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THE TECHNIC.

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EXAMINATIONS are over, and the brief holidays following in their wake have gone. Nearly all of us have paid a visit to the Registrar's office, some to come out rejoicing, others to find that they were no longer considered members of the Institute. To these few we bid farewell, for we're sorry to see you go, each one of you.

But to follow the rejoicing many. We step out into the hall, and there, staring at us from behind its frame, is the hour plan for the second term. And such an hour plan! In bold letters we see proclaimed to us that we shall remain in school until five o'clock each day. Gentlemen of the Faculty, do you appreciate what this hour plan says to us? It shakes its fist in our faces and says, "You shall have no athletics!"

Now, as to the reasons for this new order of things: First and foremost, an attempt has been made to more evenly distribute the recitations throughout the week, and to avoid bunching too many on one day. So far as we can see, efforts along this line have been productive of very little good. Three and four recitations a day are no uncommon occurrence with the new schedule. Before the change the Junior class was the only class to have as many as five in one day, and one of these was Economics, for which no preparation was required. We conclude, therefore, that no improvement in this direction has been brought about by the change.

According to the old hour plan, some few electives came from four to five in the evening. This was probably unavoidable, but we can not see why this can be given as an argument in favor of having all students due until five o'clock every day. Just because a few students are unfortunate enough to be due until five on some days is hardly a good reason for thrusting the same misfortune upon all students.

To break up loafing on the streets is another alleged object of the change. Loafing is undoubtedly a bad thing, as well for the loafer himself as for the good name of the Institute. But we fail to see how moving up the afternoon program is to change the present state of affairs. There are about a dozen fellows who make a habit of loafing, and they would just as gladly loaf from one o'clock till three, as from four to six. To us it seems unjust, therefore, to punish the entire student body for the acts of a few, especially when it seems hardly likely that the punishment will have any effect on the few.

The effect that the new hour plan will have on athletics is evident. Boarding-house keepers can not be induced to serve supper much after six o'clock, or what is equivalent, students can not be induced to remain out for practice later than six. If we allow fifteen minutes for the necessary change of clothing and bath, there would be left for actual practice about three-quarters of an hour each day. This time is entirely insufficient for a team which is to accomplish anything.

We have tried to bear in mind that athletics should not be made the all-important feature of our college lives, but we believe, and have statements from members of the Faculty to strengthen our belief, that athletics, as carried on at Rose, that is, considered as a diversion and relief from our sterner duties, is productive of great good.

As an avoidable and undesirable condition of things, we feel justified in condemning the hour plan now in force, and know that we are voicing the sentiment of the majority when we recommend that the Faculty take any steps possible to change back to the old plan.

To the Editor of The Technic:

So far as may be judged from any reports of meetings, published in THE TECHNIC, the Rose Scientific Society has been practically dead for the past two years. This being a matter much to be regretted, I venture to address to you, and through you, to the students of Rose, a few words in regard to this matter.

As a former President of the society, I fully appreciate the difficulty of arranging a successful schedule of meetings; at the same time it is a proven fact that it is possible to do so. Nor is it quite fair for the officers of the organization to lay the entire blame on a lack of interest on the part of the student body. There is always a certain natural reluctance on the part of any student to appear in the role of a public speaker, which hesitation, of course, requires effort on the part of the officers of the organization to overcome. It has been my observation that the society's success bears a direct ratio to the amount of effort that those in charge are willing to make. The value of the club is not often appreciated by the students; it is nevertheless very real, both in information to the listener and in the facility of expression acquired by the speaker. It is, therefore, by no means time wasted, for the student, already busy, to prepare a paper for delivery before the society.

May I not, therefore, urge upon the officers of the Scientific Society a sense of their duty in aggressively pushing the affairs of the club and upon the students the necessity of actively responding to the advances of the officers, in order that a valuable organization may not die for lack of a little effort. HARRY A. SCHWARTZ,
Rose, '01.

We agree heartily with Mr. Schwartz in his statement that the condition of the society is greatly to be regretted. Last year no papers were given, and to all intents and purposes, the society was dead. During the present college year, President Delle has succeeded in bringing it back to life, and so far five papers have been read. While we commend this good work on the part of the officers, we still think that more interest should be shown by the students at large. The attendance at meetings has been far from satisfactory, as sometimes hardly more than a dozen men listened to the papers presented. Members of the Faculty have seemingly forgotten that they, as well as all students, are invited to attend. More papers should be presented, and if possible, illustrated with lantern slides.

Let us then, Faculty and students, get together and see if we cannot bring the Scientific Society back to the position it occupied several years ago, and we may rest assured that the enjoyment and the good we get out of it will amply repay us for our time and efforts.

FOLLOWING in the footsteps of those who have gone before, the Senior Class held an informal celebration on the occasion of its last recitation period. The second term of the Senior year is taken up in office work, laboratory, shop and thesis, so that January 22nd was the closing day for all regular class work.

At a few minutes of four, an alarm clock gave the signal. "Nine rahs for Waggie" were given, and then the fun began. Blank cartridge pistols, tin horns and cow-bells joined in to make "the durndest noise you ever heard." Then the class yell was given, and the boys once more became dignified Seniors, feeling sure that in the way of making noise they had filled all expectations.

SINGLE PHASE TRACTION.

By N. H. WILLIAMS.

IN the industrial history of the world no more remarkable chapter occurs than that relating to the last twenty years of electric railway development. Eighteen years ago there were about 100 electric cars in the world. Six years later there were 55,000.

The first cars were supplied with about ten horse power. The new locomotive on the N. Y. Central develops 2,250 horse power and fills the place of one of the best modern steam locomotives. $2,500,000,000 represents approximately the investment in this country alone in electric railway apparatus during this brief period. This is 50% more than the investment in all other electrical industries combined.

In view of the important bearing that the electric railway has upon both social and commercial progress, any system which promises improvement in efficiency or service becomes at once a thing of interest.

In the early days of electric lighting the direct current was used at 110 volts pressure. This voltage was determined by the fact that incandescent lamps could not be made that would work satisfactorily on a higher voltage.

The first central stations were those in London and New York, each having a capacity of 3,000 lights, requiring a current of about 2,700 amperes, since 100 watt lamps were used. To distribute 2,700 amperes at 110 volts over any considerable territory, without excessive line losses on the one hand or enormous investments in copper on the other, is impossible.

It soon became apparent that progress demanded a higher voltage and lower current. If 2,200 volts could be used instead of 110, the current for the same power would be one-twentieth as large and the line drop for the same conductors one-twentieth, which means that for a given conductor the percentage drop would be $\frac{1}{400}$ as large. Hence it becomes possible to distribute current twenty times as far with the same weight of copper and the same percentage drop in voltage.

The high voltages were made possible by the introduction of the alternating current. The simplicity and efficiency of the alternating current transformer are rather remarkable. A laminated iron core wound with two coils of insulated wire constitutes the apparatus by which currents at one voltage may furnish the energy for producing currents at any other voltage and of almost equal energy. The high voltage currents were transformed to 110 volt currents where they were to be used and hence the transmission was accomplished at high pressure and consequent small losses.

The electric railway was no sooner in successful operation than a demand for long lines became apparent, and the same difficulties confronted the engineers that had been successfully met in the field of electric lighting. The problem was not so easy as the earlier one, because the alternating current was not so easily applied to running motors as to operating electric lights.

It became necessary to convert the current to a direct low potential current before it could be used.

The majority of the long lines now in use are operated by the system which grew out of the necessity of the hour. It is in brief this: A three phase alternating current at comparatively low voltage is developed at the central power house. This is transformed to a high voltage three phase current. 15,000 volts is used in many cases. The high voltage current is transmitted to sub-stations along the line, where it is transformed to a low voltage three phase current and again by rotary converters to the 500 or 600 volt direct current that is supplied to the trolley lines.

It will be understood that these sub-stations can not be far apart, and furthermore that their maintenance is a considerable item of expense. If it were possible to use the single phase alternating current, as for electric lighting, the problem would be greatly simplified. One wire might take the place of four; a single static transformer on each car would supply the current to the motors, and the sub-station, with its expensive apparatus and skilled attendant, would no longer be needed. It would be strange if many engineers were not attracted by the problem, in view of the advantages to be gained by its solution.

Incidentally some defects of the system now in use on city lines may be mentioned. When the ordinary car is starting, while the force applied is large, the speed is so small that the power used is a minimum. The power taken from the lines is, however, a maximum at such times, the large share of it being a heat loss in the controller and motors. This results in large fluctuations in the load on the generator and hence in reduced efficiency at both ends of the line. If a car stops at every crossing, its speed is either accelerated or retarded a large part of the time. With the present system, all the energy used in getting up speed is lost in a few seconds at the brake shoes.

The electrolytic effect of direct currents on water and gas mains frequently proves disastrous and has in some cases led to troubles involving expensive repairs. With the alternating current these troubles would disappear. A few years ago all these things were of minor importance, the question of supreme interest being whether the car would go at all.

The opinion of engineers for some time has been that heavy traction and long distance rapid transit would ultimately be accomplished through the use of alternating currents.

Of all the systems that have been proposed, one or two only can be considered as having reached the commercial stage in their development. Most of us are familiar with the experiments two years ago at Zossen, Germany, whereby a speed of over two miles a minute was attained. Here the three phase induction motor, supplied with current from three trolley wires, was used. The experiments attracted considerable attention, but engineers were not slow in condemning the three trolleys as impracticable, and to-day interest seems to be centered in single phase apparatus.

Among the first serious advocates of the single phase equipment was Mr. B. J. Arnold. As early as 1900 he opened the discussion at the meeting of the American Institute of Electrical Engineers. In June, 1902, he presented a paper explaining his system in detail. At this same meeting Mr. H. Ward Leonard mentioned his locomotive under construction at that time at the Oerlikon Works in Switzerland. In September, 1902, Mr. Lamme, chief engineer of the Westinghouse Works, presented a paper describing a single phase motor which he had developed.

By studying a little more in detail these three systems we shall have a general idea of the work so far done along these lines.

Mr. Arnold built his first locomotive to run on an experimental road, running northeast from Lansing, Mich. The essential features of the system are as follows: The power is taken from an overhead trolley wire at about 15,000 volts and transformed to any convenient low voltage to supply a single phase induction motor so mounted that both rotor and so-called stator are capable of rotation about the same axis. (See Fig. 1.) The rotor is geared to the axle of the car and it also operates, by means of a crank, the piston of an air compressor.

The stator, when in motion, operates the piston of a second air pump. When the car is in use the motor runs all the time at nearly constant speed and hence maximum efficiency. The power not actually used at any time in running the car is used in storing air in tanks under pressure. If the car is to run at full speed, the stator stands still and the rotor is in motion. If it is to climb a grade the motor may be supplemented by the air already stored acting through the compressor now running as an engine. When the car is to be stopped the valves are so shifted that the rotor compressor is pumping air and the stator is released. Thus the energy of motion of the car is stored in the tank and the car is brought to rest. In the meantime the stator is accelerating so that the motor continues to run at normal speed and normal load, and air is pumped by the other compressor.

