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Rose Technic Staff
Rose-Hulman Institute of Technology

THE ROSE TECHNIC.

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THE members of the Senior class are to be congratulated upon the pleasing prospect contained in the program of the annual excursion, which is to be made to Chicago this year, and in turn their thanks are due to the Chicago Tech Club, which, although in point of time still an infant organization, has shown a commendable amount of general activity and interest in the affairs of the Institute. It has been particularly instrumental in making the proposed trip one of the greatest possible pleasure and profit. The visiting of large and well arranged plants representative of the leading industries is always interesting to the man of engineering tastes. Under the unusually favorable conditions which surround the present excursion, not the least of which is the company of men of wide experience whose endeavor will be to explain any processes not easily understood, and call attention to points of importance which might be overlooked by the casual and uninformed visitor, the members of the class and of future classes who may be similarly favored will without doubt reap much of direct practical value to them in their respective chosen vocations as well as quite a fund of general information. Coming as it does just at the close of the four years' course, the event forms quite a fitting element of the program of the last few weeks of a thorough scheme of instruction in engineering.

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SPEAKING of the coming Inter-Collegiate Field Day to be held at Lafayette on May 29th, the Purdue *Exponent* has the following to say:

"Everything is to be done in first class style from the arrangements for the contest to the entertaining of our visitors. A representative is to go to Greencastle, Bloomington and Wabash to induce the students to accompany their track teams. A special train will run from these places to Lafayette and there will be a one-fare rate for the round trip. It is expected that at least two hundred will be present from these three institutions. Purdue should give them a hard contest and a royal, friendly reception."

At first reading we were inclined to feel that an intentional slight had been given the Institute and its students, in the fact that we were omitted from the list of institutions especially favored with a visitor from Purdue on a mission of enthusiasm and encouragement for the state meet, and in the promised double pleasure of "a hard contest and a royal, friendly reception."

But upon second thought it is plain that there is a good sized compliment involved and we shall proceed to appropriate it. The Field Day Committee may have thought that it was not worth while to take any special measures to arouse the enthusiasm of the students of Rose, but it was probably for no other reason than the assurance from past experience that no urging would be necessary. And they will not be disappointed. As has been remarked before, "to mention the

Rose Athletic Association is to mention the Institute." On the day in question, all exercises of the Institute will be suspended and every one, members of the faculty as well as students, will be invited to spend the day in Lafayette. It is safe to say that very few will neglect the opportunity.

There is one item in their arrangements, however, from which we hope the committee will not think it useless to include us. That is the reduced railroad rates. No matter how badly we want to get there no one will object to getting there as cheaply as possible.

Safely there, we will do our best to get a hand in any hard contests that may be lying around loose, and as to the royal, friendly reception, we can safely trust that to the hospitality of our fellow "iron-pounders." Our most extreme wish would be that our enjoyment in being entertained may not fall short of that afforded us when in years past we have had the privilege of taking the part of the host.

* * *

THERE is some degree of regret to be expressed in that the new gymnasium could not have been completely furnished in time to give the present athletic team more benefit from its use. Still this does not detract from the feeling of satisfaction which every student and alumnus must feel in seeing that it has been possible to carry out the plans so completely. It has been the policy of those who have had the erection and equipment of the building in charge to give the preference in every case to that which was of the first quality and best adapted to serve the permanent needs of the students. This has taken somewhat longer it is true, and the showing which is apparent to the casual visitor is not, perhaps, as great as it would have been had a larger amount of apparatus of a cheaper and inferior grade been installed with the idea of serving temporary purposes. But it is well known that temporary makeshifts are very prone to become only too permanent. It is far easier to decide to purchase something new which is needed than it is to replace that which "might do a while longer." As the building stands it will be possible to begin work of a very thorough character at the opening of the next fall term, and whatever may be added from time to time to the equipment will be made to carry out to that extent the ideal of a well arranged modern gymnasium.

* * *

NEXT to the perceptive or discriminative skill required to perform successfully an observation or series of observations in any department of scientific investigation, perhaps the faculty of greatest value to the observer is that of knowing how to record the results obtained in a convenient and accurate manner. Some form of record is essential with even the very simplest of operations if the information derived therefrom is to have any definite value. And when we pass to those of more complex nature the value of the permanent record increases in a manifold ratio, becoming of supreme importance in connection with experiments or determinations which are intended to establish facts or laws of widespread moment. In some cases the observer himself has been able to deduce very little of value from his own work, but leaving behind him careful records of his painstaking labors, these have been taken up by others less skillful in the art of making the observations but far more skillful in the methods of deductive and mathematical reasoning, and in their hands additions to the sum of human knowledge of untold importance have been made. The work of Sir Isaac Newton is perhaps the strongest example that could be mentioned. Himself of no great reputation as an experimentalist, he collaborated and developed the work of many others, some of whom labored long before his time, and as the fruit of his reasoning gave to the world the great discoveries which honor his name.

Viewed in such a light the note book of the student in the laboratory acquires a greater significance. It is not simply to serve as a record of what he has done, a mere memorandum for the time being of isolated results and figures to be thrown aside when the work is completed. It is in itself a means of education to which as much or often even more time can be with profit given than to the actual work of experiment. The ideal

form of record in any case must satisfy the condition that it be complete in itself without verbal explanation. It should show not only the final results obtained, but indicate the operations and methods of reasoning by which they were arrived at, so that to another person who may have occasion to look over the record, or even to the student himself after the lapse of time sufficient for the figures to become cold, there may be no uncertainty as to the means employed.

The average student is prone to neglect his note book, as the instructors in the laboratories can no doubt testify. When engaged in an interesting experiment the temptation to keep on until the time has expired is often a great one, and a few scattered figures on scratch paper are relied upon as the basis for a later write-up, or in default even of this much, the notebook of a more careful companion is borrowed long enough to copy his record of the work. If the experiment proves to be uninteresting or seemingly unprofitable, the note book is likely to share in the disinterest and suffer again. Such reasons, together with the usual amount of carelessness indulged in by mankind in general, render the finding of a really good laboratory note book a rarity.

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THROUGH the courtesy of President Mees we are enabled to present in this issue some of the illustrations from the series of pamphlets now being published by the Institute illustrative of the work of the four general departments or courses. A number of the plates from the Modulus, '96, are also to be used, giving a very good idea, so far as pictures can do so, of the Institute and its work.

A CONTINUOUS INDICATOR FOR ENGINE TESTS.

BY PROFESSOR THOMAS GRAY.

In order to determine the amount of work which the working fluid does on the piston of an engine, an instrument, called an indicator, is used. This instrument generally draws a diagram, the coordinates of which are respectively proportional to the distance the piston has traveled from the end of its stroke and to the pressure on the piston. The area of such a diagram (commonly called the indicator card) is proportional to the work done per stroke and hence when multiplied by the proper constant and by the number of strokes per unit of time gives the power of the engine. The procedure here referred to is fairly satisfactory when employed under favorable conditions, but it frequently happens that the amount of work is not the same for successive strokes, and then it becomes necessary to draw a series of cards long enough to cover the longest cycle of variation of the engine. Gas engines, for example, when governed by cutting off the gas supply when the speed reaches a certain limiting value give good illustrations of this kind of variation. The work per stroke in such engines sometimes varies through a wide range while the change in the form of the card gives valuable information as to the nature of the combustion in the cylinder.

The instrument described in this article was devised four or five years ago for the purpose of studying the variation of the area and form of the indicator cards given by gas engines under different conditions of working. It has since been used for that purpose and also for illustrating the effect of throttling, varying the cut-off, etc., in ordinary and in locomotive engines. Recent experience in the use of the instrument for locomotive engine tests has led to considerable modification and improvement of details. For the opportunity to make these trials I am indebted to the officers of the Terre Haute & Peoria Railroad, who not only placed one of their large compound

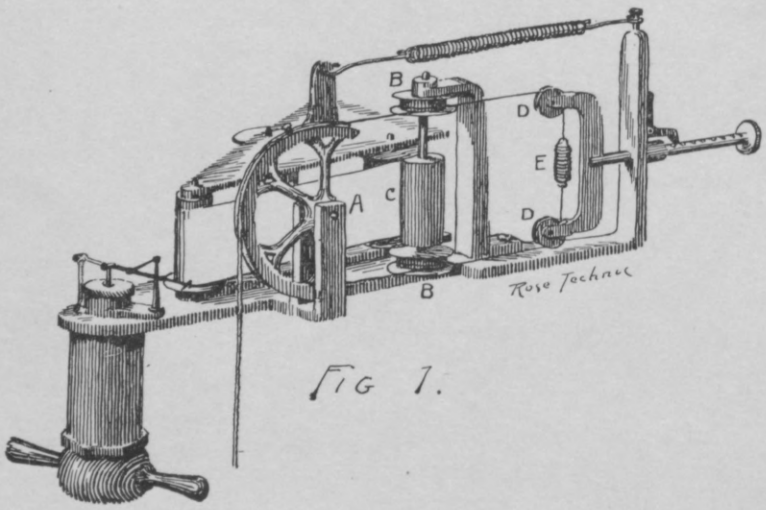


FIG 1.

locomotives at my disposal, under regular working conditions, but gave me great assistance in making the tests. A few samples of the results which have been obtained are reproduced on a small scale in the accompaning plate. The gas engine cards were obtained by Messrs. McMeans and Rice in the course of the tests of the White and Middleton gas engines at the Soldiers' monument, Indianapolis, which they have recently made in connection with their graduation thesis. The sketches and diagrams for this article have also been furnished by Mr. McMeans.

The most important feature of the continuous indicator is the mechanism for producing continuous forward motion of the record sheet from the backward and forward motion of the piston of the engine. Referring to Figure 1, the wheel A is made to oscillate backward and forward through the required arc by means of any of the ordinary reducing motion arrangements used for taking indicator cards. Cords are attached to the upper and lower sides of the wheel A and carried in the same direction round pulleys B B on the upper and lower ends of the cylinder C. The other ends of these cords are led round small pulleys D, and connected together through a short spring, E. If we now suppose the wheel, A, to be turned in such a direction as to pull the upper cord towards it, round the pulley, the lower cord will be at the same time released and the cylinder will turn in response to the upper cord, the lower cord simply acting as a friction brake to steady the motion. The turning moment in opposite directions on the two pulleys may be found as follows: The upper cord being pulled by the wheel, A, the tension, T, on that end will be greater than that on the end to which the spring is attached T` in the ratio $\frac{T}{T`}=e^{\mu\theta}$ where e is the base of the Naperian system of logarithms, μ the coefficient of friction between the cord and the pulley and θ the angle of lap of the cord measured in radians. The turning moment is (T–T`) $r$ where r is the radius of the pulley and this must, therefore, be $(T-T`)\,r = T`\,(e^{\mu\theta}-1)$

