Fall 11-1894

Volume 4- Issue 2- November, 1894

Rose Thorn Staff
Rose-Hulman Institute of Technology, library@rose-hulman.edu

THE ROSE TECHNIC.

VOL. IV. Terre Haute, Ind., November, 1894. No. 2

TERMS.
One year, $1.00. Single Copies, 15 Cents.
Issued Monthly at Rose Polytechnic Institute.

Entered at the Post Office, Terre Haute, Ind., as second-class mail matter.

WE wish to express our very sincere appreciation of the many kind greetings and notes of encouragement the alumni have sent us since the appearance of our October issue. Let us emphasize that we are indeed very grateful for these expressions of their interest in THE TECHNIC but would be greatly pleased to receive those more substantial notes of encouragement which may be identified as the Freshman recognizes chlorine—by the "slightly green odor." In plain English, we want more subscriptions, and, since comparatively few alumni have subscribed, we would suggest that those who intend to do so, should remit at once so that we may be in a position to know just how good a journal we can afford to make of THE TECHNIC this year. It may as well be stated right here that we do not expect to declare a dividend nor do we intend to go in debt to publish this paper, and that the receipts will entirely govern the expenditures.

Doubtless many a busy alumnus expects to subscribe but not finding it convenient to hunt up a dollar bill, etc., etc., puts it off to some other time, thinking THE TECHNIC will continue to be sent him. In this he is mistaken. We cannot afford to send THE TECHNIC unless we are reasonably sure that he wants it and expects to pay for it.

We have been assuming that our alumni were slightly too busy to give this matter prompt attention. If we have made a wrong assumption then the trouble must be with THE TECHNIC or its management, and, if this be the case, we shall consider it a personal favor to have our failures pointed out.

If there be any alumnus so parsimonious that he deems THE TECHNIC not worth the subscription, even in the good which it does him indirectly by bringing the work of the alumni and students before the public, then he is not worth discussing, and we will only say that we hope the powers that will be in the hereafter may recognize his true worth.

Just here it, perhaps, would be best to remind the members of former Technic Boards of the action taken last year, striking them off the list of complimentaries. The reasons for this action were given at the time, and we only mention it, to avoid any misunderstanding.

* * *

SECOND only to the matter of subscriptions comes the one of alumni contributions. Undoubtedly the alumni understand our position since the previous editors have spared no words, time nor labor in making it clear. But the present incumbent has decided that nothing shall be left undone to make the Alumni Department a success and as we have been on the war path since last June we intend to continue along the alumni trail and follow it to the end. If our constant harping on this matter becomes a bore, we shall have no apology to offer except that we deem it necessary. The trouble with the Alumni Department of late, has been the lack of notes and personals. This portion of THE TECHNIC is of great interest to all our readers, especially to the alumni themselves, and we should like to see

these columns contain a budget of news which will indeed be worth something to the busy alumnus who has no time to write to many of his old class-mates.

But it is simply impossible for the editors to improve the journal in this particular without the direct aid of the alumni. Last year we distributed a number of cards to be used in sending us these items of interest, and hoped that even the busiest alumnus might find time to jot down his bit of news and mail the card which was already addressed to us. Very few of these cards have been returned and we hope our contributors will bring them out of oblivion and put them to some use. Articles have been decidedly scarce, too, but if we can rely upon a number of alumni to fulfill their rather indefinite promises to contribute in the indefinite future—why—our columns will be indefinitely well filled and we shall be indefinitely well pleased. This indefinite factor is not very encouraging and we sincerely wish it was eliminated, or at least, that it occasionally be substituted by something more definite.

We again ask the alumni to let us have their criticism, their contributions and their subscriptions so that we may continue to make The Technic more worthy of them and their Alma Mater.

* * *

THE carnival eve of the sprites and spooks, and of other spirits, whose pranks betray them to be "of the earth, earthy," has again passed. The faculty doubtless feels relieved since the mischief done was not as great as might have been, and will soon begin the investigation of the usual Halloween phenomena, the distribution of red paint.

It is a fact which seems to be pretty well established, since even the Terre Haute newspapers concede it, that the Polys indulged in very few pranks which were harmful to any person or property. Only one could be so considered, and that was the painting of a fence on Locust street —a fence which has suffered this same treatment for the past three years. The Technic does not wish to give the impression of sanctioning this piece of rowdyism, which is hardly worthy of the prowess of some rock-throwing street urchin, much less a Polytechnic student. But this is insignificant in comparison to the contemptible tricks which are thought by many people to be perpetrated by the students. The attention of these good people should be called to the fact that the usual number of street-crossings were torn up, the fences knocked to pieces and gates hung on electric light cranes, while it is absolutely certain that the Polys had nothing whatever to do with these depredations.

The fact that after Halloween Terre Haute always appears to have been the center of a cyclonic region, in future should be attributed to the right causes—a rowdyish lot of home talent and an inadequate police force.

* * *

PROF. GRAY, for some time, has been advocating the organization of a scientific society among the students since he realizes of what great value to the would-be scientist is even a little experience in conducting original research. The faculty, it seems, concurred with him in this and the result is that Rose will soon have a student society for scientific research, modeled after similar societies which are so common in European schools.

The society will be composed of the Seniors and Juniors as active members, the members of the faculty and the alumni will constitute the associate members, while the Sophomore and Freshman classes will form the Junior membership.

As an inducement for the students to join this society the faculty gives them the right to make their experiments on laboratory time, that is, of course, if the subject be worthy of such a concession.

Late in October a committee was appointed to draft the constitution and by-laws. The Technic will give a more complete account of the object of the society after the committee has reported.

At present we would like to advance the opinion that the officers of this society should be chosen from among those students who are not already overloaded with extra work. There seems to be a tendency continually to heap more work upon

a favored few without trying to distribute it more evenly. Certainly there is no reason why we should not endeavor to scare up a dark horse occasionally and let him have a chance to display his mettle by bestowing upon him a fair portion of the burden of these college societies.

Moreover, if the students will show one half the determination in the work for this society as the Juniors exhibited in placing their five ton rock on the campus, we may be assured that the benefits derived will not be inconsiderable and that we shall have a society of which we can feel justly proud.

* * *

IT is pleasant to note that the faculty will continue the receptions to the students which were brought into vogue by our former president, Dr. Eddy.

The recent reception, the first of the season, was tendered to the Freshman class. It is reported as having been an enjoyable affair and highly successful in bringing out the new students. The faculty intends to give receptions to the different classes early in the winter and then occasionally have social gatherings to which the whole school will be invited. This plan is indeed an excellent one, and it is hoped that no book worm will dishonor his class by absenting himself from the reception given to it.

We regret that so many of our best students find practically no time to make acquaintances among the people in whose midst we are placed. True, society would make many petty demands upon their time, which, for men well up in their classes is really scarce, enough. Nevertheless these men, wherever they may be placed, should lose no opportunity to become acquainted with the best people of the community, for, though we should be guided by higher motives, yet there is nothing which practically keeps young men in the path of rectitude more than the knowledge that we should ever strive to be worthy of the friendship of the noblest and best of our acquaintances. It is needless to point out further the function of these student receptions, which afford us the opportunity to become better acquainted with the people of Terre Haute with such a small loss of time that even the most confirmed "plugger" can not complain. Every Poly should show his appreciation of these social events, which are solely for his own pleasure and profit, by doing all in his power to make them successful—but this does not mean in any case for him to let some other fellow fulfill his social duties, as was done too often last year.

* * *

IN a recent number of *The Illini* we notice a conversation over the telephone between a student of the University of Illinois and the man on Mars. It seems that U. of I. had defeated Yale for the championship of the world and was now arranging for a game with the champions on Mars. We quite agree with U. of I. in their implied hope for the time when the athletic teams of the west may make it thus interesting for those of the more conservative colleges on the other side of the Alleghenies. We call attention to the remarks in our athletic column concerning the Western Inter-Collegiate Athletic Association and express the desire that the western colleges will endeavor to hasten the day when we may champion over our brothers in the east, and that we cease to connect it with such improbabilities as, for instance, the telephone connection between U. of I. and Mars.

* * *

THE TECHNIC is issued on the 15th of each month and our contributors who wish to have their articles illustrated should send us the drawings not later than twenty days before the publication of the number in which the article is to appear. In many cases the drawings have to be redrawn and after the cuts are made, proofs must be sent to the contributor, so that the drawings should be sent us at the very earliest opportunity. Drawings should be made on good white paper with drawing ink.

MAGNETIC MEASUREMENTS

BY PROF. THOMAS GRAY.

In the following short paper I have given a brief account of the fundamental principles involved in certain methods of magnetic measurement which are of importance particularly in the determination of the magnetic quality of iron. A short statement is given of the way in which the different units of measurement, with which we are concerned, are related to each other but considerable elementary knowledge must be assumed and hence no discussion is given as to how apparatus is made for the measurement of current or of how the constants of such instruments are determined. The readers of THE TECHNIC have mostly at their disposal text-books which supply the necessary information in a more complete form than could be given in this paper.

In forming the electro-magnetic system of units of measurement for magnetic and electric quantities advantage is taken of the force of repulsion between two similar magnetic poles. The unit magnetic pole is taken as either one of a pair which supposed concentrated at points a unit distance apart repel each other with unit force. In the centimetre gramme second system the unit force is one dyne. A magnetic field is any space in which a magnetic pole experiences a force tending to move it and the unit field is a field in which the unit pole experiences the unit force. From the statement above it thus appears that the unit pole produces unit magnetic field at unit distance.

Again it is found that a conductor through which an electric current is flowing is surrounded by a magnetic field and this is taken advantage of in the definition of the unit current. The current which if made to flow round the circumference of a circle of unit radius produces, at the centre, a magnetic field of as many units intensity as there are units of length in the circumference of the circle is taken as the unit current. Thus the unit current flowing round an arc of unit length and unit radius produces unit field at the centre of curvature of the arc. But if the unit current when flowing round a circle of unit radius produces a field of 2π units intensity it will act on and be reacted upon by a unit pole at the centre with a force of 2π units. The circle round which the current is flowing in this case is in the field produced by the unit pole and since the distance of the pole is unit, the field must be unit, hence a conductor of unit length in direction across a magnetic field, is acted on by unit force when the current flowing through it is unity.

Suppose now that unit length of the conductor of last paragraph is allowed to move in the direction of, and against a resistance to motion just equal to, the force and unit work will be done by the electro-magnetic forces per unit distance moved over; also if it moves unit distance in unit time work will be done at unit rate. Now to make the system such that to raise unit quantity of electricity one unit of potential requires unit work the electricity must have lost one unit of potential in flowing across the conductor and doing the unit work required to move it. This unit fall of potential is produced by the motion of the conductor with unit velocity (unit space in unit time) across the magnetic field. Thus the potential difference or, in a closed circuit, the *e. m. f.* produced by the motion with unit velocity, in a direction normal to its own length and the direction of maximum force, of unit length of a conductor, in a unit field is unity. We may imagine the moving conductor to form part of a closed circuit so arranged that this part can move while the remainder remains at rest and we see that as the conductor moves with unit velocity the rate of increase of area enclosed by the circuit is unity. This gives us another way of stating the definition, namely, that a circuit which increases in area with unit velocity in a direction transverse to the direction of force in a magnetic field has unit *e. m. f.* induced in it.

