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THE TECHNIC.

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NOTICE TO SUBSCRIBERS.

Hereafter we shall follow the general rule regarding subscriptions, and shall continue sending THE TECHNIC to subscribers until notified to discontinue.

AN occupation which could be indulged in to cosiderable advantage by any one who has the time and is so inclined is the preparing of papers either for publication or for delivering as lectures. Too often we hear the complaint, coming from sources which leave no doubt as to its truthfulness, that one of the greatest faults with our young engineers is their inability to state in well rounded phrases, facts and information which they possess, but which are of no practical use either to themselves or others on account of their failing in this direction. Many men are gifted in that they are able, without undue exertion, to express in intelligent and flowing words, that which another may be equally as well aware of, but which does him little, if any, good for the simple reason that he cannot express himself as clearly as is necessary. Fortunately this is one of the human failings which can be readily remedied and any student of average ability who will dilligently work upon a discourse in connection with some subject upon which he is fairly well informed, will soon find that each attempt makes it easier, and by continued trials he will soon be able to so concentrate his thoughts upon his subject, that he will be able to think and write to some purpose. Each reference investigated will add some scrap to his supply of ready knowledge and teach him to be on the look out for such items in the future. The powers of concentration will be strengthened, the ability to express in clear and logical terms and to present in legible form, available information will be fostered and above all the power of self-control will have been so exercised as to make it easier to master such difficulties in the future. For either students or alumni of Rose there is always an opportunity to present such papers and with the abundant advantages offered, especially to students, who have at their disposal a library whose books are easy of reference and whose custodian is ever willing to assist in any possible manner.

The scientific society and Technic are the channels thro which students are invited to air their views, while the columns of the latter are always open to contributions from our Alumni. We are sorry to say that during the past year considerable difficulty has been experienced in securing articles from each of these sources. We regret to think that students and alumni are slow to avail themselves of these opportunities.

FOR convenience and security against loss spacious lockers were provided when the gymnasium was bu lt. These were fitted with combination locks of the most approved design, similar to others which had given entire satisfaction for like purposes. Everything reasonable was done to make the equipment as complete and substantial as possible, and in return it was reasonably expected that those who were accord-

ed the privilege of using these conveniences would use discretion and judgment and be somewhat mindful of the rights of others who had privileges similar to their own. Contrary to these expectations considerable annoyance and inconvenience has recently been caused by certain petty acts of vandalism committed in the gymnasium. Lockers have been forced open repeatedly and the combination locks have in many cases been rendered useless by mistreatment. Numerous losses, in themselves insignificant, have been reported, and although the theft is on a small scale it nevertheless comes under this category, the mere semblance of which should be avoided in all affairs where the reputation of the student body is at stake.

One of the smallest courtesies which one gentleman can accord another is some slight regard for his personal welfare and convenience. Such a spirit as is displayed by certain students in this regard is certainly lamentable and so far as possible should be overcome. We fear that if these acts of vandalism and kleptomania are allowed to continue certain students will soon be eligible to membership in the State reformatory.

Considerable trouble has also been experienced recently in securing the property which rightfully belongs to the Athletic Association, and which is supposed to be turned over to the proper official after the season during which the property was used has expired. Numerous football suits are still in the possession of individuals, as are also several footballs used last fall. Numerous individuals borrowing baseballs from the manager have also failed to return the same. All of this is a useless and costly expense and a practice which only serves to prevent the school spirit from attaining its proper proportions. By it a few selfish individuals are benefited at the expense of the majority.

THIS year the events of the State field day will be conducted under an entirely new set of rules which are in accordance with the new constitution recently formulated and adopted by the Indiana Intercollegiate Athletic Association. More interest is being displayed this year than for some time past, and under the new reforms it is expected Indiana's athletics will be materially improved. One of the prominent features of the new constitution is to make athletics purely of a scholastic nature by avoiding the very semblance of professionalism. If the rules enacted are lived up to by all of the members no trouble will be experienced in this respect. In order to avoid trouble as regards the eligibility of men for positions on the various athletic teams it is required that each team submit to its competitor a certified list of players signed by the chairman of the faculty athletic committee. Such players must be *bona fide* students and in good standing. The dues have also been raised to ten dollars per annum, and a provision made for paying the expenses of the delegates from the various schools to the meetings of the association. No delegate will be allowed expenses who does not appear at the meeting. A finance committee has also been created which must sanction all bills before they become payable. We are also glad to learn that the date for the annual field day has been definitely settled and is the last Saturday of May. The new constitution clears up many points which have been in dispute, and if lived up to by the members of the association, trouble in future years will be avoided.

Electric Wiring, by Cecil P. Poole, New York. The Power Publishing Co , Flexible leather covers, pocket size.

IGNORANCE of the materials handled and of the ultimate uses for which they are intended will no longer be tolerated in any of the numerous divisions into which the art of engineering is separated. Without a good system of wiring in which the proper contrivances are used and the wires properly proportioned an electric plant amounts to practically nothing and too often some of the most important parts of the line work are allowed to rest entirely with men whose ignorance of the very fundamental principles of their vocation is amazing. For practical men, who are anxious to become better acquainted with their work,and who are desirous of making

themselves more valuable, the above work is intended as it treats in a practical manner of the subject under consideration. Numerous tables accurately calculated and carefully tabulated form an important and valuable adjunct to the work. The chapter on alternating current wiring is especially valuable as in it many points are covered which are usually not touched upon in such a work. The subject matter is so arranged as to be easy of reference and the entire book is neat in appearance and of a very convenient size for pocket use.

Going abroad? Some advice by Robert Luce, Boston, Mass., Robert and Linn Luce. Paper, pocket size, 163 pages, 50 cents.

COMPARATIVELY few of the large number of American college students ever have an opportunity of going abroad but to those who are fortunate enough to be allowed this privilege the above work will particularly appeal. It sets forth and answers in a systematic manner and in such a way as to be easy of reference, the numerous questions which are liable to arise in connection with such a trip. The part in reference to European Colleges and Universities will be of particular value to a student contemplating a course of study abroad.

Technic of Mechanical Drafting. A Practical Guide to Neat, Correct and Legible Drawing, by Charles W. Reinhardt. New York. Engineering News Publishing Co. Cloth, 10½x8 ins., 36 pages, 10 plates. Profusely illustrated, $1.00.

ONE of the greatest accomplishments of an engineer is to be able to produce rapidly and with facility drawings which are easily legible and which convey to others in as direct and concise a manner as possible the designs of the originator. One of the latest and most concise treatises on the art of mechanical drawing is the above which in a most logical manner gives in convenient form the gist of the varied experiences of one who has won considerable fame as a draughtsman. The book is intended more for the use of practical draughtsman and is certainly a valuable addition to the literature of which it is an excellent exponent. It is of convenient form and style and is accompanied by a series of ten plates which illustrate most practical and legible methods of representing the numerous materials of construction and various machines, etc. which the average draughtsman will be called upon to reproduce.