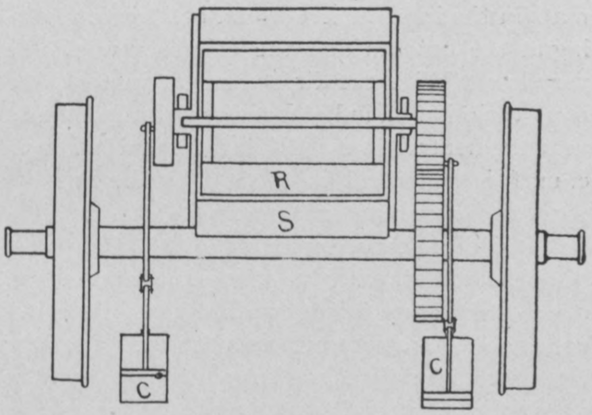


Fig. 1.

The advantages of such a system are obvious. Each car becomes an independent unit capable of running for some distance on the energy stored in the compressed air. Where high tension lines are undesirable, as in villages through which the road passes, the trolley lines may be omitted. Where the sidetracks are numerous, it would not be necessary to furnish each with a trolley line. Any speed is possible up to and even beyond synchronism.

The energy usually lost in stopping the cars is saved, since the compressors furnish the braking action. Any of the single phase motors may be used in connection with this system.

The Ward Leonard system of motor control was first proposed in 1891, but it was not considered in connection with railway work till recently, when it was given a rigid test at the Oerlikon Works.

The system, at first thought, seems complicated, but it certainly has some advantages over the others that have been tried. Power is taken from the trolley line and after transforming to a low voltage is delivered to a single phase induction motor that runs continuously while the locomotive is in use.

This motor drives a direct current dynamo, the two being combined in a single motor-generator.

The direct current from this second machine is applied to the traction motors. The control is accomplished by varying the strength of the dynamo field, and thus the opening and closing of circuits carrying heavy currents is entirely avoided, and furthermore the braking is accomplished through the electric system and power is returned to the line whenever the motion is retarded.

To stop the car it is only necessary to reduce the field strength of the dynamo until the e. m. f. generated is less than the counter e. m. f. of the motors. They then become generators and the energy of motion of the car is reconverted into electrical energy and sent back through the dynamo now acting as a motor, then to the alternating current machine and thus to the line. The braking occurs only because of the motion of the motors and skidding is impossible, since if the wheels should stop turning the magnetic force tending to stop them would instantly disappear.

The system is easily adaptable to almost any conditions. If an interurban road is to enter a city, the power from the 500 or 600 volt trolley line may be turned into the direct current motors, two in series, while in the country the single phase alternating current at high tension may be used.

The chief disadvantage is the great weight of the equipment, which, for locomotives, is not undesirable, but for individual cars becomes a decided drawback.

There remains to be considered the Lamme system, which is being pushed by the Westinghouse Co. It is certainly making its way, probably because of the enterprise back of it, as well as because of its simplicity and its easy adaptability to existing conditions. The system consists merely in the use of a series motor built especially to operate on a single phase alternating current, the power being taken from the trolley line at high voltage and transformed on the car to a low voltage suitable for use by the motors.

That seems extremely simple, but until recently it has not seemed within the range of the practicable, even if it were possible. The solution of the problem lay in the designing of a motor that would operate on a single phase current and be comparable in efficiency to the direct current machine.

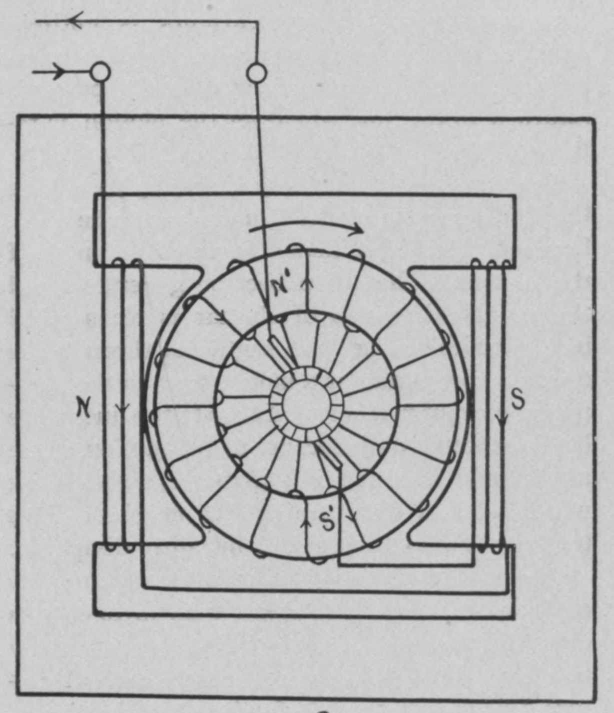


Fig. 2.

There is nothing exactly new or striking in Mr. Lamme's invention, but to him and to the Westinghouse Co. is due the credit of having put single phase traction on a commercial basis. Considering the relation of this system to future development, it will be interesting to study the series motor a little.

Figure 2 represents a series motor supplied with a direct current. The ring armature is pictured because it is simpler than the drum, although the latter would be used in practice; also a multipolar machine would be used instead of a bipolar motor as shown in the figure.

If we trace the circuits around the iron cores, it is evident that magnetic poles will be developed as shown and that the armature will rotate in the direction of the arrow.

If the current were reversed, all poles would be reversed and the armature would continue to rotate in the same direction. If, then, the current were an alternating current, the motor should run, and it would, but not satisfactorily. The magnets would get hot from the eddy currents in the iron. There would be furious sparking at the brushes and the efficiency would be very low. With the direct current motor there is no variation of induction through those turns near the neutral line at N′ and S′, and hence no e. m. f. is generated in them. As the brushes span two commutator bars and short-circuit a coil it is of no consequence.

With an alternating induction in the armature, a secondary e. m. f. is set up like that in the secondary of a transformer and the coils near the line of commutation are in position to get the maximum effect of this varying induction and, as they are short-circuited, large currents are generated in them and consequent sparking at the brushes occurs.

This difficulty is overcome in the Lamme motor by inserting sufficient resistance between the armature coil and the commutator segment to cut down the current in the short-circuited coil till neither the coil nor the commutator is damaged by it. The field magnets are made weaker than is usual with direct current motors in order to decrease this inductive effect.

The heating of the magnets is avoided by laminating the cores as in the case of transformers. The self-induction of the armature of an ordinary motor would interfere very decidedly with the flow of an alternating current through it. Compensating coils are used on the alternating current motor to partially neutralize this self-induction. They are wound in slots cut along the pole faces parallel to the armature axis, and each coil spans the space between two poles. These coils are usually in series with the field and armature, but if each coil constitutes a separate closed circuit the induced currents set up in them are quite effective in reducing the self-induction of the armature.

These machines give results which are comparable with those shown by continuous current motors, and furthermore they will run quite satisfactorily on a direct current, and hence are well adapted to running from interurban lines with their high tension alternating currents to the city lines equipped with direct current apparatus.

The control of alternating current motors can be accomplished by means of rheostats such as are used on the cars run by direct current, but the alternating current furnishes better methods. The simplest device adopted by the Westinghouse Co. is displacing all others. An auto-transformer is used for changing to low voltage on the car. This differs from the ordinary transformer in having one coil instead of two, the secondary being a part of the primary. One end of the transformer circuit is connected to the trolley and the other end is grounded through the wheels and the rails. A series of taps are led from the transformer conductor near the grounded end. By shifting the motor connection from tap to tap the voltage may be varied between certain limits as few or many turns of the transformer coil are included in the motor circuit. The motor circuit is not broken by this shifting of connections and choking coils are used to prevent excessive current in that part of the transformer coil that is short-circuited. It will be seen that only the power actually used is drawn from the line, whereas with direct currents only the full line voltage is available.

A number of roads equipped with single phase apparatus are now in successful operation and the number is rapidly increasing. Two of these are in Indiana.

The great 135-ton locomotive which was exhibited by the Westinghouse Co. to the delegates to the International Railway Convention last May is the first single phase locomotive built for heavy traction. In test it handled a train with ease that was a heavy load for one of the largest steam locomotives on the Pennsylvania road. A steady draw-bar pull of 65,000 lbs. was developed. The locomotive is built in two parts complete. One-half of it has handled this same train successfully with a draw-bar pull of 49,000 lbs. The locomotive is equipped with six 225 h. p. motors designed to run at 320 r. p. m. at full load. The current is a 25-cycle 6,600 volt current and is taken from an overhead trolley line by a sliding shoe or pantagraph trolley. It is transformed on the car to a normal voltage of 325. The commutation proved satisfactory and

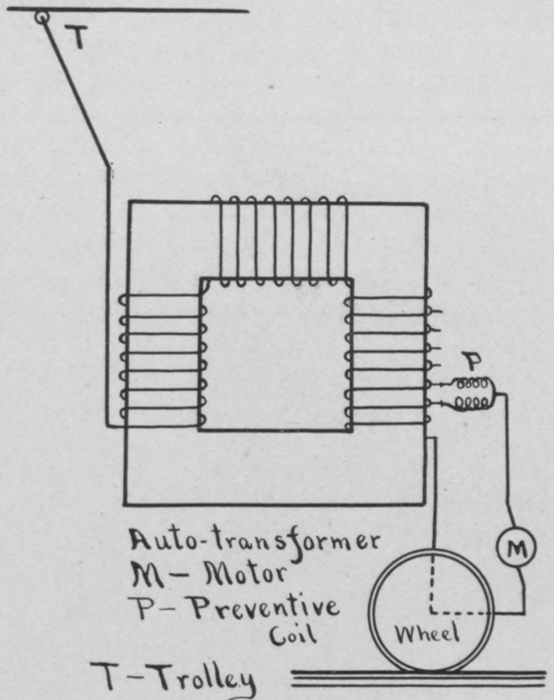


Fig. 3.

the efficiency was 86.6% at normal load, and at half load it remained practically the same. The power factor was 86.5% at full load.

That the N. Y. Central should equip its terminals with the direct current apparatus at this time raises the question as to whether it was thought better than alternating apparatus. This certainly seems significant, yet if we consider the pressure brought to bear by legislation and the immediate necessity of a system, thoroughly tested and certain of success, it is not difficult to account for their decision. Mr. Sprague, who was influential in deciding in favor of the direct current, has recently defended the action of the committee at some length in the *Electrical World*. The influence of this action by the N. Y. Central is largely counteracted by the announcement made last September that the New York, New Haven & Hartford road had ordered twenty-five new single phase locomotives for its New York terminal work. They are bought at an expense of $30,000 each. Each locomotive will weigh 78 tons, will develop 1,600 h. p. and be capable of a speed of 60 miles an hour with a 250-ton train.

An illustration of the advantage of single phase equipment is to be found in the experience of the Indianapolis & Cincinnati Traction Co. The company had already contracted for three phase generators when the single phase came to be considered as practicable. The plans were changed and the single phase system adopted. The three phase generators were still available, as the current could be transformed to two phase currents and different sections of the line operated from the two phases. The change effected a saving in first cost of half a million dollars on 93 miles of road.

