it is possible to reach any point of the buildings with two effective fire streams.

For boiler washing purposes a Deane triplex pump, of 225 gallons per minute capacity, was placed in the machine shop. This pump delivers water at 100 lbs. pressure to the hose valves in the engine house and to the engine pits in the erecting shop.

Drinking fountains are placed in convenient locations in the locomotive, forge and coach shops, and in the engine house.

Compressed Air Systems.

An Ingersoll-Rand air compressor of 275 cubic feet capacity, belt driven directly by a 50-horse power motor, furnishes compressed air for shop purposes. This compressor delivers air at 100 lbs. pressure into a storage reservoir supported on the roof trusses, from which point air is piped to valved air outlets throughout the locomotive shop, forge shop, coach shop and engine house, and also to air valves distributed among the freight car repair tracks.

Sewer System.

The storm sewer system, which empties into Bogue Lusa creek, near the south end of the railroad company's property, is designed to carry off roof drainage from buildings and drainage from turntable, cinder and wheel pits. The yard areas are taken care of by open drains. The storm sewer system is provided with concrete manholes, each fitted with a perforated cast iron curb and cover. The sanitary sewer from the lavatory building has a separate lead to the city sewer system.

A rather unusual feature of the shops in general is the attention which has been given to appearance and the harmonizing of the structural designs and color scheme with the carefully studied landscaping of the city of Bogalusa. The entire town, including buildings for all purposes, is an interesting result of what can be accomplished by an effort to please the eye, without in any way detracting from general utility. The shops, with their dark red metal roofs, light grey concrete walls, and white window trimmings, surrounded as they are by the deep green of the pine forest, present an appearance not often equaled.

The engineering and construction of the complete plant ready for occupancy, which was handled by The Arnold Company, was executed by Mr. A. R. Kipp, engineer in charge, and Mr. H. H. Dickinson, superintendent of construction. Mr. P. L. Battey, chief engineer, railway shops department, had general supervision over the work.

NOTE—We are indebted to Mr. P. L. Battey of the Arnold Co., Mr. H. G. Pearsall, Mr. W. C. Park, and Mr. H. W. Burkheimer, of the railroad company for unusual courtesies in connection with the preparation of this article.—Ed.

Blacksmith Shop

Production of Steam Cylinder Castings

By H. M. Ramp.

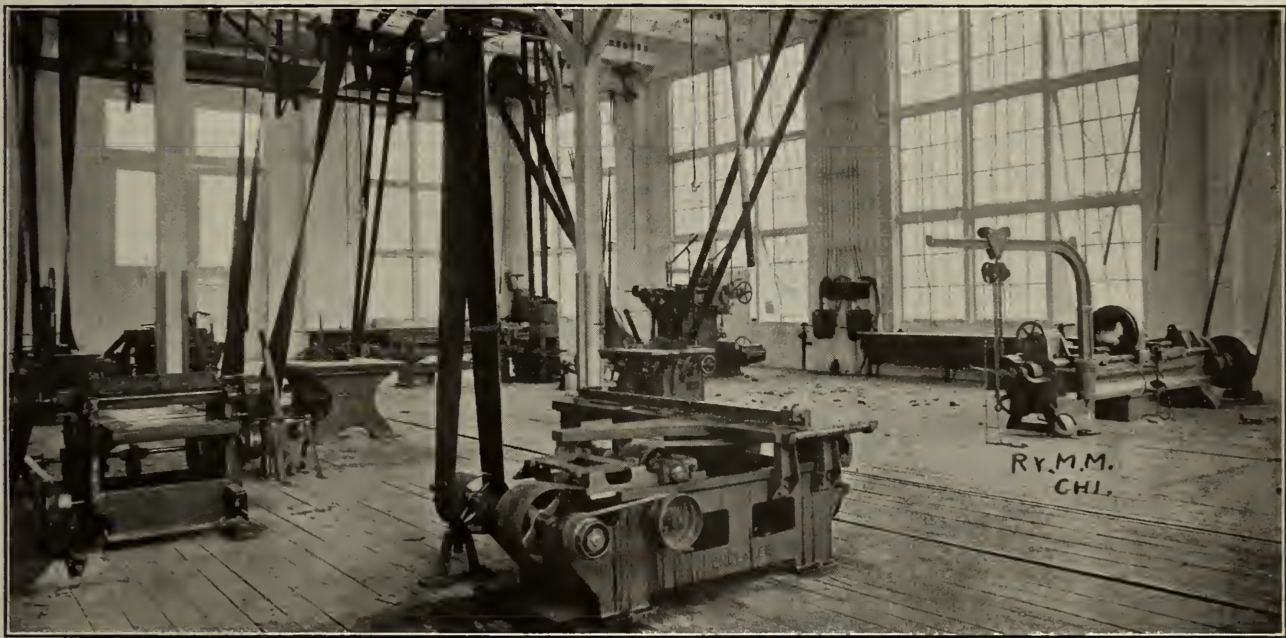
The steam-engine cylinder has always been regarded as one of the supreme trials of the foundryman's skill, and likewise has occupied a place high in the traditions and history of the business. The young moulder feels he has reached the apex of his attainments when he is given the responsibility of moulding cylinders, while the experienced moulder feels a source of satisfaction when they are reported through the machine shop, and test as sound and perfect. There are many castings that are more difficult to produce, but none that have the widespread reputation for the exaction of the moulder's skill, or are produced in such a variety of quantity. The service they are put to, the wear they receive, the necessity for absolute cleanliness, their intricate and complicated cores,make them a work of art when produced perfectly; there are so many things that can destroy their utility and efficiency, and, in short, they represent a grade of castings that must be perfect in all details of workmanship and material.

The sand they are moulded in must be right; it matters not whether they are made in green sand or dry, the sand must be open enough in either case. It is just as easy for a dry-sand mould to close and cause the iron to boil and collect dirt spots as it is for a green-sand mould to cut and scab; but with this added disadvantage a green-sand mould shows the effects on the surface of the castings more plainly when the sand is close enough to cause the iron to boil and fret than it does on one made in dry sand. If the sand is too close something must be used to make it open. Sharp sand is nearly always available, or a grade of heavy open sand; even fine gravel or pulverized stone, if the others cannot be obtained, but the sand mixture must be open. It will require more care in moulding, more nails and gaggers, more attention to solid firm ramming, but it must be open enough to permit the easy escape of the gases, or one cannot hope to produce either a smooth or a clean casting.

In this connection it should be stated that it pays to make cylinders in dry sand. It is true there is some question regarding the smaller sizes, but the reduction in loss, both in the foundry and the machine shop, and the better finish of the casting, make it a money-saving project in the end. The cost of a dry-sand mould should be very little greater than that of one made in green sand. The extra expense would include the fuel for drying and the use of an iron flask.

The blackings used on a dry-sand cylinder and its cores are often responsible for dirt in the casting. A blacking that is applied wet should, when dried, be hard and firm, and should be able to withstand a vigorous rubbing with the band without developing dust or a disposition to rub off, and should never come off under the application of the soft brush. If it does there are several remedies. One is to mix the blacking with clay wash; another is to go over the finished blacking with a camel-hair brush and molasses water; and the third, which the writer has found of the greatest service, is to mix from 10 to 20 per cent of talc or soapstone with the blacking. In the case of very poor blacking and the qualities of some sands, it may be necessary to use two or three of these remedies, but usually the talc is all that is required. The cores should be blacked and treated in the same manner as the mould, as they are a part of it, and there is little use to make a good mould and poorly blacked cores. Always use enough blacking—the most expensive is cheap on the individual casting, and it protects the surface of the mould and the cores. Some moulders put on enough, but have acquired the habit of slicking it all off with their tools instead of working it down to a uniform and substantial surface.

There has been a great difference of opinion as to the best way to pour a steam cylinder. Some cling to the old method of casting on end with a riser the full size and thickness of the cylinder wall extending an indeterminate number of inches above the flange, to receive all the dirt, which is afterwards machined off. Some have gates on the flanges, and others resort to the use of pop gates on top. But the most reliable and the most logical method is to use a core or drawgate as near to the bottom of the mould as possible, with the cylinder cast on the side, so that any dirt that may enter will lodge under the exhaust or port cores, where it can do little if any harm, and gradually fill the mould without wear and tear on the cores or surface of the same. It also reduces the tendency to shrinkage or spongy spots in or about the bore of the cylinder. While it is not necessary to cast on end, it is true that much dirt will arise in the head when this method is used, but it is possible and practical to cast them on the side when the workmanship and material are right.



Corner of Woodworking Department

The cores of a steam cylinder are frequently considered the supreme test of the coremaker's skill, and often he is responsible for dirty cylinders that are unjustly attributed to the moulder. If the vents are not free and sufficient in number, if the sand is too close, or too much binder is used, there will be an agitation produced in the mould that may not amount to a blow, yet it will be of sufficient violence to cause the accumulation of dirt that will spoil the casting. The sand must be open, no matter what binder is used; but if the cores are made with flour they will require a more open sand than if made with linseed oil or some of the core compounds. In any event, the foreman is not justified in laying the blame of a dirty cylinder to the moulder until he investigates the cores. In addition to the vents being free and open, the moulder should look well that they receive a free passage to the air. When wax strings are used, beware of paraffin. It softens and rots the sand next to the strings when it melts and soaks in, and has often been the cause of the iron breaking through into the vents in the port cores, or other places where the wax vents come close to the surface of the core. Use good beeswax or some prepared wax that is known to be free from this weakness. Wherever it is possible, iron forms should be made on which the port cores are dried. They dry more rapidly and retain their form, relieving the necessity for filing and fitting, and the destruction of the finished surfaces.

Use as few chaplets as possible in the castings. Fasten every core possible with bolts from the prints of the cores. Do not use wire. It is dangerous, and a drop of melted iron will cut it in half.

Up to this point we have simply referred to workmanship and the tools and supplies used in production, but equally great is the question of the iron to be used. It is as essential that the mixture be correct as any other detail. The ideal cylinder will show a fine, clear, uniform grain, free from spongy or soft spots, and as hard as it can be satisfactorily machined. A cylinder that is too soft wears out of round quickly, and the engine loses its efficiency. But worse than this is the casting that has soft spots or hard spots, or open, spongy places in the bore, such as often occur at the junction of two sections, where the metal is heavier and retains its heat longer than other parts of the casting. This is the cause of much disastrous wear and cutting, and is more detrimental than a soft cylinder. These spongy places, or shrinkage spots, are sometimes remedied by the use of chills in the corners, or next to the intersections where the shrinkage occurs. Sometimes they are placed in the core that forms the bore, and while this will close up the spongy places the practice is not good, as it causes the iron under the chill to be of a different degree of hardness, which brings us back to a casting that does not wear uniformly, with its indisputable results. The correct mixture of the proper irons will overcome these spongy, shrinkage spots, without the use of chills, and will also give a fine, strong iron. If the cylinders are in average section 1¼ in. or under, the following analysis will give a close, clean and solid casting:

Silicon, 1.60 to 1.80 per cent; sulphur, under 0.10 per cent; phosphorus, 0.90 to 1.00 per cent; manganese, 0.50 to 0.80 per cent. If they run heavier the silicon can be reduced as low as 1.00 per cent and the manganese increased to 1.00 per cent, according to section. Light cylinders for automobiles or gas engines can be made from the first mixture and beautiful castings produced. To make this mixture so it will possess the required qualities, a great deal more than the mere fact of conforming to the chemical analysis must be observed.

First: The character of the pig iron must be known; its physical qualities or working qualities are as much value to the foundry as all the chemical determinations possible, for there are physical characteristics in pig iron—we call them physical because chemistry has not as yet revealed them—that cause two irons from different furnaces, but of practically the same analysis, to act and work quite differently. There are certain furnaces, both in the North and South, that produce iron the natural composition of which is to be hot short, develops shrinkage holes and spongy spots where two sections of unequal area join, or where heavy ribs or bosses occur. The analysis of this iron may, however, prove it to be satisfactory for the purpose intended. When the trouble in this direction is pronounced, change the brand of pig iron used, for it is possible and probable that some of the difficulties of this character date back to the ore used to make the iron, and cannot be corrected by any known method.

Second: Use a small percentage of scrap steel in the mixture—in the first mixture 5 to 10 per cent., and in the second 10 to 15 per cent. This is required for two reasons: it breaks up the graphite carbon into a finer grain or flakes, which makes the casting closer grained and stronger, with little increase in hardness; and second, because it counteracts the influence of the high phosphorus, which has a tendency to make the iron weak or erratic. The amount of steel scrap used does not affect the amount of carbon present in the iron to any extent, as the iron takes up from the fuel, in every case, the amount of carbon that has been reduced in the total mixture by the use of steel scrap. For example, if an iron containing 3.50 per cent of total carbon is melted with an equal portion of steel containing 0.50 per cent carbon, theoretically the resultant mixture would contain about 2.00 per cent carbon. But such is not the case. The melted iron takes up carbon from the fuel until it contains almost as much as the original pig iron. The introduction of steel with cast iron into the cupola converts it back into cast iron, but with this difference; the graphitic carbon is broken up into finer flakes, or exists in a different chemical combination.

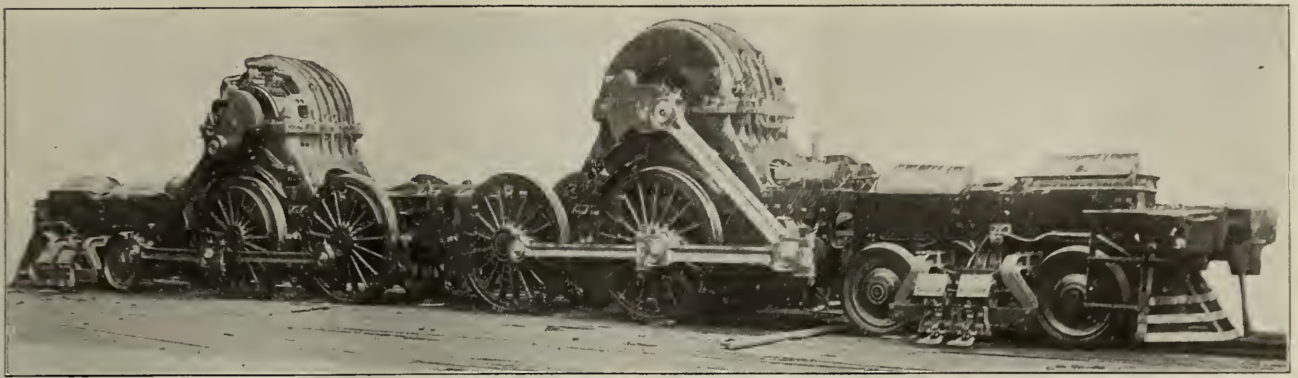
No doubt some criticism will be made of the amount of phosphorus advised, but it is also true that phosphorus is the most abused of any of the elements in cast iron. There is a deep-seated prejudice that it makes iron weak and erratic under any circumstances, but such is not the case. It is true that a moderately high silicon iron will be weakened by its use, but with the silicon kept to the limits given, and steel scrap used as directed, an iron of as uniform strength and quality can be produced as from a lower phosphorus iron. When kept within the limit of 1.00 per cent it has a softening effect, as well as closing up the grain in a remarkable manner, and coupled with the small percentage of steel it gives that close, fine, uniform polish to the iron so much to be desired in cylinder castings. Again, it is the element that does more than all the rest to eliminate the spongy or open spots in the finished castings. It and a fairly low silicon are the remedies, so far as analysis is concerned, to cure this disease. One of the reasons for this is that it retains the metal in a liquid state at a low temperature, and careful experiments will prove that it is the most powerful factor, properly handled, to make the grain of the iron fine and uniform, and to cure the spongy spots in heavy sections.—The Foundry.

New Electric Locomotive, Pennsylvania Railroad

A new type of electric locomotive has been developed by the Pennsylvania Railroad and has been tested out over the electrified lines of the Long Island R. R. These locomotives, one of which is shown in the two illustrations herewith, are to be placed in service in the New York tunnel extension of the Pennsylvania.

When work was first started on the Pennsylvania tunnels and station the engineers of the railroad company, co-operating with those of the Westinghouse Electric & Manufacturing Co. took up the problem of designing an electric locomotive which would cope successfully with the heavy grades necessary in the river tunnels. Since then electric locomotives have been designed, constructed, and tested, and special recording track sections have been laid and electrified. Much electrical apparatus has been built, and voluminous reports and records were compiled before the completion of No. 3998, the first "Pennsylvania" type of electric locomotive to be finished, and the one which was given its first test recently on the Long Island R. R.

Number 3998 weighs 330,000 pounds and is designed to pull a heavy freight train at a speed of some 60 or 70 miles per hour. The first twenty-four electric locomotives to be built for service in the New York tunnels will be assembled at Altoona shops. The electric apparatus is to be built at the East Pittsburg shops of the Westinghouse Electric & Manufacturing Company, while the mechanical features will be made in the railroad's locomotive shops.



Chassis of Pennsylvania Tunnel Locomotive

The "Pennsylvania" type locomotive is built in two sections, joined at the middle. Each section has eight wheels, four of which are drivers, 68-in. in diameter, the other four being truck wheels 36-in. in diameter, constituting in their arrangement and weight distribution what in steam locomotives is called the "American" type. The sections are permanently coupled back to back by a distinctive arrangement of Westinghouse friction draft gear and levers, so that the leading section effectually pilots the rear one. This obviates all necessity of turning the engine, as it runs equally well in either direction, and all manipulating levers are duplicated in each section, so the operative simply changes ends.

Two pairs of drive wheels are coupled to a jack shaft, in line with the driver axles, which in turn is coupled to a motor crank shaft, to which a single motor delivers all its power. The cranks are ninety degrees apart, so there can be no "on-centre" position. The motor crank revolves uniformly and at constant effort, differing therein from steam practice, and while the pressures on the connecting pins and rods vary throughout each revolution, the turning effort of the drive wheels is the same as for the motor, constant throughout each revolution.

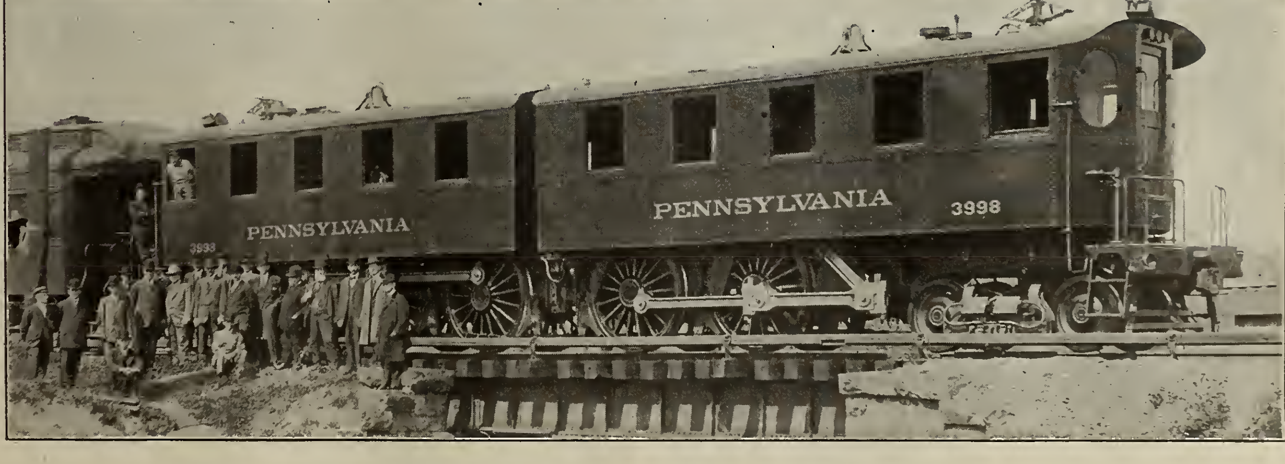
Distinctive from steam practice, all rods and moving parts have pure rotation only, and are thus counter-balanced for all speeds, thereby delivering no more shock to the track and roadbed than a passenger car of equal weight. The motor and side frames, jack shaft, and all other gear, are spring supported from the driver and truck wheels, so that there is no track stress other than that local to a single pair of wheels. In this arrangement of motor support and connection, the center of gravity height closely approximates that in high-speed steam locomotives.

A decided improvement in the "Pennsylvania" type is the use of a single motor for two pairs of drivers, and the benefits secured by its position. The motor is located high up from the roadbed, secure from snow, dirt and water, and space limitations are largely removed. In its design it possesses electrical features never before secured on an electric locomotive. The single motor weighs, without gear, 45,000 pounds, and in weight and power it is the largest railway motor ever constructed. It projects into the cab and, in fact, fills a large part of it.

The main control apparatus is in a bulkhead centrally located so that there are ample passage-ways along the sides. At one end is located the electrically driven air compressor for operating the air brakes. In the operating end of the locomotive there is a Westinghouse brake valve for high-speed brake operation and also the engineer's controller, by which all electrical manipulation is secured.

The electric supply will be secured from a third rail, by four contact shoes on each locomotive. At some points where the great number of track switches will not permit this, power will be secured from an overhead conductor through an air-operated overhead contact shoe of which there are two on each locomotive.

The new locomotive is of steel construction throughout, and each section has the usual bell, sand box, and whistle. The latter is blown by air. The first twenty-four "Pennsylvania" type electric locomotives to be built will have the following dimensions:



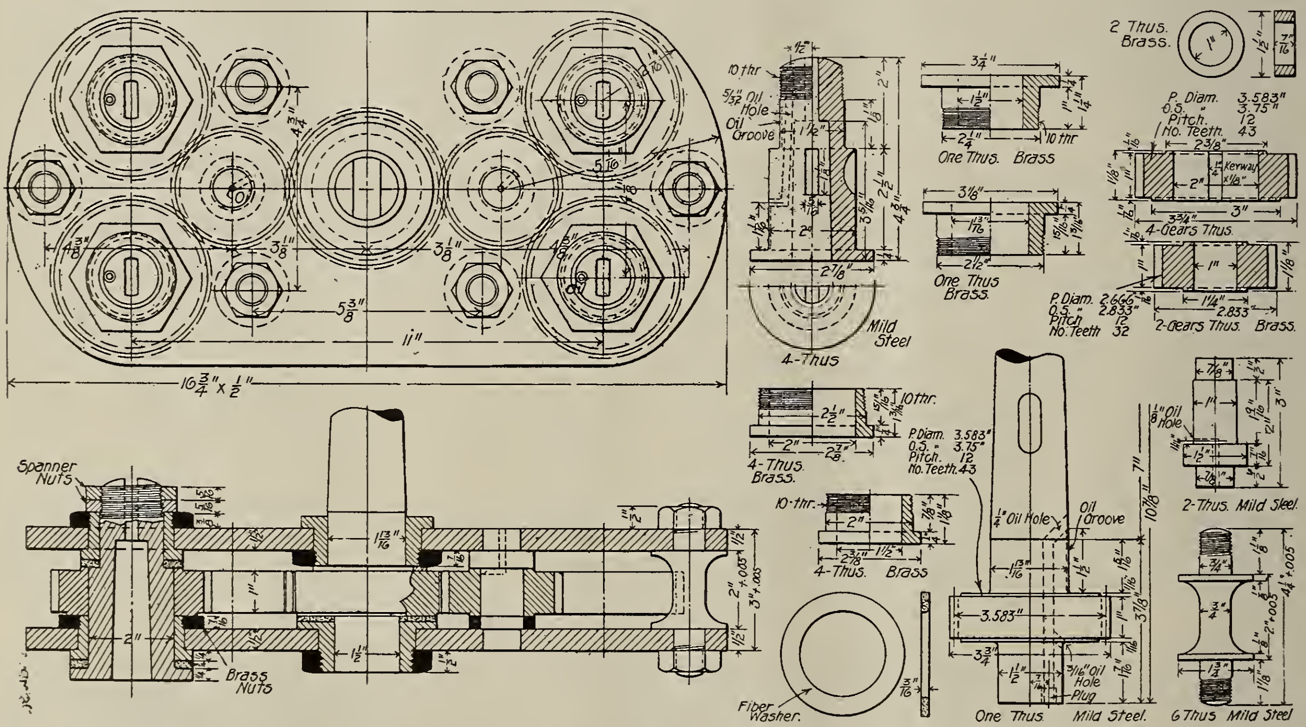
Pennsylvania Electric Locomotive for Tunnel Service

Total Weight, tons	166
Weight of Electrical Parts, tons	62
Weight of Mechanical Parts, tons	103
Total Horse-Power	4,000
Maximum Draw Bar Pull, pounds	60,000
Maximum Speed, 60 to 70 Miles per hour under load.	
Diameter of Drive Wheels, inches	68
Diameter of Truck Wheels, inches	36
Weight on Drivers, tons	14
Mechanical Shock Without Injury, pounds	600,000
Length Over All, feet	65
Total Wheel Base, feet	56

Notes on the Silvis Shops, C. R. I. & P. Ry.

A handy and labor-saving device at the shops of the Rock Island system, at Silvis, Ill., is a multiple drill attachment for use with the ordinary single spindle drill press. Two ½-in. steel plates about 8x17-in. are fastened together in such a way as to leave a space of 2-in. between them. The drill press shank, placed at the center, is of mild steel, 1 13-16-in. in diameter, with a No. 5 Morse taper. The shank is geared through an idler between the plates to four drill chucks, as shown in the accompanying drawing. The attachment is used on the job of drilling and tapping the four holes in standard eccentrics. These holes are located too close together to be drilled on a multiple spindle drill factured by the Pond Machine Tool Co., and is used exclusively for this work.

At one side of the shop is the old rack for resting engine cabs. It is made of timber and is supported from below by 4x4-in. upright posts. Across the shop is the new rack which is made up of "I" beams: one extending out from each post of the building and two laid transversely across them. The end of the suporting beam is held by a tie rod to the post as shown in the illustration. The advantage of this rack over the old one is quite apparent—the cabs are up out of the way with a clearance of about eight feet below, unobstructed by posts.



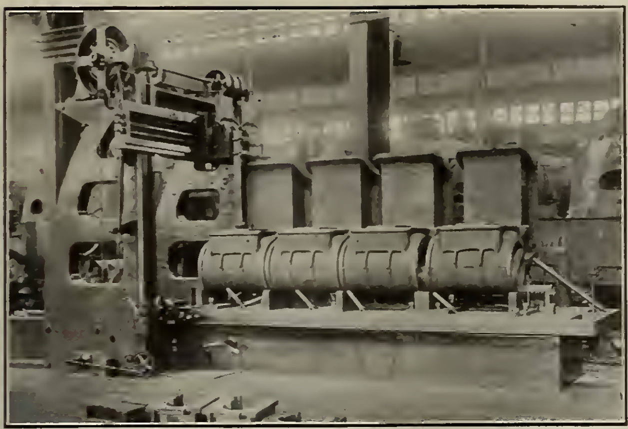
Multiple Drill for Eccentrics, Silvis Shops

press and by the use of the above, the job can be done in one-quarter of the time in which it was formerly done. This device is the idea of G. W. Seidel superintendent of shops.

In order to save time where small lathe work is needed, a portable lathe has been rigged up. A gear was shrunk on the second step of the cone, and a motor mounted on the frame and geared to the lathe cone. A large hook was fastened to the frame so that the lathe can be picked up by the crane and dropped alongside the pit where it is needed, electrical connection being made nearby.

An accompanying illustration shows a large planer in the machine shop and is noteworthy as showing four large cylinders being machined at once. The planer was manu-

A praiseworthy feature of the shop, and one which reflects great credit on the management, is the emergency hospital adjoining the office of assistant superintendent J. E. Kilker. The room, located near the center of the shop, is about 8x17-ft., well lighted, provided with glass-topped instrument tables, a reclining table and everything necessary for emergency work, whether it be a filing in the eye, or a mangled limb. A young man, who has had a number of years' experience in this work, is in attendance. He has a desk near the door in the adjoining office and when not in the hospital, he devotes his time to the office. In serious cases, after the emergency treatment is given, an engine is waiting and the patient can be rushed to the company's hospital in ten or fiften minutes. It is used very freely in



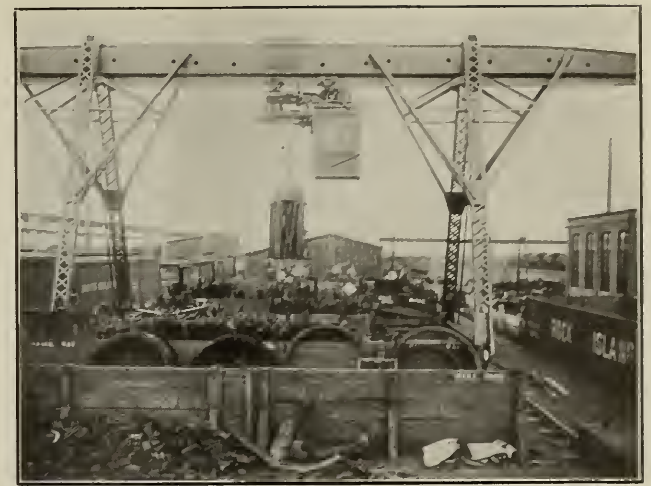
Large Planer Arranged for Machining Cylinders

cases of minor injuries and for these alone has proved a beneficial and profitable investment.

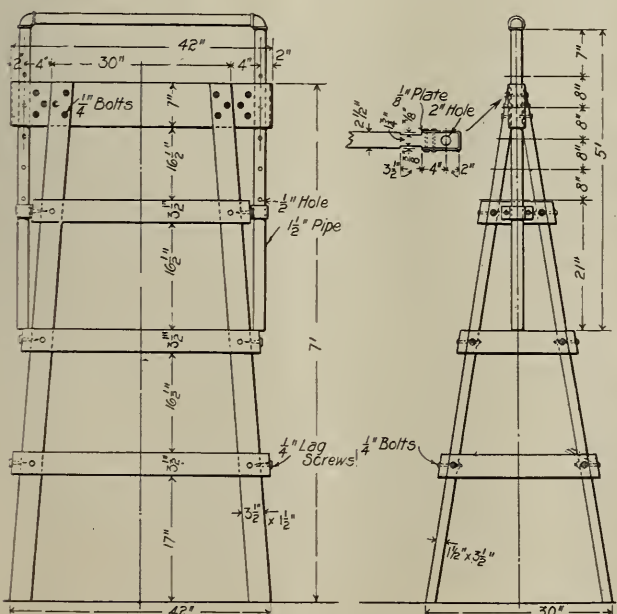
Good results have recently been obtained in the boiler shop by the oxy-acetylene process of welding. Two very successful welds have already been made under the direction of W. M. Wilson, general foreman boilermaker. One of these consists of an inserted patch on a side sheet, the total length welded being 7 feet, 9 inches. A cut taken across the end of this weld showed the joint to be perfect. A side sheet, having a crack 30 inches long, was to be welded in the same manner, the length of the weld in this case being 10½ feet.

A handy device which has been gotten up in this shop is an adjustable "horse," which obviates the use of scaffolding. The horse is about 7 feet high and 3½ feet wide. The adjustable feature is made up of three pieces of 1½ inch pipe, connected by elbows in such a way that the central piece is parallel to the top of the horse, while the other two pieces pass through the top timbers. There are a series of holes in these two pieces, so that the whole can be fixed at any convenient height by inserting bolts through them.

The method of handling castings and scrap at the shops is one in which general storekeeper F. D. Reed justly takes great pride. The casting platform is equipped with a transverse crane and magnet while the scrap platform is equipped with a 4-ton gantry crane and magnet. The scrap is picked out of the car and dropped in a large bin where it is sorted. It is then picked up by the magnet and placed in various bins as required. The sheds for filings and shavings are seen at the end of the platform in the illustration, doors being provided in the roof, allowing the magnet to be dropped in. A load of about 1,500 pounds of the finest material can be picked up at one lift. The magnet alone weighs 4,800 pounds, has a diameter of 52 inches and is operated on the crane voltage of 220. The scrap is handled for about 9 cents, the greater part of the cost being for sorting.



Scrap Platform and Crane



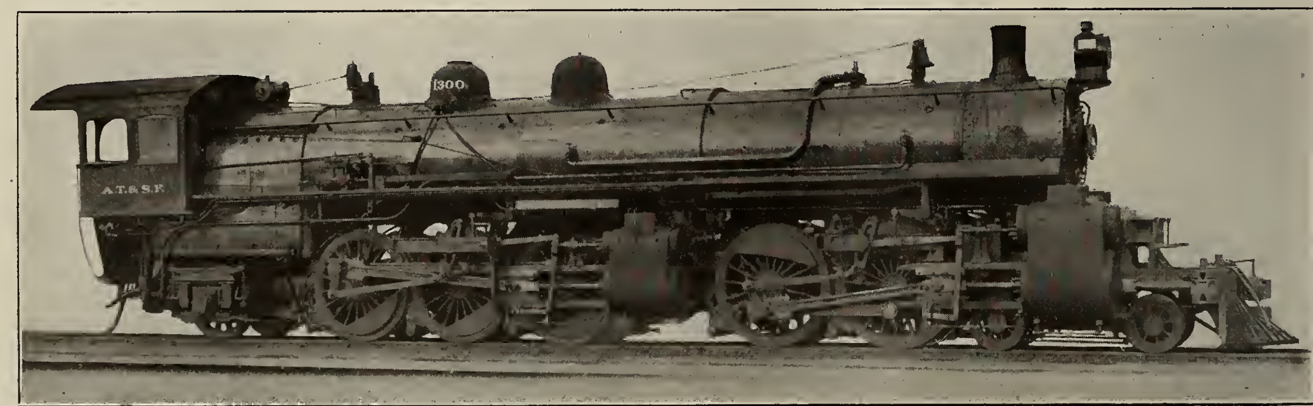
Adjustable Horse for Boiler Shop

Showing Construction of Cab Racks

Mallet Articulated Passenger Locomotives, A. T. & S. F. Ry

The Baldwin Locomotive Works has recently completed two Mallet articulated locomotives for the Atchison, Topeka & Santa Fe Railway. Apart from their constructive details, which embody various new features, these engines are of special interest as Mallet locomotives, because they are intended for passenger service. The tractive force exerted is 53,000 pounds, and as far as weight and hauling capacity are concerned, these locomotives mark a great advance over the heaviest passenger engines heretofore used.

The 4-4-6-2 wheel arrangement has beeen adopted for this design, and so applied that the engine is capable of readily traversing 16 degree curves. The leading truck has a rigid center; the driving tires are all flanged and the trailing truck is of the Rushton type, with outside journals. The equalization of the forward group is similar to that of an eight-wheel locomotive, namely, the truck is independent; while the drivers of the rear group are equalized with the trailing truck, precisely as in a Pacific type locomotive. The articulated frame connection is similar to that used on the consolidation Mallet engines recently built at these works for the Southern Pacific Co. The front and rear frames are joined by a cast steel radius bar, which is bolted to the upper and lower rails of the front frames, and thus constitutes an exceedingly strong transverse brace.



Santa Fe Articulated Passenger Locomotive

The boiler is equipped with a firebox of the Jacobs-Shupert type, in addition to which there are a feed-water heater, a superheater, and also a reheater between the high and low pressure cylinders. The construction of the Jacobs-Shupert firebox has previously been described in Railway Master Mechanic. The inner and outer shells each consist of a series of steel plates, which are flanged to a channel section. Between each pair of channels is riveted a stay plate. These stay plates unite the inner and outer shell, and have suitable openings cut in them to permit the steam and water to circulate freely. The flanges of the channels comprising the inner shell, are placed on the water side; while in the case of the outer shell, the flanges are on the outside. With this arrangement, the operation of riveting is facilitated, and no rivet heads are exposed to the direct action of the fire. The channel webs are suitably cambered to resist pressure. Large openings are cut in the stay plates over the crown, and here the bracing is effected by means of expansion links. The throat and back head are stayed by bolts, in the usual manner. All stay bolts are of course avoided in the sides and crown, and are replaced by the stay plates and expansion links, which are sufficiently flexible to insure freedom from breakage.

In the present instance, the inside and outside shells are each built up of twelve channel sections, which are united at the bottom, to a double riveted mud ring of ordinary construction. The fire tubes are 19 feet long; they terminate in a combustion chamber 10 feet 9 inches long, in front of which is the feed-water heater section. This chamber is 7 feet in length; it is traversed by 314 tubes, 2¼ inches in diameter, and is kept filled by two non-lifting injectors located right and left under the cab. The feed discharges through an outlet on the top center line of the heater, and is then forced into the boiler proper through two checks, placed right and left a short distance back of the front tube sheet. The combustion chamber is surrounded by a separable joint. This is effected by two rings, which are riveted to the front and back sections, and butted with a V-shaped fit. The rings are united by 36 horizontal bolts, 1¼ inches in diameter.

Oil fuel is used in these locomotives. The burner is placed in the front end of the firebox and the oil is fed through a heater consisting simply of a long steam jacketed pipe. These details are arranged in accordance with the railway company's practice.

The steam dome is placed well forward, and connection between the throttle valve and superheater is effected by a cast iron dry pipe. The superheater is placed in the combustion chamber; it is of the Santa Fe type, and consists of a cylindrical drum, traversed by fire tubes. The drum is fitted with internal baffle plates, by means of which the steam is compelled to circulate around the tubes; while a transverse partition divides it into two main compartments. The rear compartment is used as the superheater, while the front compartment constitutes the reheater. Short connecting pipes convey the steam from the superheater to the high pressure steam chest, where the distribution is controlled by inside admission piston valves, 19 in diameter. The exhaust from the high pressure cylinders is passed through the reheater, and then enters a single pipe placed on the center line of the engine. This pipe is fitted with two ball joints and a slip joint; a short distance back of the low pressure cylinders it divides, and separate leads convey the steam to the low pressure steam chests. Here the distribution is controlled by outside admission piston valves, fifteen inches in diameter. The exhaust pipes are led forward, ahead of the low pressure cylinders, and are united into a single flexible pipe which conveys the steam back to the smoke box. This arrangement was adopted in order to secure a fairly long pipe, and so avoid excessive slip in the joint when the engine is traversing curves.

Walschaerts motion is used throughout, and is controlled by the Ragonnet power reverse gear. The connection between the high and low pressure reverse shafts, is effected by a single reach rod, placed on the center line of the engine. This rod is fitted with a universal joint, which is guided between the inner walls of the high pressure cylinder saddle. The gear is so connected that all the radius rods are down when running ahead.

The front frames are stopped immediately behind the low pressure cylinders, and are bolted and keyed to a large steel box-casting. This casting supports the low pressure cylinders, and to it is bolted the truck center pin. The front bumper and deck plate are also of cast steel.

The overhang of the boiler is carried on the front frames by a single support, placed between the two pairs of driving wheels. This support also acts as a centering device. It consists of two steel castings, between which is interposed a cast iron shoe, 2 inches thick. Clamps are fitted to prevent the frames from dropping away when the engine is lifted from the rails.

The tender of this locomotive is, in its way, quite as interesting as the engine. The oil and water tanks are of 4,000 and 12,000 gallons capacity respectively, and are rectangular in cross section. The front and back bumpers are of cast steel; the frame center sills consist of 15-inch channels, and the side sills of 12-inch channels. The trucks are of the six-wheeled, equalized pedestal type; the wheels are steel-tired with cast steel spoke centers, and were manufactured by the Standard Steel Works Co. The truck frames and pedestals are of cast steel, and each truck has two bolsters, which are suspended on swing links between the center and outside axles. The center plate is in one piece with a heavy steel casting which is seated on the bolsters, and bridges the middle transoms. These latter are cast in one piece with the truck frame.

This engine unquestionably marks an epoch in the development of the American passenger locomotive. This is true, not only because of its type and size, but also because it combines, to a degree not heretofore attained, those features which have proved of greatest value in reducing fuel and water consumption, viz.: feed-water heating, superheating and compounding. The engine has been designed in the light of considerable experience with heavy articulated locomotives, and there is every reason to believe that its performance will be satisfactory.

Following is a tabulated list of principal dimensions, weights, etc.:

Gauge	4-ft. 8½-ins.
Cylinders	24-in. and 38-ins.x28-ins.
Valves	Balanced Piston

BOILER.

Type	Straight
Material	Steel
Diameter	72 ins.
Thickness of Sheets	$\frac{11}{16}$-in.
Working Pressure	200 lbs.
Fuel	Oil
Staying	Special

FIRE BOX.

Material	Steel
Length	119⅝-ins.
Width	63¼-ins.
Depth, front	74-ins.
Depth, back	74-ins.
Thickness of sheets, sides	$\frac{5}{16}$-in.
Thickness of sheets, back	⅜-in.
Thickness of sheets, crown	$\frac{5}{16}$-in.
Thickness of sheets, tube	$\frac{9}{16}$-in.

WATER SPACE.

Front	5-ins.
Sides	5½-ins.
Back	5-ins.

FIRE TUBES.

Material	Steel
Thickness	No. 11 W. G.
Number	294
Diameter	2¼-ins.
Length	19-ft 0-in.

FEED WATER HEATER TUBES.

Material	Steel
Thickness	No. 11 W. G.
Number	314
Diameter	2¼-ins.
Length	7-ft. 0-ins.

HEATING SURFACE.

Fire box	202 sq. ft.
Fire tubes	3275 sq ft.
Feed Water Heater Tubes	1279 sq. ft.
Total	4756 sq. ft.
Grate Area	52.5 sq. ft.

DRIVING WHEELS.

Diameter, outside	73-ins.
Diameter, center	66-ins.
Journals, main	11x12-ins.
Journals, others	9x12-ins.

ENGINE TRUCK WHEELS.

Diameter, front	31¼-ins.
Journals	6x10-ins.
Diameter, back	50-ins.
Journals	8x14-ins.

WHEEL BASE.

Driving	30-ft. 4-ins.
Rigid, front	6-ft. 4-ins.
Rigid, back	12-ft. 8-ins.
Total Engine	51-ft. 11-ins.
Total Engine and Tender	94-ft. 5½-ins.

WEIGHT.

On Driving Wheels	268,000 lbs.
On Truck, front	58,050 lbs.
On Truck, back	50,400 lbs.
Total Engine	376,450 lbs.
Total Engine and Tender, about	600,000 lbs.

TENDER.

Wheels, number	12
Wheels, diameter	34¼-ins.
Journals	5½x10-ins.
Tank capacity	12,000 gals. water
Fuel capacity	4,000 gals. oil
Service	Passenger
Fire Box	Jacobs-Shupert type
Superheater	Santa Fe type
Reheater	Santa Fe type
Superheating surface	323 sq. ft.
Reheating surface	798 sq. ft.

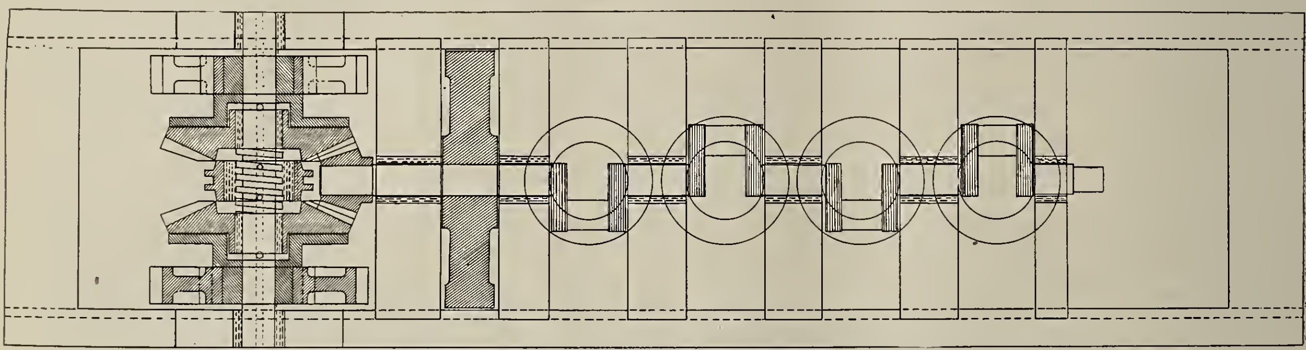
NOTE—This article was received too late to allow of the reproduction of the drawings. We hope to publish the latter in our next issue.—Ed.

The proper drafting of locomotives is an important factor in conserving the coal and its supervision should be left to a man whose duties require him to ride engines. The front end should be kept as near air tight as possible; steam pipes free from leaks; and other pipes and draft riggings in proper position. The exhaust nozzle should be of such a size that when other conditions are favorable engines will steam freely. There is no economy in trying to run a larger nozzle than engine will steam freely with.—C. F. Smith, R. F. E., T. R. R. of St. L., before the St. Louis Ry. Club.

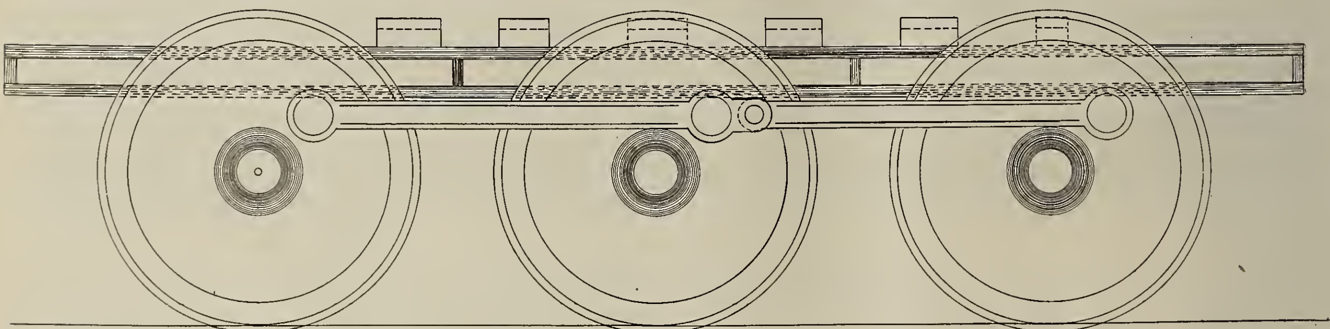
New Gasoline Motor Car

A car, the engine of which appears to embody many new principles in the application of gasoline motor power to passenger cars and locomotives, has recently been perfected by the Prouty Gasoline Car Co., of Chicago. Mr. E. Prouty, the inventor, whose office is at 1110 East 66th street., Chicago, has for many years been working on a gasoline engine which, in its application to railroad locomotives and cars, will be as flexible in control and as reliable as the steam locomotive while still embodying the advantages of the internal combustion engine.

In the application of the power, the clutch is of prime interest and a drawing is shown herewith. An examination of its mechanism would perhaps lead the reader to believe that the faces in contact would seize and that a release would be difficult. This, however, it is stated, is not the case, but on the contrary, the clutch can be thrown ahead, backward, or out of contact without difficulty. The power is transmitted to the driving axle from the clutch through gears. The transmitting gears run in multiples from zero up to ten miles an hour, five to one; and up to thirty miles, direct, with engines at 300 R. P. M. Additional speed is attained by speeding up the engine. A universal draw-bar bolster prevents vibration in the coach, all the machinery being on the truck.



BASE PLAN 40000LB PROUTY GASOLINE LOCOMOTIVE = 80000LB LOCOMOTIVE BUILT ON SAME PLAN.



The standard plan of the engine has four 12x12-inch cylinders, four cycle type, water cooled. There are no starting devices such as cranking, powder, springs or compressed air employed. The engines are always at rest when the car is stopped, saving fuel and much annoyance to the passengers and the public, and the many troubles and frequent accidents attending the various plans to start gasoline engines.

A mechanical feed is used as a decided improvement over the carburetor in gasoline engines for traction work. It brings the gasoline engine up to the standard of steam in reliability under the fluctuating condition of railroading. A drawing of the engine shown herewith should be of considerable interest.

Some Advantages of Grinding

By S. J. Kelley.

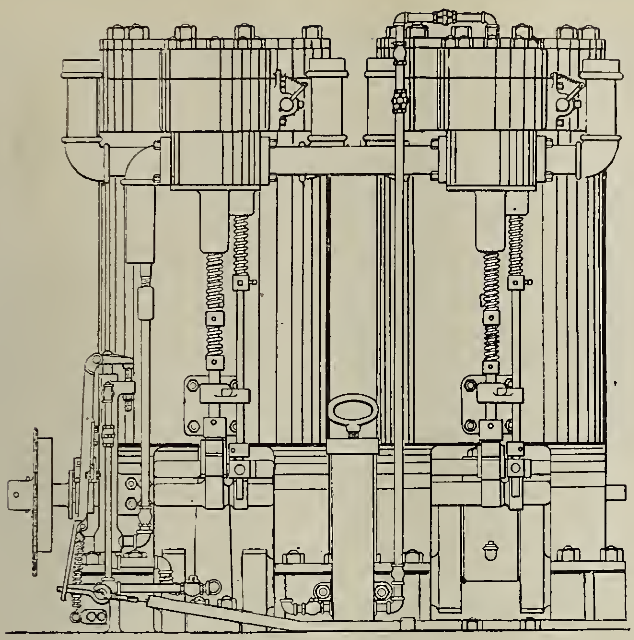
Some years ago, when grinding machines were first used, they were employed on hardened work, such as tools and shafts, that had to be finished with great accuracy. Since then they have been developed so that now the grinding machine is a common tool, even in small shops, where accurate work is done, and especially where the work must be interchangeable.

An emery wheel 12 ins. in diameter and ¾-in. face will, at the right speed, present 1,700,000 cutting points a minute; a wheel of 1¼-in. face will present 2,000,000 cutting points, and will cut from 1½ to 4½ sq. ft. of surface a minute. For this reason a grinder will not only do the work faster, but better, than a lathe, and the advantages represent both capacity and accuracy.

Success depends largely upon the grade of wheel selected with regard to the work to be ground. Some try to make a wheel adapted for brass answer for cast iron, and use a wheel for cast iron on tools. A wheel may glaze if run too fast, and also if it is too hard. A wheel which must be forced to the work will not cut freely, and will not do good work. Better work can be produced with high-speed steel with a soft wheel, while with soft steel better work can be done with a combination wheel and several grades mixed together, sometimes four and five grades of emery being mixed in one wheel. Vibrating work should be ground with a hard wheel, as vibration also has a bad effect on the face of a wheel.

To rough cast iron use wheels number 40 to 60, grades G to K, and to finish cast iron a wheel number 80, grade K to M; brass and bronze, wheels 80 to 150, grade F to K; hard steel, number 80 to 120, grade I to M.

A shaft finished in the lathe and filed by the most expert mechanic will not be exactly round. A piece, to be ground, may be turned to from 0.005 to 0.012 in. of the finished size, then the grinder left to do the rest. A wheel 12 ins. in diameter and 1½ to 2-in. face, is best, although some prefer a ¾-in. face, because there is less tendency to heat and spring light work. Some heavy machines, made for roughing work, will



Prouty Gasoline Engine

do it faster than a lathe, but probably the better way is to rough it in the lathe to 1-16 in. of finished size, and then grind it.

If a wheel is run at the right speed and the work is run too fast, the machine will not work well, as the face of the wheel will constantly break away and change both the surface and diameter of the work and wheel. If a wheel runs too fast and the work at the right speed, the wheel will glaze quickly, as there is not strain enough to break the grain of the face, and the heat produced on the wheel will cause it to glaze, and if run too slow the right quantity will not be turned out. About 6000 ft. a minute is a good speed for general work, and the machines should be regulated to keep the proper speed. For soft steel and wrought iron the speed can be from 6500 to 7000 ft. a minute. If the wheel on hand is a little hard, lower the wheel speed and increase the speed of the work.

At times the work will grind wavy and show chatter marks running around it like a thread. In this case the spindle of the wheel may be loose, the wheel itself may be loose, it may have a hard spot in the face, or it may be too hard. Tighten the bearings a little, and if the chatter does not stop, change the wheel for a softer one. Sometimes the face of a wheel is too wide, and will cause trouble on light work. A wheel should be watched carefully to see whether it cuts evenly all round and does not glaze in spots.

If glazing occurs in spots the work will be cut intermittently, causing ridges and flat spots. In this case use the diamond to true the face, and if this does not stop the trouble, use a softer wheel. Care should be taken to true up wheels so as to have the face straight, holding the diamond firmly. Water should be used freely on a wheel to keep the heat generated by grinding uniformly, and not change the outline of the work. No matter how much it may be ground, with too much heat the work will never be right, whether round or straight.

In grinding a long shaft or piston rod the ends are held firmly in the center and if the center becomes hot the shaft will expand at the ends and be ground too small. Grinders are sensitive machines and when handled by an expert, stock may be reduced to within less than 0.0001 in. of size.—Southern Machinery.