Condensers. A Series of Lectures and Articles upon the Subject, reprinted from the columns of Power. New York. The Power Publishing Company. Flexible cloth, 5¾x9 ins.

THE rapidly increasing use of condensers in connection with the best equipped power plants has rendered it absolutely necessary for the practical man to be well posted as to the various types employed and their particular advantages and disadvantages. One of the most comprehensive short works upon the subject is the above, which explains in terms readily intelligible to those who are not adepts in the art of steam engineering the theory as well as the operation of condensers now in general use. The numerous tables included in the book render it of especial value to those who may be called upon to calculate the efficiency, etc. of various types of condensers. The entire subject is presented in such a clear and logical manner as to be easily comprehended by the mechanic of average ability and intelligence.

The Compound Engine, A series of Lectures by F. R. Low, reprinted from the columns of Power, New York. The Power Publishing Company. Flexible cloth, 5¾x9 ins.

THIS is a short but exceedingly complete treatise on one of the most absorbing topics of steam engineering. The author presents his subject in the clear and intelligent manner, which is a characteristic of all his writings, avoiding so far as possible technicalities which might be confusing to the novice. The work is replete with diagrams and explanatory illustrations, all of which are executed in a manner compatible with the high degree of skill displayed in the typography of the book.

Light Waves.

By E. S. JOHONNOTT.

LIGHT waves furnish us with one of the best means for attaining a defiinite standard unit for measurements of length. The chief units recognized in the world today are the yard in the English system, and the me're in the French. The former is the distance between the centers of two transverse lines on a bronze bar, and the latter, nearly an equal distance on a similar bar of platinum. All other standard units of length are obtained by comparison with these as standards.

When a stone is dropped into a pond of water, a vibratory motion is propagated from one point to another in the surface, causing ripples to run out in all directions with the point of disturbance as a center. If we imagine a shot imbedded in jelly to have a vibratory motion, we have vibratory disturbances, propogated in all directions from the shot and producing waves in the jelly not unlike ripples on a water surface. Those which are propogated in the direction in which the shot vibrates, are called longitudinal waves and are analagous to sound waves in air; those which are propogated in a direction perpendicular to the motion of the shot, are called transverse waves and are analagous to light waves in the other.

The velocity with which these various wave motions are propagated increases with the elasticity of the medium and diminishes with an increase in its density. The velocity of the waves in the jelly, and also sound waves in air, are only a few yards per second, while the velocity of light is 186,000 miles per second. Thus the elasticity of the ether must be very much greater than jelly or air or its density must be almost infinitely smaller.

The principal of interference is the basis of all accurate methods of measuring the lengths of light waves. Interference in wave motions is the resultant motion in a medium of two or more wave motions simultaneously traversing the medium either in the same or in opposite directions. Interference in sound waves may produce sound more intense than any of the components or may produce silence. In the same manner interference in light waves may increase the illumination at a point or produce total darkness.

Before taking up some of the simple forms of interference, we will discuss briefly the manner in which interference in light waves takes place.

Most wave motions may be represented by a curve called a sine curve in which the displacement of the particles from their position of equilibrium at any instant is represented by the ordinate to the curve. If a medium be traversed by two waves simultaneously in the same direction in such a manner that the crest of one coincides with the crest of the other, the resultant effect is the same as if a single wave with the sum of both displacements traversed the medium. If the two waves have the same amplitude and traverse the medium so that the crest of one coincides with the hollow of the other, the resultant effect in the medium is no motion at all. In any other relative position of two waves of the same length their resultant effect may be represented by a single wave whose amplitude will depend on the distance between the crests of the two component waves. This is the manner in which interference in light waves ordinarily occurs.

It is, however, possible to have interference occur between two waves of equal length traveling in opposite directions. Waves produced by such interference are called stationary waves because the crests of the resultant waves as well as the hollows always remain at the same positions

in the medium. These waves are readily produced in sound by interference of direct and reflected waves. Lippman's process in colored photography is based on the principal of stationary light waves.

Another very good illustration of stationary waves is obtained by the interference of the direct and reflected waves in a string which is fixed at one end while the other is subjected to a vibratory motion of a proper period.

The most effective conditious under which interference in light waves occurs are,

(1). When the waves are travelling in the same direction.

(2). When the separate waves originate from the same source, *i. e.*, from the same vibrating particles, and are again brought together after having traversed paths of different optical length.

The application of these principles has been brought to the greatest perfection in the interferometer invented by Prof. Michelson. Instead of its being possible for only the most skillful manipulator to obtain even a faint effect, by means of this instrument even the most inexperienced may readily adjust the fringes so as to be able to undertake the measurements of dimensions of the most minute order. At the the request of the French government, Prof. Michelson was called to calibrate (so to speak) the standard metre in wave lengths of light. In this work a special form of interferometer was used. The accuracy of the measurements depended on counting a number of fringes equal to the number of wave lengths of light in a metre, viz : about 2,000,000. Since this number was accurately determined to within a few tenths of a wave length, we thus have a method of explaining the standard metre and its copies with the highest degree of accurracy should they become destroyed.

The whole of Prof. Michelson's work on the interferometer has been published by the French government in a separate volume.

LYNN, MASS., FEB. 8th, 1900.

Mr. C. L. Mees, Pres.
Rose Polytechnic Institute,
Terre Haute, Ind.

DEAR SIR :—Replying to your letter of Feb. 6th, would say that my occupation and address are the same as given in the last catalogue.

In reference to the portion of the work at the Institute which I found of the greatest value, this is rather a difficult question to answer. I know very well from what I have seen from later graduates that there have been very radical changes since '86 and '87, and that they have been almost without exception for the better. Therefore, if I may change the question a little bit, I would rather tell you something of our experience in college and university graduates as a general rule, and particularly from an engineering standpoint.

The greatest difficulty has been and is now being experienced in obtaining a sufficient number of able men to carry on experimental, development, and general engineering work. Their faults in the experimental line lie not in the failing to get accuracy, but rather in failing to appreciate the necessity of promptly reporting in an intelligent manner on the work which has been assigned to them.

In taking up the test of a piece of apparatus, the man should first outline roughly what general lines he proposes to follow, in what respect the apparatus is to be tested, and then his observations should be systematic so that at any time his record sheets can be taken up and a fairly accurate idea obtained of what has been done and what has been shown at any period of the test. Unfortunately we find that this feature is very often overlooked. The notes are kept helter-skelter and nobody but the man himself is able to decipher them, and until the report is turned in they are absolutely useless.

Another weakness very often met with is the lack of ability to clearly state what they find and not be led astray by individual observations or single tests. Neither do they apply a sufficient amount of reasoning to the results to see if they are consistent, and very often a considerable length of time is spent in making tests which are inconsistent with each other, and will lead to false conclusions if they lead to any.

