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THE TECHNIC

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THE Student Council at its February meeting took a decided stand in favor of the establishment of a regular general assembly period, once every two weeks, or even more frequently, and appointed a committee to wait upon President Mees to request that he take action in the matter as soon as possible. The committee consulted with Dr. Mees, who expressed himself as heartily in sympathy with the movement and promised to take steps toward making the necessary arrangements before leaving for Bermuda. The time is not to be taken from class work, and attendance will be compulsory for all students and members of the faculty. (Faculty please notice.)

The exact nature of the meetings has not been determined, but they are not likely to follow any certain form. The lectures by Alumni and other engineers and prominent men will be continued as a part of the assemblies, and several will be devoted wholly or in part to the awarding of athletic monograms as heretofore. Matters of general interest in student affairs will be taken up and discussed by members of the Student Council and anyone else who desires to speak. Reports of athletic managers and other student officers may possibly be read. The participation of the Student Body in general is desired and should prove the most valuable feature of the new plan. The discussion of undergraduate affairs will tend to make the conditions and the problems confronting the various student enterprises and organizations familiar to everyone in school and should serve to make the Student Body a more united organization itself. At present there are too many students who merely attend classes and so far as being in college activities is concerned might just as well be taking engineering from a correspondence school.

It is the earnest desire both of the Faculty and the Council that these meetings be made of sufficient interest so that no steps will be necessary to force attendance by everyone connected with the institute. That they will fill a long felt want is acknowledged, but to make them of interest will depend in part at least upon the active participation of the Student Body as well as every member of the faculty.

THIS month we present an exceedingly valuable article by Robert L. McCormick, '91, Professor of Mechanics in the Institute. While the article savors too highly of Rankine to furnish light reading material, it will nevertheless be found worthy of careful study and should prove useful to many in practical designing. Much time and work was spent by Prof. McCormick in working out the formulae and the accompanying chart, which was prepared by Prof. Peddle. We have endeavored to present the chart in a form suitable for practical use by designing engineers.

The article on abrasives published in this number is perhaps the most complete treatise on the subject which has appeared in recent years. It takes up both natural and artificial abrasives and presents many valuable pointers upon grinding practice and abrasives in general. For the use of this article we are indebted to Mr. George W. Chormann and The Carborudum Co., of Niagara Falls, N. Y., manufacturers of artificial abrasives. The paper was prepared by them for use in connection with a recent large convention.

AT a public meeting of the students of Columbia University to learn the undergraduate attitude toward increased armament for America and to express disapprovel of "the propaganda for militarism which has been foisted upon the American public by vicious and insidious war scares in the popular press," the following resolution was enthusiastically adopted: "Resolved, That we, the students of Columbia University, in mass meeting assembled, hereby go on record before Congress and the people of the United States, as opposed to militarism in general and an increase in our army and navy in particular."

An anti-militarist organization was formed and a committee chosen to carry forward the propaganda in Columbia and also to spread it among the other colleges and universities of the country. THE TECHNIC has received some of the committee's literature on "the menace of all militarism," and has been requested to aid in the movement.

College men constitute one of the greatest potential forces in the country and influence is being brought to bear upon them from both sides on this question, particularly at this time when the fallacy of military force preventing a war seems to be fairly apparent to everyone. President Schurman of Cornell in a recent interview strongly favored the military training of men in all our colleges in order to create a large reserve force which would furnish army officers in case of war, and last summer college men were drilled in military camps for war.

Inasmuch as the opinions of a youthful undergraduate with no special knowledge of the subject under discussion are always apt to appear somewhat foolish to older and wiser men, we refrain from any decided comment on either side, but it is safe to say that the one thing college men and all men should stand for now and always is permanent peace for the whole world and the ultimate disarmament of all nations at the earliest practicable time.

To engineers, scientists and educators the setback to the advance of civilization and scientific knowledge caused by the present war is appalling. For years the countries now in the death struggle have advanced hand in hand with America in the field of scientific research, each contributing its part to the sum total of human knowledge, and each sharing in the benefits from the discoveries and inventions of the others, Now all Europe is torn by war and the most highly civilized countries on the globe are industriously engaged in applying this same knowledge to the destruction of lives and property, to the tearing down of the culture and cilization of the centuries, on a scale never before even remotely approached and with weapons embodying the most recent discoveries and developments of science and engineering all over the world.

To the American engineer the responsibility brought by the present European madness is enormous. The country is now more than ever before dependent on its own resources, and upon its engineers chiefly rests the responsibility for carrying it through the crisis. To this country the world must look chiefly for progress and it is the technically trained men who will be called upon to see that it does not look in vain. The next few years output of that generous progeny of stalwart young men of whom we hear so much on the third Wednesday in May, face the prospect of bearing a greater share of the world's work upon their shoulders than any previous classes which have graduated from the Institute.

THE Modulus question is once more up for discussion and this time something definite must be decided upon in the nature of a change in the manner of its publication. One thing about its publication that is decidedly unfair is that the entire burden is placed upon certain classes, while others have none of the work, financial worry nor the honor if there be any. This would be avoided easily by making the publication a two-class book, or better still by putting it into the hands of a board appointed from all the classes and directed by upper classmen, thus giving the subordinate members a little experience to help them when they in turn are called upon to put out the succeeding volume.

One suggestion has been put forward that has no perceptible advantages and a number of serious drawbacks. The proposition is to combine The Modulus with the December number of the THE TECHNIC and put out a special Christmas edition of the latter in the form of a college annual. Just why THE TECHNIC should be called upon to add to its already varied functions that of an annual is very hard to see. THE TECHNIC has a definite purpose, in fact several of them, but these do not include the purposes of a college annual. Such a number would be entirely out of keeping with the character of this publication and would detract materially from it. Just what would be gained is a mystery, unless it be some sort of financial backing. The volume would have to be fairly expensive to make any showing at all and it must be remembered that every Technic subscriber, including every student and more of the alumni than would ever buy the hybrid publication, is entitled to a December number and would have to get the said hybrid without any extra cost. Now where will the money come from to finance the thing? The Student Council would scarcely be justified in paying for it from the Student Fund and THE TECHNIC will certainly never consent to raising its subscription price one cent for such a purpose. To raise it as much as a dollar, the minimum cost of the book, would be absurd.

Whatever is decided upon, one thing is certain—if the Modulus is to exist at all it must stand on its own legs and not expect to be carried as a dead load on the shoulders of THE TECHNIC. We should certainly hate to see such a grand old institution as The Modulus tottering along toward its grave and we are willing to do everything in our power to maintain its independent existence, but when it tries the Old Man of the Sea stunt, THE TECHNIC would prefer to get out the chloroform bottle and call a hearse.

That we need a publication of the character of The Modulus is admitted. In fact, we need an annual edition of it rather than the present bi-ennial. To put forth such an elaborate edition as the last Modulus, even biennially has proven too great a financial load, the bills for the last one being still unpaid. The suggestion outlined above carried with it the proposition to cut down the cost to about one dollar. Now it would be just as easy to cut down the cost and issue The Modulus separately every year as it would be by the other plan.

Our idea is to put forth every year a modest publication, artistically in good taste but with most of the expensive engraving work cut out. There would of course have to be pictures of the buildings, the faculty, the organizations and the classes, but the latter could be made very small and inexpensive, something on the order of the freshmen and sophomore pictures in the 1915 Modulus. There would be more reading matter, more real live information about student activities and organizations, the Institute, its equipment, its plans, its courses, its problems, its faculty and their work. That we can put out a book comparing favorably in general make-up with the annuals of the largest universities, has been proven, but there is no object in our doing so under the conditions. We ought to make our annual different from all others, distinctive and characteristic of Rose. It should show by its nature that the Institute is a technical school and emphasize its strongest points by being itself somewhat of a technical nature. The aid of the faculty should be called in to help out this side of the volume.

Let us try to get out something new, something distinctive, something unique, something that belongs to the Institute and reflects every phase of its life and activities, but is still simple enough in its make-up so that its financing will not be too great a burden. Simple though it may be, if it is unique and truly reflects every phase of Rose Polytechnic it would be a much greater credit to the Institute than the old sterotyped annual which is now successfully imitated by practically every high school in the country.

College Notes

Yale has a standing army of nearly 25,000 living Yale men. Of the graduates, 17,570 are at present living in the United States. In New York and Brooklyn 2,965 graduates are registered, while at New Haven, 1,437.

As a result of the investigation of the Bureau of Education it is shown that of the graduates of the thirty-seven largest colleges, 25 per cent. teach, 20 per cent. enter business, 15 per cent. become lawyers, 7 per cent. become physicians and 7 per cent. enter the ministry.

A new intercollegiate organization has been formed by university graduates in New York, Boston, and Chicago. Its purpose is to make the college man more useful to the community.

Freshman fussers are to be card indexed at the University of Colorado. The relation between their fussing and their studies is expected to be obtained by this means.

$100,000 having been granted to the University of Iowa by the state board, a new dental building will be started at once.

In 1880 the University of Kansas held a field meet. On the program, were sack races, three-legged races, wrestling and archery. Later the list included egg races, vaulting, bicycle and wheelbarrow races, and obstacle races. College sports have changed greatly in the last thirty years.

The New York State College of Forestry at Syracuse University has been presented with a new building. It will be the only building in the country devoted entirely to educational work in forestry.

According to statistics recently compiled at Brown, it appears that 71 per cent of the students are fraternity men.