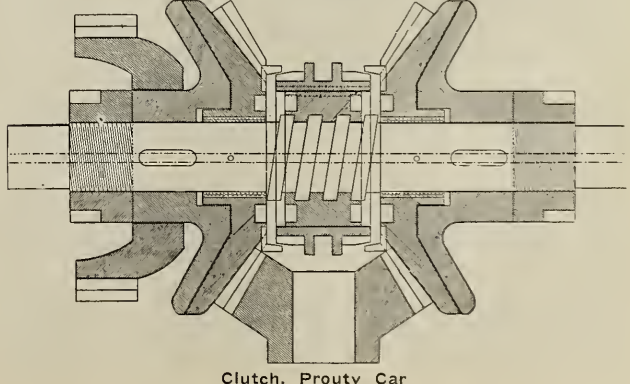
Reference to Chicago Electrification in Illinois Central Report

The Report of the Illinois Central Railroad for the year ended June 30, 1909, contains the following reference to the electrification of the company's lines out of Chicago under the heading "Electrification of Chicago Terminals":

"The subject of electrification of the Chicago terminals of this company has had and is having most earnest and thorough consideration. The problems presented are unique and complex. There are no great freight terminals operated by electricity, and it is questionable, even aside from the great expense involved, if it is practicable. There are over 310 miles of track in the terminals, and there is a very heavy exchange of cars between this road and other roads in Chicago; to effect this exchange it is necessary that the trains of this company shall go upon the tracks of other companies, and that their trains shall come upon our tracks; with this road alone electrified, this exchange of cars would not be practicable.

"Without precedents to guide, the estimates of cost are at best unreliable; from the best obtainable information it would appear that the cost of electrifying the terminals of this company would be more than $18,000,000, a great sum to expend upon what would be of doubtful success in operation. Earnest and painstaking investigation and consideration are

Prouty Gasoline Car



Clutch, Prouty Car

being given to the subject, and pending a solution of the problem that will be satisfactory to all the interests concerned this company is devoting great attention to reducing to a minimum the noise and smoke of its locomotives. The board has authorized the purchase of, and the officers are negotiating for, cars propelled by gasoline motors and adapted for handling suburban passengers. Experiments in the use of coke as fuel for locomotives are being pursued."

Coal Tar as Coating for Iron Pipes

In a paper read before the fifth annual meeting of the Illinois Gas Association. Mr. Robert B. Harper considers clean coal-tar pitch, free from water, acids, or soluble mineral matter, as the most efficient type of covering for the prevention of soil and electrolytic corrosion of iron pipes. Such a pitch, he states, should be as hard as it is possible to make it without being brittle at ordinary temperatures, and should not crack when struck a hard blow. The pipes to be coated should be smooth, free from moisture, rust and loose scale, or any foreign matter. Burrs or other projections of metal should be filed down before coating. The clean pipe should be left in a melted bath of pitch until the metal and dip are of the same temperature, which should be just sufficient to melt the pitch to a uniform liquid condition. The pipe, when removed, should have a smooth, uniform, black, glossy coating, 1/32 in. thick. and free from lumps. bubbles, or foreign matter. It may be profitable to wrap the cold-coated pipe with an overlapping strip of a tough yet flexible paper, or with cloth, and reimmerse the wrapped pipe in a slightly softer pitch only long enough to saturate and coat the paper or cloth. Coal-tar pitch may also be used for a field coating. Careful work is imperative, because one bare spot in a pipe concentrates there the whole corrosive effect of stray currents.

The Assam-Bengal Railway (India) enjoys the singular, if not unique, distinction of collisions between trains and wild elephants, five such cases having occurred during the second half of 1908. These animals abound in the Langting-Hathikhali and Bokajan-Barapathar districts, and are constant night trespassers on the railway line. It is said that the Governments of Eastern Bengal and Assam have under consideration the question of the introduction of Khedah or trapping operations.

The Selling Side

The Milwaukee Car Manufacturing Co., Milwaukee, Wis., has authorized the building of an addition to its erecting shop, to cost about $15,000.

The American Bridge Co., New York, has announced its intention to build a plant at Gary, Ind. It will have an initial capacity of 10,000 tons of fabricated steel per month.

The Harlan & Hollingsworth Corporation will build an addition to its plant at Wilmington, Del. The new building is to be 173 ft. x 300 ft., built of concrete and steel.

The Illinois Steel Co., Chicago, has announced that an additional structural mill will be built at the South Chicago plant. The new mill is to have a capacity of 15,000 tons a month.

The O. M. Edwards Company, Syracuse, N. Y., is to furnish the window fixtures on 80 cars for the Pittsburgh Railways, now being built by the J. G. Brill Co., Philadelphia, Pa.

John H. Nicholas, formerly assistant general sales agent the Lackawanna Steel Co., New York, has resigned to ...me vice-president of the Lackawanna Bridge Co., Lack... N. Y.

The Isthmian Canal Commission asks bids up to November 5 on leather belting, rubber valves, gaskets, iron pipe fittings, cable screws, dies and miscellaneous supplies. (Circular No. 541.)

Geo. W. Daves, at present signal engineer of the Chicago & Alton at Bloomington, Ill., has resigned and after November 1 will be connected with the signal department of the Railway Supply Co., Chicago.

W. C. Bradbury, 4269 Cook avenue, St. Louis, Mo., has joined the selling force of the O. M. Edwards Co., Syracuse, N. Y. Mr. Bradbury is to look after the territory adjacent to St. Louis and also the Southwest.

The Springfield Manufacturing Co., Bridgeport, Conn., maker of grinding machinery, has been bought by F. H. Brandes, who for the last thirteen years has been superintendent of the Bullard Machine Tool Co., Bridgeport.

R. D. Gordon has been appointed sales manager of the Miller & Vidor Lumber Co., Galveston, Tex., with headquarters at Galveston. This is a new office and does not conflict with the work of T. E. Meece, who remains with the company as sales agent.

DeWitt C. Smith, formerly manager of the paint department of the Joseph Dixon Crucible Co., Jersey City, N. J., has resigned to become manager of the Philadelphia branch of the Detroit Graphite Co., Detroit, Mich., with headquarters in the Land Title building, Philadelphia, Pa.

E. H. Symington, formerly manager of western sales of the T. H. Symington Co., Baltimore, Md., with headquarters in Chicago, who has been absent from duty for the past three years, due to injury sustained by being kicked by a horse, has fully recovered and has been stationed at the Rochester plant, Rochester, N. Y., as works sales manager.

Mr. A. L. Whipple has opened an office at 50 Church street, New York, and will handle several specialties for steam and electric roads. He will do business under the name of the Whipple Supply Co.

The meetings of the committee to decide on the place for holding the next convention of the Master Car Builders and Master Mechanics will be held in New York, November 10.

Mr. Guy H. Gibbs, who has been with the Westinghouse Electric & Manufacturing Company for the past eight years, four of which have been with that company's Cincinnati office, is now with the Western Electric Company at Cincinnati, Ohio.

The Garner Nut Lock Co. has been organized at Houston, Texas, with a capital of $50,000.

The net earnings of the United States Steel Corporation for the quarter ended Sept. 30, 1909, were $38,246,907, against $29,340,391 for the quarter ended June 30. The record of earnings covering corresponding periods in the last three years demonstrates how fully is established the recovery in industrial conditions. Detailed statements by months indicate a steady advance since the turn for the better in February, 1908. Unfilled orders on hand Sept. 30, 1909, amounted to 4,796,833 tons, against 4,057,939 June 30, 3,542,595 March 31, 3,603,527 Dec. 31, 1908, and 3,421,977 Sept. 30, 1908. The directors have placed the common stock upon a 4 per cent dividend basis by declaring a quarterly distribution of 1 per cent as against the previous rate of ¾ per cent. The common capitalization of the corporation is, roundly, $500,000,000. The increase in the dividend rate, therefore, of 1 per cent per annum will mean an increase in expenditure for dividends of $5,000,000.

The American Valve & Meter Company, it is announced, will erect immediately a $25,000 addition to its large plant at 1125 Gest street, Cincinnati, Ohio. Through Dwight S. Marfield, attorney, the company has acquired a piece of land on Court street with which when improved it will have a building with frontage of 110 ft. and depth of 90 ft. The addition will be of reinforced concrete and three or more stories in height, and is expected to be complete and ready for occupancy early in the new year. The company is engaged in the manufacture of railroad supplies, including Poage automatic water columns, switch stands, water meters, etc., for which the demand is steadily increasing. There will be some new tools required and a modern gas engine equipment for power.

The Safety Car Heating & Lighting Co. has just closed a contract with the United States lighthouse board for the furnishing of 18 B-III Pintsch gas buoys complete with lanterns and 20 additional Pintsch gas buoy lanterns. This order is another evidence of the popularity of the Pintsch system for harbor and river lighting. The entire 38 lanterns, above mentioned, are to be supplied with the inverted incandescent mantle which has proved so successful in service, many times increasing the projecting power of the lantern heretofore used.

The Pressed Steel Car Co., it is said, will open its Woods Run plant, which has been closed for a number of months, on November 1.

Within the last two weeks the Pilliod Company, Swanton, Ohio, has received orders for Baker-Pilliod valve gears for four consolidation engines for the Mexican Railway, two ten-wheel engines for the Missouri & North Arkansas, five Mallet compounds for the Norfolk & Western, 15 ten-wheel passenger engines for the Seaboard Air Line and six switch engines for the Central of New Jersey.

Charles F. Spalding, president of the Spalding Lumber Co., and director in a number of prominent companies, died at his home in Chicago, October 24. He was born in 1865, educated at Exeter academy, learned the lumber business in northern Michigan and at the death of his father took control of the first steel steamers on Lake Michigan.

Solid truss high-speed brake-beams, made by the Davis Solid Truss Brake-Beam Co., Wilmington, Del., have been specified for the 10 coaches ordered by the New York, Ontario & Western from Harlan & Hollingsworth. David solid truss brake-beams have been specified for the 750 gondola cars ordered by the Lehigh Valley from the Standard Steel Car Co., and the 250 gondolas ordered from the Cambria Steel Co.

The Western Elaterite Roofing Co., Denver, Colo., reports a constant increase in the demand for Elaterite roofing for roundhouses, shops and other railway buildings. This roofing has been in the western market for over ten years and is being recommended by railway companies and large users of roofing material as most satisfactory. Elaterite roofing consists of a base of Elaterite roofing cement reinforced with a burlap center and finished with a saturated wool-felt backing and a flake-mica surface. It is claimed it will give many years of service without any maintenance expense, as no recoating is required.

R. L. McIntosh, assistant mechanical engineer of the Missouri Pacific, has resigned to go to the Commonwealth Steel Co., St. Louis, Mo., at its Granite City shops. Mr. McIntosh was born in Milwaukee in 1879, graduated from the College of the City of New York in 1901 and served as special apprentice in the Susequehanna shops of the Erie, and then as mechanic in the West Milwaukee shops of the Chicago, Milwaukee & St. Paul. From 1901 to 1905 he was employed by the Northern Pacific as material inspector, engineer of tests, mechanical office assistant and shop assistant. He was made assistant mechanical engineer of the Missouri Pacific in 1906.

The Pacific Car & Foundry Co. has bought land at Portland, Ore., for a plant with a capacity for building 10 freight cars a day, as well as doing general repair work on locomotives. The company owns the W. L. Holman Co. plant in San Francisco, Cal., and is building a plant at Richmond, Cal., which is to have a capacity of 10 freight cars a day and eight passenger cars a month. The Holman plant is to be continued in operation for building passenger cars and street railway cars. The president of the company is H. A. Bowen, general superintendent of the National Dump Car Co. J. W. Riess, first vice-president, is general manager of the Holman company. W. H. Judson, second vice-president, has been connected with the American Car & Foundry Co. for a number of years.

The General Electric Co., Schenectady, N. Y., continues to show an improvement in business and its orders are running about 85 per cent. of what they were in the best year since the company was organized. Although sharp competition has narrowed the margin of profit on certain electrical apparatus, the showing of the company for the current fiscal year will be much more favorable than in the preceding year. A substantial surplus after the payment of the 8 per cent. dividend will be shown. The company has been spending millions of dollars for the purpose of remodeling and systematizing its plants, and the result has been a very material reduction of operating costs.

The Warner & Swasey Co., Cleveland, Ohio, is building a large addition to its new plant. The buildings are of single-story, steel and concrete construction, and equipped with electric cranes and other modern features. This new addition is to be completed by December 1st.

Mr. Edward C. Brown, who is manager for the Dearborn Drug & Chemical Works in the Hawaiian Islands and the Orient, has been elected president of the Commercial Club of Honolulu. This club is similar to the chamber of commerce and association of commerce organizations in the large cities of the States. This is an honor highly esteemed, and is an evidence of the high standing of the Dearborn company's representative in the Hawaiian Islands.

The Lakeside Forge & Wrench Co. acquired the plant of the Springfield Drop Forge Co., of Springfield, Mass., and began operations with a full force of men September 27, 1909. Mr. Eugene Childs, formerly connected with the Trimont Mfg. Co., of Roxbury, Mass., is the president and general manager of the company.

Personals

C. P. Ludwig has been appointed general superintendent of the Alabama Consolidated Coal & Iron Co. Ry., with offices at East Birmingham, Ala. He succeeds J. N. Vincent.

M. M. Myers has been appointed a general foreman of the Atchison, Topeka & Santa Fe Ry., at Wellington, Kas.

W. H. Kidneigh succeeds H. Giegoldt as a foreman of the Santa Fe at Waynoha, Okla.

P. J. Colligan succeeds J. G. McLaren as master mechanic of the Chicago, Rock Island & Gulf Ry., at Dalhart, Texas.

W. B. Embury succeeds W. J. Monroe as a master mechanic of the Chicago, Rock Island & Pacific Ry., at Chickasha, Okla.

H. F. Walbrand, Cedar Rapids, Ia., E. B. Van Akin, Eldar, Mo., J. M. Burford, El Dorado, Ark., and C. L. Bitzer Pratt, Kas., have been appointed road foremen of equipment on the Chicago, Rock Island & Pacific Ry.

F. J. Boyd, Chicago, M. J. McDonald, Manitou, Mo. and F. Connolley, El Reno, Okla., have been appointed assistant road foremen of equipment on the Chicago, Rock Island & Pacific Ry.

F. D. Mahaney, Grand Junction, Col., and J. H. Farmer, Alameso, Col., have been appointed master mechanics of the Denver & Rio Grande R. R.

In accordance with the Hine system of organization, the Houston division of the Galveston, Houston & San Antonio Ry., has discontinued the titles of master mechanic and division engineer and has made the following, assistant superintendents at San Antonio: T. C. Worthington, T. H. Mooney, C. E. Wright, E. F. Beaumont. In accordance with the same system, the following have been made assistant superintendents of the El Paso division: R. M. Hoover, D. W. Fitzgerald, C. R. Morrill, C. Wall.

Chas. M. Hays has been appointed president of the Grand Trunk Ry., with offices at Montreal, Sir Chas. R. Wilson having resigned.

A. E. Yohn, master mechanic of the Huntington & Broad Top R. R., has been promoted to superintendent, with offices at Huntington, Pa.

C. H. Jones has been appointed acting master mechanic of the Huntington & Broad Top R. R., with offices at Saxton, Pa.

J. F. Walker has been appointed a master mechanic on the Illinois Central R. R., with offices at East St. Louis, Ill.

J. L. Butler has been appointed the master mechanic of the New Orleans & Northwestern R. R., with office at Farriday, La.

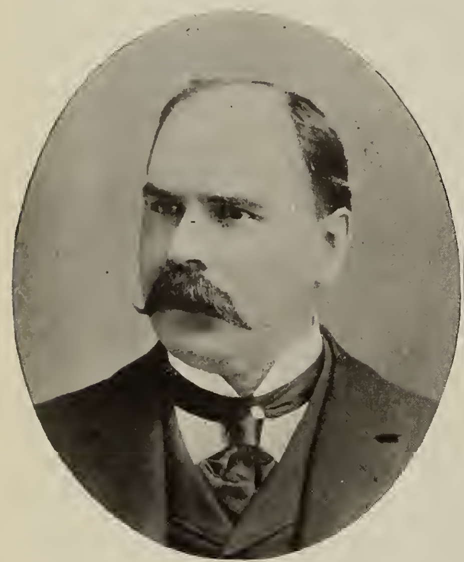
T. J. McPherson has been appointed master mechanic and master car builder of the Peoria & Pekin Union Ry., with office at Peoria, Ill.

Wm. Boughton has been promoted to general master mechanic of the Pere Marquette R. R., with office at Detroit, Mich.

E. F. Essick succeeds Wm. Boughton as master mechanic of the Pere Marquette R. R. at Saginaw, Mich.

A. Reid has been appointed air brake repairman of the Pere Marquette R. R. at Saginaw.

D. H. Deeter has been promoted to general master mechanic of the Philadelphia & Reading Ry., with office at Reading, Pa.



D. H. Deeter

John G. Neuffer

Wm. Boughton

W. M. Wilson, recently general foreman boilermaker for the El Paso & Southwestern system, has accepted a similar position at the Silvis shops of the Rock Island.

Ira G. Rawn, vice president of the Illinois Central R. R., has been appointed president of the Chicago, Indianapolis & Louisville Ry., taking effect November 1st. Mr. Rawn has been connected with the Illinois Central since 1903, having been made assistant to J. T. Harahan at that time. He was advanced rapidly through the offices of general superintendent of transportation, assistant general manager and general manager. Before going to the Illinois Central Mr. Rawn was general superintendent of the Baltimore & Ohio. He started his railroad service as a telegraph operator on the Baltimore & Ohio at Cincinnati twenty-nine years ago. He is 51 years old.

W. T. Dorman has been appointed a road foreman of engines of the St. Louis & San Francisco, with office at De Quincey, La.

W. C. Steers has been appointed assistant master mechanic of the Cincinnati, Hamilton & Dayton, at Lima, Ohio, succeeding J. J. Kelker, resigned to go to the Denver & Rio Grande.

W. L. Jones, general foreman, car repairs, of the St. Louis-Louisville lines of the Southern at Princeton, Ind., has been appointed general foreman, car department, of the St. Louis, Brownsville & Mexico, with office at Kingsville, Tex.

President S. M. Felton of the Chicago-Great Western Ry., has announced the appointment of John G. Neuffer as superintendent of motive power, effective at once, to succeed W. E. Symons, who is assigned to special service. Mr. Neuffer was until recently superintendent of machinery of the Illinois Central R. R. A short history of his life with his photograph was published in the August issue of the Railway Master Mechanic.

The Buying Side

Carr H. Butcher, purchasing agent for the Interstate R. R., was born in Maynardville, Tenn., August 1, 1882. In 1903 he entered Lincoln Memorial University from the commercial department of which institution he graduated in 1905. Until 1908 he was rapidly advanced in the employ of C. M. McClurg & Co., Knoxville, Tenn. He resigned his connection with this concern for his present position.

To Die No More

Ben Catley, one of the best known traveling men and experts in steel and iron, died after a surgical operation September 30, in St. John's Hospital, Allegheny, Pa., aged 75 years. He was useful beyond the privilege of most men. His life was an exceptionally active one, beginning as a boy in the English coal mines. He saw service in the Crimean War, followed by over half a century with Pittsburg mills, some of which have done passed out of existence. His earlier experience was with Reese, Graff & Woods, prominent in iron over 40 years ago. He was Government inspector of material and manufacture of ordnance at the Fort Pitt Foundry during the Civil War. He was later with Graff, Bennett & Co., and was associated with Robert Anderson, one of the pioneers in steel making and founder of Anderson, Dupuy & Co., now part of the Crucible Steel Company of America. He represented for many years the Carbon Steel Company, and for over 15 years, and until his death, was with the Zug Iron & Steel Company, serving the last two years in the capacity of manager of the bar department. Although his early life lacked school advantages, his desire to learn and his serious temperament made him a constant student, and his fine library of standard books and his frequent contributions to scientific and industrial journals and to the daily press testify to his mental ability and activity. He was a man of deep-seated religious conviction, and on frequent occasions ably filled the pulpit of his own and other churches. He was actively at work up to a few days before his death. He leaves a widow, three sons and two daughters.

New Literature

BOILER WATERS.—By Wm. W. Christie; 235 pages, cloth, 6x9; published by the D. Van Nostrand Co., New York. Price $3.00.

This book is something of a pioneer, the subject never having previously attained the dignity of treatment in a volume of its own in this country. Railroad men have been among the foremost in developing the soft water idea for steam boilers, and credit is given the Railway Master Mechanics' Association for its share in the progress of the work. The author treats the subject in an interesting way, while still introducing chemical analyses and tables enough to make the book one of great reference value. Each of the important subjects relative to the use of impure water for steaming purposes is handled in a masterful way. Water softening plants are given considerable attention and the illustrations, consisting of photographic reproductions and line drawings are so numerous as to assist the reader materially in obtaining an excellent knowledge of present day necessities and methods along this line of study.

A. E. Yohn

Carr H. Butcher

Benjamin Catley

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APPLIED MECHANICS FOR ENGINEERS.—By E. L. Hancock, Assistant Professor of Applied Mechanics, Purdue University; 382 pages, cloth, 5x7½; published by the MacMillan Company, New York. Price $2.00.

The author intends this work as a text-book for college engineering students in the Junior year, the book is essentially a text book to be used in connection with class room work, but is a valuable addition to the library of the engineer who finds that his memory is deficient along the line of mechanics at just the time he finds an application. Each new principal in the book is followed by several concrete applications and the study is therefore made more easy for the searcher for information in daily life.

* * *

FOUNDRY PRACTICE.—By James M. Tate and Melvin O. Stone; 234 pages, cloth, 5 by 7; published by John Wiley & Sons, New York. Price $2.00.

This treatise was compiled for the use of engineering students rather than for the practical foundryman. It is therefore somewhat elementary in its treatment of the subject. Its adaptation, however, is not confined to the college engineering course, for it furnishes a means for the technical man in commercial life to "brush up" on foundry methods when occasion demands. The authors are familiar with all the problems explained and the work is therefore an authoritative one. An interesting and useful feature of the book is a glossary of foundry terms and expressions. The book is now in its third edition.

* * *

OIL ANALYSIS.—By Augustus H. Gill; 175 pages, cloth, 5¼x8; published by J. B. Lippincott Company, Philadelphia and London.

This book, now in its fifth edition, was primarily written to meet the demands of the author's classes in technical analysis at the Massachusetts Institute of Technology. It is, however, a valuable reference book for any man who has to do with the selection of oils for any purpose. The work is divided into two parts, the first, made up of four chapters, deals with petroleum products, sub-divided into burning oils and lubricating oils; animal and vegetable oils, and a chapter on general considerations regarding lubricants. The second part, made up of four chapters, deals with examination of certain oils; vegetable oils, sub-divided into drying oils, semi-drying oils and non-drying oils; animal oils, sub-divided into the marine and terrestrial classes; and waxes. An appendix made up of tables, reagents and railroad specifications adds materially to the value of the book.

* * *

INTERNAL COMBUSTION ENGINES.—By R. C. Carpenter and H. Diedrichs, Professors of Experimental Engineering at Cornell University; 597 pages, cloth, 6x9¼; published by the D. Van Nostrand Company, 23 Murray street, New York. Price $5.00.

The more or less recent developments in the internal combustion class of prime movers have been so comprehensive that the mission of such an up-to-date work as this is one of wide scope. Fundamental and theoretical principals are covered in terms made as simple as possible. The book is divided into eighteen chapters, the headings of which furnish an insight into the general treatment of the subject. A few of these headings are as follows: Chap. I., Definitions and Classification; Chap. II., Thermodynamic Principals; Chap. III., Theoretical Discussion of Various Cycles; Chap. IV., Theoretical Cycles Modified by Practice; Chap. V., the Temperature—Entropy Diagram; Chap. XVIII., Cost of Installation and of Operation. A careful reading of the work cannot but give the searcher a comprehensive knowledge of the most modern practice in gas engine application and its value as a reference book can hardly be estimated. A chapter on gas engine fuels contains very interesting information as to the value, use and process of manufacture of denatured alcohol. The incorporation of this subject in view of recent developments, impresses the reviewer as an item of special value. The book is now in its second edition.

* * *

THE SAFETY OF BRITISH RAILWAYS.—By H. Raynor Wilson; 240 pages, cloth; 4¾x7¼; published by P. S. King & Son, Westminster, London. Price 3/6.

An analysis of the causes of accidents on English railways with a history of legislation on the subject, the book takes up in chapters the causes of accidents in the past, block systems, brakes, signaling, automatic couplings, footboards, tires, etc., each in its relation to the subject in hand. The author suggests in this work that whereas the accidents of the past have been properly ascribed to the errors in the Machine, the accidents of the present era are due to failures of the Man, the Machine being now perfected. The data in tabular form is obtained from the Government blue books, but as here compiled in a handy volume, it should be of much greater convenience to the interested reader.

* * *

THE A. B. C. OF RAILROAD SIGNALING.—By W. H. Elliott, Signal Engineer N. Y. C. & H. R. R. R.; 75 pages, cloth, 5x7¼; published by the Mackenzie-Klink Publishing Co., Chicago.

A lecture delivered before the Harvard School of Business Administration, this work is intended to serve as the first step of instruction in the art of railroad signaling. However, it contains an exposition of principals which would probably greatly assist the accomplished signal engineer. The book is profusely illustrated with photographic reproductions and line drawings.

* * *

LOCOMOTIVE MANAGEMENT FROM CLEANING TO DRIVING.—By Jas. T. Hodgson and John Williams; 383 pages, cloth, 5½x8½; published by the Railway Engineer, London. Price. 2/6.

Concerning the authors, Mr. Hodgson is mechanical superintendent of the Municipal School of Technology at Manchester, England; Mr. Williams is a locomotive inspector of the Great Central Railway. The book is primarily intended for the engine driver and, as its title indicates, it contains a compilation of the things he has to know in advancing from cleaner to driver. A mastery of its contents should make the student a master of the trade. Although book knowledge is not alone all that is necessary for such an end, yet a perfect mastery of the contents of this book would only be possible when combined with the knowledge gained from practical experience. The work is of interest to the American railroad mechanical man because its excellent and thorough treatment of the subject teaches many lessons yet unlearned in this country. The book is well illustrated with half tones and drawings, which greatly assist in the study of the text.

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SHOP TESTS ON ELECTRIC CAR EQUIPMENT.—By Eugene C. Parham, M. E., and John C. Shedd, Ph. D.; 121 pages, cloth, 5x¼; published by the Magraw Publishing Co., 239 West 39th street, New York City. Price $1.00.

The testing of electric car equipment is very conveniently done in the laboratory. In the car barns, however, there are numerous difficulties which arise from the lack of the instruments and facilities which the laboratory affords. This work is the first of two books designed to cover in a practical manner this problem. Simple explanations, illustrations, and practical examples are freely used in order that the information may be profitably used whether or not it is perfectly understood, current, voltage, and resistance measurements are taken up in the greater part of the book. Miscellaneous tests are treated in the remainder. Among the latter, barn men and shop men should find much of every-day application.

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METHODS OF THE SANTA FE.—By Chas. B. Going, 124 pages, cloth, 6½x9¼; published by the Engineering Magazine, New York. Price $1.00.

The five chapters comprising this volume were written by the author for the Engineering Magazine and appeared in the issues for March, April, May, June and July. The work was developed after a thorough study of the subject and while it contains much of the ordinary in railroad operation, there is much of interest in the expositions of problems and institutions peculiar to the Atchison, Topeka & Santa Fe Ry. The chapter on "Administration, Supervision and Extension of the Bonus System" appealed to the reviewer as an article of unusual interest and, in view of recent developments, should appeal in the same way to all railroad men. "Storekeeping and Manufacturing Methods" is given a chapter, which is an exposition of an excellent system. The book is well illustrated and beautifully bound.

* * *

STRUCTURAL DETAILS.—By Henry S. Jacoby; 368 pages, cloth, 6x9; published by John Wiley & Sons, New York. Price $2.25.

The author has created in this volume a work which corresponds to a course of instruction conducted by him in the College of Civil Engineering in Cornell University during the past nineteen years. In this course the students receive their first instruction in the application of the principles of mechanics to the design of the details of structures. Experience has shown that in many respects, problems involving timber construction are better adapted for this purpose than if confined to structural steel. Following this idea, the book is developed into an excellent and valuable treatise on timber construction work. Chap. I. contains the digested results of extensive experimental investigation and research. Since their theoretic and practical value depend largely upon the conditions under which the experiments are made, and the limitations of space preclude their complete description, the original sources of information are given in every case. The book, aside from furnishing a study of principles is one of great value for reference purposes.

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BUSINESS MAN'S HANDBOOK, MARINER'S HANDBOOK, ELECTRICAL ENGINEER'S HANDBOOK.—By the International Correspondence Schools. Each 3¼x5¼, cloth bound and with about 400 pages; published by the International Textbook Co., Scranton, Pa. Price 50 cents each.

These little books are full of information pertaining each to the subject as indicated by the title, that for the electrical engineer and the mariner are treatises of the subjects from the elements to proficiency. All of them contain tables and other data of every day necessity. The handbook for business men is necessarily more general in its scope, taking up business law, money exchange, mathematics, correspondence, etc. The books are well indexed in such a manner as to provide a means of easy reference. This book appears to the reviewer to be almost a necessity to all, whether or not engaged in business, as the information contained therein must often be procured in some manner or other.

* * *

INTERNAL COMBUSTION ENGINES.—By Wm. M. Hogle, 1909; 250 pages, cloth, 6x9, published by the Magraw-Hill Book Co., New York. Price $3.00.

This work is designated on the title page as a reference book for designers, operators, engineers and students. The writer has aimed to treat the subject from a practical viewpoint and involved mathematical discussions have been eliminated to a large degree. The history of the development of the internal combustion engine is given concisely in about four pages. Following are two short chapters on the four cycle and two cycle principles. The succeeding chapters on practical operation carburettors, producers, fuels and compression are well written, and show the writer as a man in touch with the practical side of the question. The last chapters are devoted to details of cam machinery, valves and ports, the cylinder, governing devises, etc. The last two chapters are devoted to engine testing.

* * *

GAS ENGINE MANUAL.—470 pages, cloth, 6x8½, published by Theo. Audel & Co., 63 Fifth avenue, New York. Price $2.00.

A work touching on almost every detail of the gas engine question, and well supplied with illustrations. A number of chapters at the beginning are devoted to the theoretical side of the gas engine. Producers, pistons, valves, governors, ignition, lubrication are taken up in successive chapters and a considerable portion of the book is taken up with descriptive and illustrations of various types and makes of engines. The book is concluded with chapters on testing, hints on management and the automobile.

* * *

THE GAS ENGINE.—By Forest Jones; 450 pages, cloth, 6x9; published by John Wiley & Sons, New York. Price $4.00.

A discussion of gas and oil engines arranged primarily as a textbook for class instruction and experimental work and also for commercial testing and operating. The general consecutive order is: Descriptive, operative, testing for faults, theoretical and results of trials. The book is well illustrated; in many instances short descriptions are given immediately underneath the illustration, which makes an understanding of it much more simple. In the concluding chapters, results of a number of tests at the St. Louis coal testing plant are given and also complete descriptions and results of a test on a 500 h. p. gas engine plant at Worcester, Mass.

* * *

A handsome souvenir booklet entitled Water Treatment has just been issued by the Dearborn Drug & Chemical Works of Chicago and New York. It contains descriptive and illustrative matter concerning the laboratory and manufacturing processes, and also a short chapter on the lubricating department.

* * *

The Rockwell Furnace Co. of New York has issued a catalogue of forging, heating and welding furnaces. Many different types of furnaces are shown, together with photographs and dimensions of same.

* * *

"The Crank Shaper" is the title of a new bulletin which is the first of a series being published by the Reliance Electric & Engineering Co. of Cleveland, Ohio. It gives valuable information regarding the power required to drive crank shapers and the productive efficiency of belt and motor-driven shapers.

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The Cleveland Twist Drill Co. of Cleveland, has a new leaflet giving dimensions and prices of its "Paragon" flat taper shank drills and sockets.

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A leaflet on the "Osborne" valve and coupling has been issued by the Osborne High Pressure Joint & Valve Co. of Chicago.

Proceedings of the 10th Annual Convention of the Chief Joint Car Inspectors' and Car Foremen's Association of America

The Chief Joint Car Inspectors' and Car Foremen's Association of America opened its tenth annual meeting Sept. 15, 16 and 17, 1909, at the Broezel hotel, Buffalo, N. Y., with President H. Boutet in the chair. W. H. Sanford, chairman of the entertainment committee, in opening the convention, said:

"Mr. President, Ladies and Gentlemen:

"It is indeed quite a pleasure for me to stand here before you. To be chairman of the entertainment committee is an honor that I thought at first was going to be a very difficult task, but I find it a very pleasant one indeed. Everything is coming along nicely, and I anticipate that you will all have a pleasant time. I am going to leave that to your judgment. Three or four days from now you can tell us all about it. In the absence of the mayor of the city of Buffalo, I take pleasure in introducing to you Councilman A. H. Burt, of the city of Buffalo, who will now address you in a few words of welcome."

Address of Councilman Burt.

I assure you I am somewhat embarrassed in appearing before you this morning, not having any preparation, and knowing nothing of the convention or the details of your work. Only a few minutes ago the mayor called me up by 'phone and asked me if I would kindly represent him in welcoming you to this the "Queen City of the Lakes." I told him that I could not take his place, but that I would be very glad to come over and say a few words for Buffalo. I said furthermore: "I want it distinctly understood between you and me that at any time you want to call for assistance from me, you are at liberty to do so, and I am at your command. Of course, you understand that is not political business. He belongs to an opposite political party from what I do. But when it comes to representing or doing things for Buffalo I am at his command."

I commend any organization that can be of benefit or importance or interest to this, the most beautiful city in the United States, which you will say before leaving it. I take great pleasure in welcoming an association of this kind to Buffalo, because as I understand you are an organization that are in the work seeking to better your condition and the condition of the traveling public in the safety of life and limb, by improved and better conditions, and in this I am also pleased to have told me that you are not only being assisted, but that your organization is promoted by the various railroad companies of this country. It certainly is laudible that the railroad companies are desirous, though it may cost them millions, to improve in any way and manner the equipment to better safeguard your lives and the lives of the traveling public. It is commendable on your part that you meet in a convention of this kind to confer with each other, thereby creating a better fellowship for the benefit of all.

We are pleased to welcome you to this city because we have a city of which we are justly proud. Our transportation facilities are equal to any other city on the continent. I speak with reference to the railway and water facilities here,—you know of them quite as well as I,—with reference to the numerous traffic lines centering in Buffalo and with reference to our many advantages here. There is much to see in Buffalo and I hope you will have an opportunity of seeing the most of it, because I think you will be so well pleased with our city that it will be your desire, if not your determination, to return to Buffalo to make it your future home. If you do, I assure you that we will welcome every one of you with open arms. I hope that your stay here will be so enjoyable that you will regret the parting and will welcome the day when you may return and become Buffalonians.

On behalf of the mayor of the city of Buffalo I greet you and give you a cordial and most hearty welcome. (Applause.)

Address of Mr. Brazier.

Mr. President, Ladies and Gentlemen:

I know how to sympathize with Mr. Burt; a few years ago I was in the same position as you were; I had to be the acting mayor. It is the fellows who are acting who have to do the work. I cannot, in behalf of the association, thank you for I am not a member of it, but as a railroad man who thinks a great deal of Buffalo, and in behalf of the New York Central, which I try to represent, I want to thank you for your very cordial reception, and to the mayor, through you, for your kind remarks. There is a great disappointment in store for you here today; our silver-tongued orator, Eugene Chamberlin, was to be here to respond. I left him at Niagara Falls yesterday. I have not come with any preparation whatever. I do not need any preparation to talk to car men, because I have come right up from where you men are.

Group of Visitors at the C. J. C. I. & C. F. Convention

I started railroading as a car repairer some years before some of you were born, and I know what it is to do hard work. I know what it is to go to a wreck and put in a pair of wheels without any help, so I want to ask your indulgence. I am going to talk plainly to you. If I sat down and wrote up a fine flowery essay it would not express what I want to say. I have a reason for it, because some car men who started railroading under me hold good positions today; another reason, there are so many of our own men here from the New York Central. Twice a year we have meetings of all our foremen in the car department. We believe in organizations of this kind and of the kind that helps to elevate our men. When I got up at the hotel this morning I wondered what I should say, and for fear I would leave out something I jotted down some notes to keep me on the track.

In looking over postal cards you will find a great many from which a great deal of common sense can be obtained. I found one which says: "The man who knows more than the boss generally gets to be boss; the man who thinks he knows more generally gets fired."

I want to say something about the probabilities that are in store for you younger men. You know in railroading those who hold positions do not know from one day to another how long they will be there. I hope to hold my position as long as I behave myself, but I would be false to my trust if I did not say something to you boys of the chance that you have today over the way it was thirty or forty years ago. There is not a railroad in America today but that is suffering from the fact that we cannot get the proper material to make good foremen.

I did not care whether the clock struck six or what; I was always ready to attend to my work. If I am a little egotistical I think you will appreciate it more if I give you a little history of how I advanced and the better chances there are today, especially in the west; the eastern railroads generally get into a rut and stay there. The man who took my place seventeen years ago is there now at the same salary that I drew. You boys out west never stay fifteen years; you either are bounced or advanced. Pull and influence cuts no figure whatever. I can refer you to our general superintendent of motive power; he began in a shop and advanced to foreman, round house foreman, superintendent of motive power and is now in charge of all this territory of the New York Central Lines—a common, every-day, approachable, lovable man; a man who wins men. That is the kind of a man who will succeed. Our general manager, Mr. A. H. Smith, was a bridge builder, superintendent, train master and now at the head of the New York Central railroad. Mr. Brown, the president, was a telegraph operator a few years ago, today he is at the head of the New York Central lines. So I say there is just as good chance for most of you here to advance if you go on the lines these men have, and not to be worried about pay-day or your advancement.

I can count three men—I will not give you their names—in here now. One, when I first came to the New York Central held a litttle position that didn't pay much; that man has been advanced until today he is one of the highest general foremen on the line. He has never asked for an increase in pay; everything has come to him unsolicited. The officials keep tab on a man who is constantly finding fault with his pay.

If a man is working in Buffalo and there is a position vacant at Syracuse and he wants it, he compares his work with the fellow down in Syracuse and that kills him. We advance our men and they all know that if there are any vacancies they are going to get them. I regret that once in a while we have to go outside to get a special man. The great trouble with men is that they want to be advanced too fast. They want to be superintendent the first thing. I want to say to you that no college can educate a man to be a handler of men. He has to know that he is handling men and not cattle. I want to impress upon you the necessity of getting all the education you can. There are evening schools that you can take a course in that will educate you, and you will find as you get older it will be a great help to you. But the point I want to make is: going through college will not make you able to handle men.

I regret to say we have had quite a number of bright men in the shop, but when they came down to handling men they have not been successful as we have desired. You men are the men, as they say in the army, behind the guns. If my work is in any way successful it isn't I that makes it so; it is the lieutenants under me who bring it up to success. I could do nothing alone.

Mr. Thompson has planned most of the entertainment for you and I know that he regrets his inability to be here. He has written me in the hope that I would be here.

I want to give you one more illustration of how men succeed. At a small station between here and New York, as I used to ride back and forth, I noticed the very trim condition of one man's shop. He has flowers out in the front of his place and it looked very neat. I asked who the foreman was at that point and was told. Slowly, step by step, that man has been advanced. He has been getting increased pay due to his management of his plant and because he got results.

I want to impress upon you young men the possibilities and grand chances open to you in the future by attending strictly to business. On increase of pay, I say the men who advance faster under me are the men who do not ask for an increase, but those who let their work shine.

There is a treat in store for you, as the silver-tongued orator has arrived. I want to say to you that I am glad to see so many of you here. I hope you will have a very pleasant and instructive convention. (Applause.)

President Boutet: We have with us today the silver-tongued orator, Mr. E. Chamberlin, of the New York Central, who will now address you. (Applause.)

Address of Mr. Eugene Chamberlin.

Mr. President, Ladies and Gentlemen of the Chief Joint Car Inspectors' and Car Foremen's Association of America:

It is most difficult to follow Senator Brazier. He is so felicitous and instructive, thoroughly grounded in a practical knowledge of the business, yet his heart is overflowing with the milk of human kindness, and on these occasions he permits me to shine "by reflected glory." In his family, consisting of about 4,500 men, it is impossible to determine which one is nearest to his heart, as he plays no favorites, but treats all with entire fairness and impartiality, and thus winning their full confidence.

I feel that I can say without fear of contradiction, that there is no body of men in the railroad service upon which rests greater responsibility than your own—no service requiring greater efficiency, more intelligence and quicker action in cases of emergency. Your judgment must be based upon absolute facts, for the reason that there is rarely an appeal from your decisions. You are in a sense "sentinels posted at the great gateways of traffic," and your signal may accelerate or retard the movement of freight. Your duties are fairly well defined by the Master Car Builders' rules; yet we must admit that the Master Car Builders' rules are subject to interpretations that are many and varied, thus requiring for their administration men far above the average of intelligence, and with a thorough, practical knowledge of the work.

Most of you will recall the time when freight cars were first delivered by the owning road to connecting lines, you were required to return them in the same condition as when delivered. This required a "post mortem" of every car offered in interchange to determine the responsibility, delaying traffic, causing controversy, and retarding the movement of traffic. Many of you here—some whom I have known personally for years—can recall the time when a man with a "chunk of chalk and a Scandinavian dialect" could tie up the entire traffic of your system. In 1896 there was a change in rules, involving a change of principle in which the car owner was made responsible for all defects, except those occurring from unfair usage. There was an immense improvement in the movement of traffic by that change, and the question now arises: "Are you ready for a further advance in the interest of our car efficiency, which is the vital question with railroads today?" Are you ready for a proposition that may further accelerate the movement of freight? If so, what have you to suggest? It has been remarked by men of intelligence and understanding in the railroad world that there remain two ways of securing traffic on lines where conveniences and tariffs are similar. First—by courtesy to the public and shipper; and second—by ability to provide competent equipment, and to deliver freight at given points in minimum time, or in less time than a competing line, and upon this subject I am going to refer to an article which my attention was called to a few days ago in a technical journal of some considerable repute, suggesting a marked change in present methods. I will say in advance that this article was as great a surprise to me as it possibly will be to you, and it is apparently so radical in character that we would both hesitate before subscribing to the doctrine; but it contains much that is food for thought and is deemed worthy of more than passing notice. Briefly quoting, it says:

"Quick, free movement of tonnage is the first thing to be considered in this country. This is especially desirable during a car shortage. Railroads should provide equipment competent to withstand the ravages of traffic and consider physical defects whenever occurring, as one of the hazards of the business. Making car owners responsible for the physical condition of their equipment under all circumstances instead of certain circumstances, will result in a more serviceable equipment and secure a more rapid movement of traffic. As inspection for responsibility absolutely results in a delay to traffic. Inspection for anything but safety is deplorable.

"Master Car Builders' rules based on 'honesty' are considered weak on this account. If this weakness be a temptation it is easily removed by placing at points of repair men whose duties are not only to look after the interest of the road making the repair, but the road for whom the repairs are made."

These are not my suggestions, but they are simply mentioned for your consideration.

I sat at the M. C. B. convention in Atlantic City last June and listened to a paper presented by a superintendent of motive power of a very important line, and if the facts recited in that paper were true—and there is no reason to doubt their veracity—the Master Car Builders' repair card stands condemned at the outset. Case after case was recited where bills had been rendered by railroads against other railroads that were "hazy" to say the least, in many cases where there was no evidence of repairs having been made. If that be honesty, gentlemen, the sooner some plan is adopted that does not bear this peculiar brand of honesty, the more money honestly managed railroads will have in their treasuries. We are a progressive race and should be honest. We are proud of the success of the institutions of this country; and none are greater than our railroads with upwards of 230,000 miles of main line, and in combination representing one-sixth of the wealth of the country; having an income four times greater than that of the federal government, and employing in one capacity or another, one person in every sixty-two of our enormous population. Corporations having their affairs administered by men of courage who do not fear to build for the future; who look forward to a scheme for rewarding the faithful servant so that the latter days of his life may be passed in peace and comfort; corporations who are spending considerable sums of money for the education and advancement of your son and my son, or some other man's son—possibly who has not had the advantages of a common school education—placing these boys in great railroad shops under competent masters that they may be efficiently instructed, enabling them to take up the burden and carry it with greater ease than their fathers, who must soon lay it down—all commendable—all most worthy objects, that are certainly entitled to our sincere appreciation.

Gentlemen, you and I have the honor to serve (in a modest capacity perhaps) these great corporations. Upon them we depend for our livelihood, and it seems to me that common decency and our manhood requires that we should give them in return our best thought and service. I was brought up in the school which you are serving, and I want to say as I look into your faces this morning, that I believe that you men here, and we sincerely trust the men who follow you, are giving and are going to give a most excellent account of this stewardship.

In conclusion we would be deemed most unchivalrous were we not to ask you gentlemen to join in paying our most profound respects to the ladies who grace this occasion and dignify it by their presence. There is no audience that I prefer to talk to more than the ladies, but always when they are alone, when the gentlemen are not present. Ladies, the mere fact that you are here in attendance upon the good men of your families here.

with your kindly words, with your patient ways, with that great loving tender heart of yours—places the seal of dignity and approval upon this convention, or any other, that may not be derived from any other source. And on this beautiful morning we stand before you with uncovered heads, in an attitude of respect, paying this public tribute to your many virtues. (Applause.)

Mr. T. J. O'Donnell being called upon, responded as follows:

Address of T. J. O'Donnell.

Mr. Chairman of the Entertainment Committee, Ladies and Gentlemen:

I feel keenly the timidity of being selected to reply to the golden remarks of such high-minded and broad-gauged gentlemen as Mr. Brazier and Mr. Chamberlin, who have just addressed you. However, I deem it a high honor in our home city to say a few words in response to such remarks and I trust that you will have indulgence with the same. Some ten years ago, when I was connected with Mr. McBeth on the rolls of the New York Central, when that broad-minded liberal official, A. M. Waitt, with whom many of you are thoroughly acquainted, came to the New York Central, the rumor came around that a gentleman named Brazier was to succeed in the car department. Naturally us subordinates pricked up our ears as to what kind of a man Mr. Brazier would be. I remember his first visit to the office that I was associated with. When he came in with Mr. Waitt the first glance at the gentleman gave us all confidence that we were safe in our positions. He said: "Good morning, ladies and gentlemen. I hope you are well," in that cheerful way that gave confidence without any further ado. Since that time Mr. Brazier has kept up to that high standard with the subordinates on the lines he represents, and at the present time, while I haven't the honor to be directly associated with him, still the New York Central and its allied lines have a greater part of the interchange on the frontier and naturally a good share of my duties come in contact with Mr. Brazier as his subordinate. And I think I voice the sentiments of this body in stating that it is the earnest wish of this convention that Mr. Brazier and Mr. Chamberlin and such men who are controlling the destinies of the railroads at the present time, may long be spared to guide the helm of ship and that the wisdom and strength may be given them to carry on their work successfully, and when they reach the Great White Throne they may hear these words: "Well done, good and faithful servant."

Now, Mr. President, on behalf of this association I am going to move that a rising vote of thanks be given to the two gentlemen for the time they have given this body this morning. I know personally that they have come from long distances at great sacrifice to be with this association.

Seconded by many and carried unanimously.

Address of President Boutet.

Gentlemen:

It will be necessary for me to repeat what I said to you last year, that it was with a great deal of pleasure that I am again given the honor of addressing you as your president at this, our tenth annual meeting, and the fourth time that I have had the honor for which I desire to express my thanks.

During the last year your executive committee held two meetings, one in Cleveland on January 23, at which meeting several recommendations were made to the M. C. B. Association, regarding interchange rules, some of which caused Rule 125 to be changed and Rules 127 and 128 to be taken out of the book. Other changes recommended by us were not adopted, but have caused considerable discussion both pro and con, and in making recommendations for changes, it would be well to bear these in mind.

The other meeting was held here in Buffalo on April 18, to select a place of meeting and make necessary arrangements.

Our association has continued to steadily grow in membership and influence, having had some very kind praise given to it by some of the officials of the railroads and railroad papers.

The increase in membership during the year was 51.

I would like to call the attention of our members to the matter of making bills against car owners, to be sure that in all cases the repairs have been made in accordance with the bills rendered and that M. C. B. repair cards put on cars covering all repairs made.

There is no question but that the M. C. B. rules have been the only means by which the railroads of this country have been enabled to transact the business of the continent, and without them it would be impossible to conduct the transportation that is necessary to carry the different products of any portion of the country to the markets of the world, but the M. C. B. rules are based on honesty and it is absolutely necessary that each and all of us use every endeavor to maintain them in their entirety.

If we can see anything that we believe would improve them we should suggest these changes to our superiors for their consideration, bearing in mind, however, that the officers who have charge of these matters have a larger field to look over than we have, and while we may think that the changes would be beneficial, they may see something from another standpoint that would make the changes detrimental.

I would suggest that you change Article 2 of the constitution to read as follows:

The object of this association shall be to provide an organization, through which its members may agree upon such recommendations to the M. C. B. Association that will, if possible, bring about an absolute uniformity in interchange of cars at all interchange points in America.

The rest of the article to remain as printed.

Change Article 4 to read as follows:

The officers of this association shall be a president, vice-president, secretary and treasurer, five elective members, they with the other officers shall constitute the executive committee, of which the past president shall be the chairman.

We will have some very important papers read at this meeting, some bearing on interchange, and I would invite your close attention to the reading, especially of the paper prepared by Mr. F. M. Lucore, of the American Railway Association (published in the October Railway Master Mechanic), and one by Mr. L. D. Roberts, manager of the Pueblo Joint Car Inspection and Interchange Bureau (published in the October Railway Master Mechanic.)

While you may think you are getting along all right with your system, you must remember that the railroad officials of this country are constantly on the alert to improve conditions in all lines of service, and if we would hold our own or advance it is necessary for us to keep up with all improvements whether with interchange, construction or repairs of cars.

Since our last meeting death has invaded our ranks and taken Mr. John Whorle, chief joint car inspector at Columbus, O., from among us, his death having occurred Dec. 6, 1908. His funeral was attended by quite a number of our members and an obituary appeared in the January issue of the Railway Master Mechanic.

I trust that we will have as good an attendance of the members present at all meetings as we have had in the past, and that as much interest in discussions may be taken. If so, I guarantee that none of us will leave Buffalo without having learned something that will be of much service to us in our positions and will well repay the company for sending us here.

I wish to thank the officers for helping to make this meeting the success I feel that it is going to be, especially our secretary, who has been untiring in his work during the past year.

I wish also to thank Mr. T. J. O'Donnell, one of our executive committee, for the active interest he has taken, as I feel that the work of the other officers of the association would not have been able to make our stay in Buffalo one-half as interesting or enjoyable as it will be, because of the lively interest taken by him and the car foremen of Buffalo.

I also wish to express my thanks to the entertainment committee and the contributing firms for their generosity in helping to make us all enjoy ourselves and that they will always be remembered by us. I feel sure that each of us and the ladies, too, will greatly appreciate what has been done for us and will always remember with a great deal of pleasure our trip to Buffalo.

Mr. Sanford: I think most of you have the little cards which give an outline of the entire proceedings for the three days. The ladies will take an automobile ride around the city while the men are holding their meeting. At 9 o'clock this evening there will be a reception at the hotel and informal dance. To-morrow at 2 o'clock all the ladies and gentlemen will take the train and go down to Niagara Falls. Automobiles will take us around the grounds and we will take a trip around the Great Gorge Route; then to the International hotel, where a banquet will be served at 8 o'clock. There will then be dancing until 11:10.

Secretary Skidmore read his report as follows:

Secretary and Treasurer's Statement of Receipts and Disbursements, from September, 1908, to September, 1909.

RECEIPTS.

On hand Sept. 7, 1908	$52.14	
Received from entertainment committee	18.72	
Received from social members as dues	130.00	
Received from active members as dues	197.00	
		$397.86

DISBURSEMENTS.

Two (2) photographs of Detroit convention	$ 2.00	
Subscription for the Railway Master Mechanic	176.00	
Expressing convention proceedings to Chicago	.90	
Chas. Waughop for badges 1906 convention	5.50	
Secretary, salary 1907 and 1908	10.00	
Floral piece sent to John Wohrle funeral	10.00	
Rubber stamp	.50	
One month's rent of typewriter	2.50	
Printing invitations, letter heads and envelopes	13.00	
Postage	17.50	
Stenographer	26.50	
Executive committee and secretary's expense, arranging for Detroit convention	24.00	
Entertainment committee	100.00	$388.40
Balance on hand Sept. 8, 1909		$ 9.46

130 active members in good standing.
30 active members delinquent.
55 social members in good standing.

215 Total

It was moved that the report of the secretary be received and referred to the proper committee. Also that that part of the president's report referring to amendments or changes in the constitution be referred to a special committee of three to present the amendments in proper shape before this convention for its adoption.

Motion seconded.

President Boutet: There is something hanging on that. The committee will not be able to report at this meeting, and I would suggest that you refer it to the executive committee with power to change.

Mr. Trapnell: That is not in order. I do not believe that any legislative body of men can confer the power upon an executive committee to change a special law. That should be done by the legislative members themselves, because while the executive committee may feel that this would be all right, the organization might not so construe it. Therefore I consider your remarks not in order.