Another weakness is that, granting a man has obtained all necessary data and kept it in good shape, he very often lacks the ability to express himself well in writing a report and fails to bring out with the proper prominence the leading characteristics of the matter in questton. Either they are too concise, thus not giving anywhere near enough information, or they turn out a very elaborate report loaded with glittering generalities, and not saying anything in particular. The ability to make clear and definite statements, first, of the premises, second, the observations, and finally, the conclusion, is very rare. Of course you will appreciate I am speaking generally. We have any number of exceptions to this rule, but probably 90% of the assistant engineers, which we try and put aside, are rejected principally for this reason.

Another failing is that they neglect to appreciate the

necessity of promptness, and dilly-dally over half a per cent where a percent or two makes no particular difference. There are many places where extreme accuracy is necessary, but there are others where an error of a percent or two would not make the slightest difference, and the failure to distinguish between these is very noticable.

Another qualification which would be desirable, is the ability to issue clear and definite instructions upon an engineering matter which are not capable, under any circumstances, of having two meanings.

A line of study which has not been taken up, so far as I know, at any of the universities, is in regard to costs. The chief function of an engineer in commercial life is not to make the very highest grade article which can be made, but it is to make something which is simply good enough for the purposes, at the lowest possible cost, and it is therefore necessary for him to understand what affects costs, in what respect it can be cheapened, and how much more expensive labor is than material. Very often considerable saving can be made by saving a dollar on labor and spending a dollar, or even more than a dollar, on material.

I think it would be well to consider a line of study in this direction, familiarizing the student with what percentages should be added on account of capital invested, depreciation of tools, what percentage should be added for material and what for labor in order to earn a good interest upon an investment and to pay dividends of a predetermined amount. But over and above everything else, I am inclined to put the ability to take a piece of work in hand, do all you propose to do on it, issue instructions, report or whatever it calls for, and have this job completed so that it will never need to be referred to again on account of incompleteness in regard to detail; in other words, getting the work done, filed and out of the way.

Yours very truly,

F. P. Cox.

In the letter from the Institute to the Alumni seeking information for the new Catalogue, were inserted several questions, requesting the views of the Alumni upon several subjects of interest to the students. Many pleasing responses were received involving considerable good information. Most of the points touched on, however, are summed up in the accompanying letter.—[EDITOR.

The Senior Trip.

LOOKING back there will always remain with the members of the Class of Nineteen Hundred as a memory of one of the most pleasant experiences during their college career, the tour of inspection to Chicago, than which no city on the face of the globe can boast of carrying on certain industries on a larger scale. The colossal proportions of everything, the immensity of output, the regularity of organized labor, the perfection of detail and by no means least the magnificent distances, made a deep impression and a lasting one, on every one of the party, and more especially on those of greater records for traveling, and similar trips. That the experience was of a very great educational value can not be doubted, that it was at the same time one of many pleasures is admitted by all. After a by no means weary journey of five hours, we were received by quite a representation of the members of the Chicago Tech Club who escorted us to our hotel, where all of us, after a little confusion, were finally lodged. Thereupon these gentlemen escorted the more venturesome to a nearby restaurant where ravenous appetites were appeased, for it must be remembered that the time on the train was so taken up with pastimes, to some profitable, to others less so, that the needs of the inner man were entirely forgotten. Then we were taken to several places of interest, winding up with a little banquet, gotten up on the spur of the moment, in celebration of the many introductions passed that evening. On the following day, bright and early, the whole party, with the exception of the chemists, were piloted to the site of the ill-fated colisseum where an excellent opportunity was offered for inspecting the erection of arches, these being 100-foot span three hinged arches. Had any of us been a man with a hoe the party might have come to grief, for here work was abandoned, a strike being on, and the place was under surveillance of union men, but fortunately the discriminating powers of the pickets taught us that we were hardly there for the purpose of wielding the trowel or the hammer. Here the party divided up, the Electricals and Mechanicals under the chaperonage of Prof. Wagner and Mr. Clement, led by W. W. Crowe, 95 going one way, the Civils with Prof. Howe, as faculty representatives, guided by J. T. Montgomery, going the other. Following the Electricians and Mechanics we come first to the Western Electric Co's Plant where the testing laboratories, draughting rooms, vaults for the storing of drawings, wire insulating rooms and the telephone department were of especial interest in the light machinery departments, while heavy machinery was used in the machine shop, power house and heavy armature winding.

In the afternoon Frazer & Chalmer's estab-

lishment was visited. The casting of some immense engine parts was made while here and boilers in all stages of completion were to be seen. Here, as in nearly all places visited, the most modern machinery is found.

Having passed through these works it is said all the boys repaired to the corner for soda water. Thence the procession wended its way to the place of the McCormick Harvesting and Reaper Co., where according to an electrician, the only things noteworthy were the peculiar methods for turning out awfully many machines for very little money. A thing which struck many as being peculiar was the fact that the foundries were on the third and fourth floors.

A freak in the form of a gasoline engine automobile mower was being experimented on and caused considerable comment among the boys. On returning to the Civils we find them studying a number of elevated girders, and then we follow them to Tattersal's, where very large arches were studied and admired, and even the boxing ring received its share.

Now we go to see Waddell's wonderful Halsted street lift bridge, commonly called the Monument of Folly, by Chicagoans. We were fortunate enough to see it in operation, and some of the boys made the ascent, but say they wouldn't want to try it again. Thence we were whisked off to the wonderful stock yards where we witnessed some fire-proof erection and incidentally went through the whole establishment. Then we went to the American Bridge Co.'s Works, and there saw plate girders and car axles manufactured. Thence to the Van Buren and Metropolitan Elevated Rolling Lift Bridges and back to the hotel.

In the meantime the Chemists, with Dr. Noyes, visited Searle & Hereth, the manufacturing pharmacists, and then left the State, going to Whiting, Ind., where they were shown through the refinery of the Standard Oil Co., where they saw the processes of refining by distillation and steam. They were taken through the chemical laboratories, the paraffine department, the refrigerating and filtering departments. In the process of roasting all appliances are operated electrically.

They next went through the National Smelting Works and then joined the others at the hotel.

At 7:30, Chicago time, we were ushered into the large dining room of the hotel where the Alumni of the Chicago Tech Club tendered us a banquet, and a festive spread it was, indeed. Aside from the mere material pleasure of eating—a student's appetite is not unjustly proverbial—there was that very great pleasure one feels in meeting men who have trod the same paths along which one is still toiling, who have been successful, and who are, from a loftier position, extending toward you the hand of goodfellowship.

Mr. T. L. Condron, '90, as the grandfather of the Alumni, gave us the word of welcome, and J. H. Loofborrow, '00, thanked him in the name of the class.

After the banquet Mr. Alexander Smith, professor of Chemistry, of the Chicago University, suggested our going with him to see the last act of comic opera given by students of Chicago University, and he in full evening dress, with Dr. Noyes, dusty from the day's work, carrying an old cigar box full of something chemical under his arm, led us, twenty-five men strong, into Studebaker Hall. We all appreciated this very much.

A few of the irrepressible Electricals visited the Edison Distributing Station after the opera, and were well repaid for their trouble. It is from this point that all the underground lighting power is distributed, and here one may see the largest set of storage batteries in the world. These are connected up with their dynamos for heavy duty occasions. Thus ended the first day.

