Winter 3-1907

Volume 16 - Issue 6 - March, 1907

Rose Technic Staff
Rose-Hulman Institute of Technology

VOL. XVI. TERRE HAUTE, IND., MARCH, 1907. No. 6

THE TECHNIC.

TERMS:
One Year, $1.00. Single Copy, 15 cents.
Issued Monthly at the Rose Polytechnic Institute.
Entered at the Post Office, Terre Haute, Indiana, as second-class mail matter.

THE article on "Screw Threads Formed by Cold Rolling," which appears in this issue, is of interest not only because it gives information in regard to a process of which most of our readers would otherwise remain always ignorant, but also because the author, Professor Ames, was formerly Professor of Machine Drawing and Design at Rose, and his name is connected with much of the past history of the Institute.

IT is interesting and encouraging for undergraduates to read such accounts as that of the second annual meeting of the Rose Tech Club of New York. When the familiarity with the ways of the Institute, extended over two or three years, begins to breed a mild indifference to the importance of its work, a reminder of the personnel and accomplishments of the larger brotherhood of graduates is apt to give a truer magnitude to ideas of the opportunities which are offered to us as students.

THE plan for improving the baseball field by filling and grading so that the diamond would drain well, has been abandoned for the time being, chiefly because the funds at hand are not enough to allow of a first-class job. The committee having the proposition in charge acted wisely in deciding not to improve at all rather than improve the grounds only temporarily. As it is, the field is good enough in fair weather, and if it should be rendered unfit for good playing by a storm at the time of a game, perhaps arrangements may be made for the use of other grounds.

THE hydro-electric power plant in the Hawaiian Islands, described in this issue, is the logical result of an effort to obtain maximum return for minimum outlay. In the cultivation of sugar cane in this region, it has become the custom to irrigate all fields, the water supply in many cases being bored wells from which the water is pumped to distributing reservoirs. Australian coal, and to a certain extent California oil, are used as fuels, though expensive; bagasse is hardly satisfactory, except in the mill where the cane is crushed, and under the conditions, the development of water power at a distance of thirty-five miles was a sound investment.

The plant described is of the type which has been used in some of the California power development projects, using water with high head and in comparatively small volume. The natural conditions in these islands are favorable for this type of plant, a heavy rainfall over a comparatively small watershed providing a reliable water supply at a considerable elevation above sea level, and the usual steepness of the mountain sides permitting a small loss of head due to friction in the pipes,

SCREW THREADS FORMED BY COLD ROLLING.

By W. L. AMES.

EVERYONE is more or less familiar with the ordinary method of forming screw threads, which consists in cutting a spiral groove into a cylinder, the outside diameter of the screw being that of the original cylinder. Here is an obvious waste of material, and to those of us who have stood over a lathe and directed the course of the threading tool forward and backward to the accompaniment of banging clutches and shrieking belts, there is a feeling of a possible waste of time as well as of material.

To be sure, this method is not that used in cutting threads where large quantities of a size and kind are made at one time, but with the best practice of either open or solid die thread cutting there is the loss of material and a more or less loss of time.

Years of struggle to win a living from the barren hills of New England have developed in the Yankee a horror of waste and an instinct for cutting corners in his routine of toil.

Though the necessity of which his invention was born is perhaps not now so urgent, yet your real Yankee never sees any new process in operation that he does not become possessed of the desire to improve it.

It is then not at all surprising to find that nearly a century ago a Connecticut Yankee applied for and obtained a patent for a means of forming screw threads "which consists"—to quote his own claim—"in the method of raising or producing the thread by forcing up the metal of the cylinder or wire of which the screw is made, so as to constitute the thread by rolling and compressing the cylinder between grooved plates or dies."

In his specifications he mentions the various forms of dies which may be used, and describes that which he prefers. That the present approved practice is the same, is a compliment to his mechanical judgment. In fact, this early inventor worked out his problem very thoroughly and makes quite complete statements as to the essentials of the new method of forming screw threads.

The proper form of the dies will be easily understood by making a simple experiment. Form two oblong blocks of any plastic material, as wax or hard soap, each having one plane smooth surface for the acting face of the "die." Place the blocks on a table with their faces toward each other and parallel, and place vertically between them a screw or bolt end. Now press the screw between the blocks, moving one back and forth over the other, keeping the parallel position and rolling the screw between them, increasing the pressure on the screw, till grooves are formed on the two dies as deep as the threads on the screw will permit.

If the faces of the blocks are now examined they will be found to consist of straight inclined ribs, the section of which is the same as that of the V on the screw. The angle of the ridges with the edge of the block will be that of the developed helix of the screw, and for a right hand thread, slope downward from left to right.

If it were possible to harden these blocks or dies, it is evident that if a plastic cylinder be placed between them and subjected to the rolling operations above described a screw thread would be rolled on it. While this rough experiment would hardly show it, a moment's consideration will, that on the two lines of contact of the screw with the dies at any point, the point of a rib on one die will be exactly opposite the bottom of a groove on the other die, which means that the dies must be in proper relation to each other when the blank is introduced between them. If the points of the ribs were opposite on the line of contact, a double thread of the same pitch but half the depth would be formed.

The writer has no evidence that the original inventor made a commercial success of his process, nor till many years later did other men working along this line make a satisfactory product; the reason being that the character of the wire on which the cold rolling was to be done was not suitable to the work. The best material of that time was charcoal or Norway iron, which, while tenacious and ductile in the direction of the grain, would split under pressure, and a rolling pressure is particularly effective in developing any structural defect in wire.

It was not until in the seventies, after the introduction of mild steel made by the Bessemer and open-hearth processes, giving to manufacturers a homogeneous material capable of almost unlimited distortion cold,—that rolled thread screws were satisfactorily made.

In the late seventies and early eighties, H. A. Harvey, whose name is known in connection with improved armor plate, made several inventions in dies and machines for making roll threaded screws. He first used a fixed concave and a continuously rotating convex die. This combination has the advantage of being more rapid than the reciprocating die. As, if the convex die occupy three-fourths the circumference of a circle there is a loss of 25% of the time when the dies are not engaged on the screw, while in the reciprocating dies the loss must be always something over 50%; a gain of one-third in production. The objection to this form of dies is the difficulty of adjustment, as evidently there is only one position where the cylindrical surfaces can be parallel, and any change in position will affect it.

Curved dies are more difficult to make and more likely to change shape in tempering. This form, however, can be used to advantage on small brass or copper screws, but on steel it is difficult to get the requisite pressure to form perfect threads,—and Mr. Harvey's next improvement was to combine two or more pairs of dies with means for automatically transferring the incompleted screw from one pair of dies to the next and so on, in order to get the requisite depth by successive rollings.

Curved dies were soon practically abandoned excepting for light work, and plain sliding or reciprocating dies were adopted.

Between that time and the present many variations were tried out; as, for example, moving both dies instead of one, having one move slowly through its stroke and the other make several short, quick strokes, the action being much as one would make in forming a cylinder by rolling between palms of the hands.

However, the advantage of simplicity and ease of adjustment outweighed other considerations. For though a machine may have a theoretical efficiency of 75%, if it easily gets out of adjustment and requires a skilled operator for a considerable time to readjust it, the production report for that machine may be far below that of a simple machine having only 25% theoretical efficiency.

The best machine has a very rigid frame, one die being fixed, the other carried by a reciprocating slide driven by a connecting rod from a crank pin, the line of the slide being above the center of the crank disc to give a quick return to the slide. The crank disc is driven through a gear to get the necessary power. This, with an attachment for introducing the blank between the dies at the proper time, are briefly the essential features of a screw rolling machine.

The conditions necessary for the production of a perfect screw from this machine are,—

Properly formed dies, *i. e.*, ribs properly spaced and matching the mating die. The support for dies to be such that they remain parallel and unyielding throughout the stroke, and most important of all, that the blank be of correct and uniform diameter. This latter, because no stock is taken from the blank and the formation of the dies do not permit it to stretch, so that if the blank be large the screw will be correspondingly large.

Comparing the roll thread screw with the cut thread, it is seen that the former cannot vary in pitch, but does depend on the diameter of the blank for correct diameter of screw, while the cut thread screw is not so much affected by the diameter of the blank. The die removing the surplus metal, if oversize, is likely to vary in pitch, depending on the condition of the die and the character of the stock.

In tests for strength the rolled thread has been shown superior to the cut. This is no doubt partly due to the method of forming the thread and partly to the fact that a more brittle material is better adapted for cutting.

In rapidity of production, the roll thread screw far outdistances its rival.

Some years ago when steel was at a low price, a statement appeared in the papers to the effect that if a carpenter dropped a wire nail the time it took for him to pick it up was worth more than the nail. The statement can easily be true, as a wire nail is not a highly finished product, and is near to the raw material, *i. e.*, wire. So near, in fact, that the large wire mills quote nails today at 15c per 100 lbs. above the price of wire and furnish them packed in 100-lb. kegs, the kegs alone costing perhaps 10c each.

But when a gross of machine screws, headed, dressed, slotted and threaded, perfect as to pitch and diameter, put up in a board box and labeled, can be furnished at such a price that the mechanic, at 40c per hour, who spends more than five seconds in hunting under the bench for a screw he has dropped, is not acting for the best interest of his employer, it would seem that the limit of economy in production was nearly reached. This low cost is possible only by the use of automatic machinery, and indeed on this product it is used to such an extent that if the labor item was entirely left out, the cost schedule would be changed but very little.

If he is a benefactor of mankind who makes two blades of grass grow where only one grew before, then we should honor that Connecticut Yankee who, though never knowing of the abundant yield, sowed the seed so many years ago, by publishing his "new and useful Improvement in the Mode of Manufacturing Screws."