When this is considered, together with the decrease in operating expenses, it leads to interesting speculations regarding the future of electric traction.

ALUMNI NOTES.

Mr. Arthur L. Robinson, Jr., '15, is now in Panama, in the capacity of Master Mechanic for the Panama Railroad Company, and his address is: Care of Panama Canal Commission, Culebra Cut Division, Panama.

Frank J. Jumper, '99, and Charles H. Jumper, '02, have taken positions with the Union Pacific Railroad, at Omaha, Neb.

E. E. Larkins, '05, who has been in Chicago with the Chicago and Eastern Illinois R.R., since his graduation, has gone to Omaha with the Union Pacific.

William S. Menden, '91, formerly Chief Engineer for the Metropolitan West Side Elevated Railway, of Chicago, is now in Brooklyn, N.Y., as Chief Engineer of the Brooklyn Rapid Transit Company.

Charles J. Larson, 1900, has been made Erection Superintendent for the Eastern Territory of the Allis-Chalmers Co., of Milwaukee, with headquarters at 71 Broadway, New York. This territory comprises fifteen states.

Herbert E. Watson, '05, is with Mr. Larson, in New York, and they are testing the big Allis-Chalmers engine used for the Interborough Rapid Transit Co.

O. F. Osborne, '02, is now in the employ of the General Electric Co., and is at Chicago. He was formerly connected with the Allis-Chalmers Company.

Mrs. Helen Bloom
requests the honor of your presence
at the marriage of her daughter,
Carolyn Louise,
to
Mr. William Scott Hanley,
on Wednesday morning, January the twenty-fourth,
One thousand nine hundred and six,
at eight o'clock,
Church of the Immaculate Conception
Aurora, Indiana.

Mr. Hanley is of the class of 1905. He will make his home in Chicago, and will be at home to friends after February 14th.

While in Louisville, on the 30th of January, the Basket Ball Team was very fraternally entertained by the Rose Tech Club of that city. A banquet was prepared for them at the Galt House and as again at Chicago, when the Foot Ball Team was received by the Rose Tech Club there, (an event which we failed to report), the Alumni showed its characteristic goodfellowship and loyalty.

Mooney, '08, on his return to Rose from California, gives us this message: "Mr. Fred B. Lewis, of Los Angeles, who graduated last year from Rose, wishes to be remembered to the student body and the faculty. He is employed by the Edison Electric Company in their testing department."

HIGH TENSION MAGNETOS.

By ROBT. J. SCHEFFERLY.

THE improvements that have been made in nearly all the industries owing to the advent of the automobile are simply marvelous. In the electrical line great improvements have been made in primary and storage batteries, jump-spark coils and magnetos. When gas or gasoline engines were still in their infancy low tension magnetos and jump-spark coils were tried, but they were so unreliable that they were forsaken for the primitive hot-tube ignition. In the last year or two the manufacturers of automobiles and parts have been trying to get something out of the line of ordinary ignition and hence the development of the high tension magneto.

The first efforts along these lines were cumbersome affairs and so unreliable that it is a wonder that they have been able to recover from their bad reputation. The chief cause of failure seems to have been the deterioration of the permanent magnets and the breaking down of the insulation. The French, English and Germans were the first to make them successfully, but from present indications the Americans will not be far behind them.

Up to the season of 1905 very few magnetos of this type have found their way into this country except on imported automobiles. One firm in Detroit, "The Packard Motor Car Co.," has adopted "The Eisemann" magneto (German) and are importing them for their 1906 model. Many attempts have been made in this country to manufacture them, but as far as is known to the writer, only two will be used to any extent in the coming season of 1906.

Before going any further it might be well to consider the principles involved in high tension ignition in general. Figure 1 is a diagramatical

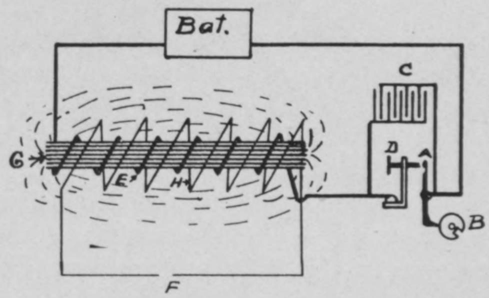


Fig 1.

representation of the electrical connections of the ordinary induction or high-tension coil with a cam actuated make and break instead of a vibration. In this illustration G is a bundle of soft iron wire forming the core of the coil. E is what is called the primary winding and consists of from two to four layers of coarse copper insulated wire (about No. 16 to No. 20). Over this is placed the secondary winding, H, consisting of probably 50 to 60 layers of No. 36 or No. 38 silk insulated copper wire. This secondary coil has no connection whatever with the primary coil and is generally separated from it by hard rubber, mica, mineral fiber, or even porcelain. One end of the primary is connected to the battery, while the other end is joined to the platinum tipped screw, D. The lever, A, carries a platinum rivet at the point where it comes in contact with screw D when released by cam B. Platinum is used for these contacts on account of its non-corrosive qualities and also on account of its high conductivity and infusibility. A condenser, C, constructed of alternate layers of tinfoil and paraffined paper is connected between D and A. A spring causes lever A to complete the circuit when released by cam, B, and the core, G, is magnetised to saturation. The lines of force take the direction indicated, and since they have been increased from zero lines to maximum, a current has been generated in the secondary coil, H, according to the law of induction. The electromotive force of this current varies according to the ratio of the number of turns in the secondary and primary windings and is also proportional to the rapidity with which the core is magnetized or demagnetized.

There is, however, a "lag" or contrariness in the core to assume the magnetized or demagnetized state owing to the self-induction in the primary coil, (caused by the rising magnetism of the core) which acts against the battery current. In the same manner the self-induction in the primary coil retards demagnetization when the current is broken. In the latter case, however, the self-induced current flows in the same direction as the battery current and hence tends to maintain the diminishing magnetism. This self-induced current, being of fairly high voltage, draws an arc at the circuit breaker and in this way also prevents demagnetization.

In order to obtain an effective secondary spark, at the time of breaking the primary circuit, a condenser is introduced as shown in the diagram. This condenser performs the following functions: 1. It absorbs the self-induced current, thereby preventing the destructive arc at the circuit-breaker. 2. The nature of the condenser is such that it repels this self-induced current with a force proportional to the quantity flowing in and thus quickly stops it. 3. As soon as one side is charged it discharges this current back through the primary in the opposite direction and continues until this current is dissipated. At each reversal a high-tension spark is induced at the secondary terminals. This series of events, however, happens so quickly that they all appear as one spark when the circuit is broken. These sparks in the ordinary coils will jump an air-gap of ¾ to 1 inch.

In the Eisemann System, used on the 1906 Packard, the magneto proper is only a substitute for the battery, as a non-vibrator jump spark coil with its condenser is also used. In Figure 2, representing this system, V is the armature and is wound round with coarse insulated wire. When this armature is revolved between the pole-pieces, R and S, which are magnetized by six permanent magnets, K, the wire cuts the lines of force and a current is induced which is led out to the two rings, J and I. When the armature reaches the position shown in the diagram it is cutting the most lines of force, consequently is producing the maximum electro-motive force. Up to this time the armature has been short-circuited. Just at this moment of maximum E. M. F. the cam, B, separates A and D and allows the current to take the course through the primary coil, changing its state from zero lines to maximum. In this detail the Eisemann system differs from the battery induction coil system, as the secondary spark takes place at the time of this "making" the circuit instead of at the time of breaking it. The reason why this can be done in this case is on account of the great rise of voltage in the armature due to the self-induction of its own coil. It really amounts to the same thing as the current which is self-induced in the primary of an ordinary jump spark coil when the circuit is broken. In this system the condenser is used as shown in the diagram and is enclosed in the wooden box containing the primary and secondary windings.

Figure 2 shows this system as applied to firing a four cylinder engine. One end, H, of the sec-

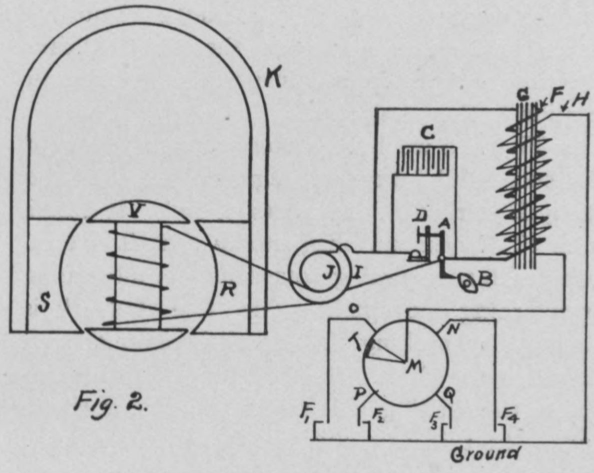


Fig. 2.

ondary is grounded to the engine, while the other end is connected to a rotating arm whose outer end, T, is always at one of the points, O, N, P or Q, when the secondary spark takes place. The insulated terminals of the spark-plugs, F_1, F_2, F_3 and F_4, are connected with these points and the high-tension current distributed among them in the proper sequence. Hence the name "secondary distributor" which is always applied to this part of the magneto.

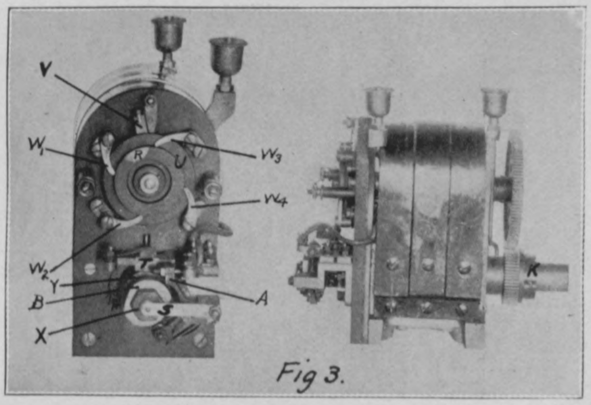


Fig 3.

In Figure 3 we have the external appearance of this magneto with the dust covers removed to show some of the working parts. The ends of the armature windings are connected to X and Y, with which the brush, T, and springs make contact. The distributor, U, receives the high-tension current from the coil through the brush, V. The brushes, W_1, W_2, W_3, W_4, distribute it to their respective spark-plugs as the segment, R, comes in contact with them. The cam, B, causes the lever, A, to make and break the circuit at the proper times. The shaft of the magnet is connected to the engine by means of a flexible coupling, or by means of gears, in such a manner that the spark takes place at the proper time. In order that this timing may be advanced or retarded at will, a special groove is placed in the shaft with a sliding sleeve, K, and key over it.

Another type of high-tension magneto which is really more deserving of the name, than the one above, is the Bassee Michel. It is not as well known as some of the other types, but its mechanical and electrical details are excellent. Its outward appearance is plain and neat and is very much like the small iron-clad induction motors.