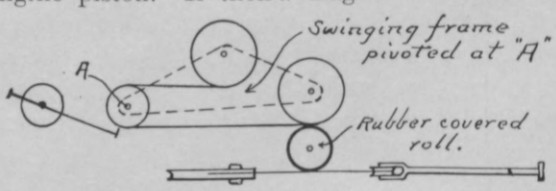
Similarly the turning moment due to the lower cord will be

$$(T`-T``)\,r = T``\,(e^{\mu\theta}-1)$$

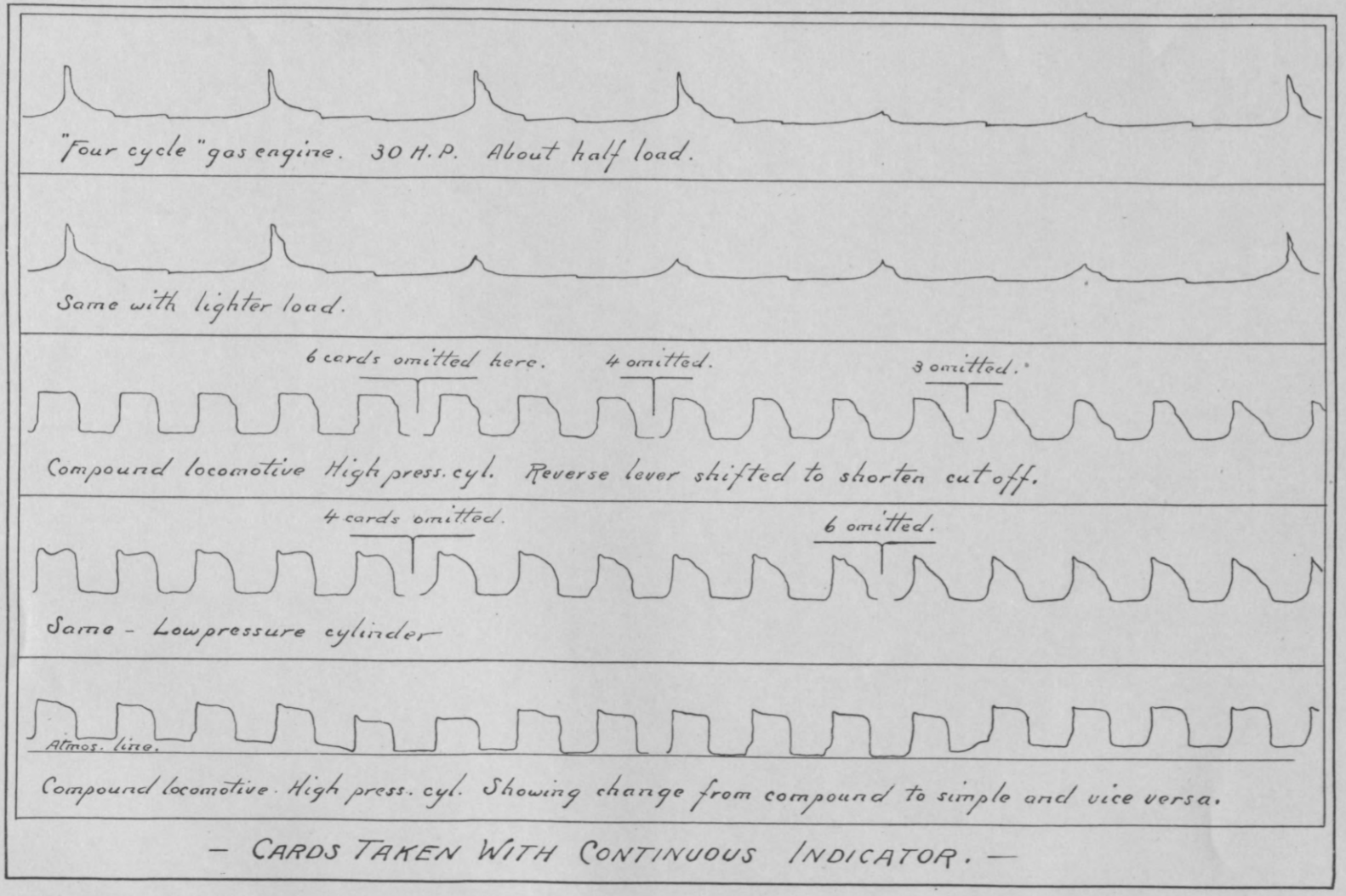
Hence, the resultant returning moment is

$$(T-T`)r-(T`-T``)r = (T+T``-2T)r.$$

This turning moment is always such as to turn the drum in the direction the wheel, A, *pulls* the cord and as the cord passes over the same side of both pulleys the cylinder always turns in the same direction whichever direction the wheel turns. Again the velocity of the rim of the wheel being controlled by the piston of the engine is always the same fraction of the velocity of the piston. Hence, the motion of the paper is always in the same direction and its rate of motion is always in a constant ratio to the motion of the engine piston. If then a diagram be drawn on



the paper by means of a pen the height of which above a datum line, corresponding to zero pressure, is proportional to the steam or gas pressure in the cylinder the area of the diagram will indicate the

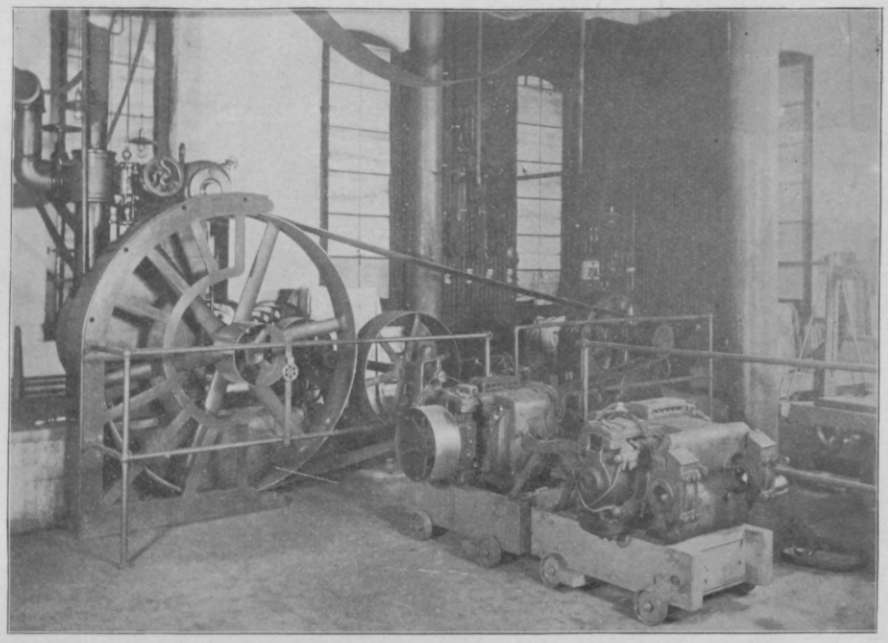


— CARDS TAKEN WITH CONTINUOUS INDICATOR. —

work done on that side of the piston. This work is positive for the forward stroke and negative for the backward stroke. For the study of the action of the working fluid the effect of different setting of valves, etc., this form of diagram is most convenient, but for the determination of work done it is better to arrange so that the height of the pen which draws the diagram is simply the difference between the force on the two sides of the piston, because in that case the integration is simpler, the area in all cases indicating positive work while the instruments indicate both ends of the cylinder at the same time. When the record sheet is folded along the atmospheric line the upper part of the diagram becomes, in that case, simply a corrugated line for the steam engine case and the individual cards can be made very short and still the average work obtained very near to the truth. The datum or atmospheric line, as this line is commonly called, is drawn by a separate pen, not shown in the sketch. This pen serves the double purpose of giving the datum for the diagram and of marking the rate of motion of the record sheet. In order to mark time and thus give the speed of the engine at any instant the pen is carried on a flexible index arm attached to the armature of a small electro-magnet, in the circuit of which a break-circuit clock is included. In the indicator now in use this clock marks half seconds and is found to work very satisfactorily.

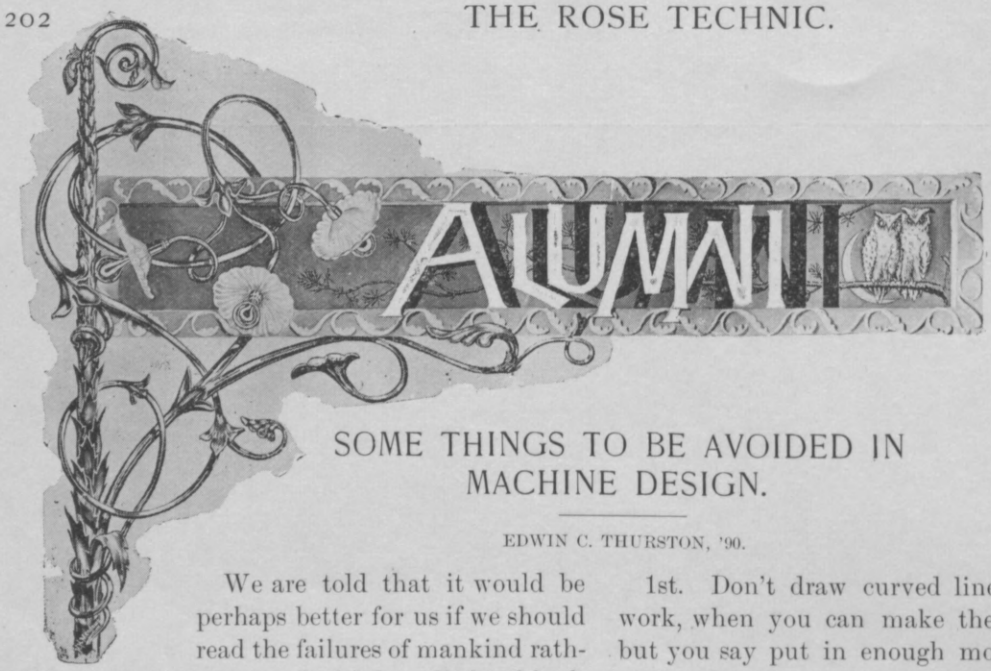
The paper ribbon, on which the record is taken is about two inches broad and is carried on a light brass drum, which is kept from turning too freely by means of a friction pawl bearing on the flange. The paper from this drum is taken round an idler cylinder, which gives a bearing surface against which the pens bear when writing the diagram. From this cylinder the paper passes to a second brass drum, on which it is wound up by direct frictional contact through the paper to the driving cylinder.

When properly adjusted, this method of winding the paper past the record pen and on to the storage drum works very well but the adjustment has to be carefully made to prevent any tendency of the paper to motion towards one end or the other of the storage drum. A somewhat more perfect but more expensive arrangement is to have the storage drum driven by clockwork and a spring while the driving cylinder is simply used to control the motion. Both of these arrangements and several others that have been devised give cards of uniform length, no matter how much paper is on the storage drum. When quantitative measurements from the cards are not desired the storage drum may be substituted for the driving or controlling cylinder and the paper wound on this, direct. The cards are then longer the greater the amount of paper on the storage drum, but this is unimportant in such a case, because the change for successive cards is very small. The paper used is about a thousandth of an inch thick, of texture suitable for writing with ink and suitable for taking blue prints direct from the ribbon. The diagrams, given in the plate show the successive cards for a cycle of changes taken from a 30-horse power gas engine when running on a brake and transmitting to it about 18-horse-power in one case and 9-horse-power in the other. The engine gives an explosion every second revolution, and it will be observed gave a succession of four explosions and then missed twice, and two explosions and then missed four times. The cards, immediately after the engine had made a few strokes without taking gas, show the effect on the explosion of the purer mixture of air and gas. The remaining diagrams are, as explained above, samples of cards taken from a compound locomotive. They show the effect of changing the position of the reverse lever and of changing from compound to simple and from simple to compound, under conditions which will be discussed elsewhere after the full results of the tests have been worked up.