President Boutet: I can state that the remarks made by the president are perfectly in order. If this body sees fit to leave the wording of this to the executive committee it is just as legal as it would be if made by any other committee. I am not in a position to state why I am asking for that, but it is in harmony with the association.

Mr. Lynch: Is that in order to change the by-laws? It is usually done by a two-thirds vote of the members present.

Mr. Trapnell: For an explanation to the body here assembled, the president advises me why he does not want it done at this time, or until later in the session. Therefore, with the permission of my second I will withdraw my motion.

Discussion of M. C. B. Rules.

Mr. O'Donnell: The usual plan is to go through the book of rules, rule by rule. Why wouldn't it expedite the business to simply take the changes.

Rule 5.

Mr. Schultz: I would like to have that rule thoroughly discussed. Cars are accepted on record and the rule requires that a defect card be placed upon the car at time of interchange. This rule has not been lived up to throughout the country. In Chicago we are accepting cars on record. It must be contrary to this rule.

Mr. Pierce: The changing of that little word is of deep significance. If our friends on the banks of the Mississippi and elsewhere will only follow that rule the railroads of this country would be justified in saying to the members of this association: "Well done, thou good and faithful servant."

Mr. Schultz: The question has not to my knowledge been brought up there. It may have been discussed at a meeting Monday night when I was not present, but the fact is that the rule is not being lived up to; cars are being run on record the same as they were before.

Mr. Waughop: I have heard of this place called Chicago. The Master Car Builders in making that change from may to "must" were entirely correct. It must be done. It is a positive order. Possibly Chicago will get in line with St. Louis, which is correct.

President Boutet: We must not discuss what we are doing at our different points. We are discussing M. C. B. rules—what is the proper interpretation. Let us base our remarks on them.

Mr. Schultz: I wanted to get a general understanding as to what the sentiment was in regard to this rule.

Mr. Lynch: I think the rule is generally understood. My interpretation of the rule would be just as it reads, and that all railroad companies must adjust themselves to that if they wish to live up to the rules.

Mr. O'Donnell: I think the spirit of putting that word "must" in there, as Mr. Lynch states, was to more clearly define the carding of defects; but if certain railroads at any certain point see fit for their own best interests to interpret certain rules on the interchange of cars, I fail to see what interest it would have to a point 800 miles away from that point. If you wreck a car you put on a card for the receiving company. If you wrecked a car six months ago and it is soon to be dismantled, we hesitate to give away $40 or $50 for a car to go to the scrap heap. I leave it to you which is the best rule.

Upon motion duly carried the subject was passed.

Rule 7.

Mr. Barnabee: I would like to hear from some of the members present as to what a brake burn is.

Mr. Waughop: It is a skidded wheel.

Mr. Trapnell: I would like to ask Mr. Waughop if a wheel cannot be burned without being skidded.

Mr. Waughop: It can.

Mr. Trapnell: A burned wheel or a brake burn is not a slid flat wheel, but a wheel caused to be coned—burning the chill of the wheel by long application of the brake.

Mr. Charles Hitch: I believe it is a wheel that has been slid on a rail probably 1½ or 2 inches; some point under the limit of a skid flat wheel. That wheel remains in service anywhere from six to eight months, probably a year. I never in all my experience, and I have had 23 years' experience, have removed a wheel from any equipment due to defect mentioned by my friend on the right. I have seen them where they have been discolored from heat—the brake shoe wearing on the wheel from long application of the brake, but I never have had occasion to remove one for that cause. I have seen hundreds of wheels removed because of coning or shelling out. Where a wheel has been slid upon a rail you will find that the shelling out is at the center. A shelled out wheel not due to sliding has a raised center. You will find it in circular form with a raised center to it. In that way a brake burn is caused by sliding on the rail.

Mr. O'Donnell: Upon the request of Mr. Thompson I have placed some cards at the disposal of this body to be filled out in order that transportation will be provided for the trip to the Falls and around the Gorge Route. Mr. McEwen requests the name and title of each person who desires to make the trip.

Secretary Skidmore: In filling out the card be careful to give the correct name and address, as I expect to use the same card to obtain addresses to which I will have the Railway Master Mechanic sent.

Mr. Brazier: As a member of the Master Car Builders' Association I regret that I have not the proceedings of our last convention here. I wish you might see the discussion on brake burns. If you will look at what that association has said on it you will see that you can either save or spend a lot of money if you do not quite understand the position that the M. C. B. Association takes on brake burns. I was brought up to believe that wheels should be made of such material that they would stand an ordinary brake and not have the shelling caused by heating. I am not sustained in this by other people, and our discussion at Atlantic City will give you some very interesting points. I know the New York Central wants every benefit to which it is entitled, and this means bread and butter to every road represented.

It was moved by Mr. O'Donnell that the discussion close.

Rule 17.

Mr. O'Donnell: Rule 17 covers the delivering company's defect. As I understand it, steel tired wheels are included in this rule. That has come up with a number of foremen in Buffalo and it was taken up at their last meeting. If you slide a car having steel tired wheels, and you secure a defect card from the delivery company, how does the owner secure recompense for the loss of the metal to those wheels? Is it the Master Builders' intent that they shall be reciprocal?

Mr. Waughop: Is this a freight car?

Answer: Freight car moving with steel wheels.

Mr. Bradley: I think in that case the delivery company would get the defect card from the receiving line for the slid wheels; the receiving road in turn should bill the delivering company and forward the defect card to the owners for the loss of metal. They would in turn reimburse the owner of the car for the loss of the metal.

President Boutet: How would you go about it to reimburse the owner of the car? A had delivered to B one of C's cars. A gave B a card covering a pair of slid flat wheels 2½ inches in length. B removes the wheels and turns up the tire. How does C get any pay for the loss of metal?

Mr. Bradley: In my judgment the owner is entitled to reimbursement for the loss of metal off of that tire. The receiving company is doing the work and they have a perfect right to charge the delivering company for the work and also for the loss of metal. If the owners are to receive reimbursement, in my opinion, that is the only way they can get it from the party who does the work. The party who turns the wheels is only entitled to the labor, but there is a shortage on that tire and he is also entitled to charge for the loss of metal to reimburse the owner.

Mr. Cleary: Why not apply Rule No. 9 for passenger coach?

Mr. Waughop: I recommend that we recommend to the Master Car Builders that that rule be made to conform to passenger rules in regard to loss of metal.

Mr. O'Donnell: Why not write to Mr. Hennessey, chairman of the arbitration committee, and ask for a ruling on the subject?

President Boutet: They will not decide a question unless they have a case presented to them.

Mr. O'Donnell: You are right about that. We have a number of men here who are not members, but who can give us valuable information. I ask that they be given the privilege of the floor.

President Boutet: It has always been the custom to accord the privileges of the floor to any railroad man present. When it comes to voting the vote remains with the members only.

Jas. Stark: Let us have an expression on how the matter of a steel tired wheel is to be disposed of if turned down by other than the owner. To me the rules do not make any provision for reimbursing the owner of a car for loss of metal and service if the wheels are turned down by other than the owner.

Mr. Schultz: I do not believe there is any provision made to reimburse the owner in a case like you mention.

Mr. Brazier: I do not like to cross a bridge before I come to it. The Pennsylvania has many thousands of steel wheels running; the New York Central has thousands of cars running, and I think you should make a recommendation to the Master Car Builders that some provision be made and that future rules should cover it. If it were put up to me I would tell the boys to turn down the wheels and say nothing about it.

Mr. Waughop: What is a slid flat wheel under the rules? I have always claimed that a wheel must measure with the gauge 2½ flat. If there is two flat spaces I won't condemn it.

President Boutet: This association has decided that a slid flat wheel must be slid flat 2½ inches at one point and the gauge set down flat.

Mr. O'Donnell: Under our agreement here if a wheel is destroyed up to the limit of 2½ continuous around the tread, we give a defect card.

Mr. Kipp: If it don't go 2½ we don't remove it.

Mr. O'Donnell: Our agreement is based on honesty and fairness and I consider it is dishonest to compel a man to take out a wheel and not be paid for it. We charge the delivering company for slid wheels if the wheel is destroyed—if the depth is such as to destroy the wheel. If the depth is up to 2½ that wheel is no good. I do not think it an injustice. It is reciprocal. We get cars with seven or eight wheels that are destroyed. It is a matter that the arbitrator is paid to decide and he does it.

Mr. Bradley: Where they are numerous and they do not come up to 2½—this gentleman stated that he had two spots, one after the other, he would not give a card. I do not think that is safe to run. If you have two spots and they measure 2¼ inches you have 4½ inches of slid bottom on that wheel and I do not think it is safe to run.

Mr. Waughop: We understand it isn't safe to run, but what is the rule.

Mr. Bradley: I would like to ask what you would do in a case of that kind?

Mr. Waughop: I would simply pass it on and let the foreman do what he pleased with it.

Question: Under the rule can you charge the owner?

Answer: I would not charge the owner.

Question: How is the receiving company going to be reimbursed for the wheel?

Answer: Run the wheel.

Question: You say it isn't safe to run?

Answer: I said I would not consider it safe to run.

Mr. Stark: I move we decide by a vote of this body whether it shall be straight 2½ inches or card for less.

Mr. Green: I think the rule is decisive that it must be slid flat 2½ inches.

Mr. Schultz: I move you that it is the sense of this meeting that cars delivered in interchange, slid flat wheels must be 2½ inches to be a delivering line defect, at one or more places and the gauge must set down flat as per figure 3.

Charles Hitch moved to amend so as to cover flat spots so numerous as to endanger the safety of the wheel.

The question was put upon the motion and carried, with several dissenting votes, however.

Rule 22.

Mr. O'Donnell: Is every bent axle unfair? According to that rule you cannot consider a bent axle except as an unfair defect. I think we see numerous cases where axles are bent in ordinary service.

President Boutet: It does not say that.

Mr. O'Donnell: Do you charge the owner for it?

President Boutet: No.

Mr. Waughop: You cannot do it. You have to card the defect in interchange.

President Boutet: That is in interchange.

Mr. Waughop: This is interchange I am talking about.

Mr. Bradley: That rule says "axles bent by unfair usage." There was no evidence to show that the car was derailed.

Mr. Waughop: You charge to the owner, but do you expect to get paid for it? The rule is plain. An axle bent is strictly cardable whether fair usage or unfair usage.

Rule 31.

President Boutet: If a car is delivered from one line to another with the inside parts of a triple valve missing, it is considered delivering line defect.

Mr. Head: We have always taken the position that robbed parts is unfair usage.

Is it necessary to have the diameter of a hose branded on an M. C. B. standard hose to make it interchangeable?

President Boutet: If applied after September it would be necessary to comply with M. C. B. rules. That is the understanding I have of it.

Mr. Head: The rule reads very plainly: "Cars equipped with 1¼-inch M. C. B. standard hose and so branded." Does that mean the diameter? We had that question up with the Pennsylvania people at Ft. Wayne. There are a great many 1¼ hose that are stenciled but some are not, but the Pennsylvania company has decided that all hose offered in interchange should bear the complete M. C. B. label including the diameter.

Mr. Waughop: If it is not M. C. B. standard it will be removed, the proper hose put on and charged to the delivering line in interchange.

C. Stark: The rules do not specify any certain size for M. C. B. standard. We have 1 inch hose labeled M. C. B. and 1¼ and 1 3-8. I cannot understand why it should be removed and charged to the owner.

President Boutet: What is the M. C. B. requirement after Sept. 1?

C. Stark: That is what I want to find out—how the members understand this in regard to M. C. B. standard hose. I have seen repair cards attached to cars since Sept. 1, reading "Applied one M. C. B. standard air hose." I want to know whether a 1¼ hose would be standard to a car that was manufactured prior to Sept. 1 and applied after Sept. 1.

Mr. Jones: M. C. B. specifications call for 1 3-8 hose. A car delivered at an interchange point is a cardable defect after Sept. 1 unless you apply a 1 3-8 hose. It is so lettered on the label. The air hose has to show in raised letters that it is 1 3-8 hose.

Mr. Cass Hitch: M. C. B. standard air brake hose is 1 3-8 inch and bears the stencil M. C. B. and also has a serial number, showing application. I understand that a 1¼ air brake hose, M. C. B. applied prior to Sept. 1, 1909, is acceptable. All other hose are regarded as not M. C. B. hose.

Mr. Gainey: I will agree with Mr. Hitch, but I want to say that there are a great many hose that have been made and running for the past year which are 1 3-8 and are not stenciled. They have all the labels except that, and I do not know how any one will condemn them, although they haven't that number. The M. C. B. rules state that it must be on the back of the hose. We have probably 1,600 hose which are all 1 3-8 inch; they are M. C. B. hose in every detail except they haven't the number on them. There is no reason why they should be changed just simply because that is left off, and there is no technical point that will come up in the billing. There are a great many inspectors who have been putting 1¼ on their repair card until their attention was called to the 1 3-8 standard size.

Mr. Jones: How are you going to determine the size of an air hose when it is delivered at interchange points unless it is so stenciled? If it is not stenciled, it is a cardable defect.

Mr. Pierce: Our chief joint inspector some time ago addressed a letter to the foremen of our territory asking their opinion of the matter. I told him that I was not very much interested; that the Big Four for the last three years has been putting on 1 3-8 horse and it was so branded; but it is a question with me whether the Big Four is in line now or not. While we have been furnished hose branded 1 3-8 previous to Sept. 1, we have received 1,200 hose for application since Sept. 1 with M. C. B. Standard branded on it, but it does not say whether it is 1¼ or 1 3-8.

Mr. O'Donnell: We do not remove air hose that is stenciled M. C. B. when we know in our own minds that it comes up to the standard with the omission of the figures 1 3-8. We consider that it is an injustice to take off an air hose and charge the car owner or the delivering line when we know it is 1 3-8 and it is stenciled M. C. B. I think the intention was that it would not actually require the lettering on. I know lots of roads are furnishing hose on that basis.

Mr. Carr: If you take rule 33 and read it as it is, it does not say that any hose of that size could be accepted unless it is branded. I do not know how any inspector is going to determine which hose is correct. If you take rule 130 you will see that these objections are not allowed; 1 3-8 and so stenciled is the only hose that will be acceptable after Sept. 1.

Mr. Lynch: It is my opinion that the rule is wrongly worded. If I take the recommendation adopted by the arbitration committee correctly, the word "manufactured" should be substituted for the word "applied." At Cleveland air brake hose lettered M. C. B. standard will be accepted regardless of when it was applied. Our instructions to inspectors are that cars equipped with air brake hose other than 1 3-8 M. C. B. standard and so on; 1¼ M. C. B. standard hose and so branded, manufactured prior to Sept. 1 will be accepted in interchange. Were we to enforce the rule and note literally, it would work a very great hardship on all railroads in the country today. I know one road entering Cleveland that has ten different serial numbered hose on which the size is omitted, manufactured July, 1909. Another is similarly situated; while others have hose branded M. C. B. standard, 1¼, yet the inside diameter is 1 3-8. The error is in the manufacture and I think we should accept air brake hose in interchange that are branded M. C. B. standard, regardless of when they were applied.

Mr. Brazier: My understanding is the same as Mr. O'Donnell's. The words M. C. B. Standard ought to be sufficient, but I do not want to stop the dicussssion on it. A circular letter should be issued. I can readily see the technicality. The hose should meet all requirements and we ought to be honest enough to pass it if it does. I will see at our next meeting if they think it is important enough to issue a circular letter. There is a chance for an argument.

Mr. Waughop: Don't you think it would be proper in issuing a circular of that kind to specify "M. C. B. Standard, 1909?"

Mr. Brazier: That is my understanding and I meant to incorporate that.

Thereupon an adjournment was had until afternoon.

WEDNESDAY AFTERNOON SESSION.

President Boutet: I want to call your attention to two or three rules upon which motions were made to close the discussion, but there was no motion made that such and such was the sense of the meeting. What is the use in discussing a rule if we do not understand what the sense of the meeting is?

Mr. Stark: I was going to suggest something along the same line. We ought to come to some conclusion from the discussion here this morning. I find there was a varied difference of opinion, and if it were possible I wish we might have a committee appointed to draft a clause or resolution defining the sense of this association. It occurs to me that the executive committee would be a proper committee to prepare such a resolution, and if it is in order I would move that they draft a resolution, defining, if possible, the sense of this meeting with reference to rule 33.

Seconded and carried.

Mr. Hogsett: I believe it is the sense of this meeting that all cars offered in interchange, branded M. C. B. Standard, be accepted regardless of whether they are marked 1 3-8 or not.

Rule 35.

Mr. Vittum: There has been some discussion regarding this rule and there has been some question about the original interpretation. It necessitated calling together our executive committee to prepare some interpretation on the rule; therefore I bring it before this body that we may decide in our own minds what the interpretation is. Rule 35 makes missing air brake hose, and so on, delivering line defects and also makes them delivery line defects when damaged by unfair usage. We held and it was so decided in our executive meeting that all of these parts were delivering line responsibility except pressure retaining valves broken when the end of the car was broken from the inside out, it was owner's defect. Therefore under such condition the pressure valve would be owner's defect.

Mr. Carr: All of those defects are delivering line defects and joint inspectors have a right to card for same.

Mr. Stoll: Toledo interprets Rule 35 something similar. The arbitration committee has also decided that when retaining pipes and valves are broken, not due to rough usage, that the owner is responsible.

President Boutet: I went before the arbitration committee and stated that there was a question as to whether the interpretation given at Cincinnati was correct or not and would like to have them decide. The answer was: "If you want to get a decision on that you will have to bring up a case before the arbitration committee."

Mr. Stoll: There is an arbitration decision in which the committee says that the car owners are responsible for retaining pipe or valves broken from fair usage.

President Boutet: That question was as to a car in interchange; that is what the matter came up about. This association decided last year that a broken retaining pipe and valve was owner's defect unless the car showed signs of rough usage. Do you wish to take action on it at this time?

Mr. Charles Hitch: It appears to me that these items enumerated in Rule 35 are defects caused by damage to a car. The rule reads clearly: "Also pressure retaining pipe when damaged by rough usage." I infer that that rule means any of these items that were damaged through the damage to a car and unfair usage.

Mr. Vittum: I would like to have a thorough discussion from the fact that we have authorized defect cards for any of those except under those conditions; the delivering line is responsible. This is a serious question: it means the issuance of a great many defect cards. If we are wrong in the matter I would like to know it. I hold that they are all delivering line defects except under the conditions specified in the last clause of this rule.

Mr. Stark: I think there is a decision, case No. 655, which states quite plainly and in a very few words that none of these parts can be broken under fair usage, and I do not think there is much chance for a discussion.

Mr. Carr: I think there is a difference in the construction placed on that rule and we claim that in case a car is delivered with a pipe broken loose from the triple valve it is the delivering company's defect.

Mr. Shultz: It seems to me that the intention is in order to make this a delivering line defect, the car itself must show evidence of rough usage.

President Boutet: To get it before the house plainly, suppose you make that as a motion.

Mr. Schultz: I move that it is the sense of this meeting that Rule 35 be interpreted to mean that damage to pressure retaining valves and retaining pipe, when the car shows no evidence of rough usage, be considered an owner's defect.

Mr. Carr: By looking at Rule 30 you will see the bracket to include these two rules. When you look at Rule 35 you will see that the bracket includes 33, 35 and 36, and it says "delivering company responsibility." The rules today are to have the air brakes in first-class condition and they are not in first-class condition when the retainer pipe is broken. We want every retainer valve we can get. When you say it is delivering company's defect you release the road from responsibility. The object of the rule is to keep the air brakes in first-class condition.

Mr. Gainey: Regarding the way we handle the matter at Cincinnati, there isn't must left for me to say. If a pressure retaining valve is broken by the end being forced out we won't card for it.

President Boutet: Suppose it is broken at the end sill and the pipe pulled out of the elbow?

Answer: That would be a delivering line defect.

Mr. McMunn: Mr. Carr has said it was a delivering company's defect providing the pipe was broken off at the triple valve. If it were broken by vibration would it be considered a delivering line defect? I believe, as a rule, it is owner's defect. In the east, as far as I can learn, it is handled this way: If the retaining valve or pipe is broken, due to the end of the car having been burst out, provided you do not have a combination of three posts broken, it is considered owner's defect. When you get down to triple valve and the pipe is broken there, provided it is broken due to vibration, we would consider it owner's defect.

Mr. Gainey: I will agree with him. It is handled just that way at Cincinnati. But they all sit here and do not get into an argument unless somebody takes the opposite side. It ought to be a delivering line defect at all times, because if you shove the end of that car out and it is fastened properly, you are not going to break it. There isn't one out of a hundred that is fastened properly.

Mr. Carr: It is owner's defect until you offer it in interchange, and when you offer it in interchange in a defective condition it becomes delivering company's defect. If the road sees fit to repair it, they charge it to the owner, but not if they deliver it in that condition to the delivering line. I think the rules bear me out.

Mr. Schultz: We all know that the breaking of a retaining pipe off of a triple valve is a very common occurrence, and they do break on account of the vibration of a car. The last paragraph, in my opinion, takes particular care of that point.

Mr. Charles Hitch: Rule 30 that has just been cited relates to the different parts of the brake apparatus. I am still of the opinion that any of these items mentioned in Rule 35 caused by damage to the car by unfair usage, are delivering line defects; but if they are not made by damage to the car which makes the delivering line responsible, then they are owner's defects. That is the way I understand the rule, and I believe that is the correct way. There are other defects provided for down further in the rule. To make them delivering line defects they must have been made by unfair usage to the car.

Mr. Vittum: I think if the delivering line fails to make the proper repair and charges, the owner—the retaining pipe broken out caused by unfair usage—it then becomes delivering line defect. and joint inspectors ought to card for it, except in the condition named in the last paragraph of this rule.

Mr. Carr: At Cincinnati we have two interpretations of this rule. If you take the preface you will see that the last paragraph says that all inspection of cars at interchange will be made in accordance with the following rules.

President Boutet: Cincinnati interprets Rule 35 to mean that no card will be given for pressure retaining pipe and valve unless the card denotes rough usage. At Columbus a card will be given if the car is offered in interchange. The rules were discussed last year. I put the same interpretation on the rules that this association did and put it up to our executive committee and they stated that our interpretation was correct. The executive committee at Columbus differed with us. I again put it up to my association and they still insisted. Our interpretation is that the owner is responsible for a broken retaining pipe or valve unless the car denotes rough usage.

Mr. Milburn: The case of 655 says that none of the articles would be missing in rough usage. No damage can accrue in rough usage.

President Boutet: That interpretation is based on rules reading about as they are now. I can see no difference except what I have advocated.

The motion of Mr. Schultz is that it is the sense of this meeting that a broken retaining pipe offered in interchange is an owner's defect unless the car shows signs of rough usage. If that motion prevails it will carry with it the sense of this meeting that no card will be given unless the car denotes rough usage.

Mr. Weal: There is nothing in the rule which says it is a delivering company's defect when offered in interchange. Air pipe broken from vibration or from rusting off, or anything, in my opinion, would be owner's responsibility, whether offered in interchange or not.

Mr. Carr: The rules say that a missing door is owner's defect; if offered in interchange it is a cardable defect. It strikes me that this is a parallel case. Unless you open the door and let cars be delivered in interchange with a pressure retaining valve broken, you are going to encourage shifting the burden of the delivering line to the receiving line.

President Boutet: It is not my intention to try to disparage your opinion at all. We come here to get the interpretation of the rules as printed.

Mr. Stall: His argument of the side door is that it is owner's defect in transit and delivering line in interchange. I think the motion should prevail.

Mr. Schultz: In Rule 35 it provides when cars give way in service that the same items may be charged owners. I am willing to amend my motion by including that.

The question was put upon the motion and carried with but three dissenting votes.

Mr. Head: I would like to ask a question: Can the threads on angle cocks and cut-out cocks become worn out in fair usage, and is it delivering line defect?

Mr. O'Donnell: I think a proper charge against a car owner for such repairs is entirely proper. I think Mr. Schultz of Chicago, can tell you.

Mr. Schultz: I consider it a fair charge where there is no sign of rough usage. When the threads become worn out it is proper to charge to the owner.

Mr. Hitch: I think it is proper to charge to the owner.

Mr. Charles Hitch: I agree with the gentleman ahead of me that an angle cock might become in that condition, but I do not see how a cut-out cock can be worn out.

Mr. Schultz: The vibration of the train line causes more or less opportunity for wearing out.

Voice: "Rule 30 reads: "Missing or worn out parts."

Mr. Head: Our experience has been that the frequent application of the angle cock will cause the threads to become worn, and it is through no rough usage that at times it becomes necessary to renew the angle cock on account of worn-out threads. We consider it owner's defect. Therefore I move you that the renewal of angle cocks and cut-out cocks on account of worn-out threads be considered owner's defects.

Motion was carried with two negative votes.

Rule 38.

Mr. Marlow: If a car should be offered in interchange with a 1-inch train line what should be done?

Mr. Stark: You can refuse the car; apply 1¼ pipe and charge car owner.

President Boutet: If there is no further discussion we will take that as the sense of this meeting.

Mr. Turney: I had a case come to my notice where the feed troughs in stock cars were considered under this rule.

I move you that the proper interpretation of Rule 38 as placed by this association, in the mention of inside or concealed parts of cars, cover those of the inside parts of stock cars such as feed troughs, water troughs, as owner's defects.

Motion was seconded.

Mr. Schultz: I was a member of a committee where we made a thorough investigation in regard to this same question. We decided that where a feed trough or water trough were not a part of the outside structure, it should be a delivering line defect. And if there was an opportunity for them to be hit by the lading or otherwise, it should be considered owner's defect. On a majority of the cars they are visible on the outside and form a part of the outside of car.

Mr. Stoll: The rule says the inside parts. I believe they are on the inside of the car and therefore should be charged to the owner.

The motion was carried.

Rule 41.

Mr. Jones: Would advertising on private line cars be considered a delivering line responsibility?

President Boutet: According to M. C. B. rules, yes.

Mr. Schultz: I believe in the proper handling of business that it is absolutely necessary that the consignee, whether the owner of the equipment or not, apply to his cars a card saying who the shipper is, without any glare of advertising, its destination and contents. It may seem unfair that he be given that privilege, but it is not apt to go astray. In Chicago we have a district where all the large packing concerns are located and it is a great convenience. I also know that the railroad companies absolutely rely upon the information contained on that card. I think it is the proper thing and should not be discouraged.

President Boutet: We are here to get the proper interpretation of the rules, not to say what the rules ought to be.

Mr. Schultz: I interpret the rule to permit that privilege. My personal experience is that they are a help. That it permits the shipper to place a card upon the car, showing who the shipper is, the class of shipment, the road over which it goes, the consignee and destination.

Voice: His interpretation is correct.

President Boutet: If there is no objection we will take it as the correct one.

Mr. Farran: I would like to ask what he would do with an empty car under the same condition.

Mr. Schultz: I instruct my inspectors to pull them off.

Mr. Brady: That is what some more of us are doing, but is that the rule?

Voice: The card should be removed at destination.

Mr. Kipp: These cards are on loaded cars only. Any one would be at liberty to remove a card on an empty car, before the car is offered in interchange.

Mr. Schultz: Empty cars for example that are moving from the manufacturer to a railroad for which they are being built. These cards ought to be permitted to stay upon the car until it reaches its destination.

Mr. Farran: The rule says they should be permitted on all loaded cars. The Union Tank Line Co. is hauling empty cars from points out west to points east with their regular route card. The size is 7x10, and the M. C. B. rules give the size of the card as 5x8. There is no advertising on the card any more than the routing of the car, showing destination. Some roads are passing them.

Mr. Forest: I believe that this is solely a transportation matter and that the car department men haven't a thing to say about it. Neither should we be asked to interpret the rule at all. It is a transportation matter and we are not transportation men.

Mr. Skidmore: While it may be a transportation matter, it is an M. C. B. rule and it is put there for us to work by and interpret as to its meaning and get a fair understanding of it. That is what we are here for today. While the rule is all very plain and shows the size of the card and all the necessary information that may be put on it, I do not see why it should not be easily understood: that no card to exceed these dimensions will be permitted on cars. Before this rule was put into effect the cars were covered with advertising, glued and pasted and tacked—anyway an advertisement could be put on a car. Now they have all been taken off. The Master Car Builders' Association has adopted the size of a card that they will allow the shipper to put on, showing the information, and I do not think that we should be so short sighted, if it becomes necessary to put one of these cards on an empty car to forward it through to some other point, that there should be any exceptions taken to it. Of course, none of us would take exceptions to the standard railway card used by a railroad company for forwarding empty cars on. We should not take any objection to a shipper's card on a private line car, for forwarding a car on that card to some other point. I do not think there should be any doubt or question as to what kind of a card should be on a car because it is printed very plainly.

Mr. Schultz: In order that it may be placed upon an empty car moving from the manufacturer to the owner, a card as provided in Rule 41 and on page 20, I think, should be permitted. I consider the transporting of an empty car from a manufacturer to the owner as commercial business and I move that it be handled the same.

Seconded and carried unanimously.

Rule 47.

Mr. Stoll: My interpretation is that in case it is necessary for a receiving company to apply a pocket coupler in place of a stem, he cannot bill the owner for making the betterment. The original construction is a stem. If it becomes necessary to replace the stem or spindle with a pocket, it is at their own expense.

President Boutet: That is my interpretation. He must either put back a spindle coupler or do the other at his own expense.

Mr. McMunn: Inasmuch as it is owner's defect and a pocket is applied, I would say that he should be billed for the repairs.

President Boutet: He could bill for the repairs but not for any betterment.

Voice: A pocket coupler is not a delivering company's defect.

Mr. O'Donnell: I fully agree with Mr. McMunn. I interpret that to mean that a pocket attachment M. C. B., that they do not consider it wrong repairs. Any time it is necessary to do so you can bill the owner. They simply go on to show who they are responsible to, and then to say that you are not obliged to consider these repairs as wrong repairs and the owner would not come back at you. In other words they throw the spindle attachment aside entirely.

Mr. Stark: It is not improper repairs.

Mr. Skidmore: I move you that it is the sense of this meeting that when a pocket attachment is applied to a car originally equipped with a stem attachment, it would be proper to charge the car for the necessary changes in applying the pocket.

Voice: I would not agree to that motion. The pocket attachment changes the original construction of the car. If the pocket attachment could be applied in place of the spindle, I should agree that it was a betterment and the owner ought to be satisfied to have the pocket in place of the spindle; but if it has to be changed I should think we were not working according to M. C. B. rules to do it.

Mr. Brazier: You are the men who ought to be ashamed of yourselves, if you do not know. You ought to go on record and put your foot right down on the spindle coupler. You ought to be ashamed to argue on it at all. These discussions are good, but there is much against the spindle coupler. It is unsafe to run.

Voice: The question is whether we have a right to go to work and change the original construction and put a car in the condition that we would have to put it in to use a pocket in place of a spindle.

Mr. Carr: If you have a coupler on one end and a stem attachment on the other, what are you going to do?

Mr. McMunn: I do not see how there is much room for argument. I will read Rule 47. We are certainly not responsible to the delivering company and this rule says we are not responsible to the owner. To whom are we responsible? Why can we not bill the owner? Rule 45 makes no mention of the delivering company and Rule 47 says you are not responsible to the owner.

Mr. Skidmore: It is well known that everybody connected with the car department has been trying to discourage the use of the stem coupler as much as possible, for that reason the M. C. B. has adopted a rule making the owner of a car equipped with a stem coupler responsible for the change. Two years ago we decided that that was the proper interpretation of the rule, and I am surprised to see so many get up here with the opinion that it would not be proper to charge for making a change in a car with a spindle attachment to a pocket. Mr. Brazier has said he would be glad to have their cars equipped from a stem to a pocket. Put on something that would be safe.

Mr. Pierce: Rule 47 covers improper repairs. Is there no change? Rule 48 says the company making such improper repairs shall place upon the car at the time and place the work is done an M. C. B. defect card. That covers the ground as far as I can see.

The question was put upon the motion and carried.

Rule 54.

Mr. Bradley: It seems to me that there is a chance for argument. I will venture to say that there are many inside of these four walls who will say he is accepting cars loaded with end sills split and damaged, yet they are safe to run, and when the car returns he has a combination.

President Boutet: Cincinnati has always interpreted damaged sills to mean those that are damaged bad enough to repair.

Voice: You understand simultaneous damage has been lost sight of.

President Boutet: You run the car and break two other sills and you become reseponsible for all three of them.

Voice: By the revision of that rule it is working a hardship on every road in the country.

Mr. Schultz: We have a local agreement which provides that if a car delivered by a Chicago road to another road which has a Chicago ownership, and at the time of delivery the car had a broken end sill, and it returned with additional damage—it may be longitudinal sills. We request that the delivery line should pay. It applies to cars which have the Chicago ownership. We do not pretend to legislate and take care of those over which we have no jurisdiction.

President Boutet: During our last trip to Buffalo to make arrangements for this meeting we run across a gentleman who had been connected with a private car line, and he stated that it was the custom of the private car lines to get their cars with one or two sills broken—cover it up in such a way that it would go out on the road and let the car come back with a combination of defects. In that way the private car lines are making the railroad companies pay for rebuilding.

Voice: I did not mention any particular line or railroad. I say it is working a hardship on every railroad in the country; that is my opinion, and from practical experience I know it to be a fact. Every road in this country is accepting cars loaded with perishable freight with defective end sills and when the car is delivered back they have to card it. What can you do, reject the car, or send it back to the owner for an end sill? If it is safe to run you will not, and when the car is returned to some other point the other fellow has to card for a longitudinal sill, etc.

Mr. Jennings: If we have a car come along with a broken end sill we take a record and if it comes back with a broken draw sill it does not form a combination.

President Boutet: If you receive a car with a broken end sill you run that car to its destination on your line and the car comes back with a broken end sill, that does form a combination.

Mr. Jennings: It forms a combination, but the car went with a broken end sill and when it came back with a broken draw sill it would form a combination, but the D., L. & W. would not be responsible.

President Boutet: Haven't the arbitration committee decided that the D., L. & W. would be responsible?

Mr. Jennings: I should refuse to give a defect card if my record showed that it had a broken end sill when it went.

Mr. Burns: Rule 49 covers that.

Voice: That rule has been changed. Every man here ought to get upon his feet. It should be repealed. It is not simultaneous damage. You have a combination and you cannot get away from it.

President Boutet: It would be a pretty good idea to make the owner responsible for nearly all wooden sills on freight cars.

Voice: We started it with a defect on damaged end sill and ended up with a broken end sill. We are receiving cars every day with a damaged end sill and they are safe to run. But if you allow the car to run and it is broken, you are in for it.

Mr. Schultz: We can only recommend that the damage to the sill must be simultaneous, and if not it must be owner's defect and they will never do that for the reason that it is a penalty to make repairs while they have an opportunity.

Mr. Gainey: The Master Car Builders will not listen to a recommendation of that kind because they have already taken that word out of there and they did that to make the road responsible. If one road received a car with one broken sill and broke two others, it makes them responsible because they did not repair it at the proper time.

Voic: You can say to the men that you haven't any argument since the rules have been revised.

Mr. Gainey: Doesn't it even up at the end of the year from one road to the other. All roads even up on that at the end of the year.

Voice: I consider that poor argument. I do not want to be personal at all, but suppose you represented the Sante Fe or any one road and they handled from 70,000 to 75,000 a month of different lines; see what it would amount to.

President Boutet: It appears to me that this discussion is uncalled for. There isn't anything pertaining to the proper interpretation, while there does seem to be some misunderstanding. Unless some one has a motion we will pass on.

Mr. Waughop: The auditing committee beg leave to report that we have examined the books of the secretary and find the same correct. After all dues are paid except salary of the secretary, there is $9.46; the secretary's salary is $30, leaving a deficit of $20.54.

Signed by Messrs. Waughop, Lynch, Berg and Trapnell.

It was moved by Mr. Schultz that the report be adopted, printed in the minutes and the committee discharged. Seconded and carried.

Mr. Waughop: We have gone over your recommendations and asked for some changes in the wording of it. We would like to have another meeting tonight on the subject and ask for further time.

On motion further time was granted.

Mr. O'Donnell: I believe it has been the custom at these meetings to reserve all papers prepared until the last half day of the session. I believe many will agree with me that you cannot do justice to these papers as well on the last day as you do not have the crowd to listen, and if it meets the approval of this body, I am going to move that we now take up the reading of these papers and also the next two sessions, on the last half hour of the session.

Seconded and carried.

Mr. F. M. Lucore, of the American Ry. Association, made a very able address to the association, which was printed in the October issue of the Railway Master Mechanic.

Mr. O'Donnell: I move that this body extend a rising vote of thanks to Mr. Lucore for his presence here as one of our number and for his excellent address, which, if followed out, would be of great advantage to all the different departments of the railroad, especially ours.

Seconded by many and carried unanimously.

President Boutet: On behalf of the association I wish to extend my congratulations to Mr. Lucore for the line of thought which he has presented, and I think the outline, if followed out by all of us, will gain good results. He has taken the game of base ball as an example. We may all try our utmost to attract attention to ourselves, but if we will bear in mind that we are one link in the chain that is necessary for the transportation companies of the world, we will accomplish far better results than if we attempted to draw attention to ourselves individually.

Mr. Farran read a paper by Mr. L. D. Roberts, which was published in the October issue of the Railway Master Mechanic.

It was moved by Mr. O'Donnell that the report be accepted; incorporated in the minutes; that a vote of thanks be extended to Mr. L. D. Roberts, of Pueblo, for the paper, and also a vote of thanks to Mr. Farran for the able manner in which he has presented it to this association.

Seconded and carried unanimously.

Mr. Cleary read a paper.

(This paper appeared in the October issue of the Railway Master Mechanic.)

Mr. Skidmore: I move that the paper be received as read, spread upon the minutes and published in our proceedings, and that Mr. Cleary be accorded a vote of thanks for the paper and the able manner in which he presented it to the association.

Seconded and carried unanimously.

Mr. Brady read the paper of the Cincinnati car foreman which was printed in the October issue of the Railway Master Mechanic.

It was moved by Mr. O'Donnell that a vote of thanks be extended to the committee that prepared the paper and to Mr. Brady for the manner in which he presented the same.

Seconded and carried unanimously.

Mr. O'Donnell read a paper on "Interchange Traffic," which appeared in the October issue of the Railway Master Mechanic.

It was moved by Mr. Turner that the paper be received, spread upon the minutes and incorporated in the proceedings of this convention and that Mr. O'Donnell be accorded a rising vote of thanks for the same.

Seconded and carried unanimously.

Mr. O'Donnell: Before we adjourn I think every person present realizes that we have done three days' work today. On account of the excessive heat and almost unbearable noise, I am going to ask that a committee be appointed to look into a near-by meeting place for our following two sessions. It is difficult for the president to carry on the work in this room.

The suggestion was voted down.

THURSDAY MORNING SESSION.

President Boutet: I have had many inquiries as to who Mr. Lucore is, and I wish he would stand up and explain it.

Mr. Lucore: I am just one of you men who is trying to help improve the transportation service of this country. I feel that I am a railroad man just like the rest of you. I occupy a very humble position, but my employment places me in touch with the movement of cars and I am so situated that I can give quite a bit of time to studying the things which relate to car movement. As you doubtless know, I am one of the employes of the American Railway Association—an association which is interested in all phases of railroad work, and I feel that the Chief Joint Car Inspectors and Car Foremen represent one of those influences in transportion which is bound to help very materially in the business. I feel as though I always want to attend your meetings and keep in touch with what you do.

President Boutet: I think the members will be more than pleased with his explanation. In my different talks with him he has shown a disposition to try to get as close as possible to the work in order to obtain information looking toward facilitating the movement of cars. He is always willing and anxious to render any assistance to this association, and I do not think any of you need have any fear pertaining to any discussions that we may have.

Mr. O'Donnell: I think that any man who wanted any information as to the reason of Mr. Lucore being here should step up to the platform and see if he has a yellow streak in his makeup. He has met us with the best of intentions. I am very sorry that our president found it necessary to apologize for his presence here. I, as one of the members from Buffalo, should have no fear in expressing my opinion.

Mr. Lucore: What you just said gives me a thought and I begin to understand. I would like to say that I had not until this moment the slightest notion that anybody here would be at all diffident in expressing his opinion. I did not think that I cut any such figure as that. I want to disabuse your minds. I do not occupy a position that exercises authority over any one and if I say anything I want you to understand that it is from my own standpoint and that in saying it I do not bind anybody but myself. That makes me think of a little experience I had a number of years ago. A man on the railroad with which I was connected conceived the idea of having department meetings perhaps twice a month. He used to be president of the Master Car Builders' Association and he held a pretty good position on the railroad. We little fellows would come to the meeeting and some of us would hesitate about talking freely, and he speedily shook that out of us. He said: "If you are not going to come here and speak what you think yourselves you might just as well stay at home. I do not want anybody to be influenced in what they think or do by what I say or think. We must come here without any strings on us and say what we think; otherwise we might just as well stay at home." I do not want anybody to feel any hesitancy on my account in what they may say, and I ask the same of you. Just count me one of you. (Applause.)

President Boutet: I hope that none of the members will feel bashful in getting up and speaking for fear it will not appear well in the minutes. If any member makes a remark that would not look well in print, before it goes to press it is changed in such a way as to express his true intent. I trust you will get up and express yourselves freely.

Mr. Waughop: That brings a thought to me in regard to Mr. Lucore. Truth is a divine attribute and the foundation of every virtue. Whatever I say in this meeting I mean, and whatever you say you ought to mean. It is possible that we will digress from the regular line and put in something that we do not want to say; that will be attended to by the secretary.

Rule 59.

Mr. Brady: My interpretation of Rule 59 is that if we apply a different kind of metal brake beam to a car which necessitates changing the hangers of the head, to apply a defect card for wrong repairs.

Mr. Skidmore: In case a metal brake beam meeting the M. C. B. requirements was applied that required a change in the hanger and heads, what would it be necessary to apply a defect card for?

Mr. Burke: I would issue a defect card for wrong brake hangers.

President Boutet: If you have an S. P. car that has a hook hanger head and you applied a Sterlingworth brake beam with a loop hanger?

Answer: We would apply the same kind. In case we couldn't use a loop hanger it would be necessary to card.

President Boutet: There isn't a place for a hook hanger; you apply a loop; the proper equipment was a hook hanger, what would you card for?

Answer: You would card for wrong brake hangers. All the different companies use a different kind of brake hanger. If we got one of our cars with a wrong brake hanger we would take it off and put it on a car that carries that kind.

Mr. Meyer: I should think that a card with two wrong brake hangers would be all that would be required. That is the only change we have made. All that is required is a defect card for the change that we make.

Mr. O'Donnell: I do not agree with the gentleman who previously spoke. I have been one of a committee that has recommended that change for the last five years in the Central Railway Club, and the original rule made it necessary for you to apply a similar make of beam to the one stenciled. We thought that entirely out of line and we recommended that with attachments standard to the car, and would take another beam without requiring a change in detail of the original construction, that we could charge the owner. If you change the hangers or anything you have got to put on a card for the entire beam and the parts because you take away the standard of the original construction. I think that is the meaning of that rule.

Mr. Myers: It would be necessary to card for the brake hangers and the wrong beam if you applied a different kind of a beam with hangers that required a change in them. That is the reason for that paragraph. They cannot use the same kind of a beam.

Voice: Mr. O'Donnell's opinion seems reasonable, as does also this gentleman. When the owner receives that car back home he has to change that beam as well as the hangers in order to get the standard of the car again. All parts must be changed back to the original.

Mr. Turney: The reading of that clause makes it to me quite plain. If a railroad company equips their cars with a certain kind of a beam it is hardly fair to mix the beam and turn it over to them withtout protecting them with a mixed material. Any beam meeting the M. C. B. specifications may be used and they have to be carded for if requiring a change of hangers.

Mr. O'Donnell: Providing the hangers and other parts meet the requirements of the old beam that you remove. I would not say it that way. We all appreciate the fact that the metal brake beam meets the M. C. B. test, and any railroad having these metal beams on hand have a thorough understanding that they meet the test. I cannot agree with you. I do not think it is right.

Mr. Turney: I expect I did not state it just right. What I wanted to convey was the M. C. B. would permit the use of any beam provided there was no change in the hangers.

Mr. Schultz: I think we are a little too technical. The idea is to permit the application of a metal beam that meets the M. C. B. specifications; if in doing this it is necessary to change the hangers, it seems to me that a defect card for the change necessary to apply this beam is all that is required.

Mr. Head: Mr. O'Donnell's idea is correct and we charge for the beam what would be the credit for the beam taken off.

Mr. Forest: My interpretation of that rule is that in the case as it is provided it is necessary to card for the beam and the hangers together.

Mr. Green: That would be my interpretation of the rule.

Mr. Gainey: I would like to ask what they would do in case a car were equipped with a National hollow beam with a hook hanger? If they would put on the same kind of a beam with a loop hanger?

Mr. Vittum: I think whenever you change the hanger you change the original construction, and my opinion is it should be carded for because it makes a change in the original construction.

Mr. Schultz: I cannot see how this change would impair the strength of the car. You all understand that M. C. B. material can be used, providing it does not impair the strength of the car. In this instance we are permitted to use the brake beam that meets the M. C. B. requirements.

Mr. O'Donnell: I move you that it is the sense of this body that the proper interpretation of the change in Rule 59 is to the effect that you can apply any metal beam that meets the M. C. B. requirements to any equipment when it is not necessary to change the detail of the original construction, especially in regard to hangers and other parts.

Motion was duly seconded.

Mr. Lynch: I think there should also be added "provided the beam is as strong as the beam which is standard to the car."

President Boutet: His motion would cover that.

Mr. Lynch: The beam must be as strong as that standard to the car, even though it meets the M. C. B. requirements. There are light beams of M. C. B. specifications and there are heavy M. C. B. specifications. That must mean something in the rule when it says it must be as strong as that standard to the car. Some railroad companies have beams that are stronger than M. C. B. specifications. They might raise a question. I think it should be incorporated in the motion "provided the beam applied is as strong as that standard to the car in compliance with the rule."

Mr. O'Connell: I have no objection to incorporating that as a matter of safety in case of argument. I think that point was in the minds of the Master Car Builders when they made that rule. The M. C. B. specifications naturally require that any beam on the market will stand the test; but Mr. Lynch's statement is well taken.

Voice: I think Rule 58 answers the question. If a man takes off a brake beam of one make, of course he is expected to put on one as strong.

Mr. Skidmore: I believe that Mr. O'Donnell's motion was correct without the amendment. It was that any metal brake beam may be applied that meets the M. C. B. requirements. It is necessary for a beam to meet the requirements for the larger capacity cars. I do not think it is necessary to add that it should be of the original construction at all. When you apply a beam meeting the M. C. B. requirements with 100,000 capacity car, I believe it is always necessary to put one on standard to the car. That is only a difference of opinion. If it meets the M. C. B. requirements I think this association should so decide on that point and not take into consideration whether one man's beam is stronger or not.

Mr. Lynch: My object in asking that to be incorporated in the motion is that the rule makes the provision that the beam applied must be as strong as that standard to the car. I am not prepared to say whether this beam is as strong as that or not, but you may note a very light capacity beam from a heavier beam, and I think that a light capacity beam should not be applied to a heavy capacity car. I therefore think that should be incorporated in the motion and do not see what hardship it might work.

Mr. Schultz: I look at this rule in relation to the brake beam the same as I do to rule 52, which permits the application of any M. C. B. coupler. It provides a penalty to the road making the repairs, holding them responsible for the change that is necessary to apply this brake beam. The two rules are identical. Rule 62 has worked very satisfactorily up to the present time; the other rule has not been tried.

Mr. Waughop: How many of you know what the specifications are? I question whether any man here knows what the specifications are on that point. Personally I think the Master Car Builders should put in that rule what the specifications are. I do not know it and I am honest enough to say I do not know.

The question was put upon the motion and carried.

President Boutet: It is decided by this body, if you apply a metal brake beam of one kind to a car that had been equipped with another and it changed the head so as to require a change of hangers, you would be required to card for the wrong brake beam and wrong brake head.

Mr. Trapnell: If you repair a car with a different type of brake beam than that originally on the car, whereby you had to change the brake hangers, you would card brake heads and hangers; how would you handle the National hollow beam where the head is part of the beam? I believe that the card for metal brake beam is superfluous and should not be allowed.

President Boutet: With most of the metal brake beams the head is riveted or fastened on with a truss rod. Is there any question as to a brake beam of the same kind having been applied to a car with a different head?

Mr. Waughop: Would you card the car for wrong brake beam and wrong hangers?

President Boutet: If the car had been equipped with one kind and I put on another kind it would be necessary.

Mr. Waughop: St. Louis will give joint evidence.

Mr. McMunn: If it were on the repair track would you give joint evidence? If you repair the car and put a different brake beam on, what would you do?

Mr. Waughop: I wouldn't do it.

Mr. McMunn: Assuming that you are foreman of a repair track; a National hollow brake beam is missing; you apply a Sterling brake beam and you change the hangers, what would you do?

Mr. Waughop: It would be proper for the foreman to apply an M. C. B. defect card for wrong repairs, but the chief inspector on the movement in interchange would give only joint evidence.

Mr. Berg: I am very glad to hear that. Brother Waughop is loyal to himself. He has been the strongest advocate for the application of the defect card and found more fault with foremen for not doing so than any man in the association.

President Boutet: The question is, the same kind of a brake beam applied to a car with different hangers; what would be the interpretation of the association on that?

Voice: I do not see how the association considers that any different from the other. You have changed the original construction. You have decided that where you change the hangers the car has to be carded for wrong brake beam and hangers. That has been the decision of the association. I do not agree with it.

President Boutet: The decision is that if you apply a brake beam of another make to a car. There is quite a difference in the fittings of the parts.

Mr. Gainey: I cannot agree with him. The vote just taken carried with it the point that you are taking now. All you would change is the hangers and the head, and I am of the opinion that all you have to card for is the hangers and the head because you have not changed the original construction.

Voice: That is all we changed in the other case.

Mr. Berg: There ought not to be any further dispute regarding the understanding of that difference between the National hollow brake beams with the different heads. If it isn't according to the original construction it should be carded just the same as any other beam, with heads that necessitated change of hangers, including the wrong hangers.

Mr. McMunn: The question is, if you remove a National hollow brake beam for any cause, and you apply a National hollow brake beam with a different type head which necessitates the change of the hangers, I am of the opinion that all that is necessary is to card for the heads and hangers, and it is not necessary to card for the body. Even though you should issue a defect card for the wrong brake beam, if there is no part damaged you could not make a bill for it. Bill for whatever repairs are made only.

President Boutet: Before this rule was discussed I knew there was a difference of opinion as to the different kinds of brake beams. Some were under the impression that if you applied a different kind of a brake beam to a car you would have to card for the entire brakebeam and hanger, but they were of the opinion that if you applied the same kind of a brake beam with a different hanger, you would be required to card for the heads and hangers. Knowing that difference is why I admitted the subjects. It leaves the matter open so we can discuss it on both sides.

Mr. Charles Hitch: I believe that Rule 59 conveys the idea that any metal brake beam applied to a car which requires a change of hangers in order to apply it, is wrong repairs and should be carded as wrong brake beam, and it carries with it the heads, bushings and any alterations of that beam. I do not think it is necessary to specify the heads and hangers because the heads vary. I have had quite a number of them that have the bushings separate. If you are going to card for wrong head, it conveys the idea that the beam is wrong; if you have to alter the hangers in order to apply it, even though it is the same kind of a beam. I move you that it is the sense of this meeting that Rule 50 be interpreted to mean that any metal brake beam meeting M. C. B. specifications applied to a car which requires a change of hangers, is wrong repairs, even though it be the same type of beam the car was originally equipped with.

Seconded by Mr. O'Donnell and Mr. Stark.

Mr. O'Donnell: I think Mr. Gainey asked that question as a matter of information. We have passed several resolutions defining our understanding of this rule. Why should we tie it up with that? It is an open question in my mind and I do not think we ought to pass it.

Mr. Lynch: I think Mr. O'Donnell is right. The rule does not provide for this condition that we are discussing, and it seems to me that all that would be necessary in that case would be to card for the hanger. The heads are M. C. B. standard. I do not think it would be necessary to take any action on the motion.

President Boutet: According to my understanding you certainly differ a great deal. Mr. O'Donnell in his remarks created the impression that if you would put on a National hollow brake beam in place of a Sterlingworth and you changed the hangers it would be necessary to card for all of it.

Mr. O'Donnell: To be consistent with my original motion I must do that. I will vote in the affirmative if the motion is put.

Mr. Lynch: The rule does not provide for this condition of applying a brake beam; therefore in order to be consistent we should only card for the wrong hangers.

Mr. Gainey: Mr. O'Donnell had my idea exactly. If the first one carried by this association then the second ought to be. That is why I asked the question, to see if it would not change their minds. It has not changed it on the first and it should not change it on the second.

Mr. Skidmore: I object to withdrawing the motion. It was made in good faith and we do not come up here to side-step anything and leave it to the other fellow to settle. We are here representatives from different parts of the country and we ought to be able to decide any question that may arise. When you get home you will be asked, what did you do with that question? We will have to say we just let it go. We are practical men and are competent to pass our opinions as to what we think is right, and therefore I think we should come to an understanding on the point raised by Mr. Gainey.