On the following day, under the guidance of Mr. Condron and Mr. Montgomery, the entire class visited the Illinois Steel Company's plant, and to describe this would fill a volume. It was by far the most interesting exhibition of the trip.

Some more soda and then we were taken to the Chicago Ship Building Co.'s yards, and there had an excellent opportunity for studying the

methods of shipbuilding, there being three steel vessels in different stages of completion on the runways and one in dry docks. Thence some of the party went to the power house of the Elevated Railroad where they saw immense Westinghouse dynamos connected with cross compound engines.

This concluded the sights as mapped out in the itinerary and the boys scattered to the four winds to enjoy themselves until the evening of the next day when we returned to our theses with a feeling of most profound gratitude toward all those who had made our sojourn in Chicago such an exceedingly pleasant one.

A few of the interesting incidents causing much amusement were that Madison was never late, Kidder had to make the banjo play and Maier and Appleton tried to slide down stairs gracefully.

The old friends we met were :

T. L. Condron, '90.
M. E. Becker, '93.
W. W. Crowe, '95.
L. Sanford, '96.
T. L. Camp, '97.
J. H. Lendi, '97.
S. L. Avery, formerly '00.
S. S. Frank, '92.
H. S. Hart, '93.
G. W. Phillips, '95.
F. F. Sinks, '96.
J. H. Hellweg, '97.
J. T Montgomery, '98.
J. M. Platts, '99.

The Steam Turbine.

By ROBERT YORK, '00.

THE recent advances in electrical engineering have been closely followed by those in steam engineering. Electrical Engineers may look for ward with pleasure to the development of an engine so well suited to their needs. The results obtained by the use of the steam turbine are quite surprising and much more so to those who have not kept a watchful eye on its progress. Although it is returning apparently to our old form of steam motors, the principles are well founded and if the mechanical details are well carried out there is a bright future for the steam turbine. The theory of the turbine is readily understood although the thermodynamic principles involved are somewhat more complicated. From $\int pdv$ it is seen that if steam issues from a jet into a perfect vacuum, its energy will be converted into momentum due to indefinite expansion. Of course if the vacuum is not perfect, the entire energy is not converted into momentum. The weight of steam per unit volume being small and the energy it contains comparatively large the velocity it must have when its energy is transformed into kinetic energy is quite high. Work being the product of force and space, and the force produced by a jet of steam or water acting on a vane moving in the direction of the velocity of the steam or water, being inversely proportional to the velocity of the vane, it is evident that the product of the two factors, force and space, will be a maximum when they are equal and, therefore for a maximum efficiency, the velocity of the vane should equal one half that of the issuing jet. This applies to such motors as the Pelton water wheel and the steam turbine, in any case the proper components of velocity being used.

The steam turbine is a machine or motor which transforms the kinetic energy of the steam into mechanical work by its action upon suitable vanes. It is not to be confused with some forms of the rotary steam engine which is actuated by the pressure of the steam on vanes or pistons and not by the impact of the steam on vanes as in the case of the steam turbine. As there are three types of steam turbines, it will be well to describe how this is accomplished in the three types. In the De Laval, manufactured by the De Laval Steam Turbine Works, of Stockholm, Sweden, the steam is expanded in jets which gradually increase in size as they approach the

vanes, as shown in fig 3, this gives a high velocity to the steam, consequently the energy now being partly in the form of kinetic energy is transformed into work as previously stated.

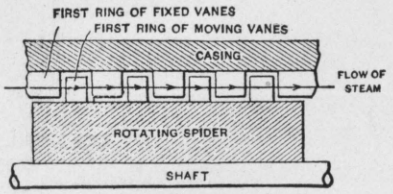


Fig. 1

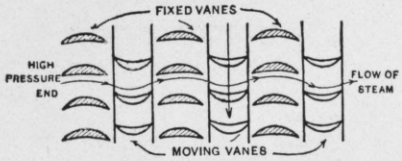


Fig. 2

Turbines of this class run on about 16 pounds of steam per B. H. P. per hour, in the larger sizes of 200 H. P., 300 H. P., or more. It might be remarked here that the De Laval Turbine is used quite extensively in Europe where it has become very popular. The large plant of the De Laval Steam Turbine Works, at Stockholm, is working to its utmost capacity in order to supply the demand for the European market, for this reason, the De Laval Co., have not advertised or solicited trade in this country. There are a few small turbines of this type in some of our technical schools.

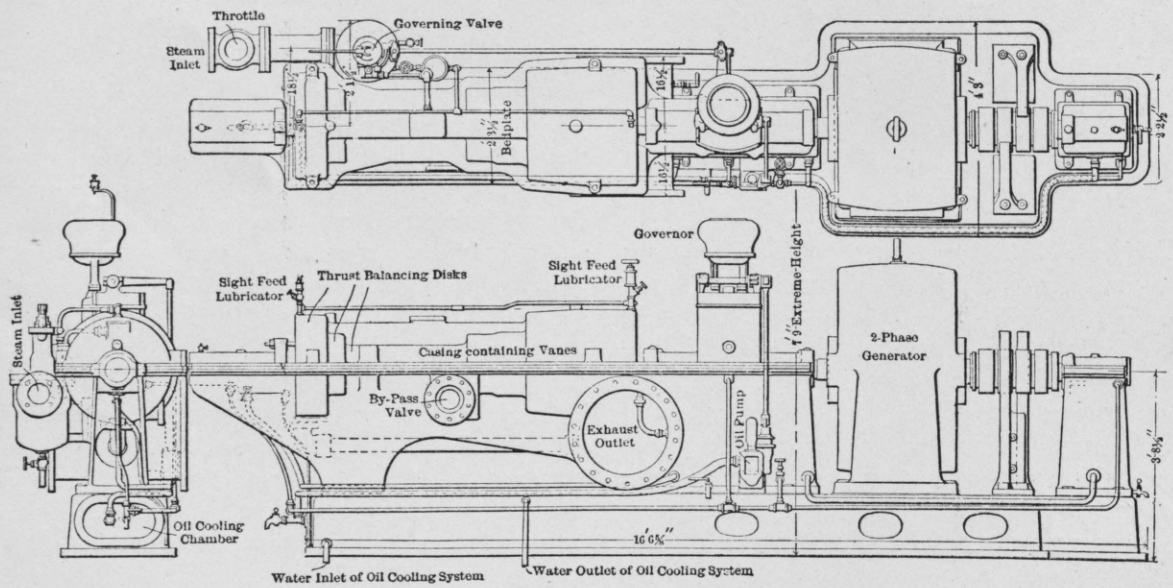
The Dow turbine, invented by J. H. Dow, of Cleveland, O., has not gotten out of its experimental stages so far as the writer is able to ascertain, at least it has not been on the market long enough to be in use but very little. This turbine, invented about eleven years ago, was of the outward flow type, that is, the steam on admission goes in near to the shaft, thence in both directions parallel to the shaft then out radially where it encounters the movable and stationary vanes alternately till it reaches the outer part which is in connection with the exhaust or condenser. By referring to fig. 2, it will be made clearer how the movable and stationary vanes, or blades perform their part. In Oct. 1889, the first turbine of this type was exhibited in Cleveland, O., it weighed 68 pounds, and developed 10 H. P., with a steam consumption of 47 pounds per H. P. H. A special use to which this type of motors was applied was to drive the fly wheel which propelled the Howell sub-marine torpedo This 10 H. P. turbine was used also to run an elevator, an arc light dynamo, etc. It run at a speed of 21000 revolutions per minute and was reduced by gearing to 1750 R. P. M., which by the way was a most remarkable velocity for gearing.