A PART OF ELECTRICAL PLANT.

PORTION OF ELECTRICAL STANDARDIZING ROOM.



SOME THINGS TO BE AVOIDED IN MACHINE DESIGN.

EDWIN C. THURSTON, '90.

We are told that it would be perhaps better for us if we should read the failures of mankind rather than their success. I think a little of both good, and with this in view I give to my fellow college men a few points which might prevent them from falling into errors and having these things brought to their notice in this way rather than by sad experience.

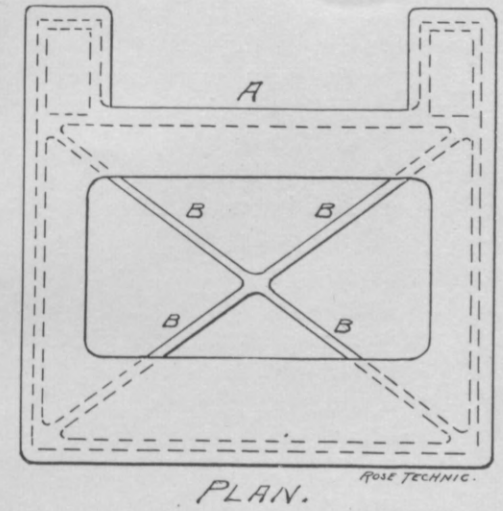
Also it is a way of presenting a matter on a principle that it is often easier to tell what not to do rather than what to do. So if we go a little farther and not only tell what not to do but what to do, it would be agreeable and instructive.

There are many excellent things in machine design of which we all know, as well as many things to be avoided. I do not propose to exhaust the things to be avoided, but merely to call attention to some that have been impressed on my mind in my own experience, in the hope that those here presented will furnish food for thought and discussion.

When a designer is given a problem, that is when he has acquired a knowledge of what is to be accomplished from any source, and has selected such so-called mechanical movements as will accomplish his purpose, he often finds that he is limited for space in certain directions, to build the frame work around the moving mechanism as he knows it should be to resist the strains to the best advantage, but barring such conditions,

1st. Don't draw curved lines in your frame work, when you can make them straight,—yes, but you say put in enough more metal to make up for the difference between going straight and going around; that is what we have to do when we can't help it; but why not go in a straight line when you can save the metal; besides you will find that the difference in the amount of metal required is a very high percentage, if you try the experiment.

Let us consider a familiar example, the usual type of column milling machine: the table supports the work, the saddle supports the table, the knee the saddle, the knee by the column which also carries the spindle and overhanging arm, yet what a difference is seen in the amount of vibration by connecting the outer end of the arm to the knee by two straps of very light section in comparison with the amount of metal in the other parts of the machine, surely the knee and column have an abundance of metal. "A friend of mine" once had the bright idea to do away with an old-fashioned "A" brace and substitute a more modern one in its place with one side cut away, so to speak, to make it more convenient to get at the work; of course he put "more metal" so as to make it "just as rigid as the old one was" but when applied to the machine "the song and dance" that that cutter set up, convinced him beyond a doubt that the "old-fashioned" "A" brace had some points of superiority after all, the new



PLAN.

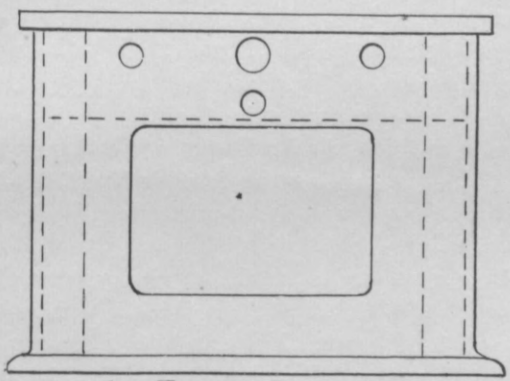


FIG. 1. FRONT ELEVATION.

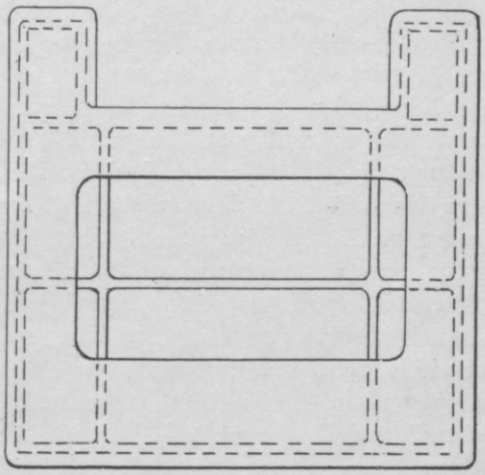


FIG. 2.

brace was consigned to the shed and according to last accounts, the "old-fashioned" "A" brace was still in use. I will add that a few machines have this so-called modern brace for special work where the other could not be used. However the cut taken is not so heavy as is expected of a machine for general work.

2d. Don't use diagonal bracing in large cast-iron frames or bodies for machines as in Figure 1. I am aware that many good builders of machinery use this form of bracing, and I will not say that conditions do not exist that will justify the use of this style of bracing; nevertheless I think that if designers fully appreciated the conditions that exist in this style of bracing it would be less used.

Take the case illustrated by Figure 1, forming virtually a box of uniform thickness, except at the back "A" which is increased in order to bolt to it other parts of the machine; in the front there are several small openings besides a large door; the braces "B" which extend diagonally across the inside are of uniform thickness and a little thinner than the outside walls; now where the trouble comes, first, is in making the castings; I do not refer to the moulding but to the fact that, owing to these diagonal braces, the strains caused by the shrinking of the metal in cooling is sufficient to part the bar of metal over the door; the foundry foreman not seeing the real cause of the trouble, resorted to the foundry trick of casting a thin web across the small openings in the front, to stop the cracking, but not succeeding, the web was made thicker and thicker, still without success; this web was thickened from time to time until it measured $\frac{3}{8}$ of an inch, the wall itself wasn't over $\frac{9}{16}$ thick; he had stopped the casting from cracking but had made a deal of trouble for the shop to drill and break out the $\frac{3}{8}$ web left where the openings were supposed to be; then came the kick from the shop; they could not cut out the openings and the foundry man could not make sound castings without the web; what was he to do?

Having called my attention to the matter, as I had considerable of such work given me to

straighten out, he asked me to use my influence with the foreman of the machine shop to get him to accept castings with the webs in them, but this I knew he would not do, so I set to work to find the cause of the trouble and if possible to prescribe a remedy; I had not looked far before I was convinced that the diagonal braces were the sole cause of the trouble; now to illustrate this action, you can make a crude apparatus as in figure 3, consisting of two sticks crossed and fastened at their center; with a string drawn around the outside much like a kite frame; now suppose the string on one side as "A" was replaced by a fine thread, and the string on the opposite side "B" by a heavy piece of rubber, we should expect that the force exerted by the rubber would break the thread at the opposite side; precisely

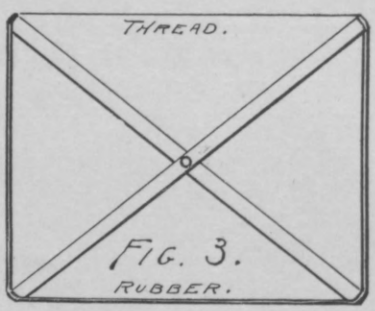


FIG. 3.

the same condition of things exists in the castings represented by figure 1, the diagonal braces being the thinnest, cool first and become solid like the sticks in our apparatus; the two side walls and the front cool about alike, but not so fast as the braces, being a little thicker; the front, however, is the weak part on account of the openings and is therefore represented by the thread; the back wall being much thicker keeps hotter and shrinks after the sides and front walls are solid or perhaps in a semi-solid condition; this shrinking of the back wall is very much like the elasticity of the rubber in our model causing the front to pull apart or break the same as the thread.

Yes, but some one says I have seen castings braced in this way that gave no trouble at all in cooling; I know you have, so have I, but that does not prove that simply because the metal was so distributed it did not crack, that the casting is not under strains due to shrinkage. To put the question in a practical way, supposing you were having a machine built, that is you were footing the bills, "that is the tender spot," and the question of bracing came up, which would you choose, the one which caused internal strains to nearly, if, not quite, pull the casting apart, or the style which relieved the casting of such strain. To return to the case in question, let us see how the difficulty was overcome; having decided that the diagonal bracing was the cause we changed them to straight parallel braces as seen in figure 2; the pattern was first changed experimentally, but the first casting made, with all the openings cast through the front, proved the success of the experiment.

It will be seen in the figure 2, that the two braces attached to either side of the door opening extend directly across to the back wall, which is increased in thickness for the purpose before mentioned, thus connecting the main support at the back to the front which carries the feed working parts.

To refer again to figure 1, it will be seen that the wall at the back, although thickened, has no support except its own thickness, which, strangely enough, is reduced to about one-half between where the bolts come and the corner, so that the diagonal braces do not support either the front or back, besides being detrimental to the castings; in this case the change was so marked that the planer hand called attention to the reduction in the amount of vibration while the tool was cutting, so we see in this case not only is the diagonal bracing detrimental to the casting in itself, but is better placed as in figure 2, to resist the strains while the machine is in operation.

3d. Don't use metal too sparingly; we hear considerable about "the anvil principle" and probably no where is it so important as in machine tools; it is not a question, simply of enough metal so it wont break, but of so much metal that the chatter or vibration caused by the cutting tool will not throw the machine into vibrations to an objectionable degree.

Let us consider this "anvil principle" a little; suppose I had an anvil suspended in the air and I should strike it a blow with an ordinary hand hammer, you would not expect it to swing much from its former position, but if I strike it a heavy blow with a sledge, you might expect to see it swing a much greater amount.

Now science tells us that the amount of movement is in proportion to the weight of one to the other, it teaches us that when a man jumps from the earth, he kicks the earth away from him, and that the distance through which each moves is in proportion to the weight of each; as to how far the earth moves I will leave for you to figure out; this is the condition which we want in machinery, and particularly in machine tools; there must be metal enough, and rightly placed, to so far outweigh the force necessary to do the cutting, that the machine, to all practical purposes is perfectly rigid.

4th. Don't lump the metal; simply to fill up the spaces available with so many pounds avoirdupois is not the writer's meaning, but plenty of metal wisely distributed; bunches of metal here and there only make trouble in the foundry, and I think that the foundryman is entitled to some consideration, besides it causes unequal shrinkage in the castings resulting in shrink-holes, often mistaken for blow-holes; these holes are often seen at the bottom of teeth in gears large gears especially after cut, while the rim showed no trace on the outside; these will be invariably found opposite the junction of an arm or a similar place when several members meet.

5th. Don't use slow belting speeds; a belt loses in efficiency very fast as you come down the scale of speeds; about the slowest running belts I know of are feed belts and they are likewise the least efficient and most unsatisfactory thing about a machine. We never like to run a belt less than 1,000 feet per minute. If we want slow speed use gearing, which brings us to the next point.

6th. Don't use small ratios in gearing; high belt speed coupled with large ratios in gearing give the greatest efficiency, if your belt speed is 1,000 feet per minute. What the ratio of the gearing will be, depends upon what the final speed has to be, it may be 1 to 4 or to 20 or more.