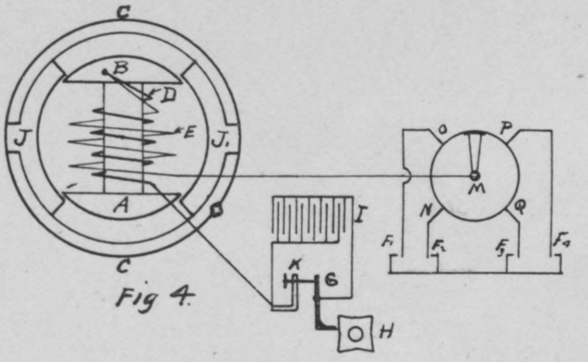


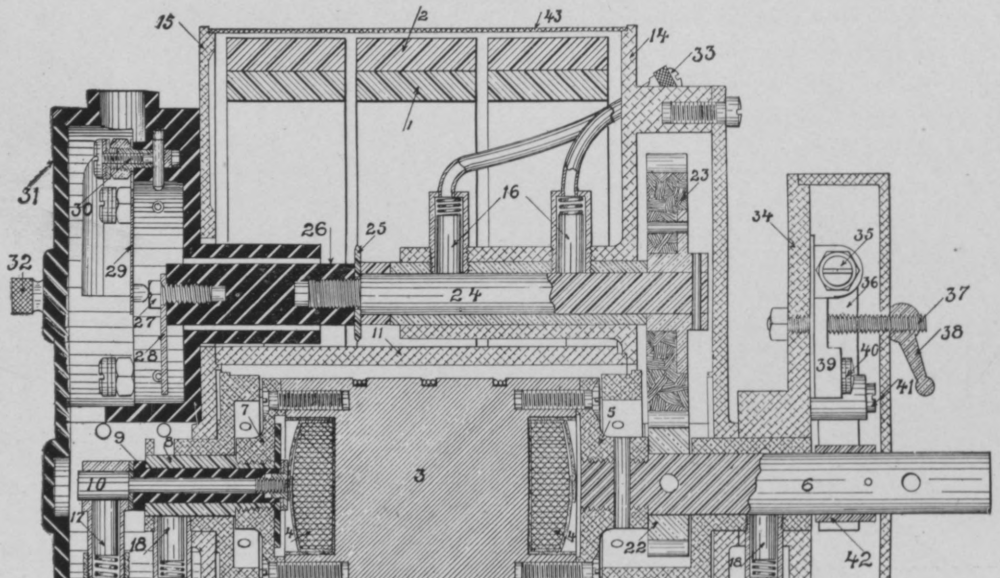
Fig 4.

Figure 4 shows a diagram of the electrical connections of this system. C and C_1 are permanent magnets which, together with the pole-pieces, J and J_1, form the fields. The magnets are semi-circular as in the diagram, and completely surround the armature. A is the usual shuttle-type armature, built up of sheet-iron laminae, and wound similar to the ordinary induction coil, that is, it contains both the primary and secondary windings. The beginnings of both coils are grounded at B, and the other end of the primary is led out through the shaft to the platinum-tipped screw, K, while the live end of the secondary is carried from the armature by brush contact to the secondary distributor. The platinum-tipped spring, G, normally is in contact with the screw, K. The condenser, I, is interposed between G and K for the same reasons as it is used in the simple induction coil. In the actual machine this condenser is made in two pieces and hangs over the outside of the magnets and the whole covered with a circular metal casing.

Normally the armature is short-circuited by having the live end of the primary in contact with the grounded spring, G. When the revolving armature reaches its position of maximum E. M. F. in the primary, the cam, H, breaks the circuit and a high-tension current is induced in the secondary as in the simple induction coil.

In the diagram these different parts are spread out for clearness, but in the magneto itself they are very compact and enclosed. The armature shaft is geared to the crank-shaft of the engine and the magneto is placed in a cradle. Thus by revolving the case containing the fields and cam the time of ignition is advanced or retarded in relation to the crank-shaft.

In Figure 5 we have a cross section of one of the successful American magnetos made by the Remy Electric Co., of Anderson, Ind. It differs from the Eisemann magneto in that it it does away with the spiral groove shaft for advancing or retarding the spark. The time of spark is changed by rocking the circuit-breaker around the armature shaft. To this circuit-breaker are locked the shifting pole-pieces and the armature ends. In this way, shifting the circuit-breaker not only changes the time of breaking the circuit but also changes the time of maximum current generation to suit. With this magneto is furnished a special non-vibrator coil with its condenser. At the speed of 25 or 50 turns of the



LONGITUDINAL SECTION, REMY HIGH TENSION MAGNETO.

1, Inside magnet. 2, Outside magnet. 3, Armature core. 4, Armature winding, wound in a double insulation of mica and fiber. Winding is taped, varnished, bound with steel binding wires and baked. 5-7. Hard brass armature ends. 6-8, Armature shaft. 9, Hard rubber and mica beston insulation. 10, Hardened steel conducting pin. 11, Top yoke of magneto frame (aluminum). 12, Bottom yoke of magneto frame or base (aluminum). 16-18, Felt wick oiler. 17, Conducting bearing. 19-20, Hard brass ends of shifting pole pieces. 21, Shifting pole pieces. 22, Small brass gear. 23, Fiber gear. 27, Hardened steel screws. 29, Steel distributor spring with hardened steel point. 31, Molded hard rubber distributor. 35, Contact screw. 37, Circuit breaking lever (aluminum). 39, Insulated block. 40, Primary terminal screw. 42, Cam. Nos. 19, 20, 21 and 34 are locked together. A timing angle of 110 degrees is possible.

armature shaft per minute, the makers claim a ½ inch spark and a spark 1½ to 2 inches in length at a higher speed.

There is no doubt but that there is still room for improvement in regard to size, weight, fewer parts, and reliability. The manufacturers are improving their machines from time to time and all are working for this same goal. The main difficulty seems to be with getting the desired strength of magnetism per square inch of magnet steel and then retaining it. The sparks produced by magnetos in general, differ more from the ordinary jump-spark produced by means of battery current than one would imagine. The sparks are usually short, red and very thick, and so much hotter than the ordinary sparks that an engine shows a marked increase of power when a magneto is applied.

One of the difficulties encountered in the type which carries its primary and secondary coils on its armature is the breaking down of the insulation. This is often caused by the spark-gap becoming greater than normal requirements, as for instance in the case of breaking a secondary wire or disconnection from the spark plug. In order to guard against this the manufacturers usually put in a fixed spark-gap of ⅜ to ½ inch so that if the above accidents should happen, the spark would take place there instead of piercing the insulation of the armature.

ALUMNI NOTES.

The Rose Alumni of New York City have organized a Rose Tech Club, with a membership of about forty. We hope to give a more detailed account in our next issue.

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There has lately been organized among the employes of the Electric Controller and Supply Co. a society for the presentation and discussion of engineering subjects. Meetings are held every two weeks on Wednesday evening, and along with a social evening, a paper is presented and freely discussed by the members. This club was created by a Rose man, and Rose men are on its membership roll. It would no doubt be of interest to the Alumni to know more of this work, and we hope that it will be our pleasure to publish in this department the papers that have been read before the society by members of our Alumni.

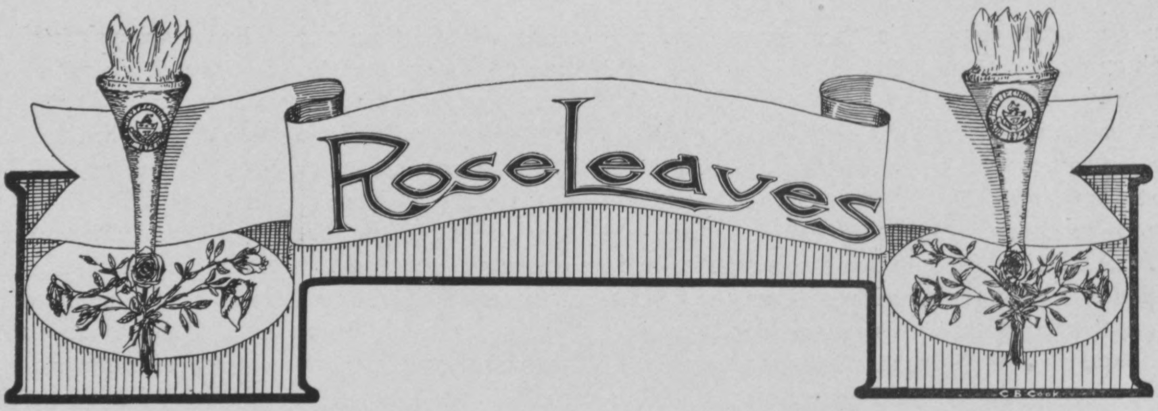
—

J. Edw. Daily, '05, has given up his position with the Columbia Improvement Company, of this city, and is now with the 'Frisco at Chicago. Daily took the Mechanical course, but is engaged in Civil Engineering work, and says he expects to stick to it.

—

Charles E. Mendenhall, '94, and Miss Dorothy Reed were married February 14, at Talcottville, New York, on Feb. 24th. They will sail for Italy and join Dr. and Mrs. T. C. Mendenhall, who have been abroad for the past four years.

Mr. Mendenhall is Professor of Physics at the University of Wisconsin.



WIRELESS TELEGRAPHY.

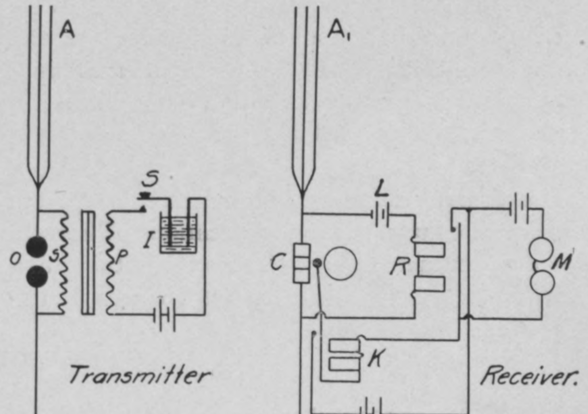
By WALTER HENSGEN, '06.

WIRELESS telegraphy as commonly applied means the exchange of signals, by electric means, for communication between two distant stations without metallic connection between them, the ether being used as the medium of transmission of the electro-magnetic waves on which the system depends. This would, strictly speaking, include Bell's Photophone, and signaling by induction solely; these have so far only been found applicable to comparatively short distances. These electro-magnetic waves or impulses will readily pass through ordinary walls or other non-metalic substances, are reflected by metal plates (much like light reflected by a mirror), are refracted by prisms of pitch and polarized by screens of parallel wires. Such a polarizer will only transmit vibrations at right angles to the wire, showing that the waves are plane polarized parallel to the spark gap. All these phenomena, namely reflection, refraction and polarization, are common to sound, light and radiant heat, except the third, which is only true for light and heat. Prof. Hertz, who was one of the first to experiment with these waves, showed that their velocity of propagation is the same as that of light. We see then the marked similarity between the ordinary optical experiments and those with electro-magnetic waves, except that the latter have a much longer period of vibration and consequent greater wave length than the former, occupying a place far to the left of heat waves in the spectrum. The time of oscillation of an ordinary Leyden jar is from $\frac{1}{6}$ to $\frac{1}{3}$ millionth of a second, giving waves 250 to 380 feet long.

