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THE TECHNIC.

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THE TECHNIC extends greetings to its readers, and wishes each and all a pleasant and prosperous New Year.

WE note with satisfaction that William S. Hanly, '05, has been elected President of the I. I. A. A. and Secretary of the I. C. A. L. "Some men are born great, others attain greatness, and others have greatness thrust upon them." We feel confident that this man is deserving of the high honor bestowed on him, and therefore, President Hanly, accept the congratulations of THE TECHNIC.

THERE is considerable difference of opinion as to class cuts at the present time. Cutting is always wrong, as it is a direct violation of an Institute rule. It sometimes occurs that an entire class wishes a holiday that it not in the catalogue. Then it rests with the class. But when two or three wish to stay away, and haven't the courage to take the consequences, and so prevail upon the rest to cut, then it is time to stop. It reminds one strongly of the picture of the monkey and the cat getting roasted chestnuts off a hot stove.

THE Annual Track and Field Meet of the I. C. A L. will be held in Terre Haute this season under the auspices of the I. S. N. Last year Rose had the privilege of acting as host in this city, and the boys did themselves proud as entertainers. Last year we lost the meet by two points. This year the pennant seems to be within our reach. Some one will say that "Things are seldom what they seem." But we must have it, and the only way to make sure of it is to work hard and work all the time. A pleasant feature of this arrangement is that the Rose athletes will not have to leave home and endure a tiresome car ride.

WE take great pleasure in presenting, as our leading article this month, the President's address, as given by President Mees before the Indiana Academy of Science on Nov. 26, 1904. This society has for its object the consideration of matters of scientific value. The twentieth annual meeting of the Academy was held at Indianapolis, Friday and Saturday, Nov. 25 and 26, on which dates papers were read on Physics, Mathematics, Astronomy, Ethnology, Botany and Zoology. The membership is extended through all the colleges and universities of the state, and also includes many professional men not allied with any institution of learning.

HISSING at any athletic contest is very discourteous and savors of rowdyism. If a referee or umpire is unfair it rests with the captain to make the complaint and not the crowd. Hissing from the galleries invariably makes the official more severe in his decisions. Good systematic rooting is what is wanted. Anyone can be a game winner, but it takes a man to be a game loser. When an opponent makes a good play give him credit for it, and don't call it an accident because he is against us.

IT is a great relief to find so little cribbing going on, but still there is some. In the case of a large class every student is placed more or less on his honor, for it is next to impossible for the person in charge to watch everyone. Of course, if the instructor doesn't happen to catch you, you will get your mark all right, but if your fellow-students see you it is fully as bad. Perhaps, after we are all through at old Rose, you may desire a recommendation from a classmate, but he, in justice to himself, will be unable to help you. This is only one of the many ways in which this miserable habit is apt to harm you, so it should be carefully avoided.

WE have a basket-ball team to be proud of, and one that is well worthy of support. With two games already to our credit and all the fellows in fine form, we can look forward to seeing some first-class basket-ball this season, and the championship is by no means out of our reach.

THE advisability of interchanging the museum and the general assembly room on the third floor has been considered, and at present the change seems out of the question on account of heating and lighting during examinations. The question of using it as a dancing floor was also brought up, but in order to do this a new floor would be necessary.

Recent Theories in Electricity and Matter.

By CARL L. MEES.

THE following article is a portion of the President's address as given before the Indiana Academy of Science, at the last regular meeting. On account of lack of space considerable introductory matter has been omitted, as well as explanatory discussion accompanying its reading:

Some thirty years since Sir William Crookes, as well as Hittorf, studying the behavior of electric discharges through highly rarified gases, came to the conclusion that the radiation from the Kathode in a high vacuum was not a wave motion, but a material substances having inertia.

Crookes gave the name Radiant Matter to this radiation and characterized it as a fourth state of matter neither molecular nor atomic.

Since then great impetus has been given to the study of Kathode rays through the discovery of Roentgen rays, Becquerel rays and other phenomina associated with Kathode rays. The result of these investigations has been to establish the fact, that in the Kathode rays we have to deal with exceedingly minute particles or corpuscles projected from the Kathode. These corpuscles, where they impinge upon glass or other solids give rise to phophorescence, X rays, heat, etc., as the case may be. Thomson, Schuster and others showed that the particles were negatively electrifled; they were able to determine their masses and velocity of projection by studying the deflection of the stream in a magnetic field. These measurements represent a long series of experiments, devised and executed with consummate skill, under the leadership of J. J. Thomson, and may be said to constitute the most brilliant work in experimental physics during the beginning of the new century.

They establishe the fact that these flying particles are not atoms of matter, but are bits of chips of atoms of a mass of about $\frac{1}{700}$ to $\frac{1}{1000}$ or the mass of a Hydrogen atom and move under favoroble conditions with a velocity not much less than the speed of light—each corpuscle carrying a negative charge of electricity. The determination of the amount of this negative charge per corpuscle next engaged attention. To accomplish this, the total quantity of electricity on a collection of particles was measured, a relatively simple problem. If now the number of particles were known the charge upon each one could be easily calculated. This problem is so interesting that the method pursued will be briefly indicated. To count the particles they must be made visible. C. T. R. Wilson, working in the Cavendish Laboratory, discovered that when positively and negatively charged particles are present in moist dust free air a cloud is produced when the air is cooled by sudden expansion, though this expansion was quite insufficient to produce condensation without the presence of electrified particles. The water condenses about the electrified particles as nuclei, and if they are not too numerous each one becomes the center of minute drop of water. Sir George Stokes has shown how the size of a water particle may be determined from the rate at which it falls. By measuring the speed with which the cloud formed by these particles falls, the data for determining the size were at hand.

Now, measuring the total amount of water in the cloud and dividing by the volume of a single drop, the number of drops or particles was found. The number of particles and the total charge carried by them is now known, and in turn the charge upon each individual particle calculated.

It was found that the charge per single corpuscles is 6.5×10^{-10} electrostatic units. It was also shown experimentally that no matter what the nature of the gas which was contained in the tube, or whatever electrode used, the particles were of the same mass, carried the same charges and behaved indentically in every respect, and that they were therefore invariably constituents of the atoms or molecules of all gases.

Since Faraday's enunciation of the laws of electrolysis through the work of Kohlrausch, Hittorf, Van Der Walls and others, there has been a well-established theory explaining the behavior of liquids conducting electricity, known as the the theory of Ions, or Wanderers. If a salt is dissolved in water and a current is passed, the electricity seems to be transferred, together with an atom or group of atoms forming the salt, and the amount of electricity carried stands in a simple relation to the combining weight of the atom or group of atoms carrying the charge.

A great number of experimental facts point to the conclusion that the chemical atoms forming the molecules are not in a permanent union, but that a continuous interchange is going on between the atoms of different molecules. At any moment by far the greatest number of atoms are combined, but there are a certain number of free wandering atoms carrying their appropriate electrical charges. These free atoms or groups of atoms are the ions, and under electric forces may be directed in their wandering, carrying with them their individual electric charges, positive and negative, to be given up to the terminal electrode in case of an electrolytic cell. The amount of electricity carried per hydrogen atom may be easily determined experimentally, and is found to be identical in amount with the charge carried by one of the Kathode or Thomson corpuscles in the vacuum tube. There seems to be good ground to believe that we have here to deal with a rather definite natural or molecular unit of electricity. In the case of liquid electrolysis the electric charge seems attached to a group of molecules called ion, differing according to the solution. In the rarified gas, or in gaseous conditions, these charges seem to be attached to or constitute corpuscles always alike and independent of the nature of the gas.

The corpuscles found to constitute the stream of Kathode rays are not confined to this some what inaccessible region, but are given off in large quantities by incandescent metals, by metals illuminated by a violet light, and, as shown by Becquerel, Mme. Curie, Rutherford, and others, by radium and all radio-active substances.

Recent investigations indicate further that radio-activity in a small and varying degree is almost universally notable, and in many cases is associated with the projection of these subatomic corpuscles invariable in nature of about $\frac{1}{1000}$ of the mass of a hydrogen atom.

An entirely different state of affairs is found for positive electrification. The positive charge complementary to the negative charge is always found to be associated with masses of the same order as an ordinary molecule, which varies with the nature of the gas in the vacuum tube, or with the surface from which the discharge of the invariable negative corpuscle is projected. This remarkable fact is very suggestive, and enters largely into the forming of the present theory of electrification. Dr. John Stone gave the name of electrons to the small negative corpuscles, suggested probably by the name of ions or electrions applied to the wandering groups of atoms in electrolysis.

A property analogous to inertia was long since noticed in electricity, known as self-induction. Prof. Rowland showed also that a static charge of electricity, moving with the velocity of light, produced the effect of a current and a magnetic field. Coupling these few mentioned well-known phenomena with the behavior and character of the electrons, a theory as to the nature of electricity is at once suggested, namely that the electrons constitute negative electricity, which is therefore of corpuscular nature, and that positive electrification consists in the absence of these corpuscles from ordinary matter. This view approximates closely to Franklin's one-fluid theory of electricity. We may then say that we know a great deal about this electric fluid. It is corpuscular in nature. We know the mass of each corpuscle; the charge each one represents; the velocity with which they move, and something about their size.