NEW YORK ROSE TECH CLUB.

The second annual meeting of the Rose Tech Club of New York was held at the Building Trades Club, Broadway and Twenty-fifth street, New York, Saturday evening, February 23, 1907. The meeting was very successful, both in point of number present and the enthusiasm displayed by the boys. One of the noticeable features of the meeting was the great number of members of the earlier classes. On account of this fact, the meeting was more dignified than an ordinary gathering, and the speeches more substantial. A glance at the list of those present brings out the importance of the engineering work under the supervision and management of the older members of the alumni present and proves that although Rose is small in numbers, it is second to none in the ability of its alumni.

During the hour of social intercourse preceding the dinner there were many surprises as friends from wide distances shook hands with each other, probably for the first time since they left Rose. From early in the evening until two in the morning, when the party dispersed, reminiscences of school days could be heard on every side. The whole evening was filled with hearty laughter as one incident after another of the good times the members had at Rose was mentioned. Mr. Chas. M. Sames, '86, acting as President in the absence of Mr. S. D. Collett, '90, ushered thirty-one Rose men into the dining room of the club promptly at 8:30, where an elaborate menu had been prepared, and all the participants were seated in the order of their classes. Dr. Mees occupied the seat of honor. To the left at the head of the table was seated the acting President, Mr. C. M. Sames, '86, and to the right Mr. H. St. Clair Putnam, '86, Toastmaster, and Mr. A. Eugene Michel, '03, Secretary. During the dinner a photograph was taken of the banquet table. As the members were sipping the last drop of their coffee and lighting long Havanas, Mr. Putnam emphasized the loyalty of Rose men for their Alma Mater and introduced Dr. Mees, President of the Institute, as the principal speaker of the evening. As the "little man with the heavy voice" arose, a great burst of enthusiasm and hand clapping burst out, and the smiling face of "Doc" brought the boys back to the time when they were in school. His speech was both serious and humorous in turns, intermingling the problems at present confronting the Institute with anecdotes in which he and those present were intimately connected, and the hearty good wishes of the faculty. He urged the boys to keep in close touch with the Institute and with each other, and it was plainly evident that his remarks made a deep impression on all present.

Next, Mr. J. M. Nelson, one time Instructor in Chemistry at Rose, and now a Graduate Student of Columbia University, spoke of his connection with Rose, and eulogised it in comparison with the larger institutions of the East.

Mr. Chas. M. Sames, the next to speak, urged that Rose continue its present high standard among the technical schools of the country.

Mr. Edward G. Waters, '88, who has recently returned from England, spoke of the superiority of American technical schools over those of England. He also recommended New York City, the greatest engineering center of the country, as an appropriate place for gatherings of Rose men, and believed that the meetings of the New York Tech Club should be made to play an important part in the history of the Alumni.

All the others present made five minute speeches, covering everything from reminiscences and experiences since leaving Rose to the enthusiasm for the work of the Institute.

Letters and telegrams of regret from those who could not attend were then read by the Secretary.

The following were present :

Dr. C. L. Mees, President Rose Polytechnic Institute, Terre Haute, Ind.

John M. Nelson, ex-Instructor in Chemistry, R. P. I., Graduate Student Columbia University, New York City.

Chas. M. Sames, '86, Editor "Technical Literature," New York City.

H. St. Clair Putnam, '86, Consulting Electrical Engineer, New York City.

Edward G. Waters, '88, formerly British Manager General Electric Co , now Assistant to President, Schenectady, N. Y.

Geo. R. Putnam, '90, U. S. Coast and Geodetic Survey, Washington, D. C.

Harvey J. Lefler, '90, Construction Engineer, New York City.

William H. Boehm, '91, Supt Fly Wheel Dept. Fidelity & Casualty Co., New York City.

Francis W. Hurlburt, '91, Electrical Engineer Foreign Dept. General Electric Co , New York City.

Eugene F. McCabe, '81, V. P and Genl. Mgr. Mifflin County Gas & Electric Co., Lewistown, Pa.

William S Menden, '91, Chief Engineer Brooklyn Rapid Transit Co , Brooklyn N. Y.

Arthur M. Hood, '93, Patent Attorney, Indianapolis, Ind.

Arthur Rice, '93, Construction Engineer New York Telephone Co., New York City.

Hubert G Kilbourne, '94, Sales Manager L. A. Becker Company, New York City.

Archie G Shaver, '97, Signal Engineer Hall Signal Company, Garwood, N. J.

Theodore L. Camp, '97, Mgr. United Wrapping Machine Co., New York.

Frank A. Whitten, '98, Automobile Designer, The Lansden Company, Newark, N. J.

John T. Montgomery, '93, Manager, M. A. Mead & Co., Pittsburgh, Pa.

John E. Hubbell, '98, Patent Attorney, Philadelphia Pa.

Henry C. Schwable, '99, Electrical Engineer, Stephen T. Williams & Staff, New York City.

William G. Davis, '99, Mechanical Engineer, Westinghouse Machine Company, New York City,

Chas J. Larson, '00, District Supt. of Erection, Allis-Chalmers Co , New York City.

William C. Appleton, '00, Electrical Engineer, Crocker-Wheeler Co., Ampere, N. J.

R. R. Warfel, '01, Chemist, Babcock & Wilcox Co., Bayonne, N J.

A. Eugene Michel, '03, Advertising Engineer, The Geo. H. Gibson Co., New York City.

William A. Peddle, '03, Signal Engineer, New York Central R R. Co., New York City.

Edward H. McFarland, '04, Turbine Engineering Dept., General Electric Co , Schenectady, N. Y.

J. Newton Ross, '04, Resident Mgr., the Westinghouse Machine Company, Cos Cob, Conn.

Geo. H. Crane, '04, New York City.

Chas. R. Peddle, '05, Signal Dept., Interborough Rapid Transit Co , New York City.

H. John Wilms, '06, Turbine Testing Dept., General Electric Co., Schenectady, New York.

The following officers for the ensuing year were elected at the business meeting :

President, Mr. Chas. M. Sames, '86, to succeed Mr. S. D. Collett, '90.

Vice-President, Mr. H. St. Clair Putnam, '86, to succeed Mr. Sames.

Sec.-Treasurer, Mr. A. Eugene Michel, '02, re-elected.

THE LOAN FUND.

Amount previously acknowledged	$320.00
John D. Galloway, '89, (more if needed)	250.00
H. S. Putnam, '86	50.00
G. R. Putnam, '90	10.00
W. J. Klinger, '96	10.00
R. A. Phillip, '97	10.00
C. B. Speaker, '05	10.00
	$660.00

While the fund is growing slowly, yet letters received indicate that the matter is arousing considerable interest among the alumni and that, in case of need, there will be ample response to take care of any worthy undergraduates. Every man who can possibly afford to do so ought to "lend a hand."

ARTHUR M. HOOD,
Sec'y-Treas. Alumni Ass'n.

ALUMNI NOTES.

During the past two months Mr. Benjamin McKeen ('85), a member of Rose Tech's first graduating class, and Mr. Francis H. Miller (95) have had quite severe attacks of typhoid fever. At times during the illness of each, Mr. McKeen and Mr. Miller were in a critical condition. However, it is pleasant for this department to be able to write that both men are convalescent.

John A. Nicholson, '02, and Miss Myrtle Wylie were married February 6, at Washington, Neb. Mr. and Mrs. Nicholson are at home at Sidney, Neb.

J. S. Brosius, '93, left the employ of the Western Electric Co. on the 1st of December last, to take a position in the drafting room of the Electric Controller & Supply Co., of Cleveland, Ohio, where there are already a number of Rose men.

Brent C. Jacob, '03, has changed his address to 101 Hutchinson Ave., Swiss Station, Pittsburg, Pa.

CAMERA CLUB.

At a meeting of the Camera Club, held March 5th, prizes for the February contest were awarded. The subjects for the contests were the Rose Orphans' Home and the Highland Lawn Cemetery gates. There were quite a number of pictures, and all showed that considerable time and pains had been taken to obtain the best results possible.

A first prize, consisting of an extensible photo album was won by Routledge, '07. The second prize, a photo thermometer, was taken by J. B. Shickel, and Bond, '07, was awarded honorable mention. The club expects to make its work more interesting as soon as the bright days of spring come.

THE TECHNIC has received a copy of Bulletin No. 107, from The Electric Controller & Supply Co., describing their new Type G controllers, of which an extended description is given in the review column.

THE TECHNIC is indebted to S. D. Collett, '91, for a menu of the annual dinner of the Indiana Society of New York, which was held at the Waldorf-Astoria on March 6th, together with a list of the members of the organization, which includes the name of F. W. Hurlburt,'91, as well as that of Mr. Collett. It is somewhat eye-opening to note that to reside in the Hoosier State may be a stepping-stone to membership in a society which has such names as Lyman Abbott, Albert J. Beveridge, Finley Peter Dunne and John T. McCutcheon on its rolls, but this may perhaps be reserved as something to look up and forward to.

HYDRO-ELECTRIC PLANT IN THE HAWAIIAN ISLANDS.

By A. GARTLEY, General Manager The Hawaiian Electric Co. (Ltd.)