Similarly we may imagine the *e. m. f.* to be pro-

duced by causing the magnetic field to flow together across the conductor in such a way as to diminish in area with unit velocity without changing the total force or amount of induction or, in Faraday's language, by causing the lines of force to come together, but the total number to remain the same. What we have to keep in mind is that we can get *e. m. f.* in a circuit either by moving it, or part of it, in such a way as to enclose a greater area transverse to the direction of force or by keeping the circuit at rest and increasing the intensity of the field. In either case we speak of increasing the magnetic induction or the magnetic flow through the circuit, and when this change is such as to be equivalent to a rate of change of a unit of field per unit time the rate of change of induction and the *e. m. f.* produced are each unity.

Now suppose the circuit to contain an instrument for measuring the quantity of electricity which flows through it and let the total induction through the area inclosed by the circuit be changed with the result that a quantity Q of electricity is caused to flow. Let E be the *e. m. f.* at any instant during the change of induction. The quantity of electricity which flows in the time dt will be $\frac{E}{R}dt$ when R is the resistance of the circuit. The whole quantity Q is the sum of a series of terms of this form taking up the whole time t occupied by the change or in symbols $Q=\int_0^t \frac{E}{R}dt=\frac{1}{R}\int_0^t E dt$. But E is, as indicated above, the same as the rate of change of induction and hence $\int_0^t E\, dt$ is the same as the integral change, that is total change, of induction. Hence, if I represent this change it is measured by the quantity R Q. Change of induction through a circuit can thus be measured in terms of resistance of the circuit and the total quantity of electricity made to flow by the change.

It is to be noticed also that in accordance with the above explanations the total inductions through any circuit may be obtained by dividing the area into small elements, measuring the intensity of the field at each element of the area and summing the series ia where i is intensity at any element and a the area of the element. The total induction I is thus $=\int i\, dS$ where S is the area over which the induction is to be measured.

One of the simplest methods of measuring the intensity of a magnetic field of wide extent and moderate intensity is that which Gauss used for measuring the horizontal component of the earth's magnetic field. A description of this will be found in almost any laboratory text book. When the field is limited in extent and of great intensity such as that between the field magnets and the armature of a dynamo some other method has to be used. Still other methods have to be adopted when the field is in the interior of a solid. It is to these latter cases and particularly the last that this paper refers.

In the case of the field between the poles of a large magnet like that used for a dynamo the intensity may be deduced from a direct measurement of the force which acts on a wire through which a current is flowing when it is placed across the field. The wire may, for example, be made to form part of a frame suspended from one arm of a balance and the force weighed while the current through the wire is at the same time measured by means of a current meter. In this case the force is measured in gravitation units and requires to be converted into "absolute" units by multiplying in the force of gravity on the unit of mass. A series of measurements made with the wire at different positions in the field allows the total induction to be calculated and if the number of turns, n, in the magnetizing coil and the current c flowing through it be both determined the corresponding magnetizing force $4\pi n c$ may be calculated. A series of such determinations for different magnetizing forces, that is, different strengths of current in the magnetizing coil enables the observer to draw a curve like that in Fig. 2 from which, as described below, the various magnetic qualities can be deduced. Another convenient method of surveying the intensity of the magnetic field between and near the pole faces is to take a small coil and connect its terminals to a ballistic

galvanometer then, place the coil at marked positions in the field and observe the deflection of the galvanometer produced by suddenly withdrawing it. The relative deflection for different positions gives the relative intensity of the field at these places and an experiment in a known field enables the whole to be reduced to absolute units. The record in this case would be the same as the last, namely: a set of curves giving the relation of induction to magnetizing force.

A similar method to that last described was used by Rowland in his experiments on the magnetic properties of iron. In this case a specimen of the iron in the form of an anchor ring was used and the magnetizing and testing coil both wound round it. The change of induction

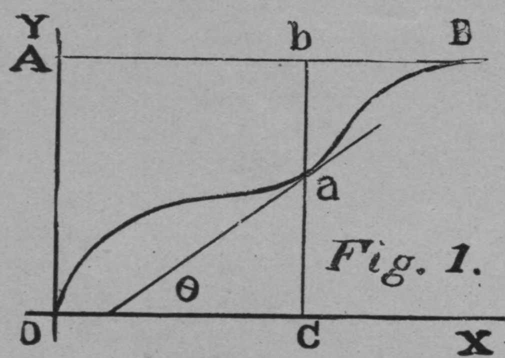


Fig. 1.

through the testing coil was then produced by interrupting or closing the circuit of the magnetizing coil. The amount of induction produced by different magnetizing forces were deduced from the deflections of a galvanometer in circuit with the testing coil. The constant of the galvanometer was determined by means of a standard coil used in a known field. For specimens of large size this method fails because the induction produced in the iron reacts on the magnetizing coil causing such a back *e. m. f.* in it as to greatly lengthen the time required to complete the magnetization. It then becomes impracticable to obtain a ballistic galvanometer with a long enough period to give results which are comparable for different amounts of induction. A modification of this method was introduced in Hopkinson, and has been used by a number of experimenters. This consists of making the specimen in such a form that it can be separated at a joint and the test coil suddenly removed. In this way the magnetization may be completed and then the test made by suddenly opening the joint and allowing the coil to spring out, thus changing the induction through it from the total through the iron to practically zero in the air at a distance from the iron. The results in these cases also give the relation of the total induction to the magnetizing force.

In cases like those which arise in the testing of iron for use in transformers, it is desirable that the actual piece of apparatus should be tested, but as this excludes Hopkinson's method and Rowland's can not be used, some other method has to be adopted. The following is found to serve the purpose, and as the reduction of the results involves all the calculations which are required in the other methods referred to above, this method is the only one at all fully discussed. Take, as an example, a transformer having closed iron circuit such as those manufactured by the Westinghouse General Electric Co., and others. Suppose the number of turns, resistance and other particulars of the primary coil to be known. When a moderate *e. m. f.* is applied to the terminals of this coil the current establishes itself very slowly, and a record of the curve giving the relation of current to time after the closing of the circuit can be readily made on a chronograph sheet by means of a self-recording current meter. The record takes a form something like that shown in Fig. 1, in which time is taken as abscissae and lengths proportional to current as ordinates. The curve indicates that the current rises somewhat quickly at first, then very slowly, and afterwards more quickly, until nearly full strength is attained. Let us make the scale of the curve such that the ordinates represent the product of the current and the resistance of the circuit, or C R. Here the line A B drawn parallel to O X will represent the curve of total *e. m. f.* applied to the circuit, or what is commonly called the impressed *e. m. f.* In this case it is supposed constant. At any point *a* in the curve the impressed *e. m. f.* is divided into a part

ab which is opposed or neutralized by the *e. m. f.* induced in the magnetizing coil by the changing induction in the iron. Put L for the coefficient, which multiplied by the rate of variation of the current in the magnitizing coil gives the rate of change of induction and we can write $\frac{dI}{dt}=L\frac{dc}{dt}$.

But $\frac{dI}{dt}$ is the electromotive force induced in each turn of the magnetizing coil by the rate of change of induction. Hence $L\frac{dc}{dt}=\frac{e}{n}$, where e is the induced *e. m. f.* and n is the number of turns in the coil, and, therefore, $I\int_0^C L\,dc=\frac{1}{n}\int^T e\,dt$ where C is the maximum current and T the time required for the current to reach its full value. Now the induced *e. m. f.* is represented in figure 1 by *a b*, and the value of $\int_0^T e\,dt$ by the O *a* B *b* A O. The induction up to any value of the current represented by $\frac{\overline{ac}}{R}$ can therefore be got from the record by measuring the area up to *a b* and by dividing by *n*, the induction corresponding to different values of the current are obtained.

We may thus draw a curve of the induction produced by different currents or by different magnetizing forces by measuring the area between O A and successive positions of *a b*, and deducing the current or the magnetizing force from the corresponding values of *ac*. This method applies whether the line A B be straight or not, and is frequently used in the testing of transformers on alternating current circuits, in which case, however, special appliances of a more elaborate kind have to be used to obtain the curves O *a* B and A *b* B. When the magnetizing current is carried through a complete cycle of values, from maximum in one direction to maximum in the other direction and back, the magnetization curves, or curves showing the relation of induction and magnetizing force, take the form shown in figure 2. When constant *e. m. f.* is used the cycle may be gone through by allowing the current to come to its full value in one direction, then reversing the impressed *e. m. f.* and allowing the current to attain full value in the other direction and again reversing and allowing the current to come to full value in the same direction as at first. The curves given in figure 2 are those which are obtained directly from experiments on the intensity of the magnetic field between the poles of a magnet, or by the method of Rowland, Hopkinson, &c., referred to above. It is clear that the reversal curves corresponding to the curve of figure 1 may be derived from those of figure 2 by an inverse process.

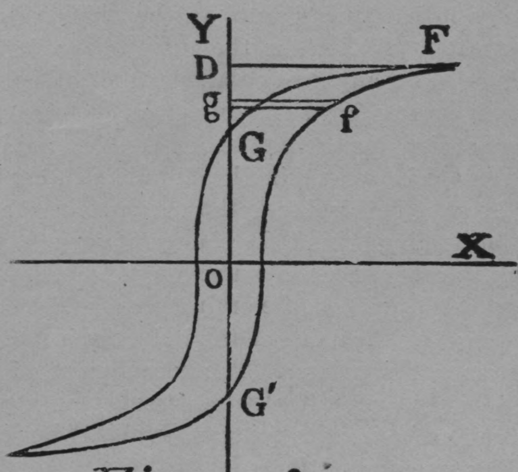


Fig. 2.

Again, from the equation $L\frac{dc}{dt}=\frac{e}{n}$ and the relation from the curve figure 1 that $R\frac{dc}{dt}=\tan\theta$ we get $L=\frac{R\,e}{n\tan\theta}$ and hence by measuring $\tan\theta$ from the record the different values of L corresponding to different values of the magnetizing force may be obtained. This shows that when $\tan\theta$ is small L must be large or that the flat part of the record is due to the great change of magnetization produced by a small change of the magnetizing force when the total magnetizing force has the value corresponding to the value of C derived from the ordinates at that part of the curve. The quantity n L is what is called the coefficient of self-induction of the magnetizing coil it is constant for

media like air but variable when the coil surrounds iron.