If positive electrification consists in the detachment of an electron and negative electrification in the attachment of an electron to an atom, and if these electrons have mass, a positive atom will have suffered diminution and a negative atom an increase of mass. The question, of what nature is the mass of the electron, is an interesting one.

The mathematical investigations of J. J. Thomson on moving charged spheres show that such a sphere has inertia because of the charge independent of its ordinary mass, and that it is proportional to the square of the charge, and inversely as the radius of the sphere. It will be seen from this that if the particles be made small enough the inertia may be increased indefinitely, and that in electrons, therefore, the inertia may be due largely or entirely to the concentration of the small unit charge, or that inertia may be electric.

The electronic theory is capable of explaining in a more satisfactory manner than any other, the many known electrical phenomena. Thus, in gaseous conduction, we observe flying particles like bullets in free flight carrying the electricity; in liquid conduction the electrons have to drag with them atoms of matter and move slowly, They have to work their way through the rest of the material Instead of going at a rate of speed of the order of thousands of miles per second, they travel of the order of inches per hour, depending upon the potential gradiant. In solids the atoms of material are fixed in their position or vibrate a little. The electrons are handed from one to the other.

How is electrical radiation explainable?

That light and electrical radiation are ether waves is reasonably certain; how they are produced, or how matter can generate them has been a puzzle. The result of many experiments seems to show that matter and ether are disconnected; that ether waves can not be directly produced by the motion of molecules in the manner in which sound waves are produced in the air by a tuning fork. Ordinarily molecules, or atoms of matter, seem to be incapable of getting hold of the ether, as it were. It became necessary to assume that it is not the molecule or atom vibrating which produces the waves, but rather the charge upon the atom, or as we would say, the electrons in the atom. They seem to be able to get hold of the ether. That an electron, accelerated in its motion, would produce these waves can be shown dynamically. The Kathode rays are invisible in space, but let the electron strike an obstacle and thus be accelerated, then radiation results as X rays, etc.

An orbital motion of the electron in or around an atom means that there is a central acceleration. This would be just as effective in producing radiation as a longitudinal vibration.

Larmor, Fitzgerald and Lorenz predicted that if light vibrations were produced by electrons revolving in orbital motion, as each moving electron represents a current and the electrons have motion, if the source of light were placed in a magnetic field, changes in the spectral lines from the source of light should result. The revolving electron would have a gyroscopic behavior. Zeeman experimentally showed that the predicted changes to occur, thus strikingly verifying or strengthening this theory of radiation.

Remembering, now, that the spectra of elements consist of hundreds and thousands of lines often, and that the vibrations are probably produced by the acceleration of electrons. Also bearing in mind the electrical peculiarities of atoms in electrolysis, also the fact that an electron is a bit of an atom chipped off, always the same, no matter what atom it may have been broken from, does not the speculation become interesting whether atoms of elements as we know them, may not be formed by aggregations of electrons in planetary arrangement, revolving in orbits determined by the energy distribution in the system. Thus, that an atom of hydrogen is composed, say of 350 positive and 350 negative electrons in planetary arrangement in violent orbital motion, so as to produce by electrical forces and centrifugal inertia a stable system, that 16 times as many in another stable group would form oxygen, and so on for all elements. Elements on this view would be regarded as a different grouping of one fundamental constituent, the electron. Of all possible groupings many would be unstable, the more stable forming known elements, the less stable having only an evanescent existence.

For a given number of electrons there may be several different configurations of stability, explaining some changes in the properties of atoms of the same element, well recognized chemically. The periodic law of Mendeljeeff becomes explicable. Prout's law assumes a new form ; instead of the hydrogen atom as the unit of which the atomic weights of elements are multiples, we have the electron as unit between $\frac{1}{700}$–$\frac{1}{1000}$ of the mass of the hydrogen atoms.

In heat phenomena we have irregular molecular agitation, which, if lost, can be made up from the energy of surrounding medium ; if not made up, there will be the ordinary phenomena of cold or cooling.

To the motions of the internal part of the molecule the idea of heat and temperature do not apply. The atom, if it lose electrons and energy with it, loses an essential ingredient. The radiating power of its constituent electrons would cause a change in the atom of matter which within itself has, therefore, the seeds of changes and decay. It would ultimately decompose into the electrons of which it is made up. This presents a serious difficulty. The process may be slow, the radiation loss imperceptible by ordinary means, but in the long run a degenerative result should be perceptible.

Have we any evidence of such degeneration?

Recently the phonomena of spontaneous radioactivity, discovered by Becquerel, extended by M. and Mme. Curie, and so skilfully experimented on by Rutherford and Soddy, have been carefully studied. At first it was supposed that these rays from a radioactive substance were ether impulses of the nature of X-rays; subsequently, as mainly composed of electrons. As a matter of fact, determined by most careful study, both are given off, but more important than these it has been shown, that there is a flinging off of actual atoms positively electrified, not minute like electrons, but of ordinary atomic dimensions. In their passage they ionize the air, meeting an obstruction like a cannon-ball striking a target, produce a flash of light and heat, but their velocity is enormously great as compared with a cannon-ball's velocity.

At first sight it would seem that we have to deal with an ordinary evaporation, or chemical decomposition, as the ethereal and other effects are secondary, but Prof. Rutherford, especially, has with great skill determined approximately the atomic weight of the minute by ordinary chemical methods imperceptible amount of substance thrown off. He finds that the emenation is not the radioactive substance at all, but an entirely different material. The interesting point then is, what relation does the material thrown off bear to that which is left behind. The atomic weight of Radium, one of the heaviest substances known, is about 225, that of the projected portion only of the order of two more nearly that of Hydrogen or Helium. The substance left behind should then have an atomic weight of the difference between the two if it results from flinging away a part of its own atom. The substance left behind in the radioactive material upon examination is found to be gaseous, as it can be handled like a gas, diffuses away, can be drawn through tubes, can be condensed at the temperature of liquid air. This residue is radioactive but rapidly decays in power, leaving another residue, different again, also radioactive, and finally leaves a residue which seems to pitch away electrons only.

Accepting these laboratory facts we are brought face to face with a strange transmission of matter going on spontaneously. As pointed out, an evolution from elemental conditions has been suspected. Mendeljeff's Periodic Law, Prout's Hypothesis spectroscopic evidence has indicated it, but never had it been actually observed. In radioactive substances it seems to be going on before our eyes. The quantities are unweighably minute, but by their electric actions these imponderable hopelessly minute quantities have been studied, and ordinary chemical operations performed upon them, the electroscope proving as illustrated in the beginning, enormously more sensitive as a measurer than the balance.

The theoretical conclusion concerning the inevitable loss of energy of an electrically constituted atom, finds remarkable confirmation in the dissolution we find in radioactive substances. Massive complex atoms composed of many electrons, it can be shown, are liable to get into an unstable condition, which will be reached when some of the particles, by resistance, have their speed increased to a critical point, when they will be thrown off and may form a new system. Thus the element would be the stable by-product of radioactive substances. On the whole it is quite likely that the percentage of such unstable atoms in a mass will be very small, and that in consequence say one in a million million million will fly to pieces. Just as in the heavens, though there are millions upon millions of stars and planets, encounters are few. Remembering the estimates of size given in the beginning, if say an atom of hydrogen consists of 700 electrons, and these in their orbital motions around one another effectually fill the space equal to the size of an atom as calculated by Thompson, Kelvin, Reighley, and others, the distances between the minute electrons would be of the order we find in an astronomical planetary system.

It has been calculated that the collapsing of the electrical constituents of a Radium atom by as much as one per cent. can supply the whole amount of the observed radiation for 30,000 years. It is to be supposed, then, that Radium and radioactive substances are gradually disintegrating into a more stable system, and this in turn into still more stable, but at a vastly slower rate, so that if the change in Radium be reckoned in thousands of years in the more stable substance, it might become millions, and so on.

We reckon geological times in hundreds of years; astronomical configurations in millions of years. It is probable that the changes we begin to suspect in the foundation stone of the universe, matter must be reckoned in millions of millions of centuries. In so far as cosmical history is concerned, matter may appear to us permanant, though at the rate of a hundred atoms per second, a couple of pounds of matter would require a period of a million times the age of the earth to drift away. Whether the amount of matter in the universe is constant we know not; it may be resolving itself into electrons, but so slow is the is the operation that it may not be noticed.

Recapitulating then, it may be taken as definitely proven :

1. That an electrically charged body possesses a property akin to inertia.

2. That every atom of matter can have associated with it a definite quantity of electricity called an ionic charge, and that no atom can have a fractional part of such an ionic charge.

3. That the attachment or detachment of such an ionic charge, or electron as it is called, brings about in the atom either a positive or negative state of electrification.

4. That the negative electrons can be separated from the atoms of matter; that when so separated from the atom they are projected at enormous velocities.