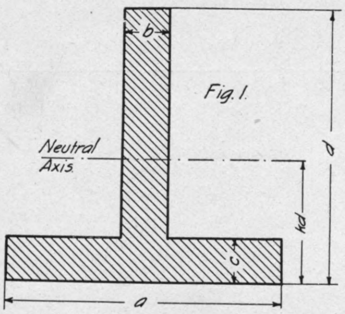
University of Kansas has the distinction of having the first women cheer leader in the world. Miss Elizabeth Morrow assisted in directing the yells at the Kansas-Missouri Game.

The students at Wisconsin have become very enthusiastic over hockey and archery.

The Design of Cast-Iron T Beams

By Robert L. McCormick, C. E.

When a beam of symmetrical section is made of a material whose resistance to tension and compression is different, it will fail, if subjected to a bending moment, by the stress to which is offers the least resistance. Cast iron is usually five or six times as strong in compression as tension, and in such beams the greatest intensity of compressive stress should be about five or six times the tensile stress. In order to accomplish this the neutral axis of the section must be at a sixth or a seventh of the depth of the beam from the tension side. To take a T section and by trial to so proportion it that this result will obtain is a tedious operation and the following formulae were derived by the writer to eliminate the labor which may be wasted in the design of T sections.



Referring to Fig. 1, let

A=area of section.

W=area of web.

d=depth of beam.

b=thickness of web.

c=depth of flange.

a=width of flange.

I=moment of inertia.

S_t=section modulus for tension.

y_t=distance from neutral axis to outside tensile fiber.

y_c=distance from neutral axis to outside compressive fiber.

f_t =allowable fiber stress in tension.

f_c =allowable fiber stress in compression.

Then

$$I=\frac{(Ac+Wd)^2-4Wd(Ac+Wd)+4WAd^2}{12A} \qquad (1.)$$

$$y_t=\frac{Ac+Wd}{2A} \qquad (2.)$$

$$S_t=\frac{(Ac+Wd)^2-4Wd(Ac+Wd)+4WAd^2}{6(Ac+Wd)} \qquad (3.)$$

Since the fiber stresses are given in the specifications for cast iron, the neutral axis of the beam should be at a distance from the tension side of the beam expressed by

$$y_t=\frac{Ac+Wd}{2A}=kd \qquad (4.)$$

in which k may be found as follows :

$$\text{Since } \frac{y_t}{f_t}=\frac{y_c}{f_c}=\frac{y_t+y_c}{f_c+{}_tf}=\frac{d}{f_c+f_t}$$

$$\frac{y_t}{f_t}=\frac{kd}{f_t}=\frac{d}{f_c+f_t} \text{ or } k=\frac{f_t}{f_c+f_t}$$

From (3.)

$$S_t=\frac{d}{3k}(Ak^2-2Wk+W) \qquad (5.)$$

and if W=nA

$$S_t=\frac{Ad}{3k}(k^2-2kn+n) \qquad (6.)$$

also from (4.)

$$y_t=\frac{Ac+nAd}{2A}=kd, \text{ or } c=d(2k-n) \qquad (7.)$$

which shows that n must be less than 2k.

In the application of these formulae, the known quantities are the depth, d, usually taken at one-eighth to one-fourteenth of the span, the allowable fiber stresses and the bending moment on the beam. The section modulus which equals the bending moment divided by the fiber stress is therefore easily obtained.

To apply this to a concrete example, assume a bending moment of 200,000 in. lbs.

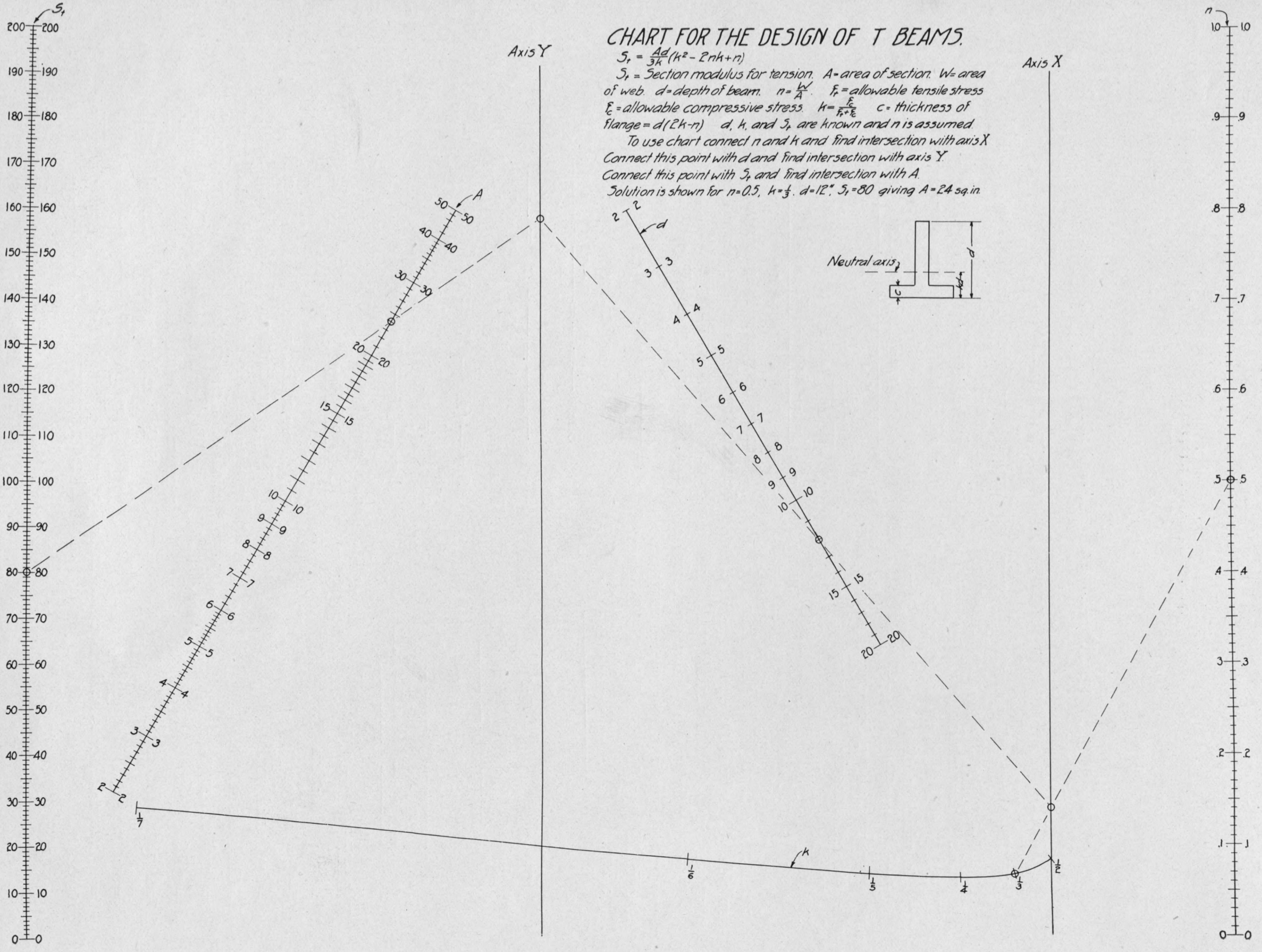
CHART FOR THE DESIGN OF T BEAMS.

$S_t = \frac{Ad}{3k}(k^2 - 2nk + n)$

S_t = Section modulus for tension. A = area of section. W = area of web. d = depth of beam. $n = \frac{W}{A}$. f_t = allowable tensile stress f_c = allowable compressive stress. $k = \frac{f_c}{f_t + f_c}$ c = thickness of flange = $d(2k-n)$ d, k, and S_t are known and n is assumed.

To use chart connect n and k and find intersection with axis X. Connect this point with d and find intersection with axis Y. Connect this point with S_t and find intersection with A.

Solution is shown for $n=0.5$, $k=\frac{1}{3}$, $d=12''$, $S_t=80$ giving $A=24$ sq. in.



f_t=2500 lbs. per sq. in.

f_c=5000 lbs. per sq. in.

d =12 in.

$\therefore k = \frac{1}{3}$.

from (6),

$$S_t = \frac{d}{3k}(Ak^2 - 2wk + w) = \frac{4}{3}(A + 3W)$$

$$= \frac{200000}{2500} = 80$$

Assume $W = \frac{1}{2}A$, or $n = \frac{1}{2}$

$$\therefore \frac{4}{3}\ (\frac{5}{2}A) = 80, \text{ or } A = 24 \text{ sq. in.}$$

and since

$$c = d(2k - n) = 2 \text{ in.}$$

or the section would be as shown in Fig. 2.

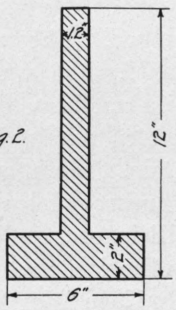


Fig. 2.

It is evident that since n must be less than 2k, W will have values between $\frac{2}{3}$ A and 0 ; also A will be a minimum when W is a maximum. The greatest economy can therefore never be obtained, as the minimum value of A would give c=0 and b indefinitely large, a result evidently not of practical application.

To solve this problem in another manner, we may assure a value for c of say 1 in. ;

then since c=d (2k—n)

$$\therefore n = \frac{7}{12}$$

$$\text{and from } \frac{d}{9}(A + 3W) = \frac{4}{3}(A + \frac{7}{4}A = 80)$$

$$\text{whence } A = 21\frac{9}{11} \text{ sq. in.}$$

$$W = \frac{7}{12}A = 12\frac{8}{11} \text{ sq. in.}$$

$$\text{area of flange} = 9\ \frac{1}{11} \text{ sq. in.}$$

$$\therefore A = 9\frac{1}{11} \text{ in. and } b = \frac{140}{121} = 1.16 \text{ in.}$$

This section would be more economical, and also on account of the flange and web being nearly equal in thickness there would be less danger of shrinkage cracks. The section as finally designed will have a web slightly thicker at the bottom than at the top to allow for the draft of the pattern, but that will not materially affect these formulae.