A small thimble-sized jar would give waves about 3 three feet long, and if we push the reduction to the limit of the light waves or $2/10^6$ feet we would require a circuit of atomic dimensions. This suggests that the long electro-magnetic waves emitted by a condenser undergoing oscillating discharge are in reality the same in kind as the short ethereal waves which affect the retina of the eye, and that light and heat waves are excited by electric oscillations in the atoms or molecules of the incandescent matter. Just as an alum solution absorbs heat waves, and iodine solution absorbs light waves, so moist blotting paper absorbs electro-magnetic waves. These waves are looked upon by many as something quite mysterious; I have here attempted to show that there is no marked difference between them and light and heat which are recognized by the senses, except in length and period.

The action of the waves at the receiving station is probably most clearly explained by the principle of sympathetic vibrations. As a familiar example of these, take one singing some note into the top of an open piano, the loud pedal being at the same time depressed so that all strings vibrate freely. Then the wire whose note corresponds to the note sung sounds as an echo, due to sympathetic vibrations of that particular string. Dr. Mees used other sound analogies in his article in THE TECHNIC for March, 1904. A similar action is obtained by discharging a Leyden jar in the neighborhood of a similar jar connected to a spark gap. A spark gap is simply two metallic spheres a short distance apart. If the two circuits be correctly adjusted as to capacity and inductance, a spark is seen at the spark gap of the second when the first is discharged, the second thus acting as a receiver and the first as the transmitter In practice an induction coil is used whose primary circuit contains the battery, signalling key and interrupter; the secondary contains the spark gap, one side of which is grounded and the other side connected to an aerial wire whose length depends on the distance messages are to be sent. This constitutes the transmitting group. In place of the tuned jar as receiver the coherer is used, which in its normal condition, made up of numerous particles of fine filings or composition, is an imperfect conductor, and offers a very high resistance; the current of the battery cannot pass through it to actuate the relay, but when influenced by electrical waves, cohesion or adhesion of the particles takes place, the resistance breaks down and it becomes a fairly good conductor, allowing the battery current to flow through, its resistance falling from an infinite value to between 200 and 500 ohms, thus allowing the current from local battery to work the relay which in turn automatically allows a stronger current to work the de-coherer and automatic recorder or sounder, as arranged in secondary circuit. The de-coherer taps the coherer, and in this way restores its high resistance, the result being that the recording circuit is closed for a space of time equal to that during which the key is pressed down by the operator at the transmitting station. Connections are shown in the figure.

For experimental purposes and short distances an induction coil as used on automobiles, with 5 or 6 cells suffices, although not economical. A coherer of the Branly type is easily made by thrusting two pieces of copper wire, about No. 14, 3″ long, into a glass tube about 2½″ long and $\frac{3}{16}$″ internal diameter, through two pieces of cork or rubber, which fit the tube snugly and placed $\frac{3}{32}$″ apart. The wires are pushed through the corks till just projecting on inside so as to make contact with the coarse aluminum or iron filings which fill the space between the corks. The remainder of the tube may be filled with sealing wax or paraffine to keep out moisture. If possible the tube should be exhausted before sealing. This style of tube loses its sensitiveness if overheated by too great a current. Such a coherer serves quite well for recording lightning flashes, by grounding one side and connecting the other side to an aerial, or to an aerial line through condenser.



Among the qualitative wave detectors, whose number increases weekly, to judge by the patent reports, may be mentioned Hertz's Resonator, a prepared frog leg, sensitive vacuum tube, special galvanometer connected to spark gap, thermopile method similar to Langley's, Branly tube mentioned before, mercury drop separated by greasy disk into two parts, which coalesce under difference of potential, and electro chemical detector similar to Lippmann's electrometer, and others. Rutherford's magnetic detector is often used for quantitative laboratory experiments. Its operation depends on the fact that a reverse field, due in this case to the sympathetic vibrations, has a marked effect on the magnetization of a highly magnetized bar measured by a magnetometer. Various forms of primary interrupters have been used. The common attracted armature type much used on medical coils is both slow and wasteful when the break is in still air; blowing a current of air on the break improves it somewhat, but is inconvenient; making the break under oil between platinum point and mercury surface works better. One of the best forms is doubtless the Woehnelt eletrolytic circuit breaker whose action depends on the polarization of the positive or platinum pole which stops the flow of current until it recovers from its polarization; the negative pole is a sheet of metal, both poles being in a solution of dilute sulphuric acid. It will not work, however, unless there is a certain amount of inductance in the circuit. A certain coil giving as a maximum 100 vibrations per second with a mechanical interrupter easily gave 3,000 per second with the Woehnelt type.

The commercial uses of wireless systems are largely, of course, for communication. They are also used in meteorology to record lightning discharges and other electrical disturbances in the atmosphere. It was proposed in Switzerland to use it for standard-time distribution, the master clock controlling the others by means of the ether waves. In military operations it proves valuable, as the whole outfit for a station may be placed on an automobile; likewise mines can be exploded from a distance and torpedoes directed in their course from the shore.

To make the system commercially successful necessitates the perfection of the selective feature of the thing. It has been shown that the exchange of signals between two stations is comparatively simple, but to get the message to the intended station and prevent the others from getting it, and resulting confusion, has not proven so easy. Several selective systems have been patented, but how reliable they are remains to be proven by experience. The capacity of the aerial has a great effect on the working; the addition or subtraction of a few feet of wire may change failure into success, simply by its capacity effect. Of course the question of covering distance resolves itself into using sufficient energy to good advantage at the transmitting station, and also in having the receiving apparatus of highest efficiency and sensitiveness, as there is no question but that apparatus can be produced to work thousands of miles.

MANDOLIN CLUB.

The Mandolin Club gave a concert at the Washington avenue Presbyterian Church, on February 8th. The program was rendered to a fairly large and especially appreciative audience. The Mandolin Club, as well as those assisting, were greeted by rounds of applause. The mazurka, "Bells of Moscow," certainly has a Russian "iski" turn to it, displaying a quality of tone and expression that is remarkable for a mandolin orchestra. The good-night selection was the best of all. "A Day in the Cottonfields," introducing the negro dance, by the use of sand-jigs, and the old river steam-boat whistle, blended with the characteristic melody, caused those who hail from the South, or who have ever visited there, to listen spellbound till the last darkey was out of sight in the distance.

SCIENTIFIC SOCIETY.

Meyers, '07, read a paper on "Railroad Construction" before the Scientific Society on Dec. 16. He explained in general how the work of the civil engineering department is carried on in modern railroad work.

One of the most interesting features of his paper was a description of the method used in replacing old bridges without interrupting traffic. During last summer's vacation Mr. Meyers was a member of one of the civil engineering corps engaged in building a third line for the Chicago & Eastern Illinois railway from Momence to Chicago, and his paper was composed mostly of notes taken while in the field.

"Telephony," the subject of the next paper given before the society, on Jan. 20, was ably treated by Hensgen, '06.

Mr. Hensgen has been doing some original research work in the transmission of sound, and consequently was well posted on his subject.

By means of sketches, diagrams, and the actual apparatus itself the practical operation of receivers, transmitters and telephones used in connection with central exchanges was made clear

He also explained how the different telephone systems are operated.

The members of our Orchestra spent a very pleasant evening as the guests of the Misses and Doctor Mees on Thursday, February 8th, the other guests being members of the Faculty, their wives, and several other friends.

Our director, Mr. Hugh McGibeny, of Indianapolis, was with us, and a regular rehearsal was held under his leadership. Unfortunately, Mr. McGibeney was compelled to leave early in the evening, in order to catch a train for Indianapolis, and we had to get along without him the rest of the evening. However, Dr. Mees came to our rescue and directed several numbers, and the manner in which he did it demonstrated the fact that he is as well versed in musical matters as he is in scientific subjects. The Doctor was, in former years, an accomplished violinist, and has always taken great interest in the affairs of our Orchestra. He was urged to favor the company with a solo, but he refused on the plea of being out of practice, as he had not touched a violin for twenty-five years. In spite of this disappointment, the affair was a most enjoyable one.

Much interest was added to the occasion by the solos rendered by Stock, '07, and Wanner, '09, whose work brought forth rounds of applause.

Refreshments were served in the course of the evening, and it was not very far from midnight when the party broke up.

On Wednesday, January 17, Rose's "Grand Old Man," Mr. W. C. Ball, addressed the students. The announcement of a speech by Mr. Ball is always hailed with delight, for the boys appreciate that it means a good, lively talk, full of excellent advice from our "older brother."

The management of the *Modulus* wishes to announce that those intending to purchase a copy of this year's book should order it in advance. Only a limited number of extra copies will be printed, and the price will be advanced to two dollars for those who have not handed in an order.

AWARD OF R's.

At a General Assembly, January 13, the R's for 1905 were given out, including the new reserve "double R's," which are given for faithfulness in practice.

Professor Hathaway, as Faculty Chairman on Athletics, presided, and presented the following men with R's:

Base-ball, 1904—Harry Baylor, '07.

Base-ball, 1905—Miner, '07; Douthett, '08; Freudenreich, '06.

Track, 1905—Turk, '07; Modesitt, '06; McCormick, '07; Brannon, '07; Lee, '06.

Foot-ball, 1906—Whitlock, '10; Schmidt, '08; Peck. '06; Rotz, '06; Jackson, '06; Wilms, '06; Strecker, '07; Benbridge, '06; Taylor, '07; Douthett, '08; Bard, '07; Unckrich, '08; Pritchard, '09; Lammers, '08; Lee, '06.

Foot-ball Reserves, 1905—Ryan, '06; Schauwecker, '06; Scharpenberg, '07; Wickliffe, '07; McDaniels, '07; Bogran, '07.

WABASH, 52; ROSE, 11.

Our first basket-ball game this season was with Wabash College at Crawfordsville. Our team was "up in the air," to use a slang expression, and did not come down to anything like their usual playing for more than two or three minutes at a time during the game, and Wabash being accustomed to their small floor, and having played several games before that one, easily won from us by a large margin. At times, though, our team would wake up a little and play fast ball, with the result that Wabash would fall back on her usual scheme of having some one injured in order to get his breath. The second half was much more interesting than the first half, and we scored four field goals during that period. Trueblood and Johnson played best for Rose, Trueblood throwing one very pretty goal from the center of the field. Sprow and Freeman, of Wabash, were the goal throwers of the game, having seven and eight goals each, respectively.

Summary of the game follows:

WABASH.

	FIRST HALF.			SECOND HALF.		
	Field Goals	Foul Goals	Fouls	Field Goals	Foul Goals	Fouls
Diddle, f,, ...	3	0	2	4	1	1
Freeman, f., . . .	4	0	2	4	0	1
Sprow, c., . . .	7	0	0	0	0	0
Williams, g . . .	0	0	1	0	0	3
Wicks, g., ...	1	0	1	2	0	0
Totals, ...	15	0	6	10	1	5

One point awarded by referee.