5. That the small electrons are the same no matter what kind of an atom they are chipped from.

6. That electrons when accelerated give rise to either vibrations as X rays, light, etc.

7. That they are exceedingly minute and can penetrate to great depth in solid materials.

8. That their mass is somewhere about $\frac{1}{1000}$ of the Hydrogen atom.

9. That the ordinary phenomena of electrification, current, etc., can be satisfactorily explained through their behavior.

10. That the electrons are given off from highly heated surfaces; from negatively charged surfaces when illuminated by violet light; that they discharge rapidly positively charged surfaces and can thus be detected readily in quantities absolutely unrecognizable by a balance.

11. That they are associated with radioactivity most intimately.

12. That in radioactive substances there is an elemental change.

Speculative.

Is the inertia of matter due in a large measure to the electrical inertia of electrons?

13. From dynamical consideration bodies like electrons, grouped in more or less stable dynamical equilibrium, would have electrical inertia, and this would explain many chemical and electrical properties of matter. Can atoms therefore be

made up of such electrons in planetary arrangement?

14. From theoretical considerations of the properties of electrons the amount of energy intrinsically contained in the atoms is enormous, and may explain the large quantity of energy radiated in radioactive material.

15. May the electron not be a connecting link between atomic matter and ether.

One of the great difficulties in the electronic theory of Electricity and matter is that a positive electron has never been detached from the atom.

Its promise so far is great. It supplies one of the elements in Maxwell's theory of electricity hitherto wanting.

It is fascinating, and upon a minute scale suggests that molecules and atoms have a structure similar to cosmic sytems.

It offers no ultimate explanation of the universe that we can ever hope to attain. As the microscope and telescope revealed the finer elements of cosmic and material structure so it seems to bring us a step nearer to a conception of the more nearly elemental structure of the material of the universe.

It should not lead us to wild speculation because of its seeming power but to the effort to test experimentally in the most painstaking and impartial manner its illumining power and gladly to improve and modify it as facts are revealed.

Utilization of Water Power.

By HARRY J. McDARGH, '96.

THE utilization of vast water powers in late years has been made possible by the successful transmission of electrical energy. It matters not whether it is desired to transmit the power for a distance of ten miles or a hundred miles, good results are obtained. The feature of electric power transmission is the high efficiency regularly obtained from electrical apparatus. Should a steam engine show eighty-five per cent efficiency it is considered a good result, but large electric generators show from ninety-five to ninety-seven per cent efficiency, and transformers as high as ninety-eight per cent. A transmission line seventy-five miles long, properly constructed, will transmit power with as little loss as a fair belt transmission of eighteen to twenty feet. Nevertheless the average water-power proposition of today requires careful consideration and economic construction so as to insure the proper return on the investment. It should be known approximately before going into details, not only how much power can be obtained for so many dollars and cents, but also how many dollars and cents you can get for your power.

When considering the improvement of a water power, there are a number of facts to be ascertained, the two most important being the amount of head which can be obtained and the minimum flow of the stream. The fall of a stream is an easy matter to find out; the minimum flow, however, is not so simple. One is sometimes fortunate in obtaining the results of U. S. Government Stations located on the streams in question. These experiments usually extend over a period of several years, and can be used to great advantage in conjunction with personal surveys. When there are no accurate records of the discharge of the stream, and it is intended to use the entire flow, one must not depend upon what he is told, either by the parties interested in the development, or by the proverbial oldest inhabitant along the river, as to what the lowest water mark really is. Experiments should be made throughout the season of low water and the minimum flow determined. Should the season be an abnormal one, due allowance must be made after a thorough study of the various conditions.

No two water powers can be designed alike; each one has its peculiar characteristics to be treated individually. The most common development of today is that of damming the stream at some suitable point to obtain the head, and placing the power house adjacent, either at right angles to the stream or parallel thereto. In the first case the site of the dam will have to be wide enough to afford the proper length of the weir dam, and also a bulkhead of equal length to the power house. In the second case, the water enters a forebay at one end of the weir dam and is led to the feeder pipes. The value of a storage reservoir formed by damming the stream is in some cases of vast benefit. For instance, suppose we have a river giving a minimum flow of 1,200 cubic feet per second, a storage reservoir from a dam of fifty feet in height of 26,000,000 cu. ft., and it is intended to run the plant for twelve hours of the twenty-four. This will allow during the twelve hour run the use of 2,400 cu. ft. per second by drawing on our reservoir for a height of two feet. Our power then will be based upon 2,400 cu. ft. per second with 49 feet head, instead of 1,200 cu. ft with 50 feet head. Use of the reservoir may be made in a similar manner for any other run that may be decided on, as 10, 11, 13, 14 or 15 hours.

One important feature in the designing of the plant is to have water in the forebay in as near a state of perfect quiet as possible before it enters the feeder pipes. The operating loads on the powers of today are usually irregular, and they can easily be taken care of on account of the close regulation of the wheels, if we have the forebay of such size as will readily respond with a sufficient amount of water. I have a case in mind where the water is led from the river to the power house by an open feeder something over one and one-half miles long. For a steady pull on the source the flow is very regular, and the velocity of the stream low, but at several periods of the day, when the loads are excessive for short intervals the water in the head race is consumed so fast that its level drops immediately and as much as is necessary to cause an increased velocity sufficient to pass the required volume. This is very detrimental to the efficiency of the plant, for as the head of the water over the center of the feeder pipe decreases, the quantity of water passing to the wheels decreases. In this case the only remedy would be for the feeder to be large enough to accommodate the maximum flow at any period, or by having a large storage reservoir to depend upon. Many of the first transmission plants had to be overhauled at great expense on account of this fact that the water could not reach the wheels freely enough to take care of the varying load on the generator with sufficient promptness to give the necessary regulation. I have knowledge of two cases where the hydraulic part of the two plants, costing $800,000 had to be altered at an expense of $175,000 in order to secure the regulation which is necessary in an electric plant.

Still another feature is that of the tail race. Here again we need ample cross section, and the better way is to have an independent tail race for each unit. The tail water should never have a velocity to exceed three or four feet per second. Some time since, I was called in, together with an electrical engineer, to make an examination of a plant, to find out why the four units in the station did not deliver an equal amount of power. The examination was short for the simple reason that the tail water from the four units emptied into one race of ony sufficient size to accommodate about one and one-half units. The result was that when all four units were in operation, the tail water rose from nothing at the unit nearest the outlet to a height of from ten to twelve feet on the draft tube of the unit on the opposite side to the outlet. It was simply a case of loss of head from the backwater in the tail race. An expenditure of $4,500 remedied the defect.

There are a number of different parts of the plant which require special consideration for each different location; such as the head, waste and sand gates, refuse and fish racks, length of weir dam, etc. The latter item is a very important one on streams subject to heavy flood conditions, for if the weir is not properly designed, the head of our power will be reduced to such an extent as will cripple the plant during the period of high water.

Another feature of the plant which depends on the immediate condition, is the size of the units used. Too many times the unit is entirely too large for economic and efficient service. To explain, suppose we have a plant of 3,000 h. p. total output. Usually it would be better to install three units of 1,000 h. p. each instead of two of 1,500 h. p. each. The percentage of time at which the plant is to run at its peak load is small, and as the machines always give the best efficiency when operating at nearly their full capacity, it is better to have two 1,000 h. p. units at full speed than two 1,500 h. p. units at two-thirds speed. The first cost will be greater in the first condition, but practice has proven that it is economical in the end. Another thing which has been proven is, that it is always economic to install an extra unit over and above the total capacity. For instance, in the example just taken there should be four 1,000 h. p. units, although the output is only 3,000 h. p.

These are a few of the features entering into the utilization of a water power, and it is to be hoped that some one may be interested in what has been said.

ALUMNI NOTES.

We hear indirectly of the recent marriage of Mr. W. Offutt Mundy, '95, at Detroit, Michigan. Mr. Mundy is Master Mechanic for the St. Louis Transit Company.

Mr. Edward Walser, '96, was married November 12th, to Miss Della M. Wilhelm, at the home of his wife's sister in Denver, Colorado. The wedding trip included a visit to St. Louis and to Terre Haute. Mr. Walser is Chemist for the Montana Zinc Company at Walkerville, a suburb of Butte, Montana.

Mr. Shelby S. Roberts, formerly division Engineer for the Henderson and St. Louis Divisions of the Louisville & Nashville Railroad, with office at Evansville, Indiana, is now located at Elizabethtown, Kentucky, in the position of roadmaster for the same company.

Mr. Chas. J. Larson, '00, Erecting Engineer for the Allis-Chalmers Company, of Milwaukee, Wisconsin, spent a few days here during the holidays. From here he went to St. Louis to superintend the closing out of the exhibit of that company.