The permeability of the iron is the ratio of the induction per unit area of the cross section of the iron to the magnetizing force per unit length of the iron circuit, which produces it. If then we put μ for the permeability, and S for the cross sectional area and e for the length of the iron circuit we get $\mu = \frac{F\,l}{4\,\pi\,n\,C\,S}$. When figure 2 is drawn so that abscissæ are magnetizing forces per unit of length of the iron and ordinates induction per unit area of cross section of the iron the ratio of the ordinates to the abscissæ give permeability. Now, as the curve illustrates, the induction for any particular magnetizing force is always greater for decreasing than for increasing magnetizing forces and hence the permeability appears to be greater in the first than in the second case. This is due to the change of magnetization lagging behind the change of magnetizing force in consequence of an action resembling friction which prevents the ordinates of figure 2 from representing the value of the induction proper to the magnetizing force. The mean value of the two curves approximally represents the proper value to take in calculating permeability but both values are required in order that the behavior of the material under varying conditions can be understood. The existance of this lagging action of the iron gives rise to dissipation of energy when the iron is carried through the magnetic cycle. This causes the cores of transformers used with alternating currents to heat and at the same time lowers their efficiency. Let us look at how the loss of energy is shown by the curves. The rate of working on the magnet and circuit when the current is increasing is E C where E is the impressed *e. m. f.* and C is the current. Of this rate of working or activity a part C^2R is, in accordance with Joule's law, wasted in the conductor while the remainder goes to perform the work of magnetizing the iron and producing the magnetic field round it. Energy is absorbed in producing magnetization at the rate of $E\,C - C^2R = C\,(E - C\,R)$.

But E—C R is the back *e. m. f.* due to the induction through the coil which in the record, figure 1, is represented by *ab* or $L\frac{dc}{dt}$. Hence, the rate of working on the magnet is equal to $C\,L\frac{dc}{dt}$ and the total work during a change of current from C_1 to C_2 is $\int_{C_1}^{C_2} C\,L\,dc$. But $L dc$ is equal to $d\,I$, the change of induction, and hence if I_1 and I_2 be the inductions corresponding to C_1 and C_2 the total work due to that, change of induction is $\int_{I_1}^{I_2} C\,dI$.

Suppose now that figure 2 has current for abscissæ and that induction for ordinates then for any value of C represented by the length $g\,f$ the differential of energy may be represented by the elementary area $g\,f$, the breadth of which we suppose dI. The $\int_{I_1}^{I_2} C\,dI$ will thus be the area back of the curve $F\,f\,G^1$ between the values of induction indicated by the limits. If I_1 be equal to $O\,G^1$ and I_2 to O D the total work done between current zero and the maximum value will be obtained, and will be represented by the area $G^1\,f\,F\,D$. Again in the return part of this cycle the induction diminishes and work is given back by the magnetic field the corresponding amount of which will evidently be represented by the area G F D G. There is, therefore, an amount of work done in producing the magnetization which is in excess of that given back by the amount represented in the area $G^1\,f\,F\,G\,G^1$. Hence for the whole cycle the area of the closed loop represents the energy dissipated. Let the area of this loop be a and suppose N cycles to be gone through per second and the rate of dissipation is $N\,a$.

The energy dissipated per cycle depends on the range of induction and is found to vary more rapidly than the induction. It can be approximately expressed by the formula Const. $I\,n$ where n varies somewhat for different parts of the range of I and lies between 1.5 and 1.8 for different kinds of iron. Good iron magnetized to near saturation dissipates from 10,000 to 15,000 ergs per

cubic centimeter per cycle. Thus 10,000 cubic centimeters of iron (about 180 pounds) if carried through 100 cycles of magnetization per second, each cycle approximately reaching saturation, would dissipate, at the lower value above given, $10,000 \times 10,000 \times 100$ or 10^{10} ergs per second. To produce this rate of magnetization without doing anything but heat the iron would require an activity of 1,000 watts or about one and a quarter horse power. The dissipation of energy in transformers is usually one-third or less of the amount per cubic centimeter here given because the iron is not magnetized to near saturation.

In the discussion with regard to loss of energy in the magnetic cycle it has been assumed that all the energy dissipated in the iron was due to the magnetic lagging action of the iron which has been called by Ewing hysteresis. If there be currents induced in the iron, as is almost always the case when the cycles are rapid, the area of the loop in Fig. 2 includes both the magnetic loss and the loss due to induced currents in the iron.

ARTIFICIALLY CRYSTALLIZED CARBON.

BY INSTRUCTOR H. H. BALLARD.

During the last fifteen or twenty years there have from time to time appeared in the scientific journals, articles descriptive of experiments whose object was the artificial production of the diamond, and which have, in the main, been based upon theories with regard to the conditions of its formation in nature.

The two sources of the diamond which have been most studied are the beds of the Cape of Good Hope, and meteors. In the former case it occurs in what appears to be the pipe of an extinct volcano, which is filled with mineral deposits of various sorts. After a study of the facts with regard to the diamond in this locality M. J. Werth concludes that the conditions of its formation were high temperature and pressure, and rapid cooling. The structure of the crystals points to their having been formed from a molten mass and not from solution. The condition of pressure is deduced from the presence, in some crystals, of inclusions of liquids and gases under pressure, in some instances so great as to cause the crystal to fly to pieces on being removed. The last condition is more a matter of theory. It seems probable that the material in which the diamond is found is of different origin from that of the diamond itself. Hence the latter must have been introduced from without, and, according to the author, under conditions of intense explosion. By this means the molten carbon would be buried in the earth and suddenly cooled. This condition also seems to be a necessary consequence of the fact that when the diamond is heated it changes into graphite, so that by a slow cooling we should expect to find this latter form of crystallized carbon.

In meteoric iron the situation is more complicated, but as to the method of crystallization of the substances there found, little doubt can exist that they have been deposited from solution in molten iron. Here are found several allotropic modifications of carbon, all more or less impure, and among them the diamond in crystals of microscopic size.

It was probably the last named fact that led to the investigations of Henri Moissan upon the artificial crystallization of carbon, and in his work he has reproduced the various substances observed in meteoric iron under very much the same circumstances as those in which they exist in nature.

To obtain the high temperatures necessary, Moissan made use of the electric arc. His "electric furnace" consists of a cylinder of some refractory

material, into which project electrodes of carbon, so arranged that the distance between them can be regulated. The material to be heated is placed in a carbon crucible. By means of this furnace substances which have hitherto been considered infusible, *e. g.* lime and magnesia, have been melted with ease, and aside from the study of carbon many interesting results have been obtained.

First, a study was made of the solubility of carbon in and its crystallization from molten metals at ordinary pressures. The results were in general the same, viz., the separation of carbon, either in the amorphous form or as graphite. No crystals of greater specific gravity or hardness were obtained by this method, which consisted of melting a mixture of the metal and carbon (from sugar) and allowing it to cool, either slowly in the air or more rapidly in some liquid. The metal was then dissolved by means of acid, leaving the carbon undissolved, as graphite when very high temperatures were used, otherwise as a mixture of amorphous carbon and graphite. Of the latter several varieties were observed, one of which differed from the ordinary graphite in that when it was dipped in nitric acid and afterward heated it exhibited the phenomenon observed in the socalled "Pharaoh's serpent." To this new variety the name graphitite was given.

In another series of experiments the effect of pressure was tried. Carbon from sugar was compressed in a cylinder of soft iron, which was then closed at both ends and immersed in molten iron contained in the carbon crucible. The latter was then removed with its contents from the furnace and dipped under water until the temperature had fallen to a dull, red heat, after which it was allowed to cool in the air. By this means a shell of solid iron was formed around the inner mass which still remained in the molten condition confined by the outer crust, so that on solidifying, because of the consequent expansion, a great pressure was produced within the mass. After cooling the metal was dissolved as before, and the carbon and other substances remaining unattacked bore strong resemblance to some portions of the material obtained by a similar treatment of meteoric iron. The carbon was present in different degrees of density, varying from that of graphite to that of diamond. It was principally, however, in the form of a very dense graphite in small crystalline particles. By acting upon these with powerful oxidizing agents, thereby burning away the greater portion, there was finally left a mass of microscopic crystals, which were no longer attacked by the reagents, were very hard, and corresponded exactly with the carbonado (black diamond) found in the mines of the Cape of Good Hope and in meteorites. A few of the crystals were transparent and showed all the properties of the diamond. In size they were microscopic, the largest measuring only .5 m.m. across. Enough of these crystals were gotten for an analysis and they were found to consist of practically pure carbon.

Previous to the work, a brief resume of which is given above, an Englishman, J. B. Hannay, published in the Proceedings of the Royal Society (1880) an account of a series of experiments also looking toward the crystallization of the diamond, but conducted on a somewhat different plan from that pursued by Moissan.

Hannay found that the alkali metals, when melted, possessed the power of absorbing large quantities of hydrogen and of withdrawing this element from hydrocarbons when heated with them, leaving the carbon free. By finding the proper conditions he hoped by this means to obtain the desired end. He considered that high pressure was essential and to obtain this he placed with lithium (the metal which was found to give the best results) some easily volatile hydrocarbon oil in a thick glass tube, which was then sealed and heated. Only amorphous carbon was thus obtained.

In working with glass, he was, of course, confined to the temperatures below that at which his tubes began to soften. So, to obtain higher temperatures he employed wrought iron tubes, with walls half an inch or more in thickness. The pressure was so great during the experiments that the ordinary methods of closing tubes, by means of caps screwed on, was found inadequate to prevent leakage and nothing short of a weld was found to

answer. Thus hermetically sealed, many of the tubes, though made with the greatest care and of carefully selected material, exploded, thus showing the high degree of pressure within, produced by the highly heated vapor. The results of this work were very much the same as in Moissan's. Crystallized carbon of various degrees of density and hardness were obtained and in three instances microscopic diamonds. But in an article published last spring in the *Chemical News*, Hannay states that he has devised an apparatus by means of which he hopes to be able to melt carbon in quantity and crystallize it as diamond. Carbon is a substance which volatilizes at ordinary pressures without melting, and, as has been stated, the indications, both from natural and artificial sources, are that the diamond has been crystallized from a molten mass and not from solution. Therefore, in order to melt the carbon and at the same time prevent its subliming, the operations must be carried on with closed vessels at a high temperature and pressure, and in such a manner that the carbon shall not be dissolved.

We will await with interest the publication of Hannay's latest results. The theory of the problem is comparatively simple, but its practical application a matter of great difficulty. It would seem, however, that the artificial production of diamonds of useful size is not an impossibility. Thus the practical side of the problem has been advanced. And on the other hand, the investigations of the two authors above cited, as well as others, all tend to establish the truth of the ideas set forth by Werth as to the method of formation of the natural diamond. But when he explains its presence in a medium which is, in all probability, of an entirely different origin, by saying that it was shot into its position, many feet below the surface, by the force of an explosion, he would appear to be bordering on the fanciful, especially when we consider the minute size of some of the crystals. The results of experimental study seem rather to indicate that its origin is terrestrial, and that its present position is not the primary one but was attained by volcanic or similar agencies. The question is still an open one and will probably remain a matter of speculation.

A Civil Engineering Term.

"The Frog Number."

ALUMNI

THE ALTERNATING CURRENT TRANSFORMER IN LIGHTING PRACTICE.

The first question to be considered in this connection is: What constitutes a good transformer from the station superintendent's standpoint? My answer would be:

1. One in which the open circuit losses are a very small percentage of the capacity.
2. One in which the variation of secondary voltage between open circuit and full load is within three per cent.
3. One in which the insulation resistance is sufficiently high to prevent burning out or grounding under all but the most extraordinarily unfavorable conditions.
4. One of such mechanical design that fuses can be easily and safely renewed, and that it presents a neat appearance.
5. One that can be readily handled by linemen, which consideration involves as light weight as can be attained without sacrifice of efficiency.