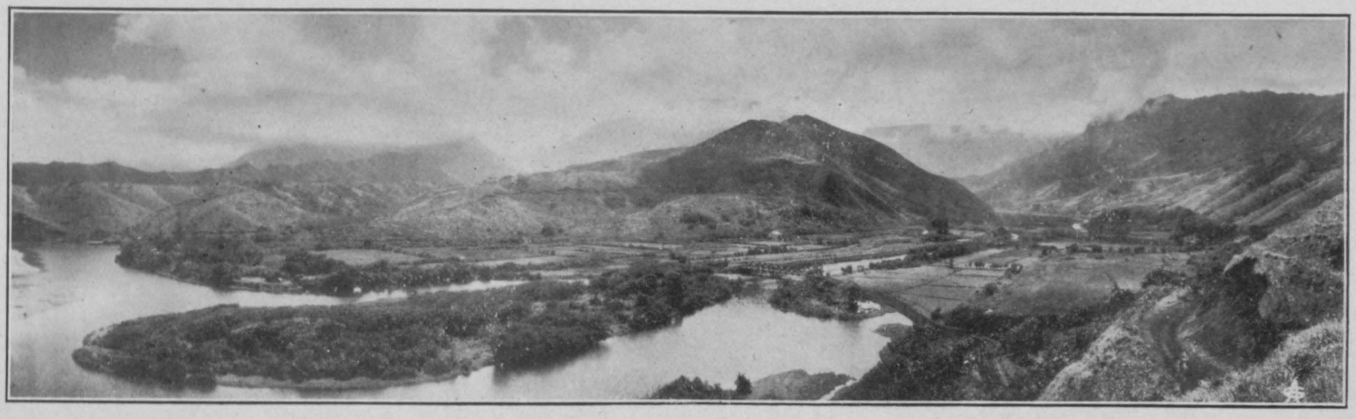
(Read before the Hawaiian Engineering Association, at its October, 1906, meeting.)

IN presenting this paper to the Engineering Association I shall not go into the details of the organization and promotion of the Kauai Electric Company, but will adhere strictly to a description of the technical details.

The object of the promoters, in building an electric plant was to generate power from a mountain stream in Wainiha Valley on the northwest side of the island of Kauai, and to utilize the same in operating pumps at McBryde Sugar Plantation on the south side of the island. It was estimated that about 2500 horse-power would be required by the McBryde Sugar Company.

When operations were commenced at Wainiha there were absolutely no facilities for receiving freight, housing the men or transporting the machinery. It was necessary to build a wharf on the beach and connect this wharf with the power-house by a light railroad of 30″ gauge and 14-pound rails. Warehouses were built near the wharf to receive the freight, houses were built at the power-house site to accommodate the men and trails were made into Wainiha Valley for the transportation of stores and the material for the tunnels.

Water is taken from the bed of the Wainiha stream through the head gates at an elevation of 710 feet and carried through a conduit consisting of tunnels and ditches, there being 32 tunnels and 8 connecting ditches having a fall of .2 per 100 feet.



PANORAMIC VIEW OF WAINIHA VALLEY. KAUAI, HAWAIIAN ISLANDS.

Preliminary surveys of the water, power-house site, pole line, ditches, etc., were made in the latter part of 1904. Contracts were placed for conduit, power plant and transmission line in March, 1905, and the plant was completed and formally opened early in August, 1906.

Wainiha Valley is a deep valley which cuts into the heart of Waialeale, a mountain approximately 6,000 feet in height. The valley is about fifteen miles long and receives the under drainage from a large plateau of an elevation of from four to five thousand feet. The Wainiha stream is said to have the most constant flow of any stream on Kauai.

The tunnels are 6 feet wide, 4 feet high with an arched rise of 2 feet and comprise 17,400 feet of the total length of the conduit.

The ditches are 5 feet bottom, 9 feet top and 6 feet deep and 5-foot berm, the slope on the high side of the ditch being ¾ to 1. The combined length of the ditches is 5,600 feet.

All tunnels are through solid rock and considerable difficulty was encountered with what is known as " Kanaka " rock, it being necessary during construction to install power drills on two of these tunnels.

During the construction of the conduit a careful record of the progress of the work on the tunnels was kept and platted on a tracing from month to month showing graphically the exact conditions.

The head gates are just below a bend in the bed of the stream and advantage was taken of the deflection to construct a large overflow. There is a sluice gate immediately below the overflow to take care of sand and debris deposited in the ditch above the screen. A screen grating placed at an angle of ½ to 1 intercepts any floating debris and is placed immediately above the head gates. There are three 3-foot head gates operated with a rising screw stem. It was found necessary above the head gates to throw an arch across the ditch and build a stone wall about three feet above the level of the top of the ditch to deflect the flood water which is at times two to three feet above the level of the top of the ditch. At several points along the line of the conduit where streams cross the ditches or where the tunnels break out into gulches, aprons have been built over the ditches and across the tunnel entrances to carry the storm water, provision being made, however, to receive into the conduit the normal flow of water from these various small streams. One large stream, the Maunahena stream, supplies a daily flow into the ditch of from eight to ten million gallons. There are sand traps, spillways and flushing gates at several points along the line of the conduit, the largest and most important spillway being between the last two tunnels.

Water is received at the lower end of the conduit into a fore-bay of substantial size and construction. The conduit ends in a tunnel on the backbone of a ridge and the fore-bay is excavated out of the solid earth, the total depth being 12 feet. The excavation is lined with a concrete lining 18 inches thick on the walls and 6 inches on the bottom.

There is a 42-inch sluice gate level with the bottom of the fore-bay, and immediately in front of this, and extending entirely across, there is a wall two feet six inches high, the object of which is to act as a baffle to retain the sand which might be precipitated into the fore-bay. This wall also acts as a support for a screen which extends the entire width. This screen is 20 feet long by 11 feet high and is made up of 3-16x3 inch flat iron bolted together and separated with pipe thimbles ¾ inch long. It is placed in the fore-bay at an angle of about ½ to 1 in order that it may be readily cleaned with rakes.

In the front of the fore-bay there are three 42-inch outlets, two of which connect with two pipe lines and the third to be connected to a future pipe line. These outlets are closed with rising screw stem wooden gates. Just outside of the fore-bay there is a riser pipe on each pipe line to admit air into the pipe line when the valve is closed.

A spillway 12 feet wide is provided on one side to take care of the rise of water in the fore-bay which might be caused by the inertia of the water should the pipe line be suddenly shut off.

The level of the water at the fore-bay is 655, the level of the center of the pipe line is 648. This depth of immersion, together with the ample screen area, it is believed, will insure a full pipe of water at all times.

Two pipe lines lead from the fore-bay to the power-house immediately below, a distance of 1700 feet.

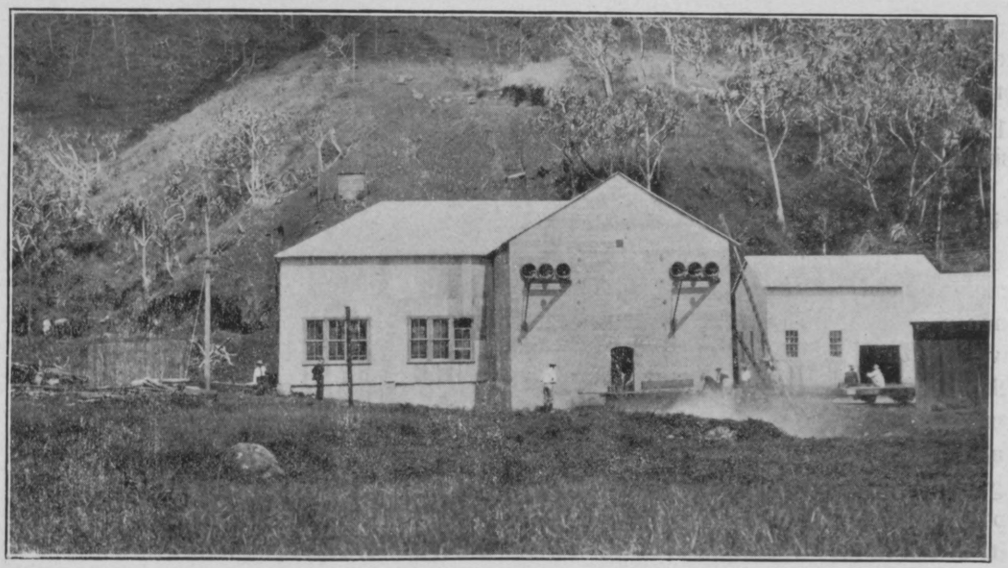
The first section of pipe is 42 inches, tapering to 34 inches at a distance of 20 feet, the thickness at this point being 3-16″. The 34″ 3-16 pipe extends for 880 feet where it is reduced to 30 inches, the remainder of the pipe being 300 feet 30-inch diameter ¼″ thick; 280 feet 30-inch diameter 5-16″ thick; 220 feet of 30-inch diameter 3-8″ thick.

The two pipe lines are covered throughout their entire length and are anchored in the trenches at intervals of 150 to 200 feet. The anchorage consists of an angle iron riveted to the under side of the pipe, this in turn having a piece of steel plate riveted to it, the steel plate bearing against two 35-pound steel rails about 6 feet long laid crosswise of the ditch and embedded solidly. This method of anchoring seems to have been very successful. There are three man-holes in the length of each pipe for access to the pipe should stoppage or leakage occur.

There are no air valves or relief valves in this pipe line, as only a complete stoppage of the pipe or a complete stoppage of the water wheel nozzles can throw an excessive strain on the pipe. Should the pipe be suddenly emptied a small riser pipe, referred to previously, would be depended upon to supply air.

former. The alleyway has a traveling crane of sufficient capacity to handle the transformers and is used as a storage space for an extra transformer. This house is constructed entirely of concrete with an iron roof. Its floor level is 6 inches below the level of the main station, to prevent accident from fire should the transformer oil become ignited or boil over.

The station as at present equipped has two 1200 kilowatt generators direct connected to Pelton water wheels, two 70-kilowatt exciters, a switchboard and seven 500 K. V. A. transformers. Allowance has been made for an additional 1200-kilowatt unit.