The Parsons turbine, manufactured by the Parsons Marine Steam Turbine Co. L'm't'd., Wallsend on Tyne, England, is of the parallel flow type. This will be understood by referring to fig 1. The steam enters through the stationary blades passes on through the moving vanes expands in next set of blades where it acquires velocity, then it passes on through the next set of vanes and so on until it has gone through the necessary "compoundings" to reduce the pressure of the steam to the pressue of the exhaust. There is also an inward and outward flow type of the Parsons. Mr. Parsons in describing his motar says :—"The efflux of steam flowing from a vessel at 15.6 pounds per sq. inch, absolute pressure through an orifice at 15 pounds, absolute pressue is 366 ft. per second ; the drop of pressure of .6 pounds corresponding to an increase of volume of 4%. The whole 45 turbines are so proportioned that each one, starting from the steam inlet has 4% more blade area or capacity than that preceding it. Taking the pressure at the exhaust end to be 15 pounds absolute, that at the inlet end will be 69 pounds above atmosphere. The steam enters from steam pipe at 69 pounds pressue, and in passing through first turbine it falls 2.65 pounds in pressure, its velocity due to fall being 386 ft. per second, and its increase of volume 3.85% of its original volume. It then passes through the second turbine, losing 2.55 pounds pressure, and gaining 3.85% in vol-

ume and so on until it reaches the last turbine where its pressure is 15.6 pounds, before enter- and 15 pounds on leaving. The velocity due to last drop is 366 ft. per second. The velocity of the wheels at 9200 revolutions per minute is 150 ft. per second or 39.9% of mean velocity, due to the head throughout the turbines.'' This is a description in part of one of his turbines with 45 sets of moving vanes or turbines and gives a good idea of the method used in designing.

The speed as has been stated is quite high. One Dow turbine runs at a speed of 35000 R. P. M., others run at 20,000 V. P. M., while the more recent type runs at a much lower speed, pact and efficient system for the generation of electric energy.

The general advantages of the turbine are, simplicity, compactness, lightness and cheapness, freedom from friction since there are no reciprocating parts or valves therefore high mechanical efficiency, very little condensation as the steam changes in temperature gradually and the same temperature exists at any one place, this is a decided advantage over the cylinder engine where live steam is admitted into the cylinder which but an instant before was in connection with the exhaust and hence its temperature much lower.



500 H.-P. Turbine and Alternator.

3600 R. P. M., in the large sizes. To show the effect of these high speeds take an example of one inch cubes of cast iron, their centers of gravity being on a circle of 12″ diam., running these at a speed of 15000 R. P. M., gives a tensile stress of about 10,000 pounds per sq. inch, on the inner plane of the cube where we suppose it to be fastened to the hub.

The velocity of the steam in the turbines is 100,000 ft. per minute more or less according to the amount of expansion. This shows why the speed of the turbine is so high. With the more recent turbines they are now able to direct connect them to dynamos, which makes a very com-

Also as there are no reciprocating parts and everything is perfectly balanced no foundation is required except to support so much dead weight even in the larger sizes.

In 1896 the Westinghouse Machine Co., of E. Pittsburg, Pa. obtained the patent rights of the Parsons turbine in the United States and after some years of experiment have made some great improvements. The three 500 H. P. turbines direct connected to 300 K. W., two phase alternators recently installed in the power plant of the Westinghouse Air Brake Co. which in a short time will be depended upon entirely for the motive power and lighting of these works are

the first turbines to be so used in this country.

These turbines operate at a speed of 3,600 R. P. M. with a boiler pressure of 125 lbs. There is no gearing used as with other turbines of the DeLaval type, which operate at 1,300 R. P. M. and thus have to be reduced. A single bed plate supports a unit of one turbine and its generator.

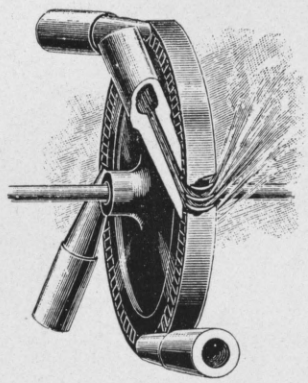


Fig. 3.

The cylinder of varying internal diameter which supports the stationary blades is shown in Fig. 1.

The steam entering at one end passes through and out at the other producing thereby an unbalanced thrust which has to be counteracted by the three balancing discs at the steam end of the spindle contained in the turbine casing and shown in Fig. 1.

Another interesting feature of these turbines are the bearings which consist of concentric brass tubes surrounding the journal and are put together with easy fits with oil between them. The oil films in the spaces form the real wearing surface as the brasses show no signs of wear. The oil tends to reduce the vibrations acting as a cushion. Lubrication is affected by means of a pump operated by a worm gear located between turbine and generator. The oil is used continuously but has to be cooled, the bearings which are lubricated being partially in contact with the steam and are also heated by conduction. The shaft is not rigidly confined. This is essential in all turbines of high speeds, as it permits the rotating system to revolve about its true center of gravity and not necessarily its geometrical center.

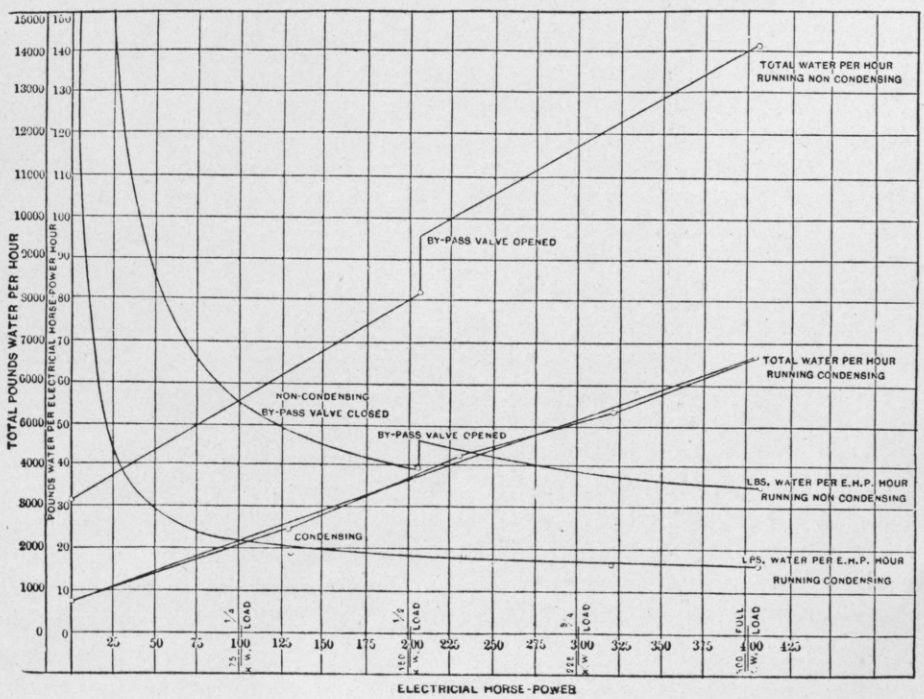


Fig. 4.