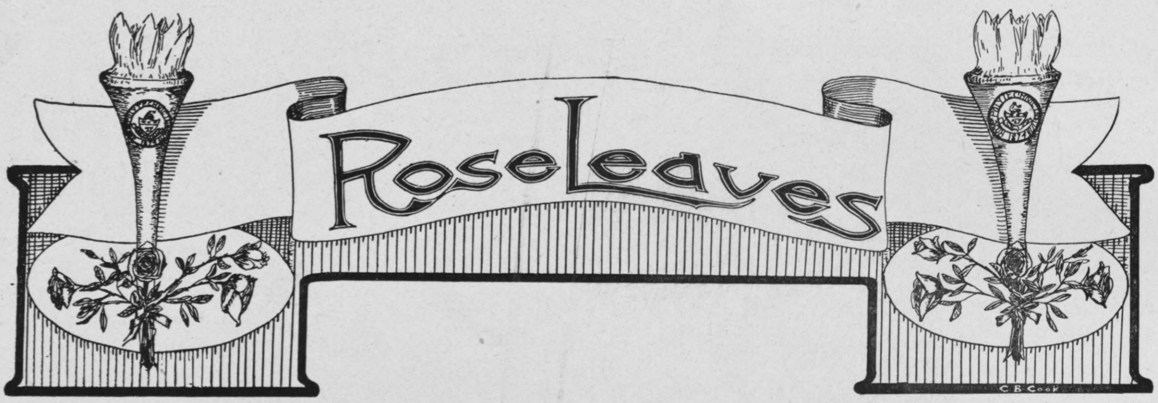
Mr. Robert C. Warren, '02, who has been Assistant City Chemist of Kansas City, Missouri, has recently taken a position as Chemist with the Tennessee Cotton Oil Company at Memphis, Tenn.

Mr. Brent C. Jacob, '03, has left the Western Electric Co., to take a position with the Electric Controller & Supply Co., of Cleveland, Ohio.

Mr. Edwin S. Allen, once a member of the Class of 1892, suffered a second stroke of paralysis in Cleveland, Ohio, where he has been Superintendent of the United States Government Stamp Cancelling machines. He is now in Indianapolis and sufficiently convalescent to be able to walk out. Mr. Allen was an old Terre Haute boy.

The storks visited the home of Professor of Machine Design, John B. Peddle and his wife, presenting them with a New Year's gift in the shape of baby girl. THE TECHNIC extends its hearty congratulations to "Jacky," only regretting that the new-comer can never be numbered among the students of Old Rose.

The class letter of '04 has been started. The letter will be sent to the following men, and the route follows the order in which names are given: Hill, Touzalin, Garrettson, Smith, French, Noelke, Dorn, Hahn, Sharp, Cory, Barbazette, Mullett, Crain, McFarland, Whitten, Bowsher, Miller, Bryon, Hazard, McCormick, McNabb. If any member finds that his name is not given above, it is because he has neglected to send his address to Hill, 1463 Monadnock Bldg., Chicago. On receipt of your name and address, Hill will arrange to have the letter sent to you when your turn comes.



The Single Phase Alternating-Current Motor.

By CLAUDE E. ROBERTSON, '05.

THE subject "The Single Phase Alternating-Current Motor," at present is receiving a great deal of attention. Several companies are giving this phase of the business considerable study, among which is the Wagner Electric Manufacturing Company of St. Louis, Mo., whose motor is one of the most successful on the market. An attempt will be made in this article to describe some of the major points in its construction and operation.

These motors are built in sizes from 1/8 to 35 horse-power, the open type construction ranging from 2 h.-p. up, and the enclosed type is confined to the smaller motors. The standard windings are for 104 and 208 volts, in frequencies from 25 to 133 cycles, thus enabling them to be supplied from the ordinary service transformer, although they will operate at a voltage between the limits of 100–120 or 200–240 volts. They may be wound at voltages much in excess of this.

Figure 1 shows in perspective one of their type "A" open type motors.

The fields are built up of thin punched mild steel discs insuring a high permeability and a low hysteresis loss. These are then bolted together, filed, insulated and passed to the field winder; the coils, one for each pole, are hand wound, the winding process being carried out by

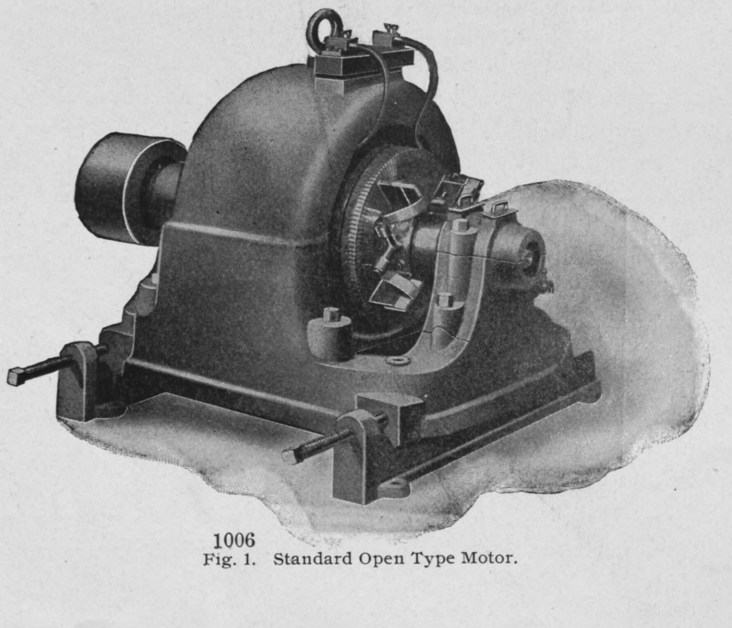


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Fig. 1. Standard Open Type Motor.

two men standing on opposite sides of the field. The wire for winding is wound on shuttles of a convenient length, generally holding enough wire to complete one or two poles. The winder starts the wire in one of the two middle slots on each side of the center tooth of the pole and hands the shuttle through the field to the assistant, who in turn passes the wire into the other slot and hands the shuttle to the winder. He repeats the operation until the required number of turns is in each slot, then the wire is carried into the adjacent slot, one on either side of those just filled, in a sort of a spiral fashion, and so on until all of the remaining slots of the pole are filled. The winding in this way produces a field which is strongest at the center of the pole, where it is most needed, and tapers uniformly in strength each way and is practically neutral at the extremities. The action of the armature does not distort the field in a marked degree.

Fig. 2 shows the complete field winding for a four-pole field. The coils are held in place by beveled wooden wedges driven in from the side. The figure shows how the stampings are held together. The field ring is placed in motor frame shown in cross-section in Figure 3. The

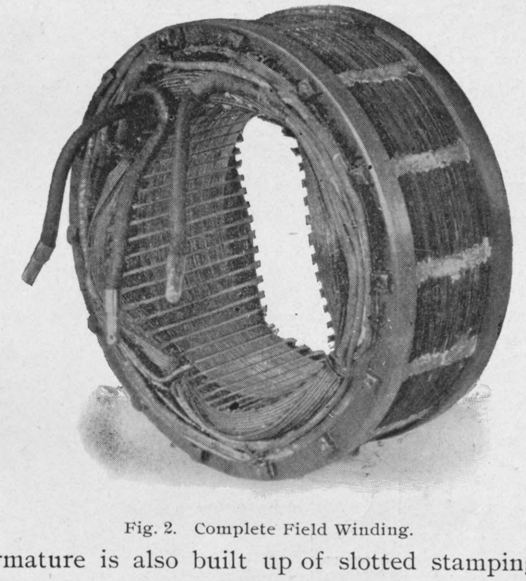


Fig. 2. Complete Field Winding.

armature is also built up of slotted stampings, and in general appearance it is much like the ordinary direct current armature. The coils are wound on formers and are interchangeable, the winding being a simple progressive one. The coils are connected to the commutator in the same way as in the direct current case. The commutator in itself is different, in that the brush-bearing surface is perpendicular to the shaft instead of being parallel to it. This enables the brushes to be removed from it in a direction parallel to the shaft, and at the same time introduces a complete circle of copper segments, thus completely short-circuiting every commutator bar. This when short-circuited is analogous to the squirrel cage winding, used in poly-phase motors. This operation is caused by the automatic governing device, which is contained within the armature. This may be seen in cross-section in Fig. 3, and is described later.

The motors are applicable in various ways—pumping work, motor work, motor generator sets, constant shop driving, etc.—but not so well in work requiring extremely frequent starting, and a wide speed variation.

The starting is a simple matter, and for ordinary conditions, where no extreme high starting torque is required, no starting resistance is used, simply close the motor switch. For other conditions of starting, requiring a heavy torque, ordinary starting resistance is used. It starts in a manner similar to a direct current series motor, the brushes bearing on the commutator. On attaining speed near synchronism, the brushes are removed from the commutator and each commutator bar is short-circuited by the automatic governing device contained within the armature as before mentioned. From now on it runs as an induction motor. If, for any cause, the motor should slow down below the required speed, the brushes automatically return to the commutator, and it again runs up to the full load speed.

These motors start under full load and require no condenser or other phase-displacing apparatus. They develop on starting a torque which is several per cent. greater than their full load torque.

Reference to Figure 3, the cross-section of a Type A (open type) motor, shows the relative parts of the automatic governing device with all of its adjacent mechanism. The position of the governor weights when the armature is at rest is shown in solid lines. In this position the brushes shown in dotted lines rest on the commutator, and the short-circuiting ring is shown within the commutator over the spring barrel somewhat to the right. On attaining the full load speed the governor weights fly out until they assume the position indicated by the dotted lines, and at the same time the short-circuiting ring moves to the left and engages with the commutator. The brushes are removed in a direction parallel to the shaft. The spring serves to keep the brushes on until the armature has attained the proper speed.