In these examples the fiber stresses used are the ones specified by a prominent railroad for cast iron beams for track scales.

When the ratio of tensile to compressive stress is one to six, these formulae show that a T section, to satisfy this condition, is hardly practical.

$$\text{for then } k = \frac{1}{7}$$

$$S_t = \frac{d}{21}(A + 35W), \qquad c = d\ (\frac{2}{7} - n)$$

Since n lies between 0 and $\frac{2}{7}$, it follows that the area of the web will be small and therefore the web will be thin while the flange will be very broad. In such cases a beam of different section such as a double T may be used. A short approximate solution for this section will be found in Rankine's Applied Mechanics.

The chart for solving equation 6 which accompanies this article will be found very useful and sufficiently accurate for all purposes. It is self explanatory, but I may add that n is assumed at the beginning of the solution.

The writer wishes to acknowledge his indebtedness to Professor J. B. Peddle for assistance in preparing this chart and to commend it to the readers as a valuable addition to this paper.

Abrasives

By George W. Chormann
Sales Mgr. Wheel Dept., The Carborundum Co.

WHEN we consider the importance of the part played by abrasives and abrasive tools in practically every branch of modern industry, we must wonder at the comparatively small supply of information to be obtained with regard to the general principles governing abrasion. Very little has been written on this important subject, and that knowledge possessed has been obtained principally by comparison of results from actual trials made with different materials. In this way it has been possible to deduce certain general rules for the selection of the correct abrasive and best kind of abrasive tool for a particular class of work.

Abrasion is defined as the wear away of one body by another of harder material. The body of harder material is then known as an abrasive, and this term may be applied in its true sense when referring to certain grinding and polishing materials. In its specific sense, when used in connection with modern artificial abrasives, the term is incorrectly applied, as these materials cut rather than abrade. The term "abrasive" has, however, been given a wider significance, and now includes generally all materials used in the grinding or polishing of other substances.

Natural Abrasives.

The first materials used by man as abrasives were found in Nature's store, and were used in their natural state; or in other words, were natural stones. They were employed principally in the production and preservation of edge tools, and to these the term abrasive was certainly correctly applied as the desired results were obtained by a tedious rubbing process between the abrasive and the softer material.

With the advance of knowledge in connection with the applied arts, a more rapid method of abrasion was sought. This was found in the grindstone, which consisted of a block of natural sandstone hewn into the form of a disc several inches in thickness and provided with a central arbor hole. The stones were mounted on a shaft and rotated slowly by means of a crank fastened on the same shaft. The results obtainable from such an arrangement were far superior to those obtained from any method previously employed. The use of the natural stone wheels was limited very largely by the fact that they did not have the physical properties, strength, etc., required for the effective grinding of metals. Grindstones in their original form, and improved by the power drive, are however, still in use, and a reason for this may be found in the fact that the machinery required to operate them is of the simplest form.

The next important advance was made when certain natural materials possessing abrasive properties, but found in Nature in a form unsuitable for use, were crushed to grain of a desired size, mixed with a bonding material and the mass moulded into the form of a wheel. Such wheels could be operated at a considerably higher peripheral speed than was possible with the grindstone, and could be made of materials possessing higher abrasive qualities.

Emery.

One of the first materials to be used and to become of value for the production of this new and improved form of abrasive tool was emery. Emery is a material many times harder and tougher than the abrasive constituent of sandstones, and is the intimate mechanical admixture of corundum and either hematite or magnetite, both of these latter mentioned minerals being compounds of iron and oxygen. Its value as an abrasive depends upon the amount of corundum present. It is extremely tough, and were it not for the fact that the emery obtainable from Nature's store varies considerably in quality, and is often high in impurities, it would be of high value for certain classes of grinding.

As a binding material for these abrasive grains hydraulic cement was first used in an attempt to imitate the natural stone. Such attempts met with only limited success and a further step was made in the adoption of organic or vegetable substances, such as rosin, sulphur, rubber and shellac, as well as silicate of soda, the three latter mentioned materials being successful to a certain extent.

Such bonds, although still found to be of value in the preparation of grinding wheels for special work are not adapted for grinding operations where large quantities of material are to be rapidly removed. Their failure is attributed to the fact that the range of possible grades of binding is limited with such materials. The cost of such materials is also excessive.

As the grinding wheel came to be considered more and more as an indispensable tool in the working of metals, improvements were rapidly made in the method of bonding the abrasive grain. Bonding materials of a semi-abrasive nature were, therefore, substituted in the place of the vegetable bonds previously used. These bonds consisted principally of fusible clays which were mixed with the abrasive grain, the mass formed into the desired shape and then brought to a temperature, sufficiently high to vitrify the mass. The actual amount of abrasion performed by a binding material of this kind in an abrasive tool is believed to be negligible, and in fact has been shown to be productive only of heat. This applies to any binding material, but as a bond is necessary in the preparation of any abrasive wheel composed of an effective abrasive this factor must always be considered and reduced to a minimum. Such a result can be accomplished best with a vitrified bond. Difficulties were experienced with the bonding of emery grains with this type of bond as the impurities contained in the emery, together with the uncertainty of its quality, prevented the attainment of duplicate or even results.

Corundum.

Along with the development of better methods of bonding abrasive grain, other natural materials were substituted for emery, principal amongst them being corundum.

Corundum, which is an aluminium oxide, is found in Nature as crystals usually rough and rounded, or massive with nearly rectangular partings. There are many varieties of corundum, of which the ruby, sapphire and emerald are of the gem class. Corundum is, as has already been stated, the abrasive constituent of emery, in which it is so finely divided that it cannot be separated from the other components.

Next to the diamond corundum is the hardest known material occurring in Nature. In Mohs' scale of hardness corundum is given as 9 compared with the diamond as 10. The hardness of corundum must not be confused with its abrasive efficiency, for although corundums vary but slightly in hardness, there is often a wide variation in the amount of abrasion which they are able to accomplish. The hardness represents the resistance of the corundum to abrasion, or to being scratched by another material, and also its power to scratch another substance. A fragment of corundum entirely free of decomposition may when tested prove to be of a hardness represented by 9, but to have a cutting efficiency that is very much lower than that of another piece whose hardness is just the same. The abrasive efficiency of a mineral or substance depends upon its hardness and fracture. The fracture should be irregular and not along parting planes as is often the case with corundum, in other words, the cutting efficiency depends upon that property which enables it to retain a sharp edge, and many that exhibit it in the first stages of crushing do not show it in the finer fragments or grain.

As corundum is a product of nature it is often associated with foreign materials which are always softer than the corundum itself. These foreign materials, if present in large quantities, affect the abrasive efficiency very materially. If present in small quantities, the abrasive efficiency of the grain is not affected to any extent, but such impurities are found to be very objectionable when attempts are made to bond such grain into an abrasive wheel by means of a vitrified bond.

In the earth's make-up certain grades of corundum are obtainable which are suitable for abrasives, and by proper selection it is possible to obtain a grade of corundum of a fairly uniform quality, but as parting planes of fracture exists to a large extent in all corundums, its abrasive efficiency is effectively reduced by this factor. If it were not for this fact corundum would be of exceedingly high value in the grinding of materials possessing toughness.

Garnet.

Before leaving the subject of natural abrasives it is necessary to mention garnet, as this material although of no great importance in the grinding of metals, has been found to fill an important place in the grinding or sanding of wood. For this class of work the garnet grain, after being thoroughly cleaned, is affixed to the surface of either cloth or paper, by means of suitable glues, and is in this way used either in the hand or in the form of belts or discs mechanically driven. As garnet has a low point of fusion it is impossible to bond the material in the form of wheels with anything other than vegetable and silicate of soda bonds. This fact limits its value considerably, although there is a possibility that with a suitable vegetable bond, abrasive wheels might be made with garnet grain to successfully grind the softer metals.

In the scale of hardness, garnet lies between 7 and 8. This particular degree of hardness does not, however, account for its high value in the grinding of wood. The more probable explanation of this peculiar property is found in the fact that a fragment of garnet is seldom solid, but fractured along irregular planes. This property permits the grain to be easily broken down so that sharp cutting edges are always in contact with the fibrous material being ground.

Quartz.

Quartz is also used in a way similar to garnet for the rubbing and sanding of wood, but it is not found to be of such high value for this class of work as garnet. The material is, however, more cheaply procured than garnet and is consequently used considerably.

Artificial Abrasives.

There are several reasons for the superiority of an artificially produced abrasive material, over those obtained from Nature's store. Principal among these is the possibility of obtaining a far more uniform and pure product by artificial means than can be found in the earth's make-up. The regular cleavage existing in some natural abrasives can be eliminated in the artificial, and the reduction of the abrasive efficiency from this source overcome. Further, artificial abrasives have been produced possessing far greater hardness and abrasive properties than anything that nature has supplied, with the exception of the diamond. The difficulties caused by the impurity and un-uniformity of the natural abrasives had attracted the attention of many prior to 1891, in which year Mr. E. G. Acheson discovered an entirely new substance, silicon carbide, better known under the trade name as Carborundum. The discoverer of this new material quickly realized its possibilities in the abrasive field, as it was found to possess a hardness far above that of anything found in Nature, with the exception of the diamond.

Silicon Carbide.