7th. Don't hesitate to use screw gearing if conditions favor it; some tell us that this form of gearing is the least efficient of all; also that it improves as we approach the spur gear, and compile tables showing the percentage of loss; all this may be so but it has not been our experience. I have in mind a heavy machine in the main drive of which is used two pairs of spiral gears, one pair with the teeth at 45° and one pair with the teeth of the gear at about 33°. Now according to published tables, these two pairs of gears would consume more than half of all the power put into them, but strange to say dynamometer tests of the machine showed that the whole machine bearings, gears and all only consumed about 30% of the power.

In my opinion nine-tenths of the trouble experienced with screw gearing in all its different forms is due to too small diameters.

You ask how large they should be, I never have seen a formula that gave it, but I should say that having determined the size of the shaft, the gear ought not to be less than six times the diameter of the shaft, and if it could be made 10 times, so much the better. Designers seem to forget that small diameters mean short lever arms, and that the pressure on the surface of the teeth is increased thereby, consequently the surfaces of the teeth cut; for instance, suppose I have a ratio of 1 to 20; instead of using a single thread-worm and a 20-toothed gear I would use a triple thread-worm and a 60-toothed gear, my ratio is the same, my diameter larger, consequently the pressure on the teeth is less.

As to the materials to use, if the gears are prorightly proportioned and properly cut, I know of no better metal than soft steel for the worm or pinion, and cast iron for the gear; on the machine to which I referred, we tried bronze and hardened steel, but came back to soft steel and cast-iron; such gears should run in oil because of the sliding action of the teeth on each other. They cost a little more than spur gears and must be care-

fully cut, but if these conditions are observed they will give no trouble.

Finally, my college men, if you don't agree with me in all I have written, you can, no doubt, have an opportunity of replying in our very interesting paper, THE ROSE TECHNIC, on such points as are not according to your judgment or experience.

THE POWER PLANT OF THE OVERMAN WHEEL CO.

Alumni Editor Technic:

I trust that the following brief description of some parts of the power equipment of the Overman Wheel Company, which present some novel features, may prove of interest to your readers.

There are, altogether, seven buildings in which power is used, and they are too widely separated to allow power to be distributed by means of shafting and belts, from one central engine.

Mill No. 1 has a steam plant consisting of two seventy-two inch tubular boilers, a pair of Harris-Corliss engines with their cranks set at 90 degrees on the same shaft, and two lighting dynamos. One of these dynamos is started late in the afternoon, when lights are needed, and furnishes current for lights only. The other one is a fifty H. P. 110 volt machine and runs continuously night and day and furnishes current for both light and power.

Mill No. 2 has a larger steam plant, consisting of three seventy-two inch tubular boilers and a cross-compound condensing Harris-Corliss engine of about two hundred and fifty horse power. These boilers also furnish steam for a sixty horse power Westinghouse compound engine driving the rubber mill, and for an eighty horse power Westinghouse compound engine used for driving lighting dynamos.

Mill No. 3 adjoins Mill No. 2 and is driven by shafting extending from the latter.

In the No. 2 engine room is a 500 volt generator of 100 K. W. capacity, furnishing current for power principally.

The wood-shop, in which all the wood work for the athletic goods department is done, is a detached building and is driven by a 500 volt motor.

Opening from the No. 2 engine room is a fireproof room containing an underwriter's fire pump, a Worthington condenser and a boiler feed pump.

The main water supply of the factory, except for drinking purposes, is derived from a reservoir, fed by a small brook, over three thousand feet from the factory. The surface of the water in the reservoir is about five feet lower than the No. 2 pump room floor mentioned above. The fire pump was formerly used as a service pump, drawing water through the long suction pipe, but considerable trouble was experienced owing to small air leaks in the pipe, necessitating frequent stopping of the pump and priming the pipe from the tank on top of the building. Last year, after the 500 volt generator was started, wires were run to the reservoir and a duplex steeple pump driven by a motor was installed in a building erected on the bank of the reservoir. This motor is started and stopped and controlled in speed by a switch and controller at the switch board in the No. 2 engine room. The pump and motor are oiled automatically and the only attention they require is a regular inspection and filling of the oil reservoirs on the motor and grease cups on the pump. The engineer has tell-tale guages near the switch board, which show the heighth of water in the tanks and, by observing them, he can regulate the speed of the pump according to the consumption of water. This equipment has been found very satisfactory and economical.

The condenser also deserves mention, as it has a novel feature in the fact that it does not need a supply of water for condensing purposes. Until about a year ago, the No. 2 engine was run non-condensing. During the busy season the load became so heavy that the engine would frequently carry steam full stroke and it became necessary to increase the power in some way. As the boilers were already worked to their capacity, if another engine was added more boilers would have to be put in. An ordinary condenser could not be put in, as the water supply was not sufficient to run it.

A Worthington condenser and cooling tower were finally put in and have proven to be a very satisfactory solution of the difficulty. The condenser is an ordinary Worthington jet condenser and the novel feature consists of a tower for cooling the water, after passing through the condenser. It is eleven feet in diameter and thirty feet high and above an open space seven or eight feet high at the bottom it is filled nearly to the top with common six-inch sewer tile, placed on end one above the other honey-comb fashion. The warm water from the condenser pump is forced through a central iron pipe to the top of the tower and is there distributed by means of a rotary sprinkler hung on ball bearings. A fan seven feet in diameter at the bottom of the tower drives a current of air up through the tiling and this cools the water as it slides down over the very large area afforded by the interior surface of several thousand pieces of tile. It is collected in a tank at the bottom of the tower and then goes back to the condenser to again perform its mission of gathering up the heat of the steam and removing the atmospheric pressure from one side of the low pressure piston. One feature, which at first thought seems a little peculiar, is that since the tank was first filled not a drop of water has been added. There is really an excess of water, which has to be carried off through an overflow pipe in the tank.

At certain seasons of the year it is necessary to run some departments of the factory all night and it often happens that these departments are in different buildings. The buildings are wired in such a manner that current for light and power can be distributed from either engine room to the whole factory. Therefore, unless more power is required than one engine can furnish, it is necessary to run but one engine all night to drive several different departments. It is very convenient to be able to pick up a motor and carry it to any room where power is required and run that room without being obliged to run another engine and all the shafting in the factory.

C. B. KIDDER, '88.

Chicopee Falls, Mass.

THE ROSE TECH CLUB OF INDIANAPOLIS.

The following is the constitution adopted by the club at its regular meeting on May 2:

CONSTITUTION.

ARTICLE I.—NAME.

The name of this organization shall be the Rose Tech Club of Indianapolis.

ARTICLE II.—OBJECT.

The object of this organization shall be to promote the fellowship of the alumni of Rose Polytechnic Institute, and to promote the interests of said Institute.

ARTICLE III.—MEMBERSHIP.

1. There shall be two classes of members, active and associate.

2. Any person upon whom any degree has been conferred by the Rose Polytechnic Institute of Terre Haute, Ind., shall be eligible for membership, and shall be deemed a member upon application for enrollment to the secretary, and upon compliance with such regulations as may then exist for the government of the club.

3. All members resident of the city of Indianapolis and immediate vicinity shall constitute the active membership, and all other members shall constitute the associate membership.

ARTICLE IV.—DUES.

1. Annual dues of 50 cents shall be paid by each member at the beginning of each club year, the said club year beginning on the regular April meeting.

2. An initiation fee of 50 cents shall be required from each applicant for membership, the said fee to constitute the dues of said applicant for the club year in which said application is made.

ARTICLE V.—OFFICERS

1. The officers of this club shall be a president, a vice-president, and a secretary-treasurer, who shall have the duties usually assigned to such officers and who shall be elected, by ballot of the active members, for one year, and shall hold office until their successors shall be duly elected.

2. The treasurer shall keep an accurate account of all money received and expended by him, and all money so expended shall be accounted for by vouchers signed by the president.

3. No money shall be expended except by and upon the order of the president.

ARTICLE VI.—COMMITTEES.

The president shall appoint, at the beginning of his term, a committee, of not less than two members, whose duty it shall be to assign to each active member of the club a date upon which he will be expected to present to the club some subject for discussion, said subject to be chosen by said member.

ARTICLE VII.—EXERCISES.

It shall be the duty of each member to notify the secretary of the subject which he proposes to present to the club at least one week before the time assigned to him by the committee.

ARTICLE VIII.—MEETINGS.

1. Regular meetings shall be held at 8:00 p. m. on the first Saturday of each month, and other meetings at such times as the president or presiding officer shall direct.

2. The president or presiding officer shall call a meeting at any time which shall be designated in writing by five or more active members.

ARTICLE IX.—QUORUM.

A majority of the total active membership shall constitute a quorum for the transaction of business.

ARTICLE X.—AMENDMENTS.

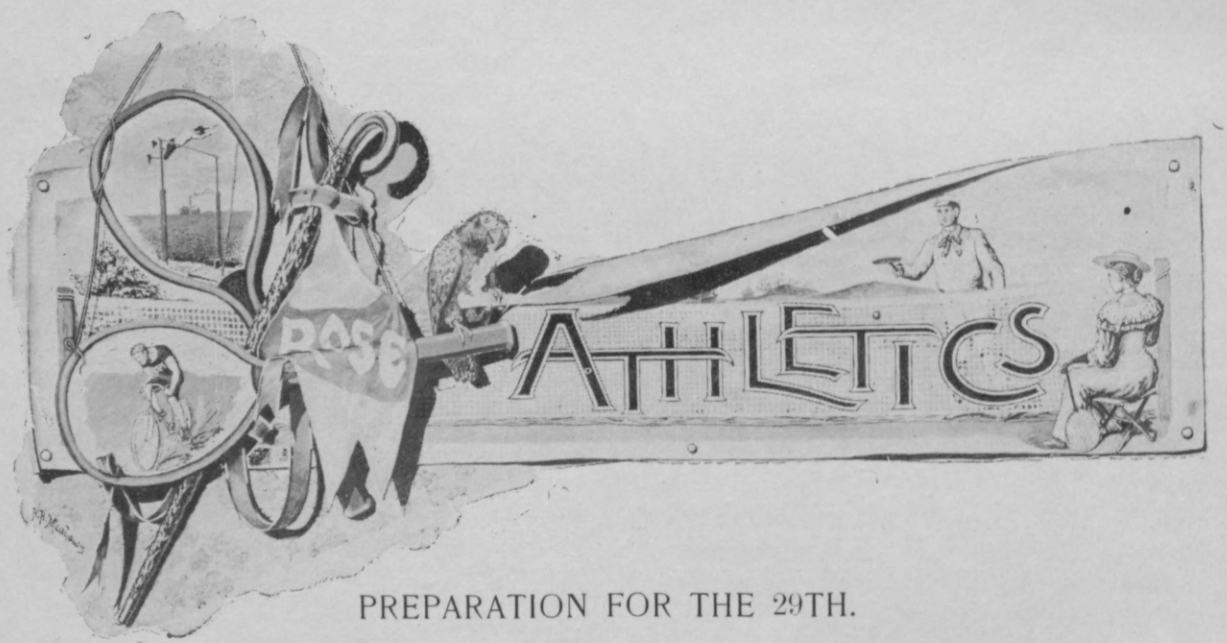
This constitution may be amended at any regular meeting by a two-thirds vote of the members (active) present, provided, that written notice of the proposed amendment has been given at least one month prior to such action.