They can be operated on any ordinary alternating current circuit without producing any variation in the voltage of the circuit. On this account they can be operated on a lighting circuit and will not affect the lamps. They may also be used on one phase of a polyphase circuit.

Alternating current motors vary in speed in direct proportion to the frequency of the supply circuit. For example, a motor operating on a 60 cycle current at 1800 R. P. M. would operate on a 40 cycle current at 1200 R.P.M. The direction of rotation may be changed by shifting the brushes.

The table below gives a tabulated list of the various sizes with reference to the full load current at 104 volts, speed and power of the 60 cycle moderate speed motor:

Type	Horse Power	Approximate Full Load Current at 104 Volts	Full Load Speed	Approximate Shipping Weight
C	1/8	3.8	1750	65
C	1/4	5.4	1750	65
C	1/2	7.7	1750	100
B	1/2	7.8	1750	235
B	1	13.2	1750	285
B	2	24.5	1750	385
B	3	38.3	1750	386
A	4	46.3	1750	505
A	5	62.	1750	825
A	7½	86.	1750	825
A	10	115.	1750	825
A	15	160.	1165	1650
A	20	220.	1165	1650
A	25	260.	1165	2225
A	30	305.	1165	2225
A	35	348.	1165	2225

A number of advantages which may be summed up and used in taking single phase motor installations is as follows:

They are self-starting under full load, and when up to running speed they can take a full load better that a direct-current motor, in that

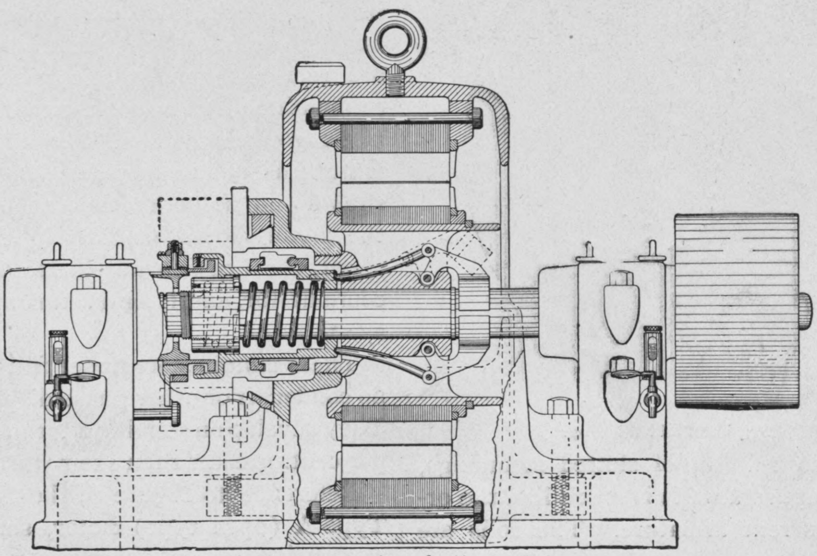


Fig. 3. Cross-section of a Type A Motor.

they cause no trouble by sparking, as they have no commutator connection.

In using single phase instead of polyphase motors a first cost saving is made in the transformer installation, as only one have to be erected ; economy in operation, since only the transformer losses in one transformer have to be paid for ; as they require only two service wires, they are simpler in installation ; since the motor has no effect on the regulation of the voltage of the circuit, lighting circuits may be used for power circuits; their efficiency and power factors are high.

In conclusion mention might be made that the Edward Longstreth Medal of Merit was awarded this company for the development of this type of motor.

The writer is indebted to the company for the cuts used in illustrating this article and the free use of their current bulletin used in the preparation of this article.

The Glee Club's production of the burlesque opera, "Red Riding Hood," has added to the history of the club another decided success. As you look back in your mind's eye upon the scenes of the operetta, you cannot help but smile at the thought of "little Willie Heick" as R. R. Hood, Blanchard as Mamma and Shryer as Grandma, with the "rare old spinning-wheel." But these are not the only ones who deserve praise, for everything was done well, from the playing of the title role, to the beating of the bass drum in the orchestra.

The fine scenic effects, the rapid changes from glaring sunlight to the soft, dreamy rays of the moon, reflect great credit on the talented super and stage manager, William Scott Hanley.

The orchestra, in its "Symphonic Poem," was on the still hunt for the Lost Chord, and as for any results achieved, is on the hunt still. In the other selections, however, it conclusively showed that it can make music when it wants to.

Fisher, as the Woodman, did some original stunts in the way of chopping trees. Canfield and Lewis drew their share of the applause by their presentation of Buttercup and Bluebell. Buster Brown liked his costume so well that he appeared in this guise the next evening, much to the amusement of some of his friends.

We should, perhaps, go through the entire cast, and praise each one individually, but space is limited, time is flying, and we must bring this to a close. So we will sum it up by saying again that everyone concerned did his part, and did it well, and the production certainly reflects credit on the club and its able leader, Mrs. Carrie B. Adams.

Resolutions submitted by the Council in regard to the death of Vernon Victor Crawley :

WHEREAS, We have been deprived by death of our fellow-student, Vernon Victor Crawley, be it

Resolved, That we, the Student Body and Student Council of the Rose Polytechnic Institute, express our sorrow and sympathy to the bereaved family; and be it

Resolved, That these resolutions be spread upon the records of the Council, and that a copy be sent to the family, and that a copy be sent to THE ROSE TECHNIC for publication.

SPEAKER,
PECK,
STRECKER,
Committee.

Resolutions of the Sophomore Class upon the death of Vernon Victor Crawley :

WHEREAS, We have been deprived by death of our friend and class-mate, Vernon Victor Crawley, be it

Resolved, That we, the Class of Nineteen Hundred Seven, do take this means of expressing our feelings and of extending our heartfelt sympathy to the bereaved family ; be it further

Resolved, That a copy of these resolutions be forwarded to the family of our deceased friend and classmate, and also a copy given to THE ROSE TECHNIC for publication.

W. W. KELLY,
M. GOODMAN,
H. L. DAVIES,
Committee.

OBITUARY.

The death of Vernon Victor Crawley, '07, only son of Mrs. Lena Crawley, occurred December 14th, at the home of his aunt, Mrs. Jas. Ernest, on North Eighth street. During the past summer he had not enjoyed the best of health. On the opening day of school in September he registered for work. When he returned home in the evening he became suddenly ill and never recovered sufficiently to resume his school work. During the first few weeks of his illness he spent much of his time studying, ever hopeful that he might regain his health and be able to re-enter school before the middle of the first term. He was finally compelled to abandon all hopes of returning to school this year and expressed a desire to resume the work next September. Throughout his illness he was cheerful and always had a pleasant word for everyone.

The deceased was born on July 8, 1886, at Sullivan, Ind. At the age of six he entered the public schools of that place and attended continuously each school year until the close of his junior year, in June, 1902. In September of the following year he entered Rose. He was a diligent student and always put forth his best efforts to do his work well.

He was converted and became a member of the Presbyterian church when he was thirteen years of age. During his residence in Terre Haute he attended the Centenary church. A mother and sister survive him, his father having died when he was two years of age. The funeral took place Friday morning, December 16th, at the home of his aunt, Mrs. Ernest, on North Eighth street. Mr. E. T. Wires conducted a short service at 8:30 o'clock. A male quartette, composed of members of the class of '07, sung some very appropriate hymns.

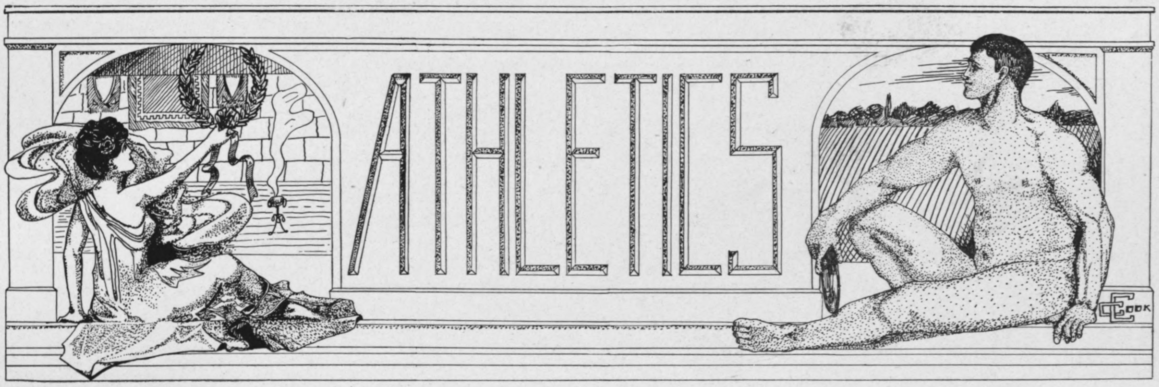
The body was taken to Sullivan at 10 o'clock over the E. & T. H. railroad, where the funeral proper took place from the Presbyterian church at 11:45 o'clock. Interment took place at Center Ridge Cemetery. Milton Goodman, W. W. Kelly and Thos. E. Routledge attended the funeral as representatives of the Sophomore class. The faculty, student body, the Sophomore class, Terre Haute friends and Sullivan High School sent beautiful floral tributes.