ROSE.

	Field Goals	Foul Goals	Fouls	Field Goals	Foul Goals	Fouls
Lindeman, f, . .	0	0	1	0	0	3
Shickel, f., . . .	1	0	1	0	0	1
Trueblood, c., . .	0	0	2	3	0	1
Johnson, g., . . .	0	0	0	1	0	0
Schmidt, g., . . .	0	0	0	0	0	0
Totals, ...	1	0	4	4	0	5

One point awarded by referee.

Referee—McCormick.

Umpire—Prof. Walker, C. B. C.

Score—Rose, 11; Wabash, 52.

Fouls—Rose, 9; Wabash, 11.

INDIANA, 45; ROSE, 23.

Our first game with Indiana came on January 16, at Bloomington. While our team was outplayed by the University men, the score is hardly a fair estimate of the relative merits of the teams. Rose's chief trouble seemed to be in not following up the ball after throwing for goal.

In the number goals thrown Freudenreich led, with seven to his credit. For Indiana Maxwell played the best game. The officials allowed the game to become very rough, and this gave Indiana's heavier team a decided advantage.

The score follows:

INDIANA UNIVERSITY.

	FIRST HALF.			SECOND HALF.		
NAME.	Field Goals	Foul Goals	Fouls	Field Goals	Foul Goals	Fouls
Harmeson, f., . .	2	0	0	4	1	3
Ritterscamp, f., .	2	0	0	3	0	2
Maxwell, c., . . .	6	0	0	3	0	1
Quinn, g., ...	1	0	0	1	0	0
Hiatt. g., ...	0	0	3	0	0	0
Totals, ...	11	0	3	11	1	6

ROSE.

Freudenreich, f.,	2	0	0	5	0	0
Shickel, f., . . .	1	0	0	1	0	1
Trueblood, c., . .	0	0	0	0	1	0
Johnson, g., . . .	0	0	0	0	0	0
Lindeman, g., . .	1	0	0	0	0	3
Totals, ...	4	0	0	6	1	4

Referree—McCormick.
Umpire—Teeter.

HANOVER, 19; ROSE, 42.

On January 18, our team changed their spirit and won from Hanover College by the score of 42 to 19 points, and they have not lost a game since that time. The contest was held in the Y. M. C. A. gym at Terre Haute, and was fairly well attended.

The first half ended with the score tied at 11 points—much too close for comfort, but those who knew the team were confident that they would greatly outplay their opponents in the second half, and no one was disappointed in his expectations in that respect, since we scored 31 to their 8 in the deciding half.

Johnson played a very good game as guard. In fact, he practically guarded two men, since Lindeman, who threw six field goals, was playing at the other end of the floor most of the time. Trueblood played all around Fisher, throwing six goals, while Fisher threw none. Freudenreich and Thurman each were fast and accurate in passing the ball, and deserve much credit for the victory.

HANOVER.

	FIRST HALF.			SECOND HALF.		
NAME.	Field Goals	Foul Goals	Fouls	Field Goals	Foul Goals	Fouls
Seward, f., . . .	1	0	1	2	0	0
Salisbury, f., . .	1	0	1	0	0	2
Fisher, c., ...	0	0	1	0	0	2
Oldfather, g., . .	1	0	1	1	0	0
Sims, g., ...	1	0	0	0	0	1
Fry, f., ...	.	.	.	0	0	0
Totals, . . .	4	2	4	3	0	5

Three points awarded by referee.

ROSE.

Freudenreich, f.,	0	0	2	3	0	1
Thurman, f., . .	1	1	1	1	0	0
Trueblood, c., . .	1	0	0	5	0	2
Johnson, g., . . .	0	0	1	1	0	0
Lindeman, g , . .	3	0	1	3	3	1
Totals, ...	5	1	5	13	3	4

Two points awarded by referee.
Referee—Markle, Y. M. C. A.
Umpire—Kisner.
Score—Rose, 42; Hanover, 19.
Fouls—Rose, 9; Hanover, 9.

I. S. N., 11; ROSE, 27.

On their own floor, January 20, the Normal team went down in defeat before the rapidly strengthening team of the Poly. It must have proved a bitter draught to most of them, as they were confident of their ability to defeat any team that the *weak* Wabash College team could defeat; however, they learned a few things besides pedagogy and child-study that January day.

The game was very rough, and while quite a number of fouls were called, there was a greater number passed over by the officials. This was particularly true of the fouls made by Normal men, although both of the officials were neutral.

Freudenreich played the star game for Rose, both in passing and in goal throwing. Trueblood played all around Mongle, but did not throw any more goals than his opponent.

The passing of the whole team was good, and the guarding of Johnson was almost perfect.

A summary of the score follows :

I. S. N. S.

	First Half.			Second Half.		
Name.	Field Goals	Foul Goals	Fouls	Field Goals	Foul Goals	Fouls
Hall, f., ...	0	1	3	1	2	5
Tribble, f., . . .	0	0	3	1	2	5
Mongle, c., . . .	1	0	1	0	0	0
Cummins, g., . .	0	0	1	0	0	2
Woodard, g., . .	0	0	1	1	0	3
Totals, ...	1	1	9	3	2	13

ROSE.

Freudenreich, f.,	1	0	1	4	0	2
Thurman, f., . .	1	3	0	0	6	1
Trueblood, c., . .	0	0	2	1	0	1
Johnson, g., . . .	0	0	3	0	0	1
Lindeman, g., . .	0	0	0	1	0	1
Totals, ...	2	3	6	6	6	6

Two points awarded by referee.
Referee—Markle, Y. M. C. A.
Umpire—Kisner.
Score—Rose, 27; Normal 11.
Fouls—Rose, 12; Normal, 22.

HANOVER, 30 ; ROSE, 33.

The second game with Hanover ended with a more nearly even score than the first, but in team work Hanover was far outclassed. Trueblood played a splendid game. He threw seven goals from the field, and got into the team work in his usual style. Shickel relieved Thurman in the second half. For Hanover, Oldfather and Salisbury played very good games. Hanover scored one more point during the second half than Rose, thus cutting down our lead to the rather close figure of three points.

The members of the team remained in Hanover over night, and were delightfully entertained by the Hanover boys. Our athletic relations with Hanover have been most pleasant, and we desire to thank them for the many courtesies shown the team.

The score of the game is given below :

HANOVER.

	First Half.			Second Half.		
Name.	Field Goals	Foul Goals	Fouls	Field Goals	Foul Goals	Fouls
Salisbury, f., . .	2	3	0	1	5	0
Seward, f., . . .	1	0	2	0	0	0
Fisher, c., ...	1	0	1	1	0	2
Oldfather, g., . .	1	0	1	1	0	2
Simms, g., . . .	0	0	2	2	0	2
Totals, ...	5	3	6	5	5	6

Two points awarded by referee.

ROSE.

Thurman, f., . .	1	0	1	.	.	.
Shickel, f., ...	.	.	.	1	0	2
Freudenreich, f.,	0	0	3	1	0	0
Trueblood, c., . .	5	0	2	2	0	1
Lindeman, g., . .	1	3	3	3	2	2
Johnson, g., . . .	0	0	0	0	0	1
Totals, ...	7	7	9	7	2	6

NEW ALBANY, 19 ; ROSE, 31.

THE second game of the trip during the holidays was with the New Albany Y. M. C. A., and resulted, as usual, in a victory—31 to 19. The team was surprised and delighted at the support shown it, there being about thirty rooters for old Rose from New Albany and Louisville, just across the river. There were several Rose pennants in evidence, and the enthusiasm was so great, that, to express it in terms of one of the players, "We had to win or we'd have been afraid to go back to Louisville." New Albany was on hand with the rooting, too, though their style was different, hats and coats being thrown onto the floor, while the noise had to be stopped several times so that the referee's whistle might be heard.

New Albany was outplayed at every point, and though the first half ended 9 to 9, yet our forwards had missed enough shots in this half to have won the game. This was due to the arrangement of the baskets, which were set in a wall of concrete, and if a ball were banked in the usual way, it would rebound almost to the center of the floor. Thus every goal we won was on a direct shot for the basket.

The second half opened much livelier than the first, and Rose left New Albany at the start, soon having a lead of six points. Long throws to Thurman or Freudenreich, who took turns under the goal, were mainly responsible for this, Johnson and Trueblood doing the passing. Then, with the score standing 25–19, and New Albany apparently catching up, Cece and Linde got busy and time was called with the score of 31–19.

Summary :

NEW ALBANY Y. M. C. A.

	FIRST HALF			SECOND HALF.		
NAME.	Field Goals	Foul Goals	Fouls	Field Goals	Foul Goals	Fouls
Lapping, f., . . .	2	0	2	0	0	0
Wrege, f., ...	0	1	4	.	.	.
Harding, g. and f.,	0	0	4	1	0	4
Borgeding, c., . .	2	0	3	1	0	1
Faulk, g., ...	0	0	0	.	.	.
Elfers, g., ...	.	.	.	1	2	1
Zoeller, g., ...	.	.	.	1	0	1
Totals, ...	4	1	13	4	2	7

ROSE.

Thurman, f., . .	2	0	1	3	*	2
Freudenreich, f.,	0	0	4	2	0	1
Trueblood, c. . .	1	0	2	1	0	1
Johnson, g., . . .	0	0	1	0	0	3
Lindeman, g., . .	0	3	4	4	1	1
Totals, ...	3	3	12	10	2	8

*Rose awarded 1 point by referee.
Referee—Attridge, Louisville.
Umpire—Mechling, Louisville Y. M. C. A.
Scorer—Bland, Rose, '05.

New Albany, Ind., Jan. 30, 1906.

DEPAUW, 24; ROSE, 33.

After defeating both Hanover College and New Albany Y. M. C. A. on their own floors, our team on the way back to Terre Haute stopped at Greencastle and took DePauw University into camp by the score of 33 to 24. This was a good margin, but we would probably have made it bigger had our team observed training rules the night previous to the game, but instead of that they attended a banquet in Louisville, and after retiring for the night at one o'clock, they got out at six the next morning to take the train for Greencastle.

At times the game was so rough that it might have been foot-ball if the surroundings had been altered to suit.

We had the best of the game throughout the first half, the score at the end being 16 to 8. Johnson played a good guarding game, his opponent making no scores during the first half. Fairfield and Trueblood kept each other moving all the time, and each one threw one goal. As usual, Lindeman had his goal getting throw with him and made seven field goals during the game. As our team had the ball most of the time, Lindeman was able to play forward, Johnson watching the goal. Freudenreich and Thurman each made a couple of pretty goals from the field.

The second half was by far the most interesting part of the game, the score this half being 17 to 16 in our favor. The playing was fast and furious. Whenever one side or the other obtained the ball a series of rapid passes, and then—goal! It was during this half that most of the rough playing was done, DePauw being awarded three points for being fouled in throwing for goal.

The worst disadvantage we had was in the narrowness of the floor, but we expect to more than make up for that February 24th, when the same teams play here.