Silicon carbide is a material composed of one atom each of silicon and carbon. These two elements are driven together by means of the high heat of the electric furnace and the resultant material is found to possess a hardness nearly equal that of the diamond, or from 9.6 to 9.7. In addition to its extreme hardness, silicon carbide possesses the characteristic of sharpness. This characteristic is accounted for by the fact that the crystal has an irregular fracture and always breaks down into fragments with sharp cutting edges. The combination of these two properties, hardness and sharpness, make this material an ideal abrasive for the grinding of cast iron, chilled iron, bronze, brass, granite, marble, etc. Silicon carbide is slightly more brittle than the diamond and to this property may also be attributed its extreme sharpness. Made at a temperature of approximately 2200 degrees C., the grain is not affected by fusion with the proper clays, and vitrified wheels are successfully made. The purity of the final product can be controlled within definite limits, so that uniform results can be obtained.

Silicon Carbide is found on the market under several trade names, principal among these being Carborundum and Crystolon.

Artifical Aluminous Abrasives.

In the manufacture of this class of abrasives highly aluminous clays are fused in an electric arc furnace in such a way that the impurities contained in the raw material are reduced, and a product consisting of almost pure aluminium oxide in crystalline formation is obtained. The crystallization of such material is irregular. This fact which is common to all artificially produced abrasives is explained by a consideration of the probable differences in the rate of crystallization of a body produced artificially and by natural means. In the latter case the crystallization has obviously been slow, and consequently well developed crystals are formed along well defined lines. The crystallization of an artifically produced material is more rapid with the result that the crystals formed are irregular and possess irregular fractures. Abrasives, of the artificial aluminous class, are characteristically tough, fracture into sharp irregular crystals and do not possess the regular cleavage common to the natural aluminous abrasives. The hardness of such materials lies between 9.1 and 9.2, which is above that of the natural corundum. Artificial aluminous abrasives are successfully bonded by the vitrified process, and have been found to give excellent results in the grinding of steel and metals possessing extreme toughness. Abrasives of this class are found on the market under the trade names of Aloxite, Alundum, Adamite, Abrasite, Borocarbon.

Scale of Hardness.

A more careful consideration of Mohs' scale of hardness to which reference has already been made is necessary at this point for a clearer understanding of the differences existing between abrasives. This scale of hardness was introduced by Mohs, a German mineralogist. Mohs chose ten commonly occurring minerals, each of practically constant hardness. These were arranged in order according to their ability to scratch or abrade one another. For the softer of these materials "Talc" was chosen and given a hardness equal to "1," and placed at the bottom of the scale. "Gypsum" was found to have the ability to scratch talc, but was not hard enough to scratch "Calcit." Gypsum was therefore given a hardness equal to "2" on this scale and followed by "Calcit" with a hardness of "3." The other minerals were then placed in position upon this scale according to their ability to scratch other substances, or to be scratched by them. In this scale the diamond was placed at the top and given a hardness equal to "10." Corundum (sapphire variety) was placed next below it and given a hardness of "9." The Topaz followed in line with a hardness of "8." Here it should be noted that owing to the imperfection of this scale, the actual difference existing betaween a hardness shown as "9" and one shown as "10" is considerably more than between "9" and "8." This is accounted for by the fact that minerals with a hardness greater than "9" are not common, and because of the experimental difficulties in determining the hardness of such substances. It is, however, generally conceded that the difference "9" to "10" is approximately equal to the difference "1" to "9." Carbide of silicon is therefore probably two or three times harder than the next below it, or those of the class of artificial aluminous abrasives. These in turn are considerably harder than the natural corundum, although their position on the scale is only slightly removed. Mohs' scale of hardness does not give an accurate figure for the hardness of a body, but simply shows its hardness relative to another body.

When choosing the correct abrasive to perform a particular grinding operation it is necessary to carefully consider the properties of the material to be ground. As has already been stated, the hardness of an abrasive is not always the determining factor, for if this were so the hardest would give the best results under each and every condition.

A vital factor to be considered in connection with any grinding operation is the production of heat. The production of a certain amount of heat is common to every grinding operation. This heat can, if produced in excess, work disadvantageously by either burning or drawing the temper of the material being ground, or by causing the grinding tool to fill with the overheated material which it is removing. The production of heat is dependent upon three factors; first, the ultimate strength of the material being ground; second, the rate of removal of stock; third, the contact area of the grinding tool with the work.

If we attempt to use an abrasive possessing the qualities of extreme hardness and sharpness to grind a material which is tough and of high tensile strength, we find that excessive heat is generated; in other words, the amount of work performed by such an abrasive upon the metal of high tensile strength has been sufficient to produce excessive heating, with the result that the abrasive tool is ruined by filling, or the work burned.

To successfully perform any grinding operation it is of course essential that the abrasive grains used are bound together with a suitable binding material, and that the grade or degree of binding should be adapted to the particular operation. In addition to a correct selection from the great variety of grades made possible in an abrasive tool by a variation of the amount and type of bond used, it is also essential that the abrasive should possess the required properties. For the grinding of hard materials which are of a low ultimate strength, or such materials which are not easily fused, the hardest abrasive is successfully used. When, however, materials of high ultimate strength, or materials which are characteristically tough, such as steel or malleable iron, are to be ground, superior results are obtained from a softer abrasive, such as found in the artificial aluminous class, as the penetration under a fixed or constant pressure would depend to a large extent upon the hardness of the abrasive. Upon the extent of this penetration depends the amount of work done and also the amount of heat generated. Although a deep penetration is permissible in the case of a material of low ultimate strength, or one that is not easily fused, it is liable to produce excessive heating in the case of materials of high ultimate strength.

Another characteristic which is essential to an abrasive for the successful grinding of steel is toughness. This property is possessed in a marked degree by abrasives of the artificial aluminous class, and is responsible to a certain extent for their superiority for the grinding of tough metals, over the harder but less tough abrasive "Silicon Carbide." This characteristic is obviously essential to the successful grinding of such materials when we consider the necessity of the abrasive grain holding the bite or depth of penetration taken and carrying it across the contact area of the tool with the work. If an abrasive grain is not sufficiently tough to hold such a cut and withstand the strain put upon it by the resistance of the material being ground, it will fracture too rapidly, or before it has had sufficient time to perform the work required of it. Such a condition would result in an excessive wheel loss without the required removal of material. The slightly softer but tougher artificial aluminous abrasive is favored in this respect in two ways when called upon to grind materials of high tensile strength; first, as the slightly softer material does not penetrate or bite into the material being ground, to the extent of a harder abrasive, the depth of bite and consequently the strain put on the grain is not as great as would be the case with a harder material. Secondly, with superior toughness it is able to hold the cut or bite taken, which in the first place is not as great as would be the case with the less tough but harder and sharper abrasive.

The necessity of selecting the correct type and grade of bond has already been referred to. For such a selection a knowledge of the actual conditions under which a grinding operation is to be performed is essential. The grade or degree of binding required in an abrasive wheel is governed to a large extent by the amount of dressing action present in the operation. The contact area of the wheel with work, the relative speed between wheel and work, as well as the depth of the cut and the condition of the surface being ground, all tend to control the amount of dressing action produced. These must all be considered in addition to the properties of the material being ground and the final finish required. Other important factors are the application of the abrasive wheel to the work and the construction of the grinding machinery used. If the work is automatically applied to the wheel a far more loosely bonded wheel can be used than is required to grind similar materials applied by hand, as the dressing action in the former case is far less than in the latter. For precision work rigidly built machinery is absolutely imperative to the production of satisfactory results. This factor must receive consideration when selecting the correct abrasive wheel for such work, as vibration increases the dressing action upon the wheel considerably.

In general, the successful bonding of the correctly chosen abrasive grains into the form of an abrasive wheel or tool depends upon the property of the bond used to break down at the proper rate. This rate should be sufficient to allow each abrasive grain to perform the maximum amount of work possible to such a grain before it is released from the mass of the wheel. It should also be sufficient to prevent the wheel from glazing. In other words, the grade or hardness of the abrasive tool should be sufficient to permit a rate of wearing away which will at all times leave a sharp cutting surface on the abrasive tool and allow for a maximum utilization of the cutting possibilities of each grain of abrasive material. The actual type or characteristics of hardness and toughness possessed by the bonding materials used plays an important part in the success of an abrasive wheel. The size of the grit selected for a particular grinding proposition is also a matter of vital importance, as upon this factor will depend to a large extent the rate of removal of material, and consequently the heat developed. The final finish depends also upon this factor, and is often a limiting condition.

It is a general practice among abrasive wheel manufacturers to signify the size of the abrasive grain used by adopting numerals representing the number of the screen through which the grit designated has passed. These screens are numbered in accordance with the number of meshes per lineal inch, so that a grit or grain designated as No. 24 would imply that the grit had passed through a No. 24 mesh screen, but would not pass through the next finer mesh used in the system.

In the class of artificially produced aluminous abrasives and in Carborundum we have a combination of characteristics required by abrasives for the successful grinding of metals of the hardest as well as the softest varieties, and those of the lowest as well as the highest tensile strength. By properly binding such materials to suit the actual conditions found in any grinding operation, results have been obtained which have been shown to be far superior to anything obtained by the use of natural abrasives, both as regards rapidity of production and economical working.

With such materials it has been possible to successfully perform grinding operations beyond the limits of possibility with natural abrasives.

Although the choice of the proper grinding wheel for the general line of grinding operations common to the foundry does not require the extreme care necessary for a successful selection in the case of fine or precision grinding; nevertheless, careful consideration should be given to every detail of each operation.

With information to the effect that a certain wheel to run at a normal speed of say 5,000 surface feet is required to grind cast iron, it is not always possible for a wheel manufacturer to supply the right wheel. The actual grade of the cast iron used should be specified in such a case. Stove castings for instance are made of a mix to produce a fine grain, even iron; machinery castings are often made of a similar grade. In a so-called job foundry the grade of metal will show greater variation and as a rule run coarser and harder. Other conditions being equal, it is found, it is found to be possible to use a harder wheel to grind fine soft iron than is required for the harder, coarser metal, with equally rapid results.