In selecting an equipment of transformers the station manager has many things to consider. Primarily he must see that money-making apparatus only is chosen. To this end he must buy nothing of inferior quality, for in electrical work as in almost no other is the best invariably the cheapest. He must also have in mind the excellence of his service to patrons. This means that the consumer must have uninterrupted service, as well as light of unvarying intensity. All in all he must exercise the best of judgment or he will sooner or later discover that his investment is a failure, simply because his transformers are not up to the standard.

But how is the station man to secure a good transformer rather than a bad one? In no other way than by submitting rigid specifications to those manufacturers who solicit his patronage and then carefully testing the transformers when delivered. It is a fact not to be disputed that there are transformers now on the market which in the points of excellence above specified are in no way superior to those first introduced in the early days of alternating current lighting. Claims are made that they "can be easily repaired by the station man himself," are "simplicity itself," and so on. When approached by a representative of such a transformer builder, the station superintendent who is alive to his own interests should face him with a list of specifications something like the following, and courteously tell him that if he can guarantee his transformer to meet these requirements he will talk business.

a. All transformers furnished shall come within the following limits for "leakage" current on open circuit:

Number of Lights.	Capacity in Watts.	Leakage per cent. on 16,000 Alternations.	Leakage per cent. on 7,200 Alternations.
5	250	8.0	14.0
10	500	6.0	11.0
20	1,000	4.5	6.5
30	1,500	4.0	6.0
40	2,000	3.5	5.5

Number of Lights.	Capacity in Watts.	Leakage per cent. on 16,000 Alternations.	Leakage per cent. on 7,200 Alternations.
60	3,000	3.0	4.5
80	4,000	2.75	4.0
100	5,000	2.5	3.5
125	6,250	2.25	3.0
150	7,500	2.0	2.75
250	12,500	1.75	2.50
500	25,000	1.50	2.25

b. Transformers shall also come within the following "regulation" or variation of secondary voltage limits:

Number of Lights.	Per cent Variation.	Number of Lights.	Per cent. Variation.
5	3.0	80	2.5
10	3.0	100	2.5
20	3.0	125	2.5
30	2.75	150	2.0
40	2.75	250	1.75
60	2.75	500	1.50

c. Transformers must be guaranteed from burning out except from overload for a period of two years from date of purchase.

d. Insulation between primary coil and core and primary and secondary coils shall withstand 5,000 volts alternating. Insulation between secondary coil and core shall withstand 3,000 volts alternating. This shall be for transformers on 1,000 volt circuits. On 2,000 volt circuits, the insulation limits shall be 7,000 and 3,000 volts respectively.

e. Secondary terminals must be so arranged that the full capacity of the transformer can be used on either 50 or 100 volts.

f. Safety fuse blocks must be of such character and mechanical arrangement that a lineman can, with safety, renew the fuse and push the block into position on a short-circuited coil.

g. Transformer boxes must be of such design that they may be filled with insulating oil if desired, and also afford good air ventilation, on the removal of suitable plugs, if dry coils are preferred.

The mechanical features involved in such specifications as the above can quite readily be judged of by the average station man. The electrical features are, however, not so easily within his range of discrimination. The tests required are very simple though, and may be readily made by an individual of comparatively limited experience.

For the "leakage" tests, no other apparatus than an alternating current volt meter and ammeter is required. These should be sensitive and guaranteed as to accuracy. The arrangement for the test would be made as in Fig. 1. B represents what will in general be the transformer for the station lights. Otherwise it is a transformer by means of which the primary voltage is reduced to the voltage at which the secondary of X is to be connected in service. R is an ordinary rheostat. A is the ammeter, and V the voltmeter. S is an ordinary switch for controling the circuit.

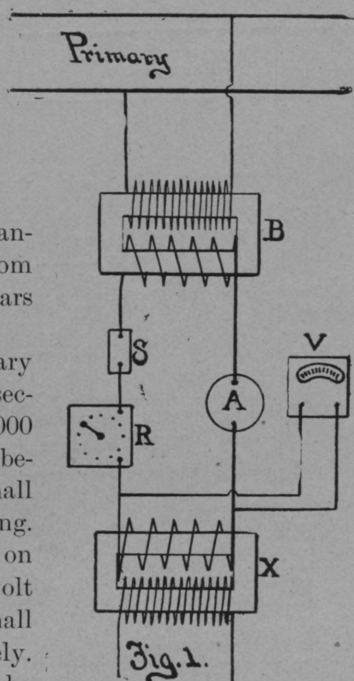


Fig. 1.

It will be seen at a glance that the "leakage" current is not to be measured on the primary coil of the transformer, but on the secondary. The reason for this is that in the average size of transformer the station will have in service, the waste primary current will be so small as to be outside the ammeter's range. Consequently the measurements are made on the secondary side where, at the secondary normal voltage, the current will be in the inverse ratio of the primary and secondary voltages. It matters not on which side the measurements are made. The "apparent" magnetizing energy is practically the same whether you have a small current at 1,000 volts or a large one at 100. The figure is given showing secondary connections since general safety and more accurate results are thus attainable.

The method of procedure is as follows: With the primary ends of X left open, the voltage at the secondary is brought, by means of the rheostat, to exactly 100 or 50, whichever the connections necessitate, and the current then read. The leakage percentage is this current divided by the

secondary current capacity. It is hardly necessary to say at this point that the information derived from this test is of considerable value, for of course every station man wants to know just how much of his dynamo current capacity is going to be wasted the day through, regardless of the actual load consumed by patrons. It is of consequence to note, however, that the volt-meter connection should be broken at the instant when the current reading is being taken.

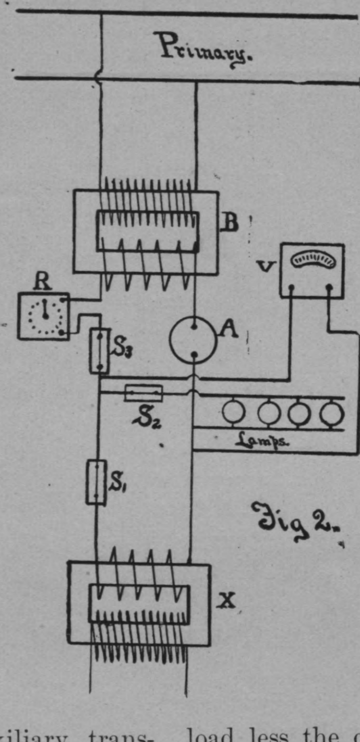


Fig 2.

There is a second point of value and interest at this stage of the transformer tests, and that is the percentage of actual energy, as well as current, wasted. It is of consequence to know what engine capacity all this open circuit transformer loss involves. The test just made does not give data from which this can be determined, for energy here is not the product of "volts" and "amperes" as in direct current work. There is the "difference of phase" with which to contend. If a watt meter is at hand the difficulty is easily overcome by placing this instrument in circuit in the above tests according to the maker's instructions accompanying it.

Otherwise another test must be made, with an arrangement of apparatus as shown in Fig. 2. Here R is again the rheostat, A the ammeter, V the volt-meter, B the auxiliary transformer, and S_1, S_2, S_3 switches. The addition is made of a number of incandescent lamps connected in multiple with the secondary of the transformer. Now the actual energy may be derived as follows:

With all switches closed read the current as shown by A when V indicates 100 or 50 volts (according to connections above explained). Let this reading be a_3. Then with S_1 open and S_2 closed read again the current at 100 volts. Let this be a_2. Next with S_2 open and S_1 and S_3 closed, read the current at 100 volts. Let this be a_1. In case the volt meter connections were, at each reading of A, broken, the actual energy E will be

$$E=\frac{V}{2a_2}(a_3^2-a_2^2-a_1^2).$$

Or, in this test

$$E=\frac{50}{a_2}(a_3^2-a_2^2-a_1^2).$$

(The demonstration of this formula will be found at the end of the paper).

For the "regulation" test, no additional apparatus will be required. Here the connections will be as shown in Fig. 3, the object eing merely tob secure accurate voltage readings on open circuit and full load. X represents again the transformer to be tested; R, a small transformer for reducing the primary voltage down to the equivalent of the secondary of X; A, the ammeter; V, the volt meter; S, a three point switch with which to throw the volt-meter on either the reduced primary or secondary circuits.

The per cent. drop with full secondary load as shown by A will then be the difference between the secondary voltage with and without load, less the difference between reduced primary voltage with and without load, divided by the secondary voltage without load less the difference between primary voltage with and without load. A number of precautions should be taken in making this test. The volt-meter connections, both primary and secondary, should be made close up to the transformer X in order to eliminate all drop in circuit wires. The ratio of transformation of X and R should be the same. Primary and secondary voltage readings should be taken in as quick succession as possible.

Other tests on the transformer will hardly be necessary, although insulation tests can be made up to any limit of voltage deemed desirable by

arranging a suitable bank of small transformers whose secondaries are connected in multiple, and primaries in series.

Desirable though it is to have at hand the information to be derived from these tests, nevertheless it is true that in very few lighting plants where alternating current is used is such data secured. This is explicable largely on the score of the comparative newness of this system of distribution, and the consequent lack of information on the part of station men as to what constitutes a good transformer. To a large percentage of station men, especially in the small plants of the country, such terms as "angle of lag," "self and mutual induction," "apparent loss," etc., have absolutely no meaning. They have heretofore, and possibly are now, buying transformers on faith alone, unaware that there is as much superiority in some transformers as compared with others as there is in a steam engine with a well bored cylinder and close fitting piston as compared with one that has been cutting away in its cylinder for a year or two. It is not a neatly designed fuse block arrangement that makes a transformer; nor is it a well proportioned box. It is, instead, one with copper and iron losses so proportioned as to give a high all-day efficiency, and also one of high insulation resistance.

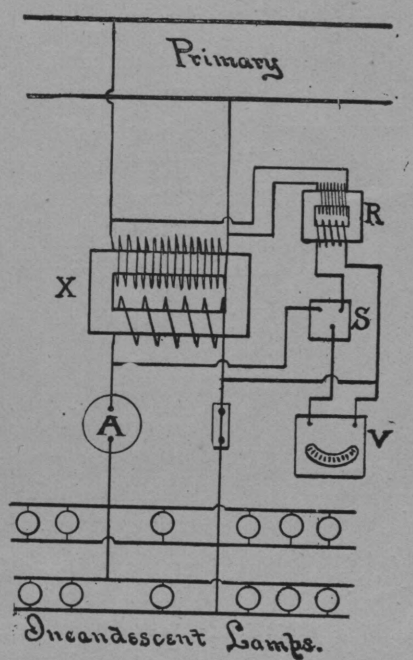


Fig. 3.

Just here may arise some misconception of what "all-day" efficiency is. A transformer may be designed to give a high efficiency on full load, and perhaps may be very inefficient on quarter and half loads. Another may be designed with high efficiency on light loads, and may fall a little short of the first in full load efficiency. The second would prove a good "all-day" transformer, as compared with the first, for its average efficiency the day through would be much in excess of the other, since the number of hours during which any transformer is loaded heavily is relatively small. So this constitutes a very important point in the selection of a transformer.