Mr. Hitch: We are not here to interpret these rules to work a hardship on anybody. We are here as a body to get the unanimous interpretation of these rules, that all may work under rules with the same ideas, and if we do that we have accomplished something. If we interpret these rules to make repairs under certain conditions it seems that the repairs will be made all over the country under the same conditions, and there would certainly be no hardship on any one individual road. They will all work under the same view and the same ruling as these rules are laid down and we interpret them here today. I believe this motion ought to carry.

The question was put upon the motion and lost.

Rule 61.

Mr. Trapnell: I would like to inquire how an inspector under this rule is going to measure this coupler without taking it out of the car and placing it in a position to get the measurements?

President Boutet: I do not believe it would be necessary to take it out of the car. It can be gauged in the car.

Mr. Trapnell: This is perpendicular.

Mr. Schultz: In order to properly gauge this coupler it will be necessary to part the car. I do not believe that very much of this will be done in order to measure. I believe that this is for a penalty to see that couplers that are worn are not in service.

Mr. Charles Hitch: I would like to ask what course is pursued when you find a coupler is worn to a size which is condemned? I mean what repairs would you make when you find a coupler will take the gauge?

Mr. Trapnell: I believe we have intelligent car men, the same as in any other occupation in life, and if they find out that a knuckle pin was badly worn so that it allowed the knuckle to come out; if the faces on a coupler were worn so that it would be impossible to keep knuckle in line, they would throw the body of the coupler away and charge the car owner for applying a new one.

Mr. Lynch: I think the rule for making the delivery line responsible for a worn coupler is a dead letter so far as interchange is concerned, because it would be impracticable to measure a coupler.

Rule 65.

Mr. Trapnell: That clause wherein it says that the thickness of the splice must not be less than the web has reference to metal sills, not wooden sills.

Rule 77.

President Boutet: I trust somebody is going to give that rule considerable thought regarding the card which goes into effect June 1, 1910.

Voice: I would like to refer back to Rule 74 in regard to tank cars. The question has been asked, how are you going to determine whether a car is one or two? How do you determine the difference? They are worded exactly—that is they are maximum weights. There is a chance to make wrong repairs.

President Boutet: The rule provides that the car shall show the limit weight stenciled on it.

Mr. Lynch: In case a car is not stenciled and is running with wrong axles?

President Boutet: Wouldn't it be a good idea to shop that car and put the weight on it? I think the owners are going to take care of it.

Mr. McMunn: May I ask that you turn to Rule 83 which refers to improper repairs of owner's defects. In case improper repairs of owner's defects are made and no bill is rendered can car owner correct wrong repairs and bill the road making same?

Mr. Burke: I put up that same argument and got sat down on. I claim that if you make improper repairs where there is no combination of defects, the company owning the car can make a bill against them.

Mr. Schultz: When a company makes wrong repairs they are responsible to the owner, whether they make a bill or not. It is proper to get joint evidence and counter bill for wrong repairs made.

Mr. Lynch: I think that is provided for. Rule 48 provides that when improper repairs of any kind are made to a foreign car, a defect card shall be applied covering the wrong material, and if the party making the wrong repairs evades the responsibility, of course sometimes it accrues to the owners' loss, but most people try to hide under Rule 83 and evade responsibility when making repairs.

Mr. Hitch: I believe that the rule covering the use of repair cards, that the owner receiving the car home for wrong repairs, even though they were owner's defects, the party making the repairs, placing upon the card the time the repairs were made, he must state whether he renders a bill or not. If he makes no bill, they cannot make a counter bill.

Mr. McMunn: I do not think it is necessary to mark on the repair card whether or not you are going to render a bill.

Mr. Skidmore: I think that you are arguing the wrong side of the question when you say no bill has been rendered. Do not forget that you want to be honest in your transactions while making repairs. If you make wrong repairs, make a bill for it. Put your repair card on the car and defect card for wrong repairs. Do not try to cover it up by Rule 83. If the owner comes back at you and detects you in the wrong act and you say "No bill, necessarily no defect card is due you." Do not do that. Live up to the rules as they are printed and what is required of you. Then there will be no such thing as referring to Rule 83 and asking "Can he bill me if I made no bill against him?" (Applause.)

Mr. McMunn: There is no rule to compel me to bill for repairs if I do not want to.

Mr. Skidmore: I would answer in this way: The rules do require you to make a bill for repairs you have made. The owner is probably responsible and you should charge him according to the rules for what repairs you have made. If your line is responsible for those repairs, of course you cannot bill him; then you should put a defect card on for wrong repairs, and mark it "No bill" so that it would be understood. For the benefit of argument: If we make no bill could they bill us back? I do not think they could, but I do not believe in doing business in that manner. Comply strictly with the rules; that is what they are made for. If the rules are bad, live up to them as nearly as possible, and they will possibly be corrected.

Mr. McMunn: The arbitration committee has ruled that you cannot charge for a malleable coupler applied to a foreign car. We will assume that a steel coupler is broken, which is owner's defect, and you apply a malleable coupler; you cannot bill for the malleable coupler. What will you do in a case like that?

Mr. Lynch: Rule 83 is under the heading "Instructions for Billing." Rule 70 "Instructions for Repairing." It does not in my opinion make any difference whether the repairs be owner's or delivering company's, or the handling company's. The repair card must be applied to the car. It seems to me that you can bill the car owner for wrong repairs to owner's defect. Otherwise Rule 83 would have no reference to that. It says "When bill is rendered."

Question: Did you ask in connection with wrong axles? You were in doubt as to how you would know whether an axle was the proper size, and you thought there was a possibility of making wrong repairs?

Mr. Lynch: Yes. If a car is not stenciled the party making the repairs can apply any size.

Mr. Weal: In strict compliance with the rules, 76 covers the situation; that is conclusive evidence that if we do not bill we are supposed to mark "No bill." This discussion regarding no bill lies with the company. They have to put a repair card on to live up to the rules anyway.

Chairman Boutet: Mr. Lynch read the rule. You can put a malleable coupler on and cover it by a defect card.

Mr. McMunn: Why should we card for owner's defect?

Answer: Because you made wrong repairs.

Mr. McMunn: I do not understand that car owner's have the privilege of billing party making wrong repairs to owner's defects for the correction thereof, when the arbitration committee has ruled that such wrong repairs cannot be billed for.

Mr. Burke: If a malleable iron coupler is applied to a car you cannot bill for a malleable iron coupler; there should be a repair card put on car and marked "No Bill." In making repairs of owner's defects and rendering no bill, you are not responsible.

Mr. Milburn: Rule 62 says plainly "Malleable iron coupler."

Mr. Head: We have had considerable concern on what Mr. McMunn asks. We claim that there is no right to make a bill on the application of a malleable coupler; but the owner of the car has a right to bill back for replacing that malleable coupler. If a bill is made for a malleable coupler, we object to that. We also demand a defect card to replace it with a standard steel coupler. Companies placing malleable couplers on cars do so without charge and become liable for the expense of making the change.

Mr. Hitch: I believe if one of my cars came home to me under the condition cited with an M. C. B. card, or a repair card, or any other card, I would bill, if I could get the evidence, the road that applied that coupler; because the rule prohibits and it is the intent to prohibit the use of a malleable coupler. The absence of material does not excuse any road.

Mr. Lynch: I think we are losing a lot of valuable time. Mr. Skidmore covered the ground. We should comply with Rules 70 and 76 when making repairs, and there is no cause for remarks, as I read the rules.

Mr. McMunn: I understood Mr. Lynch to say that in case they make wrong repairs to either owner's or delivering lines defects, he should bill. I do not believe he means that. Rule 4 states defect cards shall not be required for defects for which owners are responsible. A broken coupler is owner's responsibility; wouldn't a good malleable iron coupler be better than a broken steel coupler? If I did not have a steel coupler and applied a malleable coupler, making repairs to owner's defect, how, in accordance with ruling of arbitration committee can I bill for such repairs?

President Boutet: It is improper repairs.

Mr. O'Donnell: I would like to ask Mr. McMunn if a New York Central car came to him, would he accept the car with a malleable coupler without question?

Mr. McMunn: I should be obliged to.

Mr. O'Donnell: The foundation of the rule says that you must give the same attention and care to foreign cars as you would to your own. I do not contend, with all due respect to Mr. McMunn's argument, that that would be proper. If you put in a makeshaft you are supposed to pay for the makeshift.

Voice: I think you will all agree that he is bringing up a technicality that you are not often up against.

Rule 106.

Mr. Head: There is a provision for a charge for straightening a bent axle. An axle slightly bent can be straightened. Can we condemn an axle, if we have no means of straightening it, and charge for a new axle?

President Boutet: They must stand the loss outside of the labor for straightening the axle.

Rule 107.

Mr. Milburn: That makes the applying or rehanging of a side or end door a delivery company defect, or the road hanging the door. They cannot charge the owner for it.

President Boutet: No, sir.

Rule 126.

Mr. McMunn: That rule will bear a great deal of discussion. A car which is safe to run but unsafe to load on account of serious damage caused by wreck, shall be reported to the owner. Let us assume that we have a car on our line which is unsafe to run—has a pair of center sills and draft timbers broken. I think we would have to ask the owner for disposition of that car before we make any repairs.

President Boutet: I would interpret that rule to mean that if you have a car in your possession damaged, caused by accident, it would be necessary for you to report that car to the owner. It does not mean that you should report to the owner before you repaired the damage done to it.

Mr. McMunn: The rule says I should ask the owner for disposition.

President Boutet: I think the intent of the rule is that if you have a car wrecked on your road and you wish to make disposition of it, then you should take it up with the owner; but if you wish to repair the car at your own expense, then you need not take it up with the owner.

Mr. Livingston: I had an M. & O. box car that was sideswiped; they applied a defect card and started the car homeward. They had some difficulty in getting rid of the car. In that case do I have to report back to the owner? One of our connecting lines refused the car and we had to repair the car. We could do it on a defect card.

Mr. McMunn: A great many private companies are holding up railroad companies on that rule. They claim we have no right to make repairs without first notifying them.

Mr. Schultz: My understanding of that rule is that there is nothing in it as to getting any authority from them, providing we repair the car that is damaged.

Mr. Skidmore: My understanding is that in case of serious damage to a car in an accident, the company damaging the car quite often wants to report it to the owner for appraisement and get the depreciated value, to ascertain if it would not be cheaper to destroy the body of the car and pay the owner the amount of the value. He may ask for authority to bill that car home to the owner for repairs. If the owner so elects he would furnish that authority. So far as the line repairing the car that they have damaged on their line, I do not see that any authority is required. If you desire to make the repairs yourself you can proceed and make them, and conform to the original construction of the car. There can be no objection by the car owner.

Mr. McMunn: There should be no objection, but you could not repair it and comply with Rule 126. I believe the rule is not worded correctly, and I believe some action should be taken in regard to having the rule re-written so that its meaning could be correctly interpreted.

President Boutet: When we come to the point of making suggestions I wish you would write up the rule as you think it should be and we will present it.

Mr. Charles Hitch: It comes under the head of damaged and worn out cars. If I had a freight car on my road that received very serious damage and in my judgment it would cost less to have the car destroyed, I would report it back to the owner and get information to destroy it. If it were not damaged seriously, then I would repair it. If the damage was due to age and decay I would take it up with the owner.

Mr. Trapnell: I move you that the stenographer dig out that part that was referred to the executive committee, so that they can get busy and report their findings to the association.

President Boutet: There was one rule that was referred to the executive committee for the proper interpretation. It is not my understanding that the executive committee is going to report now; report later and insert it in the minutes.

Mr. Trapnell: I would not consider that would be a good practice. This association might not agree with the executive committee, and if we put it in the published minutes every one would have to swallow it whether it was true or not. I believe we should take a vote and decide what the rules should be. The executive committee is subordinate to this association at all times. It is for us to report back and give this association in session the benefit of our ideas, that they may approve or disapprove it, as they desire. I move you that that be taken up.

President Boutet: The chairman of the association is like the executive committee; he is subservient to the association, but I did not understand the motion that way or I should have had the stenographer do it before.

Mr. McDonnell: I would like to get a correct interpretation of Rule 65. A car moving home with one side sill spliced on one side of a car, and intersill spliced on the other side of the car in the same manner. Would there be anything due the car owner?

President Boutet: No sir. As I understand you, the side sill is spliced on one side of the car and intersill spliced in a proper manner. If an objection is taken by the owner and joint evidence, it is not worth the paper it is written on, if those are the only two sills on the car that are spliced.

Mr. Schultz: Joint evidence is simply a statement of facts.

Mr. Trapnell: There is no responsibility with the delivery line because they have not spliced adjacent sills. If adjacent sills are spliced other than center sills, joint evidence will be proper; but if a man gives joint evidence for the one side sill and also one intersill spliced on the other side, I do not see where the owner has any claim whatever. It is joint evidence erroneous secured from some one not in compliance with the rules.

President Boutet: The joint evidence is not worth the paper it is written on. The sills are spliced in accordance with the rules. They were spliced on the same end of the car, one on one side and the other on the other.

Mr. Gainey: If I had a car in my shop, a side sill broken and adjacent intersill broken, I would splice them both, and I would charge the owner for both of them, if fair usage.

Mr. Livingston: I understand the sills were spliced within eight inches of the cross tie timber. The provision is 24 inches. Isn't that what he is taking joint evidence on?

Mr. McDonnell: According to the rules you can splice the sill any where you wish except the center sill, and they must be spliced 24 inches from the body bolster. The cross tie timber is not mentioned in that transaction. These sills are spliced on the outside.

Mr. Gainey: It says the splice may be located either side of the body bolster. It does not say where you should splice, just so they are 24 inches.

Mr. Waughop being called upon responded as follows:

Mr. Waughop: In the beginning God created the heaven and the earth. The earth was without form and darkness was upon the face of the deep. And God said, "Let there be light," and there was light. In the beginning of the Master Car Builder's rules, which was in 1876, the Master Car Builders said, "Let there be light or rules," and there were rules. The first rules written in 1876 were very meager,—a small pamphlet and very much misunderstood. There was very little attention paid to the rules those days because there wasn't much interchange. Possibly some of you boys can go back to the time we had nothing but 3½x5½ journals. Hot boxes all the time. It is a case of evolution. The Master Car Builders have tried to imitate the Lord but they haven't got to it yet. I can remember when it would have cost an agent his position if he loaded a car 500 lbs. over 10 tons. That was years ago. The next evolution in the railroad car was a 3½x6 journal. That was brought up by W. H. Kohler of the Wabash, and it was thought to be a great thing. Then came the 3¾x7-in. journal, and today we have the 5x10. All that is evolution. I want to say to you boys that I have been through the mill from top to bottom, and I question very much whether there are very many of you who have met the conditions that I have met. I want to say that the Master Car Builders have not been at all times up to their position. I want to say to you, Mr. President, and to all the chiefs, no man can be a chief inspector unless he knows no man. In other words, any car you come across—no matter what the initial is—you will not consider the initial, but you will consider the defects on it—the merit of cars is the foundation. No shop man can be partial, for the instant you favor any company you fail. Look at the defects and decide the case on its merit, regardless of who it hits and there will be no trouble. The Master Car Builders have turned down our association time after time on some of our recommendations, and subsequently the same recommendation has been taken up by some car foreman's association and adopted. Personally, I think the credit should belong to us. I would like to admonish the foremen and the chiefs on one little point. Many times it has come to my attention that an inspector has been a derelict in his business, and I always consider that the first offense is my own; that man is forgiven. But the second offense on the same rule you will find it will be beneficial. You will never find an inspector or a foreman who will commit the same offense the second time. In 1879 Mr. Jacon Johan, master mechanic of the Wabash, came to me and said: "I want you to go to Chicago to open the Wabash road as car foreman, and I want to give you a little advice. 'You are a young man; don't write any more letters to headquarters than you have to. Don't report any man in a shortcoming unless you have to, and keep a certain element in the minority.' I have done that and I find it is good advice. There was one of the greatest men this country ever knew. I just want to give you a little toast. I want to say to you all: 'May the Lord take all of you but not too soon.'"

Mr. Trapnell read his paper which appeared in the October issue of the Railway Master Mechanic.

It was moved by Mr. Hitch that the paper be received, placed upon the files of this association and a vote of thanks be extended to Mr. Trapnell for the very able paper.

Seconded and carried.

FRIDAY MORNING SESSION.

Passenger Rules. Rule 3, Page 93.

Question—What is usually understood as broken glass?

Mr. Head: A year ago this association interpreted this rule that broken glass had reference only to the lights. We always construed it as any broken glass in a car except drinking glasses. The rules this year have made it very plain. Broken glass in our opinion is window glass.

Mr. Dyer: Section C, of Rule 3, in that connection reads: "Line expenses as against owner's defects and delivery Co. defects." So that it only concerns a line where a passenger runs over two or more lines. It would cause too much delay to hold a train up for that. The broken glass should become a line expense.

Mr. Head: I move that it is the opinion of this association that all broken glass is line expense, or a proratable line expense between the lines handling the cars.

Seconded by Mr. Hitch.

Question: That means by unfair usage?

President Boutet: That would mean in case of accident; in ordinary service I would take it.

Mr. Head: Of course if a car is wrecked that takes it out of everything, but with ordinary running we do not stop to know why it is broken.

President Boutet: Supposed to be broken by a passenger. The railroads handling pro rata expense on window glass regardless of how it is broken; unless the car is in a wreck, which takes it out of any expense.

Question: Would that include outside glass or double windows?

President Boutet: I would take it to include all glass in a car unless it shows signs of rough usage.

Mr. Waughop: While I am not personally interested in passenger traffic, it seems to me that where a railroad runs a coach on its line, or any line, they should return it in the same condition they received it. If in the freight traffic I would have to card for it.

President Boutet: It does not affect individual cars in interchange.

Question: It would affect cars running in two or more lines. With a car running from New York to Chicago, each road has a certain portion of cars in the line. No matter where that glass was broken it would be charged up to line expense pro rate. My interpretation of that rule is that it would include inside glass but not the outside double glass. We have had some experience in that respect.

President Boutet: If his motion prevails it would cover all window glass in the car.

The question was put upon the motion and carried, with one dissenting voice.

Rule 15.

Mr. Cass Hitch: Figures 1, 2 and 3 are not quite clear to me, and I am not able to get the desired information.

President Boutet: Is there any one who can offer any interpretation as to the thickness of a tire before it is condemnable?

Mr. Hitch: I cannot see how it can say ¾ inch, and then in another place 1½.

Question: Isn't that a different kind of a tire?

Answer: Yes; but it gives us the same information on those other cuts. I believe the cuts are wrong.

Mr. Hitch: I move you that since figures 1, 2 and 3 of the passenger rules are confusing, that our secretary be instructed to ask the arbitration committee to give the proper interpretation.

Mr. Gainey: It would be just ¼ less than 1⅛. In the center of the cut it shows 1⅛ inch, then it shows a measuring line ⅛ less, which is condemnable. The same is true of Figure 2.

Mr. Hitch: The figure shows plainly that the measuring line on the outer edge of the tire is not less than ½ inch, but he gives it ½ here and then adds ¼ inch to it and at the same time he shows 1⅛ inch.

Mr. Gainey: That is just ¼ less than 1⅛.

Mr. Dyre: The measuring lines state not less than ¼ inch; it certainly means ⅞ inch between the measuring line.

Mr. Hitch: What are you to do about Figure 2?

President Boutet: I think the figures are confusing. You will have to admit that. There are two sets of figures and two sets of measurements, and I think the motion should stand as made.

Mr. Bradley: If you notice in Figure 1, they show a tire 1⅛ and a flange 15/16, and the same in figures 2 and 3. Figure 4, a flange 15/16 and tire 1⅜. Of course that is in the throat. It certainly is confusing. I am at a loss to know just what it means. I believe the motion is well taken.

Mr. Witchel: It hardly concerns me much, but in looking at it now that 1⅛ limit seems clear to me, and the figures on the side have nothing to do with it. In case of a break of that kind it cannot be less than ½ inch.

Mr. Schultz: I move you that the action of the executive board in regard to the death of John Wehrle be concurred in by this convention, and that the resolutions be spread upon our minutes.

Seconded and carried unanimously.

Mr. Trapnell: The president suggested changes in the constitution, and I was delegated by the committee to read the proposed changes.

Constitution and by-laws of the Chief Interchange Car Inspectors & Car Foremen of America.

Article 1. Is a repetition of the caption.

Article 2. Read.

It was moved that the constitution be adopted, a section at a time. Carried.

Mr. Schultz: I would like to correct the caption of this by omitting the word "Interchange." I prefer to have it read "Chief Car Inspectors & Car Foremen of America." There are a great many foremen who have nothing to do with interchange inspection.

Mr. Bradley: I object to that for the simple reason that there may be one certain foreman or two certain foremen who have nothing to do with interchange; while there are foremen who have charge of interchange work, and we should facilitate the movement of freight. Therefore I would object to cutting it out.

Mr. Schultz: I have in mind the building up of this association; not only the prestige these men have with the railroad companies, but I want the association to grow. Where I come from there are 700 car men who hold good positions.

President Boutet: I would like to offer a little explanation to the foremen of thie association. It was originally the Chief Joint Car Inspectors' Association. At the St. Louis meeting the constitution was changed admitting car foremen to the association as members. That change was brought about by the executive committee. We thought it would admit anybody in any official capacity connected with the car department. I do not know as I have any more rights than any other member, but I certainly am jealous of the association. We have established an identity. Ten years ago we went into a permanent association, and I trust the members will consider that and try to see that we do not lose our identity.

Mr. Bradley: For that reason I made the remarks. These foremen may not have direct charge of interchange work, but may have charge indirectly through sub-officials.

Mr. Skidmore: I would like to have Mr. Trapnell read in the proposed change the members who are eligible.

Mr. Trapnell: The matter of name caused the executive committee a great deal of worry and discussion. One of the names proposed was The American Car Interchange and Inspection Association.

Mr. Schultz: We have among us representatives of two large roads who are paying their expenses, and they cannot be admitted and have a voice.

President Boutet: When it comes to defining who, it is any person oecupying an official position.

Mr. O'Donnell: I secured here in our territory a large number of members whose title would not permit them to become active members of this association, if strictly enforced; and I suggested to Mr. Boutet that we revise that part of the constitution, saying: Any person directly interested in supervision of car interchange, foreman or clerk or otherwise, shall have all the rights of aetive membership, and I hope it will be accepted.

The motion before the house that the title be accepted was carried.

Mr. Stark moved that Article 1 be adopted as read. Carried.

Mr. Hitch moved the adoption of Article 2, and that the executive committee be authorized to rearrange the words to suit the Master Car Builders' Association.

Mr. Trapnell: The matter is now up between this association and the Master Car Builders, and the President has requested them to give us the wording of Article 2, so that it will coincide with their ideas. And they will give us the wording which will be put in, providing it does not interfere with the germane idea.

Mr. Hitch: I incorporate that in the motion, and it is accepted by my second.

Mr. Schultz: It might be well to add "for the interehange and repairs of cars."

Mr. Head: Mr. Trapnell has already spoken of the delicacy of the Master Car Builders. Where we say "We deem it necessary," I think perhaps it would sound better to say "We deem it advisable."

The question was put upon the motion and carried.

Article 3.

Mr. Schultz: "To be a chief interchange inspector or ear foreman," and "any person occupying an official position in the car department."

Mr. McMunn: Another suggestion in regard to associate members. You say any man handling cars.

Mr. Schultz: They should be active and not associate members.

Mr. Stark: I think it should be "all steam railways and private car companies"; that the two be incorporated.

Mr. O'Donnell: They handle ears and they are railroads. I think it is covered now.

Mr. Trapnell: This takes in all car departments: "The membership shall be composed of chief interchange car inspectors, car foremen and any person holding an official position in the car departments of America."

Mr. Hitch moved the adopting of the recommendation offered by Mr. Trapnell. Seconded by Mr. Stark and carried.

A telegram from Mr. F. H. Clark, president of the Master Car Builders' Association, was read.

It was moved by Mr. Trapnell that the telegram be received, made a part of the proceedings of this meeting and a vote of thanks extended to the gentleman. Seconded and carried.

Article 4.

Mr. Schultz: The past president is going to be an honorary member and a member of the executive committee.

Mr. Trapnell. When we make him that. I move to insert after the word "salary," "He shall receive $50.00 a year."

Seconded by Mr. Stark, who suggested the addition of expense account.

Mr. Trapnell: Necessary expenses naturally go, as expenses handled by the exeeutive committee, properly O. K.'d at the next meeting.

President Boutet: This association is not in a position to pay $50.00 to its secretary unless you increase your dues. I would like to see the secretary get $100 if this association was able to pay for it; that would not begin to pay for the trouble; but this is a matter of love, and if you have anybody who does not want to accept it for that and not expect pay for everything he does, you had better not elect him. I trust that you will look at him in the manner in which I speak. I do not want to deprive any man of receiving what he should have for his services, but it must be a matter of love.

Mr. Trapnell: I do not see how we can ask him to do it for love. I believe if we are not in a position to offer that man $50.00, we should put ourselves in a position to give that $50.00.

Mr. Skidmore: I heartily endorse what our president has said. You must take into consideration that the president is doing something for the love of this association. It isn't the secretary who has all the work to do by any means, nor as much as the president. And I think that any member who is elected secretary and treasurer of this association, as well as the president, should be willing to do all he can to help the association along, and not take into consideration any salary that may be coming. We are working to upbuild the association; we do not want to increase the dues. The small amount that is paid only supplies you with the Railway Master Mechanic for one year, pays the postage and some little printing and other work. We can get along that way, and whoever you elect should be willing to give a little of his labor of love for a year or two.

Mr. Schultz: I believe before we spend any money we ought to provide for it. I think so far as the rank and file are concerned, they think they are paying perhaps all they should pay. There is another way by which more finances could be raised.

Mr. Trapnell: I fully appreciate the remarks made by yourself and Mr. Skidmore, but it seems to me that we are going under the caption of "America," broad America. East, West, North and South, and yet we say, as a body of men representing the greatest wealth of America, that we cannot afford to pay the secretary of this association the paltry sum of $50 a year. Suppose you elect another president and he should be unable to give the time to the secretary that Brother Boutet has been able to give. The entire work, according to your constitution and by-laws would fall upon your secretary and he should be paid for it. To be president of this association is an honor to be conferred upon any man, and he should not for one moment consider compensation: but you have a clerk of this body—one who is supposed to attend to every detail from the adjournment of this association until we assemble again, to whom this association looks for the proper data to prepare for this association that we may come and discuss intelligently. And do you expect him to do all this work and you come here and enjoy all the benefits of this association for the sum of $2.00 a year? It is absurd to ask the secretary to do something for nothing. The love of the association is just as strong today as it was when he did not hold an official position, but you may elect another secretary. Fifty dollars is a small pittance, and I move the previous question, that $50 be inserted.

President Boutet: We have considered that it is not proper to put a question on any motion until every member has had an opportunity to speak. I rise again to reiterate what I said before. If you are going to elect anybody as secretary of this association that has no love at heart, do not elect him. Bear in mind, in electing all your officers, to look after the welfare of this association. Four or five of us have worked hard in the last thirteen years to build up an association where we could associate together and exchange views; do not overlook that point. We can certainly stand it for a year or two longer until we get in a position to pay something. Fifty dollars would not compensate any secretary as salary for this association. We have been paying $20 for the last two or three years, and I believe that any man is willing to accept it at that figure. We cannot afford to raise our dues. The executive committee has fixed our dues at $2. The majority of you come here and pay your own expenses; the majority of you are drawing a salary of from $75 to $100. We have tried to have you bring your wives. The object in bringing your wives is that we may enjoy ourselves in harmless enjoyment. Bear in mind that it costs considerable money to take the families out. Cannot this be handled on the per capita rate? I would suggest that somebody offer an amendment that we continue at $20.

Mr. Trapnell: Seeing that you desire that, Mr. President, I do not believe we should specify any amount. I think we should say: "And the secretary should be paid such sum as the convention may direct in annual session." I offer that as an amendment to the motion.

Motion carried.

President Boutet: The chair rules that this covers the motion.

Mr. Trapnell: The mover of the motion excepts to the ruling of the chair.

Mr. Bradley: There are some that misunderstand the motion, and they voted strictly against their wishes.

President Boutet: The motion carries with it that the salary is not fixed, but at every annual meeting you will fix the compensation of the secretary before you adjourn.

Motion by Mr. Stark to adopt Article 6. Carried.

President Boutet: That carries with it all the dues that this association should pay. If you elect to have an official organ and they see fit to have the minutes published that way, that would cover the subscription to that paper.

It was moved by Mr. Stark that the article be adopted. Carried.

Mr. Trapnell moved that the constitution as a whole, as read and amended be adopted. Seconded by Mr. Bradley and carried unaimously.

By-Laws.

Article 1, on, motion, adopted.

Article 2, on motion, adopted.

It was moved by Mr. Stark that the by-laws as a whole be adopted as read. Seconded and carried.

It was moved by Mr. Stow that we proceed to the election of officers. Carried.

Election of Officers.

It was moved that two tellers and a judge be appointed. Carried.

Messrs. Bradley and Stow were appointed tellers and Mr. Stark as judge.

And thereupon President Boutet asked Vice-President Berg to preside over the election of a president.

Mr. Waughop: There is only one Chinaman chief inspector in the United States; that is myself. I want to put in nomination today a gentleman for president of this association who has borne the heat and burden of the day with me. I was your president for seven years; he has been your president for four or five years. It is not more than proper, according to my idea, that he should serve the same length of time and bear the same burden that I bore. I nominate H. Boutet of Cincinnati for your next president.

Mr. O'Donnel: I would like to second the nomination of Mr. Boutet on behalf of the membership of Buffalo. It is not necessary to dwell at this time on the make-up of the gentleman who is your present president, and whom I trust you will continue as your future president. Perfection in human life is difficult to attain, but I think those of you who have attended this convention for the last three days have noted the uniformity and patience of Mr. Boutet. At many times it would tax the patience of any person living, but he has always maintained that urbane and good-natured way, that has won him the affection of the members, and on behalf of our city I wish to second the nomination of Mr. Boutet for the next year. (Applause.)

It was moved by Mr. Waughop that the rules be suspended and that the nominations close and that the secretary cast the ballot of the convention for Mr. Boutet. Seconded and carried unanimously.

Thereupon Secretary Skidmore cast the unanimous ballot of the convention for Mr. Boutet and Vice President Berg declared him elected.

President Boutet: It is hardly necessary for me to express my feelings at being elected. It shows that the members have felt that they appreciate what I have tried to do for the welfare of the association. I will state that as long as I live and enjoy good health I expect to use every influence in behalf of the association in the future as I have in the past. I have entered upon my last term as your president and I trust that you will concentrate your thoughts upon such a person for vice-president who is going to carry out the policy that has been inaugurated for the welfare of this association—some person who has the time and talent and will devote it to the good of the organization. We are young and we need considerable work to help us along to get the advantages of this association, which I feel we cannot afford to be without. I think you. (Applause.)

With President Boutet in the chair the convention proceeded to the election of a vice president.

Mr. Cleary: I rise to nominate a man for vice president, and in doing so I take into consideration the interest of the association. I will nominate him whom I think will be the means of promoting the interests of this association in this state, one whom I think will elevate the association to a high plane of usefulness, T. J. O'Donnell.

Seconded by Mr. Schultz.

It was moved that the rules be suspended and that the secretary be instructed to cast the unanimous ballot for Mr. O'Donnell.

Mr. O'Donnell: I would be unmindful of the highest attribute, the best feelings of the human heart if I did not deeply appreciate the kind words that have been said by the gentleman nominating me for first vice president of this association. I would also be ungrateful if I did not appreciate deeply the kind words that have been said by the officers and members without exception since you have been in session; but I have made up my mind and when I have made up my mind nothing will revert it unless it is for the welfare of the moral suasion of humanity. I am on the executive board and I will continue as long as I have the strength and wisdom to remain on that board or the members see fit to continue me there, but under no condition will I accept a position that will lead to the presidency of this organization. I will detail my reasons why. In the duties of life we are tied up with manifold obligations that persons from the surface cannot see. I am tied up with quite a number of duties, and I do not feel that I can take upon my shoulders the position of vice president, with the understanding, as outlined by your president, that it must eventually lead to the chair. Furthermore, I have some one else to think of, my better half, and it means a lot of hard work and time away from home. The home is the place we can go and say we are free from the turmoil of the day; I want that as far as possible in the future. I appreciate the nomination, but I cannot accept it.

President Boutet: I have no doubt that you are tied up in such a manner that it would be too much for you to assume the duties. I cannot help but feel that the next meeting of this association must be held in the east for the welfare of the association, and I do not think there is a member in the room but who would be more than willing for you to act as their president. And I trust, on behalf of the association, that you will accept.

Mr. O'Donnell: I appreciate the sentiments you have expressed and I know just what you mean, but as I stated, I will do everything possible on the executive board—work hand in hand with the officers. With all respect, I hope you will accept it as final. We want a man who will take the presidency next year. I am young in the association; I do not want to accept it, but the main reasons are those I have mentioned.

Mr. Skidmore: Mr. O'Donnell is a young member of the association. While being young, he has done more than a great many of us who have been in the association many years. We all recognize that. We have seen it demonstrated since we have been here. I have seen for the past year. He had not been a member two weeks until his influence was felt. He hardly got back from the meeting at Detroit until he sent me 18 names of new members. That shows what kind of a man Mr. O'Donnell is for this association. That is the kind of a man we want to upbuild this association. You have seen what the entertainment committee has done for the association in the past few days. That has been largely brought about through the work of Mr. O'Donnell. If he is elected vice president you will see the work of his hand for the good of the association. You cannot afford to elect any one who is not of that disposition. I know of no man better fitted for vice-president than Mr. O'Donnell, and I known that the members of this association heartily endorse what I say. A large number of them have talked to me about him, the work he has done and the push he has to him in moving things along. For the benefit of this association we cannot afford to listen to the withdrawal from the candidacy of vice president the name of Mr. O'Donnell.

Mr. O'Donnell: If I did not live in Buffalo I would become egostical. I place in nomination the name of Mr. Trapnell, of Kansas City.

President Boutet: It is necessary that the former motion be put or withdrawn by the mover before we can proceed further.

Mr. O'Donnell: Do you see a yellow streak in my make-up? When I say a thing I usually mean it. I appreciate what Mr. Skidmore has said. I give you my word that I will continue on the executive board, but hope this will not be carried further.

Mr. Hitch: I think it is entirely wrong, after the remarks that have been made by this efficient man before this body to undertake to force it upon him. He appreciates what has been said, and what he has done he has done with a good will. He has vouchsafed to this association that he will continue to lend his hand, and I think it is impossible to force it upon him. There is no alternative except to accede to his wishes.

Mr. Bradley: I move that the motion be reconsidered. I understand Mr. O'Donnell's situation at Buffalo. We lock horns quite often. I known that his time is well occupied. And I move you that Mr. Trapnell be elected a first vice president.

It was moved by Mr. McMunn that the nominations close and that the secretary cast the ballot of the association for Mr. Trapnell.

The motion was seconded by many and carried unanimously.

Secretary Skidmore cast the ballot for Mr. Trapnell and President Boutet declared him the unanimous choice for vice-president.

Mr. Trapnell: Mr. President, ladies and gentlemen—At this time I hardly know how to express myself, to think that this association has seen fit to confer upon me the honor of the vice-presidency of this association. I trust that at no time during the encumbency of that office by myself that I will give you cause to regret the action you have taken. I trust that at all times I will be in unison and accord with the officers of this association for its upbuilding and advancement. A great future is in store for this organization, and in a shorter time than perhaps many of you realize, when this association will be placed upon a level with other railroad organizations of this country and will be taken into consideration when the matter of car interchange is brought up. I trust that our action will be harmonious and that we will all come together one year hence and you will be able to say to the officers: "Well done for the action you have taken." I thank you. (Applause.)

Mr. Trapnell: I do not like, as one of the elected officers, to take the floor so soon, but I take pleasure in placing before this convention for the office of secretary-treasurer, the name of Stephen Skidmore, and move you that the nominations do now close and that the rules of this association be suspended and that Mr. Skidmore be elected by acclamation.

Seconded by Mr. Bradley and many others, and carried unanimously.

Mr. Trapnell: By the authority of this convention I hereby cast the entire vote of this convention for Stephen Skidmore for secretary for the ensuing term.

Mr. Skidmore: All I can say is that I heartily appreciate the honor that you have conferred upon me by electing me secretary and treasurer and that I will do all I can to assist in establishing the Chief Joint Car Inspector & Car Foremen's Association on a larger basis, with the aid of the members.

As members of the Executive Committee the following names were placed in nomination: A. Berg, W. M. McMunn, G. C. Anderson, J. Bradley, F. C. Schultz, T. J. O'Donnell, E. R. Campbell and George Lynch.

The ballot resulted in favor of the following, who were duly declared elected: T. J. O'Donnell, George Lynch, W. R. McMunn, F. C. Schultz and A. Berg.

President Boutet: We have neglected to make any recommendations to the Master Car Builders, and I would suggest that we leave that in the hands of the Executive Committee.

Mr. Stark: The Executive Committee met in Cleveland and paid their own expenses, and I move you that the treasurer be instructed to pay the members of the Executive Committee who attended those meetings $5 a day for each meeting to cover their expenses.

Mr. Waughop: I paid my expenses and I think it is proper. I do not see why we should be repaid for something we are trying to do for the association. We have no money to pay the secretary a salary, why should we pay a man $25 who went there for the good of the association?

The motion was lost.

Mr. O'Donnell: I wish to place a motion before this body that we extend our most cordial thanks to President Boutet, Secretary Skidmore; the stenographer, Miss Unkenholz; to the Entertainment Committee and to the hotel people for the excellent manner in which they have taken care of the convention.

Seconded and carried unanimously.

President Boutet: There is one important feature that we must not forget: That we have participated in the best entertainment that we have ever had and there is something extraordinary due the members of the entertainment committee, and the contributing firms to show our appreciation, I suggest that we tender them a rising vote of thanks and elect the entertainment committee honorary members of this association.

Mr. O'Donnell: Before you do that I think you have overlooked the fact that one large hearted gentleman who has taken an active part in the entertainment arrangements, has not participated in the convention, Mr. W. O. Thompson of the New York Central Railroad, who is secretary of the Traveling Engineers' Association had to go to Denver to attend that body. He is just as much to be thanked as any of the members, and I move you that he be included.

The names of Mr. W. F. Brazier and .E Chamberlain were also proposed for honorary membership.

The question was put upon the motion and carried unanimously.

Mr. O'Donnell: I think that we should express our thanks to the ladies for the very pleasant manner in which they have mingled among us and for having graced our meetings by their presence. We hope they will all return to their homes and have a tender spot in their hearts for the city of Buffalo and the convention of 1909.

Seconded and carried unanimously.

Mr. Trapnell: There is one other thing that we have overlooked. I move you that the official organ of this association for the ensuing year be the Railway Master Mechanic, and that the executive committee make such arrangements with same as they deem necessary, and that the members be furnished with a copy of the published minutes and subscription for one year.

President Boutet: There are a number of you who have not received the paper regularly. If you will notify the editor, you will get the paper.

And thereupon the convention adjourned to meet at the call of the Executive Committee in 1910.

LIST OF MEMBERS OF THE C. J. C. I. & C. F. ASSOCIATION.

C. S. Adams, J. C. F., N. Y. O. V. W. and W. S. R. R., Weehawken, N. J.

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E. Head, C. C., C. D., Wabash Ry., Springfield, Ill., care Wabash Ry.

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Geo. W. Lewellyn, Sec'y, The Joyce Cridland Co., Dayton, O.

W. L. Momming, Storekeeper, C. & O. Ry., Covington, Ky.

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W. R. McMunn, Special Inspectr., N. Y. C., Union Sta., Albany, N. Y.

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Geo. McDonald, Dist. Car. Inspector, C. R. I. & P. Ry., Kansas City, Kas.

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NOVEMBER MEETING, A. S. M. E.

At the New York meeting of The American Society of Mechanical Engineers, held on November 9, in the Engineering Societies Building, 29 West Thirty-ninth street, there were two papers presented. One by Professor Gaetano Lanza and Lawrence S. Smith of The Massachusetts Institute of Technology, on "Reinforced Concrete Beams," and the other by Professor. Walter Rautenstrauch of Columbia University, on "Stresses in Curved Machine Members." The paper on reinforced concrete beams is the same as that given at the Boston meeting of the society on October 20. It compares the results of tests upon full-sized beams made at the Massachusetts Institute of Technology and the University of Illinois with three different theories of beams of this type. The paper on stresses in curved machine members outlines the method of procedure for the design of principal sections of hooks, punch and shear frames and other curved machine parts. Experimental results are submitted in support of the theory presented.

Railway Mechanical Patents Issued During October

Wheel guard, 934,925—George W. Mahan, Cold Spring Harbor, N. Y.

Brake handle, 934,935—George W. Rigney and Stewart J. Hanlin, Pittsburg, Pa.

Bolster for steam shovels, 934,941—William Sheppard, Paterson, N. J.

Locomotive, 934,944—Hal R. Stafford, Schenectady, N. Y.

Car truck, 934,955—William E. Woodward, Schenectary, N. Y.

Door operating mechanism for railway cars, 935,050—Spencer Otis, Chicago, Ill.

Brake shoe, 935,053—Clifton D. Pettis, Chicago, Ill.

Brake mechanism, 935,152—Bernard J. Hinkebein, New Albany, Ind.

Car brake mechanism, 935,176—Samuel B. Thompson, Fanwood, N. J.

Tank car, 935,210—Charles A. Lindstrom, Pittsburg, Pa.

Superheater for locomotives, 935,223—Oran W. Ott, Oak Park, Ill.

Superheater for locomotive boilers, 935,224—Oran W. Ott, Oak Park, Ill.

Bolt for grain car and other doors, 935,284—Frank Thomann, Summerfield, Kan.

Car coupling, 935,400—William A. Palmer, Ludlow, Ky.

Brake mechanism for railway cars, 935,436—Andrew C. Vauclain, Philadelphia, Pa.

Box car door, 935,450—William T. Anfield, St. Louis, Mo.

Safety brake apparatus for railway trains, 935,468—Daniel M. Daley, West Seneca, and Andrew H. Long and Herbert I. Maltbie, Roland, N. Y.

Freight car door lock, 935,526—William C. Kneale, Indianapolis, Ind.

Car coupling, 935,563—Louis Thamas, New Brunswick, N. J.

Car door, 936,209—Daniel S. Bailey, Rantoul, Ill.

Dirigible headlight, 936,211—James B. Baum, Grand Junction, Colorado.

Gearing for locomotive recording instruments, 935,682—Samuel T. Park and John E. Phillips, Danville, Ill.

Railway car, 935,696—Carl L. Schwartz, St. Louis, Mo.

Railway car seat, 935,700—Watson R. Smith and James A. Sanford, Jackson, Mich.

Claw bar, 935,714—Minor Waters, New Albany, Ind.

Wheel tire contour recorder, 935,728—William C. Arp and Fred F. Hildreth, Terre Haute, Ind.

Roller side bearing, 935,893—James M. Coleman, St. Lamber, Quebec, Canada.

Mail-bag hanger, 935,894—William M. Corthell, Chicago, Ill.

Brake equalizer, 935,926—Willard G. Ransom, Davenport, Ia.

Passenger car, 935,929—Harold Rowntree, Chicago, Ill.

Automatic train-pipe coupling, 935,944—Rolland G. Strother, Findlay, Ohio.

Automatic door latch, 935,946—John J. Tatum, Baltimore, Md.

Car truck, 935,951—John C. Barber, Chicago, Ill.

Car wheel, 935,962—Walter A. Church, Los Angeles, Cal.

Track-joint, 936,016—Hubert A. Myers, Goshen, Ind.

Car seal, 936,042—Einar L. Sabey, Chicago, Ill.

Freight car, 936,043—Ralph V. Sage, Westmont, Pa.

Car coupling, 936,046—William S. Schroeder, Chicago, Ill.

Body bolster for cars, 936,159—Henry F. Pope, Cleveland, Ohio.

Bolster, 936,160—Henry F. Pope, Cleveland, Ohio.

Sliding-door fastener, 936,191—Edward H. Turcott, Walker, Louisiana.

Locomotive, 936,198—Samuel M. Vauclain, Philadelphia, Pa.

Locomotive headlight, 936,200—Isaac L. Wade and William L. Smith, Roanoke, Va.

Welding furnace, 936,221—Brewster W. Cribb, Baltimore, Maryland.

Locomotive engine, 936,413—Francis J. Cole and Frank F. Scoville, Schenectady, N. Y.

Air brake system, 936,415—George E. Congdon, Jacksonville, N. Y.

Car and engine retracker, 936,439—James I. Ford, Niantic, Ill.

Brake rod coupling jaws, 936,453—George F. Hinkens, Wilmerding, Pa.

Draft gear, 936,547—Harry T. Krakau, Cleveland, Ohio.

Apparatus for depositing sand on railroad tracks, 936,567—William D. Ross, Providence, R. I.

Locomotive, 936,582—Otis N. Terry, Lincoln, Neb.

Locomotive boiler, 936,607—George Cook, Elba, N. Y.

Manufacture of steel castings, 936,623—Jacob K. Griffith, Latrobe, Pa.

Truck frame, 936,626—Alonzo L. Hastings, Philadelphia, Pa.

Tunnel attachment, 936,628—James A. Horne, Oregon City, Ore.

Tunnel attachment, 936,629—James A. Horne, Oregon City, Ore.

Journal box, 936,675—James G. Smith, Covington, Ky.

Means for packing waste in journal boxes, 936,704—Louis C. Condit, Catonsville, Md.

Grain-car door, 936,764—Abner J. Denton, Nebraska City, Nebraska.

Sleeping car berth, 936,814—Peter Rubinovitch, Boston, Mass.

Train-pipe coupling, 936,894—William M. Hiler, Quincy, Ill.

Automatic brake-applying device, 936,905—Earl P. Jessop, United States navy.

Center bearing for cars, 937,038—John C. Barber, Chicago, Ill.

Grain door, 937,056—George R. Dunn, Gary, Ind.

Car brake, 937,068—George M. Hoadley, Springfield, Mass.

Railway car brake, 937,069—George M. Hoadley, Springfield, Mass.

Dump door operating mechanism, 937,100 and 937,101—Frederick Seaberg, Chicago, Ill.

Railway car, 937,106—John W. Slaven, Galesburg, Ill.

Track sanding device, 937,358—Martin A. Brown, Baltimore, Md.

Car heater, 937,361—James M. Coleman, St. Albans, Vt.

Apparatus for preventing collisions on railways, 937,377—Thomas C. Mason, Los Angeles, Cal.

Fluid pressure brake, 937,392—Walter V. Turner, Wilkinsburg, and John S. Custer, Pittsburg, Pa.

Electric fluid pressure brake, 937,393—Walter V. Turner, Wilkinsburg, and Robert H. Blackall, Edgewood Park, Pa.

High-speed reducing valve for air brakes, 937,394—Walter V. Turner, Wilkinsburg, Pa.

Dump car, 937,416, 937,417, 937,418 and 937,419—Argyle Campbell, Chicago, Ill.

Snow plow, 937,428—Alfred Drowley and Donald D. McLean, Priceville, Ontario, Canada.

Air brake system, 937,452—George Macloskie, Schenectady, N. Y.

Brake hanger, 937,512—Samuel M. Curwen, Philadelphia, Pa.

Knee for car platforms, 937,521—Henry E. Haddock, Cleveland, Ohio.

Support for railway brake connectors, 937,534—George E. Kelly and George F. Royer, Wilkesbarre, Pa.

Automatic coupling, 937,537—Augustus Koage, Pine River, Wisconsin.

Apparatus for rolling car wheels, 937,539—Camille Mercader, Pittsburg, Pa.

Grain car door, 937,630—John F. McGlenn, Harvey, S. D.

Lubricant holder, 937,682—Harry A. MacClyment, Burlington, Iowa.

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CONTENTS.

PIECE WORK

The working out of some system which will reward the workers for their skill and attention to work and thus encourage them to execute their work at the greatest possible speed has long been the problem in railroad and manufacturing shops. The attempt to solve this problem has lead to the working out of the piece work system which is now used quite extensively and with varying degrees of success. Although piece work has been found to increase the output, it has frequently been found to cause more or less dissatisfaction among the employees and also to cause a deterioration in the quality of the work. One of the disadvantages of piece work is that it creates a spirit of every man for himself regardless of the man working along side of him and while it is true that it gives the good man a better chance, it also centers each man's interest in himself only, as far as productiveness is concerned. The employee does not consider his work in relation to the work of others. Further, as he is being paid for and considered only as regards the number of pieces turned out, he often sacrifices quality to quantity for he concludes that quantity is what is desired. An efficient system of inspection can overcome this to a certain extent, but this, in many cases, causes friction and there are also many things which get by the inspectors. In many shops care was not taken in establishing the original rate and after the production had increased the rate was cut. As a result, employees have gotten the impression, and in many cases justly, that if they make over a certain amount, prices will be cut. Generally speaking the piece work system is an improvement over the day work system, but it leaves much to be desired. With the large number of employees under one management as at present some method must be employed to develop a spirit of harmony.

The bonus or premium system is an effort in this direction which has come into use during the past few years and is now quite well known. The usual method is to pay the employee a fixed day wage, establish standard time schedules for all work and pay a certain bonus for work which is done in less than time and a half; that is, to give a bonus for an efficiency of more than 66 2-3 per cent. The Santa Fe has been very successful with this system, so much so that the past year has seen its extension to foremen, road foremen of engineers, master mechanics, the power house and various other divisions. This system not only has the advantage of paying a man for the amount of work he does but at the same time it promotes a desire to co-operate with the man working alongside, for when a number of men are working on one job, each one is interested in the efficiency of the whole operation. As the bonus is estimated over a period of a month it encourages men and foremen to plan ahead and arrange work to the best advantage and also encourages the development of new ideas which, of course, also tend to increase the efficiency.

VALVE GEARS

On another page of this issue, we are publishing an article on the Walschaert valve gear written by Hubert E. Collins. While this article may seem to some to be somewhat academic, in its treatment of the subject, the comparative unfamiliarity with the gear on the part of the roundhouse and shop men warrants this kind of handling. All who have had anything to do with the Walschaert motion,—(by the way the original spelling of the name was "Walschaerts" but it has become generally known as the "Walschaert" and the latter seems to be the best adapted to the purpose)—are aware that the familiar trouble of slipped eccentrics has no parallel in the cases where this gear or any other outside motion is concerned. Once set, the return crank is positively located and the only adjustment required is the lengthening or shortening of the connections at the valve stem. Valve setting does not present the problem that it does where the link motion is used, and knowledge of fewer details is required on the part of the roundhouse and shop employees. The idea is often met with that the Walschaert gear is a new invention, at last in its application to the locomotive. On the contrary, its use dates back to one year previous to the adoption of its competitor, the Stephenson, about the middle of the 19th century, and its use on foreign railroads is much more common than that of any other gear. One reason for this fact is immediately apparent when it is remembered that up to recently almost all English locomotives and by far the larger number of continental engines were built with inside connections.

CONCERNING THE OPERATION OF COAL MINES

Coal mining is becoming more and more an essential side issue in the operation of railroads. The machinery at the numerous coal mines operated by subsidiary concerns of the railroads properly belongs under the supervision of the mechanical departments. To many officials of this department, mining is a science in which they have had little or no experience and consequently, in some cases at least, not as much attention is directed to this subject as the occasion demands. The recent disaster at the St. Paul mine at Cherry, Ill., very forcibly calls attention to this side of the mechanical department's field and, if it is not too soon forgotten, may result in the application of new ideas tending toward better safeguards to life and property. The writer is not in position to state that in any particular instances mines have not been properly equipped with the most modern machinery; on the contrary it would be hard to show that any one large mine is essentially more poorly equipped than any other. The point is that there has been very little advance in methods for years. Without attempting much detail, it would seem that hoisting cages should be equipped with control mechanism rather than to place the whole of the responsibility upon an engineer situated, in some cases, several hundred feet from the shaft in an isolated engine room. If this is not practicable, there could be an arrangement for signalling the engineer from the cage rather than from the mouth of one of the galleries. Air compressors, now commonly in use for the purpose of driving cutting machinery, could well be equipped with a system of piping calculated to supply air to certain localities in the mine in such a way as to perform part of the duties of the fan when it is not possible to operate the latter with its accompanying draft in the ventilating and hoisting shafts. Electric lighting systems should be systematically inspected and should be in duplicate as far as the sections most liable to get out of order are concerned.

It has always been through mistakes, more or less serious, that the greatest lessons in improvement have been taught, learned and applied.

Industrial plants are being more carefully guarded from fire hazard than was the custom formerly. Railroads have not been far behind as far as the larger installations are concerned. In the smaller shops, terminals, mines, etc., this is not the case. If fire drills and other precautions are of value in the large plants, they should be proportionately valuable in the lessor instances and time and thought given to this consideration would be amply repaid in the decrease of risk.