The size and form of the castings, together with the amount of material to be removed, will also play an important part in the grading of such wheels.

Grinding of Cast Iron Castings.

As a general rule it is found that a wheel composed of Carborundum of a grit represented by from 16 to 24 and bonded with a high or hard bond, will give excellent results for the grinding of cast iron. The coarser grit wheel is generally used on the heavier castings where large amounts of material are to be removed; the finer grit wheels for the smaller and lighter castings.

Grinding of Malleable Iron Castings.

When malleable iron castings are to be ground the details of each operation should be more carefully considered than in the case of cast iron, as actual experiments have shown that the quality and texture of malleable irons met with in different foundries vary considerably. As in the case of cast iron, coarser wheels are used on the heavier castings and finer wheels on the smaller. With this material, as with steel, abrasives of the artificial aluminous class have been shown to give superior results to carbide of silicon for reasons already stated. On heavy castings grits as coarse as 8 and 10 are found to give the best results when bonded with a hard and tough bond. In some foundries it is a practice to grind or finish small malleable castings in the hard before they are annealed, and for this class of work the harder abrasive, Carborundum, has been found to be superior.

Grinding of Steel Castings.

For the grinding of steel it is generally found that a harder bound wheel is required than for malleables. It is also found that a considerably harder wheel is required for use on a swing frame grinder than is required for a stand grinder operation.

Grinding of Brass and Bronze.

For the grinding of the general line of castings found in a brass foundry such extreme care in selection of a grinding wheel is not necessary, as the same wheel, properly selected, will take care of all kinds of such grinding, with the exception of perhaps straight aluminum or copper. For this class of work a softer wheel is essential.

As a general rule the grinding machinery used in foundries does not receive the attention which is necessary to the production of economical results. A loose bearing, or vibration in the spindle of a grinding machine is very liable to cause uneven wearing on the wheel. This uneven wearing of an abrasive wheel is often attributed to faults in the bonding, or unevenness in the wheel, whereas the actual source of the trouble lies in the grinding machine and not in the grinding wheel. Vibration in a machine spindle will reduce very effectively the life of a wheel, even though uneven wearing does not take place.

The peripheral speed of an abrasive wheel should also be kept as nearly constant as possible and the machine speed changed to produce this effect as the wheel is reduced in diameter by wear. The actual speed at which the wheel is operated should be as specified on the tags supplied with the wheels by the manufacturers.

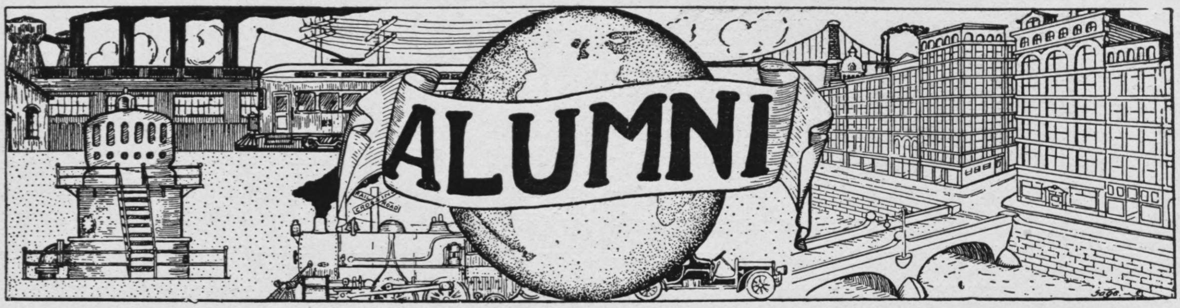
It is also very commonly found that the use of the dresser is abused in foundry practice. Wheel operators are often allowed to dress their own wheels, and if the amount of material removed by such means was carefully checked up it would be found that more of the wheel was lost from this source than by the actual grinding operation. By placing the care of abrasive wheels under a competent man it has been shown in numbers of cases that an increase in the life of an abrasive wheel used as high as 150 per cent. can be obtained. If it is absolutely necessary to frequently dress a wheel it is obvious that the wheel is not suited for the particular operation, as a correctly graded wheel should not require frequent use of the dresser.

Another important feature is the necessity of providing sufficient power to a grinding machine to enable the wheel to retain its constant speed and not slack up as excessive pressure is applied on the work.

Finally, as abrasive tools and abrasives in general have now reached such a high degree of perfection, it is necessary that the same amount of care should be exercised in their choice and preservation as is commonly given to other precision tools.

RELATIVE EFFICIENCY OF STEAM, GAS AND OIL ENGINES.

Roughly stated, a first-class modern steam engine utilizes about 12 per cent. of the available heat in the coal, resulting in, say 1.6 to 1.7 lb. of fuel per b.hp.hr. during a week's work of 55 hours. If the boilers are to be fired by producer gas, for which purpose slack and dust can be used, then each brake horsepower will require about 2 to 2.2 lb. of coal. Internally fired gas and oil engines are approximately twice as efficient as steam engines, which means that they utilize about 25 per cent. of the available heat. Crude oil being 37 per cent. better than good ordinary coal, oil engines should use only about three-eights as much oil as the coal mentioned above, say about 0.6 lb. per b.hp.hr. Then, however, as there are no boiler radiation losses over night, a material saving results and the oil consumption per week of 55 hr. may be about 0.5 lb. per b.hp.hr. Petrol and similar internal combustion engines would require about 0.4 lb. per b.hp.hr. Gas engines have also about the same efficiency as oil engines; but as there is a loss of about 20 per cent. in the producers, if these work day and night, and another loss of quite 10 per cent. if they have to stand idle over night, the efficiency of gas engines is only about 40 per cent. better than that of first-class steam engines.—*Power.*



MORE FROM PANAMA.

IN a letter from L. W. Lewis '13, who is in the government employ on the Panama Canal, he says that everything is astir in anticipation of the official opening of the Canal, which takes place in March. Everyone on the Isthmus is holding a hot iron of some sort; the Quartermaster's Department is busy with a large grandstand, the Municipal Engineering Division is working seven days each week to complete roads, streets, etc., the Electric Department is busy with maps, lamp post designs, etc., while the Dredging Division is making a great effort to clean up the slides.

The government has recently ruled that all of the employes must undergo a medical examination in the effort to weed out all of the habitual hospital visitors, and medicine topers, in order that it may be a more healthful and consequently efficient machine. In the execution of this order some consumptives and typhoid carriers were found and even traces of insanity were discovered. Of course reservations were made for them on the first boat north, and many others who were discovered and did not care to advertise their weaknesses voluntarily sailed. This bit of news may set at rest some notions of laxness in conditions in the Canal Zone. If anything it emphasizes the rigidity which characterizes so many of the governments establishments.

TECH CLUBS ENTERTAIN BASKET-BALL TEAM.

THE Louisville Rose Tech Club entertained the basket-ball team after the University of Louisville game, with a four-course dinner at the Hotel Watterson. The members of the team were very much pleased both by the nature of the entertainment and by the hospitality of the members of the club, who kept the whole team at their respective homes for the night.

The Indianapolis Tech Club attended the Butler game in a body and ate dinner together at the Marion Club before the game. The team was invited to eat with the Club, but only Mr. Wischmeyer and Manager Compton were able to accept, as the players could not eat dinner just before the game.

Alumni Notes

Announcement has been made of the engagement of Mr. Alexander P. Nicholson '12, to Miss Mabel G. Denniston of Beverly, N. J. Mr. Nicholson is employed as mechanical engineer by the Riverside Metal Co., at Riverside, N. J.

Mr. Edward A. Darst '95, died Jan. 24, at his home near Eureka, Ill. Mr. Darst was born April 27, 1869, and graduated in the Electrical Engineering Course in 1895. After graduation he took up farming at his home near Eureka, and continued there until his death.

LATEST CHANGES IN ALUMNI LOCATIONS.

Joseph F. Cronin, '13, with Atchison, Topeka & Santa Fe R. R. at Marceline, Mo.

S. N. Crowe, '13, engineer for I. E. Smith, Richmond, Ind.

Harry L. Deck, '13, with Union Seed and Fertilizer Co., Little Rock, Ark.

Harold O. Kelley, '13, with C. & E. I. R. R. at Salem, Ill.

C. G. Kronmiller, '13, with Fort Wayne Mfg. Co., Fort Wayne, Ind.

R. E. Lawrence, '13, with General Electric Co. at Lynn, Mass.

D. Levi, '13, with Greaves, Klushman Tool Co., Cincinnati, Ohio.

Raymond M. Ostrander, '13, with Westinghouse Electric Mfg. Co., Pittsburg, Pa.

Chas. N. Templeton, '13, secretary-treasurer of Linton-Summit Coal Co., Linton, Ind.

K. V. Wood, '13, with C. C. C. & St. L. R. R. at Bellefontaine, Ohio.

F. W. Bringman, '14, assistant manager of Consumers' Ice & Coal Co., Pine Bluff, Ark.

Vere S. Calvin, '14, with Engineering Corps, Vandalia R. R., St. Louis, Mo.

G. M. Derr, '14, with Central Pennsylvania Lumber Co., Williamsport, Pa.

C. A. Dutton, '14, with Curtis & Co., St. Louis, Mo.

James T. Hallett, '14, student Indiana State Normal School, Terre Haute, Ind.