There is, furthermore, an erroneous impression quite prevalent that a company making alternating current generating apparatus is the only one from which to buy transformers. This does not at all follow. Transformer manufacture has come to be an independent line of electrical development, just as is incandescent lamp making. Indeed, it is largely to this separation that the rapid improvement in transformers being daily noted to be attributed.

In practical work the transformer has heretofore not been as thoroughly comprehended as its importance would justify, but investigation along this line is being pushed and a more economic and sensible use of it is to be made in the immediate future.

In conclusion, let me offer the demonstration of the above formula, to the effect that the actual energy consumed by the transformer on open circuit, where an arrangement such as is shown in Fig. 2. is followed, is:

$$E = \frac{V}{2\,a_2}\,(a_3^2 - a_2^2 - a_1^2)$$

In an inductive circuit, such as the transformer secondary in this instance is, the current flowing has two components. One is the magnetizing current, and the other is the current due to hysteresis and eddy losses of the iron. The former follows the voltage wave at an angle which may be taken as practically equivalent to 90 degrees. The latter is coincident in phase with the voltage wave. Now, according to the instructions above given, the combined current of the secondary coil and the lamps was first read, and called a_3. Then the current

of the lamps alone, and this called a_2. Finally the current of the coil alone, and this called a_1. According to Fleming, these factors bear the graphical relation to each other shown in Fig. 4, where

$A\,C = a_3$.

$X_1\,B = a_2$.

$A\,D = a_1$.

$A\ X_1$ = hysteresis and eddy current $= C_h$.

$A\,X_2$ = magnetizing current $= C_m$.

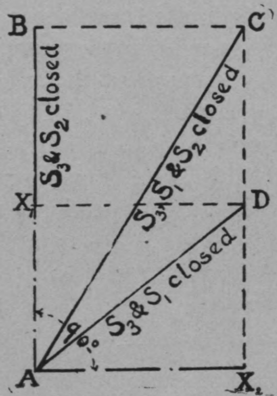


Fig. 4.

Now

$$C_m^2 = a_1^2 - C_h^2.$$

Also

$$C_m^2 = a_3^2 - (C_h + a_2)^2$$

Hence

$$a_1^2 - C_h^2 = a_3^2 - (C_h + a_2)^2$$

From which

$$C_h = \frac{1}{2\,a_2}(a_3^2 - a_2^2 - a_1^2)$$

But the product of C_h into the voltage represents the energy consumed by the coil.

Hence

$$E = V\,C_h = \frac{V}{2\,a_2}(a_3^2 - a_2^2 - a_1^2).$$

W. A. LAYMAN.

ST. LOUIS, October, 1894.

NOTES.

W. H. Boehm, '91, has entered into educational work, accepting the position of assistant in the department of Mechanical Engineering of Washington University, St. Louis. His present residence address is 2708 Morgan street.

S. D. Collett, '90, is with the Metropolitan Telephone Co., of 18 Cortlandt street, New York. Edw. Decker, ex-'90, is assistant general superintendent of same company.

Robt. D. Valentine, '93, is at present inspecting arc lamps for the Westinghouse Manufacturing Co., Pittsburg.

Geo. R. Putnam, '90, of the U. S. Coast and Geodetic Survey, made an observation here about the middle of last month, in order to determine the force of gravity. After completing his work here he favored the Seniors and Juniors with a lecture, relating to the character and purpose of his work, as well as to the description of the apparatus. He promises to give some of the results and a more detailed account in a future number of THE TECHNIC. After leaving here he went to Cincinnati, thence to Washington.

There was quite a love feast in Chicago Friday night, November 2nd., '92 men participating. Boyles, Hussey, Frank and Young were in evidence, with notes of regret from Wicks, who happened to be ailing, and from Putnam, who was so far away in South Chicago that he could not be on hand. Young has since gone to his home in Davenport, Ia., where he is spending a brief vacation.

J. T. Wilkin, '86, who is engineer for the Connersville Blower Co., has just returned from a trip to Brooklyn and Philadelphia, where he has been putting in some of their largest blowers, to be used with the pneumatic tube cash carrying apparatus which is being so largely adopted at present in many cities.

A. V H. Mory, '94, recently spent a few days with Rose friends, having stopped off while on his way home from Waltham, Mass. He was also in Washington, D. C., a few days, where he attended the National Convention of the Gas Light Association, and at the same time was a guest of A. M. Hood, '93.

Buckner Speed, '94, was in the city the 7th and 8th inst. He brought some steam gauges and indicators up in order to standardize them in the laboratory.

Edw. F. Robinson, '94, has the position of engineer for the St. Bernard Mining Co., Earlington, Ky.

Robt. L. Wilson, '92, is employed by the Westinghouse Manufacturing Co., Pittsburg.

O. R. Hedden, '94, has accepted a position with the Chicago Telephone Co.

THE WESTERN INTER-COLLEGIATE ATHLETIC ASSOCIATION.

Many inquiries have come to us concerning the Western Inter-Collegiate Athletic Association and its annual field day which will be held at Terre Haute next May under the auspices of Rose Polytechnic Institute. It is believed a few words in regard to its history and its present and future prospects will give all the information desired.

The W. I. C. A. A. is a comparatively new organization, it being formed for the advancement and improvement of amateur athletics among the western colleges and was intended to give the athlete just what the Oratorical Association gives to the college orator—an opportunity to compete not only with the few college representatives in his locality, or his state, but also to measure his powers with competitors from all over the great territory from Ohio to Colorado.

The colleges in the association at present are Northwestern University, Lake Forrest University, Washington University, Purdue University, Illinois College, Iowa College, College of Christian Brothers, University of Illinois, and R. P. I. These colleges in themselves form a strong association. But it was not the intention to stop the growth of the association with this small number, as is shown by the following article of the constitution. "The membership of this association shall be limited to colleges of good and regular standing, having an attendance of at least 100 male students."

Undoubtedly much of the best talent is in the western schools and since the west will soon possess educational advantages comparable to those of the east, we should see that the athletic advantages are equally good. This requires a more complete uniting of the western colleges in some association where the competition may be greater and where all the talent may be given the opportunity of entering the contests. Such an organization will bring up western records into such proximity to those of the east that the latter will be forced to arrange national meets to decide which portion of our country has the supremacy. The W. I. C. A. A. being already established invites the western colleges to join their interests in it, thus giving the western talent a broader and better field in which to display their prowess.

At the last meet at St. Louis the field day for next spring was given to Rose, together with the offices of president and secretary. Rose would modestly call attention to its success in managing the Indiana Inter-Collegeiate Athletic Association field days, and promises to do its utmost in making this Western Association meet the most suc-

cessful exhibition of the kind yet held in the state of Indiana. We also hope the western colleges will unite with Rose in the attempt to make some new records on the Terre Haute track already made famous by the records of Nancy Hanks and Robert J.

WILLIAM E. BURK,
Pres. W. I. C. A. A.

TENNIS.

This fall's tournament, under the supervision of Prof. Hathaway, attracted the usual amount of interest.

Farrington won the singles and Farrington and Meriwether the doubles. Only one set of the latter was played, that between Meriwether and Farrington and Miller and Speed. The other contestants failed to show up, and the sets went to Farrington and Meriwether by default. Following is the score:

Singles:

Beebe and Speed: 8–6, 6–4.

Miller and McTaggart: 3–6, 8–6, 6–3.

Farrington and Crockwell: 6–0, 6–4.

Second Round:

Beebe and Miller: 6–4, 6–0.

Farrington and Meriwether 7–5, 6–3.

Third Round:

Farrington and Beebe: 6–3, 6–1, 6–2.

Doubles:

Meriwether and Farrington vs. Miller and Speed. } 6–1, 2–6, 6–4

POLY VS. Y. M. C. A.

Saturday afternoon, October 20th, R. P. I. lined up opposite the Y. M. C. A. team for the first regular game of the season. It was anything but a favorable afternoon for foot ball, the thermometer being somewhere in the neighborhood of summer heat. Things looked a little dubious for the Polys when a comparison of the teams was made as they first lined up, the Y. M. C. A. having much the heavier men.

Y. M. C. A. won the toss, selecting the south goal, the wind being from that direction, and the ball went to the Poly. Steele caught Troxler's kick, but instead of running with the ball he passed it back to some one else and before anything could be done the Polys had downed the ball. At the start the Y. M. C. A. began bucking the center and apparently had found a weak place in the line as they gained forty yards in five downs, but at the end of that time our men began to recover and successfully resisted the onslaughts of their opponents. The Y. M. C. A. gained twenty yards more by a long run around the end, which carried them to the twenty-yard line. They, however, failed to make the requisite gains in the next two downs and the ball went to R. P. I. Then Troxler took it and started around the end but went down with Walker's arms around his neck, and R. P. I. was given twenty-five yards. By steady playing they had pushed the Y. M. C. A. across the center, when Troxler made a magnificent break through the center and carried the ball down the field, and across the line, securing the first touch-down for R. P. I. Time, fifteen minutes. Ridgley kicked goal.

Y. M. C. A. got the second kick-off, but they were immediately forced back to the center. Here Early attempted to punt, but Brown and Klinger succeeded in breaking through and reached him just as he kicked, the result being that the ball struck one of them, bounding back nearly twenty yards, at which point Austin promptly fell on it. The lines surged back and forth for several minutes more, when time was called. Score—R. P. I., 6; Y. M. C. A., 0.

In the second half the Y. M. C. A. kicked off, the ball going to the 35-yard line, but Troxler promptly regained the ground, carrying the ball to the center of the field, and from this point the Y. M. C. A.'s men were forced down the field, without the loss of a foot, across the line. Ridgley succeeded in bisecting the goal posts all right, but the ball went low, carrying away the string, and the goal was lost.

The Y. M. C. A. again kicked off but Brown caught the ball and succeeded in reaching the 45-yard line before he was downed. R. P. I. slowly advanced into their opponents' territory, but on a second down they lost instead of gain-

ing—and the umpire called "third down—five yards to gain." The ball was passed back to Troxler, who made an elegant punt, the wind aiding to carry the ball down the field, where it fell close to Early, who for some reason failed to pick it up, he, probably, expecting O'Brien, who had followed close after the ball, to touch it, thus making an off-side play. This, however, O'Brien failed to do, and when Early finally stopped the ball it had nearly reached the 5-yard line. Here the Y. M. C. A. made a desperate stand. Steele took the ball and started around left end, when Klinger broke through and made a splendid tackle, downing him five yards behind his own line. Then Early tried to punt, but failed in the attempt and a few moments later Brown carried the ball across the line, making the third touch-down. Ridgley again kicked goal. There was so little time remaining the ball was not again put in play.

Score—R. P. I., 16; Y. M. C. A., 0.

Umpire and Referee—Barnes and Robinson.

Linesman—Prof. Hathaway.

BUTLER, 32; *R. P. I.*, 0.

The game on Saturday, October 26th, was a splendid exhibition of what good team practice will do, and how unequal is the contest between two elevens, one of which has not had the all necessary amount of good steady training. It is unnecessary to give a detailed account of the game, as it would only aid the score in showing how one-sided it was.