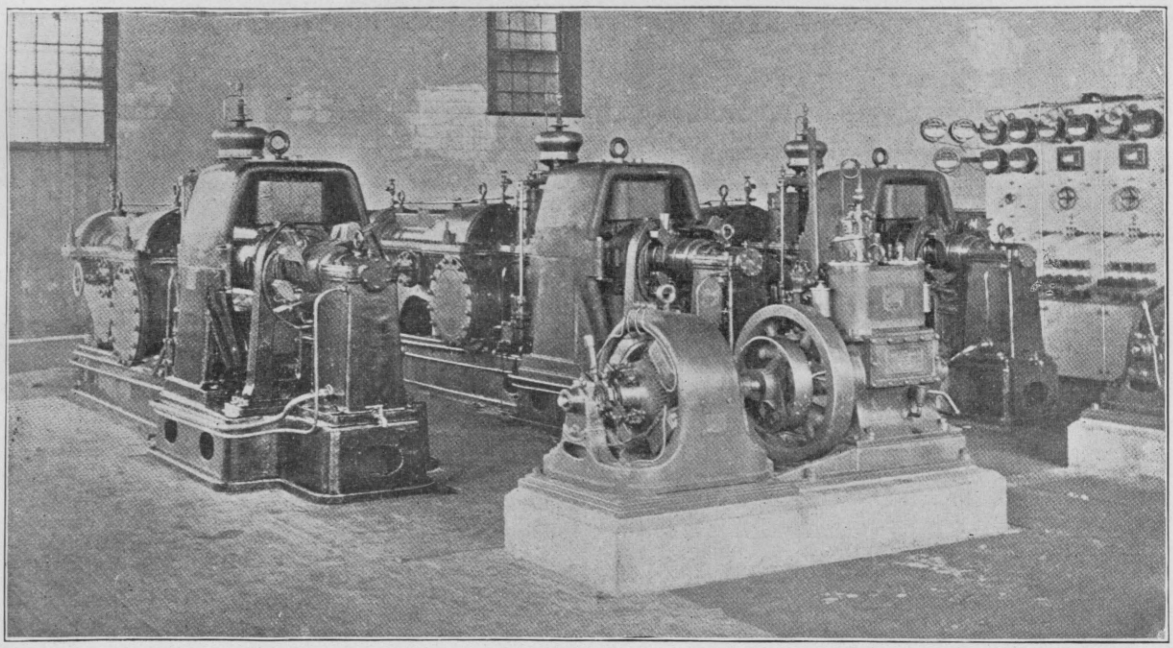


Fig. 5.

The governor which is of the fly-ball type, controls the duration of the intermittent admission of steam. The governors are extremely sensative and may be adjusted to operate within a small fraction of 1% variation between no load and full load.

The governors are arranged so that the speed may be varied within wide limits while the turbines are running, thus allowing the generators to be brought into synchronism and the load proportioned as desired.

The generators, used in the above installation, made by the Westinghouse Electric and Mfg. Co., are of the bipolar type giving a two phase alternating current of 440 volts and 7,200 alternations per minute and having a capacity of 300 K. W. each.

The steam consumption between no load and full load is shown in Fig. 4. The steam consumption from one-quarter load to full load is remarkable considering the range and economy.

Full loads 16.4 lbs. steam per electrical H. P. per hour.
¾ " 17. " " " " " " "
½ " 18.2 " " " " " " "
¼ " 22. " " " " " " "
Running light, 750 lbs. steam per hour.

It is impossible to measure the indicated horse power, but it is estimated that they are working at full load on 13.2 lbs of steam per indicated H. P. per hour, using this term in its understood sense.

These particular turbines were designed to run condensing, hence their comparatively inferior results when running non-condensing which are shown in Fig. 4. By opening the by-pass valve the power of the turbine is increased at the expense of economy. In Fig. 5 the space occupied by a 500 H. P. turbo-alternator may be compared with the space occupied by a 10 H. P. exciter direct connected to a Westinghouse high speed engine. It will be remembered that the Westinghouse high speed compound engines are about as compact as any engine on the market. The Westinghouse Co. now have work well advanced on a 2,500 H. P. turbine for the United Light and Power Co. of New York. It will be the largest unit ever attempted and will run at a speed of 1,200 R. P. M. under a steam pressure of 150 lbs. The steam turbine has found extensive use in marine electric lighting and for the propulsion of high speed vessels. The turbine manufactured

in this country is unexcelled, in many respects, and no doubt it will soon be extensively used as there are many economical applications.

The writer acknowledges his indebtedness for information concerning their respective turbines to The DeLaval Steam Turbine Works, (Aktiebolaget De Lavals Angturbin), Stockholm, The Parsons Marine Steam Turbine Co., Limited, Wallsend-on-Tyne, and The Westinghouse Machine Co., E. Pittsburg, Pa.

ALPHA TAU OMEGA DANCE.

The Indiana Gamma Gamma Chapter of Alpha Tau Omega Fraternity gave their sixth annual dance at the Terre Haute, Monday, April twenty-third.

The dining room was decorated with badges and colors of the fraternity. The mantel was covered with ferns and the bay window was partitioned off with palms. Behind this sat the Ringgold orchestra, which played excellent music until early in the morning. A supper was served, after the thirteenth dance, in the cafe and ordinary. Punch was served throughout the evening in the corridor.

Quite a number of visitors were present, among them being Messrs. Ingle and Montgomery, two Rose Tech Alumni, and Messrs. Harrison, King, Smith and Bailey, from Illinois University.

SIGMA NU DANCE.

The Beta Upsilon chapter of the Sigma Nu fraternity entertained with a dance at the Terre Haute on the evening of April 26th.

The cafe in which the buffet lunch was served was very tastefully decorated. The colors of the fraternity being used. In the ordinary, cosy corners were arranged, the decorations here and in the dance hall being in red. Punch was served. The Ringgold orchestra furnished the music for a program of 36 dances and serveral extras.

This was the maiden effort of the fraternity and was a decided success.

The following are the Thesis subjects upon which the Seniors are now dilligently employed :

Three designs for a structure to replace the condemned trestle on the highway between Terre Haute and Macksville. David Meriwether and Curtis Mees.