ALUMNI NOTES.

Robt. Valentine '93 has left the Western Electric Co., and is at present at Cannon Falls, Minn., engaged in installing and starting a commercial lighting and power plant. His address is, care of Cannon Falls Electric Co.

Friends of Howard M. Stanton '93 will be grieved to learn of his sore bereavement in the death of his mother, Mrs. A. P. Stanton at Lynn, N. C., Sunday, May 10.

Frank H. Miller, '95, spent several days with us recently, having come up to enjoy the Phi Sigma Phi dance.



PREPARATION FOR THE 29TH.

The extreme interest in field sports displayed by the students at the opening of the training season has abated somewhat, but those who have had the intention of keeping on right up to the 29th are steadily at work and are showing improvement every day. There are a large number interested in the runs but the records have not been reduced to what they should be and some hard training is still necessary to give us a place in these events. A new feature added recently to the list of events is a relay race of one mile which is to be a class affair in the preliminary field day

which occurs next Saturday, May 16th. This has not yet been added to the events of the inter-collegiate meet but will, no doubt, be given a place in the near future. In the inter-class contest of next Saturday, four men compete from each class, each man running a quarter, touching another member of his class, who continues the next quarter, and so on. It promises to be highly interesting.

Ridgely is training for Crowe's old place as all-round or Pentathlon man and it is safe to predict that he will make a worthy successor of the '95 favorite. A successor for Darst is going to be much harder to find. Ingham and Hubbell are giving the hammer a share of their attention but both need coaching very much, the former particularly as he seems unable to get the force of his swing into the throw. A little coaching in this respect would probably do wonders in improving his present record.

It is doubtful whether we'll be able to enter any one in the shot put. Austin was the most promising candidate but base ball practice takes up his time so fully that he has been unable to give the former any attention of late. This will be settled more definitely after the Poly field day of the 16th. The other events are receiving satisfactory attention. Ridgely and McMeans are both at work upon the pole vault; the Klingers take their customary spin around the track every afternoon with Newbold and Stone to pace them; Shaver and Pierson are both promising candidates for the mile walk, in fact the former has succeeded in lowering his last year's (state) record by three seconds and is almost a sure winner for the event. Professor Hathaway has Farrington and Merriwether hard at work at tennis. As this is their last year, it should serve as an additional incentive to do their utmost to win.

We must not forget that we have lost a number of our good men and consequently may lose some of the events which they formerly won for us, thus leaving a fewer number on which to rely, so if we hope to land the pennant it will only be from the hardest and most systematic training. Several of the other colleges are evincing an unusual interest in their field day preparation this year, and we must go to Lafayette ready for anything and with the expectation of a hard and hot contest.

The following are events for State field day, with the winners and records of last year's contest.

1. 100 yds. dash, 10 sec., Buschman, P. U.
2. Putting 16 lb shot, 34 ft. 5 in., Buschman, P. U.
3. Running broad jump, 20 ft. 10 in., Coleman, E. C.
4. Mile walk, 8 min. 2 sec., Shaver, R. P. I.
5. Pole vault, 9 ft. 11 in., Crowe, R. P. I.
6. Standing high jump, 5 ft. $1\frac{1}{2}$ in., Ewry, P. U.
7. 220 yds. dash, $23\frac{1}{5}$ sec., Buschman, P. U.
8. $\frac{1}{2}$ mile bicycle, 1 min. 11 sec., Klinger, R. P. I.
9. Hop, step and jump, 44 ft. 11 in., Coleman, E. C.
10. 120 yds. Hurdle, $18\frac{2}{5}$ sec., Ristine, W. C.
11. Throwing 16 lb hammer, 109 ft $5\frac{1}{2}$ in, Darst, R. P. I.
12. High kick, 9 ft. 2 in., Ewry, P. U.
13. 440 yds. dash, 54^2 sec., McTaggart, R. P. I.
14. Mile bicycle, 2 min. 46^4 sec., Klinger, R. P. I.
15. Running high jump, 5 ft. 6 in., Haworth, E. C.
16. Standing broad jump, 10 ft. $6\frac{1}{2}$ in., Ewry, P. U.
17. Mile run, 4 min. $54\frac{3}{5}$ sec., Hester, E. C.

The pentathlon was won by Crowe, of R. P. I., who scored $417\frac{1}{2}$ points out of a possible 500.

Farrington and Meriwether, of R. P. I., won the tennis contests.

BASE BALL.

That we did not expect our team to achieve any remarkable successes in the year's games, everyone will admit, but on the other hand we were in hopes that they would be able to hold their own fairly well against the different teams which they were scheduled to meet, but even in this respect

we have been sadly disappointed and with good reason, as a reference to the scores in at least two of the games will show.

The first game, which could be taken as an indication of what the playing qualities of the team were, was that with the city Y. M. C. A. nine in the latter part of April. The latter had a number of good strong players in it, and although the score was 5 to 4 in their favor, yet every one was satisfied with the results as far as our team was concerned. Trumbo was in good form and pitched a game that caused the hopes of the team admirers to rise several degrees. The boys played at what was considered a decided disadvantage as Martin went behind the bat for the first time necessitating changes on first and second.

Our hopes were rudely shaken on the Saturday following when the nine returned from Lafayette minus their scalps which were dangling at the belts of the Purdue team, having been captured by a score of 25 to 5. No one in particular could be charged with the responsibility of having lost the game. Our boys were simply outplayed and that was all there was to it, and the secret of the whole thing was lack of team work. Errors were numerous and costly, batting poor and base running likewise. Trumbo started in to pitch a good game but became discouraged at the lack of support and let down. As an instance, with three men on bases, he struck the batter out but the catcher dropped the ball, threw wild to first, the ball going to Voorhees in right, who in turn threw high over second and during all of this three men came in. Ten runs were made in the first inning, which it must be admitted was enough to discourage almost any team.

Such a severe defeat should have been the cause of hard and systematic practice throughout the following week, but although some work was done it was not of a highly beneficial character, and the result was that on the following Saturday when they met the State Normal team, loose playing and errors, together with careless base running again lost them a game which should easily have been theirs had the team work been anything as it should. It is true both pitchers were hit hard and often and batting records were improved in nearly every case, however poor fielding is to blame for this in a large degree.

Lack of interest in practice again characterized the work of the men during the week following. At no time were the whole nine out practicing together, though some of the men were in their positions every afternoon and worked as well as circumstances would permit.

On Saturday the 9th they played Wabash and the Waterloo was even more pronounced than the one which was met at Purdue. Trumbo was batted all over the field and every player, with possibly one or two exceptions is credited with from two to six errors, nearly everyone of which was costly. There was not the least bit of snap in the playing of the men, and Wabash batted balls and ran bases to their hearts content. The number of open places they found to put the ball through was astonishing; but the fact remains that every man that came to bat got at least two safe hits and some even more than that. On the other hand R. P. I. seemed to be unable to connect with the Wabash twirler's delivery most of the time and when he was found occasionally the hits were scattering and consequently ineffective. Kidder and Voorhees are credited with a two and three bagger respectively but only one was of any value, the former having brought in a run.

The game was called at the end of the seventh inning to enable Wabash to catch the train and the score at that time was 24 to 2.

WEARING THE "R".

According to the ruling of the Athletic Association the following men are entitled to wear the letter "R" on athletic costumes. This was done for the purpose of increasing the incentive to students to work for a place on the athletic team by giving them a mark of distinction. It is hoped that all our athletes will take advantage of it and wear the letter on shirt or sweater. Here are the names: R. W. Beebe, James Farrington, P. W. Klinger, W. J. Klinger, H. T. Liggett, O. E. McMeans, Richard Meriwether, C. M. Ridgely, B. F. Chandler, J. H. Hellweg, T. G. Pierson, A. G. Shaver, C. H. Tucker.

TO BE FORMALLY OPENED.

On next Friday evening, May 22, the new gymnasium building will be formally opened. The exercises will consist of short addresses by Col. R. W. Thompson, representing the Board of Trustees, Hon. F. T. Hord of Indianapolis from the Alumni, and a representative from the undergraduates and Athletic Association. Prof. Waldo of Purdue will also probably be present. After the addresses the building, as also the Academic building will be thrown open for the purpose of inspection by the visitors, and a sort of informal reception or sociable will be held. Invitations are to be issued to students and friends of the Institute.

NOTES.

As has been stated elsewhere, a local field day is to be held on Saturday afternoon, May 16th, for the purpose of settling definitely what representatives Rose is to have in the State Field Day. In addition to the Rose men, there will be representatives from the High School and from the city Y. M. C. A. team, the presence of which will lend additional interest to the contests. It is to be regretted that this meet occurs just too late to give the results in this issue of the TECHNIC.

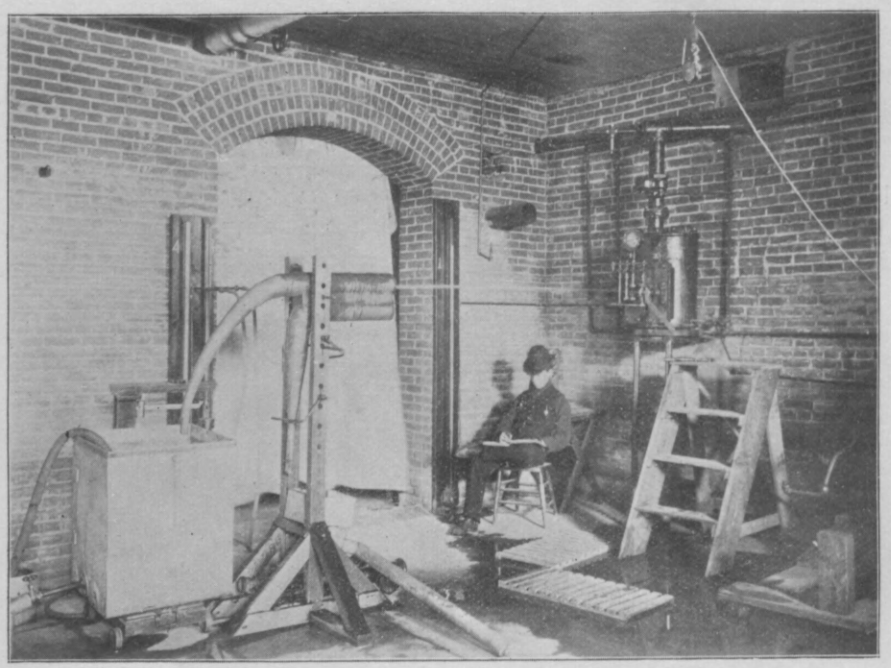
At the relay carnival held on Franklin Field, Pennsylvania's athletic grounds, in the latter part of April, Harvard won the championship race. In a five mile special between U. P. and Yale the former won in the last mile.

On May 16th Harvard and U. P. met in dual games consisting of nearly all the track and field events usual upon a field day. A similar dual meet occurs upon the 23rd between Purdue and DePauw at Greencastle. Whether the whole list of events is to be gone through with is not yet known.