Suffice it to say that Butler outplayed R. P. I. at nearly every point, they being exceptionally good on interference, while, on the other hand, this was Rose's weakest point.

Though the team work showed up so poorly the individual playing was in some cases extremely good, showing that our team contains material, that with proper training, would make formidable opponents for any team in the state.

Brown, Ridgely and P. W. Klinger are especially deserving of mention, the former making some splendid end gains almost entirely unaided, and the two latter for all round good work, but particularly in tackling.

There was one good result from the severe defeat and that was to thoroughly convince the team that every spare moment should be occupied in practice.

The score, as stated above, was 32 to 0, Butler failing on the first two goals.

R. P. I. VS. DEPAUW.

This was practically a repetition of the game with Butler the week previous. The majority of the DePauw eleven are large, heavy men, our team appearing very light in comparison. R. P. I. was badly crippled by the loss of several of her best men, Brown and Burtis being unable to play. In the first scrimmage W. J. Klinger had his leg so badly twisted that it was necessary to substitute Decker, so that on the whole the team was not in proper condition to meet the DePauw eleven. DePauw secured three touch-downs in the first half in one, two, three order, Rose only getting possession of the ball once, and losing it again after a trifling gain.

After the fourth kick-off, however, the playing became much livelier. R. P. I. had been forced across the center and down to the 25-yard line, but on an off-side play by DePauw and a good punt by Troxler, they regained a good portion of their lost ground. DePauw again got possession of the ball and carried Rose back to the 20-yard line, at which point they lost it, on another off-side. Then Troxler broke through for 15 yards and was downed on the 35-yard line. After one or two more scrimmages, during which the ball went to DePauw, time was called with the score 14 to 0, DePauw only getting one goal.

The second half opened with a kick-off by DePauw, which Ridgely caught and carried back across center to the 45-yard line before DePauw succeeded in downing him. Then Rose hammered center for 15 yards more, and prospects were quite promising for a touch-down, but a few moments later they lost the ball and with it their one chance to escape a shut out. DePauw se-

cured two touch-downs in this half and were rapidly nearing another when time was called. They kicked both goals.

The teams lined up as follows:

DEPAUW.		R. P. I.
Davis	center	Mead
Mitchell	r. g	Darst
LaHines	l. g	Meriwether
Sedgewick	r. t	Decker
Bohland	l. t	Miller
Raub	r. e	O'Brien
Reeve	l. e	Austin
Kaykendall	q. b	Ridgely
Pratt	r. h	Robinson
Dill	l. h	P. W. Klinger
Ballard	f. b	Troxler

First half—Umpire, Barnes; Referee, Blake.
Second half—Umpire, Blake; Referee, Barnes.
Linesman, Professor Hathaway.
Score, 26 to 0.

R.P.I.-NORMAL.

It looked for a while as though this game was not going to take place, as the Normal team appeared on the field with the intention of playing Somerville, their coach, and to this Robinson objected, and with good reason, refusing to play a team from the Normal containing any other men than Normal students. After a considerable delay things were finally arranged satisfactorily and the game began. It was a regular walk over for the Polys, as they could push the Normal line with ease, and had very little difficulty in getting around the end, their opponents, to the contrary, only making substantial gains in one or two cases, outside of the kick-offs, during the whole game.

Perhaps the prettiest play of the afternoon was made by Miller in the second half. He caught the Normalite kick-off and started down the field and when he saw he was in imminent danger of being tackled, he returned the ball by a magnificent punt, sending it into the opponents' territory, with a loss to them of fully 35 yards. Owing to the lateness of beginning, the halves were shortened to 20 minutes.

R. P. I. secured two touch-downs in the first half and three in the second. The Normals failed to connect.

Umpire and referee: Walker and Somerville.

Score—26 to 0.

AT OTHER POINTS.

Butler—DePauw, 38–6.
Purdue—Wabash, 44–0.
U. of Penn.—Princeton, 12–0.
U. of Mich—Kansas U., 22–12.
Yale—Lehigh, 50–0.
Harvard—Chicago A. C., 36–0.

As is seen above, Wabash was snowed under by Purdue to the tune of 44 to 0. Wabash has been considered the second-best team in the state, and it was the general opinion that the two were more evenly matched.

Perhaps the greatest surprise of the football season was that of the shut-out Princeton received at the hands of the University of Pennsylvania. The Tigers are no longer the "invincibles," and the U. of P. has attained a position in the front rank of football.

TWO MORE WORLD'S RECORDS FOR ROSE.

The twenty-fifth Annual Convention of the Indiana Young Men's Christian Associations was held last week at Columbus. One of its features as illustrating the work of the physical department was a Pentathlon contest. Teams were entered from five cities of the state. An elegant championship pennant was to be awarded the team of three men scoring the highest total number of points. A gold medal was to be given to each contestant scoring over 300 points. W. W. Crowe, '95, entered as one of the Terre Haute team, which easily carried off the pennant. The score of each man on the team was unusually high and deserve notice.

RECORD OF SCORES.

NAME.	Potato Race.	Shot Put.	Hitch Kick.	Fence Vault.	Rope Skip.	Individual total	Team Total.
Crowe	14 sec. 75	33′–9″ 83	8′–0″ 75	6′–6″ 88	4 m. $30\frac{3}{5}$ s. $129\frac{2}{5}$	$450\frac{2}{5}$	$1232\frac{4}{5}$
Modesitt	14 sec. 75	33′–6 62	8′–4″ 85	6′–4″ 80	4 m. 40 s. 120	422	
Steele	14 sec. 75	33′–2″ 61	8′–2″ 80	5′–8″ 48	5 m. $3\frac{3}{5}$ s. $96\frac{2}{5}$	$360\frac{2}{5}$	

The scoring of Mr. Crowe is remarkable in that the total number of points made, $450\frac{2}{5}$, and the time of the rope skip, 900 times in 4 min. $30\frac{3}{5}$ sec., stand as *worlds' records*, the best previous records

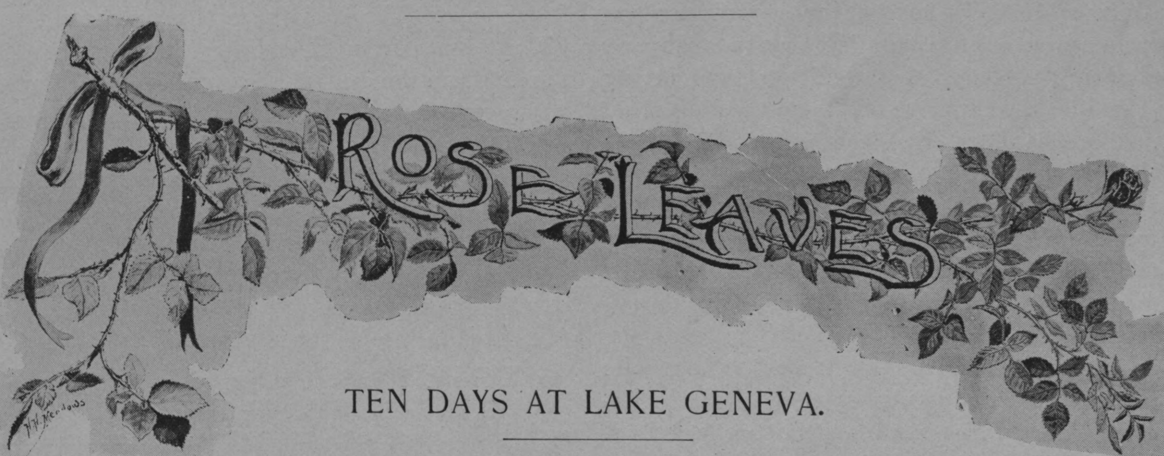
of points being 444 and for rope skip, 4 min. 37 seconds. As a winner of all round athletic contests he is acquiring well deserved fame. Rose is proud of him.

NOTES FROM THE CAMPUS.

Thanksgiving day is rapidly approaching and with it the time for the long expected game at Louisville. The eleven is putting in as much time as possible in preparation and have been greatly aided of late by the advice and instructions of Mr. Walker. We are sure the whole school joins us in extending to Mr. Walker our heartiest thanks for the kindly interest he has taken in the success of the Poly team. The eleven showed a great improvement in their interference in the R. P. I.-Normal game. This has been one of their weakest points and it is gratifying to see that, under the coaching of Mr. Walker, they are gaining strength in this direction.

Ridgely came to grief in the game with DePauw. He took a header into a scrimmage and emerged a little later with a wrecked proboscis. We are happy to say that this member of his facial configuration is healing quite rapidly and will not leave him disfigured.

It is highly probable that a game will be arranged with DePauw at Greencastle for Saturday, the 17th inst. If so a delegation of Polys should go over and yell for the boys. They may need the encouragement.



TEN DAYS AT LAKE GENEVA.

Mention the term "Summer School" to the average college student and instantly there will flash across his mind's eye the vision of hot, sweltering class rooms, and the poring over text books which he is only too glad to say good bye to for a season when June days roll around. Of a far different character was the summer school which the writer was privileged to attend shortly after the close of last spring's term. It was a school complete with faculty, lectures, students, hour plan and all, transported bodily into the country, far from the crowds and turmoil of the city, and established in camp in one of the most beautiful spots that we have ever visited. Where was it? Well, that is a question that cannot be fitly answered in two or three words.

A little body of water lying near the southern border of Wisconsin, some ninety miles from Chicago, quite irregular in shape and probably nine miles in length, bears the aptly borrowed name of the classic Lake Geneva of Switzerland. The high hills surrounding it on all sides, at times so steep as to be termed precipitous, and covered with a heavy growth of forest trees extending clear to, and in many places overhanging, the water's edge. Innumerable strongly flowing springs pour out their crystal streams from the bases of the hills. In fact, the lake itself has been

called an immense spring. Its water for this reason, probably, is of wonderful clearness, and the angler's mouth is made to water many a time at the sight of splendid specimens of the finny denizens disporting themselves in its depths. Here in this delightful spot, where it seems that nature has left little undone that would contribute to the enjoyment of the camper-out or the seeker after rest and recreation, were pitched the tents of the summer school.

However, the vicinity of the lake is not, as might perhaps be imagined, in a state of primeval wildness, but on the contrary bears constant evidence of the hand of civilization, exerted in this instance to add to and supplement the work of nature rather than to overturn and destroy as is, perhaps, too often the case. From its nearness to Chicago the lake has become a popular resort for the people of the World's Fair city, and many of its wealthy citizens have built pretty residences and laid out tasteful grounds along the shores and hillsides. Numbers of hotels, groups of cottages and camps provide for a great many visitors who are not so fortunate as to own a summer home there.

Of the latter class is the Y. M. C. A. camp. It includes about thirty acres on the precipitous north shore of the lake, broken by terraces where the tents and buildings are erected. There are several permanent buildings, among them the Reception Hall, Dining Hall, seating two hundred, and the Tabernacle, seating between five and six hundred. The sleeping quarters are provided in large tents with permanent board floors. The interior of each tent is partitioned off into four rooms and a central hall, giving accommodations, when crowded, for ten in a tent.