POWER HOUSE OF THE KAUAI ELECTRIC CO.

The power-house is a substantial iron building supported on a concrete wall, 64x40 feet and has an L constructed of concrete for the transformer house.

There is a traveling crane of 16 tons capacity, carrying two 8-ton Yale & Towne blocks. This crane travels over the entire length of the power-house and has a capacity sufficient to lift any piece of apparatus.

The transformer house has an alleyway 11 feet wide extending down through the center and on each side of this alleyway there are three entirely enclosed fire-proof cells each containing one trans-

There are two units of 1200 kilowatts each, duplicates in every respect. Each unit is a two bearing, double wheel unit of the overhung type and consists of two Pelton disc wheels, one pressed on each end of the generator shaft. Upon this shaft the rotor of the generator is mounted between the bearings of the wheel. The revolving element is carried in two water-cooled, self-oiling bearings. These bearings, the water wheel housing and the generator are carried upon a massive cast iron bed frame rigidly secured with heavy anchor bolts to a massive concrete foundation. The wheel discs are heavy castings carefully balanced and fitted with the necessary number and size of steel buckets to have a combined maximum capacity of 2500 H. P. The buckets are cast semi-steel. The shaft is a hollow forged nickel steel shaft 11 inches in diameter at the generator hub and 9¼ inches in the bearing. The bearings are 9¼ inches in diameter, 30 inches long, ring oiling ball and socket type babbited with a high grade babbiting metal thoroughly peaned in and scraped. Each journal barrel is exactly concentric with the machined ball joint and fitted in the concentric machined cast iron ball socket of the pedestal. The shell of each bearing is provided with oil compartments of large capacity and with water cooling compartments through which a constant stream of water is supplied. Oil is carried to the journals with heavy bronze parting rings. This construction insures perfect alignment, the uniform bearing of the shaft and a consant flooding with cool oil.

Water is brought to the wheels through a heavy Y casting bolted to the flanged end of the pipe line (each unit has an independent pipe line). The branches of the Y have attached thereto gate valves of the outside screw yoke, rising stem, Pelton type with nuts and seats of phosphor bronze. They are provided with worm gearing and roller thrust bearings to facilitate operating under pressure. Each gate has a suitable by-pass. There are two water nozzles to each main unit, of the needle deflecting type, mounted on cast iron sole plates and provided with forged steel trunnion pins working in gun metal bearings. The ball joints are packed with leather rings to prevent leakage when the position of the nozzle is changed. The nozzles are provided with hydraulic counter-balances and are connected through levers and rocker-shafts to an automatic governor. A flanged nozzle tip is secured to the end of each nozzle admitting of renewal. Tips of varying size are furnished from 5¼ to 6¼ inches in diameter. The quantity of water issuing from each nozzle is controlled by a bronze needle which centers accurately with the center of the nozzle tip. This bronze needle is mounted on the end of a steel shaft and is operated with a hand wheel from the power house floor. The needle end is so constructed as to always give a parallel flow of water concentric with the nozzle tip.

To provide for very accurate speed regulation a Lombard type Q, oil actuated governor is connected to the two deflecting nozzles with a set of levers and rocker shafts and the speed is regulated by throwing on and off the full stream of water. The governor itself is belted to the main shaft of the water wheel unit and receives its actuating oil under pressure from a storage oil tank having an air reservoir on top. This oil is kept under pressure by an oil pump operated with an independent water wheel. Each governor has a small motor mounted upon it which is operated from the main switchboard. The speed may be altered within narrow limits with a push button control. Should the governor become inoperative the governor may be disconnected by throwing a clutch and and an auxiliary hand-control device then thrown into mesh enabling one operator to control the nozzles.

The exciters are driven with independent water wheels and on these exciters there are no governors provided. These wheels are mounted directly on the ends of the generator shafts and are covered with suitable housings. The speed of the Pelton wheels is controlled with rigid needle nozzles operated by hand and suitable gate valves. Water is supplied to these wheels with a 6″ pipe connection from the two main 30-inch pipe-lines.

The main generators are 1200 kilowatt, 2200 volt, 3-phase, 25 cycle, 375 revolutions per minute, rotating field, engine type machines built by the Westinghouse Electric and Manufacturing Company. The rotating part is a solid steel casting pressed upon the water wheel shaft and carries the field coils. The outside frame carries the armature winding and is of the slotted type. The core is built of laminated steel of high magnetic quality built up and pressed upon a cast-iron frame. The coils are ribbon wound coils held in the slots by overhanging teeth of the laminated steel core. The field current is carried to the field coils on the rotating part through cast iron rings. These generators are of extremely good regulation and efficiency and they require but 15 per cent greater current in the fields when operating at 90 per cent power factor than when operating on a non-inductive load. The efficiency at ½ load is 92.75 per cent; at ¾ load 94½ per cent; and at full load 95¾ per cent. They are arranged so that the frame can be moved parallel to the shaft for access to the winding and field coils.

SCENE IN WAINIHA VALLEY, KAUAI.

There are two 70 K. W. Westinghouse type "S" 125 volt, compound wound, 575 revolutions per minute, exciting generators. These generaters have considerable excess capacity for lighting and small power in the machine shop.

The current is carried from the generators to the transformers through a six-panel blue Vermont marble switchboard.

The switchboard has a double set of bus bars and is so arranged that either bank of transformers can be operated from either generator or the generators can be run in parallel. Each generator switchboard is provided with ammetors, poly-phase indicating watt meter, direct current field ammeter, field switch and two non-automatic oil circuit breakers for connecting either set of bus bars, also a synchronizing outfit and volt meter receptacle.

The exciter panel has the necessary volt and ammeters, rheostat mountings and switches.

The transformer panels are each provided with one ammeter, and two single-throw automatic circuit breakers.

All the wiring from the generators to the switchboard and from the switchboard to the transformers is carried underground in 4-inch vitrified tile conduits.

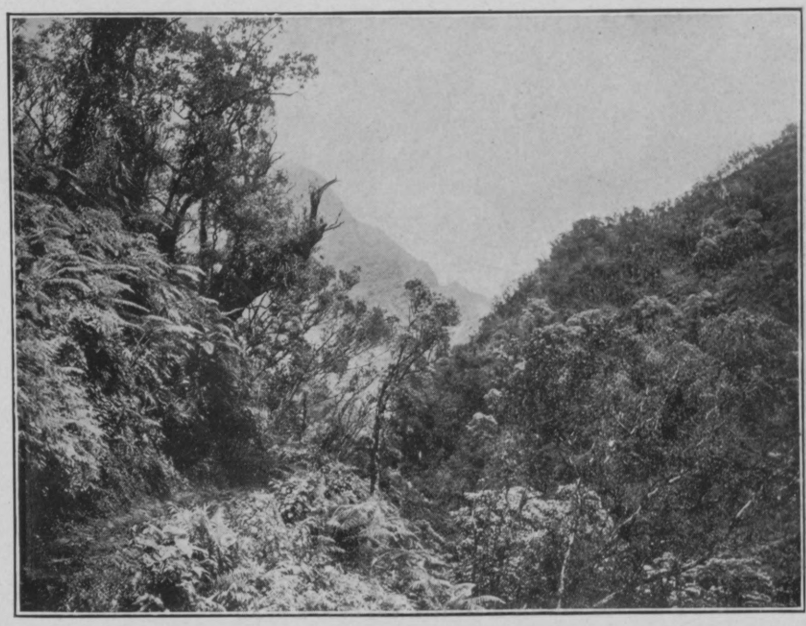
In order to take care of the output of the station and increase the voltage from 2200 volts to 33,000 volts there are two banks of three transformers each, the capacity of each transformer being 500 kilovolt amperes, with another transformer as a spare. These transformers are known as the Oil Insulated, Water Cooled type, and in addition to the main leads there are auxiliary leads which permit of the use on the low tension side, of 1900, 2000, 2100 volts, and on the high tension side of

28,500, 30,000 and 31,500 volts They are so arranged as to be connected in groups of three, from delta on the high tension voltage to delta on the low tension voltage.

The transformer windings are flat coils, separated from each other by heavy insulation, wound upon a laminated core. The core has sufficient oil ducts through it to permit of efficient cooling. The transformer windings and cores are enclosed in a boiler steel case and surrounded with oil. The oil is cooled with two sets of cooling coils made of seamless brass tubing spiral in form. Each transformer is mounted in a compartment by itself, and a pipe is carried from the transformer into the tail race to drain off the oil should the transformer take fire or the oil boil over. The valve stem of the valve controlling this oil is brought out into the alleyway to insure safe operation.

The cooling water from the transformers is taken from the main pipe line into a tank placed at a slight elevation above the power-house and is then piped into the main generator room. It is here controlled by a set of valves. Independent connections are taken to each transformer and the overflow from each transformer is brought back to the generating room and discharged into an open funnel, thus enabling the operator to see that each transformer is getting the proper supply of circulating water. Thermometers are fitted into each transformer and have an electric connection so arranged as to make contact and ring a bell should the temperature of the transformer rise to a dangerous point.

After the current is stepped up to 33,000 volts at the powerhouse it leaves the transformer house, passing through two sets of high tension switches. This arrangement is made in order that the high tension current may be cut off from each bank of transformers. These two circuits then united and are carried to the main transmission line. Horn type lightning arresters with eight foot horns and three-inch gap are tapped off the main line and the dead legs are carried to earth through a water resistance.



TRAIL TO HEAD GATES OF CONDUIT, WAINIHA VALLEY.

A set of choke coils consisting of 24 turns of No. 0 bare copper wire coiled in the shape of a spiral upon a 10-inch circle with a 1-inch gap, are interposed in the main line between the lightning arresters and the main switches.