Summary is given below, but no record was kept of the number of fouls against each man :

DEPAUW.

	FIRST HALF.		SECOND HALF.	
NAME.	Field Goals	Foul Goals	Field Goals	Foul Goals
Sheets, f., ...	1	0	2	0
Baker, f., ...	0	0	1	2
Fairfield c., ...	1	0	1	0
McKee, g., ...	1	0	1	0
Dorste, g., ...	1	0	0	0
Totals, ...	4	0	5	3

3 points awarded by referee.

ROSE.

Freudenreich, f., ...	1	0	2	0
Thurman, f., ...	1	0	1	0
Trueblood, c., ...	1	0	0	0
Johnson, g., ...	0	0	0	0
Lindeman, g., ...	3	3	4	3
Totals, ...	6	3	7	3

1 point awarded by referee.
Referee—McCormick.
Umpires—Kinsley and Lee.
Fouls—DePauw, 14; Rose, 14.
Score—DePauw, 24; Rose, 33.
Date—January 31, 1906.

INDIANA, 21; ROSE, 30.

On February 3, our basket-ball team had the opportunity to turn the tables on Indiana University, and how well they succeeded is shown by the score. It is generally conceded that in speed and snappiness of play, this game has not been equalled by any played in Terre Haute for several years. From the first sound of the whistle to the end of the game, except for the ten minutes intermission, each man seemed to be competing with every other man in the effort to cover the most ground in the least time. The game was not without its share of rough playing, either, which it seems was due to the reluctance of the referee to call fouls—he certainly could not have failed to see them committed—though neither side was favored much more than the other in this particular. Trimble, of Indiana, who umpired the game, was highly satisfactory to both sides, except that he, like the referee, was a little inclined to overlook fouls.

Both teams entered the game with three of last year's team back.

The passing of the Rose team was almost perfect, the ball being rapidly snapped from one man to another until one had a chance at the basket, and then it either went up again at the center or was juggled around again. Fumbles by Poly players were pretty scarce, though of course there were some, as is always the case.

Johnson was always at hand when an I. U. man tried for goal, and kept their field goals down to a small number.

Freudenreich went into the game rather stiff, as the result of a slight injury received in practice, and consequently did not make any of his usually large number of goals. Maxwell, Indiana's star center, only succeeded in throwing one field goal, but Trueblood, who outplayed him at every point, threw five. Shickel also played a good game, but Lindeman was probably the star player. He threw five field goals and eight foul goals.

A summary of the game follows:

INDIANA.

	FIRST HALF.			SECOND HALF.		
NAME.	Field Goals	Foul Goals	Fouls	Field Goals	Foul Goals	Fouls
Harmeson, f., . .	0	5	1	3	2	3
Ritterschamp, f.,	2	0	0	0	0	1
Maxwell, c., . . .	0	0	4	1	0	0
Quinn. g., ...	0	0	1	0	0	2
Hiatt, g., . . .	1	0	2	0	0	2
Totals, ...	3	5	8	4	2	9

ROSE.

	FIRST HALF.			SECOND HALF.		
NAME.	Field Goals	Foul Goals	Fouls	Field Goals	Foul Goals	Fouls
Freudenreich, f. .	0	0	4	0	0	0
Shickel, f., . . .	0	0	0	1	0	1
Trueblood, c , . .	4	0	0	1	0	1
Johnson, g., . . .	0	0	1	0	0	1
Lindeman, g., . .	3	5	2	2	3	1
Totals, ...	7	5	7	4	3	4

Referee—McCormick, Terre Haute.
Umpire—Trimble, Indiana Univ.
Scorer—Wischmeyer.
Timer—Post.
Score—Indiana, 21; Rose, 30.
Fouls—Indiana, 17: Rose, 11.

NOTES.

F. P. Mooney, formerly of '08, has returned to school this term. Last year Mooney was elected captain of the base-ball team for 1906, but when he did not return last September, Douthett, '08, was chosen as his successor. On Mooney's return, Douthett immediately turned the team over to him. Mooney was our star first baseman, but will possibly be behind the bat this season.

The base-ball team has started its work. The first practice of the season was called Saturday, Feb. 3rd, in the gymnasium, and a squad of about thirty candidates reported. A number of most promising fellows have come to us in the Freshman class. There are about three candidates for each position, and thus close competition is sure. Captain Mooney says that he believes he will be able to pick a good, energetic team from the material at hand.

With the beginning of this term the Faculty inaugurated a new, or rather, returned to an old arrangement of recitation and practice hours. In the new plan nearly every one has classes up to five o'clock in the evening, every day of the week. There are many reasons why this scheme is distasteful to the student body, but the one which concerns us most is that it will tend to weaken all our athletic teams as long as the rule continues in effect. It should be noted in this connection that unlike some other schools, there is no credit given for athletic work, and no time is set apart for physical exercise, here at Rose. Hence the already short amount of time in which our athletes can practice will be shortened by just one hour in reality, and by the most useful hour at that.

We here at Rose do not want to advertise the school through its athletics, but we have that spirit of loyalty which makes us wish to see our teams given at least an equal chance with those of other schools with whom we compete, but this is hardly possible under the present arrangement.

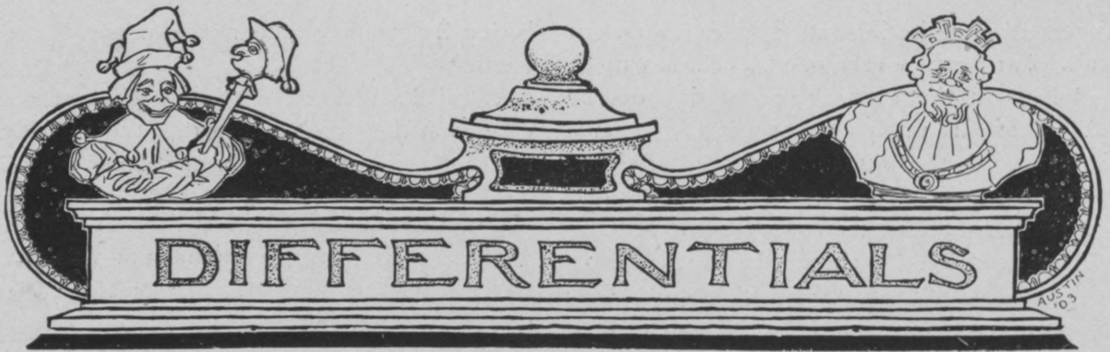
We all hope that the Faculty will consider the case from the standpoint of the student body and revise the present schedule as soon as possible.

A noticeable feature of the recent basket-ball game at the Normal gymnasium was the extremely unsportsmanlike behavior of the Normal rooters. They would applaud and cheer the bad plays of their opponents, more than a good play of their own team.

A true sportsman never derides his opponents, but always encourages his own side by applauding their good plays and he also applauds the really good plays of an opponent.

Let us profit by the Normal's example and steer clear of any such babyish attitude. We do not want to make a spectacle of ourselves.

Mr. V. W. Helm, International Secretary of the Young Men's Christian Association for Japan, while visiting the associations of Terre Haute on the first of this month, spoke at a general assembly of the students of Rose upon "The Japanese-Russian War." Mr. Helm told in an interesting and scholarly way some of the incidents and results of the recent war. As a personal witness upon many of the battle-fields, and from intimate association with the higher officers of the Japanese army, his information was exceptionally interesting and of first hand. Mr. Helm, an Indiana man and a graduate of DePauw University, has been in the Y. M. C. A. work in Japan for the last six years, and is now home on furlough for one year. As national secretary of the associations of Japan, his work has been principally in the organization of the student and city associations of that country. His chief work, however, during the most recent years has been among the soldiers of the Japanese army. Mr. Helm has been supported principally by the associations of Indiana, and this year Indiana is trying to assume his entire support. Terre Haute has taken as its share of this budget, four hundred dollars. The strategic and important work that has been done by the association in Japan is evidence of the efficiency of its organization and the need of the work. The local association was quite fortunate in being able to secure a visit from Mr. Helm. It was a fortunate opportunity, too, for the men of Rose to hear Mr. Helm upon this interesting subject.



Nelson, '08:—"Those quizzes are not hard if you know all about them."

Crumley, '09 (reading, "*C'est le fruit d'une petite plant*"):—"C'est le fuit *durn* petite plant."

Wicky:—"If you are doing that on purpose I feel sorry for you—but I think it is your stupidity."

Prof. Bennett (pulling out a key-winder):—"This is an old-timer."

Prof. Howe:—"Do you think it would be possible to have so long a grade that the engineer would have to put on brakes to stop the train?"

Strecker:—Do you mean going *up?*"

Johnson, '09, has been initiated into the P. I. E. S. and Brannon into the Sigma Nu.

Junior A:—"What does Rankine's Mechanics contain?"

Junior B:—"Everything, from a toothpick to a barb-wire fence."

Mac (in Algebra):—"You know there are tables for finding the amount of lumber in a log."

Freshman:—"Are those logarithmic tables?"

We wonder if Sam voted for five o'clock evenings at the Faculty meeting?

HASN'T FOUND IT YET.

The night watchman came into the gym during the Normal game, with a lantern in his hand. One of the rooters suggested that perhaps he was looking for the Normal's score.

Mac says that the majority of the students prefer five o'clock evenings. Guess again, Mac.

Mac says that the track teams in his day, when school kept till six o'clock, made better records than our present teams. Wrong again, Mac. All the school records are held by students who were in school last year.

Mac says he don't care a whoop whether we have athletics or not. We've known that for several years, Mac.

Prof. Howe (in Railway Practice):—"Sharpenberg, what does it cost to run a railroad?"

Sharpenberg (waking up):—"Professor, I have forgotten the exact figures. Quite a good bit, though."

Professor:—"After to-day, gentlemen, I will not call the roll, but will expect those absent to speak to me at the end of the hour."—[*Ex.*

All write-ups, stories and poems for the 1907 *Modulus* must be turned in before March 1.

The P. I. E. S. fraternity entertained the members of the basket-ball squad at supper on February 6.

At Hanover someone pointed out a tree that leaned far out over the hillside. "I wonder what kind of a tree that is," he said.

"I don't know," said Cece, "but I know it isn't a plumb tree."

Shickel (after the basket-ball game):—"If I've done anything to regret, I'm glad of it."

The Duke:—"Now let's measure the length of this bar. Mr. Lee, please get me a scale."

A few minutes later Addie came back with a spring balance.

We don't think it was treating Struck just *white* to take his trunk to the south end.

FAR FETCHED.

Senior:—"Are you going to take a blind pig course next year?"

"What kind of course is that?"

"Well, a blind pig is a pig without an eye, and that leaves P. G., don't it?"

Ralston, '09, says that the air is so dirty in Pittsburgh that men carry sponges on their watch-chains with which to clean the faces of their acquaintances before being able to recognize them.

OVERHEARD AT BUNDY'S.

Little boy (walking up to Goodman, '07):—"Is mamma here?"

Bill Bundy (to Mr. Bennett, Mr. Paige and Mr. Homberger, after taking Mr. Bennett's picture):—"Now, my dears, what class do you boys belong to?"