NOTES FROM THE UNITED KINGDOM

Amongst the many novelties in connection with railway practice and construction in Great Britain a new one of special importance is a turbo-electric locomotive, with a four-motor equipment, for experimentation in express main line running. Some practical development of this kind has been expected by references from time to time to the proposals of inventors to apply turbo-electric or petrol-electric control to the propulsion of railway trains, road vehicles, and even ships. There is no doubt that on main line railways it is difficult to show cause why many miles of copper wire should be suspended at a great cost in order to drive trains by power generated at a central station instead of on a locomotive engine. Yet the case against the employment of "electric power stations on wheels" is almost equally strong, and it remains to be seen whether using a turbine will result in sufficiently important economies to cover the cost of electrical machinery. The turbine is of the impulse type, presumably because of limitation of space; but it is to be hoped that this fact will not be seized upon as evidence in support of several technical writers who have recently been prematurely designing the perfect and final steam turbine for electrical purposes. The frequently repeated opinion that salvation lies in a hybrid form of turbine made on the impulse principle at the high-pressure and the reaction principle at the low-pressure and is by no means to be accepted without further question. It is true that some makers of the Parsons type have had, in the past, numerous breakdowns traceable to the temperature effects in the high-pressure stages; and it is true that the Admiralty now appears to favor the mixed principle turbine for small ship lighting sets. But both these points may easily be misunderstood. For ship lighting a shorter machine is naturally to be preferred; while in respect of the behavior of the Parsons bladed drum it is a fact, surprising, perhaps, but nevertheless true, that there is still room for important and advantageous changes of design, since the studies of the highest experts do not yet seem to have resulted in any clear understanding of the path of the steam and the most efficient method of utilizing it. Without prejudice to the question of the intrinsic merit of the two main types, it is certainly too early to assume that either has reached its limit of development.

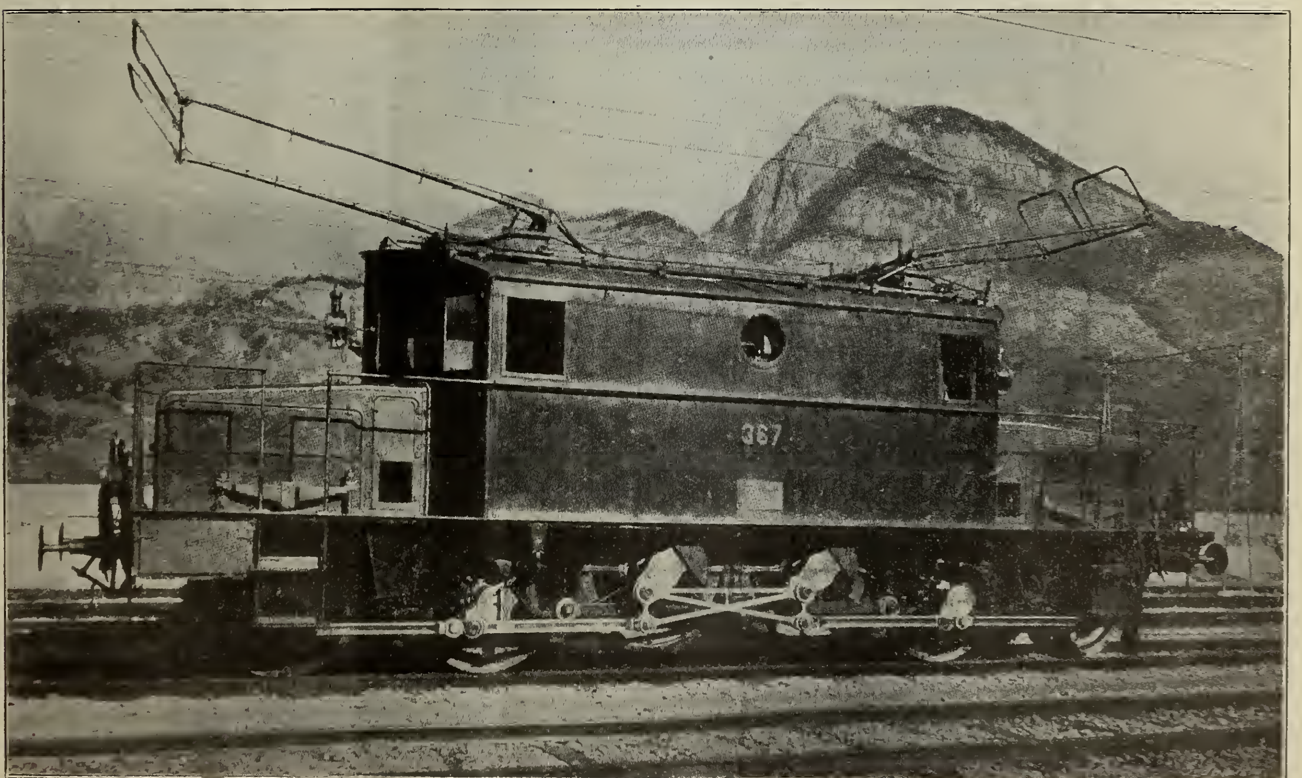
The new session of the Institution of Mechanical Engineers opened with the consideration of a paper by Professor W. E. Dalby on "Heat Transmission." Professor Dalby at the outset explained that heat is transmitted from the furnace to the boiler of an engine by radiation, connection, and conduction, and discussed the present state of knowledge of the subject from each of these different aspects. He showed that it had been established that a film or grease or water on the inside surface of a boiler and the relatively cool film of gas on the outside interfered very seriously with the transmission of heat. The importance of velocity of water flow and good circulation inside the boiler were two aspects of the same problem, that of destroying the water film clinging to the plate. Notwithstanding the large amount of data contained in the papers bearing on the subject of heat transmission, over 500 were analysed by Professor Dalby for the purpose of his paper. There is a general absence of complete data regarding the actual phenomena occurring in a steam-boiler when working under the ordinary conditions of practice. No data exists, for instance, which gives the temperature gradients at different parts of a boiler flue with accuracy; isolated experiments furnish incomplete data from which the gradient may be roughly imagined, but researches and papers alike have had very little influence in modifying the general design of steam-boilers. The Cornish boiler is still of the same design as it was a century ago. The Lancashire boiler has been scarcely modified in any essential particular. The locomotive boiler of today is a magnified type of the Rocket boiler. A research might be undertaken by the institution in which steam boilers of different types working under practical conditions may be made the subject of experiments in which all the elements of their working are measured, together with temperature measurements for the purpose of establishing the temperature gradients at different parts of the heating surface. Such a research would be very costly, but would be well worthy of the new institution. An example cited by Professor Dalby and obtained a quarter of a century ago by a talented French experimentalist, serves to reveal the very great difficulties which surround this problem. The hot gases give up their heat at an enormous (an almost unbelievable) rate. A locomotive boiler on the Orleans Railway was used for the trials. The temperature in the firebox was 2,912 deg. Fahrenheit, and in the smokebox it was 752 deg. The length of the tube along which this drop of temperature took place was 16 ft. 5 in. It is hard to realize that in such a short length the difference was well over 2,000 deg. When we consider the time element, the facts are yet more remarkable. The gases were moving at a speed of 169 ft. per second, so that they passed from one end of the tube to the other in one-tenth part of a second. Imagine such a small interval of time elapsing for a temperature drop of 2,160 deg. It remains to be seen whether we really do utilize this to the best advantage.

Four-Speed, Three-Phase Locomotive, Simplon Tunnel*

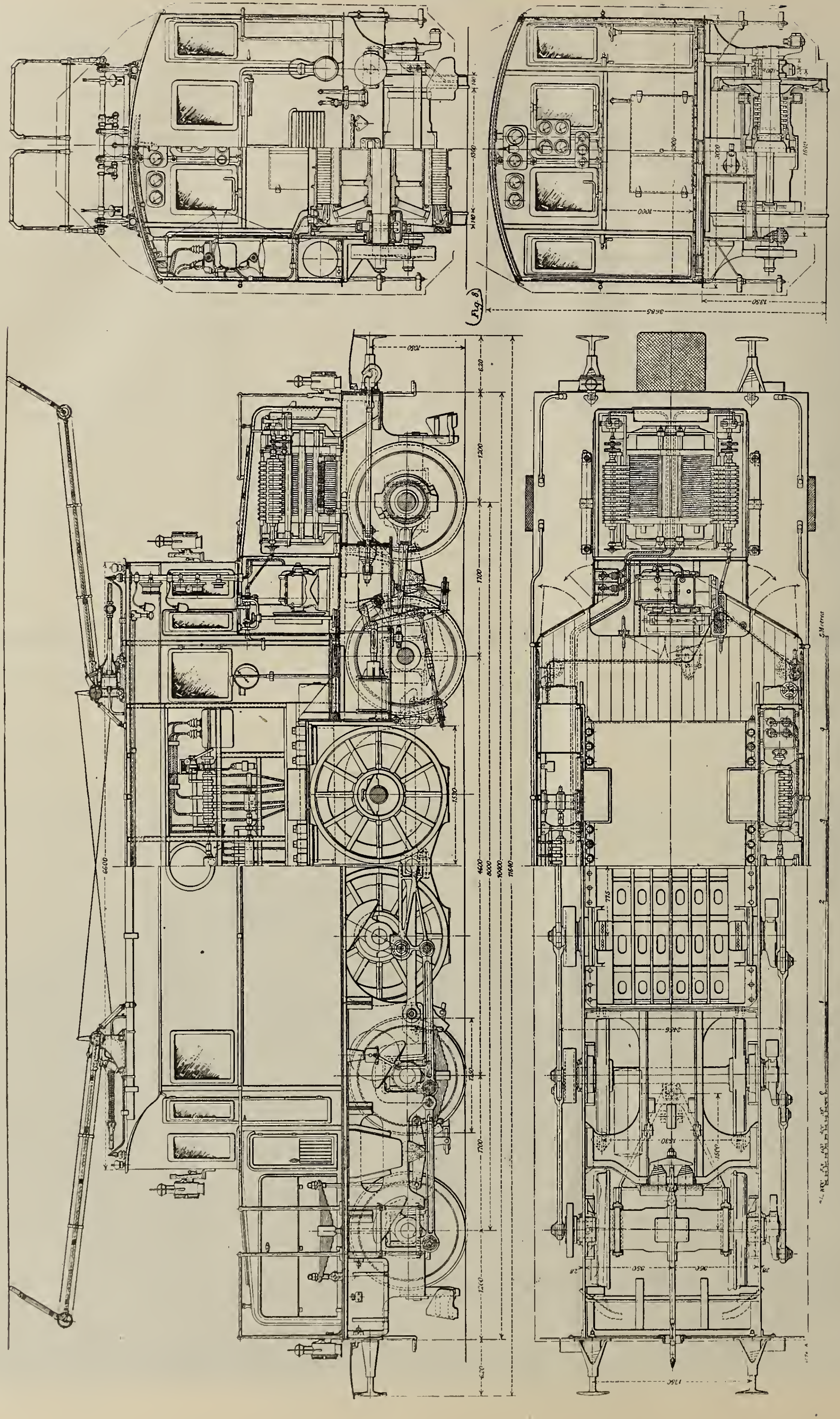
The accompanying illustrations show the general aspect and details of one of two locomotives recently placed in service on the Simplon Tunnel route in Switzerland. These locomotives, according to "Engineering" (London), were built by Brown, Boveri & Co. of Baden, Switzerland, for service between Brique and Iselle through the Simplon Tunnel.

The line between the Swiss and the Italian termini is a single track, about 22 kilometres (13.7 miles) in length, of

*From Engineering, London.



Three-Phase Electric Locomotive, Simplon Tunnel.



Four Views of the Simplon Tunnel Locomotive.

which 19.8 kilometres (12.4 miles) are in tunnel. The heaviest gradients are 7 per 1000 (1 in 143), without counting a small length on the north side where the gradient is 10 per 1000. The sharpest curve on the main line is 300 metres (984 ft.) in radius, and 150 metres (492 ft.) is the minimum used on the siding. The conditions the builders had to meet involved the hauling of one locomotive of a passenger train weighing 300 tons at a speed of 70 kilometres (43.5 miles) per hour, and the same engine was also to be capable of hauling 400-ton freight trains at about 35 kilometres (21.7 miles) per hour. Since June. 1906, when electric traction was first resorted to on the Simplon line, these train-loads have been exceeded, the passenger trains frequently weighing 350 tons, and the freight trains 650 tons, each of which is hauled by a single locomotive. The speed has been maintained at 70 kilometres except on the up-gradient of 1 in 143, where it is 35 kilometres. This latter speed is also the average speed of the freight trains. Both these speeds fit in well with the three-phase system (3000-volt 16 periods), which was that selected for various reasons, partly for that of mere convenience. With this system, however, only two running speeds have hitherto been practicable, one being half that of the other, and each being constant and independent of the draw-bar pull.

The main improvement effected in the new locomotives consists in their being fitted with motors having a short-circuited rotor, thus making it possible to obtain four speeds economically. Further improvements have also been made in the construction and fitting of the electrical apparatus, and in the arrangement of the mechanical details.

The new locomotives as shown, have eight coupled wheels, and their principal characteristics are as follows:

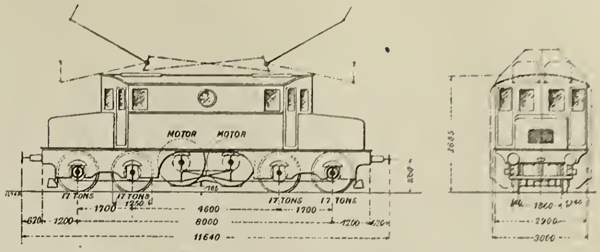
Power of motors: 1000 horse-power.

Current: three-phase at 3000 volts, 16 periods per second.

Draw-bar pull: 10,600 kilogrammes (23,362 lb.) at 25 kilometres (15.5) miles per hour; 7600 kilogrammes (16,750 lb.) at 35 kilometres (21.7 miles) per hour; 6500 kilogrammes (14,326 lb.) at 54 kilometres (33.6 miles) per hour; 4800 kilogrammes (10,579 lb.) at 73 kilometres (45.4 miles) per hour

Weight of locomotive: 68 tons.

The intention in the first place was to do away with the trailing-wheels of the older type of engines, and to utilize the whole of the weight for adhesion; and it was considered simplest, therefore, to adopt an eight-wheel type, the weight of the engine being distributed equally on the four axles. With a view to facilitate the taking of the curves, the wheel-base is, however, not rigid, the front and back coupled wheels being mounted on radial trucks which permit a slight radial and lateral play. The two central axles are fixed, and are 4.6 metres (15.1 ft.) apart. In order to facilitate the taking of curves in the absence of trailing wheels, the wheel diameter has been reduced from 1.640 metres (5.37 ft.) in the older type of engine to 1.250 metres (3.97 ft.) in the new. In the fitting of the motors care was taken not to increase the unsprung loads, which must be a minimum if shocks at the rail-joints at high speeds are to be avoided. In the older type of engine this desideratum was secured by fixing the two motors rapidly inside the frame, and transmitting the torque to the driving-wheels by cranks and coupling-bars. The same plan was adopted in the case of the new locomotives, but in view of the very long wheel-base some modifications were considered advisable. In the first place, it will be seen that the cranks on the motor shaft are not coupled to the wheel-crank by inclined connecting-rods, as in the old type of engine, but by a special frame. Each point of this frame describes a circle in space, and hence horizontal connecting-rods can be used by attaching them to suitable points in this frame. The tendency which inclined rods have to make an engine ride on its springs is thus avoided. As already stated, the outer drive-wheels are



General Diagram, Simplon Tunnel Locomotive.

mounted on radial trucks, and in order to avoid the use of coupling-rods, with an exceptional amount of slack, a somewhat special system of transmitting the drive to this has been adopted. The leading and trailing axles are hollow, being mounted on ball-bearings in the radial truck. The coupling-rods are connected to an independent shaft which passes through this hollow axle, and is mounted in the engine frame. The connection between this shaft and the hollow axle is such that a torque only is transmitted from one to the other, the hollow axle and its wheels having thus, though positively driven, a considerable degree of play relatively to the engine framing.

Since the new engines may occasionally have to work in conjunction with the older ones, they were also designed for speeds of 70 to 35 kilometres per hour. The wheel diameter being 1.25 metres, and the drive being direct, this meant that the number of revolutions per minute must be 300 and 150 respectively. With a periodicity of 16 per second these figures correspond, allowing for slip, to motors with 6 or with 12 poles. A change of the pole connections on the rotors was unnecessary, as these were built with short-circuited windings, and thus met the case as they stood, whatever the number of poles on the stator. The fact that rotors with short-circuited windings could serve, without change, for any pole numbers led to the provision for the new locomotives of stators with a second winding—viz., for 8 and for 16 poles respectively. Thus two additional rates of speed—viz., of about 52 and 26 kilometres respectively—were obtained. This, it is claimed, constitutes a substantial advance in three-phase railway work, where not more than two speeds have hitherto been provided for, because with the method of construction hitherto followed with wound roters and with four poles in the stator, at least ten slip-rings were required on the rotor, a condition which, in regard to the space occupied, the attention required, and the cost of maintenance, was unsatisfactory in actual practice. The adoption of short-circuited rotors removed this difficulty, and made it possible to build three-phase four-speed locomotives on simple and rational lines.

Short-circuited rotors and stators provided with different windings have long been known, but were previously used only for small motors. The application of the method to such large units as the Simplon locomotives constitutes therefore a substantial advance. The use of two windings in the present case, moreover, makes it possible to exert a very high torque on starting when necessary, since the two may then be connected in parallel. On the other hand, motors with short-circuited windings on the rotor cannot be started with full voltage, as the rush of current into the system would far exceed the limits admissible. For this reason each motor on the Simplon locomotives is provided with two special starting transformers, by which the pressure is reduced at starting to a safe limit, and can, as the train gathers way, be then gradually raised to the full voltage. One of these transformers is fitted at each end of the locomotive just in front of the driver's platform. There are two foot-plates, and the locomotive never requires to be turned round. Should a defect occur in one-half of the system, the engine can still get home on the other.

To facilitate the running of the engine over switches and crossings, and also in view of the high tension of the primary current (3000 volts 16 periods), there are, it will be seen, two current-collectors which lead the current from the two phases of the overhead lines to the starting transformer. The third phase is connected with the track through the wheels. The line phases are fitted with wire-fuses, and the earth phase has a transformer for measuring the total current. The starting transformers have ten steps, commencing with 3000 volts on the primary and 1000 on the secondary. The voltage on the latter is then raised up to that of the line in steps of 200 volts each. The commutator controlling the secondary voltage can be operated from either foot-plate by means of a chain gear, which operates the two starting-drums, each one of which is connected to a transformer. Intermediate resistances are inserted on passing from one stage to the other. The transformed current passes through a reversing switch, by which the two line phases can be exchanged one for the other, with a view to changing the direction of travel. Current distribution to the motors is effected through a pole switch, of which there is one for each winding—i. e., one for switching from 6 to 12 pole-numbers, and the other for the 8 to 16. An oil contact-breaker (maximum current cut-out) is connected with each pole switch, and cuts out the corresponding winding when the highest admissible current strength is exceeded, and makes it possible to locate with facility the particular winding in which a breakdown of the insulation may have occurred. The four oil contact-breakers can also be opened by hand from both platforms by means of a cord, and thus can serve as emergency switches. The reversing switch connections of the pole-changer are operated from the driver's platform by compressed air. The valves for this are combined with a small controller valve, so arranged that only the two windings of a motor, and not the two pole-numbers of one winding, can be switched in at the same time. The actual switches are conveniently located in casings mounted at the sides of the engine. A broad central passage gives access from one platform to the other.

In working a train the procedure is as follows: When the driver has been given the weight of the train he has to haul, he places the starting transformer in the position corresponding to the voltage in the secondary which his experience shows to be the most stable. At the same time he also brings the reversing switch into the position required for the given direction of travel. He then closes the pole-switches which correspond to the two lowest speeds, i. e., switches the motors onto the 16 and 12 pole windings, these windings being thus in parallel. Should the torque thereby attained be insufficient for starting the train and gathering speed, he increases it by raising the voltage on the secondary of the starting transformers, and continues this as the speed rises till full pressure of 3000 volts is attained. He thereupon disconnects the 16-pole winding, and the train then speeds up to 35 kilometres per hour, which is the rate corresponding to the 12-pole winding. Should a higher speed be needed, the driver brings the starting transformer back a few steps, switches in the pole winding and increases the current up to full pressure, and finally switches off the 12-pole winding. In a similar way, the highest speed can be obtained by switching in the 6-pole winding. On starting, according to the trainload and acceleration, the current strength is 1 to 1.5 times that at normal load. The efficiency during the starting period is between 60 per cent and 85 per cent. and the phase displacement between 0.5 and 0.8. When stopping in the ordinary way the driver first brings the pressure down to 1000 volts; he then opens the throw over switches of the pole connections, and places the controller-handle in the mid-position.: Should sudden stop be required, it is only necessary to use the emergency switch, by which means the pole-connection switches are all opened, thus cutting off the current supply to the motors. Further, in an emergency, the current-collecting bow can also be lowered, which is effected by a hand-lever and a compressed-air relay.

All the switches and handles used in starting are so interlocked that improper manipulation is not possible. The current passing through the motors is indicated by ammeters placed on the driver's footplate, and the driver is thus able to read off at any time the demand which is being made on his engine, and can see at once whether he is running with proper efficiency and with a reasonable phase difference.

The air-compressors for working the compressed-air brakes and the switches, and for raising and lowering the current-collectors, are in duplicate, and are each driven by a 5-horse power three-phase motor having a short-circuited rotor, and provided with an automatic governor. These motors are supplied with a 100-volt current from a separate winding on the starting transformers. Each compressor can, moreover, be driven separately, through a special switch, should the automatic governor fail.

The lighting of the engine is provided for by a small continuous-current dynamo, motor driven, connected with a storage battery for supplying current in case of the failure or cutting out of the line supply.

The two short bows of the current collectors have a small amplitude of oscillation, and are carried by two main arms joined together by a hollow cross-bar. They are able to oscillate independently one of the other. In the running position the short bows are always inclined in a direction opposite to the direction of travel against the effort of their springs. When the tension of these springs exceeds a fixed limit, or when the bows are near their limit of displacement, the springs of the main arms come into play, and provide for any further deflection. The sliding contact-bars are triangular brass tubes. These can revolve round their axis, and bear against the overhead wires with a pressure of about 6 kilogrammes (13 lb.). The three surfaces wear very regularly. In the Simplon service such a contact-piece lasts on an average for a total of 2800 kilometres (1740 miles), and under favorable conditions it will be good for as much as 5000 kilometres (3120) miles. The cost of replacement is therefore extremely low. From time to time a little grease is applied to these sliding-contacts by hand. They cause but little wear on the overhead wire, viz., some 0.12 millimetre (0.0047 in.) only in two years on a wire 8 millimetres (0.315 in.) in diameter.

The sliding contacts are connected to the locomotive current-conductors by insulated cables; the whole supporting frame, with its springs, compressed air cylinders, and other mountings is grounded.

The power of the locomotives, in the various conditions of service is much higher than that provided for in the specifications as given above, and it will thus be possible to cope with an increase in the normal trainload, and to use the locomotives for traction on the Iselle-Domodossola line, where the maximum gradients are 2.5 per cent (1 in 40).

The construction of the Pennsylvania Railroad tunnels from Bergen Hill, N. J., to Long Island City, was practically completed Dec. 3 when the final section of concrete was placed in Line "D," the fourth and last of the tunnels under the East River to Sunnyside Yard in Long Island City. The only construction work remaining to be done has to do with some minor features of the Long Island City Shafts. These will be completed in a very short time. With all of the construction work on the tunnels finished, it will be possible to go ahead rapidly with the electrification, signal installation, lighting and track laying.

Walschaert Valve Gear

By Hubert E. Collins.

For many reasons, it has been found necessary in locomotive practice to adopt a different type of valve gear than the well-known "Stephenson" link motion. The bulkier locomotives being built today with limited space between the frames and the increasing size of axles and eccentrics which made it hard to get at and adjust or examine the Stephenson gear is one reason why "outside" gears are becoming adopted. Many minds are at work on the problem of design of a simple reversing gear which will eliminate the above objection and clear up the error of "slip" as much as possible.

While several gears, comparatively new to Americans, are being developed and tried, the most generally adopted of them to date is the Walschaert. A study of this gear in its simple action will no doubt be of interest to the reader.

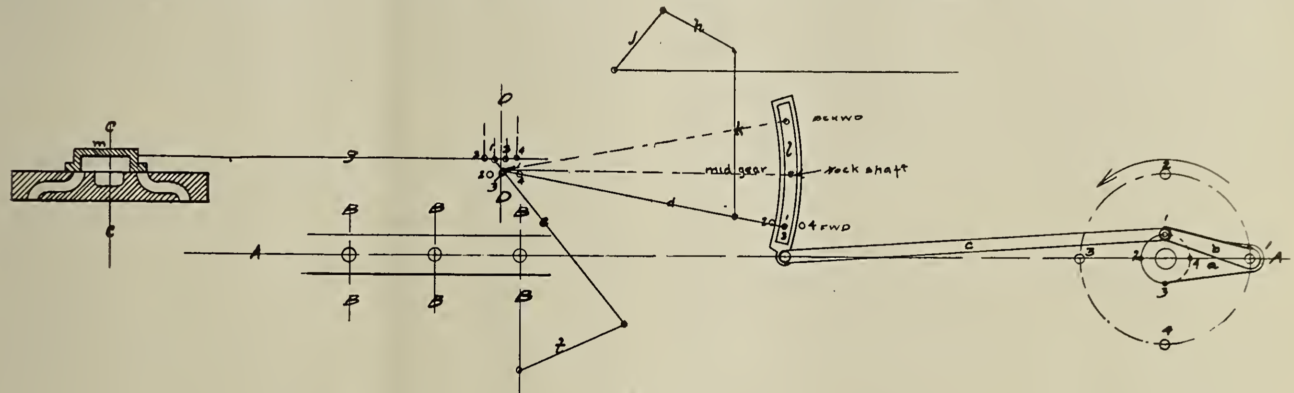


Fig. 1.

The principal features of this gear over the Stephenson link are that it drives the valve directly, or is a direct valve motion and has a constant lead under all conditions of operation. To understand this clearly, let us take up the study of the skeleton diagrams, the main features being described in Figure 1.

Here A A is the center line of the cylinder, crosshead slides, and drive wheel axles. B, B, is the center of crosshead pin on the two extremes ana center of travel. C C is the center of cylinder ports. D D is the center of valve rod pin travel. The main crank is shown at a, the valve crank at b, link rod at c, radius rod at d, lap and lead lever at e, radius link at f, valve rod at g, lifting arm at h, reversing rod at j, suspension rod at k, link at l, and valve at m.

The relative positions of the main crank pin, valve crank pin, fulcrum pin, valve rod pin and link block center for one complete revolution forward is shown at the figures 1, 2, 3, and 4.

In the main we have the guide bars on which the cross head slides. One end of these guide bars is fastened by a yoke which supports the auxiliary guide bar for the valve rod. On this yoke is fixed a rocker box. This bearing carries the rocker shaft, to which is fixed the link l. This link is pivoted on the rocker shaft in its center. In some practice the link is operated by the link rod being attached to the rocker arm on the opposite end of the rock shaft from the link, or as in this illustration, the link rod is attached to the lower end of the link direct. In either event the action is the same, and the method of application varies with the requirements.

The curvature of the link is towards the steam chest, and the radius is governed by the length of the radius rod, d, or from the center of link to the center of pin on lap and lead lever. One end of radius rod, d, spans the link and a pin passes through the fork and link block and the position of this link block in the link is varied by means of the reversing rod, arm and suspension link. The lap and lead lever is attached at one end to the crosshead by means of a radius link, and at the other end to a small crosshead on the valve rod. The point on the lap and lead lever at which the radius rod, d, is attached is determined by the designer and is at the right point to give the valve enough travel to overcome lap and lead through the motion of the crosshead alone with the radius rod in mid-position. It will also be seen that the valve is in the same position of lead at beginning of stroke with full gear forward or backward.

This is the main feature of this gear. The relative positions of the pins during a revolution forward are pointed out in Figure 1, and in order to more thoroughly understand this feauture let us follow the motion through one revolution. In Figure 1, we have the positions at the beginning of a forward stroke moving forward. The valve crank pin is advanced ahead of the main crank pin 90° for mid-travel

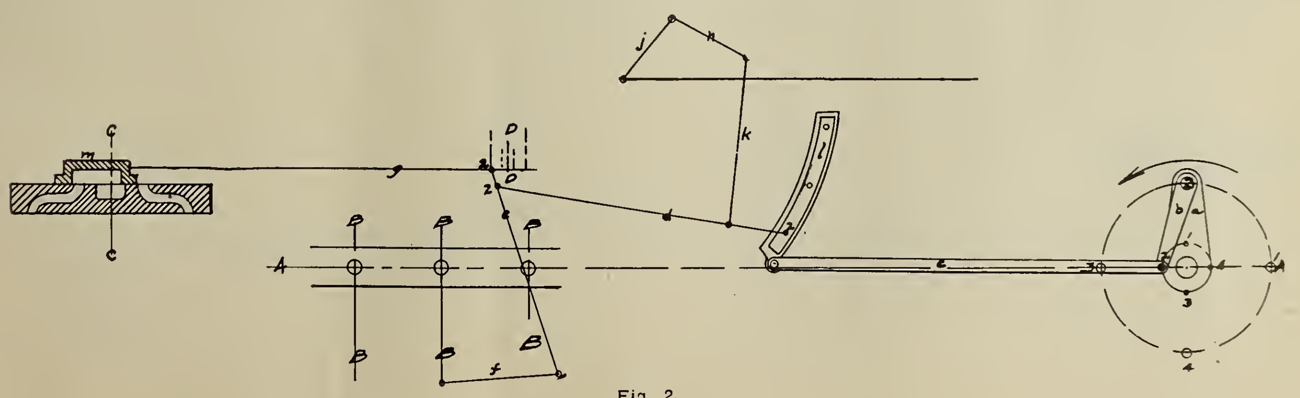


Fig. 2.

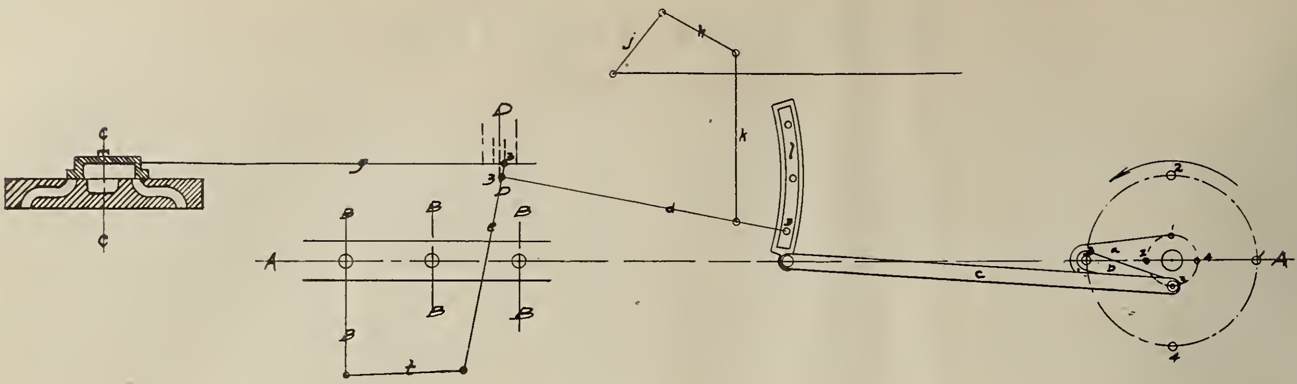


Fig. 3.

of valve, and the length of the link and radius rods are enough to advance the valve to the point of opening. It will be seen here that if the point of attachment of the radius rod to the lap and lead lever were stationary, while the crosshead moved forward the valve would move backward as the lap and lead lever would fulcrum at the point of attachment. But in this case the link block being in the bottom of the link, the motion of the valve crank is transmitted direct to the valve and the upper end of the lap and lead lever moves proportionately in the same direction as the crosshead until the extreme travel of valve in that direction is reached. This is shown in Figure 2. Here the main crank and crosshead have reached half-stroke and the valve crank and valve are at their extreme positions forward.

It will be noticed that from this point that the upper end of the lap and lead lever will move back away from the cylinder carrying the valve back toward the point of cut-off on the crank end of cylinder, while the lower end of the lever, being attached to the crosshead, still moves forward. This would cause the lever to pivot on the end of the radius rod entirely if it did not move also, but from the point shown in Figure 2 the radius rod will move with the valve crank pin, the two movements combining to effect a quick cut-off.

In Figure 3 the main crank is shown on the forward center ready for the return stroke of the forward revolution with the valve advanced for lead on that end. With the radius rod in the same relative position as in Figure 1, it is now seen that the valve is open for lead on the opposite side. This is because the crosshead is on the opposite extreme of its travel from that in Figure 1, and the lower end of the lap and lead rod being also on the opposite side of its travel, pivots on the end of the radius rod and throws the valve crosshead back enough to give the valve lead as shown.

In Figure 4 the main crank has advanced to one-half the return stroke, while the valve crank and valve are at the extreme of their travel in this direction, leaving the forward port wide open to steam.

In Figures 5 and 6 the main crank is shown on each center with the radius rod in mid-gear position. By referring to these two figures it will be seen that the valve travels only far enough in either direction to overcome lap and lead. This is accomplished by the lap and lead lever being pivoted on the end of the radius rod and actuated by the crosshead alone, throwing the valve the required amount.

By comparing the valve action in full gear with that in mid-gear, it will be seen that we have constant lead at the beginning of each stroke no matter where the link block is.

On some locomotives, where the shortest rods are necessary, the lap and lead lever is sometimes attached at the upper end to a rocker arm on one end of a rock shaft with another arm, to which is attached a block which moves in a yoke on the valve rod. The suspension link is also attached to the extreme end of the radius rod on the opposite side of the link from the cylinder. As before stated, the application of this gear is varied to suit the requirements of special locomotives. In all cases the general principle remains the same. In using this motion there is no gear under the boiler, there are no eccentrics or straps, and all moving parts are visible and get-at-able by engineer or inspector.

What to Do When Accidents Occur.

If a radius rod or link block pin should break the radius rod should be taken down, the block taken out of link, the valve centered and clamped to hold in center of seat. The lap and lead lever can remain in position swinging from valve rod or rocker arm, as the case may be, after making sure that the valve rod is rigid in position.

If a lap and lead lever should break, the ports should be covered, lever and radius rod taken down and valve fastened in middle of seat.

If a valve, valve crank-pin, or rod connecting link and pin should break, cover the ports, take down the broken parts, disconnect the lead lever from the main crosshead, taking care that the lead lever clears the latter, then clamp the valve in position.

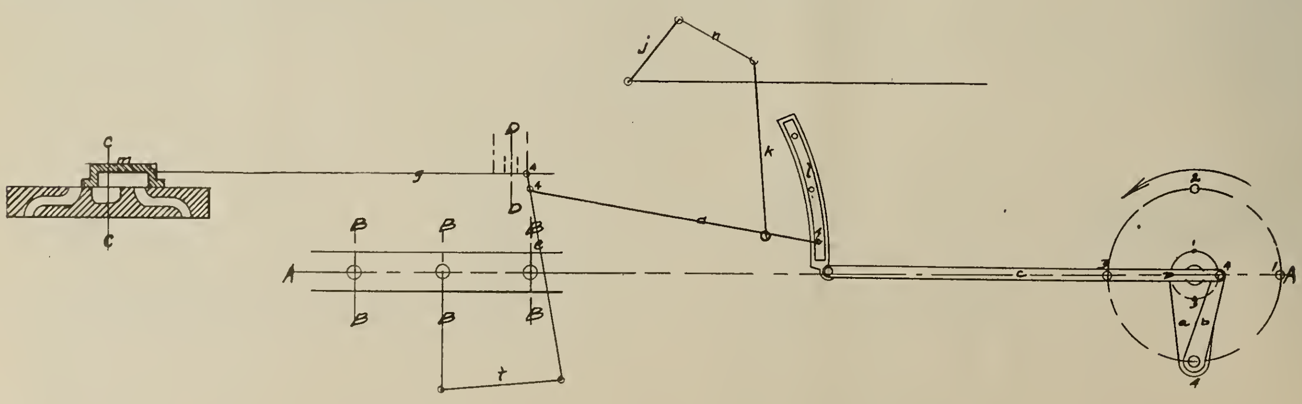


Fig. 4.

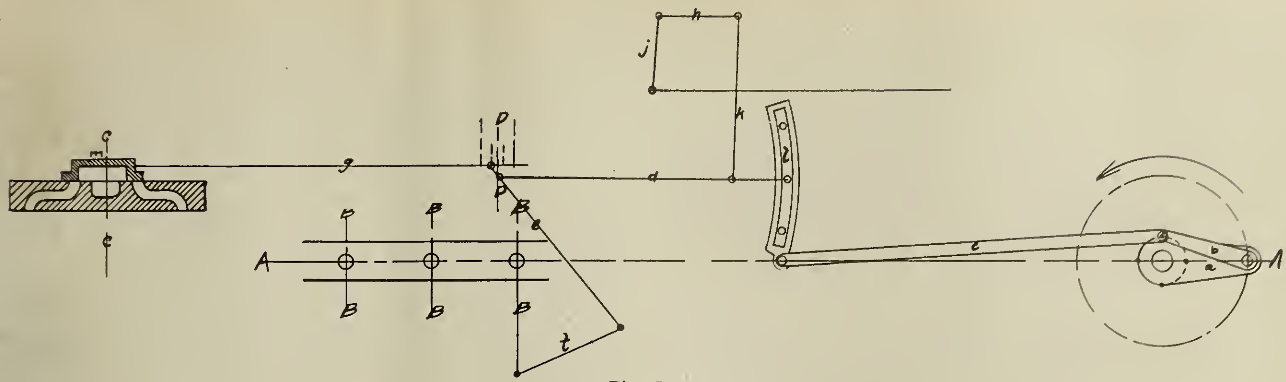


Fig. 5.

When a lifting arm or suspension link breaks and it is desired to run with both sides, a block should be put in the link to hold the link block either in top or bottom, depending on which way it is intended to run.

In all cases where ports are covered remove the main rod. To cover ports place the valve in the center, covering both ports.

Electrification of Chicago Railways*

The present controversy in Chicago over the electrification of the steam railroads has a number of features that are particularly exasperating to the partisans, both for and against the measure.

One argument advanced by those in favor of electrification is that all smoke and gases will be done away with and Chicago would become a smokeless city and that health, comfort, and cleanliness would be greatly enhanced thereby.

It is assumed that as there is or is to be electrification of railways in New York, Baltimore, Detroit, and other cities, as well as abroad, there is ample precedent and no great engineering difficulties in the way. The fact that Chicago railways have successfully elevated their tracks in spite of dismal prophecies regarding that undertaking is cited as an example of what the railroads can do in the way of gigantic undertakings.

The cheerful optimism of the electrical advocate, who will see no difficulty, mainly because of complete and absolute ignorance of the primary and fundamental requirements, let alone the higher and more involved elements of the problem, has been fed by a newspaper campaign of misinformation, one-sided argument, political issue, and exaggerated ridicule, which must be peculiarly exasperating to the railroad managers, who with clearer vision see more of the ramifications of the problem.

*From a paper by C. A. Seley, mechanical engineer, read before the Western Railway Club, Nov. 16, 1909.

It is, no doubt, exasperating to the electrical enthusiast that the railroad man cannot see it his way; to understand that the Chicago problem is not comparable to those other electrifications that have been accomplished with apparently so little of difficulty. Because it will cost some few millions is no argument at all; that is a mere bagatelle. The railroads are used to spending millions, and the expenditure would be followed by economies and increased earnings that would not only justify the expenditure and at the same time make a smokeless Chicago with all the advantages appertaining thereto.

The smoke then seems to be the main issue, and it is charged that Chicago smoke is mainly made by the railroad locomotives. At a coal conference held at the University of Chicago last spring Mr. Paul Bird, the City Smoke Inspector of Chicago, made the statement that 85 per cent of Chicago smoke was made by domestic use and the small boiler plants, and he pleaded particularly for investigations and tests and the dissemination of information as to how to properly set and fire the small boiler plants of from 5 to 100 horse power, so that their stacks would not emit smoke. It is generally understood that in large boiler plants, automatic stokers, larger grate surfaces, closer attention and inspection result in a reduced proportion of smoke as compared with the small plants where automatic stokers are not generally used and hand firing is not always of a high order of excellence.

Mr. Bird said not a word at this conference regarding locomotive smoke, and, if we add an appreciable percentage as representing the smoke of large boiler plants to the 85 per cent already quoted, it leaves a relatively small amount chargeable to the locomotives. The statement of Mr. Bird is further proven by observation.

The general atmosphere of Chicago on early Monday mornings in warm weather, when domestic heating is not required, is very different from that later on, as the manufacturing plants get into play or work rather, and their stacks get active. Now, during Sunday, while the plants

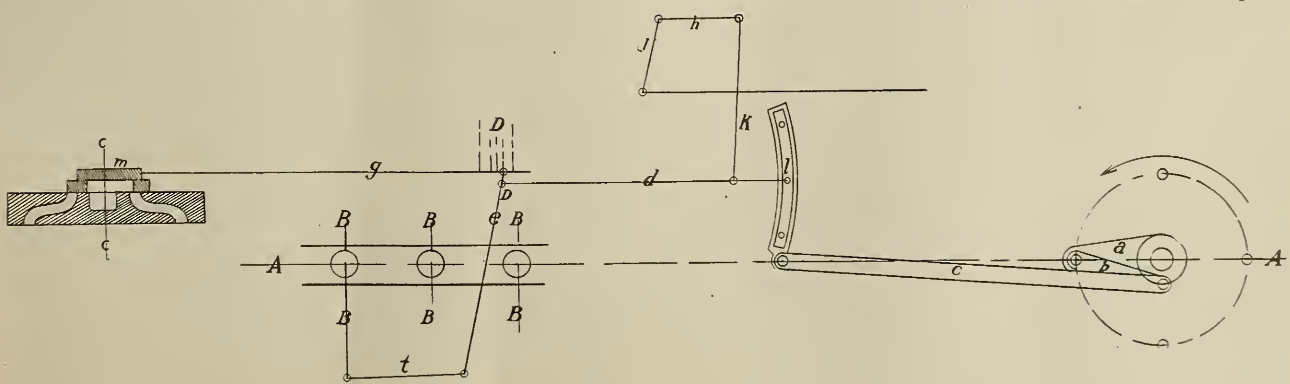


Fig. 6.

are not active, there is little cessation in railroad activity. True there are not quite so many Sunday trains, but not enough are taken off to account for the difference in the general atmosphere. Another example, take the beautiful suburban towns around us. They have as much or more railroad service as we have proportionate to their area, but their beautiful, clear atmosphere is due to absence of manufacturing and heating plants. No one would claim that the smoke of South Chicago is due to the railroads, and, if the steel plants there are not smoking, there is no work for the men or benefit to the community.

As a matter of fact, these smokeless cities are not cities of industrial development. Civilization has manifold uses for fire, or, to put it another way, fire has made civilization in a large measure. The savage has little use for fire, and the lower the grade the less it is used. The higher we go in the scale of civilization, culture, and intelligence the more use is made of the gifts of nature, and our day has witnessed a great development in the use of fire for heat, light, and power, a pound of coal now producing much greater effort by reason of improvements in the machinery in which it is utilized than in the days of our forefathers.

The railroads have not been in the rear of this march of progression. Faster speeds, larger cars, and heavier trains and the thousand and one associated factors have been developed to fulfill the requirements in moving the public and its property, as the demands of travel and trade require. On all railroads, however, the best and the poorest, those in densely populated districts as well as those traversing the almost deserted plains, use the steam locomotive with coal as fuel, except certain localities favored with oil, which lends itself as a convenient locomotive fuel when obtainable.

As a matter of fact, the steam locomotive has no equal as a motive power machine for general railway service. It is a moving power house, carrying its own provision of fuel and water for considerable distances between replenishing stations. The prosperity of the country largely depends on economic movement of its people and products, and our country leads the world in these respects. It is unnecessary to go into detail to prove this statement nor the further one that the present development of the steam locomotive has been a large factor in making this possible. We were, however, considering smoke questions, and will later take up other features of the locomotive.

There are many power plants in the city, which are burning many times as much coal per hour as any locomotive, but they discharge their smoke and consumed gases high up in the air from tall stacks. The deterioration of the air, however, is just the same for the amount of coal burned, so that the influence on the general atmosphere of Chicago is proportional to the coal burned whether in a stationary plant or in a locomotive, as the discharged gases are practically the same in chemical composition.

It is true that the locomotive discharges its smoke and gases into the atmosphere at a height of 16 feet or thereabouts above the rail, instead of from 50 to 200 feet or more, as is common in stationary plants. It is also true that at times the combustion may not be perfect on a locomotive, resulting in so-called black smoke, but the railroads will admit that this can be controlled to a certain extent.

It has been impossible in the large locomotives now demanded to proportionately decrease the smoke as has been done in large stationary plants, although the efficiency and economy per ton mile for fuel has been considerably increased, and the improvement also applies in the matter of smoke when in regular duty.

It is particularly difficult to avoid making smoke on our crowded terminals where signals call for unexpected stops, and then heavy acceleration is necessary to keep moving, so as not to block the tracks.

It has been stated that there are 650 smoking locomotives defiling the atmosphere of Chicago. This may be true as to number, but most of them are in and out and working much less than an hour within the city limits. This, of course, does not apply to switch engines, many of which work day and night in switching yards and transfer service. It is the smoke from these engines which is the hardest to control and requires the most watching, but after all it is but a minute fraction of the smoke of Chicago.

No doubt the people who select their residence close to railway tracks find the smoke a nuisance, but, unfortunate as these may be, the smoke question must be considered as a general one, the influence on the atmosphere of the city at large.

These people have selected their homes close to the railroads in most cases for convenience of transportation, and it can hardly be claimed that they do not get it.

Those farther away do not get the convenient transportation, neither do they get the smoke, except as contained in the general atmosphere over the city, and, if our proposition has been correctly stated, the railroads are responsible for only a very small proportion.

It is believed that the effect of the smoke and gases discharged by high stacks has been lost sight of in considering the general smoke situation. When it is considered that almost every business block has its boiler plant for heating and various power purposes, and that the aggregate of these for every city block in the business district runs up into the thousands of boiler horse power, is it any wonder that the atmosphere is not clear in the business district?

Then consider the heavy manufacturing plant and power stations just a little farther away with their thousands and tens of thousands and in one case nearly one hundred thousand of boiler horse power, all consuming soft coal, is it any wonder that the atmosphere of the city is not clear?

Then the thousands of apartment buildings and residences with soft coal furnaces and ranges, the shops and small factories each contributing its quota of smoke and gases, added to the above, is it not impossible to have a smokeless city, regardless of the railroads and their locomotives?

It is presumed that the power for electrification of railroads would be generated at some outside power house, where its smoke would not be objectionable to the city. Why should not the stationary steam boilers which are used for power purposes in the city also be banished along with the locomotives and outside power generation be required? This would seem consistent if the police power of the city extends over all smoke production. It would seem as though the minor offender is the one punished in this case.

It would take too much time to go into the argument on the position of the railroads, considering their prior right of occupancy of their right of way; the advantages accruing to the city and its citizens, its business and trade by reason of the extensive railroad intercommunication which we enjoy. Suppose for one moment the situation if the steam railroads were stopped at the city limits and all transfer of passengers and freight was to be handled by street car methods, what effect would that have on the prosperity and growth of Chicago?

The panacea for all this trouble is said to be electrification, but how little is really known by its ardent advocates of the engineering difficulties to be met if the proposition of banishing steam locomotives from Chicago is to be seriously considered. The advocates say it has been done elsewhere, why not here, and thereby prove their lack of information. Every railway electrification of any size to date has been primarily for the benefit of the people in the cars, and these cars operate in tunnels. Many travelers in and out of New York City blessed the day when steam locomotives were replaced by electric, and the long, disagreeable, choking Park Avenue tunnel was relieved of the smoke.

The tunnels in Baltimore are not entirely clear, but are vastly improved as to comfort in travel through them with electric power. The ability to take trains through tunnels by electric power instead of having to employ car floats is used at Sarnia and soon will be at Detroit. Some big tunnels in the Rockies are now, and others will be operated electrically as will also the Pennsylvania R. R. tunnel entrance into their New York station. The New York electrifications quoted are for handling passenger service only. When not in tunnels the roads are in a protected right of way with no freight trains, switching yards, nor industrial tracks to complicate the movement. The handling and distribution of freight at New York is practically the same as before the electrification. Both freight and passenger trains are pulled through the other tunnels cited. but the electric engines used do not go far from the tunnel portals.

As a matter of fact, they cannot. It is a common thing to see pictures of the New York Central monster electric locomotives marked 2,200 horse power, and they can exert that power for the few miles they run. It would be impossible, however, for them to take a heavy train from New York to Albany on the regular schedule of the steam locomotive. The explanation is simple. The armature of any motor must be provided with such ventilation or chance for radiation that its temperature will not rise beyond a certain degree. The armatures on these electric locomotives are such heavy bodies of metal with so little chance for ventilation or cooling that they cannot run far before reaching the temperature limit. There is no such limit to the steam locomotives and it is common to run them upward of 200 miles before changing.

The Chicago limits would not impose long distance running of electric locomotives, but the above information is given to correct the popular impression of the general feasibility of electric traction in the present state of the art.

It looks easy to propel a street car. The trolley pole is put up and a turn of the controller starts the car and controls the speed, but every car has its motors and controller, and when we consider it is common to put an aggregate motor capacity of from 50 to 150 horse power on ordinary street cars and that the New York subway cars have 300 horse power of motors and a small proportion of trailers is used, one may get a faint glimmer of what electrical traction may mean in the movement of the thousands of trains and tens of thousands of cars that are moved in Chicago daily when the motive power must be concentrated in large measure in locomotives.

It is, of course, feasible to equip Chicago suburban trains for electric traction, but the proposition is the entire elimination of steam locomotives, and the suburban movement is a small proportion of the car mileage in Chicago. If the problem was to be divided into factors of relative importance, they would be about as follows:

1. Distribution of loaded and empty freight cars to the hundreds of depots, team tracks, industries and transfers.

2. Handling of freight cars in switching and distributing yards.

3. Main line transfer freight trains.

4. Division passenger train movement.

5. Suburban passenger train movement.

The above order may be varied somewhat on different roads, due to local conditions. but fairly represents the conditions to be met on most of the Chicago railways.

Most of our roads make common use of their tracks for passenger, freight and switching movement, and in most cases it will be impossible to work them otherwise. All of these tracks would have to be equipped with electrical transmission, which in the present state of the art is only by the third rail or the overhead conductor.

The third rail is almost impracticable to consider on account of the hundreds of open crossings, switching yards, industrial and team tracks that the public now have access to and cannot be deprived of without an almost entire rebuilding of the Chicago railway systems.

The overhead trolley wire, while overcoming some of these objections, introduces others of almost equal gravity. The complication at crossings and leads in switching yards where many tracks are often involved, the heavy transmission cables and apparatus required, most of which is located on overhead bridges, spanning the tracks, makes a chain every link of which must work perfectly or else something happens. We may be accused of looking for trouble that may not happen, but why not confess that this matter of electrification is yet all too new for anyone to guarantee immunity from trouble when considering so large a problem as this one?

Trouble has a manifold meaning on a railroad. To the man down the line it may be caused by a poor fit, a hot journal, something worn out, papers lost, lack of information, or any one of a thousand things that never gets to the manager. His troubles are things of greater moment, and over and above profit and loss is the nearer question of life or death, safe travel for patrons and employes who go in or on the cars, which must have a motive power to propel them to destination. The manager has been brought up with the steam locomotive, has seen its development, knows its limitations, provides strength in tracks, bridges and structures with a view to all these things, so that profitable traffic can be safely transported.

Presto! Change! In an incredible short space of time measured by that usually allowed for developments of such magnitude, all the 650 steam locomotives in Chicago are to be replaced by electrics, and the 1,800 or more miles of track are somehow to be equipped with electrical transmission, so that the current is everywhere available and a simple twist of the wrist will start a car or a train, and there will be no smoke!

Suppose for a moment that the roads would have no difficulty in procuring and installing all this electrical apparatus, who is to assume the responsibility for the safe conduct of the business of the railroads under the new conditions of motive power? There is as much of a problem here in getting the proper classes of talent and force to design, install, and operate this new system of railroading as it would be for the city to require the abolition of automobiles and the use of flying machines, because Wright, Latham, Curtiss, Bheriot, Zeppelin and others have successfully navigated the air and because automobiles are dangerous to get in front of and they sometimes smoke.