Now that the holiday season is over, let us all put our shoulders to the wheel and finish our Association year with as much zeal as we began it. As is customary, most persons make resolutions at the beginning of the year, but the Association only means to hold on to the resolutions made at the beginning of the academic year, that of doing everything possible for the betterment of the student-body.

The basket-ball schedule for 1905 has been issued in card form by the Association, to be distributed among the students. Anyone having failed to secure one of these will be supplied by any member. No meeting was held Dec. 16, on account of the entertainment given by the Glee Club that night.

As heretofore, the reading-room table will be supplied with the current literature. Two new periodicals have been added to the list.

The Programme Committee has some interesting meetings in store for the next month. Assistant State Secretary, A. W. Hanson, of Indianapolis, and C. B. Jamison of the city association will conduct two of the meetings.



REPORT OF I. I. A. A.

THE meeting was called to order in the meeting room of the Dennison Hotel, on Saturday, December 10th, at 2:30 P. M., Jamison, of Purdue, presiding. The report of the treasurer, C. A. Sartain, of DePauw, was read. After a lengthy discussion, it was decided that each school would be furnished a copy of the old constitution—the one as revised by the committee—and the rules governing the Intercollegiate Conference Athletic Association. These are to be carefully examined by the Athletic Association of each college, and to instruct its representative as to its wishes in regard to a new constitution.

The "Big Three" seems to be wholly in favor of adopting the rules of the Intercollegiate Conference Athletic Association.

A special meeting will be held on Saturday, January 14th, at the Dennison Hotel, Indianapolis, to decide on the new constitution.

The Annual Field Meet was decided to be held at Bloomington, Ind., on the Saturday preceding the Conference meet.

The officers for the year 1905 are: President, Hanley, Rose; Vice-President, Daily, Notre Dame; Secretary, ———, DePauw; Treasurer, Sutherland, Wabash. Finance Committee: Jamison, Purdue, and Clevinger, Indiana.

The State Normal withdrew from the Association.

W. S. HANLEY.

REPORT OF I. C. A. L. MEETING.

The regular annual meeting of the I. C. A. L. was called to order in the meeting room of the Dennison Hotel, Indianapolis, Ind., on the morning of December 10th, 1904, at eleven o'clock, President Roach, of Franklin, presiding.

Brunson, of Earlham, was chosen Secretary *pro tem.*

Report of Treasurer W. S. Hanley for the year ending December, 1904, was read and accepted. His report of the State Field Meet, which was held at Terre Haute, May 23rd, 1904, was also read and accepted.

The report of the Finance Committee was found to be correct.

The Secretary was instructed to write a letter of thanks to Horace Partridge & Co., 84 Franklin street, Boston, Mass., for their gift to the Association of a tennis racquet.

In order that the matter of amending the constitution might be brought up at this meeting, the ruling of Section XV of the constitution was waived.

Wabash attempted to have the two-mile run placed in the list of field events, but failed.

It was decided to drop the standing broad jump from the list of events and substitute in its place the discus hurl.

The invitation to hold the State Field Meet in Terre Haute, under the auspices of the Indiana State Normal, was accepted and the date set, Saturday, May 13th, 1905.

It was decided not to consider an application from Butler College to join the I. C. A. L.

The officers for the year 1905, elected and installed, are: President, H. R. Sutherland, Wabash; Vice-President, Brunson, Earlham; Secretary, Hanley, Rose; Treasurer, Wallace, Hanover. Finance Committee: J. P. Kimmel, I. S. N., Chairman; S. P. Roach, Franklin.

J. P. Kimmel, H. R. Sutherland and W. S. Hanley were made a committee to revise the constitution, and report at least one month before the next meeting. W. S. HANLEY.

FOOT-BALL MANAGER FOR 1905.

At a recent meeting of the Athletic Directors the question of the new foot-ball manager was brought up, and the result was that Mr. F. N. Hatch, '06, was unanimously elected.

Mr. Hatch certainly will be a credit to the position for both his hustling and business abilities. As a result of this he already has one game scheduled up to date, and three more under consideration.

ROSE, 30; INDIANA, 14.

The basket ball season for Rose opened Saturday, January 7th, with a brilliant victory over Indiana University, at Bloomington. While every body was confident that Rose would make a good showing and had a good chance of winning, no one had expected a victory so complete and decisive as was this. At no time during the game did Indiana seem to have any chance of winning, Rose taking the lead at the start and steadily increasing it throughout the game, although it required a great effort to do so.

The game was called at 8:15, and Trueblood started something by scoring the first goal after about three minutes of play. This was followed by Harmeson and Ritterscamp scoring field goals for Indiana, but Thurman immediately converted Hyatt's foul into a point for Rose, and Trueblood again made a pretty field goal, and in less than a minute more Thurman had scored two more foul goals on fouls by Hyatt and Taber, and then landed a field goal from the right boundary line. Trueblood followed this with a sensational overhanded field goal from near the center of the field.

After a few more minutes play, Lindemann helped the good work along by scoring another goal for Rose.

Indiana was then awarded two points on fouls by Johnson and Thurman, and Taber scored his first foul goal. This was followed by another goal by Trueblood after a piece of clever pass work on the part of Trueblood, Thurman and Daily. Thurman continued to help out by making two foul goals on fouls by Hyatt. Here the whistle blew for the first half. Score: Rose, 17; Indiana, 7.

SECOND HALF.

The second half opened fast and rough, and several minutes of play went by without result, until Taber converted Trueblood's foul into a point for Indiana. Indiana then got busy and threw two field goals in quick succession, through the efforts of Harmeson and Ritterscamp. Atridge then awarded Rose one point on a foul by Teeter.

Here Rose came to the front again, and before the smoke had rolled away we were five more field goals to the good; two of these being scored by Daily on difficult chances, one by Trueblood and one each by Thurman and Lindemann, each on long shots from the center of the field. After this awful jolt to Indiana, Taber sought to better things by substituting Carr for Ritterscamp, and Cookson for Harmeson, and Harmeson for Teeter; but it was of no avail, the fast team work being entirely too much for them.

There remained but a short time to play, but Thurman brought our score to 30 by two goals on fouls by Carr and Hyatt. Indiana then got her last two points on a field goal by Harmeson. Final score: Rose, 30; Indiana, 14.

For Rose, every man played a brilliant game; Trueblood's work being the feature.

For Indiana, Harmeson and Hyatt did the best work.

SUMMARY.

INDIANA. FIRST HALF.

	Field Goals.	Foul Goals.	Fouls.
Teeter, C.	0	0	1
Harmeson, F.	1	0	1
Ritterscamp, F.	1	0	1
Taber, Capt. G.	0	1	3
Hyatt, G.	0	0	4

Awarded 2 points on fouls.

SECOND HALF.

	Field Goals.	Foul Goals.	Fouls.
Teeter, C.	0	0	1
Harmeson, F. & C.	2	0	0
Ritterscamp, F.	1	0	1
Taber, G.	0	1	1
Hyatt, G.	0	0	1
Carr, F.	0	0	1
Cookson, F.	0	0	0

ROSE. FIRST HALF.

	Field Goals.	Foul Goals.	Fouls.
Trueblood, Capt. C.	4	0	2
Thurman, F.	1	5	2
Daily, F.	0	0	1
Johnson, G.	0	0	2
Lindeman, G.	1	0	1

SECOND HALF.

Trueblood, Capt. C.	1	0	1
Thurman, F.	1	2	0
Daily, F.	2	0	1
Johnson, G.	0	0	0
Lindeman, G.	1	0	1

Referee—Atridge, Louisville, Ky.
Umpire—Kaufman, Bloomington.
Scorer—Snider for Rose.
Timer—Glover for Rose.

ROSE, 40; HANOVER, 22.

The second game and the second victory, and now for Wabash. The game on January 9, with Hanover, while not close, was certainly interesting and showed us our team had gained some accomplishments which will stand them in good stead. After a hard game Saturday, they played a snappy game from start to finish, and the passing, besides being swift and on the run, was accurate. The main trouble seemed to be in holding on to the ball, but as it was a new one, this fault was excusable.

Glover and Freudenreich went in at the start as guard and forward, and did excellent work, especially when the fact that they have played against the first team so long that they have hardly had a chance to get used to playing with them, is taken into consideration. Freudenreich made two field goals, while Glover literally stuck to his man.

Trueblood was in his old form and played the whole floor. He made one especially fine play, when, at the south goal a Rose man threw what seemed to be a "basket," but the ball, after bouncing on the rim, started to drop—he jumped up and slapped it in. Daily got the largest number of field goals, having six, while Lindeman was close behind with four. Thurman and Johnson played rings around their men, as usual.