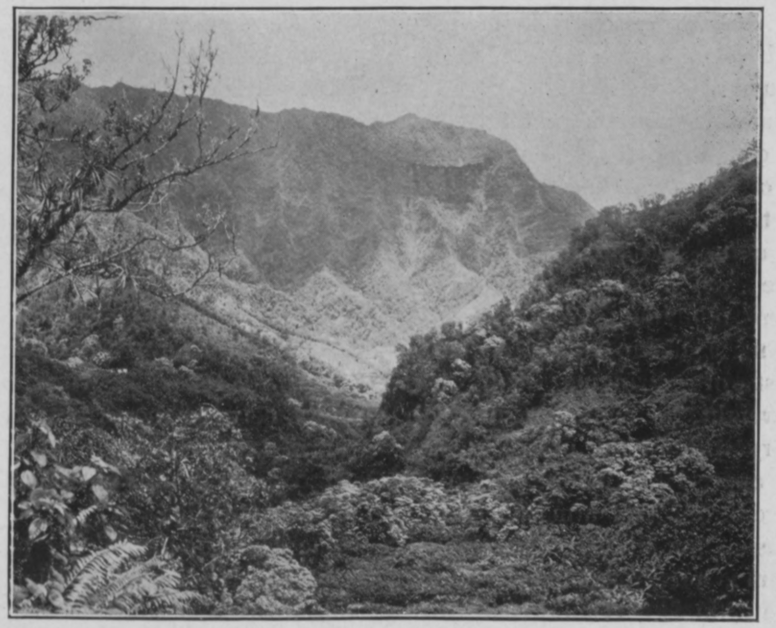
The line then extends through Hanalei Valley to the McBryde Sugar Company, passing over mountain ridges and through deep valleys for a distance of 35 miles.

The poles are 30-foot round cedar poles with 10-inch butts and 7-inch tops, buried 6 feet in the ground. The butts are protected by giving them two coats of crude oil before erection and again coating them at the ground line after erection.

The wires are carried in a triangle five feet apart and no transposition is made. The top pin is mounted on the top of the pole and the pole reinforced with an iron band 1½x¼x6" in diameter. Two other wires are carried on crossarms 6 feet long, 5"x6" in cross section and slightly rounded on top. These crossarms are bolted directly to the pole with a ¾" bolt and braced with 1½x3-16x30" braces. Where excessive strain is placed upon these crossarms, a double construction is used, that is two cross arms mounted opposite each other on each pole and two blocks are bolted to the top of the pole. The insulators are No. 316 Locke insulators 11 inches in diameter by 11 inches high, the larger part of them being porcelain throughout; some, however, are porcelain tops with glass petticoats.

At some points where sharp turns were made in the line and where the spans are 200 feet or more two poles are used instead of one, the poles being separated from each other by about 8 feet in a line at right angles to the pole line. Two 14' crossarms are placed on the poles and the wires carried on the same level at a wider separation.

The pins used on the line are of wood made from specially selected eucalyptus stock. The eucalyptus is cut into three inch squares and air dried for two years before being used and then turned up and treated with a special paraffine compound. They are 14-inches high, have a 5-inch shank 2 inches in diameter and are driven securely into the tops of the poles and into the crossarms. Where long spans are made and at bad corners a special pin of wood, iron and porcelain is used, the pin being a ¾-inch bolt with a special head and a thread for the insulator of wood. The base of the pin is of porcelain.



SCENE IN WAINIHA VALLEY, KAUAI.

The main line wire is seven stranded aluminum cable of 103,850 circular mils, equivalent in conductivity to No. 2 B. & S. gauge copper wire. The wire is secured to the top of the insulator with special soft drawn No. 3 B. & S. solid aluminum tie wire, a special sort of fastening being used.

The wire was received in lengths of 1,500 to 3,000 feet, and splices were made by the use of a special aluminum sleeve. The ends of the wire were inserted from opposite directions through the sleeve, and with the aid of special tools the sleeve was then given three turns, thus twisting the wires together. The seven strands extending from each end of the sleeve were then expended neatly around the wire itself.

The use of aluminum wire on this line has been brought into question by some, but the concensus of opinion of those who have used aluminum wire seems to be, that due to improved methods of manufacture the product now furnished is reliable and that no trouble is experienced when aluminum wire is used due to breaking down or crystallization. The cost of stringing it is less on account of its weight, the joints now used are entirely satisfactory without the use of solder, and there is no appreciable disintegration of aluminum wire from ordinary atmospheric influence. Under usual conditions even on the sea coast, aluminum is a durable metal, as it protects itself with a thin impervious coating of oxide, and in a test made on the Pacific Coast six years' exposure near the coast line showed a deterioration of less than 4-10 of one per cent.

The weight of aluminum wire is only 47 per cent of the weight of copper of the same length and resistance. Conductivity is from 61 to 63 per cent that of pure copper. Aluminum is a highly electropositive metal, and it is therefore necessary to use aluminum ties, and where other metal than aluminum is joined on to it great care should be taken to protect the joint from atmospheric influences with tape or insulation, otherwise the aluminum wire will be damaged by galvanic action.

The spans used on this line are mainly 130 to 140 feet, but in the mountain districts there are several spans over 300 feet and a maximum span of 470 feet.

The expansion of aluminum is nearly double that of copper, but as the strength is not as great it is necessary to give an aluminum line a definite amount of sag corresponding to the temperature observed at the time of erection. A set of curves were drawn and a set of instructions issued to linemen to insure proper erection.

On the main line poles there are two No. 12 copper telephone wires carried on deep groove double petticoat insulators supported on brackets, the upper wire is four feet from the cross arm and the lower wire on the opposite side of the pole five feet. Transposition is made every tenth pole. One telephone is installed on each end of the line in a specially built booth, the operator standing on a platform insulated from the ground with high tension insulators. Two 1000-volt transformers are connected in series between the telephone wires and the center connection between these transformers is thoroughly grounded, thus freeing the line of all static. The operator experiences no difficulty in communicating over this line.

The construction of the pole line presented many obstacles and the preliminary surveys were made with great difficulty. The line passes over high ridges between the valleys of Wainiha and Lumahai and between Lumahai and Waikoko, then across and through rice fields to Hanalei valley; it is then carried up a ridge to an extensive table land back of Kalihiwai to the mountain divide between Kalihiwai and Wailua, this section being through a densely wooded country swampy under foot. It then passes along the divide and down the ridge to Wailua and along the base of the mountain range to a gap between Haiku and Lawai. It is then carried over the plantation lands and across several gulches to Hanapepe.

Trails were cut, and roads and bridges built to enable contractors to take in materials, and these were permanent in character to enable the patrolmen on the line to keep the line constantly patrolled. Where streams were crossed a sort of cable suspension was erected carrying a platform so arranged that patrolmen might cross.

At the McBryde end of the line, at what is known as No. 2 pumping station, is built the receiving tension line. There is one set of high tension switches, choke coils and lightning arresters similar to those at the power house. Four cells built of concrete contain the receiving transformers. These transformers are connected in a bank of three delta to delta with one transformer as a spare, the current being stepped down from 33,000 to 2200 volts. These transformers are Oil Insulated, Water Cooled type of 875 K. V. A. capacity. The low voltage current is carried to a set of bus bars in an adjoining room to a switchboard which controls the distribution on McBryde plantation.

At the present time there are installed and in operation on this service four large pumping units consisting of:

Two 500 H. P. motors, each connected to a two-stage high-lift centrifugal pump of 5,000,000 U. S. gallons daily capacity against a head of of 341 feet, operating at 735 revolutions per minute.

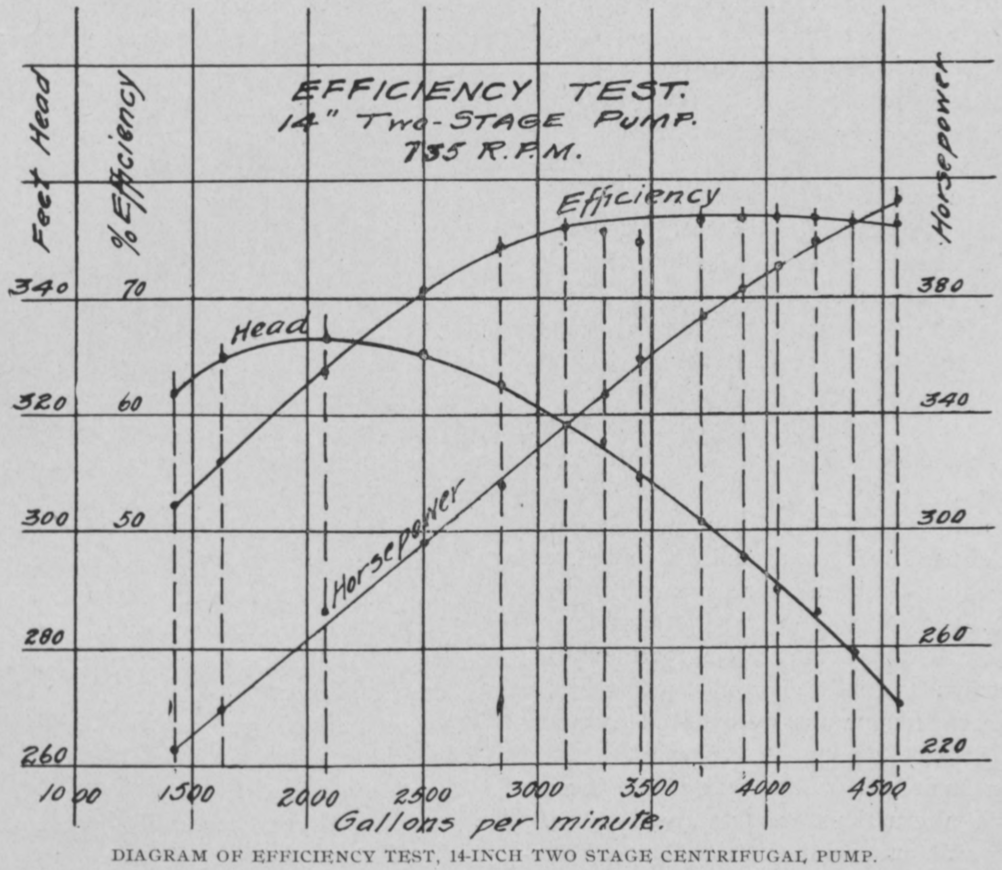


DIAGRAM OF EFFICIENCY TEST, 14-INCH TWO STAGE CENTRIFUGAL PUMP.