The Indiana delegation was favored this year with the first row of tents, right on the lake shore. A fine spring, directly in front of the camp, supplies water, which is piped to every tent. The bill of fare supplied in the dining hall was excellent, and the service—well, if the waiters were a little awkward and slow at first it was pardonable, for they were fellow-college students, inexperienced in such work. They soon learned to balance a half dozen orders, piled high on a tray, upon one hand, and steer it through the tortuous avenues of the great dining hall, with all the flourish of an old hand, although the flourish did end once in a while in a crash. So, while we enjoyed all the indescribable delights of camp life, yet many of the unpleasant features, such as the tale of the pots and kettles and the trudging "down the hill to get a pail of water" were eliminated.

The camp is the property of the Western Secretarial Institute, of Chicago, an institution for the education of General Secretaries and Physical Directors. It is open every year from June to September, during which time it is the scene of a number of conferences or summer schools. The first of these, the one which the writer attended, is known as the Lake Geneva Students' Summer Conference. The attendance this year was about 250 students from 125 colleges and universities, mostly from the central and southern states, with a few from those farther east and west. Indiana's delegation of thirty-four ranked third in size.

The President of the Conference was Mr. S. M. Sayford, who will be remembered with pleasure by most of the Polytechnic students. His able management and kindly words of advice contributed much toward the success of the conference, and won for him the hearty esteem and friendship of every delegate. Chancellor McDowell, of Denver University, was present during the entire sessions and delivered several interesting and valuable lectures. Prof. White, of the Moody Bible Institute, Chicago, and Gen. Secy. Messer, of the Chicago Association, conducted the two bible classes, following the "inductive" and workers training class methods.

L. D. Wishard, the great missionary worker and traveler, came from the Northfield, Mass., Conference, which was in session at the same time, and gave us the rare privilege of listening to some of his realistic, stirring addresses. Among these was an intensely interesting account of his visit to the great Y. M. C. A. Jubilee Convention, held in London, England, last May, which was attended by over 2,000 delegates from 26 nations, speaking 17 different languages. Its sessions were presided

over by Sir George Williams, the founder of the little organization, fifty years before, which has resulted in the Young Men's Christian Association of to-day, and who, in honor of the event, was knighted by the queen.

A number of other able men were present, either as members of the faculty of the Summer School or as lecturers. An outline of the daily programme will give a pretty good idea of the work done and may be of interest.

6:00 A. M.—Rising bell.
6:45 A. M.—Breakfast.
7:30 A. M.—Missionary Institute and President's conference.
8:30 A. M.—Bible classes.
9:30 A. M.—Association conference.
10:30 A. M.—Recess.
10:45 A. M.—Platform meeting; lecture.
12:15 P. M.—Dinner.
1:30 P. M.—Athletics.
4:00 P. M.—Aquatics.
5:30 P. M.—Supper.
7:00 P. M.—Life work conference.
8:00 P. M.—Platform meeting.
9:30 P. M.—Retiring bell.

For one who took an active interest in the athletics and aquatics, which, as will be seen, occupied the entire afternoon of each day, the above made a pretty full day's work, and the retiring bell at 9:30 o'clock was not a minute too early. Dr. Luther Gulick, of Springfield, Mass., had charge of the physical work and A. A. Stagg, of Chicago University, was present and assisted to some extent. The facilities for athletic sports were quite complete. Three first-class tennis courts are located about half way up the hill close to the camp. Clear up on top, some two hundred feet above the lake, is a level field laid out with quarter mile running track, base ball ground, standards for vaulting and jumping, etc.

A number of games of base ball were played between various state delegations. The University of Chicago easily carried off the honors in this line, having several of their college team present. On the last Saturday afternoon a team was made up in camp, barring U. of C., to play the faculty and to the utter surprise of every one, the faculty—won. The writer secured a photograph of the victorious team as soon as they calmed down enough to stand still, and values it quite highly. After this game a few field and track contests were held. R. P. I. and Earlham College succeeded in carrying off first and second places in the pole vaulting.

As for swimming and diving, the beautifully clear water of the lake, rippling up on the gravelly shore and against the posts of the steamer pier extending out a hundred feet into it, was not only a splendid opportunity but an irresistable temptation to don the scant but gaudy attire of the bather and take a plunge. Many amusing as well as instructive contests were held in the afternoons. Among them were boat and swimming races, diving blindfolded for a mark, righting, bailing out, and getting into a capsized boat while in the water, rescuing an apparently drowned person from the water, and high and broad diving from the end of the steamer pier. Thirty light and well built rowboats were at the disposal of members of the camp free of charge. The distance across the lake, about two miles, made just a nice before breakfast or after supper row, while the enthusiast in that line could get as much as he desired up to the nine miles to the village of Lake Geneva at the other end of the lake.

For those who did not care to indulge in the field sports, the winding paths along the varied and picturesque shores of the lake and up over the high hills afforded a chance for many a pleasant afternoon's ramble. The writer being a confirmed "camera fiend," of course had his little black box with him, and brought back quite a number of the prettiest bits of lake and forest scenery, as well as many of the familiar incidents about the camp.

One afternoon about a hundred and fifty of us chartered one of the little steamers which make regular trips around the lake, for an excursion to the town of Lake Geneva and back, stopping at points of especial interest. The miniature craft was loaded to about its full capacity, there being very decidedly "standing room only," and not

much of that. A merrier party it would be hard to imagine. The wooded shores and headlands re-echoed with the yells of every college represented and at every landing the denizens would be awakened from their afternoon naps by the Lake Geneva yell:

Hurrah! Hurray!
Y. M. C. A.
Geneva! Geneva!
Y. M. C. A.

The pilot said he was glad of it, as it saved him the trouble of whistling for the landings.

Upon reaching the town of Lake Geneva, the captain announced a stay of an hour and a half, so away we went scattering to see the sights. A place of probably three thousand inhabitants, the village is very prettily situated and laid out. But it did not take long to make the rounds and in about an hour the boys began to straggle back. Soon they collected on a corner of the main street, and as was inevitable in a crowd of college boys with nothing to do but put in the time, mischief began to brew. Some one discovered a bakery whose proprietor had just turned out a fresh lot of pies. In we went as one man, and called for pie. State Secretary Burt, of Illinois, led the way out into the street, and right down its center, each man with a quarter of a pie in one hand and his predecessor's coat tail in the other, the long column moved, stepping to the time of the refrain, Pie—Pie—Pie, Pie, Pie, while the shopkeepers and clerks crowded to the doors, seemingly undecided whether to smile at the sight of the baker's stock in trade moving off bodily down the street, or to fear for the welfare of the community in the imminent danger of a pie famine. The supply was soon exhausted but, with a skill born of long experience in Poly boarding clubs, the writer secured a section for himself, and then rushed off down the street to catch a snap shot of the cavalcade devouring everything before it. The three excellent negatives secured at different points on the line of march down to the steamer's pier are highly valued souvenirs of the unique affair.

Thus, with fun and frolic, rest and recreation, delightfully intermingled with lectures upon topics of absorbing interest, informal talks and conversations with men of great intellectual and spiritual power, and the study of questions and problems reaching into, and, in many cases, involving the life work of the present, the ten days passed all too quickly. On Tuesday morning when the camp broke up, a party of us decided to shoulder our grips and tramp the mile and a-half cross country to the railroad station. After making the tiresome hill back of the camp, upon whose summit the great Yerkes observatory is being erected, we paused to recover our breath and to take one long, last look at the scene spread out below. The lake stretching away off into the hazy indefinite distance, its surface showing just a trace of a ripple from the morning breeze, and dotted here and there with the tiny white sails of pleasure craft, seemed like a jewel in the rich setting of the green slopes of the everlasting hills. As we stood lingering, a host of pleasant associations and memories came crowding in upon us and it was reluctantly that we turned away.

That it was not all a pleasant dream, the fat note book lying before me as I write, as highly prized as it is well filled, is sufficient evidence. A most earnest wish would be that next year Rose should be represented by more than one delegate, for under the circumstances the proportionate benefit to be derived by two or three persons would be far greater than simply that many times unity.

O. E. McMeans.

It is indeed hard to reconcile ourselves to the death of Mrs. J. A. Parra, who was until recently enjoying the blessings of youth, health and happiness. This difficulty to realize this sad blow can but make us sympathize more deeply with Mr. Parra in his sad bereavement.

The young couple had been married only four months, and, thus coming in the midst of their new happiness, we can easily imagine how the blow was made doubly hard for our friend to bear.

Mr. Parra goes immediately to Basin, Montana, where he will be assistant superintendent of the Basin Mining and Concentrating Co.

RECEPTION TO THE FRESHMAN CLASS.

In the parlors of the Terre Haute House on Friday evening, November 2d, the faculty gave their first reception of this year to the Freshman class. Quite a number of Terre Haute people were present and the Freshman class was well represented; so there was no lack of the social element.

Dr. Mees did the honors as host and, as might be expected, filled the position so admirably that he dispelled much of the stiffness usual to such occasions.

An orchestra stationed in an alcove at the end of the hall furnished music during the evening. Up to half-past ten the guests came and went and by eleven this very pleasant social event was over.

The members of '98 feel sure that the memories of their first reception in Terre Haute will be among those of the most pleasant incidents of their college days. They only regret that it may be impossible to remember every one whom they met, and hope that during their stay in Terre Haute they may have many opportunities to refresh their memories in this particular.

RESOLUTIONS OF CONDOLENCE.

CLASS OF '98 OF THE ROSE POLYTECHNIC INSTITUTE EXPRESSES SYMPATHY FOR ITS PRESIDENT.

At a meeting of the class of '98 in the Rose Polytechnic Institute a resolution of condolence on the death of Mrs. Krebs, mother of Walter A. Krebs, the class president, was adopted. Following is the resolution:

WHEREAS, Mr. Walter A. Krebs, one of our fellow students having been called to his home by the tidings of the sudden death by accident of his mother, we, the classmen of 1898, in the Rose Polytechnic Institute, have assembled to express our sympathy with him in his bereavement. Though we have been associated but for a short time, close ties of friendship have been formed, and we cannot but feel with him the sudden shock of sorrow and pain coming from such a loss as has befallen him, and we feel impelled to offer such comfort and encouragement as may come from the assurance of warm and sincere friendship. Therefore be it

Resolved, That we extend to our president and his sisters our hearts' deepest sympathy.

Committee.

Ingle, '97, was visited recently by his mother and sister.

Ridgely received a short visit from his brother not long since.

Ingle, '97, is now only three officers. Willus has been elected treasurer.

Bentley, ex-'94, wheeled down from Chicago and made a short stay in Terre Haute in the latter part of October.

There was quite a delegation of Coates college girls to see the Butler-R. P. I. games.

Why didn't the Normal girls come out Saturday; have they lost faith in their champions?

Overheard in Conics.—Prof.: "How many normals can go through a point?"

Sophomore (almost inaudibly): "Not a blamed one of them got through, they couldn't even go around the end."

Schurmann, formerly of '96, but now attending Purdue, was visiting friends here on Sunday, Nov. 11.

Lufkin will have to quit going to church if he wants to play foot-ball, and give his knees a chance to get well.

W. J. Klinger, since twice severely wrenching his knee in the foot ball games, positively refuses to play again this season.