The only fault our team has that is serious is, the tendency to foul, seventeen being called on them during this game to Hanover's eight. But what was a good deal worse was the way the rooters received the calling of these fouls, and it was certainly good to see the way the hissing was cut short the one time it was tried. Remember, the thing that hissing is representative of, is the snake — if you want to be in that class, why go ahead and hiss.

Both the captains and members of the teams declared themselves well pleased with the referee's decisions, and this should be enough — however, if any rooters or other spectators do not agree with the referee or umpire in the future, they would certainly be wise to keep their opinions to themselves. Remember, the captain is there to do all the kicking that is required.

And now that we see we have the genuine article and a "sure 'nuff" team, let's all join voices and support them as no Poly team has ever been supported before.

Individual score is given below.

HANOVER.

	Field Goals.	Goals from Foul.	Fouls.
Fisher, F.	1	0	0
Salisbury, F.	2	4	2
Sims, C.	2	0	1
Oldfather, G.	0	0	3
Whallon, G.	2	1	2
Total	14	5	8

Note: Hanover awarded 3 points on Rose's fouls when throwing for goals,

ROSE.

	Field Goals.	Goals from Foul.	Fouls.
Daily, F.	6	0	3
Freudenreich, F.	2	0	5
Thurman, F.	1	3	1
Glover, G.	0	0	1
Johnson, G.	1	0	5
Trueblood, C.	3	1	2
Lindemann, G.	4	0	3
Total	34	4	17

Note: Rose awarded 2 points on Hanover's fouls when throwing to goal.

THE 1905 TRACK TEAM.

Now that the track season is almost here, perhaps it would be well to say a little about the outlook, and the team in general.

Practice will start shortly after exams, as it did last year, and the work will be about the same—gym work, with a few field events on two days a week, while an endeavor is being made to obtain the Y. M. C. A. gym and track on Saturdays.

The team will be allowed about $150.00 this year, and as no expense will be incurred at the State meet, it is probable that one or two short trips will be taken. As many meets as possible, both indoor and outdoor, will be arranged for, and the men making the best showing in these, of course, will represent Rose in the State meet, and after this it is possible that a few will be sent to the big meet of the I. I. A. A.

In the "hundred," "two-twenty"—in fact, in every event—we have our men of last year's team, with the exception of Hahn, Crevoisie, Unckrich and Hannum. However, of these Unckrich was the only one to score in the State meet last year, winning the 220 hurdles, but this was due only to Modesitt's bad luck, and Modesitt should lower his record this year easily.

What Turk will do in the 100, 220, 440 and running broad goes without saying, and just as much is expected of him in the discus. At the pinch he is also available for the high jump, shot-put, hurdles and hammer-throw. There is promise of good material in the distance runs also, while, in the pole-vault we have the same men, with a year's added experience.

Taking all these things in consideration, it seems that we are weakest in the shot-put and distance runs, and these will be the events where the greatest efforts will be put forth to develop good material.

In the State meet, however, we most decidedly will not have as easy a time as everybody seems to believe, and if they will stop to consider a minute they will see that it will take good hard work to win, and win we must, for "the third time is a charm." But win the meet or not, if the men representing Rose live up to their past records, the track team of 1905 will undoubtedly be the best Rose has ever had.

NOTES.

At the recent I. C. A. L. meeting things were beginning to look gloomy for those of us who wanted the State meet at Terre Haute, when Delegate Hanley, by a fine speech on Terre Haute hospitality, and—and other things, caused a unanimous vote in our favor, and also caused the standing broad jump to be cut out. It is enough to his credit to say that Rose got everything she wanted.

The following men were allowed a vote for football captain for 1905:

McBride, Lammers, Peck, Speaker, Heick, Benbridge, Wilms, Douthett, Cook, Bland, Turk, Post, Schmidt, Lee. The balloting resulted in the election of A. W. Lee, '06.

Just before the holidays Wabash defeated Purdue 25 to 17; Rose beat Indiana 30 to 14. Now, why doesn't Normal play Notre Dame?

Track men will be interested in the following records, which as near as can be obtained from old *Modui* and TECHNICS, are the school records for Rose since the first track team in 1890, made in either dual or State meets:

100 yds., Turk, '07, and Lee, '06; time, :10$\frac{1}{5}$″. 220 yds., Turk, '07, :22″. 440 yds., McTaggart, '95, :54$\frac{2}{5}$″. 880 yds., Hahn, '04, 2:10$\frac{2}{5}$″. 120 yd. hurdles, Peddle, '05, :17″. 220 yd. hurdles, no record. Running broad jump, Turk, '07, 22′ 1″. Running high jump, Wischmeyer, '06, 5′ 7″. Hammer throw, Brannon, '07, 100′ 6″. Discus hurl, Turk, '07, 104′ 3″. Pole vault Larkins, '05, 10′ 1″. In the mile Freudenreich, '98, probably holds the record, having made the distance under 5 mins., and in the shot-put Peker, who died, while attending here, is said to have made over 40′.

Klenk—"The heat is rejected every two cycles."

Kadel—"That must be a bicycle."

Lorenz—"Well, if the square root of 9 is 3, I should think the square root of nine-tenths would be three-tenths."

White—"I like a girl with a double chin. You can use both hands when you tickle her under the chin."

Gillette—"Yes, the advantages of a double chin are two-fold."

It is reported that R. Lee is learning to play checkers.

"Take care, Rachel, or you will be leading a checkered career."

Haller—"Is it *still* snowing?"

'07—Yes, I guess it is *still* snowing; I don't hear any noise."

Dr. White— "It is hard to get a lather in hard water."

Soph—"But it isn't hard to get a lather in hard times."

Dr. White—"McCormick, what chemical reaction takes place when gas is burned in air?"

McCormick (thoughtfully)—"Heat."

Bard—"Hi, there! Look out, you'll shoot me."

Cash—"I am not aiming at you."

Bard—"That's just what worries me."

Turk (looking into the dreamy eyes of one of the Terre Haute beauties)—"It could rain bricks and I would be all unconscious."

She—"You probably would—after the first one hit you."

Geo. McCormick, otherwise "Buster Brown," was initiated into the M. E. P. Some of us can vouch for it being amusing.

Overheard at a dance:

Bland—"I wish I were a great artist and could paint you."

She—"Why, I am no great artist, and yet I paint myself all the time."

It may be unmanly to give up, but it takes a lot of courage to give up your seat to a woman in a crowded car.—[*Ex.*

Some good advice to the Freshmen: "The best drawing instruments are forceps and tack-pullers."

In the Kentucky mountains. An example of hospitality:

Mother (from the back room)—"Molly, isn't that young man kissing you?"

Molly—"Yessam."

Mother—"Well, tell him to stop."

Molly—"If you want him to stop you will have to tell him yourself; I haven't been introduced."

Schauwecker—"Is your cook pretty?"

Kelsall—"No, but she cooks pretty good."

RED FRECKLES.

Turk, '07, who spent the holidays at Louisville, thinks the girls down there are awfully inquisitive. One of them asked him: "Mr. Turk, have you read 'Freckles?'" To which he answered: "No, but I used to have."

Max—"I have no younger brother, and I am glad of it."

Johnnie—"I think he would say the same thing, if you had one."

Emile Fischer, 08, has been initiated into the M. E. P.

Worthy—"A horse had a fit on Seventh street this afternoon."

Harry—"What kind of a horse was it?"

Worthy—"I don't know; I didn't see the horse; I saw the fit."

McCormick—"Give me some rope for a wig."

Clerk—"Do you want hair rope?"

At a recent meeting of the Symphony Club it was decided to give a concert, in the near future, for the benefit of our Athletic Association.

Hath says to the Sophs, after the holidays: "Well, boys, I don't suppose any of you have been on a diet of quaternions, have you?"

GEOGRAPHICAL.

Fischer—"Where is Dresden?"

Ryan—"China, of course; I saw the address in a show window the other day."

Dr. White (coming into the room while the class of '07 were giving "nine bahs" for Snead)—"My, but you are a fine lot of kids."

Hath—"I have one of those instruments, but I can't find it without looking for it."

QUEERLY EXPRESSED.

Zambrano, '08—"Fischer, take that smile out of your face."

Exchanges.

Purdue University has been given the electric air-brake instruction equipment which was on exhibition at St. Louis during the Fair. This apparatus was shown by the National Electric Company.

Michigan's alumni numbers 15,000, against Harvard's 14,000 and Yale's 11,000.

The students at the University of Iowa who took part in the Spanish-American war are to receive free tuition.

A statement from the Graduate Treasurer of Athletics of Harvard University shows an income of $112,262.39 for 1904, a profit of $33,057.51 for the year.—[*The Tech.*]

Rensselaer Tech contemplates rebuilding in the near future, having lost several buildings during the recent fires. There have been several rumors abroad to the effect that the Institute might be removed from Troy, owing to several generous offers from other cities, but these are denied by the Institute Trustees.