The prominent railway officer who is credited with saying that the railroads would electrify as soon as it would pay them to do so did not mean this in a sordid, financial sense only, but with an appreciation of the necessity for a financial return after abandoning the usual and well known methods of transportation for a new and untried system for which at the present time there is neither men, money, nor material, precedent or probability within the scope and time allowance of the proposed Chicago ordinance.

The newspapers make much of the question of economy of electrification to the railroads, basing this on statements made in technical society discussions. These statements bear no evidence of including in the comparison of costs of operating steam and electric locomotives the fixed charges incurred in the electrification, which in the New York cases must be extremely heavy, but of which there is no authentic public information. Whatever these may be applies to a passenger and suburban movement only, no freight included, so that for Chicago new and important factors must be considered.

In the statements above referred to savings are claimed for locomotive repairs and the fixed charges connected therewith. This would no doubt be true to a certain extent, as the moving mechanical parts of an electric locomotive are simpler than of a steam machine. They are all too new yet to have accurate data as to the amount of saving.

Savings are claimed for less dead time for repairs and inspection. This is conceded for the reasons stated in the preceding paragraph, except that it has been shown that electric locomotives cannot be continuously operated, unless designed and operated with a view thereto, in which case the quoted costs and savings would not apply. Greater ton mileage is claimed, but this is a question of comparative design and operating conditions. The data is based on short hauls in passenger service, there being no long distance heavy freight electric haul in existence.

Saving in locomotive ton mileage is claimed, but again this is a matter of design. Electric engines do not require a tender as does a steam engine, a factor in their favor. There are radical differences of design and weight in the present electric locomotives at New York City, and the Pennsylvania R. R. design will be unlike these two.

There is an undoubted saving in operation as to the cost of the power at the drawbar for the reason that one large plant of any kind can produce cheaper than a number of small plants, and a modern high grade power house can develop power much cheaper than a steam locomotive can, despite the fact that a modern, high grade locomotive is really a machine of very high efficiency. To utilize this cheap power, however, it is necessary to install a complete and complex system of transmission with its mains, feeders, contact members, converters, transformers, safety appliances and apparatus now foreign to steam operation.

It is admitted that electric locomotives cost about double that of steam, and to get at the final results of profit or loss in making this proposed change it will be necessary to capitalize the following items.

Cost of locomotives.

Cost of power house, ground and equipment.

Cost of transmission lines and apparatus between the bus bars at the power house and the contact shoes of the locomotives, including supporting structure, housing, etc.

Cost of returning current to power house.

Cost of revision of signals, telegraph and telephone lines.

Cost of revision of tracks, bridges, etc., and safeguarding the public.

Cost of new suburban cars, motors and apparatus, if individual or multiple car service is to be established instead of electric locomotive traction.

Add sinking fund for depreciation and interest for funding the above investment at not less than 10 per cent, which may be insufficient.

Add for current expense:

Cost of the organization to design, install and operate electrical equipment and power house, including extra supervision not required for steam operation, but not including enginemen, except as extra crews may be required for suburban motor car service.

Cost of fuel and supplies for power house, locomotives and transmission.

Deduct value of steam locomotives displaced.

Deduct value of coaling and watering stations released.

Deduct value of proportion of repair shops and facilities and their supervision released.

Deduct cost of fuel, water and supplies for steam locomotives.

Above items to be divided between the capital and current expense accounts, as they may belong.

There are a number of contingent items not included to go to one side or the other of the account dependent on the situation such as yard and station lighting, heating of passenger equipment cars, etc. The item of cost of repairs is omitted, as no data is available.

When there is a saving in operation for the total annual ton mileage equal or better than the annual charge against the electrification, based on its cost as above computed, then the railroads can afford to banish their steam locomotives as a profitable investment.

The money question in connection with electrification is a very important one. Whether profitable or otherwise, there is no doubt but that electrification of all railroad terminals in Chicago will cost some hundreds of millions of dollars. The railroads have not got this money, but will have to raise it by the same financial methods used when making extensions, buying equipment, etc., and these funds finally come from the people to whom railroad securities are attractive as an investment. It is extremely doubtful if capital would be interested in an enterprise of any kind not able to demonstrate its ability to make financial returns, and until this matter has been thoroughly canvassed by competent engineering talent as to its feasibility and results, it cannot be financed. A bad investment reacts on the poor man's invested savings as well as on the rich man's surplus, and both are interested in knowing what may reasonably be expected. It is impossible to recall any instance of so tremendous an outlay as will be required by this proposed ordinance with so little data to give assurance that it would not almost amount to confiscation of the property.

This brings up another point for consideration. The present interchange of business and equipment between the various roads frequently requires a common use of the rails of the different companies for switching and transfers, so that an electric scheme should be practically the same for all the roads in order that these movements will not be interfered with.

This might not affect the details that any of the roads might deem necessary for their particular line, but the fundamentals and general scheme must be on such similar lines as to secure the proper amount of inter-communication. There was a time when freight and passengers had to be transferred at each railroad terminal, but in our day this is done away with by agreement between the railroads, so that a carload of freight can go unbroken from Maine to California or from Canada to Mexico, and many of these cars are handled on Chicago terminals. It will, therefore, be necessary that the electric scheme be arranged so as not to interfere with interchange.

It is suggested that the wise thing to do before any ordinance is prepared that a commission be appointed, part of its membership to consist of such a number of railroad representatives as the roads may elect, but each road to have one vote for each mile of track involved. The city to have such representation as may be desired and empowered to cast votes equal in number to the total railroad vote, each thus having an equal number of votes, and two-thirds of the total number of votes should be necessary to carry any motion involving expenditure. A board of experts covering electrical, mechanical and transportation questions should be appointed, not less than three for the railroads and three for the city, to work under the direction of the commission, but to have no vote in matters involving expenditure. The city and the railroads should each furnish their members on the commission and their experts without cost to the other until a working plan is agreed upon.

It may be alleged that such an organization would produce no results: that the railroads would simply vote against any proposition and block progress. Possibly so, but how else can the railroads be shown the feasibility of electrification. The burden of proof is on the city, and if their experts after having full knowledge of the real conditions which can only be accurately reported to them by the railroads experts, can then present a feasible scheme to the commission the record of the action of that body may then be taken to court if necessary to decide the merits of the case.

Pneumatic Device for Transferring Liquids

Walter T. Tickell.

The accompanying drawings illustrate a pneumatic device for transferring liquids from barrels to reservoirs or receivers which has been in successful operation in the shops of the Yazoo & Mississippi Valley R. R. at Vicksburg, Miss., for many years for delivering oils of all kinds from barrels directly to the different reservoirs. Figure 1 shows the device as applied to the barrel with an enlarged section showing the interior construction.

Figure 2 shows all the details of the device fully dimensioned. The delivery tube A is made of 1-inch wrought iron pipe threaded at its upper end, which is screwed through the coupling plate C, and part way into brass tee D. Its lower end is turned down to 1⅛ inches to slip into the adjusting tube B. This tube is made of 1 inch wrought iron pipe, with its upper end bored out to 1$\frac{3}{64}$ inches to slide up and down tube A. It has a slot $\frac{3}{16}$ inches wide cut in its upper end, which pin K passes through. Its lower end has four openings or gates to allow the liquid to enter.

Coupling plate C is made of malleable iron or forged out, with lugs on each side for hinging handles E and is threaded in its center for tube A. D is a tee made of brass, threaded its entire length to receive tube A and a 1-inch nipple at its upper end. It is drilled for the copper tube J to pass through, and at its outer end is tapped for standard air pipe connection. EE are handles of malleable iron or forged, and

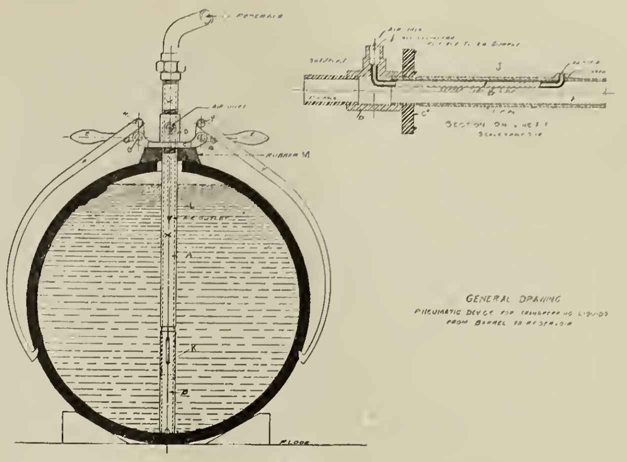


Fig. 1.

are connected to coupling plate C by pins G and connected to hooks F by pins H. F. F. are steel hooks for grasping the barrel and securing an air tight joint between the barrel and the device by means of the rubber M. J is a copper tube $\frac{15}{64}$ inch outside diameter, or near this size, which is soldered into tee D and in tube A, and kept as close against the side of the tube as it can be gotten. K is a guide pin ⅛ inch diameter for guiding and holding tube B on tube A.

The action of the appliance is as follows: The device is hooked to the barrel with hooks F and handles E are pulled down, which forces the coupling plate C against rubber M, making an air tight joint. A rubber air hose is run to the reservoir which is to receive the liquid. The air pipe from the air supply is connected to tee D; air passes through the copper tube J into the barrel.

The pressure of the air displaces the liquid in the barrel and forces it into tube B through the openings or gates, out through tube A, thence to the reservoir through the rubber

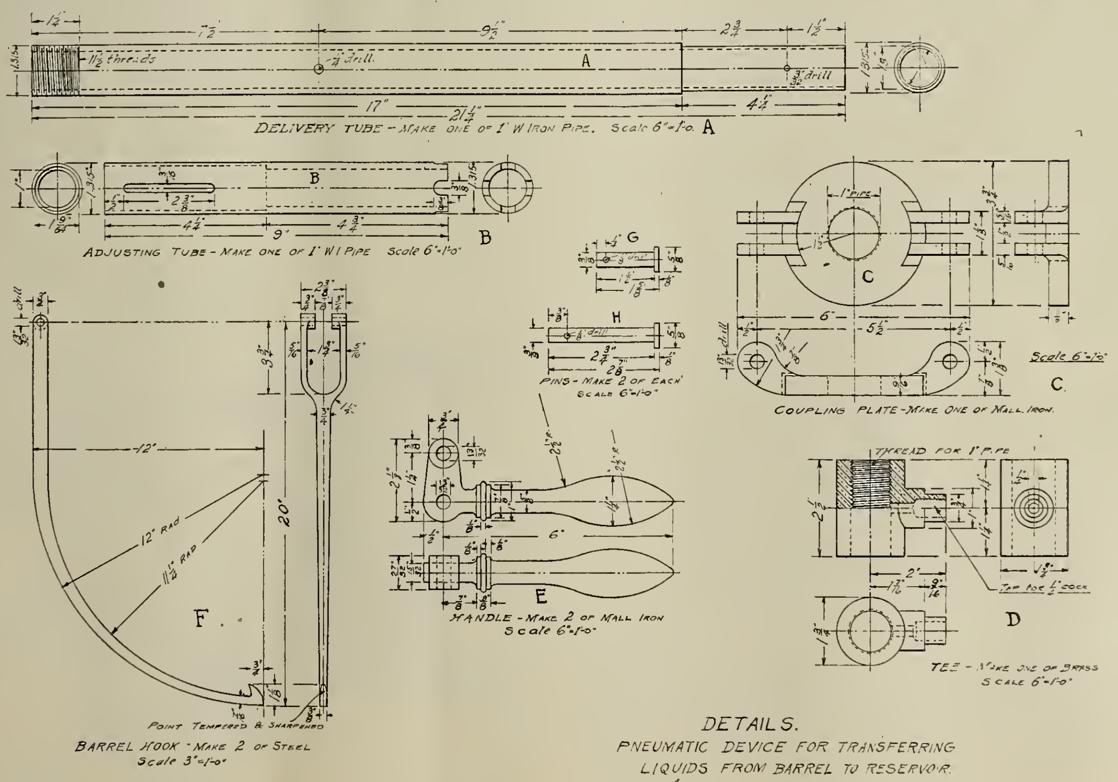


Fig. 2.

air hose. The cost of constructing the device as illustrated is about twelve dollars. The saving in time and labor in emptying barrels containing oil and other liquids amounts to quite a sum in a year's time. The device is efficient for liquids of every kind and its operation is easy, and cleanly at all times, as no liquid is ever spilt or lost during the time it is in use.

By actual test a barrel of engine oil containing 50 gallons was emptied with this device in 3½ minutes. For convenience a rope is tied around the nipple just under the union and connected to the ceiling with a pulley block and when the device is not in use it is raised to the ceiling out of the way. The air is taken from an accumulator about 300 feet away, which has a pressure of 90 lbs.

The pressure of air entering the barrel of liquid should not be over 50 lbs. for if a greater pressure was used it would cause a breaking of the barrel staves and possible bursting of other parts.

The Placing of Advertising

Trade journal advertising as applied to the exploitation of lines of heavy machinery and equipment, is a problem of great interest to every manufacturer striving to increase his sales. This class of advertising is different from general magazine advertising or any other kind of publicity.

The object of all advertising, including letters and printed matter, is to increase sales. Advertising in technical trade journals as a part of any advertising campaign, is in a class by itself, because of the nature of such publications. Technical journals are edited by technical men who write matter that is readily understood and appeals only to a certain class of men in the trade or calling represented by the publications. For this reason such journals have a character and prestige with their subscribers that no other advertising can have. Each subscriber to a technical journal is interested on account of his work, in the editorial matter of the journal. It gives him ideas and information of daily use and interest. He studies its pages and devotes more time to it than to any other printed matter and usually files each number for reference. It can be seen how valuable such a journal is to the manufacturer for advertising his product.

The value to the advertiser in technical trade journals is two-fold. First he buys space in the advertising columns where he can display with cuts and type the value of his product. Such an advertisement has both a direct value in pulling inquiries and a larger publicity value, as it keeps the manufacturer prominently and constantly before the men he wants to reach with his announcement.

A second and far more subtle value is given the manufacturer who advertises in technical journals through the editorial columns. This comes from articles of news and descriptions of new machinery or devices that are constantly being brought out or improved. The publisher of a technical journal is always anxious to secure descriptive matter of new or improved machines or appliances because this is just what his subscribers want. Every manufacturer can from time to time give the publisher matter that makes most interesting reading and at the same time is of far more value to the manufacturer than any other kind of advertising, though it costs him nothing.

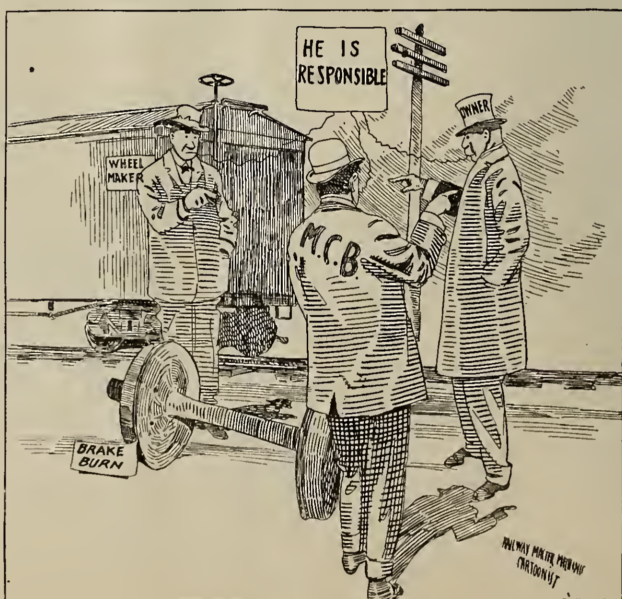
Most manufacturers realize the foregoing and maintain close personal relations with the publishers of technical journals in their respective fields. Manufacturers usually make the contracts for advertising space personally with the publisher, knowing that in so doing they will be in closer touch with the journal and better able to judge of its value.

This is practically true of such fields as that covered by the railway trade, the machinery trade and others where there are only a few journals to be considered and when the number of direct replies to advertising is naturally limited on account of the great cost of equipment and the comparatively few buyers there are.

However, there are some manufacturers who apparently feel that they can better afford to employ a clerk or other third party, whose interest in the advertising done by the concern is limited by the amount of salary he is paid, to make contracts with journals, prepare copy and furnish the information publishers may desire.

Such action occasionally causes misunderstanding due to the position the advertising managers of concerns sometimes assume toward the publisher. The publisher as the owner of a business is always open to suggestions toward improving such business, but usually he resents advice as to just how to conduct his business from advertising managers who assume to know all about the publishing business. Publishers accept advertising orders as a business proposition and render service for value received, but some advertising managers not only antagonize publishers by giving them orders as a favor, but misrepresent conditions to their employers.

With checks aggregating $9,735,508.50 mailed recently to its 55,270 shareholders in payment of the three per cent semi-annual dividend, the Pennsylvania Railroad Company has paid in dividends since it was chartered 63 years ago $329,773,437.00,—more than its entire capital stock of $324,516,950. The average holdings of Pennsylvania Railroad stockholders is 115 shares, the par value of which is $5,750. Of the total number of shareholders, 26,904, or 48.62 per cent are women. A statement just compiled shows that 16,812 shareholders are located in the State of Pennsylvania, the average individual holdings amounting to 96 shares. In the last two years the number of shareholders in Pennsylvania has increased 1,389. In New York State there are 8,648 shareholders. Their average holdings are 236 shares. More than 12,000 holders of Pennsylvania Railroad stock live in New England, while 8,530 are scattered throughout the country. About 18 per cent of the entire capital stock of the company is held abroad. On November 5, there were 8,726 shareholders in foreign countries, and their average holdings were 131 shares. The total number of shareholders of the Pennsylvania Railroad has increased 9,841 or 21.6 per cent, in the past two years.



A Familiar Controversy.

Mallet Articulated Freight Locomotives, A. T. & S. F. Ry.

The weight record for heavy motive power has again been broken by the completion of two Mallet Articulated locomotives for the Atchison, Topeka & Santa Fe Railway. These engines were constructed by the Baldwin Locomotive Works, and are similar in many respects to those completed in April, 1909, for the Southern Pacific Company. A number of important changes have been made, however, in accordance with Santa Fe practice.

The 2-8-8-2 wheel arrangement is used on these locomotives, and although their total wheel base is exceptionally long (59 feet 10 inches), they are designed to traverse 16-degree curves. All the driving tires are flanged. The equalization is continuous throughout the front group of wheels, as the drivers are equalized with the leading truck by a beam placed on the center line. In the rear group of wheels the trailing truck is side bearing, and there is a continuous equalization system on each side of the locomotive.

The boiler is straight topped, and arranged for oil burning. It is fitted with a fire-box of the Jacobs-Shupert design, a Santa Fe type superheater and reheater, and a Baldwin feed-water heater. The fire-box is built up of steel plates, which are flanged to a channel section. The channels composing the inner shell have their flanges on the water side, while those composing the outer shall have their flanges on the outside. The channel webs are cambered to resist pressure. Between the adjacent channels are placed stay plates; these are riveted to the channel flanges and serve the same purpose as staybolts in a boiler of the ordinary type. The stay plates have circulating openings cut in them; the center opening above the crown is much wider than the others, and here bracing is effected by a double row of expansion links. The throat and back head are stayed by bolts, in the usual manner. In the present instance, each fire-box shell is composed of 13 channel sections.

The fire-tubes in this boiler are 21 feet long, and they terminate in a combustion chamber 10 feet 9 inches long, which contains the superheater and reheater. In front of the combustion chamber is the feed water heater. It is traversed by 417 tubes, 2¼ inches in diameter and 6 feet 8 inches long, and is connected directly into the piping system between the injectors and the boiler proper. The feed is discharged from the heater through an outlet located on the top center line, and enters the boiler through two checks, placed right and left a short distance back of the front tube sheet.

Steam is conveyed from the throttle valve to the superheater through an internal dry pipe of wrought iron. The superheater consists of a cylindrical drum, which is traversed by fire-tubes, and is divided into two compartments by a transverse partition. Before entering the cylinders, the steam is superheated in the rear compartment; and it is reheated in the forward compartment, while passing from the high to the low pressure cylinders. Internal baffle plates compel the steam to follow a circuitous path among the tubes. The superheater section has two outlets at the bottom, from which pipe connections convey the steam to the high pressure steam chests.

These pipes are provided with slip joints, and can be readily parted. As in the Southern Pacific design, this locomotive is separable. The joint in the boiler surrounds the combustion chamber, and is located between the superheater and the high pressure cylinders; hence the necessity for placing slip-joints in the steam pipes.

The high pressure steam chests are fitted with inside admission piston valves, 13 inches in diameter. The exhaust is conveyed to the reheater through a single pipe, placed on the center line of the engine; thence to the low pressure cylinders through a flxible pipe, also placed on the center line. This pipe has one slip joint, and two ball joints; one of the latter is located immediately under the reheater, and the other, just ahead of the second driving axle. Forward of this point, the pipe is held in alignment with the frames. A short distance back of the low pressure cylinders it divides, and separate leads convey the steam to the steam chests, where the distribution is controlled by outside admission piston valves, 15 inches in diameter. The final exhaust pipe is fitted with a ball joint at each end, and a slip joint in the middle.

The high and low pressure valve motions are of the Walschaert type, and are controlled simultaneously by the Ragonnet power gear. The links are supported outside the driving wheels, on longitudinal bearers. The connections are so arranged that all the radius rods are down when running ahead.

The front frames are stopped immediately ahead of the leading driving pedestals, and are bolted and keyed to a large steel box casting, which supports the low pressure cylinders. The forward equalizing beam is fulcrumed under this casting. The general arrangement is similar to that used on the consolidation Mallet engines for the Southern Pacific Company, except that, in the present case, the box casting contains no steam passages.

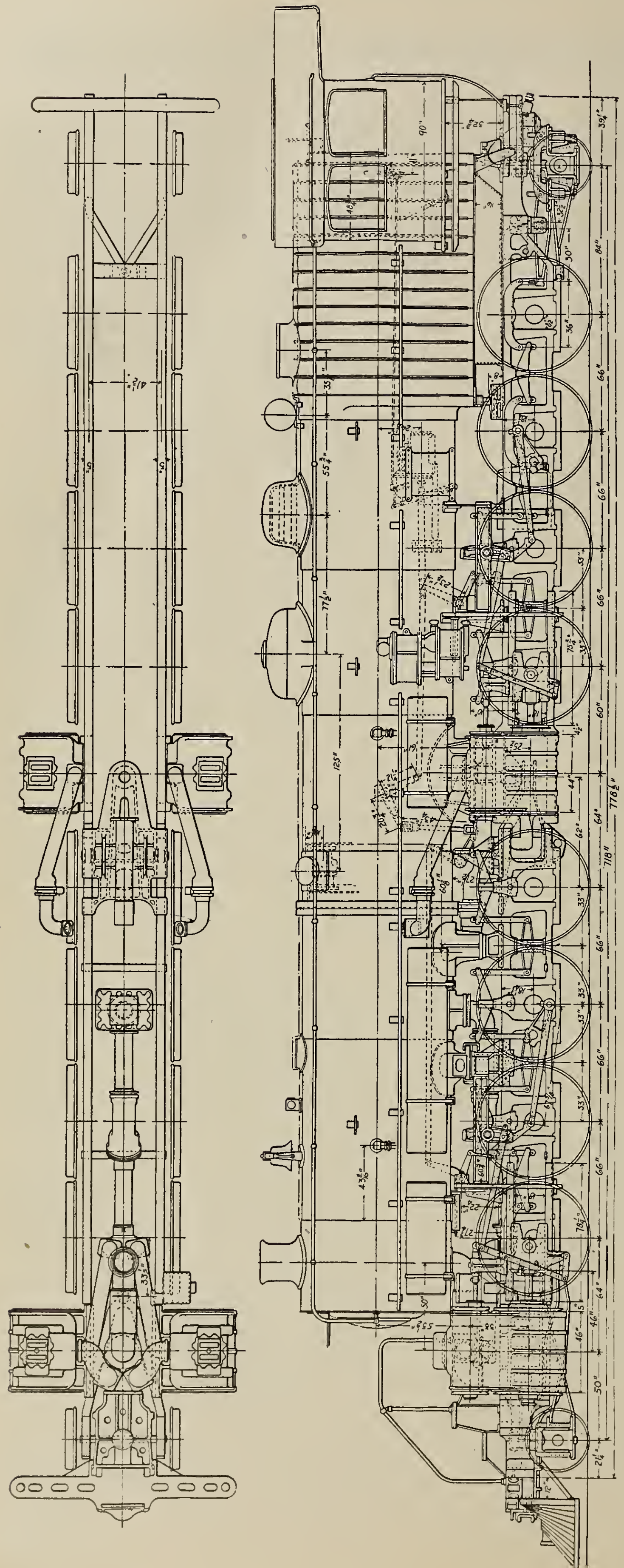
The frames are of cast steel, 5 inches in width, and spaced 41½ inches between centers. The boiler is carried, on the rear frames, by sliding shoes under the fire-box, two waist sheets, and a saddle located between the high pressure cylinders. This saddle consists of two steel castings, placed one above the other. The lower casting has cored in it a steam passage, which forms part of the connection between the high pressure steam chests and the reheater. The over-hang of the boiler is supported, on the front frames, at two points. Both supports have their bearing surfaces normally in contact, and the wear is taken, in each case, by a cast iron shoe 2 inches thick. The rear support is placed under the combustion chamber, and the upper casting, or saddle, has a passage cored in it through which the high pressure exhaust steam passes to the reheater. The front support carries the centering springs.

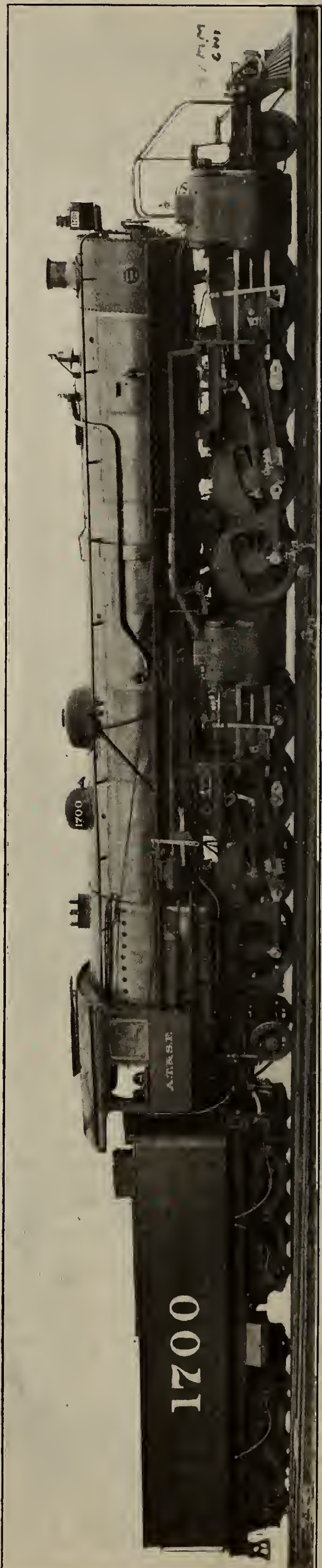
The tender of this locomotive is of exceptional capacity, as it carries 4,000 gallons of oil and 12,000 gallons of water. The tanks are rectangular in cross-section, and are mounted on a frame composed of 15-inch channels for the center sills, and 12-inch channels for the side sills. The front and back bumpers are of cast steel. The trucks are of the six-wheeled equalized pedestal type, with "Standard" steel-tired wheels. Each truck has two bolsters, which are swung suspended between the center and outside axles. The center plate is in one piece with a heavy steel casting, which is seated on the bolsters. The truck frame and pedestals are also of cast steel.

The calculated tractive force of these locomotives is 108,300 pounds and in this respect the design marks an advance over any engines heretofore constructed by the builders. While the new engines are primarily intended for freight service, the comparativly large size of their wheels should enable them to handle heavy passenger trains on mountain grades. Although they are in some respects an experiment, the previous experience of the builders with heavy articulated compound locomotives indicates that their performance will be satisfactory.

The principal dimensions, weight etc., are given in the following table:

Gauge	4 ft. 8½ ins.
Cylinders	26 ins. and 38 ins. x 34 ins.
Valves	Balanced Piston
Boiler—	
Type	Straight
Material	Steel
Diameter	84 ins.





Mallet Articulated Locomotive for Freight Service, A. T. & S. F. Ry.

Thickness of sheets	7/8 in. and 15/16 in.
Working pressure	220 lbs.
Fuel	Oil
Staying	Special
Fire Box—	
Material	Steel
Length	129 5/8 ins.
Width	78 7/8 ins.
Depth	72 ins.
Thickness of sheets, sides	5/16 in.
Thickness of sheets, back	3/8 in.
Thickness of sheets, crown	5/16 in.
Thickness of sheets, tube	9/16 in.
Water Space—	
Front	5 ins.
Sides	5 1/2 ins.
Back	5 ins.
Fire Tubes—	
Material	Iron
Thickness	No. 11 W. G.
Number	387
Diameter	2 1/4 ins.
Length	21 ft. 0 ins.
Feed-Water Heater Tubes—	
Material	Iron
Thickness	No. 11 W. G.
Number	417
Diameter	2 1/4 ins.
Length	6 ft. 8 ins.
Heating Surface—	
Fire box	236 sq. ft.
Fire tubes	4,768 sq. ft.
Feed-water heater tubes	1,617 sq. ft.
Total	6,621 sq. ft.
Grate Area	70.8 sq. ft.
Driving Wheels—	
Diameter, outside	63 ins.
Diameter, center	56 ins.
Journals, main	11 1/2 ins. x 12 ins.
Journals, others	10 ins. x 12 ins.
Engine Truck Wheels—	
Diameter, front	34 1/4 ins.
Journals	6 1/2 ins. x 10 1/2 ins.
Diameter, back	34 1/4 ins.
Journals	7 ins. x 12 ins.
Wheel Base—	
Driving	43 ft. 4 ins.
Rigid	16 ft. 6 ins.
Total engine	59 ft. 10 ins.
Total engine and tender	98 ft. 5 1/8 ins.
Weight—	
On driving wheels	412,350 lbs.
On truck, front	24,050 lbs.
On truck, back	26,050 lbs.
Total engine	462,450 lbs.
Total engine and tender about	700,000 lbs.
Tender—	
Wheels, number	12
Wheels, diameter	34 1/4 ins.
Journals	5 1/2 ins. x 10 ins.
Tank capacity, water	12,000 gals.
Tank capacity, oil	4,000 gals.
Service	Freight

Engine equipped with Jacobs-Shupert fire box and Santa Fe superheater and reheater.

Superheating surface	544 sq. ft.
Reheating surface	1,201 sq. ft.

Economy of Electric Drive in the Machine Shop*

By A. L. De Leeuw.

When the electric motor was first used in the shops, practically no other claim was made for it than that it saved power by obviating the losses in line and countershafts. Exaggerated statements were made of savings to be effected; and though it was proved later that many of these claims should be divided by a large factor, and that some should even be provided with the negative sign, these statements did a great deal of good by calling attention to the fact that great losses existed.

The writer knows of no way to determine the exact amount of these losses, but wishes to call attention to the fact that a method which has been employed quite frequently is entirely misleading. The method referred to is, to measure electrically or by indicator card the amount of power required to run all or a part of shop with and without machine load. The difference between the two readings is supposed to be the loss. That this is wrong becomes obvious as soon as one considers that the frictional load of every bearing changes with the amount of the load, and that the belt pull sets up bending and torsional strains in long lengths of shafting, which may cause losses much greater than the losses by journal friction.

The method of taking separate measurements of the work done by each machine individually, and totalling the result, is also wrong, as all machines do not require the maximum amount of power at the same time. To multiply the total by some fractional coefficient is merely a refined way of guessing. Statements have from time to time appeared, as to the amount of saving effected by the substitution of motor drives for line-shaft drives, but never with the positive statement that at the same time other changes were not made which might have some effect on the situation. This absence of reliable data is apparent all over the field of this subject, and it will therefore be impossible to say beforehand with any fair degree of certainty how much, if anything, can be gained by the conversion of a shop from a shaft to a motor drive. It will be possible, however, to indicate points which should be kept in mind, and which are the controlling factors.

Economy is the art of obtaining the greatest output with the smallest outlay. To strike a balance between these two elements, outlay and output, is the work of the industrial engineer. In a great many cases, perhaps in the majority, there are not sufficient data to enable him to do this; his work then becomes hazardous and is on a level with that of the prospector. Many reputations are based on a stroke of luck, and many have been lost by a single wrong guess. On the other hand, many hundreds of thousands, or more likely, millions of dollars have been lost to shop owners by listening to the lure of the enthusiastic engineer with more faith than data.

In considering the economical features, when converting a shop from shaft to motor drive, the following points should be kept in mind:

The nature of the shop.

The possible economies which may be effected by the installation of electric drive.

The first cost of such an installation.

The cost of its upkeep.

The cost per unit of power.

Though these are the main points to be considered in a preliminary investigation, they are by no means the only ones. They are specially mentioned here because their contemplation will naturally lead to the consideration of other points as well.

As the electric drive for the machine shop alone will be considered here, it may seem that the nature of the shop might have

*From a paper presented before the American Society of Mechanical Engineers.

been left out of consideration. In the great majority of cases, however, a machine shop is of a dual nature. A foundry or blacksmith shop, or perhaps, a plating shop is connected with the establishment; or warehouse and yard service may form a considerable portion of the operations. The yard service of a plant may be of an elaborate nature, while the machining operations are of a simple nature. It may be that the machine-snop operations cannot be improved enough by the change to electric drive to warrant its installation, yet the gains to be made by converting yard cranes and other similar apparatus to electrically driven apparatus may be so great as to make it advisable to change the mode of driving of the entire plant.

As to the possible economies which may be effected by a change of drive, this involves so many considerations that nothing but an exhaustive study of the entire plant in all its aspects will clearly show what may be accomplished. Though at one time the only economy considered was the saving of power, it is now well recognized that this is by no means the only nor the most important economy resulting from a conversion to electric drive, and that such a conversion may even be highly economical, though there be an actual loss in power consumed.

To illustrate: practically all of the work done in a machine shop, for which power is used, is the removal of chips. The writer has in mind a shop where an average of 9 tons of metal is daily fed through the shop, to be made up into high-grade machinery. This metal is for the greater part cast iron, with a minority of steel and a small percentage of bronze and other metals, just as in most machine shops. The total of chips removed amounts to less than 15 per cent or 2,700 lbs. of metal in a nine-hour day, making 300 lb. per hr., or 5 lb. per min. This shop uses an average of 225 h.p., which is 45 h.p. per min. for each pound of chips removed. Figuring that all the chips are steel, this would mean that the shop requires about 12 h.p. per cu. in. of steel removed. It should be noted that this shop is to a large extent electrically driven, and otherwise as well or better equipped than the majority of machine shops. The power costs about $40 per h.p. per year, or a total of $9,000, which in-half of it could be saved by some other mode of driving, then the total possible gain would be $4,500 per year. This shop employs about 500 men, so that the gain would be $9 per man per year. An establishment of this kind and size delivers a product of about $2,000 per man per year. If the installation of a new mode of driving could increase this output only 5 per cent, then the gain per man per year would be $40, or more than four times the gain which can be made by cutting the power consumption in two. Obviously then, the problem is to increase the amount of chips made in a given shop, and not to diminish the amount of horsepower for a given amount of chips.

As to the first cost of installation, though it may be beyond doubt that a change in the mode of driving might effect economies yet it remains to be shown that these economies give a good return on the investment, and further, that this same investment could not be placed in another direction to better advantage. What is true when a shop is to be converted from one drive to another, is also true when a new plant is to be built. Directors of industrial undertakings have frequently been criticised for apparent lack of progress, when a close analysis might have shown other more crying needs for the investment of the capital at command. Though the shop of an industrial undertaking may be the only place where its product is made, it may not be the only place where its money is made. And even should the shop be beyond doubt the best place to invest the money on hand, it remains to be shown that the proposed change of drive will bring better returns than improvements along other lines. This question will also be dealt with later.

The probable cost of upkeep must also be thoroughly investigated, especially as this is likely to be under-estimated unless one goes fully into details. In considering the probable economies, this cost of upkeep has to be estimated and deducted from the gross gains; but the same item appears again in the form of disturbance of operation, when it is much harder to estimate it. This must be done as well as possible, however, before reaching a final conclusion. These disturbances make themselves especially felt the first few years after making the change.

It is further true that most radical changes are made at a time when there is a heavy demand on the shop, either because it is thought that the output can be increased by the contemplated changes, or because the size of the power plant has not kept step with the growth of the rest of the plant, or because at such times of business prosperity, money can be easily obtained for such changes. Whatever the reasons, the fact has been fairly well established; and a change at such a time must be doubly hazardous, not only because it may fail to accomplish the desired increase of output, but because it may actually prove to be a source of disturbance, and reduce the output instead of increasing it.

As to the cost per unit of power, this should enter into the preliminary considerations, as it will determine to a large extent the kind of current to be used, and this may have a decided effect on the final economy of the system as applied to the shop.

The savings effected by driving the shop electrically may be classed under two heads: increased output and less expense. Whether savings can be effected by increasing the output depends on so many and such varied items that it seems best to show them first in an elementary way, by considering a single machine under a set of assumed conditions.

Let us take for example a 12-ft. boring and turning mill, used in a shop devoted to the manufacture of a single line of product and having enough machines of each kind to allow each machine to be devoted to a very limited line of operations. Suppose the machine under consideration to do nothing but turn up large rings, ranging in diameter from 12 ft. to 8 ft., and further, that a great number of rings of each size are to be turned up in each lot, so that the amount of time lost in setting the machine for the different kinds of work becomes negligible. Let it be further supposed that the machine is provided with a number of speeds in geometrical progression, with steps of 25 per cent, and that there is one speed which happens to correspond to the proper speed for the material used and for a diameter of 12 ft. This is supposing a set of conditions as good as can be expected in the ordinary commercial machine.

Under these conditions, the low speed must be used for all rings from 12 ft. down to 9.6 ft., and the next higher speed for all rings ranging from 9.6 ft. down to 8 ft. Supposing that the number of all rings of the same size is the same, it follows that the machine runs $\frac{6}{10}$ of the year on the lower speed, and $\frac{4}{10}$ of the year on the higher one. Allowing $\frac{1}{4}$ of the total time for chucking work, removing it, changing tools, etc., there remains $\frac{3}{4}$ of the year spent in removing chips. The machine removes chips, therefore, at the lower speed during 9/20 ($\frac{6}{10}$ of $\frac{3}{4}$) of the year, and 6/20 ($\frac{4}{10}$ of $\frac{3}{4}$) of the year at the higher speed. This higher speed might be called 12, and the lower speed 9.6. A measure for the amount of chips removed, and, therefore, for the number of pieces turned up, would then be the amount of time multiplied by the linear speed of the tool. This is not exactly correct, but near enough for a mere illustration.

So far, however, an expression has been found only for the number of revolutions of the machine. In order to reduce this to linear speed, we must consider the fact that the higher speed is the proper speed for a diameter of 9.6 ft., and the lower speed for a diameter of 12 ft. If the machine were to run all the time at the speed corresponding to the diameter to be turned up, the total output for the year could be expressed by the time the machine is actually removing chips, which is $\frac{3}{4}$.

When running at the lower speed, however, the machine has the proper speed only when the diameter to be turned up is exexactly 12 ft. At all other diameters the speed is too low. The effect is the same as if the machine were running all the time at the lower speed, and all the work were of a diameter of the mean between 12 and 9.6, or 10.8. Therefore, when running on the low speed, the output runs down from 9/20 to 81/200. Similarly, the output of the machine, when running at the higher speed, has beeen reduced from 6/20 to 55/200, and the total from ¾ to 136/200, or a reduction of nearly 10 per cent. Now, if this machine were driven by a variable speed motor, it would be possible to find a proper speed for every size of ring to be turned up, and the production might be increased from 136 to 150, or a gain of nearly 11 per cent.

Merely to say that there is a gain in production of 11 per cent is perhaps sufficient to prove that under certain conditions a change from belt to motor drive may be profitable, but it is in no way a measure of the amount of profit. If, for instance, the machine is capable of taking care of all the work in the shop, then the only gain is in the wages of the operator; if, on the other hand, there is more work than the machine can take care of, then the increased production of the machine may mean a corresponding increase in the production of the entire shop, improved deliveries, and the avoidance of a great deal of confusion, of which the money value may be many times greater than the mere saving in wages.

In the foregoing example, the advantage gained is entirelv due to the fact that a variable-speed motor was attached to the machine. This is by no means, however, the only reason why the change to electric drive may increase the efficiency of a machine. The electric drive may enable one to place the machine in a more convenient position, or bring it under a crane; or it may be the means of giving the machine more power than it could have with a belt drive; or again, it may be the means of doing away with some harmful conditions which have diminished the machine's efficiency. Among such circumstances may be mentioned the slackness of belts due to weather conditions, or to the varying loads placed on an upper floor, making the belts from pulleys attached to the under-side of this floor either too loose, having been adjusted at a time when the load on the upper floor was too light; or too tight, owing to adjustment at a time when the load on the upper floor was heavy.

Figure 1 shows the main points in which an increase in output may be expected from the substitution of electric drive for shaft drive. The electric drive will show its effect on individual machines, on the handling of work in the shop, on light and cleanliness, on the possibility of making changes of arrangement, and on the individual output of the operator.

Electric current in a shop not only makes it possible to get more production from machines individually, but admits of a number of improvements in the handling of work. The electric traveling crane has become such a common aid in the shop that it is almost difficult to realize that it is only twenty years since it was new. It is also hard to realize that it is one of the possibilities of the electric drive. The effect of the electric crane on the economy of the shop cannot well be over-estimated; though it is difficult to express in figures the amount of this economy. So much can be said, that only a few shops are over-supplied with cranes, while in a great number more cranes could be placed to good advantage. The installation of electric cranes or hoists in a shop is somewhat similar to the installation of compressed air. It is generally difficult to estimate beforehand with certainty the amount of savings to be effected, or to realize the various uses to which the apparatus will be put, but once a compressor is installed its capacity is soon exceeded; similarly, the electric crane is soon overworked.

The proper choice and installation of electric cranes and hoists is a separate branch of industrial engineering, though not generally considered as such. The best effects can be had only when the apparatus is taken into consideration with the placing of the tools in the shop, and the laying out of the shop buildings. Instances where the exact amount of savings effected was known even after the new apparatus had been installed for some time, are also rare, though not quite to the same extent as data about machine tools. The installation of a yard crane in a flask yard reduced the number of laborers from nine men to two and the crane tender. The installation of a small electric hoist, on a small traveler worked by hand, increased the output of a milling machine, besides doing away with the help of a laborer. It should be remarked here that the weight of the piece to be milled was too much to be lifted by hand, and that the time used for the operation proper was small. Instances of this kind are not rare and have come under the observation of almost any engineer connected with industrial establishments.

In line with electric cranes are lifting magnets, which are to be considered as an adjunct to the crane. They can often be used to good advantage for lifting plates, for loading and unloading pig-iron and scrap, for hauling small castings in quantities, and even larger castings provided their shape and the distribution of metal makes them adapted to this mode of handling, tor lifting drop weights, and for a number of other purposes. Though no instances are at hand, it seems to the writer that a small lifting magnet could be

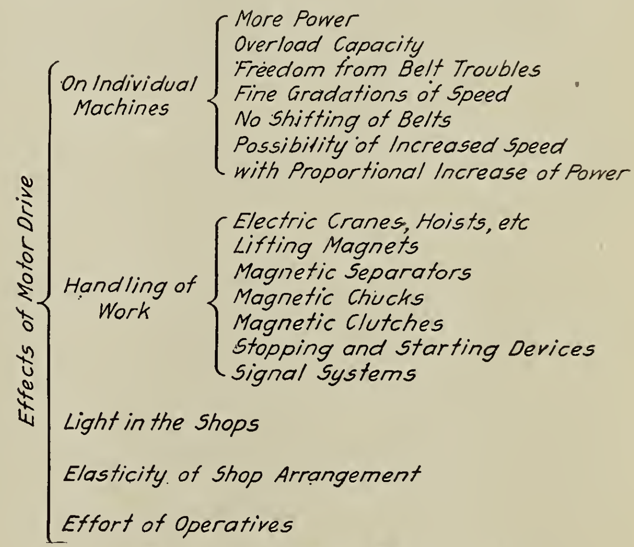


Fig. 1. Advantages of Electric Drive.

used to good advantage for collecting chips at the various machine tools in a shop.

Magnetic separators, though more commonly used in the foundry, are used also in the machine shop for the complete separation of the chips of various metals. However, they seem to be more in the nature of a luxury than of a necessity.

This cannot be said of magnetic chucks, which make it possible to do quickly, conveniently and accurately a great many jobs which would be very difficult, if not impossible, without this piece of apparatus. Magnetic chucks are of special merit in combination with small planers, shapers, milling machines, lathes and grinders. Their economical value may range from a mere aid to the operator, to the means of doing a job which could not otherwise be done at all. It is generally easy to estimate the savings to be effected, as the time for ordinary chucking methods is well known, and the time for chucking by means of the magnetic chuck, is practically negligible; further, the amount of power used for the chucks does not need to be taken into consideration. They have their limitations and are not adapted to all or even to a great number of operations; but where they are applicable at all, they are of great value.

Magnetic clutches seemed at one time destined to play a great part in shop economy. So far, however, they have been a disappointment. This seems to be partly due to inherent weaknesses of the magnetic clutch, but perhaps more to faulty construction, and especially to the fact that those who designed and developed the magnetic clutch did not quite clearly understand the requirements of the machine tools to which they were to be applied, and, further, that those who had to apply the clutch to machine tools did not understand the peculiarities of a magnet. There never was the hearty co-operation that would make the magnetic clutch a success.

It would not be surprising to see the magnetic clutch come to the foreground once more and claim its own. There seems to be a field for this kind of apparatus in controlling mechanism of all kinds, as well as for braking the movement of a machine or a part thereof. Its peculiar value in this respect would be to give the operator the means for controlling his machine, by merely touching a button or turning a small switch. The magnetic brake is employed now, especially in cranes, indicating that there is nothing inherent in the magnetic clutch which makes it unfit for application.

Attention might be called here to the possibilities of the application of the magnet in its various forms to operations in the shop, and to functions in a machine tool. Magnets now are employed for holding small portable tools in position, and might be used for vises and other handling devices. Further attention should be called to the possibility of using the motor itself as a brake, by short-circuiting the armature on a given amount of resistance.

In the previous paragraphs, mention was made of the possibility of applying the electric magnet for the purpose of controlling a machine. This might be called control from a distance, though in the applications hinted at, the distance would be very small in most cases. There is no reason, however, why this distance could not be increased at will. As a matter of fact, a number of installations are in existence where electric devices (though not necessarily electro-magnets) are in use for this very purpose. They will be found especially in rolling mills, and other plants where given amounts of material have to be handled continuously. These devices enable the engineer to minimize manual labor, besides making the plant safer and the action more continuous.

Electric signal service in shops was well known before the electric drive was thought of, but it can be greatly improved where electric power is at hand, as lamps of different colors, placed in the shop, will transmit intelligence better and with less confusion than electric bells. The telephone would come under the head of electric signals, but it is not dependent on the use of current in the shop.

One of the greatest blessings of the electric current in the shop is electric lighting. This is so generally acknowledged and so universally employed, however, that it would be a waste of space to go further into this matter here.

Another great benefit of the electric drive is elasticity of shop arrangement. Growing establishments had to be satisfied with arrangements of machinery which had no other point in their favor than that they were the only possible ones. It was often necessary to place departments where they should not be, simply because it was not possible to drive the machinery in them if they were placed elsewhere. The electric drive makes it possible to change the arrangement of the machinery, and the relative location and size of the different departments, according to the changing needs of the shop. This principle of changing the shop according to the work to be done, is carried to its logical limit in the system of floor plates and portable tools.

Besides making alterations in an existing arrangement possible, the electric drive also allows departments to be placed far enough from each other to permit of extending each one separately, without interfering with the other departments. This was generally not possible with belt drive, as the distances became entirely too large. It was generally found necessary for large plants to have a multiplicity of engines. A number of the best known modern shops are witnesses to the advantage of electric drive in the matter of arranging buildings and departments. It is hardly necessary to mention that the established ideas in regard to shop arrangement had to be largely revised, and that there is even now considerable uncertainty as to what is the best possible arrangement, but it is safe to say that there is little divergence of opinion as to what kind of drive will give the greatest possible elasticity, if elasticity is required or deemed advisable.

It was mentioned before that the variable-speed motor, applied to a machine tool, induces the operator to experiment with the best possible speeds. There is, however, another way in which the electric drive affects the efforts of the men. It is nowadays well recognized that favorable conditions in regard to light, heat, sanitary conditions, etc., have their immediate effect on the output of the shop. These conditions cannot be ideal with a confusion of belts obstructing light and gathering and distributing dirt. Though in most electrically driven shops belts are not entirely absent, they are so few that their evil effects are reduced to a minimum.

If, after considering all these points in a general way, the engineer comes to the conclusion that the electric drive will decrease expenses, then the next step will be to select the nature of the drive. The diagram in Fig. 2 shows the main points to be considered.

Whether a central generating station or a multiplicity of smaller plants is preferable, depends again on local condi-

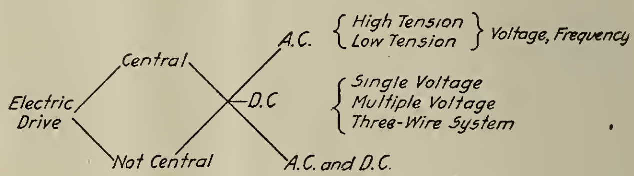


Fig. 2. Divisions of Electric Drive.

tions. Certain conditions might make a number of generating plants preferable, as, for example, in a plant which consists mainly of a machine shop requiring considerable power, with a smaller wood-working shop located at a considerable distance from the rest of the plant. In this case, the outlay for copper to supply the wood-working shop with power would be considerable; whereas, by placing an individual generating plant near the wood-working shop, the shavings might be used instead of coal.

Another case would be where a portion of the shop requires a great amount of power, but only for a short time each day, or perhaps at long intervals, thus necessitating a large outlay in generating machinery and copper. By separating this plant, the outlay for copper is avoided and a cheaper class of generating machinery may be used.

The writer has in mind a plant devoted to the making of electric generators and motors. By far the greater part of its output is in smaller units, but a certain small percentage is in larger generating units. The power required for testing these large generators exceeds in amount all the power required for the entire plant. This plant gets its current from a central station near by, but the amount of copper required for the large testing currents would be more than the cost of installation of a cheap gas engine and generator. Here again the engineer must consider conditions as he finds them and must not be governed by general principles only.

The question whether alternating or direct current should be used is especially difficult of solution, and there is a wide difference of opinion among engineers as to which is best. It may be that too many engineers look at this proposition only from a power standpoint, without giving due attention to the output of the plant. Commercial reasons also have figured largely in the past, the representatives of companies manufacturing both kinds of apparatus naturally advocating the alternating variety, as by so doing they eliminated some competition. Now that more electrical companies manufacture alternating apparatus, this phase of the matter has almost entirely disappeared.

It may be said that, all other conditions being the same, alternating current offers an advantage when the distances over which the current must be transmitted are considerable. The fact that current can be generated at high voltage diminishes the amount of copper needed for transmission, but here again the problem is not simple. Attention must be paid to the expenses incurred in step-up and step-down transformers and auxiliary apparatus; and also to the fact that money invested in copper conductors is lost only in part, while money invested in auxiliary apparatus is lost almost entirely in case of a change. On the other hand, given a compact plant, using a large portion of the power for variable-speed machinery, direct-driven by motors, and of which the lighting load is small in the daytime, and it would be natural to select direct current. As a rule, however, conditions are not so simple, and it is generally very difficult to prophesy which system will give the best results. Of late the problem has been complicated by the fact that a great many machine tools may be had with single-pulley drive, to which an alternating-current or a direct-current motor is equally applicable.

The points in favor of the alternating-current motor are then:

High breakdown point; that is, the motor goes on with no material change in speed under very heavy overload.

Freedom from commutator trouble. This is especially valuable where fine chips are made, or where compressed air is used in connection with the machine. It is not such a weighty point as it used to be, as the better makes of direct-current motors are now equally free from this kind of trouble.

Most cities are now lighted by alternating current, so that city current can be used in smaller plants, provided the machine tools are arranged for this kind of motor.

The points in favor of the direct-current motor are:

Wider air-gap, allowing a greater amount of wear in the bearings before the motor has to be repaired.

The possibility of power and lighting-loads on the same circuits without the poor regulation due to inductive load.

The possibility of using variable-speed motors. This is, perhaps, the greatest argument in favor of the direct-current motor. Though it is possible to run a great many machine tools by a motor, yet one of the greatest advantages of such a drive is not available, unless the motor is of the variable-speed variety.