C. F. Harris, '14, with Tucker & Laxton Co., Charlotte, N. C.

I. L. Kauffman, '14, with Frank Prox Co., Terre Haute, Ind.

C. C. LeForge, '14, chemist with the Peoples Gas & Light Co., Chicago.

F. M. O'Laughlin, '14, with signal dept., Northern Pacific R. R. Co., Plains, Mont.

W. M. O'Laughlin, '14, with signal dept., Northern Pacific R. R. Co., Sand Point Idaho.

E. O. Poggensee, '14, with Butte & Superior Copper Co., Butte, Mont.

H. E. Ransford, '14, with Turner Bros. Co., Terre Haute, Ind.

G. E. Shopmeyer, '14, with Engineer Corps, Vandalia R. R. Co., Terre Haute, Ind.

J. B. Tygart, '14, with Monon Coal Co., Terre Haute, Ind.

A. G. Shaver, '91, formerly Signal Engineer of Rock Island Lines, now secretary of Hallett Iron Works, Chicago.

A. A. Grieger, '03, formerly resident engineer of Louisville Water Co., now with the Paradis Construction Co. of that city as engineer.

F. N. Rumely, '03, formerly with Curtis & Co., Mfrs., St. Louis, now president of the Western Engineering Sales Co., Los Angeles.

G. H. Crane, '04, Cost Engineer of Portland Gas & Coke Co., Portland, Ore.

Robert D. Landrum, '04, manager of the Service Department Harehaw, Fuller, Goodwin & Co., Cleveland.

J. S. McBride, '05, assistant engineer in charge of Federal Valuation of C. & E. I. R. R., Chicago.

R. B. Evans, '06, engineer with Sperry Gyroscope Co., New York.

E. P. Lee, '06, with Remy Electric Co., Anderson, Ind.

H. H. Boyd, '08, with Southern Railway Co., St. Louis, as junior engineer.

F. W. Corson, '08, with the Western Electric Co., Chicago.

James M. Darst, '09, with the Toledo & Indiana Railway Co., at Wauseon, Ohio.

W. L. Edwards, '10, salesman and engineer of Farquhar Furnace Co., Wilmington, Ohio.

Donald B. Rush, '10, with J. F. Wallace, Consulting Engineer, Chicago.

J. A. Shepard, '10, manager Deming Ice & Electric Co., Deming, N. Mexico.

G. F. Standau, '10, with Milwaukee Railway & Light Co., Milwaukee, Wis.

T. Christopher, '11, superintendent of the Turnbull Wagon Co., Defiance, Ohio.

W. L. Clore, '11, with American Cotton Oil Co., St. Louis.

D. G. Evans, '11, in the U. S. Fire Service at Denver.

E. L. Ferrill, '11, draughtsman for the N. C. & St. L. Railway, Nashville, Tenn.

C. Nagel, '12, with Morris & Co., Chicago.

P. A. Newhart, '11, with Tucker & Laxton, Charlotte, N. Carolina.

C. O. Fairchild, '12, assistant chemist with the Portland Cement Co., Independence, Kas.

F. E. Meyer, '12, with the C. A. Dunham Co., Marshaltown, Iowa.

C. P. Rommel, '12, chemist with Bradley, Vroom & Co., Chicago.

B. S. Kelso, '08, in charge of the Chiriqui Railway project in Panama.

MICHIGAN STUDENTS DRY.

By affirming the conviction of Lawrence Damm, an Ann Arbor saloon keeper, found guilty of selling liquor to University of Michigan students, the state supreme court has placed the ban on undergraduate liquor drinking in the university town.

"The statute forbids the sale of liquor to any student in attendance at any public or private institution of learning in the state," said Justice Ostrander, who wrote the opinion. The court explained that adult students would be denied drinking privileges the same as citizens living in a local option county may be denied rights enjoyed by their neighbors in an adjoining county.—*Ex.*

The University of Pennsylvania has passed a resolution whereby a college degree will be required for entrance into the law school of that university. This action makes the standard of admission as high as that of any school in the world.—*Ex.*

The Senior class at Ohio State is contemplating donating a "Westminster Clock" to the school as a memorial. They have probably been looking at our junior memorial.

STUDENTS BETTER FARM HANDS.

College students are the most efficient and dependable harvest hands, said W. L. O'Brien, commissioner of labor for Kansas. "We correspond with about thirty colleges each spring," he said. "The boys come in bunches and work intelligently. When they finish in one locality they telegraph to headquarters asking where to go next."—*Ex.*

Brown, New York University, and University of Michigan alone can claim the distinction of having married men members of the varsity football teams, which represented their institution this fall.—*Case Tech.*

We also claim the distinction of belonging to this class; Pirtle '15, having been a valuable lineman on last fall's eleven, and also on the teams of his freshman and junior years.

DOES EDUCATION PAY

The average income of the uneducated man in the United States is $450 per year; of the man with a common school education, $750; of the man with a high school education, $1,000, and of the college graduate, $2,000, says a writer for the Wyoming University Bulletin.

ROSE LEAVES

THE NEW COURSE OF STUDY.

THE revision of the courses of study is completed and is published for the first time in this issue of THE TECHNIC. The rearrangements and changes are all introduced chiefly in order to make possible more intensive work and the turning out of men just a little better prepared to cope with engineering problems, and also a little more broadly educated than heretofore.

The entrance requirements have been changed in order to exphasize the advantages of more thorough elementary training in the direction of languages. Students with four years of Latin can now enter without any conditions, and French is made elective instead of required for students so prepared.

One of the most important additions to the course is the introduction of increased requirements in English, in which the old course was deficient. The requirement has been raised from one credit to three, distributed through the Freshman and Sophomore years. It is contemplated that a portion of the time will be used to give training in argumentation and presentation of reports.

The arrangement whereby a portion of the shop practice of the Freshmen and Junior years has been shifted to the summer vacation is one that will be of great benefit, both in securing greater efficiency in shop practice and in relieving the overloaded schedule by cutting down the long blocks of practice. This practice will occupy two weeks, either immediately after the closing of school in June or just before the resumption of class work in the fall. In this way the subjects can be redistributed so as to avoid overloading in any one term, and the new arrangement will also give opportunity for better and more thorough preparation for recitations and lectures.

FRESHMAN YEAR

FIRST TERM

COURSE IN	M		E		C		A		Ch.	
SUBJECT	R	E	R	E	R	E	R	E	R	E
French	4	...	4	...	4	...	4	...	4	..
Drawing—Freehand	1	1	1	1	1	1	1	1	1	1
Algebra } Trigonometry }	6	...	6	...	6	...	6	...	6	..
Mechanics	3	...	3	...	3	...	3	...	3	..
Chemistry	2	...	2	...	2	...	2	...	2	..
Chemical Laboratory	...	1	...	1	...	1	...	1	...	1
Methods of Computing	...	1	...	1	...	1	...	1	...	1
Practice—Shop	2	...	2	...	2	...	2	...	2	..
	18	1	18	1	18	1	18	1	18	1

SECOND TERM

French	...	2	...	2	...	2	...	2	...	2
German	4	...	4	...	4	...	4	...	4	..
English	1	...	1	...	1	...	1	...	1	..
Drawing Mechanical	2	...	2	...	2	...	2	...	2	..
Calculus } Conics }	2	...	2	...	2	...	2	...	2	..
Spherical Trigonometry	...	1	...	1	...	1	...	1	...	1
Projective Geometry	...	2	...	2	...	2	...	2	...	2
Advanced Algebra	...	1	...	1	...	1	...	1	...	1
Chemistry	2	...	2	...	2	...	2	...	2	..
Chemical Laboratory	2	...	2	...	2	...	2	...	2	..
Physics	2	...	2	...	2	...	2	...	2	..
Practice—Civil	...	...	...	...	3	1	...	...	...	..
Practice—Architecture	...	...	...	...	...	...	3	1	...	..
Practice—Chemistry	...	...	...	...	...	...	...	...	5	..
Practice—Shop	3	...	3	...	1	...	1	...	1	..
	18	1	18	1	19	...	19	...	19	..
Vacation: Shop Practice	2	...	2	...	2	...	2	...	2	..

A few new subjects have been introduced, the object throughout being to develop and strengthen the courses. Additional work is required in certain departments, notably in Drawing and Machine Design. Physics especially in the Junior year has been divided between the two terms so that it will not be necessary to take up two entirely new subjects at the same time. Elementary Geology has been introduced for Civil and Architectural Engineering courses, since it is recognized as imperative that students in these courses should know something of the geological character of building materials. The requirement in Applied Mechanics has been removed from the Chemical Engineering course, and the work of use to those in this line will be given in

SOPHOMORE YEAR

FIRST TERM

Course in	M		E		C		A		Ch.	
Subject	R	E	R	E	R	E	R	E	R	E
French	...	3	...	3	...	3	...	3	...	3
German	3	...	3	...	3	...	3	...	3	..
English	1	...	1	...	1	...	1	...	1	..
Drawing—Mechanical	1	...	1	...	1	...	1	...	1	..
Drawing—Freehand	...	1	..	1	...	1	...	1	...	1
Descriptive Geometry	2	...	2	....	2	...	2	...	2	..
Calculus } Analytic Geometry }	4	...	4	...	4	...	4	...	4	..
Quaternions	...	1	...	1	...	1	...	1	...	1
Physics	1	...	1	...	1	...	1	...	1	..
Mineralogy	...	1	...	1	...	1	...	1	1	..
Geology	...	2	...	2	2	...	...	2	...	2
Chemistry—Organic	...	...	...	...	...	...	...	...	2	..
Civil Eng. Camp	...	...	...	...	...	2	...	...	...	..
Practice—Civil Eng.	...	...	...	...	3	...	...	...	...	..
Practice—Architecture	...	...	...	...	...	...	3	...	...	..
Practice—Chemistry	...	...	...	...	...	...	...	...	3	..
Practice—Shop	2	...	3	...	...	...	...	...	...	..
	15	4	15	4	17	2	17	2	18	1