One 500 H. P. motor direct connected to a two-stage high lift centrifugal pump of 6,500,000 U. S. gallons daily capacity against a head of 260 feet, operating at 735 revolutions per minute.

One 150 H. P. motor direct connected to a high-lift centrifugal pump of 3,500,000 U. S. gallons daily capacity, against a head of 168 feet.

The three first mentioned pumps were built by the Buffalo Steam Pump Works at Buffalo, New York, and the last by the Byron Jackson Machine Works at San Francisco, Cal.

All of the motors were supplied by the Westinghouse Electric & Manufacturing Company.

Current is also taken to the mill, a distance of three miles from the receiving station, and used there on small motors and for lighting.

The pumps which are used on McBryde are of the high-lift turbine type. A complete description of the pumping apparatus built by the Buffalo Steam Pump Company appeared in the Louisiana Planter on September 8th, on page 157. There is also an article in the July number of the Engineering Magazine which covers several makes of this type of pump, the McBryde pumps being included. On page 519 there is an illustration showing one pump arranged for test with motor attached. Figure 7, page 511, and figure 3, page 507, show the internal arrangement of these pumps.

These pumps promise to give very satisfactory results. All parts are rotating and without valves, the runners are both mechanically and hydraulicly balanced and it is a safe prediction that the absence of valves and reciprocating parts will result in extremely small repair bills.

These particular pumps were tested carefully at the works of the pump maker where electric current in sufficient amount and of the correct number of alternations was readily obtainable. The water was measured and the input of electric current to the motor was indicated by meters, the motors were tested for efficiency at the works of the manufacturer before shipment and rarely has an opportunity been presented for determining with equal accuracy the efficiency of any pumping machinery. The attached curve shows the result of the test of the 14-inch pump designed to deliver 6,500,000 gallons per day against a head of 260 feet including friction.

It will be noted that the efficiency of the pump remains practically stationary between two-thirds of the capacity when pumping against a head of 325 feet to its full capacity when pumping against a head of 260 feet, namely 76 per cent. At a point about seven-eighths of its capacity it shows an efficiency of 77 per cent. This, it is felt will compare very favorably with a reciprocating pump driven with a motor and belt if we consider the losses due to the belting, counter shafting, the many unbalanced parts, slip in the valves and cylinders and friction in the water cylinder packing.

I have often been asked what efficiencies applied in an electric plant throughout the entire plant. This efficiency will vary widely, depending upon the construction and the class of apparatus installed. The electric and hydraulic apparatus in the plant of the Kauai Electric Company is of as high efficiency as it is possible to obtain at the present time.

The entire electric machinery was furnished by the Westinghouse Electric & Manufacturing Company and the hydraulic apparatus by the Pelton Water Wheel Company. The efficiencies applying here may therefore be cited.

The guaranteed efficiency of the water wheel is 80 per cent., but this efficiency probably reaches 82 or 83 per cent, when operating under its most economical load with a full stream on the buckets. The efficiencies of the electric apparatus are as follows:

Generator: 95.75 per cent.

Step-up transformers, 97½ per cent.

Line, 92 per cent.

Step-down transformers, 97½ per cent.

500 H. P. motors, 92 per cent.

Taking these efficiencies into account the amount of power which can actually be delivered to the motor shaft at McBryde Sugar Company, 35 miles away, is 80 per cent. of the generator output, 77 per cent. of the power on the water wheel shaft and 61 per cent. of the theoretical power in the water. Accepting an efficiency of 76 per cent for the pump the total water which can be delivered will be 46 per cent. of the actual water flowing into the pipe line at Wainiha.

From the description of this plant the layman may receive the impression that the entire plant is very complicated. The contrary is the case. The effort has been in making this installation to have all the apparatus and equipment as strong and as suitable for continuous and hard operation as possible. The station may be operated by one man on watch and the pumping equipment is far simpler than the station equipment.

The plant has been in operation for nearly three months without a breakdown of any kind. This augurs well for its capability in all parts to stand hard and continuous use.

At its regular meeting each Friday evening at 7:15 o'clock the Young Men's Christian Association, since February 15, has been having very interesting discussions on the following subjects:

1. What makes a man happy; what he has or what he is?
2. Can a man be good when he doesn't feel like it?
3. A real or an imaginary character.
4. Is anything wrong in itself?
5. The temptations of life.
6. A working force in life.
7. Pilate, the politician.

Mr. Dodge, the general secretary of the city association, has been leading these discussions. For general outline several printed questions are given to each man at the meeting, and then thoroughly discussed. The meeting is entirely informal, and every fellow may have his "say so." Any question whatsoever may be asked and then is frankly and carefully discussed.

This character of meeting has been very interesting and instructive as well as helpful. The men have entered into the discussions with a good deal of enthusiasm. It is usually true that men of the strongest characters are men who have some fundamental principles of living from which they do not vary. From this informal and free interchange of ideas and examinations of personal observations of living in every-day life one is helped to see what is the basis of a true character. Robert Browning has expressed a good thought in this little quotation:

"Whom do you consider the worst man on earth?
Be sure that he knows in his conscience more
Of what right is, than comes to birth in the
Best man's acts, that we bow before.—
This last knows better—true, but my fact is,
'Tis one thing to know, another to practice."

Each man has the freedom of his own will to determine how he shall act, and his principle is carefully observed.

At the meeting on Friday evening, March 1, a basket of pop-corn and apples helped to make the social side of these meetings more enjoyable. You do not know what you are missing by staying away.

About the end of February, an attractive display of class and school pennants, pillow-covers and kindred articles of ornament was placed over the Camera Club case, and the business card of Davidson & Wheat, a mercantile concern new to the Poly, was placed beneath the whole. Although Mr Wheat is unknown to us, the resident partner, Davidson, '10, is a very visible person about the Institute premises; his wares are of good quality and prices attractive, and we hope that his business will prosper.

On February 10th, Carl B. Andrews spoke before the Scientific Society on the subject of "Stereotyping." The nature and the use of processes of reproducing printing surfaces were spoken of, and the papier-mache process described, several matrices and casts being shown in illustration. Some types of casting and finishing apparatus were described with the aid of drawings. The meeting closed with a more or less general discussion of the subject.

ROSE, 19; DE PAUW, 18.

On Saturday night, February 9, Rose defeated DePauw in the return game by the narrow margin of one point. The game was close from the start and DePauw's lead was the greatest about the end of the first half, when the score stood 13 to 8. In the second half, however, Rose, on foul goals by Lindeman and field goals by Hadley and Trueblood, made eleven points to DePauw's five, all of which were made from the foul line.

The game was much the same style as was that played at Greencastle, but Rose was in better form for the first game and had less trouble in winning the first one than the second.

The game itself seemed to be a catch-as-catch can holding contest, in which DePauw starred. DePauw played the man more than they played the ball, and this in a way accounts for the low score.

LaFollette, of Purdue, made his initial appearance as referee before a Rose crowd and gave good satisfaction, except in his failure to stop DePauw's holding.

Field goals were scarce, only eight being made throughout the entire game. Four of these were made by D. P. U. and four by Rose. Final score: Rose, 19; DePauw, 18.

Lineup and summary:

DE PAUW.		ROSE.
McKee,	Forward,	Webster
Ell,	Forward,	Shickel
Fairfield,	Center,	Trueblood
Grady,	Guard,	Lindeman
Hollopeter.	Guard,	Hadley

Foul goals—McKee; Fairfield. 2; Hollopeter: Shickel, Trueblood, 2; Hadley.

Fouls—D. P. U., 26; Rose, 17.

Referee—LaFollette; of Purdue.

WABASH, 37; ROSE, 28.

Rose was defeated at the hands of the 1907 champions for the second time of the season. February 16, Wabash won from Rose a hard game, which was ours until the last few minutes of play, when Freeman dropped in enough field goals to decide the game.

Last year, the game here was won by Wabash by a score of 26 to 24, there being about two minutes overtime necessary to decide the game.

The game was one of the best seen on the local floor this season. Everybody played to win, and it was probably the cleanest contest of the schedule.

Freeman was star of the evening in point of goals, having ten field goals to his credit, seven of which were made in the last half.

After a few minutes playing, Rose obtained the lead and kept it until some three or four minutes before time was called for the second half, when Freeman began hitting the goal with telling effect.

The score at the end of the first half was 17 to 14 in favor of Rose; final score was 37 to 28.

Lineup:

WABASH.		ROSE.
Freeman,	Forward,	Webster
Diddle,	Forward,	Shickel
Sprow,	Center,	Trueblood
Wicks,	Guard,	Lindeman
Gipe,	Guard,	Hadley

Summary:

Field goals—Freeman, 10; Diddle; Sprow, 3; Wicks; Webster, 2; Shickel, 5; Trueblood, 4; Hadley.

Foul goals—Wicks, 7; Lindeman, 4.

Referee—Mr. Chas. McCormick, Rose, '04.