When a decision has been reached as to the nature of the current to be employed, the next step will be to decide as to the voltage. A high voltage is likely to be in favor if distance was a controlling factor in the decision to use alternating current; for it is this possibility of using high voltage, which makes alternating current desirable under those conditions. Where the distances are relatively small, it becomes simply a matter of computation whether low copper cost plus the expenses for transformers, etc., will give greater or less economy than high copper cost without auxiliary apparatus. In a great number of cases, current is bought from some power company, and in such cases there is no choice. In any case, however, it remains to be decided to what voltage the current shall be transformed. Few engineers nowadays adopt the 440-volt current, on account of the greater danger, and for the same reason 500-volt direct current is very little used. It should be kept in mind that alternating current is more dangerous than direct current of the same voltage.

Frequency depends on the use to be made of the alternating current. In late years a compromise has been reached, which fills practically all wants of the shop by one single frequency, namely 60 cycles.

Though there is still some difference of opinion, the question of the number of phases is now fairly well settled in favor of the three-phase current. It would be difficult, however, to point out the advantage of this system over the two-phase system, or vice versa, as far as use in shops is concerned.

The choice of voltage is easier when direct current is used. There was a time when the multiple voltage seemed to take a strong hold on engineers for use in machine shops, and the writer must confess that he had strong faith in the ultimate success of this system. However, the development of the variable-speed motor has made the system somewhat superfluous and it has not been installed in any new shops of late. It might be said that, for all practical purposes, the system is dead.

There is, however, a kind of multiple-voltage system in use which deserves even at the present day the serious consideration of the engineer. This is the three-wire system, which allows of the use of 110 and 220 volts in the same shop. The 110-volt system alone would require a large amount of copper for power purposes, while the 220-volt installation leads to some difficulties in regard to lighting. However, there are many installations where the 220-volt system is used throughout, both for power and lighting, while the number of shops where a 110-volt system is used for both purposes is very small.

There are a few shops using 500 volts, but the number is very small as compared with the other voltages; and it is generally possible to trace the reason for such an installation to the fact that the 500-volt current is available because used for some other purposes, as, for instance, in the case of a repair shop for a street railway system. This system is not to be recommended for a shop (though it is economical in the use of copper), for the reason that it is dangerous and where there are a large number of circuits and much metal in buildings and machinery great care must be taken to avoid grounds.

There is finally the combination of alternating and direct current to be considered. This combination has its advantages, especially where it is possible to purchase current from some large power company, which as a rule delivers its product as alternating current. Transformers reduce the voltage to the proper point at the entrance to the shop, and the low-voltage alternating current can be used for all purposes except for driving variable-speed motors, and perhaps some auxiliary apparatus such as magnetic clutches, lifting magnets, etc. As the cost of installation is generally low in such a case, and the price per unit of power usually less than it could be made for, such an arrangement is so inviting that a number of objectionable features may be overlooked. The most serious objection, perhaps, to this method of driving a shop, is that the shop has absolutely no control over the supply of current, and there is nothing to be done in the case of a breakdown but sit down and wait. This is especially serious, as power delivered in this manner is generally transmitted over a long distance which increases the chance of a break in the wires, especially in bad weather.

The mode of application of a motor to a machine tool, the selection of the motor and the lines along which economical results may be expected, are fairly well defined at the present time. The following tabulation shows the present state of the art.

Bench lathes may be driven from a countershaft, attached to the wall or bench and driven in its turn by a motor. Any kind of motor, except a series-wound or heavily compounded motor, will do. The object of the motor drive is to get the machine in the best possible location without regard to the location of the line shafting. A number of these machines may be driven by a common line shaft, driven by a motor.

Some makers furnish motor-driven engine lathes as standard apparatus. Some have a headstock with a limited number of speeds and depend on a variable-speed motor to fill out the speeds of the lathe. Others apply a constant-speed motor, or one with a limited amount of variation, to an all-geared headstock. In general the use of this class of machines in the shop would naturally lead to group drive. Advantages of the individual motor drive lie in the possibility of completing a job in one setting. There is no material advantage, if the machines are used for regular manufacturing operations, except where the location demands the motor drive.

It is of the greatest importance that axle lathes, wheel lathes and driving wheel lathes should have the highest possible efficiency, and the most convenient location. These machines are mostly used in railroad repair shops, where time saved does not mean merely the saving of some wages, but each day gained means an added day in the earning capacity of the engine. It is therefore important that these machines be motor-driven whenever installed in a railroad repair shop, though this does not mean that they should not be so driven if used for manufacturing. Direct current should be used. The economy of the motor drive should not be figured in increased ouput, but in reduction in time required to repair an engine.

Generally speaking, there is little reason why a chucking lathe should be motor-driven. Most chucking lathes are provided with the necessary mechanism to shift speeds quickly. A few types handling large work may be motor-driven to advantage, though practically the only advantage lies in the fact that small graduations in speed can be thus obtained. Such machines therefore require a variable-speed motor.

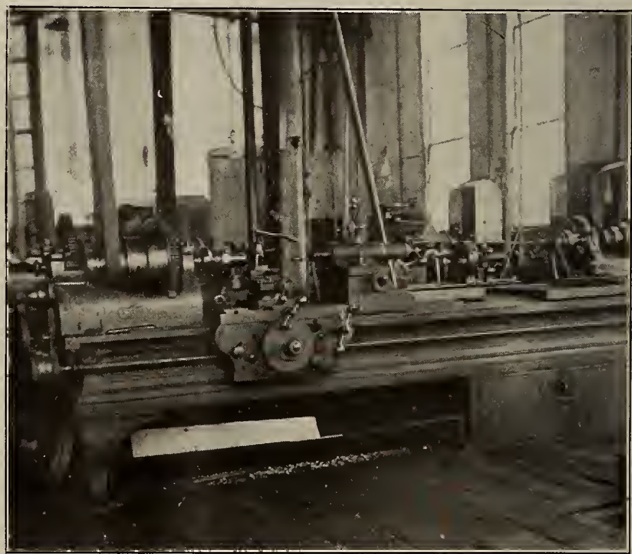
The only reason why a sensitive drill should be individually motor-driven is, that it is often used in an assembling department, where height of ceiling and crane service would make a belt drive awkward or impossible. Most sensitive drills have in themselves all the speeds required for their work, so that any type of motor will be adaptable. The motor may either be directly applied to the machine or may drive a countershaft on a stand, or be placed on the floor by the side of the machine in case the machine carries its own set of cones or other variable-speed device. Generally speaking, the upright drill is used for manufacturing operations and does not require frequent changes of speed. There are, however, many exceptions, for instance, where upright drills are used to do all the operations on a piece by means of a jig. In this case frequent changes of tools, and therefore of speeds, are required, and an individual motor drive, whether direct-connected to the machine, or operating on the countershaft, is of the greatest benefit. No great benefit can be derived from a constant-speed motor with this type of machine. Radial drills may be considered the same as upright drills. There is an additional reason why radial drills should be motor-driven—they are often used in the neighborhood of the assembling floor.

Where boring machines are specialized, performing only one operation, there is no good reason why the motor drive should be preferred to belt drives. Where, however, the machine is used for a multiplicity of operations, such as drilling, boring, reaming and facing, a motor drive is beneficial if a variable speed motor is used. The range of speed of the motor should be as wide as possible, that no gears may have to be shifted for the entire set of operations on a single hole. Especially where a boring machine is used for facing, this variable speed will be found highly economical.

Grinders in general require so many various movements driven from countershafts that it is hardly possible to apply a single motor directly to the machine. The best that can be done is to attach the countershaft to the machine and drive the former from a motor standing on the floor or on a bracket attached to the machine. In isolated cases it would be well to have one or more motors, each controlling a single operation, attached directly to the machine.

Planers in general are not benefited by the application of a motor, as the motor only complicates the difficulties of a planer drive. However, large planers which must be placed under a crane give better results when motor-driven on account of the facility of handling the work. Another possible advantage when using a variable-speed motor and controlling the speed of the motor at the end of the stroke, is that much higher return speeds can be obtained in connection with any desired cutting speed.

What is true of planers is also true of shapers and slotters. Local conditions may make it advisable to drive them individually by motor, but, generally speaking, there is no great benefit with this drive.



Lathe in Service Since 1854.

The larger sizes of knee-and-column type milling machines, if motor-driven, will give the best results if the motor is of the variable-speed type, especially where these machines are used for gang work. This is due to the fact that the speed of the mills is dependent on the largest cutter in the gang, while the feed is dependent on the smallest cutter, not counting the limitations due to the nature of the work. It is therefore important that the speed should be as close to the permissible limit as possible. When applied to this type of milling machine the motor should be as low down as possible, as vibrations in the machine have a marked effect on the quality of the finish.

Punches, bending rolls, shears, etc., used largely for boiler, bridge, structural iron and ship-building work, is generally placed in high shops and under cranes, and in locations and directions most convenient for the routing of the work. The shops in which they are placed are generally large and contain a relatively small amount of machinery, so that the amount of transmission gearing required is large in proportion to the amount of machinery. It is for this reason advisable in almost all cases to drive this class of machinery by an electric motor, which, of course, does not need to be of the variable-speed type.

Illinois Central Shops at Centralia

At times the oldest of repair shops furnish the most modern and original ideas. The employees are compelled to use originality in order to make a showing in spite of out-of-date equipment. Since all heavy repairs on the Illinois Central system are made at Burnside shops, the class of work left to the divison terminal points is only that of running repairs and general repairs to the small switch engines. The Centralia shops of the Illinois Central R. R. are nearly as old as the railroad itself and the equipment corresponds in age to the buildings. One of the accompanying illustrations shows a Putnam engine lathe placed in its present surroundings in 1854. It is still in active service. A wheel lathe built in the New York state penitentiary in 1852 is also doing good service. Mr. R. H. Horn, master mechanic at Centralia, served his apprenticeship on these two machines.

The efficiency manifested in the work turned out at Centralia can safely be attributed to the originality and interest of the employees. The latter quality was strikingly exhibited to the writer in a fire drill which is practiced at intervals frequent enough to keep the men instructed in the handling of the apparatus. A bulletin notice which is posted immediately after each drill is reproduced herewith. It shows that company No. 2 made a run of 350 feet, connected up 150 feet of hose and had a stream of water playing, as shown in another illustration, in a period of 1 minute and 10 seconds. In this instance company No. 1 failed to properly lay the hose and in the next drill its record will probably be cleared.

For the purpose of keeping the men informed on the subject of location of hydrants, apparatus, etc., blue printed diagrams are posted about the shop buildings. Whistle signals indicate the location of the fire. It is notable that the men are kept from their work for only a very short interval of time, the shops being in full operation in from three to five minutes after the alarm is given.

Illinois Central Railroad Company.

Office of the Master Mechanic.

Centralia, Ill. Oct. 15th, 190 9.

Bulletin Order No. NOTICE

To Day Fire Brigade.

Roundhouse Alarm.

Alarm given at 11:30 A.M.

Water obtained at 11:31.10 A.M.

	Distance Run:	Amount Hose Laid:	No. Men Responding:
Hose Co. #1:	350'	150'	18
Hose Co. #2:	350'	150'	18
Extinguishers Responding:			7
" Discharged,			0

NOTE: Hose Co. #1 did not get hose properly secured to hydrant and did not get the kinks out of hose, causing it to blow off hydrant and caused delay in getting water.

[Signed] J.A. Winkler, Fire Chief:
E.J. Connors, Asst. Chief.

Posted ______ ______ M. ______ 190. by ______

Filed ______ ______ M. ______ 190.. by ______

Fire Drill Bulletin.

Fire Drill—Stream Playing In 1 Minute and 10 Seconds

Locomotive Boilers

103 Bedford St., Minneapolis, Minn.

Editor the Railway Master Mechanic:

I was very much interested in the report of Mr. Hughes' (mechanical engineer for the L. & Y. Ry. Co., England) experience with the locomotive boiler as published in the October Railway Master Mechanic. I have for some years been studying the cause of a large number of failures of locomotive fireboxes, and after careful investigation I have come to a similar conclusion as Mr. Hughes, having found that the majority of firebox failures is due to the rigid construction of the firebox and tube plates, these parts not allowing sufficient freedom for expansion firebox failures is due to the rogid construction of the firebox and contraction between the heated surfaces and their outer shell of the boiler, which, not being subjected to any heat other than that obtained from the water, sets up severe strains which prove so destructive to the life of the boiler. One has but to imagine the enormous difference of temperature between the inside of a firebox or flue tube and the temperature of the outside shell to realize the amount of stresses the tube plates are subject to, as the demand for steam becomes greater, and the boiler is forced more, the liberation of steam from the underside of the closely set fire tubes becomes more difficult, increasing the resistance in transmission of the heat to the water, and causing the expansion between the tubes to be considerable, with the result that the tubes leak at their joints, or strains are set up sufficient to burst out the back tube plate, and very often the tube plates themselves are cracked between the holes, and more frequently on the top flange of tube plate, so as to allow the tubes to expand more freely. The difference of expansion is still further increased by the deposit of scale on the external surfaces of the tubes, scale being a very bad conductor of heat. Does it not seem reasonable that if we can have a flexible tube plate at both ends of the boiler that a lot of these troubles will disappear? The same argument regarding the tubes applies equally well to the firebox, only that this part of the boiler, which is subjected to much higher temperatures and is held by a large number of rigid stays to the outer shell, suffers even more than do the tube plates. The firebox is also subject to great variations of temperature, sometimes on account of excessive cold air being admitted during firing, and at other times the fires will contain holes, particularly on the large modern boilers with large grate areas that cannot be kept properly covered with coal. This cold air impinging on the sides of the firebox sets up severe local strains that cannot be overcome, unless the material of the firebox is made in such a form as to yield locally to these conditions, and I think that the "Wood" form of firebox and tube plates overcomes these troubles in a perfectly mechanical and practical way. When the corrugated firebox was being introduced for marine service all kinds of objections were raised regarding the scale lodging in the corrugations, but after a number of years' experience under all conditions of marine service it has been found not to scale up any more than the ordinary straight flue, and the corrugated furnace is now universally used in all first-class marine boilers. Since the adoption of corrugated flues for marine boilers nearly all the troubles of leaky tubes, etc., have disappeared. The same cylindrical type of furnace has been tried in the Vanderbilt style of locomotive boiler. They, however, did not do well, the failures being chiefly due to lack of grate area and to the great thickness of the metal necessary to withstand the compression strains under high pressure. Another disadvantage of the Vanderbilt type of boiler is very great difference of temperature that the furnace is subjected to above the fire bars and to the cold air entering below the bars. This sets up severe strains, much more than in any other type of boiler. The writer has been on engines with the corrugated cylindrical firebox, and it was found almost impossible to get any circulation around the firebox in this type, and before the engine could leave the roundhouse it has had to be drawn up and down the shed by means of another engine so as to mix up the water in the lower part of the furnace. In Mr. Wood's type of firebox he has overcome these disadvantages by keeping the regular rectangular form of firebox with the fire at the lowest point, and corrugating the sides and roof in one piece, and in my opinion is an ideal form of locomotive firebox. One of the great advantages is the increased heating surface of the firebox. This heating surface exposed to the direct radiant heat of the fuel has been proved to be from three to four times more valuable for steam raising than the tubular portions of the boiler, and certainly will make a great deal more steam, and be more economical than a firebox of larger dimensions with the same heating surface, as one of Wood's corrugated fireboxes. I certainly think that in the "Wood" type of firebox and tube plates that most of the more troubles we have will disappear. There is also the great advantage of increased strength without increased thickness, and reduction in the number of stay bolts necessary, besides the flexibility and increased life that one would expect from these fireboxes.

Yours truly,

David Crowther, Mech. Engr.

New Locomotives for the Illinois Central R. R.

The Baldwin Locomotive Works have recently delivered 23 locomotives to the Illinois Central R. R. Eighteen of these engines are of the consolidation type for freight service, while the remaining five are of the Pacific type for passenger service. Both designs have been worked out, to a large extent, in accordance with the "Associated Lines" standard specifications. The Pacific type locomotives are, in fact, practically duplicates of those used on the "Associated Lines." Both classes are fitted with piston valves and Stephenson valve gear.

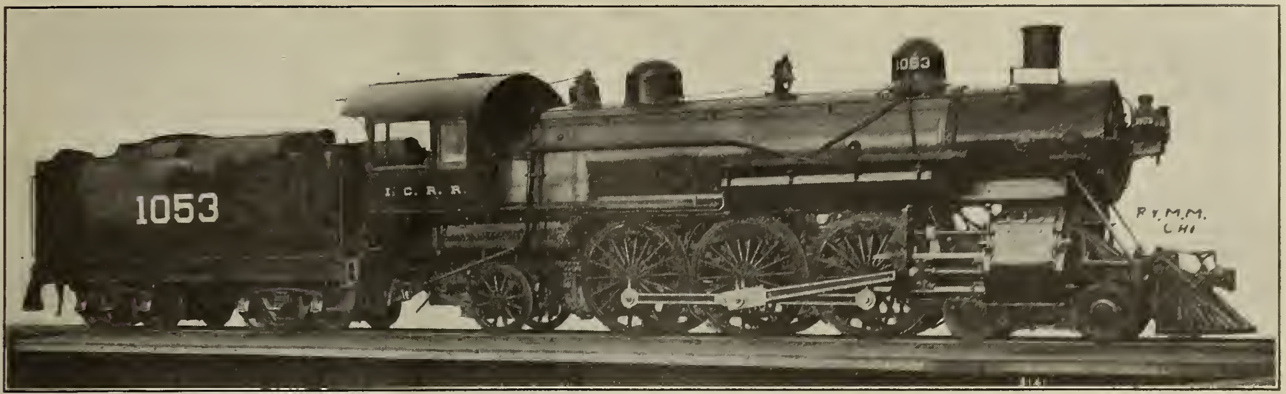
The consolidation type locomotives differ from the "Associated Lines" standard engine, principally in that the driving wheel diameter is increased from 57 to 63 inches. The tractive force is 39,180 pounds, and the result is a liberal factor of adhesion (5.12) for an engine of this type. The comparatively large wheels and ample boiler power should enable these locomotives to maintain good speed in heavy freight service.

The boiler is straight topped, measuring 80 inches in diameter. A liberal tube spacing is used, as the bridges are ⅞ inches wide. The longitudinal seams in the barrel rings are placed on the top center line, and have "diamond" welt strips inside. The firebox is wide, and is built with a vertical throat and sloping back head. The side water legs incline slightly outward as they rise. Both the inside and outside boxes have the crown and sides in one sheet. The inside crown is flat, and is stayed from T iron crown bars hung on expansion links. The mud ring is supported, in front, by sliding shoes seated on a substantial steel casting, and at the rear by a buckle plate.

The cylinder castings are arranged to take double front frame rails and are bolted to the smoke box and to each other by a double row of bolts. The steam distribution is controlled by inside admission piston valves, 12 inches in diameter. The valves are set with a travel of 6 inches and a lead in full gear of 3/32 inches; the steam lap is one inch and the exhaust clearance 1/16 inch. The by-pass valve is of the Sheedy type. A horizontal passage is cored in the cylinder casting, and is provided with a valve at each end. When the throttle is open, these valves are held against their seats by steam pressure. When, however, steam is shut off, the valves are moved from their seats by springs, and free communication is opened between the two ends of the cylinder. The valve gear is indirect acting, the valves being driven through rockers placed between the first and second pairs of driving wheels. The eccentric rods are straight and short, and the link blocks are connected to the rockers by transmission bars which span the second driving axle.

These engines are equipped with Vanderbilt tenders, having cylindrical water tanks. The longitudinal sills are built up of plates and angles, and both front and back bumpers are of cast steel. The engine and tender trucks are equipped with "Standard" forged and rolled steel wheels.

Illinois Central Consolidation.



Illinois Central Pacific.

The Pacific type engines exert a tractive force of 29,920 pounds, and are excellent examples of high powered locomotives for express passenger service. A large number of the details are interchangeable with corresponding parts of the consolidation engines.

The boilers of the Pacific type locomotives are generally similar to those described above, although they have a smaller diameter and longer tubes. The grates are so arranged in the two classes, that a large number of castings are interchangeable. In the present instance, the grate is horizontal, in one plane, while in the consolidation type, the front part of the grate is sloped to give sufficient depth under the tubes. The frames of the Pacific type are built with separate rear sections, and the back truck is of the Rushton type with inside journals. The front truck is fitted with rolled steel wheels and brake equipment.

The cylinders are closely similar to those used on the consolidation type engines, and the piston valves are interchangeable. The rockers are placed immediately in front of the leading driving wheels, and are connected to the link blocks by transmission bars which span the first driving axle. The valve rods are short, and are supported in the guide yokes. Each rocker has a crosshead pinned to its upper arm, and this crosshead engages the valve rod so that all springing of the latter is avoided.

The tender is of the "Associated Lines" standard type, with rectangular water bottom tank. The longitudinal sills consist of 12-inch channels, and the bumpers are of cast steel. The trucks are fitted with cast steel side frames and bolsters and rolled steel wheels. This tender is built with vestibule connection at the rear.

These engines represent designs which have been well tried out in service, and are doing successful work. The principal dimensions of both types are given in the tables below:

CONSOLIDATION TYPE.

Gauge	4 ft.-8½ ins.
Cylinder	22 ins. x 30 ins.
Valve	Balanced Piston
Boiler—	
Type	Straight
Material	Steel
Diameter	80 ins.
Thickness of sheets	¾ in.
Working pressure	200 lbs.
Fuel	Soft Coal
Staying	T crown bars
Fire Box—	
Material	Steel
Length	108 ins.
Width	66 ins.
Depth, front	74 ins.
Depth, back	63¾ ins.
Thickness of sheets, sides	⅜ in.
Thickness of sheets, back	⅜ in.
Thickness of sheets, crown	⅜ in.
Thickness of sheets, tube	½ in.
Water Space—	
Front	5 ins.
Sides	5 ins.
Back	5 ins.
Tubes—	
Material	Iron
Thickness	0.125 in.
Number	413
Diameter	2 ins.
Length	16 ft.-4 ins.
Heating Surface—	
Fire box	171 sq. ft.
Tubes	3,514 sq. ft.
Total	3,685 sq. ft.
Grate area	49.5 sq. ft.
Driving Wheels—	
Diameter, outside	63 ins.
Diameter, center	56 ins.
Journals, main	10 ins. x 12 ins.
Journals, others	9 ins. x 12 ins.
Engine Truck Wheels—	
Diameter, front	33½ ins.
Journals	6 ins. x 10 ins.
Wheel Base—	
Driving	17 ft.-0 ins.
Rigid	17 ft.-0 ins.
Total engine	25 ft.-8 ins.
Total engine and tender	57 ft.-7¾ ins.
Weight—	
On driving wheels	200,900 lbs.
On truck, front	22,100 lbs.
Total engine	223,000 lbs.
Total engine and tender about	356,000 lbs.
Tender—	
Wheels, number	8
Wheels, diameter	33½ ins.
Journals	5½ ins. x 10 ins.
Tank capacity	7,000 gals.
Fuel capacity	14 tons
Service	Freight

PACIFIC TYPE.

Gauge	4 ft.-8½ ins.
Cylinder	22 ins. x 28 ins.
Valve	Balanced Piston
Boiler—	
Type	Straight
Material	Steel
Diameter	70 ins.
Thickness of sheets	11/16 in.

Working pressure	200 lbs.
Fuel	Soft Coal
Staying	I crown bars
Fire Box—	
Material	Steel
Length	108 ins.
Width	66 ins.
Depth, front	68 ins.
Depth, back	64 ins.
Thickness of sheets, sides	⅜ in.
Thickness of sheets, back	⅜ in.
Thickness of sheets, crown	⅜ in.
Thickness of sheets, tube	½ in.
Water Space—	
Front	5 ins.
Sides	5 ins.
Back	5 ins.
Tubes—	
Material	Iron
Thickness	0.125 in.
Number	245
Diameter	2¼ ins.
Length	20 ft.-0 in.
Heating Surface—	
Fire box	174 sq. ft.
Tubes	2,874 sq. ft.
Total	3.048 sq. ft.
Grate area	49.5 sq. ft.
Driving Wheels—	
Diameter, outside	77 ins.
Diameter, center	70 ins.
Journals, main	10 ins. x 12 ins.
Journals, others	9 ins. x 12 ins.
Engine Truck Wheels—	
Diameter, front	33½ ins.
Journals	6 ins. x 10 ins.
Diameter, back	45 ins.
Journals	8 ins. x 12 ins.
Wheel Base—	
Driving	13 ft.-4 ins.
Rigid	13 ft.-4 ins.
Total engine	33 ft.-4 ins.
Total engine and tender	63 ft.-10½ ins.
Weight—	
On driving wheels	141,000 lbs.
On truck, front	37,000 lbs.
On truck, back	44,000 lbs.
Total engine	222,000 lbs.
Total engine and tender about	383,000 lbs.
Tender—	
Wheels, number	8
Wheels, diameter	33½ ins.
Journals	6 ins. x 11 ins.
Tank capacity	9,000 gals.
Fuel capacity	10 tons
Service	Passenger

Cableways at Gatun Locks, Panama

The building of the Panama Canal is now in its fourth and final stage. The first stage was the sanitation of the Canal Zone; the second, the rebuilding of the Panama Railroad so as to supply facilities for transporting the spoil from the excavations to the dumps; the third, the excavation of the canal; the fourth, and last stage, the building of the Gatun dam and locks, and the locks at Miraflores and San Miguel. On August 1st of this year, the excavation (182,000,000 cu. yds., of which 40,000,000 cu. yds. available had been done by the French) had advanced to a point where only 101,000,000 cu. yds. remained to be done, which, as officially stated by Col. Goethals, can be finished by August 1, 1911. The remaining excavation is proceeding at the rate of about 3,000,000 cu. yds. per month.

Keeping pace with the speed of excavation are the construction operations in connection with the Gatun dam and locks. Perhaps the most important part of the mechanical equipment are the 13 Lidgerwood high speed cableways which were especially designed and installed for building the Gatun locks. Upon 5 of these, known as the unloader cableways, will fall the brunt of the work, and upon the ability of these 5 to handle the amount guaranteed, or more, must depend the question of whether the canal will be finished and in operation on January 1, 1915, or earlier. These cableways have exceeded their guaranteed capacity by such a large percentage that the engineers in charge of this section of the work are confident that it can be finished at a much earlier date. They are recognized unofficially by Col. Goethals as "that 1913 crowd."

The work of these 5 cableways is to handle the broken stone and sand which will be required for the walls and floors of the locks. There are 6 locks, each 1,000 feet long in the clear and 110 feet wide. They lie side by side in flights of three, making a total length of more than 3,000 feet. Together they provide a total lift of 85 feet, with some to spare for changes in the initial water level. In these locks there will be used 2,000,000 cu. yds. of broken stone, 1,000,000 cu. yds. of sand and 2,200,000 barrels of cement. The stone and sand arrive in barges on a branch of the old French Canal. The unloader cableway takes it out of the barges with grab buckets and delivers it 600 feet or more away in heaps in the storage yard.. From here it is taken

Fig. 1. Five Lidgerwood Cableways at Gatun Locks, Panama.

Fig. 3. Looking at Loaded Barge from Operator's Booth.

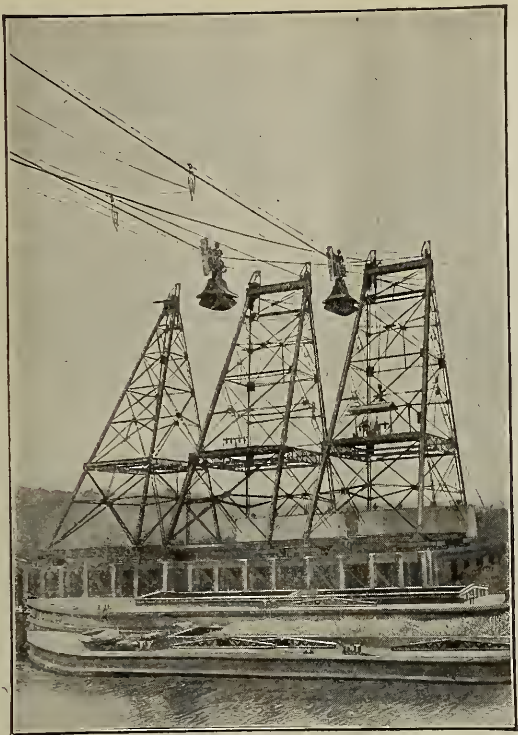


Fig. 2. Tail Towers of Unloader Cableways.

by the cars of an automatically operated electric railway to the mixers and from the mixers the concrete is taken in other electric cars to where the second set of 8 cableways can put it in place in the forms for the walls and floor. Four cableways arranged in pairs on two sets of towers handle the broken stone and a single cableway with independent towers unloads the sand from the barges and deposits it on a storage pile. Each cableway has a span of 800 feet. In the duplex cableways the cables are 18 feet apart. This corresponds with the distance apart of the transverse bulkheads in the barges. The cableways are all mounted on steel towers 85 feet high. The towers are mounted on trucks and travel on tracks, so that each cableway performs the function of a traveling crane. The unloader cableways travel the length of the storage yard. Those for building the locks travel more than 3,000 feet. They are all moved electrically, each pair in unison. From the carriage of each of the 5 unloader cableways there is suspended an improved 70 cu. ft. iron-ore type of excavating bucket. Each bucket grabs an average load of 54 cu. ft. The load is hoisted 85 ft., conveyed about 600 ft., dumped on the storage pile, and the carriage and bucket returned. This round trip has been made in 1 minute and 8 seconds. The cableways were guaranteed to handle 50 cu. yds. an hour each. They have carried 90 cu. yds. in an hour, and the average operation up to date is 60 cu. yds. per hour. This ought to be materially increased with practice. The present record is declared to be double that of any cableway previously employed anywhere.

The high speed and consequent increase in the capacity of the cableways is due to the ease with which the operation of the cableways is controlled; the rope-lead that simultaneously raises and traverses the bucket; the high-speed shock-absorber with which the fall-rope carrier is equipped, and a new type of button-stop.

The hoisting and conveying machinery in the head tower is controlled by an operator in the tall tower stationed on an elevated platform commanding a clear view of the bucket at all times and in all positions. He controls two 150-h.p. motors by master controllers of the New York Subway type, and the air brakes by two levers operating magnet valves 800 ft. away. The physical effort of operation is so easy that the operator can comfortably maintain the high speed. In all previous cableways this effort was so fatiguing that, although it was possible to attain a speed of 35 round trips per hour with mechanical levers, this could not be sustained for any length of time.

The rope-lead which simultaneously hoists and traverses the bucket causes the latter to move in a curved line corresponding somewhat to the hypothenuse of a triangle, instead of moving on the vertical and horizontal sides. Considerable increase of speed and diminution of travel is thereby effected. The high-speed shock-absorber with which the fall rope carrier is equipped is the invention of Spencer Miller. It permits the carriage to travel at the unusual speed of 2,500 ft. per minute. The button-stop employed has been successfully tested experimentally with a fall-rope carrier running at the speed of 3,000 ft. per minute.

On account of the ease of operation of these cableways, considerable difficulty has been experienced in restraining the operators from racing with each other. The cableways have frequently been operated at a speed of 3,000 ft. per minute, which, being at present too severe for the fall-rope carriers, is now limited to 2,500 feet per minute. Some of the small pieces forming the heads of the fall-rope carriers are being replaced with heavier pieces which, it is believed, will admit of even the higher speed.

Another feature of these cableways which is new is that the bucket is counter balanced like a passenger elevator. Thus only the net load has to be hoisted and only enough power is required to do this and overcome friction and inertia.

The eight cableways used for putting the materials in place in the lock walls are similar in span, height, style of towers, and method of control to those for unloading the materials, but they will never be called upon for such rapid work. While they will handle the entire amount of concrete, and besides this, the wooden forms and the many tons of old rails which are to be put into the concrete for reinforcement, there are eight of them as against five of the others, and each will have much less to do. This is necessary as the placing of the concrete requires care and deliberation.

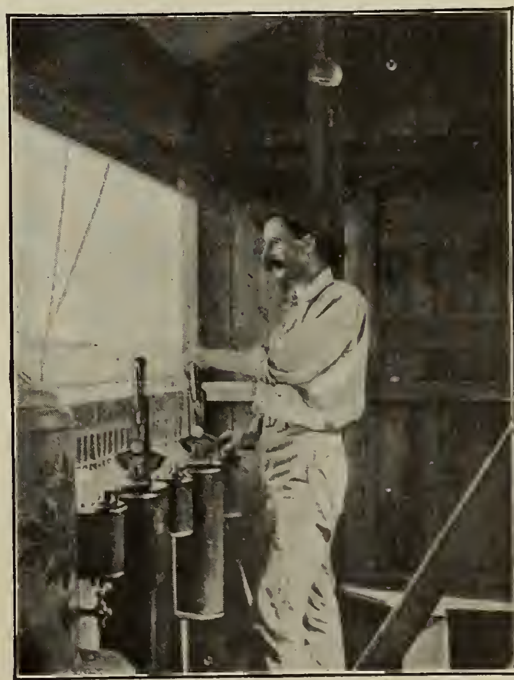


Fig. 4. Cable Operator in His Booth.

Fig. 5. View of Carriage and Buckets Showing Fall Rope Carriers.

The immense quantity of concrete material for the Gatun locks will perhaps be better appreciated if one remembers that handled separately it amounts to more than 3,300,000 cu. yds., while the total cubical contents of the Great Pyramid is only 3,800,000 cu. yds. Tradition says that it took 100,000 men a hundred years to build the Great Pyramid. The Gatun locks are morally sure to be finished before January 1, 1915, and may be ready for opening the canal for use in 1913, thus justifying the confidence of "that 1913 crowd."

Railways and Manufacturers of Railway Devices*

The Western Railroad Association comprises practically all of the large western, southwestern and northwestern railroads, the New York Central lines having their terminals in Chicago, the Erie, the Bessemer & Lake Erie, the Hocking Valley, the Grand Trunk, and the Nashville, Chattanooga & St. Louis. Our interests extend from New York to San Francisco, from Canada to the Gulf. The devices which may be used by our members are found in practically all of the classes of patents issued, presenting a vast field for inquiry. We are open to suit anywhere and at all times, except in the southeastern portion of the United States. The Association dates from some time in 1869 and was brought about by the fact that suits were then pending under the Tanner brake patent, the details of which are now unimportant. Judgments had been rendered against several roads and there was an agreement that if these judgments were finally sustained they should be used as a basis for calculating damages against roads not then sued. The amount to be paid in this event was approximately seventy million dollars. The railroads formed this Association to protect its members against unfounded claims under patents, trade-marks or copyrights, and to advise them as to all questions arising under the laws relating to these subjects.

The Association being formed and counsel employed upon a yearly salary, the cases above referred to were decided by the Supreme Court in favor of the railroads, resulting in a saving of seventy million dollars. If one per cent of this had been put at interest, the income would have paid the expenses of the Association forever. I might add here that if about one-fifth of one per cent of the amount saved its members from the foundation of the Association to the present day were put at interest, no further assessment need be made. I am not suggesting that this be done, but showing what has been accomplished.

The affairs of the Association are governed by a Board of Directors, an Executive Committee, a President, a General Counsel and Treasurer, and a Secretary. Most of the business is handled by the General Counsel. The expenses, which have run from $20,000 to $35,000 a year, and which average about $29,000, are divided among the members in proportion to their gross earnings, so that each pays its share, no more, no less.

In return for the assessment the Association defends all patent, trade-mark or copyright suits that may be brought against its members; conducts negotiations involved in the settlement of claims; renders opinions on all matters of interest included in the above subjects; issues annual reports; sends out monthly lists of expired patents; issues at irregular intervals circulars with reference to matters in which our members may be interested; passes upon licenses, assignments and other papers, and generally, renders such assistance as it can within its sphere. Furthermore, the members derive the very tangible advantage that the Association tends to discourage frivolous law suits. I might say that every year since I have been the General Counsel, the opinions alone if charged for at the usual rates would far exceed the total assessment.

So much for a general outline of our organization and its purposes. As to the methods by which these purposes are carried out, I have several things to say. Any member is entitled, without any payment beyond its regular assessment, to opinions upon all matters pertaining to patents, trade-marks or copyrights in which it may be interested. It is only necessary in order to obtain such an opinion that a request be made of me accompanied by full information. This seems simple, but is anything but that. As illustrating my meaning: An official of one of our members wrote me, saying, "I wish to use a certain car coupler. Can I safely do so?" The name of the coupler was not given, no blue print or description of it was sent. There are hundreds of couplers, and I could not possibly guess which was the one in question. This is an extreme case, but serves to illustrate my point—that to utilize the Association to

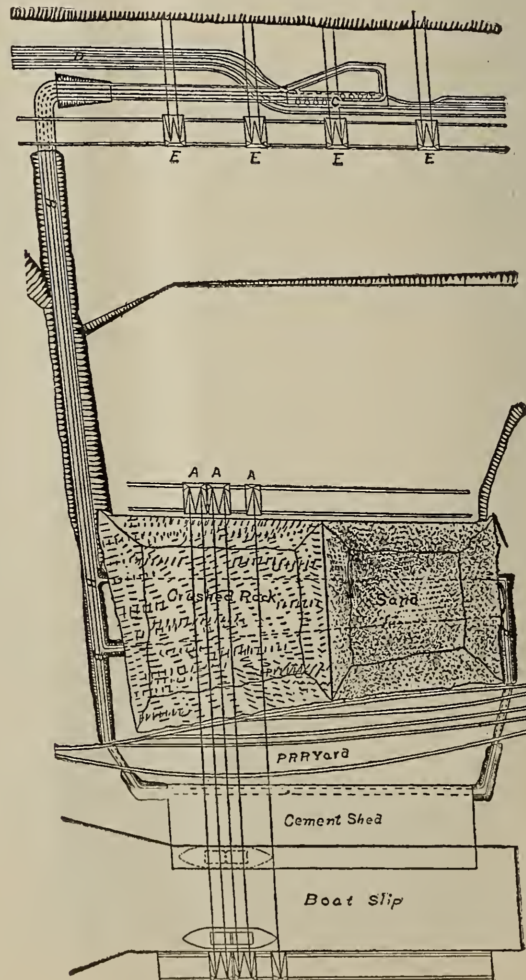


Fig. 6. Plan of Cableways, Storage Yard, Etc.

*From a paper by G. S. Payson before the Western Railroad Club.

the best advantage, exact information should be furnished when an opinion is requested.

Such requests from practical necessity and in accordance with our rules, should be accompanied by duplicate prints of the device involved and a full description. While fairly familiar with mechanical drawings by reason of a technical education and sixteen years' experience in this office, I often find that a drawing, clear to the man who sends it, because he is familiar with the device, is not clear to me because I have never seen the device. Hence the necessity for a description, which should not only include the apparently important points, but the minor points as well. At this day, when nearly a million patents have been issued, one rarely comes out involving a fundamental principle; they are mostly on minor improvements, and therefore the minor details of a device should be particularly described, because more likely to involve infringement and more easily overlooked. The reason for having duplicate prints is that one copy may be kept in my office and the other, duly identified, returned to the road. You thus have at all times an absolute check upon what I have considered and what you intend to use. You can take the blue print reported upon and follow it exactly, knowing that if there be error it is made by me and not by you. Surely there is no need for you to assume unnecessary risk.

These prints in addition to being in duplicate should be exact and full, nothing being omitted from the prints that will be in the device when used, and, just as important, nothing being added to the device when it is used that is not shown in the prints. Some years ago I passed upon a car coupler for oe of our members, advising that it could be safely used. Suit was afterwards begun, but not brought to my notice, resulting in a decision in favor of the patent and against the coupler, and I was asked why I could pass a coupler which a court could hold a plain infringement. Let it be understood that I make no pretension to infallibility; though I do my best it must needs be that errors will creep in. But this particular matter seemed so clear that I failed to understand how I could be wrong until I discovered that the road was not using the device as shown in the print, but had added a feature which in the opinion of its mechanical department was not patentable. Unfortunately it was this feature which was covered by a valid patent and the vendor of the coupler having failed, the railroad paid $7,000 as a result of a *legal* opinion rendered by the *mechanical* department. It was really a suggestion which I made as to opinions given by the wrong department that lead Mr. Nettleton to come to see me. As I view it, the mechanical department can pass upon the construction and efficiency of a device, but should not decide the questions of patents. This is for a lawyer's determination and it seems to me just as inadvisable for a mechanical or other non-legal department to pass upon a legal question as it would be for me to say that a certain locomotive or other device would not be satisfactory in service. You pay your assessment and an opinion costs you nothing additional—therefore why not get an opinion from the Association instead of sending, as frequently happens, some employe to the public library to go through 900,000 patents by main strength to determine a question with reference to which he has had no training.

In spite of the fact that this seems fairly obvious, one of my greatest difficulties arises from the addition by the mechanical departments of features which they think clearly unpatentable. to a device previously passed upon by me, without asking me about such addition. What is the value of a lawyer's opinion if a non-legal department is going to the Court of Appeals to decide what may or may not be added to or taken from the device without asking whether such mechanical alteration may cause me to alter my opinion.

Yet this is most natural. Many patents are issued which to a skillful mechanic seem ridiculous. Many of such patents get sustained and it is therefore unsafe for one not trained in patent law to attempt to say that some modification of a device which can otherwise be safely used may not lead to infringement of a valid patent.

I therefore urge orally, as I have many times in writing, that you co-operate with me to obtain results which, so far as possible, may be accurate. Give me the fullest possible information and I will do my best, but to attempt to give a legal opinion on insufficient information is like attempting to prescribe as a physician for a patient who suppresses symptoms in his judgment unimportant. Nothing is unimportant in sickness—nothing is unimportant in the patent law.

Another point. Failure to properly use the Association has led our members into doing what they are sometimes accused of, namely, copying a patented device. For example, suppose you send me drawings of a steel car and that these drawings are not wholly complete because you omit to send figures showing what seem to you minor points, which "minor points" have been copied from some car which you have seen upon your road. Yet these minor points may be precisely what is covered by a patent, the number of patents in this particular art being enormous; one man gets a patent on a gusset plate, another on a rectangular gusset, still another on one that is hexagonal. Of course, all these patents are not valid; in fact, I think many of the claims on steel car construction are wholly invalid as being for nothing but the substitution of metal in commercial forms for wood in forms equally well known, involving mere metal carpenter work. Just the same, it is the desire of our members not to buy law suits. Where the copying of a device involves litigation, it is safer and also fairer to use something else, however trivial the particular patent may seem. Nothing is more dangerous than copying a patent, relying as a defense upon earlier devices. Suppose this is done and the road is sued and asks me to defend it. The judge is bound to ask me, "Why did you copy this patent?" I reply, "Because it is invalid in view of these old devices." The judge then asks, "Why don't you use the old devicse?" The only answer is that we prefer the patented device. If so, it must be because it is better than the old devices open to any one to use. If by such use we bear the strongest testimony to the utility of the device, we can hardly blame a court for holding the patent valid on account of such utility. I want, however, to say here and now that I have never known in all my experience with the Association of any case where there has been deliberate intentional copying of a patent. There has been actual copying, undoubtedly, but this has generally come through the imitating of some device seen on some other road or on a car belonging to some other road and traveling over your lines, with the honest belief that there was nothing about the device to make it patenable. This may help you a little in the eyes of the court as proving absence of deliberate infringement, but it is an unsafe method of proceeding.

Therefore, when you ask me about any device, ask me about every part of it, leaving it to me to say what is or is not patented.

Assuming the above information to be in my hands, I examine as speedily as possible all patents relating to the particular device. We have some 160 classes of patents relating to the railroad art. These classes are made by taking the Official Gazette, which is published weekly by the United States Patent Office, going through it and ordering copies of the patents belonging in the classes which we take, and which include every device commonly asked about. All of the patents relating to car couplers, for example, are kept in one file. Now if you go to the public library you will find all of the patents there, but they are bound up in numerical order, from the first to the last of all of the nearly one million patents that are now out. To make an examination of any device you have got to go through the indexes, which are not entirely reliable, and pick out all of the patents which you think may relate to the point in question. As showing the unreliability of this method, when the former General Counsel of the Association attempted to get from the Patent Office a complete set of patents on machines for making barb-wire fencing, they overlooked forty-three patents in one year.

An examination takes from a half a day to a week or more, the work being pushed as speedily as possible. Some of my correspondents seem to think that I carry in my head all of the patents that have been issued that we may be interested in, say 400,000. This is flattering, but the statement of the proposition is its own answer.

As an illustration of what has been done, I might say that in examining a steel car I read about 20,000 claims, any one of which may be infringed. If a claim is found to be infringed, the question then arises as to whether it is valid, which involves a still more careful consideration of the patents prior to the one in question. While looking for infringement only, it is generally sufficient to read the claims, but when trying to decide whether a claim is good, I have to examine the drawings in detail and read part or all of the descriptive portion of the patent.

This may explain why all opinions do not reach you in forty-eight hours after I get your request. You get them on the whole with little delay, but occasionally some point of unusual difficulty arises, requiring consideration by the Executive Committee, or some question is asked about a device not included in our classes, which renders necessary a special examination at Washington, thus causing some delay. Also, it may well be that counsel for the parties interested have arguments they wish to submit, in which case I deem it my duty to hear such arguments, that my opinion when given, even though it may be wrong, shall at least not be given in ignorance of everything that can be said.

In requesting opinions, it frequently happens that a member asks whether it can safely use a device made under a certain patent. I wish to particularly call your attention to the fact that this is not the proper form of request. It almost never happens that a device covered by a patent is made exactly like such patent. Something is generally added to or taken from the device as shown in the patent, thereby raising new questions and making necessary prints showing exactly what it is you wish to use.

Too many devices are adopted by our members without first obtaining an opinion from the Association. This is not to be taken as meaning that every time you test a device it is necessary to ask me for an opinion on it. But whenever you decide that a device is worth making standard, or whenever any use of a device will involve considerable expense, you ought to get an opinion before such adoption or use. Remembering that such opinion costs you no more than you are already paying, what possible reason can there be for assuming an unnecessary risk? I think this is almost axiomatic, yet we are continually getting into difficulties through failure to ask me before adopting new constructions. It is not only unsafe, but unnecessary, to adopt this course because it often happens that a device that as first made is an infringement of some patent can—after you are told of the patent, and without impairment of efficiency—be changed, so as to be open to use without infringement, thus avoiding use of patents to which we have no right.

Another point to be remembered is that almost anything may be patented, and therefore whenever you make a device standard it is advisable to at least apply for a patent merely as a species of insurance. Unscrupulous men are continually appropriating the ideas of others and we have several times been put to great trouble and expense in cases where a man has taken out a patent upon a device invented by some one else—some railroad employe for example—and made claim or brought suit against the road using such device. In such case we must prove the theft. This is hard to do and the consequent expense might be avoided if the road made application for a patent at far less cost than that involved in defending a suit. I do not mean that every little thing should be made the subject of a patent application, but wherever it would cause serious annoyance or expense if you were compelled to stop using some device, it is certainly worth while to apply for a patent, if only to prevent some outsider from appropriating your ideas.

So much as to opinions; I now turn to the question of litigation. Suits against our members generally are preceded by claims for settlement, although in some instances we are sued without this. Every such claim should be submitted as soon as possible to the Association if its assistance is desired, and should be accompanied by particularly full information as to what the road has been doing with reference to the matter forming the subject of the claim. I then investigate the questions involved to determine, first, whether the patent is infringed; second, whether it is valid. In matters of particular importance the judgment of the Executive Committee is requested. The member is then advised of our conclusions and the claim is contested or settled in accordance therewith. If suit is brought and the Committee has not previously passed upon the question, it has to do so that it may authorize me to defend the suit. Such defence is not absolutely a matter of right from membership in the Association and the Committee's judgment is asked in each case. I do not know that the assistance of the Association would ever be refused, although it is possible that if a road adopted a device in direct disregard of the Association's opinion that it was not safe to do so, the Committee might consider that in such case the burden of litigation should be borne by the road.

If one of our members is sued, I want to be notified at once if I am to be in the case, that nothing may happen to affect our interests before I take charge. If you have a serious illness the proper step is to call a doctor at once, not to wait until you have but one chance in a hundred for recovery, and the same rule holds good in lawsuits.

After I am in charge of the litigation, I take all steps necessary to protect your interests. For this purpose I have in many years traveled 50,000 miles looking up evidence, examining witnesses, arguing cases. One of the commonest defenses against a patent is that the device said to be covered by it has been in public use in this country for more than two years prior to the date upon which the application for the patent was filed. As prior use has to be proved beyond a reasonable doubt, the utmost care has to be taken to be sure that the witnesses make no mistake either as to the construction of the device or the date when it was used. It is easy for a man to be honestly mistaken on such a point, but the mistake should be discovered before his testimony is taken, not afterwards. For the purpose of discovering such prior uses it is my custom to send circulars to our members as soon as suit is brought, asking them for any information in their possession. This may sometimes cause considerable work on the part of the members, but is performed cheerfully, it being realized that the benefit of one is the benefit of all. An unfounded claim if improperly defended might, in view of the number of roads interested, result in the loss of a large sum of money. A claim against one road may be small, but when you multiply it by a number of roads it becomes large; hence no question is really so small that I can safely take the chance of overlooking any possible defense, no matter what labor may be required to discover and develop it.

We have a Washington correspondent who has been connected with the Association for many years, to whom matters are sent for a report if involved in litigation or otherwise sufficiently important, and whose faithful work in our behalf has greatly assisted me and my predecessor not only in the giving of opinions, but in defending suits.

We are also frequently asked to pass upon questions involved in litigation against outside parties in which we are interested, in which case, of course, we have to take into account the merits of the case and also the standing of the lawyers for both parties and prophesy to the best of my ability what the outcome of the suit will be.

While I do not particularly desire to praise the work of the Association, this paper is in the nature of a report, and it is perhaps only fair to say that while we have won cases involving many millions of dollars, we have, since my connection with the Association, only lost one case, and that a very small one. As to prophecies with reference to litigation not under our control, we have, so far as I now remember, been right in every instance except one. We may not continue to maintain a standard so accurate, but to enable us to reach the highest possible standard of efficiency, there should be the fullest possible co-operation between our members and the Association.

It is a common error to suppose that because a device is patented it cannot infringe any previous patent. Nothing is more erroneous. As an illustration: Thousands of patents have been issued for telephone appliances, but during the existence of the Bell patent none of these could be used, even though patented, without infringing that patent. If one man has a patent on the foundation of a building and a subsequent inventor takes one out on the first story, and one coming still later patents the second story, neither the man who controls the first story, nor he who controls the second, can use his device without using the foundation also, in which case the patent on the foundation would be infringed. In other words, the issuance of a patent by the United States Patent Office is not and does not purport to be a guarantee of any sort that the device covered by such patent does not infringe some other patent granted to an earlier inventor. In this case while the owner of the first patent cannot use the improvement or addition, neither can the later patentee use what is covered by the original patent.

I have spoken about the desirability of listening to counsel for vendors of devices which you may wish to use, and this brings me to the question of the relationship of the Association to the supply men, as to which there seems to be some misapprehension. I have known it to be said that the Association controls prices and that its purpose is to interfere between the railroad that wants to buy and the supply man who wants to sell. Not so. The Association has never, since I have been familiar with its operation, had anything to do with fixing prices, and I cannot conceive of a railroad official paying any attention to what I might say on this point. The only time we are concerned with amounts to be paid is when a question of settlement of some claim arises. In this case I, of course, use by best endeavors to obtain a settlement for the most reasonable price, to which I can see no possible objection.

If by interfering between the supply men and a railroad is meant advising the road, in pursuance to a request for information, that the device in question is an infringement of some patent, there must of necessity be such interference, but if, on the other hand, interference means what I know it has been intended to mean, an improper interference, blocking sales which ought to be made, I deny in a most emphatic manner that there has ever been such intention. How ridiculous it would be. One of our members wishes to buy a device and writes to ask if it can safely do so. What possible reason could I have for saying it could not buy something that it wants to buy, other than that it was my judgment that it would be unsafe to do so. I employed by the railroads, I work with them, and naturally desire that they should buy anything they wish to if they safely can. I mean safely in the sense of infringement.

Where I find infringement I am ready at all times to hear the vendor or his attorney in opposition to my opinion. I have frequently voluntarily offered to supply men an opportunity to present in person or by attorney their views as to their side of the controversy. As a result of such presentation I have sometimes withdrawn opinions already rendered, finding upon the new information given me that my previous opinion was inaccurate. I am more than grateful for any information which supply men can furnish me with reference to questions before me. So far as I have any pride of opinion, it consists in getting my opinions right, and as a first step to getting them right, full information is an essential requisite. It often happens that this cannot be furnished by the road, in which case I am not only willing but anxious to receive it from any available source. I have yet to remember any case in which a supply man or his counsel desired to present views which I have declined to receive.

The relationship between the Association and the supply men has been and is intended to be, so far as I control it, most cordial and friendly. I want you all to feel that you are free to come to my office and as me questions whenever you wish. It may be that I cannot answer, either for want of information or because it would involve a violation of my duty to our members, but no harm is ever done by asking a question, no offense meant and none taken.

It may be that after listening to counsel I am unable to recede from my belief that there is infringement; in other words, it is impossible to always waive my judgment in favor of other counsel, however, eminent. I can then only regret the necessity of interference in sales which would otherwise be made, but this is my duty in a proper case.