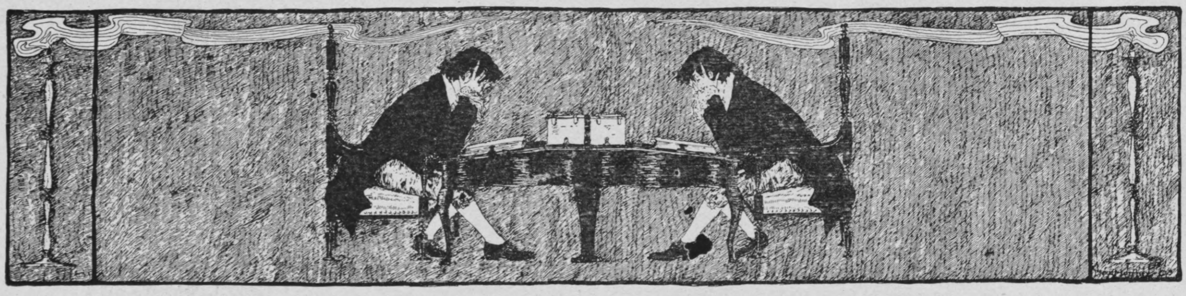
Many letters have lately been received by Walter Camp, Chairman of the Foot-ball Rules Committee, in regard to the lessening of weight on the teams and the encouragement of open play. This is to be accomplished by the rules of the future. Quite a few arguments are set forth in favor of speed and agility in place of "beef" and brute force. Statistics show a total of 13 dead and 296 injured this season in foot-ball—the same number as were killed last year, but the list of injured is unsurpassed in its magnitude. —[*Case Tech.*]

Japan has the largest university in the world. At this school at Tokio there are 48,000 students enrolled, and the principal aims of the young Japs seem to be, to be lawyers and civil and mechanical engineers. To this college Russia probably owes a large amount of her inability to defeat the Japanese.—[*Wesleyan Argus.*]

The University of California played her last game of foot-ball Christmas day.

At a recent meeting of the representatives of the "Big Nine" it was decided to pass a rule barring freshmen from athletics until they have been in regular attendance at least four and a half months.

The Engineering Laboratory is in receipt of two gas engines of recent design, which are now being installed as part of the regular equipment. They are a Meriam-Abbott double cylinder, vertical engine of 18 H. P., and a Fairbanks-Morse single cylinder horizontal engine of 20 H. P., especially designed to use kerosene as fuel. —[*The Exponent.*] C. B. C.



REVIEWS

THE American Society of Mechanical Engineers held its twenty-fourth annual meeting in New York, December 6–9, 1904. A strong program of technical papers, mostly on machinery and tools, and their tests, was presented. An election of officers for the ensuing year was held, and Mr. John R. Freeman, of Providence, R. I., was elected President.

THE *American Machinist* for December 15th contains an article describing the locomotive testing plant of the Pennsylvania Railroad at the St, Louis Exposition. The description is accompanied with a number of illustrations which show in detail the construction of this interesting engineering exhibit.

IN May there will be held in Washington a session of the International Railway Congress. This will be the first time that the Congress has met in the United States, and the second time it has been held in an English-speaking country. The first Congress met in Brussels in 1885, and the succeeding meetings have been Milan, 1887; Paris, 1889; St. Petersburg, 1892; London, 1895; Paris, 1900. Subjects bearing upon the various phases of railroad work will be discussed.

To Raise the Battleship "Maine."

WE learn from the *Engineering News* that it is proposed to entirely remove the battleship "Maine" from the harbor of Havana, where it was sunk on Feb. 15, 1898. The United States having relinquished all claims to the battleship, it becomes the property of the Cuban government, which has made earnest efforts to secure its removal, especially because it forms a serious obstruction to the navigation of the harbor.

The company which has been formed for the purpose of removing the wreck proposes to construct around the ship an immense wooden cofferdam.

"This cofferdam will be truly circular in form, with an inside diameter of 354 feet in the clear, thus providing a clearance of 15 feet at each end of the battleship. The cofferdam will consist of two concentric timber walls spaced eight feet apart in the clear, each wall being composed of 3-inch planks dressed to a uniform thickness, laid flat and thoroughly spiked together. The walls are to be tied together at intervals of between nine and ten feet by solid radial partitions also composed of 3-inch planks dressed to a uniform thickness, laid flat and thoroughly spiked together.

"It is the purpose of the company, first to remove the bodies of the sailors and their personal effects, and then to make the undertaking a financial success by the recovery of all the valuable articles, such as arms, cannon, coal, machinery, etc., and the uninjured part of the battleship itself. It is also proposed to admit visitors to the wreck after the cofferdam is pumped out, charging an admission fee; and, after the ship is floated, to exhibit it at the principal ports of the United States. It is also proposed to manufacture articles of brass, bronze and copper found upon the wreck into mementoes, to be sold with certificates of American and Cuban officials as to their genuineness. Sufficient material of all kind will previously, however, be set aside for the contemplated memorial and placed at the disposal of the memorial committee. Photographers offer large sums for the exclusive rights to take views of the wreck from time to time as the water is being pumped out. The revenue which will be derived from these sources will be much more than sufficient to pay for the cost of building the necessary cofferdam and removing the wreck.

"Should it be found possible to repair the damaged part of the vessel, it will be placed on the floating dock at Havana, and the battleship be completely repaired, when there will be for sale to some government a complete battleship which originally cost the U. S. Government $5,000,000 to build and equip."

THE following industrial publications have been received, and will be cheerfully submitted to any who may desire to see them:

"The Sargent Complete Expansion Gas Engine," from the Wellman-Seaver-Morgan Co.

A pamphlet from the Morse Chain Co., describing its silent-running high-speed chains.

Several pamphlets from the Wile Power Gas Co., giving a detailed description of the construction and operation of its gas producers.

An interesting little publication from Laurence, Scott & Co., Ltd., of Norwich, Eng., entitled, "Notes on Electric Motors," which explains in a clear manner many points relating to the construction and operation of direct-current motors.

"Machine Tool Drive," a publication from the Westinghouse Electric Co., setting forth the advantages to be derived from the installation of electric motor driving in machine shops and other industrial plants.

A binder from the Fort Wayne Electric Works, containing many bulletins devoted to arc lamps, electric generators, electric motors, motor-starting rheostats, wattmeters, voltmeters, ammeters, switchboards, cut-outs, transformers, street lighting systems and other electrical machinery and apparatus, with many illustrations. Also an index to all the bulletins issued by the company.

"Air Brake Tests," a handsomely bound book of 323 pages (5 by 7 inches in size) compiled and published by the Westinghouse Air Brake Co. in connection with its exhibit of braking appliances at the Louisiana Purchase exposition. It contains the history of the air brake in the United States as marked into periods of development by the series of well-known brake trials which indicate the important turning points of improvement. It is probably one of the most valuable and important works which has thus far appeared in connection with this subject.

THE Electric Controller & Supply Co., Cleveland, O., has just shipped the second of two 200 h. p. 200 volt Type M. T. Magnetic Switch Controllers to the Lorain plant of the National Tube Co. They are for the control of the reversing motors driving the tilting tables on each side of the plate mill. These controllers give automatic acceleration, which can be adjusted to the maximum rate consistent with safety to motors and gearing.

When reversing from full speed forward to full speed reverse the table is automatically brought to a quick stop and accelerated in reverse direction in the least time interval consistent with safety. The magnetic controller with resistance is placed near the motor, thereby effecting economy in the use of heavy wires. The operating controller, consisting of a small master switch, is conveniently mounted on the roller's pulpit, and since the contacts of this controller carry only very light current, it may be operated with exceptional ease. The construction of the magnetic controller, however, is such that, no matter how rapidly the operating controller may be reversed, the current flowing to the motor is automatically limited to a safe value.

The M. T. Controller is especially adapted to the control of motors of any h. p. driving machinery which must be quickly accelerated, but which has such heavy parts that with the ordinary manually operated controller, dangerous overloads, with consequent damage to motor and gearing, are sure to occur. This is especially true of machinery which must be quickly reversed.

Other recent shipments of controllers of this type have been made to the Carnegie Steel Co. and to the Lackawanna Steel Co., also to the Illinois Steel Co.

The above apparatus is the invention of the company's engineer, Mr. Arthur C. Eastwood, Rose, '98.

A. C. Electric Traction From Gas Power.

A SOMEWHAT unique departure from established methods in electric traction has recently been undertaken at Warren, Pa. The Warren & Jamestown Street Railway Company is equipping an A. C. single-phase electric railway system to operate between Warren, Pa., and Jamestown, N. Y., for which power will be supplied by gas engines, operating upon natural gas. The equipment is now being constructed by the Westinghouse companies at East Pittsburg, Pa.

The power station will be located at Stoneham, Pa., two miles from Warren. The initial equipment will consist of two Westinghouse gas engines, each of 500 brake horse-power capacity. They will be of the horizontal single-crank double-acting type, direct connected to two 260 kw. Westinghouse generators, furnishing current at voltage sufficient for direct use upon the high tension transmission line. The power equipment also comprises a 55 h. p. Westinghouse gas engine for operating an air compressor and exciter unit. Natural gas will be used, which has a calorific value of about 1,000 b. t. u. per cu. ft.—[*Amer. Eng. and R. R. Journ.*