ROSE, 23; I. S. N. 10.

There was much speculation as to the outcome of this game. Normal had it all planned how much they were going to beat us and Rose rooters wanted to run up the score, but Captain Trueblood compromised by putting in three second team men, and we were it 23 times to their 10. Knowing that to win the Purdue game would mean more than to win this one, no one for Rose exerted themselves to any great extent, though it required considerable skill at times to dodge the two massive columns which are a part of the Normal gym fixtures. The game at all times was hardly worthy of the name basketball, and but for the score, the game might have been played sans basketball.

The game was very slow, owing to the out-of-bounds on three sides, and as a result of the "ground rules" the actual playing time was cut down to about half, it having been previously agreed that a ball touching out of bounds should be considered a held ball. For Rose, Trueblood was easily the star, being in the team work at all times, besides making four foul goals. For Normal, Worthman and Harbaugh played good games at guard.

Lineup:

ROSE.		NORMAL.
J. B. Shickel,	Forward,	Schockel
Nicholson, Webster	Forward,	McReynold
Trueblood,	Center,	Smith
H. Shickel,	Guard,	Worthman
Curry,	Guard,	Harbaugh

Field goals—B. Shickel; Nicholson; Trueblood, 4; Webster, 4; Schockel; Smith.

Foul goals—B. Shickel, 3; Smith, 4; Harbaugh, 2.

Referee—Dorste, of DePauw.

Umpire—Kisner.

INDIANA, 30; ROSE, 28.

THE basket-ball season of 1907 is history. Rose finished the season at home and were defeated by I. U. in an overtime game by a score of 30 to 28. The game was far from satisfactory in more ways than one. First, Rose played a poor game, showing the effects of having had no practice since the game of the week previous; second, the work of the officials was sufficient cause for disheartening everybody present, and it did.

Cook won the game for I. U. by his accuracy in foul throwing, making fifteen out of a possible nineteen shots. Trueblood played a good game at center for Rose and was easily the "shining light" of the team. Sanders, guard for Indiana, was hurt by a fall early in the game and retired in favor of Bossert. Hadley retired, W. Curry going in at guard in the last few minutes of play.

In the first half, Rose kept the lead for the first fifteen minutes—until I. U. passed them mainly through the aid of nine points made one at a time by Cook. The score at the end of this half was 21 to 15 in Indiana's favor.

In the second half, however, Rose played well to play an uphill game against so many men and despite this fact gained the lead, which they kept until the last few minutes of play. In the second half the only field goal made by I. U. was the one which won the game, made in overtime.

Indiana made seven field goals and fifteen foul goals; Rose made seven field goals and eight foul goals. I. U. had one point awarded them, while Rose was given two.

A feature of the evening was the umpiring of Pritchard, of the Indianapolis Y. M. C. A.

Lineup and summary:

INDIANA.		ROSE.
Cook,	Forward,	Shickel
McCoy,	Forward,	Webster,
Martin,	Center,	Trueblood
Sanders, Bossert,	Guard,	Lindeman
Quinn,	Guard,	Hadley, Curry

Field goals—Mc Coy, 3; Martin, 4; Shickel 2; Webster 3; Trueblood, 3; Lindeman.

Foul goals—Cook, 15, Lindeman, 8.

Fouls—Indiana, 14; Rose, 19.

Points awarded—Indiana, 1; Rose, 2.

Referee—Mr. Chas, C. McCormick, Rose, '04.

Umpire—Mr. Pritchard, Indianapolis Y. M. C. A.

Halves—20 minutes.

Overtime—2 minutes.

The following gives the number of scheduled games participated in by each man, his field goals, foul goals and fouls:

	No. of Games	Field Goals	Foul Goals	Fouls	Total Points Mada
Trueblood	15	45	0	40	90
Webster	15	46	0	31	92
B. Shickel	15	40	40	21	120
Lindeman	14	41	40	80	122
Hadley	12	2	0	31	4
W. Curry	5	1	0	3	2
H. Shickel	2	0	0	0	0
Schmidt	2	3	0	2	6
Nicholson	1	1	0	0	2

SUMMARY OF SEASON.

Date	Scores	Where Played	Rules
Jan. 12	I. S. N., 16; Rose, 41	T.H. Y.M.C.A.	Intercollegiate
" 14	DePauw, 24; " 43	Greencastle	"
" 15	Purdue 41; " 18	Lafayette	"
" 18	Earlham 17; " 31	Richmond	A. A. U.
" 19	Miami U. 19; " 29	Oxford, O.	"
" 26	Wabash 56; " 12	Crawfordsville	Intercollegate
Feb. 2	Hanover 19; " 49	T.H. Y.M.C.A	A. A. U.
" 4	U. Flexner Sch'l 18; Rose 50	Louisville	"
" 5	N. A. Y.M.C A. 29; Rose 36	New Albany	"
" 6	Indiana U. 30, " 20	Bloomington	"
" 9	DePauw 18; Rose 19	T.H. Y.M.C.A.	Intercollegiate
" 16	Wabash 37; " 28	"	"
" 21	I. S. N. 10; " 23	I. S. N.	"
" 23	Purdue 33; " 22	T.H. Y.M.C.A.	"
Mch. 2	Indiana 30; " 28	"	A. A. U.

Opp. 397; Rose, 449.
Won, 9. Lost, 6.

With basketball as a thing of the past, baseball and track will hold the boards until June. Just where we will rank in these two branches of athletics, is something we cannot predict. However, baseball hopes are high, even though the team will likely be shaken up considerably from last year and new men fill places on the team.

Manager McDaniel has arranged a heavy schedule and many teams will be seen here for the first time. The schedule to date is as follows:

April 13—Franklin, at Terre Haute.
" 20—Indiana, at " "
" 27—E. I. S. N., at Charleston.
" 29—D. P. U., at Greencastle.
May 4—Open.
" 11 Open.
" 25—Lake Forest U., at Terre Haute.
" 27—Indiana, at Bloomington.
" 30—DePauw, at Greencastle.
June 1—Armour Institute, at Terre Haute.
" 8—E. I S. N, " " "

Games with Jas. Millikin University and I. S. N. are promised, but dates have not been fixed upon.

Mr. T. L. Condron, '90, addressed Rose students in the Assembly Hall on Feb. 19th, illustrating his talk with a great number of lantern slides.

After a brief explanation of the nature of reinforced concrete, for the benefit of those who had not studied the subject, a diagram of an apparatus for testing the bond between concrete and steel was thrown on the screen and explained. A number of graphical representations of tests followed. The large water filtration plant at Indianapolis was described, with a number of views of the concrete work in the structure; several concrete-steel buildings were spoken of and described with the aid of numerous views showing the process of construction. Some thirty views of various bridges, chimneys, round houses, viaducts, sewers and culverts were shown and described.

As Mr. Shickel desired to speak to the student body, the meeting was given into his charge after the conclusion of Mr. Condron's address, and on his suggestion, nine rahs for Condron were given with a will. An impromptu meeting of the Rooters' Club was held and arrangements made for noise at the basketball game with DePauw that evening.

DIFFERENTIALS.

Stock, '08:—"If Jojo asks me what a musical interval is, I'm going to tell him that's when the orchestra goes out to get a drink."

Hunley, '08:—"I wish I could find the freshman again that met me in the hall and asked, 'Is your name Isenberg?' "

Uhl, '08:—"When you're a cow-puncher out around Cheyenne, you don't sleep in a tent, you sleep right out in the heat——"

Stock:—"O, well, out there the heat is intense."

Hammond, '09, and Barthels have been initiated into the P. I. E. S. fraternity.

"Jojo" (on sound):—"You just imagine your head was up there coming down."

G. W. Trenary, a former '09, was a recent visitor.

"Jojo" (on Light):—"The red wave has the greatest wave-length."

Bernie:—"Is that why they use the red light for a danger signal?"

GEOMETRIC PROPOSITION.

Boys come to school to improve their faculties. The teachers are faculties. Conclusion: Boys come to school to improve their teachers.—*Ex.*

Trueblood (as the basketball team enters the diner on the Louisville trip):—"Well, I guess here's where we dynamite."

Stock, '08:—"I go to the barber for a shave when I have the price, and when I haven't I get shaved on my face."

Prof.:—"Decline '*Das Bier.*' "

Student:—"I do."

Prof.:—"Do what?"

Student:—"Decline."—*Ex.*

Jimmy, '07 (with a handful of bits of chalk):—"Here, have some "chalk"olates."

Thompson '10 (in Trig):—"Do we have to work problems during Lent?"

Mac:—"Yes, thats' part of your penance; I get mine in reading your papers."

Wicky:—"Organic chemistry is that which has to do with organized bodies; for instance, a crystal is an organized structure, so the chemistry of a crystal would be organic."

Hitch your wagon to a star. If its the water wagon, hitch it to the Great Dipper.—*Ex.*

McDaniel, Schofield and Wickersham, of the senior mechanicals, recently obtained a half dozen bottles of chimney gas for analysis from the flue from a boiler which had been cold for two days.

Larsen, '10 (translating "*Die Wellen verschlingen Schiffer und Kahn*"):—"The boatman—er—Mr. Bennett, I don't know what *verschlingen* means."

Mr. Bennett: —"*Verschlingen* means to swallow or devour."

Larsen:—"Oh, yes—the boatman swallowed a wave and—er—and choked."