Two designs for a truss 245 feet span for C. C. C. & St. L. R. R. bridge over the Wabash River, Jesse Loofborrow and Henry Leser.

The effect of eccentric end loading on beams, Sidney J. Kidder.

A complete design for a modern school house, William H. Insley.

The determination of sulphur in iron, H. Madison.

A continuation of the study of Ciscampholytic Acid, Edward F. Phillips.

A study of high potential alternating current power transmission, Robert York.

Investigation of laws of attraction of an electro magnet, T. D. Witherspoon and Harry S. Richardson.

Construction and test of a two and three phase alternating current motor, W. Courtney Appleton and Gustav Maier.

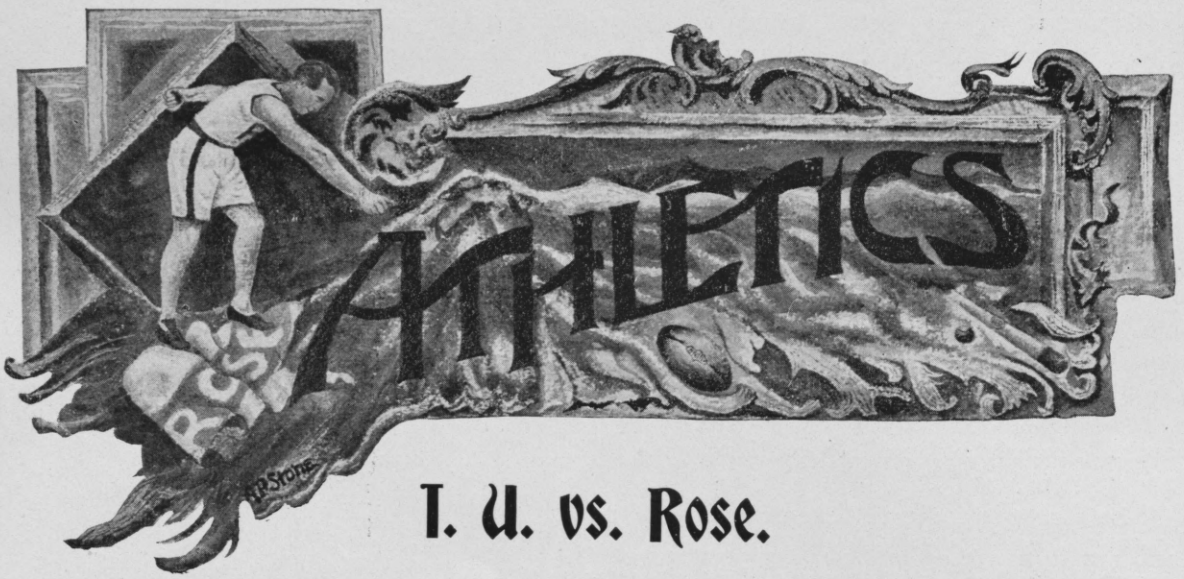
Test by means of a traction dynamometer of the performance of a locomotive in service, J. I. Brewer and C. J. Larson.

The following resolutions were adopted by the class of 1902 :

RESOLUTIONS OF CONDOLENCE.

WHEREAS, Mr. Sam D. Burge, our classmate and friend, has suffered the loss of his mother,

Resolved, That we extend to him our most sincere expressions of condolence. CLASS OF 1902.



I. U. vs. Rose.

THE base ball team went to Bloomington and again met defeat on May 5. We received the same old number of runs, 4. By the way, the team has been hoodooed this year. Every time the team went on a trip there has been 13 in the party. On the second trip to Greencastle the conductor gave the boys checks with the number 13 stamped on it and the number of the Bundy House in Bloomington where the team stopped is 113 and the team left on Friday. I. U. plays here on the 26th which is twice thirteen. Now is thirteen a hoodoo?

I. U. started the ball by making three runs in the first inning on three errors, a base on balls and a stolen base. While Rose received a goose egg for her share. In the second and third I. U. was unable to score although they got men on bases both times. Rose scored one in the second on Porter's error and Troll's single. Rose again scored in the third on Pike's and Alsop's errors. I. U. scored one in the fourth on Porter's three bagger and Hoover's single. Rose received nothing in this inning. In the fifth Merrill received a pass, stole second and scored on two passed balls. Rose in her half scored two on two singles and a double steal by Randall and Nicholson. In the sixth, Randall took Meriwether's place in the box and the fun commenced. When the smoke cleared up I. U. had a total of 11 runs and practically the game. Hills who was put in in the seventh stopped the onslaught for one inning but I. U. scored 5 in the eighth in a comedy of errors. In the ninth they did not score.

It was the same old trouble, stage fright.

The tale of woe according to the figures is as follows:

I. U.	AB.	R.	H.	PO.	A.	E.
Porter, c f	5	2	1	0	0	1
Hoover, 3b	4	2	2	3	4	2
Pike, Capt s.s	4	2	1	0	4	1
Bracken, rf.	6	2	0	0	0	1
Merril, c.	4	3	0	7	0	0
Shaw, 2b	3	1	0	4	2	0
Sutphen, l.f.	5	2	1	1	9	0
Alsop, 1b.	6	1	1	12	0	1
Hannon, p.	3	1	0	0	2	0
Total.	40	16	6	27	12	6

Rose.	AB.	R.	H.	PO.	A.	E
Randall, lf, p	5	1	1	1	2	2
Nich'lson, ss	4	2	0	4	4	4
Grimes, 3b	4	0	0	3	1	2
Gibbons, 2b	4	0	1	2	4	3
Meriw'r, p, lf	4	0	0	0	1	1
Hills, rf, p.	4	1	1	1	0	1
Troll, c f.	3	0	1	1	1	1
Hadley, c.	4	0	0	6	0	3
Total.	36	4	4	27	13	17

I. U.	3	0	0	1	1	6	0	5	0	—16
Rose	0	1	1	0	2	0	0	0	0	— 4

Earned runs, I. U. 1

3 base hits, Porter.

Stolen bases, I. U. 12. Rose 4.

Hit by pitcher, By Randall 1; Hills 3.

Bases on balls, off Hannon 1;. Meriwether 2; Randall 4; Hills 2.

Balks, Meriwether 1.

Double plays, Gibbons to Nicholson to Bowie; Pike to Shaw to Alsop.

Struck out by, Hannon 7; Meriwether 3; Hills 2
Wild pitches, Hills 1.
Passed balls, Hadley 3.
Umpire, Harris.

WABASH 10; ROSE 4.

On Saturday, May 12, the second game of the season was played against Wabash College. The first had resulted in a victory for Rose and strong hopes of repeating the trick found place in the minds of Rose supporters. However, the disappointment was keen, for the score resulted 10 to 4, This is how it happened.

Randall for Rose stepped to the bat and put a hot one down to Ragan. The latter couldn't handle it and Randall was safe on the initial bag. Hills, the rosy faced, thinking Ragan a soft mark, landed him another, this he also missed and Randall went to third, and Hills a moment later stole second. Visions of two runs floated mistly before Captain Gibbon's eye when he thought of the clean hit he was about to make, but the hit turned to a fly in left fielder Burk's hands. Nicholson followed with one to center fielder Carter and Troll flew out to the first baseman.