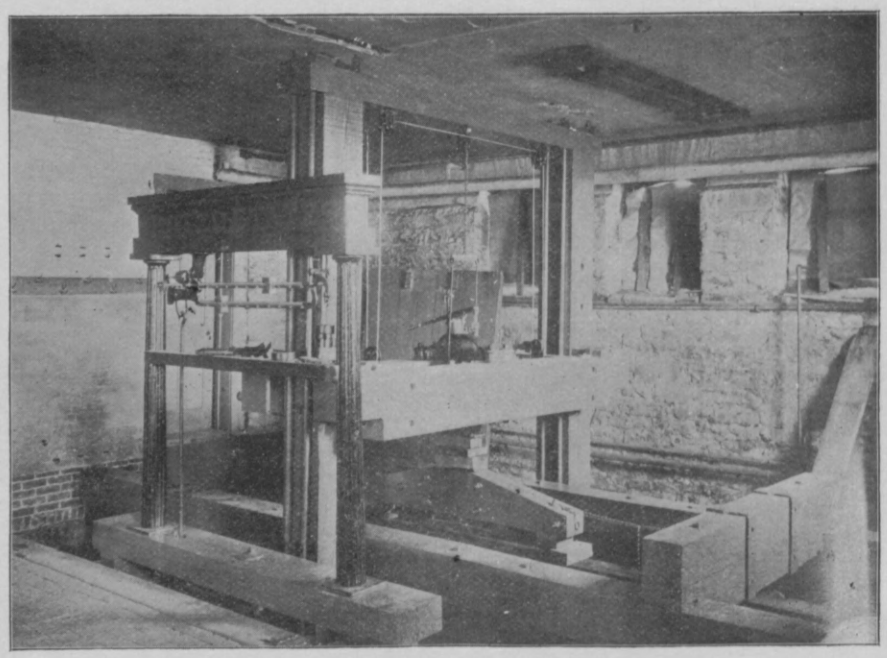
Indiana University has quite an extensive base ball schedule this season, having games with Wisconsin, Michigan, Northwestern, Chicago, Illinois and Cincinnati beside other games with the regular state colleges. The majority of the above mentioned games are to be played away from home.

WITH OTHER COLLEGES.

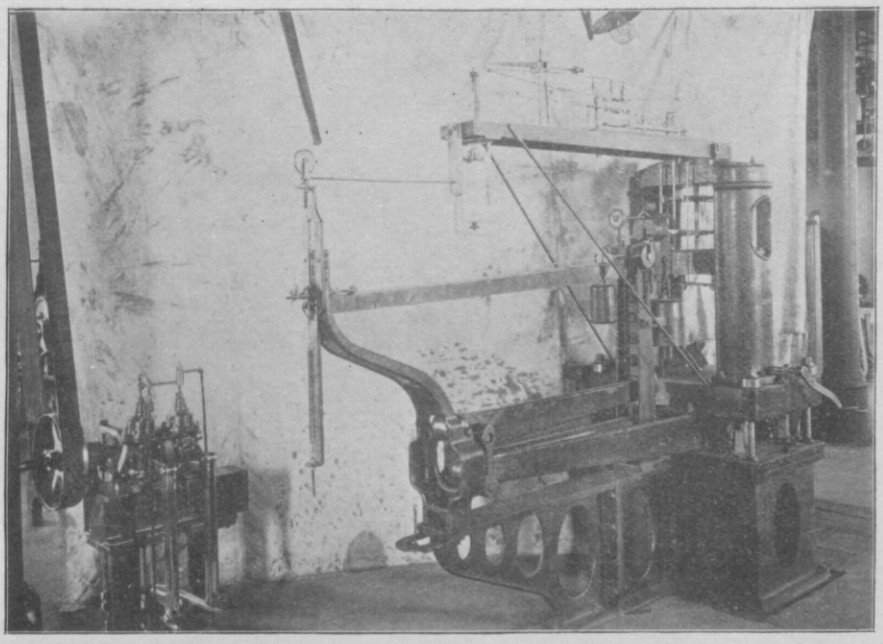
Lafayette, 27; Lehigh, 6.
Dartmouth, 7; Harvard, 6.
Princeton, 19; Lehigh, 1.
U. P., 11; Lafayette, 7.
Brown, 9; Harvard, 7.
Wesleyan, 4; Worcester, 2.
Amherst, 5; Wesleyan, 2.
Wesleyan, 14; Dartmouth, 1.
Williams, 2; Harvard, 1.
Georgetown, 14; U. P., 13.
Michigan, 15; Oberlin, 1.
U. P., 10; Cornell, 9.
Illinois, 16; Northwestern, 2.
Yale, 11; Lafayette, 3.
Brown, 16; Wesleyan, 13.
Brown, 15; U. P., 7.



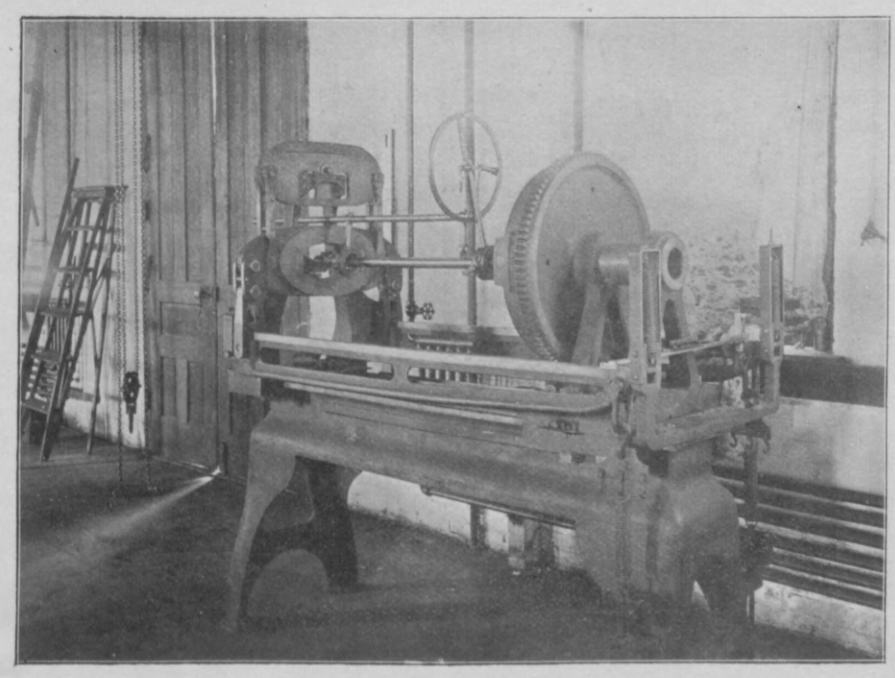
APPARATUS FOR THE STUDY OF FLOW OF WATER.



50 TON TESTING MACHINE FOR BEAMS AND FRAMED STRUCTURES.



100,000 POUND TESTING MACHINE WITH AUTOMATIC RECORDING APPARATUS.



TORSION TESTING MACHINE WITH MEASURING APPARATUS.

A MODERN GUN CARRIAGE.

BY C. H. TUCKER, '97.

Recently every one has probably become aware that our sea coasts are in a rather defenceless condition. But this state of affairs is due not to any lack of ability or inventive genius on the part of the army ordnance officers, but simply to the lack of sufficient appropriations from parsimonious congresses. The very rapid improvement in heavy ordnance caused the demand for a much more complicated carriage than the simple structure used for the old smooth bore rifles. Also the fact that these carriages must be machines in themselves; and, owing to increased accuracy of high power guns, made it of vital importance that both the gun and the carriage be exposed to the enemy's fire during the shortest period possible—hence the invention of disappearing carriages.

Several types of disappearing carriages have, during the last few years, been placed before the war department both by private firms and army officers. Of these the more important are the pneumatic carriage, the gun-lift or hydraulic carriage, and the Buffington-Crozier carriage.

In the pneumatic carriage the energy of recoil is used to compress air by means of which the gun is raised into firing position.

The gun-lift carriage is very massive and designed only for the twelve and sixteen inch guns. It rests on a hydraulic cylinder and is raised into firing position by pressure from a steam pump, the upper part of the carriage being exposed to the enemy during firing.

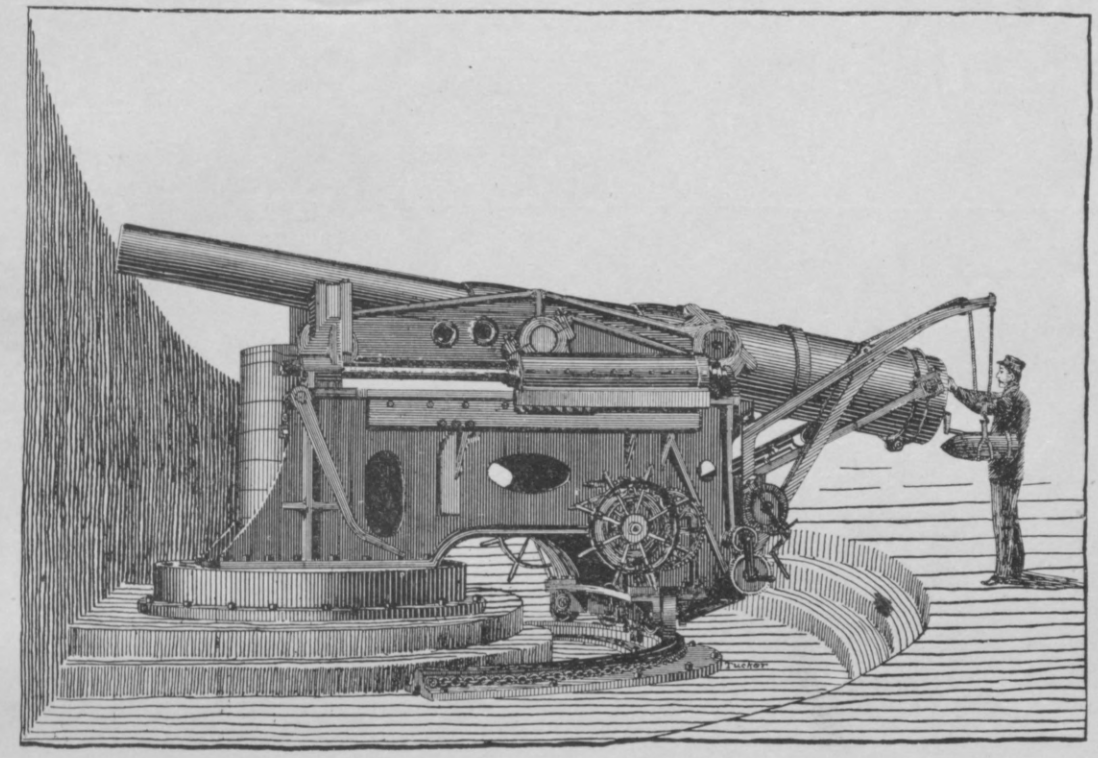
The other carriage, the most successful one, and the one which I will describe more in detail, is known as the Buffington-Crozier disappearing carriage, being the invention of two officers of the army ordnance department.

This carriage is to be used for the eight, ten and twelve inch guns. I will take the carriage for eight inch guns as a model, the others being designed on the same principles, but of course much heavier. In this article a mere general description of the carriage and the mechanical principles involved only may be entered upon.

The body of the carriage consists of two cheeks of steel-casting, the forward ends of which are supported by a circular platform resting on conical rollers of forged steel. The platform can thus be revolved about its verticle axis.