SECOND TERM

Subject	M R	M E	E R	E E	C R	C E	A R	A E	Ch. R	Ch. E
German—Scientific	3	...	3	...	3	...	3	...	3	..
English	1	...	1	...	1	...	1	...	1	..
Drawing—Mechanical	1	1	1	1	1	1	1	1	1	1
Descriptive Geometry	...	2	...	2	...	2	...	2	...	2
Calculus } Analytic Geometry }	4	...	4	...	4	...	4	...	4	..
Solid Analytics	...	1	...	1	...	1	...	1	...	1
Electricity	3	...	3	...	3	...	3	...	3	..
Dynamics	2	...	2	...	2	...	2	...	2	..
Chemical Laboratory	...	1	...	1	...	1	...	1	...	1
Chemistry—Organic	...	...	...	...	...	...	...	...	1	1
History of Architecture	...	...	...	...	...	...	2	...	...	..
Practice—Civil Eng.	...	...	...	...	3	...	...	...	...	..
Practice—Architecture	...	...	...	...	...	...	2	...	...	..
Practice—Chemistry	...	...	...	...	...	...	...	...	2	..
Practice—Shop	3	...	2	...	...	...	...	...	...	..
Practice—Electrical	1	...	1	...	1	...	1	...	1	..
	18	1	17	2	18	1	19	...	18	1

JUNIOR YEAR

FIRST TERM

Course in	M		E		C		A		Ch.	
Subject	R	E	R	E	R	E	R	E	R	E
Economics	1	...	1	...	1	...	1	...	1	..
Machine Design	3	....	2	...	1	...	1	...	1	1
Calculus	...	2	...	2	...	2	...	2	...	2
Applied Mechanics	3	...	3	...	3	...	3	...	...	..
Least Squares	...	1	...	1	...	1	...	1	...	1
Graphics	1	...	1	...	1	...	1	...	1	..
Physics—Heat	2	...	2	...	2	...	2	...	2	..
Valve Motions	2	...	...	1	...	...	...	...	...	..
Theoretical Electricity	...	...	4	...	...	...	...	...	...	..
Elem. Electrical Eng.	4	...	...	...	4	...	4	...	4	..
Applied Electricity	...	2	...	2	...	2	...	2	...	2
Electrical Laboratory	...	...	2	...	...	...	...	...	2	..
Chemical Technology	...	...	...	...	...	...	...	...	2	..
Chemistry—Physical	...	...	...	...	...	...	...	...	2	..
Retaining Walls	...	...	...	...	1	...	1	...	...	..
Practice—Civil	...	...	...	....	4	...	...	...	...	..
Practice—Architecture	...	...	...	...	...	...	4	...	...	..
Practice—Chemistry	...	...	...	...	...	...	...	...	4	..
Practice—Shop	2	...	...	...	...	...	...	...	...	..
	18	1	15	2	17	...	17	2	19	..
Vacation: Shop Practice	2	...	2	...	...	...	...	...	...	..
C. Eng. Camp	...	...	...	...	2	...	...	. .	...	..

SECOND TERM

Subject	M R	M E	E R	E E	C R	C E	A R	A E	Ch. R	Ch. E
German	...	1	...	1	...	1	...	1	...	1
Spanish	...	1	...	1	...	1	...	1	...	1
Machine Design	2	...	2	...	...	...	...	...	2	..
Applied Calculus	...	2	...	2	...	2	...	2	...	2
Applied Mechanics	3	1	3	1	3	1	3	1	...	..
Physics—Light	2	...	2	...	2	...	2	...	2	..
Physical Laboratory	2	...	2	...	2	...	2	...	2	..
Elem. Electrical Eng.	1	...	...	...	1	...	1	...	1	..
Steam	2	...	2	...	2	...	2	...	2	..
Chemical Technology	1	...	1	...	1	...	1	...	1	..
Mechanics of Machinery	2	...	...	...	...	...	...	...	...	..
Alternating Currents	...	...	2	...	...	...	...	...	...	2
Applied Electricity	...	...	...	1	...	...	...	...	...	..
Elec. Eng. Laboratory	...	...	1	...	...	...	...	...	...	..
Alter. Currents Lab	...	...	...	1	...	...	...	...	...	..
Dynamo Machinery	...	...	3	...	...	...	...	...	...	..
Strength of Materials	...	...	...	...	1	...	1	...	...	..
Stereotomy	...	...	...	...	1	...	1	...	...	...
Roads and Pavements	...	...	...	...	1	...	...	...	...	..
Electro Chemistry	...	...	...	...	...	...	...	...	2	..
Metallurgy	...	...	...	...	...	...	...	...	2	..
Practice—Civil	...	...	...	...	4	1	...	...	...	..
Practice—Architecture	...	...	...	...	...	...	4	1	...	..
Practice—Chemistry	...	...	...	...	...	...	...	...	4	1
Practice—Shop	...	1	...	...	...	...	...	...	...	..
	15	2	18	1	18	1	17	2	16	3

Graphics and Machine Design, in which the requirement has been increased.

Several courses requiring lecture and recitation work have been extended into the second term of the Senior year and recitation work will extend up to that time, to take the place of some of the office and shop practice now required.

The object of the revision is to strengthen the courses throughout and to increase the educational efficiency of the institute so as to turn out engineers who have had more time for study and reading and are consequently better equipped to enter actively into their chosen profession.

SENIOR YEAR

FIRST TERM

Course in	M		E		C		A		Ch.	
Subject	R	E	R	E	R	E	R	E	R	E
Machine Design........	2	...	1	...	...	1	...	1	...	1
Applied Mechanics.....	3	1	3	1	3	1	3	1	...	..
Thermodynamics.......	3	...	3	...	...	...	...	...	3	..
Hydraulics............	2	...	2	...	2	...	2	...	2	..
Engineering Laboratory	2	...	1	...	2	...	2	...	2	..
Heating and Ventilation	1	...	...	1	...	1	1	...	...	..
Power Transmission....	...	1	...	1	...	1	...	...	...	..
Dynamo Machinery.....	...	...	3	...	...	...	...	...	...	..
Electrical Laboratory ...	...	1	1	1	...	...	...	...	...	..
Materials of Construct..	1	...	1	...	1	...	1	...	1	..
Specifications and Cont.	...	1	...	1	1	...	1	...	...	1
Arches	...	...	...	...	1	...	...	...	...	..
Sewerage..............	...	...	...	...	1	...	...	1	...	..
Industrial Chemistry...	...	...	...	...	...	...	...	...	2	..
Electrical Design.......	...	...	1	...	...	...	...	...	...	..
Practice—Civil Eng.....	...	...	...	...	4	...	...	...	...	..
Practice—Architecture.	...	...	...	...	...	...	5	...	...	..
Practice—Chemistry ...	...	...	...	...	...	...	...	...	5	..
	14	3	16	1	15	2	15	2	15	

SECOND TERM

Machine Design	2	...	...	...	...	...	...	...	...	..
Higher Elec. Eng.......	...	...	1	...	...	...	...	...	...	..
Engineering Laboratory	2	...	3	...	2	...	2	...	1	..
Electrical Design	...	...	2	...	...	...	...	...	...	..
Gas Engines...........	1	...	...	...	...	...	...	...	...	..
Gas Analysis..........	1	...	...	...	...	...	...	...	...	..
Materials of Construct..	...	...	...	...	1	...	1	...	1	..
Thermodynamics	1	...	1	...	...	...	...	...	1	..
Eng. Problems—Chem..	...	...	...	...	...	...	...	...	1	..
Water Supply Eng......	...	...	...	...	2	...	...	...	...	..
Practice—Civil Eng.....	...	...	...	...	4	...	...	...	...	..
Practice— Architecture.	...	...	...	...	...	...	6	...	...	..
Practice—Chemistry....	...	...	...	...	...	...	...	...	5	..
Practice—Shop	2	...	2	...	...	...	...	...	...	..
Thesis	6	...	6	...	6	...	6	...	6	..
	15	...	15	...	15	...	15	...	15	..

STUDENT COUNCIL MEETING.

February 4, 1915.

MEETING called to order by President Brauns. Roll call: Anderson, Grafe, Hild, absent.

Financial Secretary made following report:

	Cr.	Dr.
Athletic Association		$129.19
Technic	$5.76	
Camera Club	1.76	
Symphony Club	4.51	
Scientific Society	9.40	
Y. M. C. A...............	10.00	
General Fund	105.63	

Election of Financial Secretary followed.

Nominations: Carlisle, Overpeck, Weinhardt.

Ballots: Carlisle 3, Weinhardt 4.

Moved by Compton, seconded by Wallner, that a special committee be appointed to confer with Dr. Mees concerning general assemblies.

Committee appointed to audit Arnold's books—Sanford, Wallner, Weinhardt.

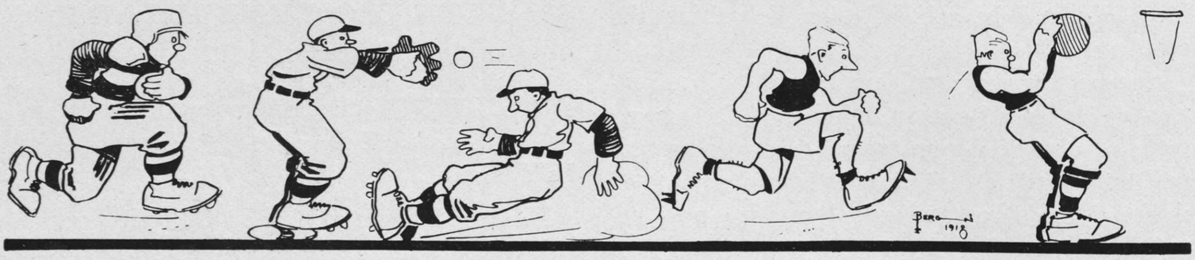
Moved by Stevens, seconded by Wallner, that meeting be adjourned.