I frequently hear that my opinions are considered ultra-conservative. Possibly so. It is my rule never to pass a device that is a bald copy of a patent without an absolutely perfect defense, and this rule has repeatedly received the endorsement of our Executive Committee. It is further my rule that whenever I think a device is an infringement, although not a copy, a defence to the patent must come at least as close to such a patent as does the infringing device. If this be ultra-conservative, I cannot help it. It is the only safe rule, and I have yet to find any lawyer skilled in the patent law who has been willing to say that occupying the same position he would adopt a different course.

If a supply man comes to me and says that I am clearly wrong in my opinion that there is infringement, or that the patent I think infringed is bad, but furnishes me nothing but assertions without satisfactory proof, I cannot see that there is ground for criticism if I say, "Very well, if that is your opinion, back it up. Sell the device to the road, but agree to protect it. If you will not do this you cannot be so confident of your position and there is no reason that occurs to me that we should take the risk, which is great enough even with protection."

One word upon this question of what constitutes full protection. Some time ago it was considered sufficient for a vendor to guarantee the cost of litigation, but upon looking into the matter I decided, with the approval of the Committee, that such a guarantee was of little value. We can defend litigation more cheaply than most, and the expense of such litigation amounts to little compared with that incurred by being forced to take off a device because the courts have held in an infringement. It is my view of a guarantee that if it is to be of any value, it should put the road dealing with the guarantor in the same position after an adverse decision that it would have occupied had it not so dealt. Suppose you spend $100,000 under a guarantee to protect you against litigation. Suit is then brought against you under a patent already litigated and held valid and infringed by the court of last resort. You have no defenses other than those deemed to be insufficient. What possible satisfaction is it to you to know that in the end you have got to come to the patentee's terms or abandon the device. It was thought by some of our roads that a guarantee against the expense of litigation included this item of scrapping an appliance, but in taking it up in a noted case the vendor said, "Go ahead with your suit and we will pay the expense." "Yes," we said, "but will you pay us what we are going to lose when we take off the device?" The answer was, "No," and from that answer dated the bond which we require in every instance where a bond is called for, and which protects us not only against the cost of suit, but also against the expense incurred by having to stop using the particular device.

We do not in all cases insist upon protection in the form of a bond. It is sometimes sufficient to merely insert in the contract of purchase a clause guaranteeing the purchaser in the proper manner, in accordance with our rules. I have once or twice even taken a letter from a vendor and in one instance at least have taken a bond to the Association for the benefit of all our members. Which one of these various forms of protection is to be adopted necessarily depends upon the facts in each case. Among such facts which are influential, if not controlling, are the amount involved, the question whether there is actual or merely threatened litigation, and the financial standing of the guarantor. This latter point may be affected by the number of bonds which such guarantor has had to issue. It may readily be that while a manufacturing concern can give two or three bonds, it might not be able to stand behind fifty, so that the conditions might change with time from what they were when the matter first arose. That is, while we might be content with the bond of the vendor in the first instance, it might be necessary to insist upon a surety company's bond later on.

There is one thing the Association does not do, and that is to solicit patents, for the reason that a patent obtained for the benefit of one member might well work injury to all the others. Moreover, if I were to attend to taking out a patent for one of our members, it might well be that later on I would be asked to defend suit brought under it against another member. This would put me in a sense upon both sides of the case, which would hardly do.

The Association is intended to give its members the best results possible, and if any one at any time thinks of something which would increase the usefulness of the Association, I shall be glad to receive suggestions. We used to send out annual lists of expired patents on railroad appliances, but at the suggestion of Mr. Clark, of the "Burlington," these are now sent monthly instead of yearly, to the satisfaction of our members, as expressed in many letters. Anything else I can do to bring the work of the Association home to you, or to increase its utility, I shall be glad to do.

I want the Association to be of use to its members, but at the same time in no way a stumbling block to the supply trade, and if I have made either of these points clear to-day, this paper has not been read in vain.

After the above paper was read, several valuable suggestions were made, of which I wish to particularly notice the difficulty to which Mr. Manchester called attention—namely, that he was often advised that a patent was infringed and that while it did not seem to amount to much, there was a risk. He then noticed that manufacturers not licensed under the patent nevertheless went ahead and took the risk involved in manufacturing the patented article. The obvious conclusion which he drew, though it was not so stated, was that if the manufacturer could take the risk, so could the railroad. This is not quite so. The manufacturer expects to make a direct money profit out of his sales. The railroad does not. Again the manufacturer may be willing to stand a law suit; the railroads do not want them. They have troubles enough without getting into patent litigation.

I might further suggest that if the infringement is perfectly plain and I am unable to find a satisfactory defence against the patent, it would be wholly improper for me to advise a railroad that there was no risk involved because this would not be true. There is always a risk in such cases. A lawyer has to point out the risk and it must then be left to his client, whether a railroad or manufacturer, to say whether such risk will be taken.

The board of directors of the Kansas City Terminal Railway Co. has approved the plans prepared by Jarvis Hunt, of Chicago, for the new union passenger station at Kansas City. The action of the directors must yet be ratified by the stockholders of the several railways. The ordinance requires the construction of a station to cost $2,800,000, but it is stated that it has been decided to build a station to cost $5,750,000. It will be located near the corner of Main and Twenty-third streets. The frontage will be 512 ft. and the train sheds 1,400 ft. long. The exterior will be of stone, concrete and steel. The general lobby will be 350 ft. long and 160 ft. wide, and the ceiling will be 115 ft. high. There will be three levels, the level of the station proper; the train service level, which will be reached by elevators, and below this still the baggage, express and postal rooms.

Gas Producer Tests

The United States Geological Survey, through its technologic branch has recently issued a bulletin entitled "Incidental Problems in Gas-Producer Tests," by R. H. Fernald, C. D. Smith, J. K. Clement and H. A. Crine. The Survey is studying the general problems involved in the economic use of fuels in gas producers as part of its investigation of methods of increasing the efficiency of the fuel resources of the country. The bulletin declares that one of the important problems is the determination, under practically constant conditions, of the duration of gas producer tests necessary to reduce the possible error to a minimum. A greater part of the bulletin is therefore taken up with a discussion of the proper length of test period. Mr. Fernald, the consulting engineer in charge of these tests, has the following to say on this subject:

"Some of the test results reported by certain gas producer manufacturers are so absurd that no careful purchaser will be deceived; but, unfortunately the alluring guaranties and special inducements regarding the cost of the installation have caught enough unwary buyers to injure seriously the business of reputable concerns. It is not uncommon to pick up advertising material that states a fuel consumption per horse power per hour based on tests of two or three hours' duration only, in which the total coal charged during that period was from 20 to 30 pounds. The producers in such tests are of course of small sizes, but the principle is the same for all.

"The initial fuel bed built up before the test is started amounts to several times the quantity of fuel charged during short interval tests, and the amount of gas that may be drawn from this foundation bed is an unknown quantity. It may be very small or may reach a large percentage of the total gas used during short tests, depending on the carelessness or cleverness of the superintendent of the test. Of course the claim is made that at the end of the test the fuel bed is always brought to the same condition that it was in the beginning, but experience in this direction need not be great to show that such conditions are practically impossible in tests of short duration. The error introduced by such an assumption may be sufficiently great to make the record results absurd. In fact, the percentage of possible error, may be so large that it is only necessary to predetermine the desired fuel consumption per horse power per hour and trust to the clever manipulation of the operator to secure that result. It is no wonder then that tests showing a consumption of only 0.6 pound of coal per horse power per hour are often reported; and apparently it is only necessary for some daring promoter to decide that a horse power should be developed with a consumption of 0.25 pound per hour for tests to be reported that show this figure.

"For accurate tests of gas producers and for a true determination of the fuel consumption, either the conditions of the fuel bed at the beginning and at the end of the test must be positively known, or the test must be of sufficient duration to practically eliminate the uncertainties that arise from varying conditions of the bed. Inasmuch as the first method is usually out of the question, it is necessary to resort to the second, at the same time securing as uniform conditions as possible in the fuel bed."

Mr. Fernald summarizes the tests as follows:

"That throughout a test the fuel bed should be maintained in uniform condition, with regard to both the character of the fire and the thickness of bed; but that failing in this, special care should be exercised to see that the fuel bed is in the same condition and of the same thickness at the close of a complete test, or at the end of a test period, as at the beginning; that a test should never be started when the producer has been standing idle for some time with 'banked' fires, as the fuel bed will not be in the average condition under which it will be required to work during the test; that, if, as the appointed hour for closing the test approaches, the fuel bed is not in proper condition, the time of closing the test should be postponed until the bed naturally assumes the proper thickness and character. No forcing of conditions should be allowed simply to bring the test to an end at a previously determined hour."

Government Transfers Work of Forest Products Investigation.

Preparations have been completed for the transfer of all the government's forest products work to Madison, Wis., where the United States Forest Service products laboratory will be located, and to Chicago, where the headquarters of the office of Wood Utilization will be established. The new forest products laboratory being erected at Madison by the University of Wisconsin, which will co-operate with the government in its forest products work and which is to cost approximately $50,000, is now in the course of construction. The laboratory will be a fire-proof building of brick, trimmed with white stone and is located near the Chicago, Milwaukee & St. Paul Railroad, with exclusive tracks and other railroad facilities. The building is expected to be ready for occupancy about January 1. In the meanwhile temporary offices will be located at 1610 Adams street, Madison. On October 1 the Yale timber testing laboratory was discontinued and the Forest Service equipment there was shipped to Madison. The laboratory here at Washington was discontinued at the same time. The timber testing laboratory at Purdue, Ind., will be operated until the middle of December, when it will be discontinued and its equipment shipped to Madison. The offices having general supervision over all the work of the branch of products will remain temporarily at Washington.

New Literature

PROCEEDINGS OF THE 16TH ANNUAL CONVENTION OF THE AIR-BRAKE ASSOCIATION. 400 pages, flexible leather; 6 by 8½.

Among the bound volumes of annual proceedings of the railroad associations, that of the Air-Brake Association is one of the most interesting and instructive. Although most of the papers contained in the book are familiar to railroad men, the discussions, which are equally valuable, are not obtainable in any other form. The book is printed on an excellent quality of paper and is elaborately illustrated.

* * *

UNIVERSAL DIRECTORY OF RAILROAD OFFICIALS FOR 1909. 650 pages, cloth, 5¼ by 8¼; published by the Directory Publishing Co., 3 Ludgate Circus Bldgs., London. Price, $4.00.

This book hardly needs an introduction, as it is now in its fifteenth year. All the steam railroads in the world are listed, as is practically every tramway operated by power in the United Kingdom. The length of each road immediately follows its name, and its gauge is given in feet and inches or in meters. The equipment and the names and addresses of the officials are valuable features of the book. A personal index or finding list containing the names of all of the officials, arranged alphabetically, is of great assistance. The scope of the work is such that it cannot, of course, be absolutely correct, but it is completely revised each year.

* * *

RAILWAY SIGNALING IN THEORY AND PRACTICE. By James B. Latimer, signal engineer, Chicago, Burlington & Quincy R. R. 420 pages, cloth, 5 by 7¾; published by the Mackenzie-Klink Publishing Co., Chicago.

In this work the author has treated the subject of railway signaling in an elementary manner in such a way that the reader who has some knowledge of train operation can gain a fair insight into the complexities of present day signaling. The subject is one which has advanced faster than have the treatises and heretofore the man who contemplated starting in the career of signal engineer, has had difficulty in obtaining comprehensive and elementary text-books. As such, this book fills a long-felt need. Block signals and interlocking plants are, of course, given considerable attention. A feature is the chapter on conventionalities in design. The book is well illustrated with drawings and photographic reproductions.

* * *

GENERAL LECTURES ON ELECTRICAL ENGINEERING. By Chas. P. Steinmetz, 284 pages, cloth, 6 by 9; published by Robson & Adee, Schenectady, N. Y.

A book consisting of a series of seventeen lectures on the subject of electrical engineering. The author, who is a consulting engineer for the General Electric Co. and professor of electrical engineering in Union University, treated the subject in a descriptive rather than mathematical manner. The lectures deal with the problems of generation, control, transmission, distribution and utilization of electrical energy and with the design apparatus and systems. The book is diagrammatically illustrated and should be extremely useful as a work of reference. It is now in its third edition.

* * *

ELEMENTS OF TRANSPORTATION. By Emory R. Johnson. 360 pages, cloth, 5 by 7½; published by D. Appleton & Co., New York.

The author of this work is a well-known figure in transportation circles. Professor of transportation at the University of Pennsylvania and recently a member of the Panama Canal Commission, he is also the author of "American Railway Transportation" and of "Ocean and Inland Water Transportation." This work is essentially a history of transportation as well as a treatise on present day methods. It is divided into four parts, covering steam railways, electric railways, ocean vessels and inland waterways. As interesting as a good novel, it is at the same time instructive and valuable for reference.

* * *

COMPRESSED AIR. By Lucius I. Wightman; 168 pages, cloth, 6½ by 9½; published by the American School of Correspondence, Chicago.

The author has produced a work of direct interest to the practical worker in compressed air, at the same time including enough theory to assist the student in getting at principals. He recognizes three general divisions of the subject, which are classified as follows: Production, transmission, and application. In the first element of the compressed air system, which consists of the compressor, the primal power is converted into the energy of compressed. Under "Transmission," methods of con-

New Pit Jack.

veying this energy to the point of application are discussed. In the third division, methods of applying the energy by means of different mechanical devices are explained. A few necessary definitions and formula derivations are included and theoretical and practical results are compared. Tables of weights, volumes, temperatures, heat transfers, work, etc., are included as necessary and convenient forms of concrete information. The book is well illustrated with halftones, line drawings and diagrams. As a book of reference this work should be of great assistance to every engineer, and as a means for study it should be very useful to the practical worker.

* * *

CARBURETTORS, VAPORIZERS AND DISTRIBUTING VALVES. By Edward Butler; 176 pages, cloth, 5¼ by 8½; published by Charles Griffin & Co., London, England. Price 6s. net.

The author has treated exhaustively the subject of supplying liquid fuel to the cylinders of internal combustion engines. The designs peculiar to each class of engine is considered with great care. It is due to the perfection of these details that the internal combustion engine is rapidly being brought to the forward rank among prime movers, and it is the knowledge of these details on the part of the practical man which renders possible their efficient operation. The book is divided into twelve chapters, each treating of one of the general types of carburettors, valves and operating gear. Chapter I, however, includes a general study of the fuels and their application. It gives a short history of engine design. The book is well indexed, making it of great value as a reference book. It is illustrated with upwards of one hundred sectional drawings.

* * *

The Wisconsin Engine Co., of Corliss, Wis., has issued bulletin C-4, which is to be the first of a series of similar bulletins. Some interesting reading matter is given concerning the Corliss engine in general and of the heavy duty belted type manufactured by this company, in particular. The cover is blue on a heavy stock and is arranged to accommodate future bulletins. An unique feature of the cover consists of three white squares on the backbone to admit of private filing marks. The whole forms a very interesting, artistic and valuable publication and is well worthy the attention of anyone interested.

* * *

"A little oil fed accurately is more effective and adds more years of life to your hammer than a bucketful fed by guess." So says the Madison-Kipp Lubricator Co., of Madison, Wis., in a booklet dealing with Madison-Kipp oil pumps for steam hammers.

* * *

The Hayes Track Appliance Co. of Geneva, N. Y., has issued a leaflet of views of Hayes derails in use in the vicinity of Chicago.

* * *

Circular No. 1181 by the Westinghouse Electric & Mfg. Co., of Pittsburg, Pa., deals with portable direct current ammeters and voltmeters.

* * *

The Scully Steel & Iron Co., of Chicago, has issued a 96 page stock list for November.

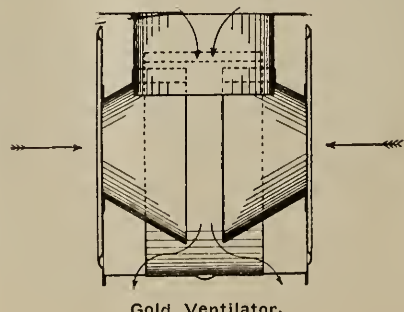
New Size Hydro-Pneumatic Pit Jack

The almost universal tendency to equip round-houses and locomotive repair shops with air pressure pipe lines was recognized several years ago by the Watson-Stillman Co. of New York, when it introduced a new design of 15 and 30-ton pit jacks in which air pressure was utilized. The favor with which this new operating principle was received, has caused this company to bring out a larger size of the hydro-pneumatic pit jack to meet the increasing weight of modern rolling stock. The capacity of the new size is 45 tons. The one illustrated, which was built for the St. Louis South western R. R. runs on a 24-inch track, has a 4¾-inch ram with 54-inch stroke, has a clearance of 5⅝ inches from the rail to bottom of saddle, has a height of 2 feet 10 inches from the rail to top of saddle when down, and extends down into the pit 3 feet 7⅜ inches from the top of the rail. The hydro-pneumatic operating system gives this jack the quick movement of a pneumatic tool in moving the ram up to its work and thus effects a considerable time saving. After the jack has been placed in position, air pressure from the shop system is admitted on top of the liquid in the cistern, thus forcing the water rapidly through the pump until the ram comes to a bearing under the load. A few strokes of the hydraulic pump will then raise the wheels sufficiently to remove the sections of track. The saddle is lowered in the usual way by the valve stem key.

An Efficient Car-Ventilator

The ventilation of passenger cars is so intimately connected with the question of heating that it is only natural and logical that the more progressive car heating companies should be prepared to furnish ventilators to act in conjunction with the heating apparatus, and in this connection, the new ventilator recently brought out by the Gold Car Heating & Lighting Company is of particular interest. The unsatisfactory method of ventilating passenger cars has long been a matter of comment, but many ventilators are on the market which are really very unsuited for the purposes for which they are recommended.

The new "Cyclone" ventilator, manufactured by the Gold Car

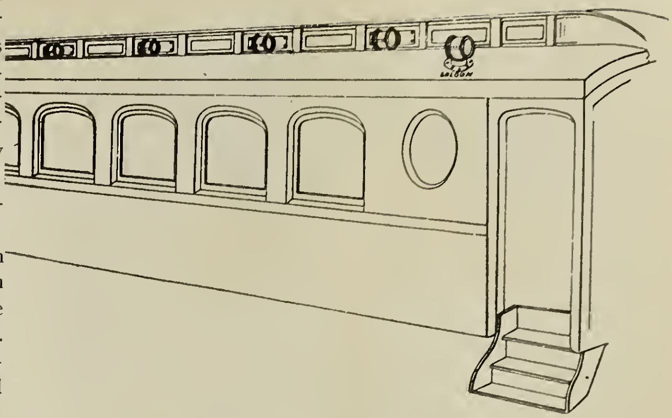


Gold Ventilator.

Heating & Lighting Company, is quite an advance on most of the types of ventilators heretofore in use, and its capacity for educting air seems to be much greater than any of the others which are on the market. The general appearance of the ventilator is illustrated by the drawing, the opening into the car being 5 in. in diameter. the outside diameter of the ventilator 10¼ in., while the thickness is about 7½ in. It is made of heavy galvanized iron, thoroughly riveted together so as to stand comparatively rough usage, to which all railway equipment is subjected.

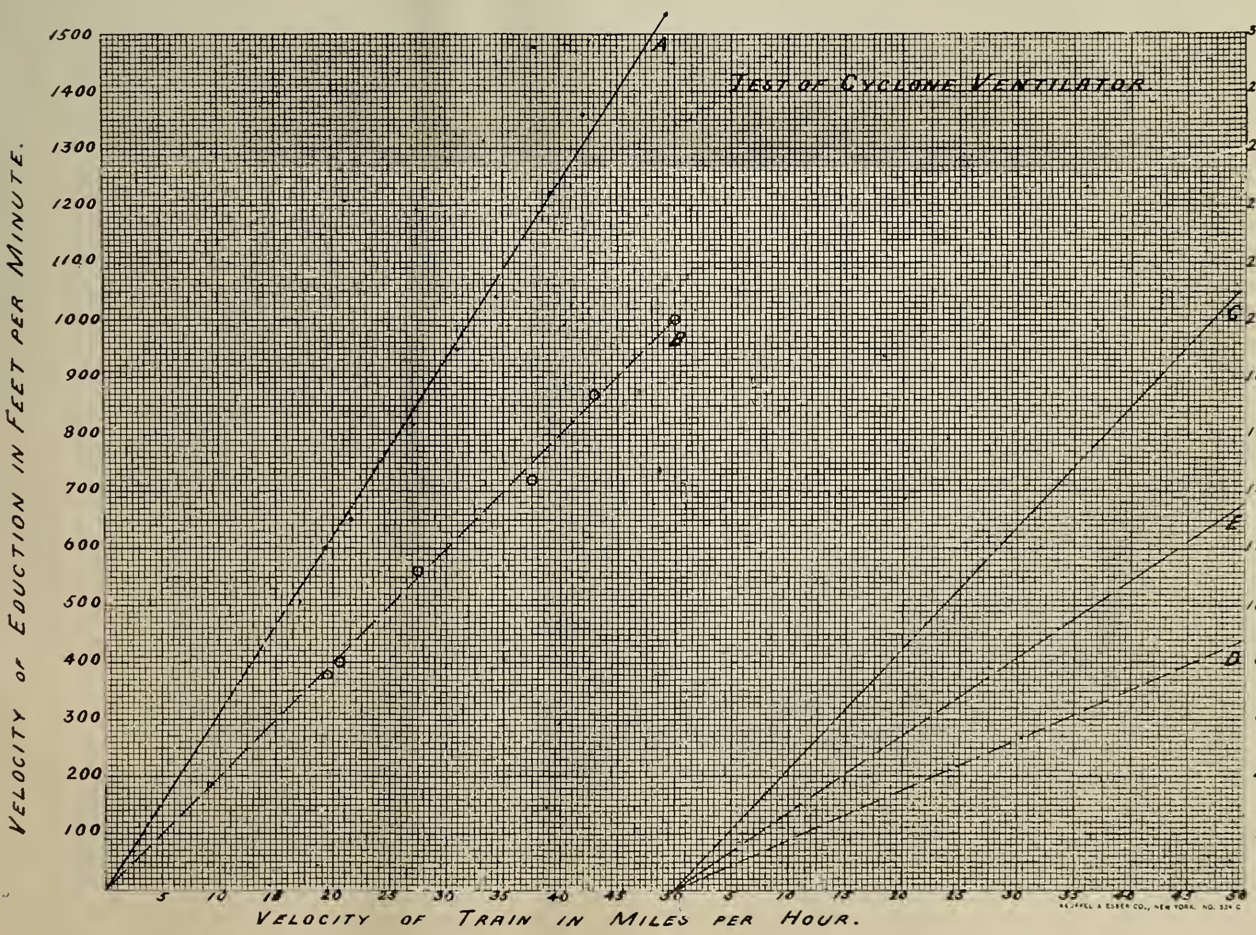
In order to test the efficiency of the ventilator, tests have been made similar to those conducted by the M. C. B. committee in 1894, the effect of a moving train was produced by testing the ventilator in front of a "Sirocco" blower with a 16-in. outlet. Various speeds, up to 50 miles per hour, were obtained by changing the speed of the blower. The air velocity was determined by using a tangible draft guage.

In the diagram, line A shows the velocity of eduction for the various blasts, regulated to correspond with different train speeds in miles per hour. In making these tests the ventilator was secured to the side of a box in a similar manner to its location on the side deck of a passenger car, as shown in the sketch representing the method of placing these ventilators on railroad cars. An anemometer was placed immediately inside of the opening and the velocity of eduction was measured by this anemometer. The dots along the line A show the actual results of the various tests, and the line drawn gives about a mean position for this group of points. In a general way, it shows that at a speed of 49 miles per hour, the velocity of eduction was 1,530 feet, and at 30 miles per hour the air was pulled out of the box through the ventilator at a speed of 930 ft. a minute. As line A is straight, the velocity of suction, by means of ventilator, is evidently directly proportional to the velocities of the train.



Ventilator Applied to Passenger Car.

In order to obtain some comparison between the "Cyclone" and those that were tested in 1894, by the M. C. B. Committee, one of the type of ventilators giving the best results in that test was submitted to the same treatment as the "Cyclone" ventilator. The results are shown by the line B, the open circles giving the points taken from the actual tests. From these two diagrams it is evident that the velocity of eduction through the ventilator, with which comparison was made, was not quite two-thirds that of the "Cyclone" ventilator, and while the "Cyclone" ventilator was 5 in. in diameter at the neck connecting to the deck of the car, the ventilator against which it was tested was only 4 in. in diameter, and in determining the volume of eduction we have considered that if a 5 in. size had been available, the velocities would have been the same and the quantity of air removed would



be in direct proportion to the areas of the necks of the two ventilators.

At the right hand side of the diagram are several lines, showing the volume in cubic feet per minute of air educted, the line C corresponding to the 5-in. "Cyclone" ventilator under test, and from which it is evident that at 49½ miles per hour (which was the speed at which the M. C. B. Committee tests were made, there were 210 cubic feet of air educted from the interior of the box or car per minute. With the 4 in. ventilator, with which this was compared, there were 87 cu. ft. per minute educted at 49½ miles per hour, as shown by the line D. If, however, we increase this value by the ratio of a 5-in. circle to a 4-in. circle, we have the results shown by the line E, in which it is evident that the volume of eduction would be 137 cu. ft. per minute, at 49½ miles per hour. It is evident, therefore, that the "Cyclone" ventilator has a capacity of fully 50 per cent in excess of the ventilator against which it was tested, and as stated before, which represented one of those giving the best results in the M. C. B. Committee tests. These tests gave 90 ft. per minute as the greatest volume of air removed from the interior of a car with a ventilator, at 49½ miles per hour, so the relative value of the "Cyclone" ventilator is evidenced from a comparison of these figures.

In connection with the heating and ventilation of passenger cars it was determined by one of the largest railroads in the country that an allowance of 1,000 cu. ft. of air per passenger per hour would be sufficient for satisfactory ventilation, and the removal of carbonic acid and other noxious gases. If we consider that the express train averages 40 miles an hour speed, we find that the capacity of the "Cyclone" ventilator is 170 cu. ft. per minute, or 10,200 cu. ft. per hour. In the case of a local and suburban train, while the average speed is much less, the frequent opening of doors for the admission and distribution of passengers admits a large amount of air, and generally much more than needed for actual ventilation. On express trains the doors are open less frequently, and entire dependence must be placed upon the ventilators. Thus, it is evident that one ventilator would be sufficient for ten passengers under the assumptions above made, or that a car seating 80 passengers would only require 8 ventilators to keep the atmosphere in the cars in a comfortable and healthful condition.

The sketch shows that it is possible to place many more ventilators in the deck of a passenger car than would be absolutely necessary, and it also shows that these ventilators can be placed on a horizontal roof surface, for instance, the ceiling of the salon, as well as on the vertical surface of the sides of the deck, and in either case the efficiency of the ventilator, as an exhauster of air within the car, will be dependent upon the speed of the train, as shown on the diagram.

Under these conditions, there will be no difficulty in maintaining the interior of a car entirely comfortable and free from unpleasant odors or obnoxious gases, as the capacity of the ventilator is so great that there would be no difficulty in removing these from the car and keeping the air pure and healthy.

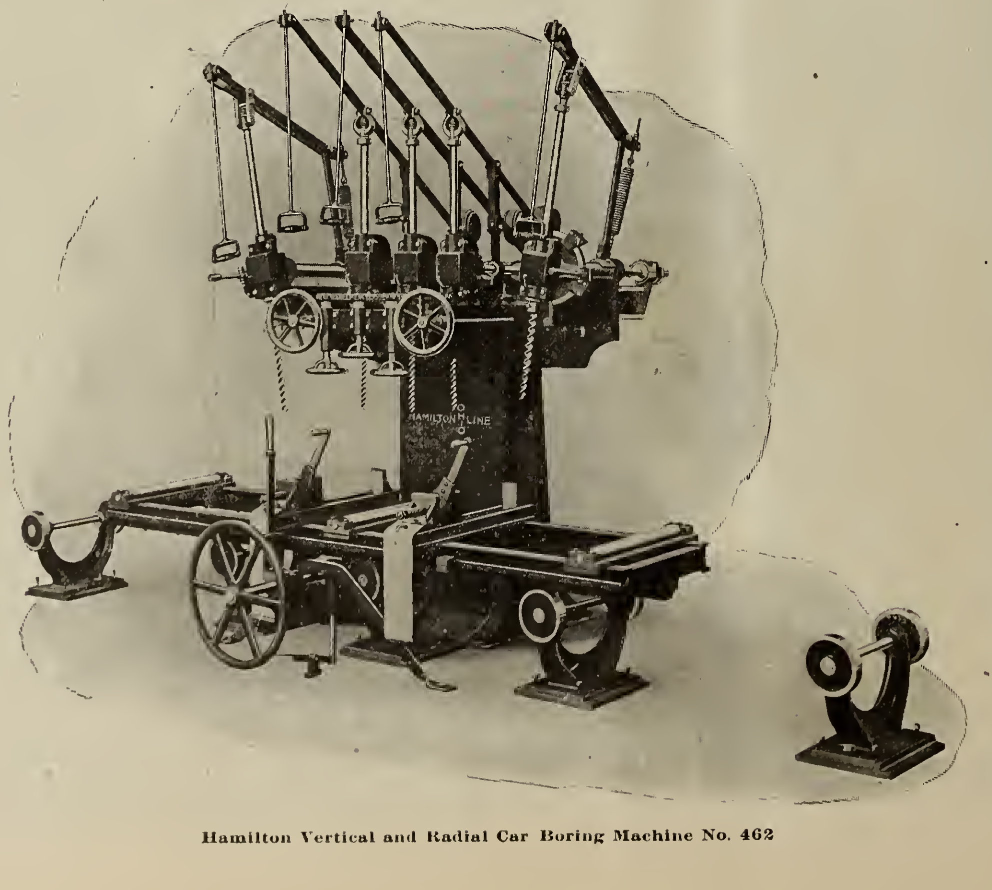
This ventilator is also adaptable to refrigerator cars, and when so used gives the excellent ventilation so necessary for the preservation of fruits and vegetables.

Vertical Car Boring Machine

The illustration shows a machine equipped with five spindles for boring heavy timbers in car shops. The number of spindles, however, can be varied to suit individual requirements.

The spindles, mounted in heavy housings, slide on the frame in improved dovetail slides. They have 20-inch stroke and transverse adjustment of 22 inches by hand wheel and pinion, and chain feed. The radial spindles can be set to any angle up to about 30 degrees in either direction, right or left.

The traveling table is built of steel "I" beams bolted and riveted together and provided with roller bearings and quick-acting eccentric clamps. The table top is 27 inches wide,



Hamilton Vertical and Radial Car Boring Machine No. 462

inclusive of clamps, taking material 20 inches x 16 inches. This size can, however, be varied to suit requirements. This table is furnished in any length from 10 feet up to 40 feet long, and fitted with the required number of clamps for holding material properly. It is 24 inches in height and travels on roller bearings 8 inches in diameter mounted in housings on bed plates, so they can be adjusted to exact line and level.

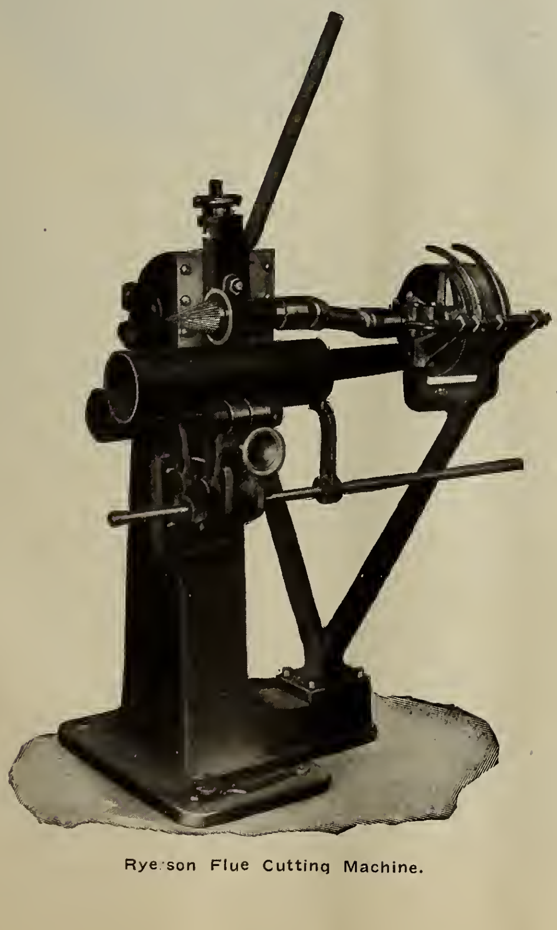
Both hand and power feed are provided for the table, the power feed being transmitted through a friction clutch operating on the rack and pinion, and the hand feed through a large pilot wheel operating on the same rack and pinion.

The machine is manufactured by the Bentel & Margedant Co. of Hamilton, Ohio.

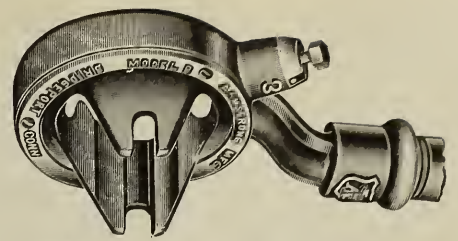
Ryerson Flue-Cutting Machine

There has long been a call for a good substantial machine for cutting pipe or tubes, of sufficient capacity to handle the general range of work, designed in such a way so as to occupy a small amount of floor space and simple enough in its operation to permit of its being run by unskilled help. After years of experimenting along this line, Joseph T. Ryerson & Son, Chicago, have placed on the market the machine shown in the accompanying illustration. It is now in use in a number of railroad shops, and is giving satisfaction.

The Ryerson flue cutting machine is practically noiseless in operation, and has a capacity for cutting tubes or pipes from ⅜" to 6" in diameter. It is arranged so that the work may be cut off any desired length and is very rapid in its operation. The cutter wheel is direct connected by means of a knuckle joint shaft to a 12 in. x 3 in. pulley which should travel about 200 R. P. M. The object of the knuckle joint drive is to permit the tubes or pipes to be run out



Ryerson Flue Cutting Machine.



Ratchet Attachment for Pipe Cutting.

back of the machine so that they may be cut to any desired length. The feed of the cutter is accomplished by means of the hand lever shown; balance weight being provided to secure an automatic release. The lever is so balanced that it requires but very little pull upon it to cut tubes of any size. The rollers on which the tubes revolve are arranged so they can be brought close together or spread apart quickly to the proper distance for taking care of the various sizes of tubes or pipe.

For reaming out the slight burr from the inside of the tube, which is sometimes caused by the cutting wheel, a fluted reamer is provided and attached to the end of the shaft as shown in the cut. This reamer will ream tubes up to and including 3 inches in diameter. A larger reamer for tubes of greater diameter can be furnished and attached to opposite end of the shaft just outside of the end bearing box. Each machine is furnished complete with one cutter wheel 4½ inches diameter, and a fluted reamer for handling tubes up to 3 inches in diameter, and all necessary wrenches. It weighs approximately 825 lbs.

Ratchet Attachment for Pipe Cutting

The Armstrong Mfg. Co., Bridgeport, Conn., has recently placed on the market a new ratchet attachment for use in connection with the Armstrong stock in cutting pipe. This attachment is made to fit stocks No. 2, 2½ and 3, and will soon be made in the No. 1, 6 and 7 sizes.

The Selling Side

Kearney & Trecker, West Allis, Wis., manufacturers of machine tools and milling machinery, have begun work on an addition to the main plant, which will cost about $35,000. The new building is to be 170 ft. x 160 ft. and is expected to be completed by spring.

The John A. Roebling's Sons Co., Trenton, N. J., has ordered from Tate, Jones & Co., Inc., Pittsburg, Pa., the entire oil-burning equipment for six 30-ton open-hearth steel melting furnaces. The company has also received orders for equipment for one open-hearth furnace for the Lobdell Car Wheel Works at Wilmington, Del., and the equipment for one open-hearth furnace for the Londonderry, N. S., plant of the Canada Iron Corporation.

Three McKeen motor cars, coupled together, left the McKeen Motor Car Company's works in Omaha, Neb., on November 2, propelled by their own power, en route to Portland, Ore. One car is of the 70-ft. type and is for the Salem, Falls City & Western, which will put it in service out of Salem. The other two cars have been bought by the Oregon & California and the Oregon Railroad & Navigation, and will be used in Oregon and Washington. To date, 57 McKeen motor cars have been built. Fifty-six are operating in the United States and one in Mexico.

The executive committee has decided to hold the Master Mechanics' and Master Car Builders' conventions on the Million Dollar Pier, at Atlantic City, June 15-22, 1910. The Master Car Builders' convention will be first and will begin on

Wednesday, and the Master Mechanics' on Monday. The plan to bring both into one week did not carry. Headquarters will be at the Marlboro-Blenheim hotel. The permanent secretary of the Supply Men's Association is J. D. Conway, late chief clerk to the superintendent of motive power, Pittsburg & Lake Erie R. R. His address will remain in the city of Chicago, as heretofore. The exhibits committee consists of B. E. D. Stafford, S. P. Bush and C. D. Storrs. The total space available for exhibits this year will be 69,000 square feet, an increase of 11,000 square feet over last year. The space charge will be forty cents per square foot.

The Illinois Steel Co. will build an addition to its warehouse at the North Chicago plant. The new building will be 250 ft. wide and 400 ft. long. New equipment will include nine 10-ton traveling cranes and a number of cutting tools.

The Long & Allstatter Co., Hamilton, advises that it will begin work at once on an addition to its plant. The increase in size of the plant is necessitated by the large number of orders for heavy machinery.

Jason Paige, contracting engineer for the American Bridge Co., New York, has resigned to take a similar position with the Lackawanna Bridge Co., Lackawanna, N. Y.

The Davies Supply Co., Chicago, dealer in steam fitting supplies, is having plans prepared for a building on Ontario street. The site has been leased for fifteen years.

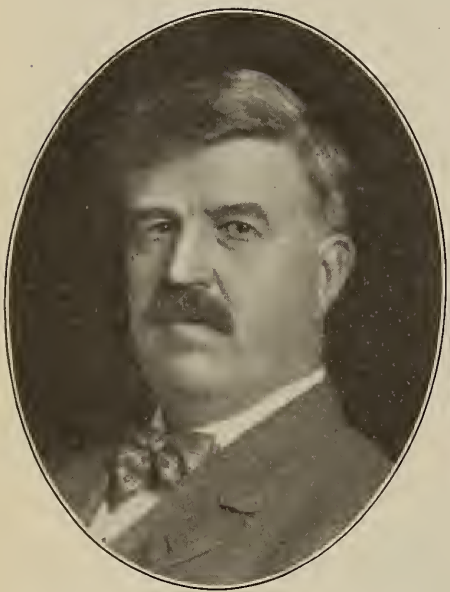
George F. McKay, formerly traffic manager of the Lackawanna Steel Co., New York, has resigned and since Nov. 1 has been connected with Hazard, Mudge & Co., Buffalo, N. Y., with headquarters in New York.

The American Car & Foundry Co. plans to build an addition to its Detroit plant. The building will be one story high, 60 ft. wide and 1,000 ft. long, and will be of brick and concrete.

Dalton Risley, manager of the railroad sales department of the National Refining Company, Cleveland, Ohio, who has been making a special study of "Long Time Burner Oil" for switch lights, semaphores, etc., has recently evolved, by special process, an oil which fulfills the conditions while eliminating the objectionable features heretofore existing. Mr. Risley, "the man who made the National famous in the railroad field," has had twenty years' experience in the oil business, five years of which has been in the application of the work to the railroad field. He has had wide experience in general shop practice and is the patentee of a number of useful devices of railroad mechanical application.

Personals

H. U. Mudge, second vice president of the Chicago, Rock Island & Pacific has been elected president of that road. He succeeds B. L. Winchell who goes to the St. Louis & San Francisco as its president. Mr. Mudge was born in 1856 in Minden, Mich., and received his education from the schools in that place. He was early thrown upon his own resources and began his railway career as a water boy on the tracks of the Santa Fe in 1872. Then he became a telegraph operator, then brakeman, conductor, train dispatcher and roadmaster. In 1889 he was made superintendent of the Rio Grande division. Then he became superintendent of the Western division with headquarters at Pueblo, Colo. Successively he was general superintendent of the Eastern division, general superintendent of the entire system and then general manager. In 1905 he left the Santa Fe and was elected second vice president of the Rock Island.



H. U. Mudge.

B. L. Winchell.

Dalton Risley.

C. M. Newman has been appointed a general foreman on the Atlantic Coast line, with office at Charleston, S. C.

W. A. Reel has been appointed a general foreman of the locomotive department on the Baltimore & Ohio at Sandusky, Ohio.

S. A. Whitehurst succeeds W. H. Stubb as a master mechanic of the Central of Georgia. His office is at Savannah, Ga.

G. W. Freeney succeeds R. Ellzey as a general foreman of the Central of Georgia at Atlanta, Ga.

Jacob Haight has been appointed the master mechanic of the Central R. R. of Oregon, with office at Union, Ore.

E. E. Cunningham succeeds G. E. Bruns as a road foreman of engines on the Chicago, Burlington & Quincy at Hannibal, Mo.

G. E. Johnson, a master mechanic of the Chicago, Burlington & Quincy, has been promoted to general master mechanic of the Lines West of the Missouri River.

C. M. Bailey succeeds G. E. Johnson as a master mechanic of the Chicago, Burlington & Quincy at Wymore, Neb.

H. S. C. MacMillan has been appointed assistant master mechanic of the Chicago, Milwaukee & St. Paul, at Minneapolis, Minn.

C. A. Beebe has been appointed a road foreman of engines on the Chicago, Milwaukee & St. Paul, at Mitchell, S. D.

W. Ivens has been appointed a road foreman of engines on the Chicago, Milwaukee & St. Paul, with office at Milwaukee.

P. H. Kiley has been appointed a road foreman of engines of the Chicago, Milwaukee & St. Paul, with headquarters at Savannah, Ill.

E. Nolan has been appointed the master mechanic of the Chicago, Peoria & St. Louis, with office at Jacksonville, Ill.

H. H. Hale has been appointed the master mechanic of the Cincinnati, Hamilton & Dayton, with office at Lima, Ohio.

W. E. Salber succeeds G. W. Waite as electrical engineer of the Cleveland, Painesville & Eastern with office at Willoughby, Ohio.

M. J. Powers has been appointed a master mechanic on the Denver & Rio Grande, at Denver, Colo.

W. L. Miller.

P. H. Peck.

R. M. Van Arsdale.

F. D. Mahoney has been appointed a master mechanic of the Denver & Rio Grande, at Grand Jct., Colo.

J. H. Farmer has been appointed a master mechanic of the Denver & Rio Grande, at Alamosa, Colo.

H. C. Patterson has been appointed the electrical and mechanical engineer of the Illinois Traction Co., with office at Decatur, Ill.

F. B. Hartman has been appointed the general equipment inspector of the Southern, with office at Washington, D. C.

F. Galvin succeeds W. S. Cox as the master mechanic of the Texas & New Orleans with office at Houston, Tex.

To Die No More

Robert M. Van Arsdale, proprietor of the American Engineer and Railroad Journal, died very suddenly of apoplexy at his home, 276 W. 71st street, New York City, on the evening of November 23d. He was born in Titusville, Mercer Co., New Jersey, on July 1, 1848. Mr. Van Arsdale was connected with trade journalism from his twenty-fifth year, when he became connected with a commercial paper in Chicago. In 1875 he joined the staff of an eastern railway paper as an advertising solicitor. He remained in this position for about six years, and on January 1, 1880, purchased the National Car Builder, which was then being published in New York by Vose, Dinsmore & Co. and James Gillet was retained as the editor. In January, 1896, Mr. Van Arsdale purchased the American Engineer and Railroad Journal from M. N. Forney, who remained as the editor for one year, the two papers then being combined under the name of the American Engineer, Car Builder and Railroad Journal. Two years later the name was changed to its present title, and has been greatly enlarged and most successfully conducted by him. Mr. Van Arsdale's success as a publisher was largely due to his extensive acquaintance and numerous friendships; but perhaps more to his high ideals of what a monthly technical journal should be, his excellent choice of editors and the free hand he gave them in the management of the paper. His demise will be widely regretted. He leaves a widow, but no children. The remains were brought to Chicago, his old home, for interment.

Peter H. Peck, for years master mechanic of the Chicago & Western Indiana Ry., and closely associated with railroad societies and organizations, died on November 28th. Mr. Peck has been in railroad service since 1865. In July of that year he entered the Keokuk shops of the Keokuk & Des Moines Valley Ry. He served this road as fireman and in February, 1869, was made engineer. He served this road and later the St. Louis, Keokuk & Northwestern Ry. in this capacity, until August, 1878, when he entered the service of the Hannibal & St. Joseph Ry., also as locomotive engineer. He was promoted to division master mechanic of the same road in November, 1882, and served until May, 1887. Since the latter date he has served the Chicago & Western Indiana R. R. as master mechanic. Mr. Peck will be much missed in railroad circles all over the country, but particularly in Chicago. He was recently elected to the office of treasurer of the Western Railway Club, which association he has rendered great assistance since its organization.

William L. Miller, president of the W. L. Miller Heating Co. of Chicago, died Sunday in El Paso, Texas, of pneumonia. He was born May 29, 1867, in Detroit, Mich. With his brothers, Charles and F. W., he organized the W. L. Miller Heating Co. in 1905. He left for El Paso for his health in October, and has been declining ever since. He was a member of the Chicago, Cleveland and New York Athletic clubs, Lovell Moyre Lodge No. 82, A. F. and A. M., of Muskegon, Mich., and of Muskegon Lodge, B. P. O. E. Funeral services will be held Friday afternoon under the auspices of the Muskegon Masonic lodge in Muskegon. He is survived by his widow, now living in Muskegon.

Railway Mechanical Patents Issued During November

Die for pressing car wheels and like shapes, 937,749—Aaron K. Andrews, Burnham, Pa.

Hanger for freight car doors, 937,751—Amos O. Banks, Baltimore, and Geo. E. Banks, Brunswick, Md.

Lateral motion roller bearing device for car trucks, 937,752—John C. Barber, Chicago, Ill.

Air brake, 937,839—Lorenzo E. Morel, St. Hyacinthe, Quebec, Canada.

Car pipe line coupling, 937,874—Peter A. Senecal, Winnipeg, Manitoba, Canada.

Adjustable brake head, 937,930—William E. Fowler, Jr., Hammond, Ind.

Air brake safety valve, 937,991—Orlando Gibson, Hollidaysburg, Pa.

Passenger railway car, 938,037—James H. E. Branson, Philadelphia, Pa.

Draw bar and draft attachment, 938,133—William Emberger, Niles, Mich.

Locomotive boiler, 938,171—Sidney A. Reeve, Worcester, Mass.

Car refrigerating apparatus, 938,181—Richard H. Thomas, Chicago, Ill.

Hose coupling, 938,183—Joseph M. Towne, East Orange, N. J.

Process for rerolling metal shapes from old railroad rails, 938,197—James E. York, New York, N. Y.

Car mover, 938,328—William McLeish, Appleton, Wis.

Car brake, 938,340—Charles V. Rote and Parke E. Shee, Lancaster, Pa.

Car door, 938,427—Francis X. Malocsay, Jersey City, N. J.

Lock for Grain Doors of Box cars, 938,469—Cyrus O. French, Kansas City, Mo.

Nut lock, 938,515—Joseph E. Robinson, Wheeling, W. Va.

Torsion lid for journal boxes, 938,523—Thomas H. Symington, Baltimore, Md.

Brake beam, 938,535—Charles H. Williams, Jr., Chicago, Ill.

Steam superheater, 938,568—Ernest H. Foster and John Primrose, New York, N. Y.

Railway motor car, 938,582—William S. Hovey and Milton H. Rix, Three Rivers, Mich.

Automatic train line coupling, 938,585—John W. Jackson, Uhrichsville, Ohio.

Car door and means for operating it, 938,719—Warren M. Smith, Prospect Park Borough, Pa.

Hose coupling and gasket therefor, 938,731—John E. Ward, New York, N. Y.

Bolster construction for car underframe, 938,770—Felix Koch, Bellevue, Pa.

Car door for grain, coal, etc., 938,789—Richard R. Reaveley, Fort William, Ontario, Canada.

Locomotive ash pan, 938,824—Robert W. Clark, Nashville, Tenn.

Steel car axle and method of making the same, 938,827—Andrew C. Cunningham, Norfolk, Va.

Car track sanding device, 938,837—Wilfred E. Fielding, Paterson, N. J.

Car axle lubricator, 938,852—Thomas Hardy, Jr., and August Droll, Troy, Ill.

Nut lock, 938,880—George D. Lawson and Andrew Wheeler, Rose Hill, Va.

Process of treating manganese steel ingots, 938,892—Winfield S. Potter, Mahwah, N. J.

Process of rolling manganese Steel, 938,893—Winfield S. Potter, Mahwah, N. J.

Sleeping car berth, 938,920—Arthur West, Chicago, Ill.

Car brake, 938,935—Nicholas P. Zech, Milwaukee, Wis.

Refrigerator car, 938,958—John M. Borrowdale and John Strain, Chicago, Ill.

Dump car, 938,976—Charles H. Clarke, Crafton, Pa.

Air hose coupling, 939,211—Edward L. Brown, Cleveland, Ohio.

Superheater for locomotive boilers, 939,237—Lewis E. Feightner, Lima, Ohio.

Door operating mechanism for dump cars, 939,298—Spence Otis, Chicago, Ill.

Refrigerator car, 939,315—Herman Pries, Michigan City, Ind.

Draw bar and yoke attachment for draft gears, 939,390—Cyrus L. Bundy, Jersey City, N. J., and Julius J. Acker, Horton, Kan.

Motor hand car, 939,423—William S. Hovey and Milton H. Rix, Three Rivers, Mich.

Car door operating mechanism, 939,425 and 939,426—Charles A. Lindstrom, Allegheny, Pa.

Lumber roller for cars, 939,452—Edgar L. Stocking, Buffalo, N. Y.

Dump car, 939,588—Charles H. Clark, Crafton, Pa.

Folding car seat, 939,593—John S. Farrell and Jesse S. Lewis, Pittsburg, Pa.

Grain car door, 939,660—Henry J. Bickle and Malcolm McMillan, Gladstone, Manitoba, Canada.

Car brake, 939,701—John W. Johnson, Custer, Okla.

Car coupling, 939,720—Watson S. Lennon, Tucson, Ariz.

Car ventilator, 939,784—Carl M. Askegren, Pensacola, Fla.

Locomotive headlight, 939,832—Joseph A. Hamby and Samuel S. Butcher, Columbus, Ga.

Car truck, 939,870—Charles S. Shallenberger, St. Louis, Mo.

Regulator for air brakes, 939,896—Charles J. Doerr, Erie, Pa.

Car door, 939,919—Francis X. Malocsay, Jersey City, N. J.

Air brake retaining valve, 939,928—Jos. F. Spiegel, Galeton, Pa.

Truck bolster, 939,946—Jacob J. Byers, Cameron, Mo.

End gate for mine cars, 939,944—Louis F. Brubaker, Cambridge, Ohio.

Refrigerator car, 940,124—Alfred G. Brown, Winona, Minn.

Car truck, 940,133—Edmund A. Curtis, Decatur, Ill.

Locomotive tender frame, 940,157—Clarence H. Howard, St. Louis, Mo.

Dump car, 940,187—John Pearson, Chicago, Ill.

Standard attachment for logging cars, 940,262—Mark Majette, Columbia, N. C.

Air brake system, 940,314—John W. Hicks, Goldsboro, N. C.

Car roof, 940,355—John Pearson, Chicago, Ill.

Car frame, 940,357—Edward Posson, Chicago, Ill.

Underframe for railway cars, 940,358—Edward Posson, Chicago, Ill.

Car brake, 940,373—William J. Stahr, Nescopeck, Pa.

Track sanding apparatus, 940,375—Joseph W. Stickley, Norfolk, Va.

Car construction, 940,378—Thomas Dunbar and Lars J. Berg, Chicago, Ill.

Railway coach, 940,383—Roland A. Felton, Birmingham, England.

Brake beam, 940,417—Henry Ziemss, Jr., Chicago, Ill.

Lifting jack, 940,433—Eugene Cook, Kalamazoo, Mich.

Locomotive headlight, 940,446—Silas W. Emery, Big Run, Pa.

Check valve for locomotive boilers and the like, 940,453—Theodore R. Fondren, Lancaster, Tex.

Track sanding device, 940,476—William H. Prendergast, Savannah, Ga.

Forward truck for locomotives, 940,494—William L. Austin, Philadelphia, Pa.

Motor car wind screen, 940,529—James Hodgson, Carlisle, Eng.

Emergency car coupling, 940,553—Edward Posson, Chicago, Ill.