The cheeks, at the rear, rest on a steel piece carried by four cast-iron wheels. These wheels roll on the traverse circle, thus permitting the whole carriage to be swung around and the gun fired at any horizontal angle. The carriage is traversed by means of a chain wheel, operated by gearing on each side of the carriage, the chain passing from the wheel around to each end of the traverse circle. On each cheek, resting on rollers set in the top of the cheek, is a top-carriage, which supports a lever arm and contains a recoil cylinder.

The gun is carried at the upper ends of the lever arms, while the lower ends are attached, by cross-heads, to the counterweights, consisting of heavy,



AFTER RECOIL.—LOADING POSITION.

cylindrical, lead castings resting on an iron plate. The counterweight is constrained to a vertical motion.

Attached to the breech of the gun are the elevating arms. The gun is depressed or elevated to any range by hand wheels on the sides of the carriage. These are geared to a rack on the insides of the cheeks carrying the lower ends of the elevating arms.

From this description of the carriage, it may be noticed that, as the top carriage moves back in recoil and the lower ends of the lever arms rise vertically, the upper ends of the arms carrying the gun must move along the curve of an ellipse on these two paths as axes. Also the breech moves along the arc of a circle, with the elevating arm as radius

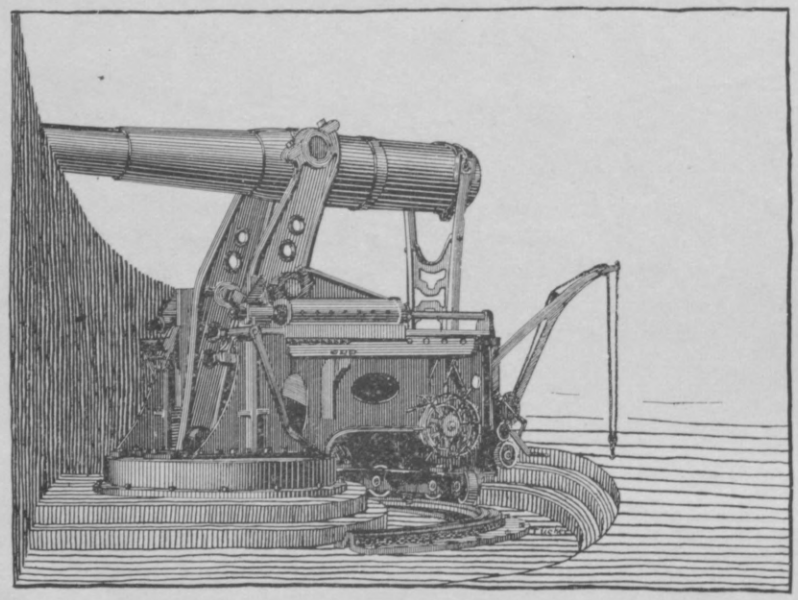
In considering the motion of the muzzle in disappearing, suppose the piece to be "in battery" or position for firing and to have just been fired. The recoil of the piece on the lever arm forces the top-carriage back and raises the counterweight until the lever arms are in a nearly horizontal position.

From the path of the breech and the journal of the gun in the upper end of the lever arm we may trace the motion of the muzzle. Fig. 1 shows paths of muzzle in disappearing from elevated, horizontal and depressed firing.

During the first instant of recoil the muzzle drops slightly as it comes back, then it follows an almost straight path for about five feet, gradually rising, however, until it is higher than at first. Finally, during the last few inches of translation, the muzzle drops abruptly behind the parapet. This motion of the muzzle is one of the chief advantages of this style of carriage, as it allows the gun to be mounted quite close to the parapet, thus affording greater protection.

In considering the mechanics of this action we have, for the weight of the projectile for eight inch guns, 300 lbs., and the service charge of powder

125 lbs., giving a pressure of 37,000 lbs. per square inch in the powder chamber. From this pressure this projectile receives a muzzle velocity of 1,950 feet, and a muzzle energy of 7,907 foot-tons. The momenta of the gun and projectile will be equal,



"IN BATTERY."

and the weight of the eight inch gun being 32,-500 lbs., the energy of recoil will tend to give it a velocity of eighteen feet per second. Most of the energy of the movable parts is absorbed in the recoil cylinder, although a small part is taken up in raising the counterweight through a height of about five feet. The weight has its least relative velocity while the gun has its greatest velocity, for it moves along the minor axis of the ellipse while the gun moves along the arc. Owing to this accelerated motion, strains due to setting in motion this large mass are minimized.

The action of the recoil brake in checking the momentum of the piece is as follows: Fig. 2, shows tranverse section of recoil cylinder. The piston (P) which remains stationary, is slotted at the sides to fit two steel bars (T) bolted to the inside of the cylinder. These bars, called throttling bars, are cut out to a particular curve, the depth of the bar increasing from right to left. The depth of the slot in the piston being equal to the greatest depth of the bars at each end.

Each cylinder is filled with a non-freezable oil and the cylinders connected with each other by a copper pipe in order to equalize the pressure in them during recoil.

Before recoil the piston is at the extreme right of the cylinder, and there is a small aperture between the bar and the bottom of the slot in the piston through which the oil may flow from one side of the piston to the other. But as the cylinder moves to the right in recoil the throttling bars, sliding through the slots in the piston, will, by their increased depth, gradually close up the apertures until finally no more oil can flow through and the gun comes to rest.

The whole motion of the gun and carriage in recoiling is so easy and graceful that it has been compared to the opening and closing of a senorita's fan; indeed, it is difficult to realize that such great forces are at work.

The embankment or parapet behind which the carriage is mounted is constructed of a mixture

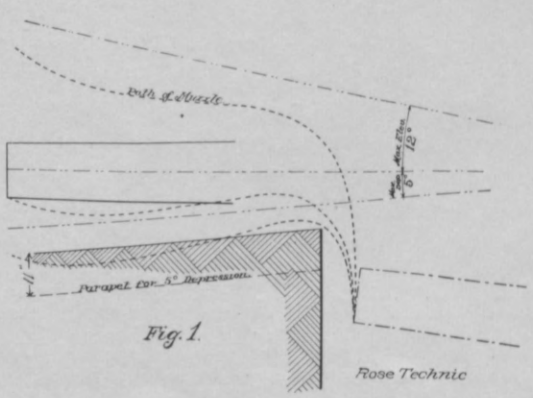


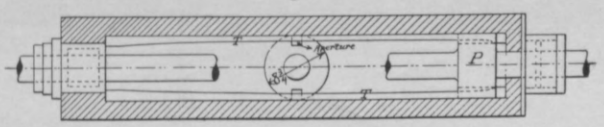
Fig. 1.

of sand and cement thirty feet thick—enough to withstand the heaviest projectile from a modern naval vessel. It stands over ten feet above the platform upon which the pintle of the carriage is anchored and affords protection to the whole carriage to an angle of seven degrees below horizontal.

The gun may be aimed from loading position by traversing and elevating, the range and direction being given from the central conning tower.

When the gun has reached its position after recoil it is held there by means of two pawls which catch on vertical racks on each side of the counterweight. To bring the piece again "into battery" these pawls are tripped by means of levers at side of carriage and the counterweight drops down into its well, pulling the gun up on the other end of the see-saw. At the test of the first carriage at the Sandy Hook testing grounds ten shots were fired in twelve minutes, showing the rapidity of fire which may be obtained.

Fig. 2.



Rose Technic.

The eight-inch gun weighs 32,500 lbs. and is about twenty-three feet long. The counterweight weighs 35,000 lbs. and the carriage proper 45,000, so the whole carriage mounted weighs nearly sixty tons.

The eight-inch gun has a maximum range of eight miles (with elevation of 12°) and its projectile will penetrate fourteen inches of steel at one thousand yards and ten and one-half inches at three thousand five hundred yards, or about two miles. This is the smallest of the high power guns used in coast defence. Five of these carriages were completed at the Watertown Arsenal.,* Mass., last summer, and mounted at Fort Wadsworth, New York harbor. Five more carriages for ten-inch guns are being completed there and thirty more by private firms, such as Cramp and Sons and the Bethlehem Steel Works. Now that more appropriations are being made for fortifications, numbers of these carriages for guns of different calibre will be made and distributed to the sea coast cities.

The name of disappearing carriage is really a misnomer, as it is the gun and not the carriage which plays hide and seek with the enemy.

One can well imagine the feeling which will come over the enemy at sea upon noticing the muzzles of several guns rise above the fort wall, fire their pre-aimed shots and disappear from sight, all within a small fraction of a minute.

I have affixed some interesting data on guns of different calibre:

	8" gun	10" gun	12" gun	16" gun
Weight in lbs	32,500	67,200	128,719	280,000
Weight of projectile	300	575	1,000	2,379
Weight of powder	125	250	487	1,060
Muzzle velocity, ft., sc.	1,950	1,975	2,100	1,675
Muzzle energy, ft., tons	7,907	15,548	27,040	64,084
Penetration in steel at muzzle	16"	20"	27"	34"

*The Watertown Arsenal is situated on the banks of the Charles river about twelve miles out of Boston. It has a capacity of about thirty carriages per year. For several years the arsenal has been under the direct supervision of Major James W. Reilly, Ordnance Department, U. S. A.

Y. M. C. A. NOTES.

Verling W. Helm, assistant state secretary, was in town over Sunday, May 10th. He held a short conference with a few members of the Poly association to discuss the prospects of a delegation to go to Lake Geneva this summer. Mr. Helm is a young man of marked ability as a speaker and as a leader, and has done much toward the success of the Y. M. C. A. work in Indiana colleges.

The topic discussed at a recent mid-week meeting of the association was "Christian Athletics." This is a popular subject and called forth an interesting discussion. Shaver had charge of the meeting.

Mr. Roney, president of the state executive committee, addressed the association Wednesday evening May 13th. His address was very interesting and profitable.

The annual announcement of the Lake Geneva Students' Conference is out. Rose has for the last four years sent from one to three delegates to this conference, and it is to be sincerely hoped that as

many can be sent this year. The conference commences Friday evening, June 19, and closes Sunday evening June 28. Last year delegates from 115 colleges, from Ohio to California, were present, all the Indiana colleges being represented. The list of speakers for this year includes some very able and well-known men. A good many students will recognize with pleasure the name of S. M. Sayford, of Boston, as well as that of Prof. W. W. White, of Chicago, and Rev. J. Wilbur Chapman, of New York, all three of these having been heard in Terre Haute. Besides these there will be S. J. McPherson, D. D., of Chicago; L. Wilbur Messer, of Chicago, and Bishop Vincent, of Buffalo.

Athletics and aquatics of all kinds will, as usual, occupy a prominent place among the attractions, the afternoon of each day being entirely given up to these sports.

Lake Geneva is certainly one of the most delightful summer resorts of the north, and it would be worth while for any student, whether a member of the Y. M. C. A. or not, to take advantage of the extremely low rates and spend a few days in this beautiful place, and meet some of the best students from all the western colleges.

THE PHI SIGMA PHI DANCE.

The Phi Sigma Phi fraternity gave its annual dance Friday evening April 24th, at Bindley hall. The occasion was a most enjoyable one, attended by about seventy-five couples from this city besides many others from a distance. The hall was tastefully decorated with bunting in the fraternity colors, pale blue and white, the corners being draped as little Moorish canopies or tents, furnished with couches and chairs arranged *tete a tete*, and lighted with the softened glow of shaded lamps. The stand for the orchestra was banked with palms, and smilax and ferns were used with good effect among the other decorations. A splendid program of twenty-six dances was arranged and greatly enjoyed by all.