Nourse:—"They tell me that Boyd has gone into training for the exams."

Robbins:—"Gone into training?"

Nourse:—"Yes, he's eating only one meal a day now."

Plew, '07 (in Electricity):—"I don't know what kind of a fan it is, Professor, but the fan won't start unless you give it a push."

Uhl, '08:—"You ought not to go to sleep in Chemistry lecture, Stock; it makes Doc White think he's like a minister."

Stock;—"I didn't hear him say anything that sounded like a sermon."

Uhl:—"Didn't you say yesterday that Chemstry was hell?"

Nelson, '08:—"I don't believe in alarm clocks; if a fellow can't get up he ought to sleep."

Homberger:—"C. P. stands for chemically pure."

Sophomore:—"What does cc. stand for?"

Wicky (in French):—" I don't know whether that exercise is worth reading or not,—Mr. Lammers, suppose you read it."

Cash (in Civil):—"The railroads don't make much effort to shorten a straight line, do they?"

Wicky:—"There is many a man that writes verses, who has no desire to become a poet or any other kind of fool."

Each Senior at Purdue is assessed five dollars toward defraying the expenses of the annual—*The Debris*. This, however, includes one copy of the book.—[*Medical Exponent*.

Trenary, '09:—"You all want to come, fellows; some time in the spring the Glee Club is going to give 'Pianoforte.' "

Bundy (as D. Byrn leaves the gallery):—"Come again, *Dublin*."

Howard Burgess, last year's editor-in-chief of the Purdue *Debris*, has been elected editor-in-chief of Earlham's annual—the *Sargasso*.—[*Earlhamite*.

Plew, '07:—"There is not much difference between theory and practice—if the theory is right."

Mac:—"There is no use doing anything for posterity, because they never did anything for you." Mac says this isn't original and is not for publication.

Married: Wednesday evening, Jan. 10, 1906, at the residence of Rev. L. E. Sellers, of the Christian church, occurred the marriage of Miss Opal G. Shively to Mr. John D. Hull, of Detroit, Mich. The bride is the only daughter of Mrs. B. F. Shively, of North Seventh street, while the groom is a member of the present Sophomore class.

Before this number of The Technic is issued most all of the illustrations for the 1907 *Modulus* will be in the hands of the engravers. Drawings have been received from the best artists of each class, and the character of the drawings turned in justifies the prediction that this feature of the book will be an improvement on previous *Moduli.*

The *Modulus* this year will be a larger book, better bound, printed on better paper than before, and, with the co-operation of every student, a better book in every respect than previous issues.

Frank P. Mooney is back at Rose, after having spent seven months in electrical work in southern California.

Soph:—"Now that Hull's got married, I wonder if they'll go to running mother-in-law jokes in The Technic."

Hath sub-one: — "The only reason that I didn't get along better in Dutch is that I didn't drink beer."

If the Faculty is ever at a loss for adequate punishments for the most flagrant breaches of college discipline, let them try imprisoning the culprits within hearing distance of the phonograph of Tuthill, '09.

EXCHANGES.

Etiene Gomella, Professor of the Polytechnic Institute of Tomsk, Siberia, has been at Purdue for several days past collecting information concerning the work and methods in the various lines here given touching the interests of railways.—[*Purdue Exponent.*

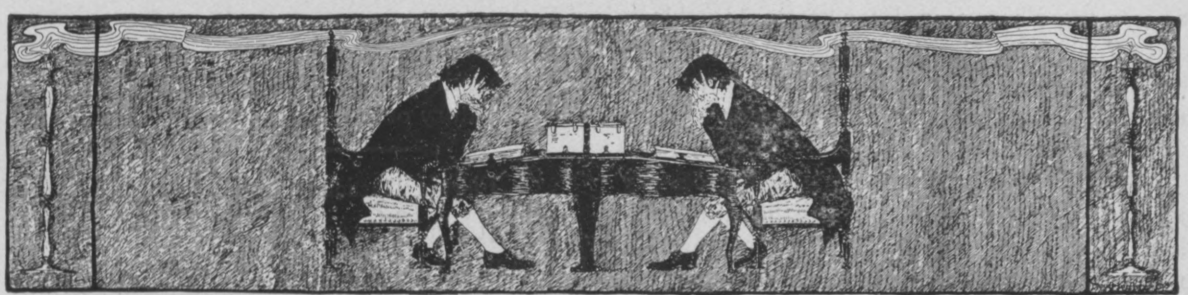
A Pole Cat:—A small animal to be killed with a pole; the longer the pole the better.—[*Exchange.*

High Potential:—"You say that a labor-saving device has at last been applied to religion?"

Low Potential:—"Yes, Edison has patented a rotary converter."—[*Armour Fulcrum.*

YALE'S ACCOUNT.

The expenses incidental to running Yale athletics have grown to remarkable proportions in the last decade. The last statement of the Yale financial union, for instance, showed total receipts of $106,396.66, and expenditures of $74,174, leaving a balance of $32,222. At 4 per cent. this annual revenue from Yale athletics capitalizes at $2.660,000, which could be said to be an athletic endowment of that sum, an endowment of $1,000,000 more than Yale had 25 years ago for educational purposes, $500,000 more than the general funds of the university in 1904, and more than a third of the entire gross funds and assets of the university today."—[*Case Tech.*



REVIEWS

A Magnetic Brake.

The Electric Controller and Supply Co., of Cleveland, Ohio, a concern in which a number of our Alumni are interested, has lately gotten out a brake for use in connection with electrically driven machinery. It is known as their type "Q" brake, and embodies many new and valuable features.

The braking force is provided by friction plates of metal which run in oil. The stationary plates are square and are prevented from rotating by studs at the four corners. The rotating plates are circular and are supported by and keyed to the hub. These circular plates are free to move laterally. The moving plates dip in the oil and throw it by centrifugal force to the top of the case, from where it drops onto the friction plates, effectually lubricating them. This lubrication renders the coefficient of friction absolutely constant, and the oil also serves to convey the heat away from the plates and distribute it over the surface of the case.

The brake is released by an electro-magnet which acts through a very small air gap. It operates quickly and on comparatively little current. The braking force is applied axially and is balanced within the frame of the brake, allowing no blow or unbalanced thrust on the bearings of the motor.

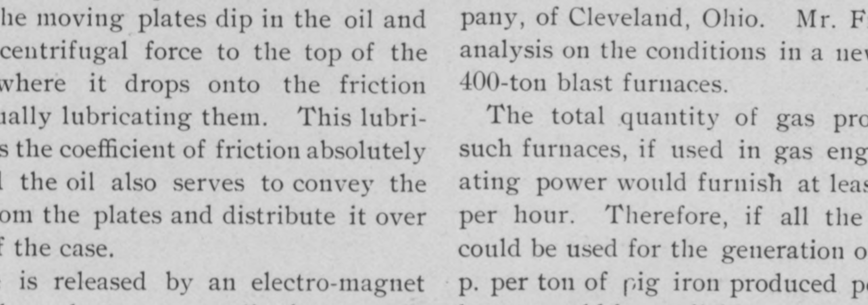
The illustration shows the general appearance of a number of different sizes of these brakes.

The Cost of Power From Blast Furnace Gas.

Some interesting information is to be found on the subject of the cost of power generated by the use of blast furnace gas in a paper presented before the Western Society of Engineers, by Mr. H. Freyn, engineer in charge of the gas engine department of the Wellman-Seaver-Morgan Company, of Cleveland, Ohio. Mr. Freyn based his analysis on the conditions in a new plant of two 400-ton blast furnaces.

The total quantity of gas produced by two such furnaces, if used in gas engines for generating power would furnish at least 43,500 h. p. per hour. Therefore, if all the gas produced could be used for the generation of power, 50 h. p. per ton of pig iron produced per twenty-four hours would be available.

It is generally figured that about 30% of the



gas generated is required for heating the blast. About 7,200 b. h. p. will be required for the gas blowing engines. Auxiliary machinery will require about 1,200 b. h. p., and the gas washers will require about as much more.

After deducting the quantity of gas necessary for the various purposes of the blast furnace plant, there remains available for other purposes in rough figures, 2,000,000 cubic feet of gas per hour. This quantity of gas at the rate of 100 cubic feet per brake horse power per hour would provide for 20,000 b. h. p. In other words, there will be available for sale or some outside work, 25 h. p per ton of pig iron produced per twenty-four hours. On account of the unavoidable irregularities in the operation of the furnaces, it would not be safe to count on more than one-half of this power. But even at this estimate it would seem quite possible to make of some of the great furnaces, greater centers of power distribution than even Niagara Falls.

Mr. Freyn's final conclusion is that with a 10,500 h. p. plant in connection with two 400-ton blast furnaces, electrical power could be produced at a total cost of $17.88 per b h. p. per year, or at about 2.95 mills per kilo-watt hour, "Which is away below the best figure ever reached with a steam engine power plant."

Automobile Testing Plant at Purdue University.

The *Railroad Gazette*, in a recent number, gives a detailed description of an automobile testing plant lately installed at Purdue University.

"An automobile of any type, whether steam, electric or gasoline driven, may be mounted, operated and tested on it and the power delivered and the efficiency may be determined. The driving wheels of an automobile mounted for testing are carried by the supporting wheels of the plant. These wheels are mounted on an axle which revolves in fixed bearings. The automobile is held in position by a traction dynamometer. A friction brake on the axle of the supporting wheels absorbs the energy given by the machine. A motor driven pressure blower delivers air through adjustable piping for cooling the radiators of steam and gasoline machines, and a motor-driven exhauster takes air from a point near the exhaust of the machine, thereby freeing the laboratory of obnoxious gases."

Electric Traction for St. Claire Tunnel.

The St. Claire Tunnel Company, operating the tunnel under the St. Claire river at Port Huron, on the line of the Grand Trunk Railway, has been compelled to adopt electric traction. The system which they are installing has some unusually interesting features, not least of which is the fact that they are to use Westinghouse single phase alternating current motors in their equipment. The locomotives will weigh about 62 tons and will develop a draw-bar pull of 25,000 pounds on a 2 per cent. grade of 10 miles an hour. The principal dimensions of these locomotives are as follows :

Length over end sills, ...	27 feet	9 inches
Rigid wheel base, ...	12 "	0 "
Width over all, ...	9 "	6 "
Height from top of rail to top of cab, ...	12 "	6 "
Diameter of driving wheels, . .		62 "

Each locomotive is equipped with three motors of 250 rated horse power, one motor on each axle of the locomotive.

It was necessary to adopt the electrical system of traction for the tunnel because the steam locomotives were unable to handle the traffic with sufficient rapidity. The service requires that each unit shall take a train of 500 tons through the tunnel block from summit to summit in fifteen minutes.

Among several most interesting articles in the Transactions of the American Institute of Electrical Engineers for January, there is one, entitled "Power Plant Economics," by Henry G. Stott, which is especially worthy of notice. A number of the engineering papers are reprinting this article, and no electrical student should fail to read it.

THE TECHNIC'S copy of the Transactions can be had upon application to the Reviews Editor.