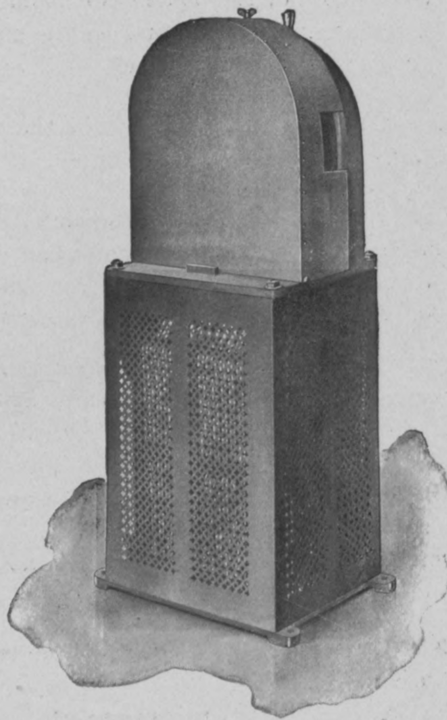
Our Clarence Sproull's a gentleman on whom there are no flies.
He walked up to a telegraph pole and cried, "Ah, there! My size!"

With the coming on of spring the Glee Club has taken on signs of renewed vitality and has, like the early feathered songsters, burst into melody. On Feb. 15 the Glee Club gave one of its concerts at the Maple Avenue Church to a large and appreciative audience. On Feb. 19 a similar concert was given at Grace Church, corner South Fourth and Willow streets. The club began its out-of-town engagements by a concert held at Clinton Friday evening, March 8.

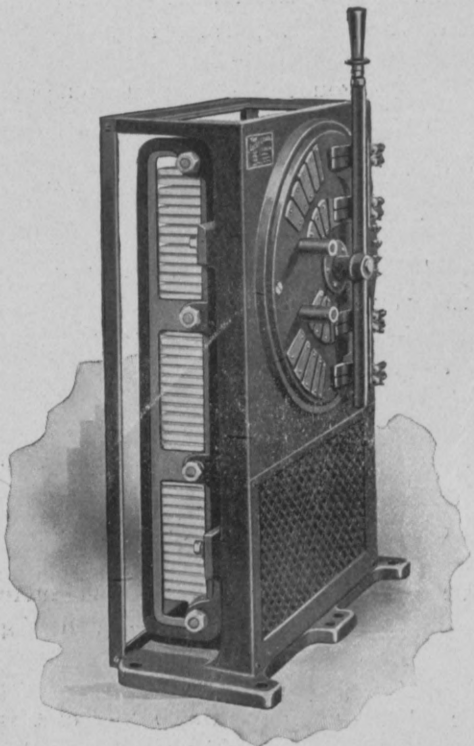
REVIEWS.

A New Line of Controllers.

THE Electric Controller & SupplyCo.,of Cleveland, Ohio, are placing upon the market a new line of controllers termed Type "G," which have a rating of 1 to 50 h. p. These controllers were built to meet the requirements of general crane service where the conditions are not severe enough to demand the use of the Dinkey Ventilated Controller. The Type G-3 and G-4 Controllers are built with coil resistance and the Types G-5 and G-6 Controllers are built with cast grid resistance. When it is desired to place controllers above or in the rear of the operator the Type "G" Controller is furnished arranged for under lever operation. They are also furnished with spring return for operation from the floor by means of pendent ropes or chains. A number of crane users have decided that a 15 or 20 ton crane requiring a 25 or 30 horse power motor on the hoist and bridge motions may be operated from the floor by any of the men in the shop, thus saving the wages of a crane operator who probably would be idle half his time. It is a very simple matter to put cutouts at either end of the trolley travel and at either end of the runway to prevent accident. The Type "G" Controller meets this demand for a controller up to 50 horse power arranged for operation from the floor by means of ropes. This controller is a self-contained unit, the resistance being placed in the frame, making it necessary to run only four wires between the controller and motor. Reversal is accomplished by the use of a single lever, no separate reverse switch being required. The Type "G" Controllers are self-contained, compact, and accessible. All parts are made to jig and are interchangeable. The contact face is of heavy slate free from metallic veins. The segments are of copper, which are screwed to brass lugs, to which all wiring connections are made. By this construction any of the contact



Type G-6 Controller. ¾ front view, case on.



Type G-5 Controller. ¾ front view, case off.

segments can be removed and replaced without disturbing the wiring connections. The contact arm is of soft cast iron and carries the fingers and finger holders, the insulation of which is of heavy pressed valcabuston bushings. The contact fingers are of dropped forge copper of great hardness, and may be removed and replaced without removing the contact arm. A powerful and effective blow-out is provided in all sizes of these controllers. The frame for Type G-3 and Type G-5 Controllers consists of a main casting in one piece provided with a cover, the removal of which affords easy access to all resistance connections. The case enclosing this frame is of perforated steel, thus allowing ample ventilation. The frame of the G-4 and G-6 Controllers consists of a bottom casting which supports the resistance, and a top casting which supports the contact slate and arm. The top and bottom casting are connected by means of four steel corner posts, around which a casing of perforated steel is provided for ventilation and protection to resistance. The top casting of G-4 and G-6 Controllers supports the contact slate which is completely covered and protected by a sheet steel casing. This protects the operator from coming in contact with any live parts of the controller, and also protects the working parts of the controller from dust and dirt. Easy operation is secured by a lever which is keyed to the arm shaft at the back of the top casting, which gives a short movement of about 10 inches in either direction for both starting and reversing. The resistance for the G-5 Controller is a single bank which may easily be removed as a unit without disturbing the other parts or moving the controller. The resistance for the G-6 Controller is made of two banks supported on bars attached to the frame, and may be removed in separate units without disturbing the other parts. The resistance for Type G-3 and G-4 Controllers is made up of Type E coils which consist of a heavy asbestos tube stiffened by means of a central brass tube which serves to bring the rear terminal forward, facilitating the necessary connections. These controllers are very adaptable for service up to 500 volts. Six points of control are provided with G-3 and G-5 Controllers, and eight points of control with the G-4 and G-6 Controllers.

The Wtlliamsbridge Wreck.

The Railroad Gazette for February 22nd gives the following account of the wreck of the New York Central & Hudson River electric train:

"On Saturday evening, February 16, the New York Central & Hudson River train No. 25 X, a White Plains local express, scheduled to leave the Grand Central Station, New York, at 6:12, was derailed near Williamsbridge, 10 miles from the Grand Central. The train consisted of two electric locomotives, with one smoking car, one combination car and three coaches. The combination car and three coaches were thrown on their sides, and dragged in that position something like a car length. Eighteen passengers were killed at the time and three died up to the following Monday at the hospitals, making a total of 21 so far killed. Four others are in the hospital in a dangerous condition, and 140 others were injured. The reason given for hauling this train with two electric motors instead of one is that the contact shoes on the right hand side of one motor and the contact shoes on the left hand side of the other motor had been removed, so that to insure continuous contact the two motors were used. The motors are 37 feet long, measured over the buffers; they have a leading radial truck, eight drivers coupled, and a trailing radial truck. The rigid wheel base is 13 ft. long; the total wheel base is 37 feet; the weight is about 190,000 lbs. The cause of the derailment is not definitely known, but it seems beyond question that the trouble began with the trailing radial truck of the leading locomotive. When the train stopped, the leading truck of this locomotive and the coupled wheels were in their place on the rails, uninjured, while the trailing truck was broken and standing astride the right hand rail. At the point where the trouble began the curvature was 3 degrees and the elevation of the outer rail was 4½ in. All the evidence so far obtained indicates that the speed was about 50 miles an hour and so far no evidence has been developed to controvert this. The general dimensions and weight of the high-speed steam locomotives used for many years, in similar service on the New York Central are as follows: Over all length, 36½ ft.; weight 200,000 lbs. The center of gravity of the electric locomotive is lower than that of the steam locomotives. The derailment was due to a violent spreading of the track under such stress that the spikes were sheared smoothly on a level with the surface of the tie plates. The track was of the strongest type of construction, with 100 lb. rails, tie-plates, 16 to 18 ties to each 30 ft., bedded in rock ballast. The fact that the spikes were sheared is, so far as it goes, proof that the track was strong, and that the elevation of the outer rail was sufficient to resist a turning movement. The summary up to the date of this writing is simply the location of the trouble at the trailing truck of the leading locomotive and the development from that point of such severe stresses as to spread the rails and leave the following cars to their fate."

Evolution of Flue Cleaning.

"The removal of scale deposits from boiler tubes was one of the slowest items in the care of locomotives to develop into a rational operation in keeping with its importance, for the reason that the cheapest way out of it was always thought good enough.

A history of flue cleaning dates back to the time when scales were laboriously picked off by chisels in the hands of the cheapest labor. The next stage witnessed was what was thought to be a remarkable improvement, in which two large, half-round files were driven into the top of a wooden horse, leaving the edges in the form of an X. This tube rested in the angle thus formed and was pulled back and forth against the edges of the files until the scale was removed.

These two methods continued until a revolving drum of flue length and taking in a part of a set at one time, was brought out. Here the flues were rid of scale more thoroughly than by any other process, simply by friction and gravity, and this principal has been worked out in all the later devices of the kind, but with improvements in details that leave but little to be desired.

Later an attempt has been made to accomplish the same results by heating the tubes and plunging them into a tank of cold water. This process removes scale very thoroughly, but has the disadvantage of leaving the tubes bent, which entails an expense for straightening.

All of the methods cited except that last mentioned have been accomplished by dust and din that called down the execration of all in the vicinity. To eliminate these objectionable features the whole device has in many cases been placed underground and made to revolve under a stream of water. One of the latest improvements in this line is a brick structure erected especially for the purpose; of a size large enough to take in the flue cleaner and its motor, which is separated from the cleaner by a partition. When the doors of the house are closed, all dirt and racket are confined within the walls of the building. The scheme is a revelation of refinement not often seen in rough work—and it pays."—*Railway Master Mechanic.*