THE SENIOR TRIP.

President Mees spent Saturday, the 9th, in Chicago completing the arrangements for the second of the annual excursions to be taken by the Senior class of the Institute. The members of the class, accompanied by Professors Gray, Howe, Ames, Noyes and Brown, and possibly President Mees, will leave in a special car attached to the 4:50 A. M. train on the C. & E. I., on Monday, May 25. A full program has been arranged for the three days which it is proposed to spend in the city. Many places of interest to the students of each of the different courses will be visited. Among them may be mentioned the works of the Western Electric Co., the Illinois Steel Co., the Edison Illuminating Co., the Chicago Ship Building Co., P. D. Armour & Co., the Kirk & Fairbanks Soap Manufactory and the great car works at Pullman. On Monday evening a visit will be made to the Chicago Central Telephone Exchange and the operation of the various circuits and switchboards explained and examined. The following evening the visitors will be entertained at dinner by the Chicago Tech club. The club has taken much interest in the trip and has given valuable assistance in arranging the program and in securing very favorable rates for entertainment. The present intention is to return on the afternoon of Wednesday, but this may, if circumstances warrant it, be extended until Thursday.

Field Day May 29th.

Fry, '97, advises all to beware of rocking chairs that walk.

Westfall, '97, is riding a new Patee, and Hanley, '99, a Windsor.

Ingle, '97, received a new Remington cycle, recently, as a present from his father.

Prof. W. "Now get that well mixed in your minds." Probably he meant fixed.

The Freshmen have challenged the Juniors to a game of base ball for the twenty-third.

Haney and Kessler attended the state Sigma Nu convention held at Greencastle last month.

Wonder if Prof. H. could put down the expression for the total energy expended in a mile run.

Rose flags should be strongly in evidence on Field Day. Patterns can be had at Mrs. Burton's office.

Hubbell '99 has been throwing the hammer lately and has one throw of eighty-seven feet to his credit.

Four Freshmen ran a trial relay mile the other night in 4 min. 5 sec., Froehlich making the last quarter in 58 seconds.

The Seniors will celebrate the anniversary of good Queen Vic in starting on their pilgrimage to Porkopolis on the 25th.

Hanley, '99, lost a tooth while playing on his bass horn during the Normal-R. P. I. game. Hanley was at one end of the horn, a Normalite at the other.

The Sophomore civils are doing some very practical work in locating and laying out a cut-off between the Vandalia and Big Four railroads just west of Maxville.

Prof. W. was discussing the meter of verse when Kidder wanted to know if two diameters were equal to a tetrameter. He meant dimeter.

Watt Klinger is riding a crimson Syracuse and Pete will soon appear on a new Stearns yellow fellow. Wonder if there will be any family scraps over questions of color?

Prof. Ames will probably move with his family to "Park Row" during the summer, making nearly complete the list of the faculty who reside in that beautiful suburb of the city.

On Monday, May 4th, the Senior chemists took a day's outing on their wheels with Dr. Ballard, who was to instruct them in the art of taking photographs. Several fine negatives resulted from their trip.

At a picnic and dance given at More Park on last Monday evening street car headlights were used with telling effect in hunting up couples who had unconsciously wandered too far away among the trees.

The Senior electricals spent Saturday morning May 2d, at the works of the Terre Haute Shovel and Tool Co. Among the many labor saving devices noticed, one at least would no doubt prove very popular in the Institute shops. It was an ingenious swinging seat hung in front of one of the machines.

Werk, '96, met with quite a painful accident in the chemical laboratory the other day. He was standing over a mixture of coal and sodium peroxide and added a few drops of water, when there was a bright flash which took off two large patches of skin from the forehead and also burned his nose. Fortunately he closed his eyes in time to prevent any injury to them.

Some ingenious Freshman perpetrated a "hot" joke on Mc C. some few days ago by drilling a small hole in a stick of chalk and inserting the business end of a parlor match of the snappiest variety. When it went off in the middle of a long "series" they say Mac was too mad to blush.

The Juniors were patiently watching the minutes slip by on the dial of the hall clock, when at the breathless instant of 10:09:55 Dr. Mees came hurrying in with the news: "Prof. Gray is coming." "Ah!" remarked an amused bystander, "Prof. G. thought it wise to employ an advance agent to secure an audience."

"Studied an hour last night and two this morning. Had beefsteak for supper and hash for breakfast. Wrote a letter home and didn't ask for any money as directed not to, but got absent minded and put an 'awfully hard up' in the P. S. from force of habit."—From a Freshman's daily account of himself to Dr. M.

A Junior was enjoying the fresh spring breezes from a seat on the window sill of Prof. H.'s room, when two classmates, sympathizing with his desire for freedom, quietly lifted him out and dropped him gently on the brick pavement. The altitude was only about ten feet and he came down cat fashion, so that the shock of contact injured neither pavement nor Junior.

It happened in the foundry and they tell it at Harry's expense. Two Freshmen were wearily pounding sand side by side moulding two patterns which were exact duplicates of each other, and somewhat difficult to work. Harry kindly came to the assistance of one of them and very carefully trimmed his mould up and drew the pattern, surveying the job with a well satisfied air. While his back was turned for a few seconds the two flasks were quickly exchanged, and No. Two called out, "See here, Harry; how's this?" "Well," said he, turning around, "that's pretty good, only it needs some patching here and there." And then as he went out to the pattern room he remarked, with a significant wink, to the man by the door, "That fellow will make a crack moulder if he keeps on."

Said a Senior, as he emerged from the deathlike stillness of the quiz into outer freedom, "What formula did you use in that fourth problem?" "Formula, nit!" said his companion, "I just multiplied everything in sight together."

Ford, '98, has recently figured in another bicycle smashup. This time he came into violent collision with a Normalite cyclist who got decidedly the worst of the encounter, having the chain and a dozen or two spokes broken from his wheel.

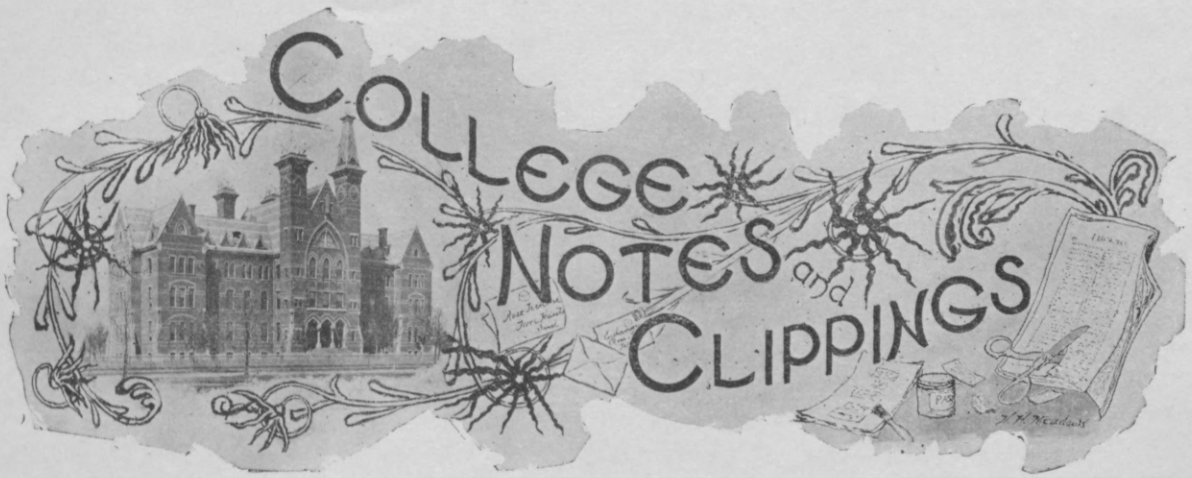
Several students took part in the annual Rockville run of the Wabash Cycling Club Sunday, May 10. W. J. Klinger captained the first division of ladies and their escorts, and C. M. Ridgely and A. P. Stone rode up ahead of the crowd and took charge of the registry book at Rockville. There were a total of 570 names recorded of which probably 350 were from Terre Haute.

Instructor Harper was much astonished when a couple of Seniors meeting him on the campus turned out of their way to remove their head coverings and bow low to him as he passed. He found upon inquiry that it was not the effect of Prof. W.'s talks on the history of feudal times, but rather a recent green carpet lecture on proper reverence for those set in authority over us.

The Freshman class, which at present numbers two and thirty, has adopted a new yell, as follows:

Flei-zig, flei-zig,
Zwei und dreiszig,
Rose Polytechnic
Neun und neunzig!

Two accidents, both more or less serious, have occurred on the bicycle track lately. The first was due to the carelessness of the small boys who frequent the campus and greatly interfere with training in various lines, notably the cycling. This time one of them ventured on the track once too often and was struck by the wheel of P. W. Klinger. The boy was quite badly cut by one of the pedals and "Pete" was so scratched up that he has been footing it for a week. The second accident was due to the rear tire rolling from C. M. Ridgley's wheel throwing him heavily and wrecking the wheel proper completely.



I. U. boasts of having a student band.

Michigan won from Wisconsin recently in an agricultural contest.

The erection of an infirmary at Harvard has been proposed.—*Pennsylvania.*

The *College Folio* contains a photograph of the young ladies on the editorial board.

In a recent contest, Harvard defeated Columbia and U. S. Naval Academy at fencing.

The women of Cornell have secured the services of Miss Hill of Wellesley to train their crew.—*Ex.*

The U. of M. ball team has started on a trip to play Chicago, Wisconsin at Madison, and returning play a second game with Chicago.

Oxford can stop a girl taking the degree of B. A., but it can't prevent her adding the honorable name of "M A" to her titles.—*Philadelphia Times.*

At Stanford University there is a student's fire company, which is trained for service by being called out unexpectedly on false fire signals.—*Ex.*

The first number of a new exchange, *The College Era*, of Toledo, Iowa, was received last month. It is a neat paper and contains some interesting articles.

The $5,000 Prize Lathe, offered at the World's Fair to the technical school which should be voted the most popular, was awarded to Cornell, which succeeded in getting one-eighteenth of all the votes cast.—*Ex.*

The entire Sophomore class at Bloomington, Ill., was recently expelled for refusing to answer questions concerning the ringing of the college bell at midnight.

Kenford Smith at Centre College, lowered the collegiate record of 10 seconds for 100 yards, held by Crum, to $9\frac{4}{5}$, equalling the world's professional record—*Purdue Exponent.*

We learn from the *Earlhamite* and the *Indiana Student* that students from each of their representative institutions have been training hard for field day, and are in good form.

Prof. Hastings of Yale, made an important discovery recently, resulting in a new type of telescope in which the defect known as "Secondary color abberration" is abolished.

In the April number of the *Student Life* there is a story which begins thus:

"Kate Wilson crooned a tender lullaby as she sat with her work beside the little home-made, unpainted cradle which contained her treasure, her baby girl. Gently she rocked it with her foot while she plied the shining needles shaping, with dexterous fingers, the little sock which, in the coming winter, was to keep snug and warm the *ten* pink little toes now exposed in all their prettiness to the warm July sunshine streaming in at the window."

The youngster was evidently going to be strictly in it—with both feet.