"The Professor" had some very important business to attend to, and regrets that he was unable to meet the Junior Class on Hallow'een.

Inquiring Freshman.—What under the sun did those Juniors get that stone and have it put there for? One who knew.—For thirty dollars!

The Klinger boys were favored last week with a visit from their parents. They were entertained by Mr. and Mrs. Beville, where the boys room.

The gymnasium class, which has been slowly gaining in membership and interest, will probably take a boom with the advent of cold weather.

Whitcomb, '98, made an excellent marshal Saturday, and if he had been ordered to remove both teams from the field would undoubtedly have done so.

'95 men will be pleased to hear that their first class president, Mr. E. R. Lamb, was married recently. He is now at home at 1007 N. Illinois st., Indianapolis.

Mr. Tuller, of DePauw, came over to witness the DePauw–R. P. I. game and doubtless had the pleasure of guying his brother, Tuller, '95, over the defeat of the Polys.

It has been a time-honored custom among all classes, in all institutions, to leave untouched and to hold in respect the deeds of alumni classes. What honor has been won by the classes who recently defaced the work of '93?

Some of the Freshmen were highly honored the night of the reception. It is reported that two of the prominent members of the class were escorted to the Terre Haute by a body guard of admiring Sophs, the latter bearing all expenses, including carriage hire.

The Coates College young ladies recently listened to a sermon from the text, "What is man that thou art mindful of him?" We sincerely hope they will consider that we are boys.

Friends of Chas. A. Manning, formerly of the class of '95, but now of U. Mich., will be very sorry to hear of the sudden death of his father, Capt. J. A. Manning, of Michigan City.

Darst, '95, has shown the same intense interest in football that so characterizes everything he does. Indeed he was so interested in pushing the Butler center over the field that he wished for "third half."

It is rumored that Newbold is inventing a new system of quarternions. We can all appreciate the difficulty of such a task and will wait impatiently for his solution of the problem which baffles him at present, viz.: if $2y=0$, does $y=2$ or $\frac{1}{2}$?

The foot-ball team has in its possession a large banner of canvas with hiereogliphics that look somewhat like '97. It was observed on Halloween night floating, or rather stranded, over the telephone wire on North Seventh street. The team propose to sew it up into a bag, stuff it and swing it up for practice in tackling.

A certain '94 man into the went library the other day, and began searching promiscuously for some books and papers; the librarian approached him and asked what he wanted, and was in turn asked, "What is that to you." The visitor continued stirring up papers, and several hours' work was unraveled before Mr. Simon could introduce himself.

In one of the snap shots of our game with Butler, their coach is seen writing in a note book; every one supposed that he was taking "pointers" to use in coaching, or probably keeping an account of the game. We now know that he was simply taking down our signals, and the corresponding plays. He explained them to the team between the halves, and our plays were known to them as well as to ourselves during the second half. Troxler says mathematics may be exhausted, but our next code will stand forever.

We appreciate Mr. Harrison's kind offer to put electric lights on the campus so that our team and the Y. M. C. A. team could practice at night, and regret very much that the danger of contracting cold from playing in the night air prevented the execution of his plan.

Montgomery, '98; Chandler, '97; and McMeans, '96, were delegates from the Polytechnic Y. M. C. A. to the State convention at Columbus, Ind., last week. They report a highly interesting time. A majority of the 250 delegates were from the colleges and universities of the State.

The game next Saturday with DePauw at Greencastle is the last before the Thanksgiving Day game, and all who can should go over to encourage the team in the first game away from home. An attempt will be made to get rates, and a good crowd should be the result.

The latest problem for students in physical laboratory is as follows: Given a tube open at each end and inserted vertically in a beaker of water—the whole to be placed under the receiver of an air pump. Find the degree of exhaustion of receiver in order for the water to rise ten inches in tube above line of water in beaker. Also determine ratio of exhaustion of receiver to that of experimenter. It might be added to encourage the other classes to attempt the solution of the problem that the Seniors came very near solving it under the instruction of Dr. Ballard.

Ridgely's nose is all right, and only a slight scar that will not be permanent is left; still, it was thought best not to play him Saturday. It was the first match game ever played by the Polys since he has been here in which he did not play.

The fence painting this and in former years has caused considerable comment and not a little feeling against the Polytechnic students in general. In former times it has been well grounded, but after the talk which Dr. Mees gave the school on the subject, in which he explained the childishness of such a thing the classes decided to stop it, and it gives us pleasure to state that we have obtained proof from a reliable source that last Halloween's work was done by the town boys.

Kingsbury, ex-'97, is at present enjoying life with a cavalry company in the wilds of Arizona, and in a long letter to one of his Rose friends gives a graphic account of the pleasures and burdens of such a life. "Kingy" was fond of retiring early while among us, a very exceptional trait among Rose men; there was, however, no proverbial "difference in the morning," for he could sleep without bad dreams until it was too late for breakfast. In his new life he says he rises at 4 o'clock every morning, and often mounts guard during the night, and yet speaks of it altogether in such glowing terms, that we hesitate to publish the letter from an indisposition to boycott Purdue.

SCIENCE AS APPLIED TO LOVE.

I give some reasons here below
  Which I am sure must prove
That science teaches men the way
  A maiden's heart to move.

And if this theory is correct
  The girls can learn at last
Why Polytechnics flirt so much
  That people say they're fast.

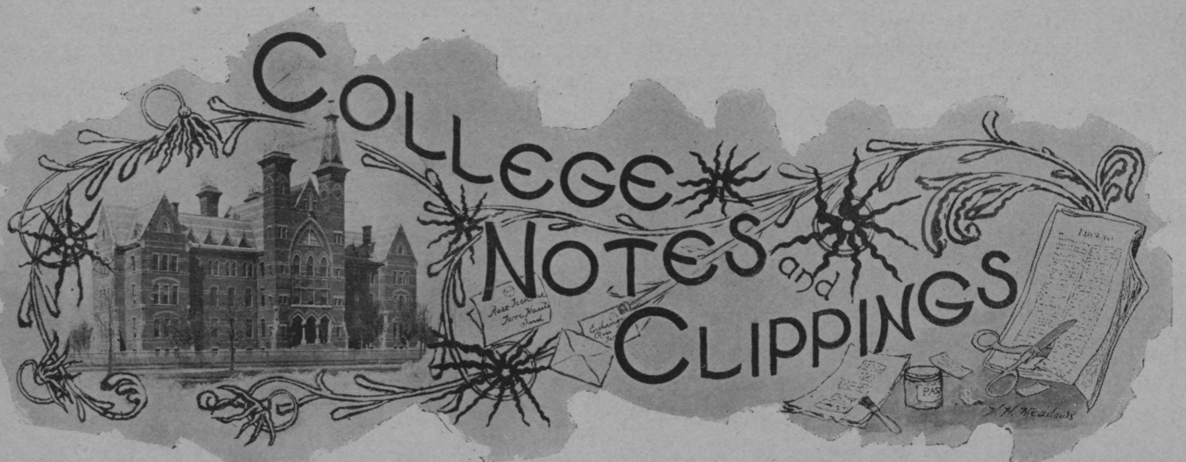
In books on trigonometry
  We all begin with "signs,"
The "introduction" quite o'erlooked
  Or left for future times.

In conic sections afterward
  We study "graceful curves"
In which "e-lip-tic" functions play
  A part that upsets nerves.

Girls are "magnetic," so we're told,
  And though your heart be steeled
The "lines of force" will hold you fast
  If once you're in the "field."

When by experiment you've learned
  Dynamics' great receipt
Always apply your "force" with "arms,"
  The "couple" is formed complete.

A. L. R.



The Seniors won the interclass foot ball championship at Harvard.

Foot ball is said to have been a crime during the reign of Henry XIII.

Scarlet has been adopted as the college color of the University of Chicago.

The Harvard Crimson has made arrangements to be furnished by telegraph with news from other colleges.

Of the twenty-three men who received honors at Harvard this year, eleven are prominent athletes.—*Ex.*

R. D. Wrenn, the tennis champion, is practicing the position of quarterback regularly with the Harvard eleven.

The University of Pennsylvania has a handsome new chemical laboratory, with a library and smoking-room attachment.

She sat on the steps at the eveningtide
  Enjoying the balmy air;
He came and asked, "may I sit by your side?"
  And she gave him a vacant stair.—*Ex.*

"And so, Mrs. DeGollyer, your poor boy was killed by savages?"

"Ah, yes."

"South Africa?"

"No, college."—*Ex.*

The approach of the foot ball season is oppressively felt by the barbers in the vicinity of collegiate institutions.—*Ex.*

"Oh, would I were a bird," she sang,
  And each disgusted one
Thought to himself the wicked thought,
  Oh, would I were a gun."—*Ex.*

An Ann Arbor student says that they have just two rules, namely: Students must not burn the college buildings nor kill any of the professors.—*The Lombard.*

An Indian College was opened in the Indian Territory last week, and they say that the Freshman's yell can be heard to the remotest confines of Oklahoma.

A Freshman thought chemistry tough,
Till he found that the Prof. he could blough,
  He made use of his tongue,
  And although he was yongue,
In time he became the right stough.—*Puck.*

In the intercollegiate tennis tournament of the eastern universities Malcom Chase, of Yale, was victor in singles, and Chase and Foot, of Yale, won the doubles.—*Ex.*

Little Dot—"Mamma says th' cat is full of 'lectricity."

Little Dick—"Of course. Put your ear down on 'er an' you can hear the trolley."

Our Willie passed away to-day.
His face we'll see no more,
What Willie thought was H_2O
Proved H_2SO_4.—*Orient.*

Efforts are being made to revive the game of lacrosse, at Harvard, in obedience to a demand for a game which does not bar men who are too light to play foot ball.

Walter Camp, Bob Cook and George Adee, the Yale triumvirate of coachers, have agreed upon an important innovation for Yale athletic teams. Hereafter no member of one will be allowed to be a candidate for another athletic organization of the university.—*Polytechnic.*

"One of the most prominent Yale professors told me last year that more of the high standing men at New Haven had gone into foot-ball than into any other of the sports, and that the average standing of the foot ball men of last season was above the average standing of the highest standing class that ever graduated from Yale. It may seem, sometimes, that victory of a single year depends upon brawn rather than brain, but it will be found along in a series of years that the team winning the most times is the one having the highest class material, both as to pluck and brains."—*Walter Camp in the Stentor.*

A winsome wee sweetheart is she,
And much—they say—too good for me,
She has of millions, two or three,
My fiancee.

But, since this is 'twixt you and me,
The best, I'm sure, you will agree,
Is that, in one short month she'll be
My financee.—*Ex.*

A Freshman revelled with his chums,
And drank full many a drop;
Next morn he cut off both his thumbs
So now he cuts the shop.—*W. P. I.*

She had asked me
Would I help her
With her latin.
'Twas so hard!
Would I help her
Conjugate that
Mean, irregular
Old word
Disco. She just
Kept forgetting
The subjunctive
All the while!
Pretty lips so
Near, so tempting,
Tended strongly
To beguile.
Thought I'd teach her
By example.
Didicissem?
I should smile!

—*University Herald.*