Ragan, the first batter for Wabash, made a hit past second. Carter flew out to Troll, Schaeffer was out at first, Hills to Bowie. Burk was made a present of first and Montgomery knocked a light bounder to Hills, with the ease and grace of a veteran, the pitcher passed it over to Bowie and retired the side, but no, not that, for with only two yards to throw the ball he places it so high that Bowie would have needed a Kokomo gas derrick to reach it and Ragan and Burk came racing home. Peterson now puts out a high one and Troll gathers it in.

Grimes out, Montgomery to Posten, Fishback hits, but latter is out at second and Bowie fowls out to catcher.

Posten makes a hit, reaches second on Hadley's bad throw and tries it to third, but the bad throw has been captured by Troll, who makes a beautiful throw to Grimes and retires Mr. Posten at third. Jones fans, and Portmess flies out to Grimes. Hadley and Randall can't locate the sphere in the third and Hills flies to Montgomery.

Ragan out, Grimes to Bowie. Carter reaches first on Hills slow work in getting his short grounder to Bowie. Schaeffer flies out to Nicholson, Burk waits again and Montgomery comes to bat. Carter in the meantime has made a clean steal of second and third and now caps the climax by stealing home, while Hills and Hadley dream of bygone victories in football or something else very remote from Crawfordsville.

Montgomery does the fanning act to perfection, and the side takes the field.

Rose makes her first run in the fourth by Nicholson getting his base on balls, stealing second, reaching third on passed ball and coming home on Grime's hit.

Fishback and Bowie score in the fifth, both getting first on errors and coming home on Hill's beautiful two bagger.

No more runs for Rose until the ninth, when Grime's makes one on hits by himself and Troll and a swelling of Ragan's error column.

Wabash scores one in the fourth, two in the fifth, and then waits until the eighth when every one gets a bat and Peterson, Posten, Portmess and Ragan come home with runs.

Below is tabulated score:

Player	AB.	R.	1B.	PO.	A.	E.	Player	AB.	R.	1B.	PO.	A.	E.
Randall, 1 f	4	0	f	0	0	0	Ragan, 2b	5	2	2	5	1	4
Hills, p.	4	0	1	0	3	3	Carter, c f.	5	1	0	1	0	1
Gibbons, 2b.	4	0	0	2	1	3	Schaeffer, c.	4	0	0	3	2	0
Nich's'n, s s.	3	1	0	3	3	1	Burk, 1 f.	2	2	0	2	1	0
Troll, c -.	4	0	1	2	1	1	M tgom'y, 3b	4	1	1	6	1	1
Grimes, 3b.	4	1	2	2	1	1	Peterson, s s	3	2	1	2	0	0
Fishback, r f	4	1	1	2	0	0	Posten, 1b.	5	1	1	6	1	1
Bowie, 1b	4	1	0	8	0	0	Hardy, r f	2	0	0	0	0	1
Hadley, c.	3	0	0	5	0	0	Portmess, p,	4	1	2	1	2	0
							Jones, r f.	2	0	0	1	1	0
Total	34	4	5	24	9	10	Total	33	10	6	27	11	8

	1	2	3	4	5	6	7	8	9	Total.
Rose	0	0	0	1	2	0	0	0	1	4
Wabash	2	0	1	1	2	0	0	4	*	10

With the approach of Field Day, which will take place on the 26th of May, the usual question is asked: "What are our prospects?" The truth of the matter is that as far as the pennant

is concerned, we will not be in the race. We will send a team, however, and make as good a showing as possible. The principle object will be to show the other colleges that athletics has not died out entirely at Rose, and to get matters into better shape for next year. The great trouble seems to be the lack of confidence, and the desire to do as little training as possible. Comparing the records which our men have shown themselves able to make with those of the other colleges of the State, there seems to be no reason why we could not be able to send a winning team to the State meet. The men, however, do not seem to be satisfied with a possible second or third place, and think that if they can not come out and beat everyone else the first time they try, that there is no need of their training, and they drop the matter entirely.

The meet this year promises to be a very interesting one, in that it will mark the revival of athletics in the State.

Notre Dame will most likely win the pennant, but who will be next in order will not be decided until after the meet. Perdue, I. U., and Earlham all seem to have strong teams and it would be very difficult to pick the best of the three. The present indications are that the points will be very evenly divided.

The men who will represent Rose this year will be: Peker, '02, in the discus throw, 16 lb. hammer throw and 16 lb. shot put; Warren, '02, Cox, '02, and Schefferly, '03, in the bicycle races and Huthsteiner, '01, in the dashes and the high jump. Post, '03, in the half-mile and mile runs, and Arnold, '03, in the quarter-mile run.

"I say, Flory, when will the Technic be out?" Flory: "Yesterday."

Levi, '03, seems to come in for a good share of the attention of his class.

A good many of the Freshmen expect to be real Sophomores before long.

During the recent hot spell parties of students were frequent visitors at the swimming pool.

The diamond is splendid now. The grass is entirely off, and the rough places have disappeared.

Mr. Mitchell is not likely to take any more pictures of his landlady hanging out her wash. She objects.

Now is the season when the classes usually have so much trouble in keeping stray dogs out of the halls.

Most Sophomores have finished their work in Descriptive Geometry. Next recitation review will commence.

The Senior trip was voted a decided success in more ways than one. The tales told of Madison fill several volumes.

Richardson, '00, was unfortunate enough to cut off the end of a finger on his right hand while working in the machine shop.

On account of the death of his mother, Burge, '02, has left the Institute. It is hoped he will be able to be back among us next year.

The crowds of small boys which have infested the campus lately at ball games, are a great nuisance, and should be kept off if possible.

Dr. Theo. Mees, President of Woodville Seminary, Woodville, Ohio, and brother to the president of Rose, recently visited his son Curtis Mees, '00.

The Civil Engineering Department will soon receive a large number of imported slides illustrating existing architectural and engineering structures.

The season for shows is nearly over, but, unfortunately for study, there are other amusements just as absorbing which take up just as much time.

The absence of a number of the professors at the meeting of Mechanical Engineers in Cincinnati caused some re-arrangement of the classes, but no confusion.

The tennis courts are in fine shape, and are well used. Prof. Hathaway's games with a friend who is an expert player have been watched with great interest.

The Sophomores have started their laboratory work in mineralogy. Most students had finished their work in qualatative analysis and were ready for the work in mineralogy.

Professor Wickersham says one of the "compliments" paid his book runs thus: "If you are fond of visiting lunatic asylums, read Enoch Willoughby and stay at home."

Prof. Hathaway has found his match in tennis at last, in Mr. A. P. Simmonds, of Indianapolis, Ind. Mr. Simmonds is quite a player, as he has played in tournaments against the best players of the United States and ranks among the first ten.