Adjournment.

JOHN M. SANFORD,
Recording Secretary pro tem.

FOUR COLLEGES GET CASH.

Wabash College is to benefit to the extent of over $50,000 by the recently announced gift of John D. Rockefeller to the educational institutions of the United States, according to a preliminary report published Wednesday night. The local college, this report says, is one of four Indiana institutions which will receive a part of the fund the oil king has granted. According to the report, Wabash, Earlham, Franklin and DePauw will share the sum of $230,160, the Indiana portion of the great amount Rockefeller is giving.—*Butler Collegian.*



ATHLETICS

SO far the basket-ball season has had only one redeeming feature, and that, paradoxical as it may seem, was the Normal game in which we were defeated by our bitterest rivals. There was nothing humiliating about the loss of the game itself, for a game which requires two over-time periods before it is decided can scarcely be called a real defeat. The real glory of the evening belongs to the students of Rose Polytechnic, who while never wavering for a moment in their allegiance to the team, took defeat like sportsmen and gentlemen and so far as true sportsmanlike spirit was concerned, carried off the honors of the evening.

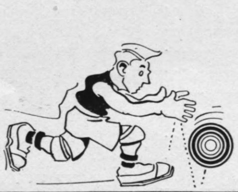
It can be truly said that so far as the Rose side was concerned there was not the slightest untoward word or action, in spite of the extremely trying circumstances, the close game and the state of nervous excitement on both sides. Ably led and controlled by Sammy Finkelstein, the gang stayed by the team to the last minute and went down with colors flying to the last, the only regret being that luck did not stop the game when the Engineers happened to be in the lead.

The season started most auspiciously with a victory over the strong Dental College team, which had previously defeated Butler. The final score was 69 to 21, the fast team work and accurate shooting of the Engineers utterly bewildering the tooth-pullers, who were simply not in the game at all after the first half.

The second game, that with the University of Louisville at Terre Haute, was the first great misfortune of the season. While not showing quite the class displayed in the first game, the team started with a rush and outplayed the Kentuckians throughout the first half, which ended 20 to 12 in our favor. In the second half the team lost its speed and its eye for the goal, missing shot after shot and the Louisville quintet romped home with the victory, 38 to 35.

The first road game was with Central Normal at Danville. The second team was used throughout the first half, which ended with the score 17 to 12 in favor of C. N. C. but in the second half the regulars came back strong and won out 33 to 31.

Then came the Normal game, the hardest fought, closest game ever seen in Terre Haute. The hall was packed and excitment was intense from start to finish. So far as team work was concerned Rose seemed to have a shade on the teachers, but the former were woefullly weak in shooting baskets, which practically



IT MAY LOOK THIS WAY TO THE CROWD, BUT—

cost them the game. In practically the last second of play, with the score 23 to 22 in favor of Normal, a foul was called on Royer and it was up to Hegarty to save the game. Save it he did, for the time being at least. The referee announced that a five minute overtime period would be played, and both teams went into the fray once more, fighting with every ounce of reserve strength. At the end of the five minutes the score was once more tied at 27 to 27 and a second period had to be played. The crowd was wild and the players simply battled man to man, with first one in the lead and then the other. In the last few minutes of play with Normal in the lead at 31 to 30, the teachers caged two lucky long distance throws and the game ended 35 to 30, but with all due credit to the victors for their well earned laurels, it was as close to a draw as any game ever played.

After the Normal game one misfortune tread upon another's heels. The Butler game at Indianapolis was lost 34 to 28, in spite of the fact that Butler was known to have a weak team—weaker by far than our own. The next trip was to Evansville and Louisville, the team meeting inglorious defeat at both places. In the return game with Central Normal, Rose won but with less than half the score that should have been run up. Then followed the slaughter at Bloomington at the hands of Indiana, the weakest team in the conference, of whom we have always previously been a feared rival.

The season so far is decidedly discouraging especially to Coach Wischmeyer, who has generously donated his services to the Athletic Association. Just where the weakness lies is hard to state. The material is as good or better than has ever before been in school, but they lack the ability to fight through to victory. There is absolutely no excuse for a losing team and the general attitude of the players and its resulting showing is simply a reflection of the attitude of the whole Institute toward athletics.

—J. N. C.

SUMMARY OF THE GAMES.

Indiana Dental College at Terre Haute, January 12.

Rose 69. Dental College 21.

Barrett, Orr..........F............ Severin
Brown................F....Deakzine, Miller
Hegarty, Davis.......C............. Lartor
J. Carter ....G.............. Heck
Kingery, Risser.......G......Long, Gilmore

Field Goals—Barrett 8, Brown 7, Hegarty 10, Carter 6, Orr 3, Severin 5, Deakyn 3, Long 1. Foul Goals—Hegarty 1, Severin 2. Fouls called—On Rose 9, On Dental 2.

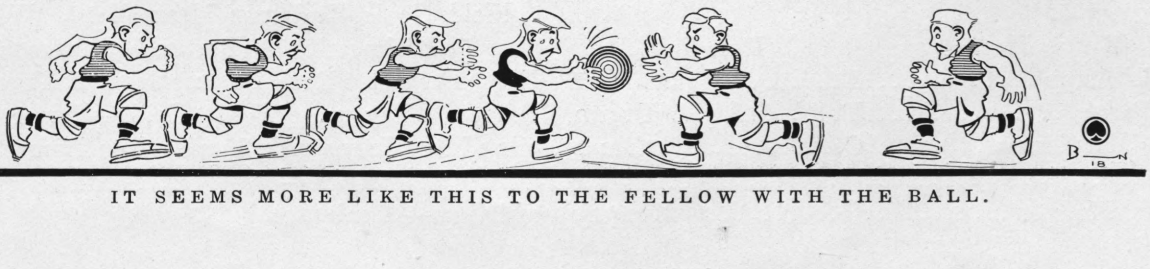
Referee, Bilyou. Timekeeper, Hathaway, Scorer, Stevens.

University of Louisville at Terre Haute, January 16.

Louisville U. 35. Rose Poly 28.

Rogers...............F........Barrett, Orr
Kornfeld.............F............. Brown
M. McDaniels ....C............ Hegarty
R. McDaniels, J. Mc-
Daniels ....G.......Carter, Capt.
McCaleb ....G........... Kingery

Field Goals—Rogers 4, Kornfeld 9, M. McDaniels, J. McDaniels, Barrett 2, Brown 4, Hegarty 7, Carter. Foul Goals—McCaleb 5. Referee—Billyou. Timekeeper—Hathaway. Scorer—Wann.



IT SEEMS MORE LIKE THIS TO THE FELLOW WITH THE BALL.

Central Normal at Danville, January 20.

Rose Poly 33.		Central Normal 31.
Orr, Barrett	F	Thomas
Andrews, Brown	F	Peyton
Davis, Hegarty	C	Brown
Carter	G	Corner
Yatsko, Kingery	G	Small

Field Goals—Orr, Barrett, Brown 4, Davis, Hegarty 4, Yatsko, Kingery 2, Thomas 3, Peyton 6, Brown 6. Foul Goals—Rose 5; Central Normal, 1. Referee—Shelby. Scorer—Compton. Timekeepers—Henry and Thomas.

Indiana State Normal at K. of C., January 22.

Normal 35.		Rose Poly 30.
Schenck	F	Brown
Knaugh	F	Barrett
Stiffler	C	Hegarty
Wann	G	Carter
Royer	G	Kingery

Field Goals—Schenck 3, Knauth 6, Stiffler 3, Wann 2, Brown 3, Barrett 4, Hegarty, Carter and Kingery. Foul Goals—Knauth 7 and Hegarty 10. Referee—Horne, Evansville, Y. M. C. A. Umpire—Reckert, Yale. Scorer—Schockel. Timekeeper—Brietweiser.

Butler at Indianapolis, January 30.

Butler 34.		Rose Poly 28.
Richardson	F	Barrett
Moore	F	Brown
Good	C	Davis
Wise	G	Carter
Lockhart	G	Kingery

Field Goals—Moore 6, Richardson 3, Good 3, Wise 3, Barrett 3, Brown 2, Davis 2, Carter 2 and Kingery. Foul Goals—Barrett 8, Moore 4. Fouls—Rose 10, Butler 12. Referee—Cook of Indiana. Time of halves—20 minutes.

Evansville Y. M. C. A. at Evansville, February 5.

Evansville 55.		Rose Poly 21.
Lillicrap	F	Barrett, Orr
Perry	F	Brown
E. McGrew	C	Davis
A. Budke	G	Carter
J. McGrew	G	Kingery

Field Goals—Perry 6, Lillicrap 10, Budke J. McGrew 4, E. McGrew 6, Barrett, Brown 3, Davis 2, Carter, Kingery 2. Foul Goals—J. McGrew, 1 in 3 trials; Barrett, 1 in 1 trial; Orr, 0 in 2 trials. Referee—Horne of Evansville.

University of Louisville at Louisville, February 6.

Rose 21.		Louisville 36.
Barrett	F	Rogers
Brown	F	Kornfeld
Davis	C	McDaniels
Carter, Yatsko	G	R. Daniels
Kingery	G	McCaleb

Field Goals—Barrett 3, Brown 2, Davis 1, Kingery 1, Rogers 8, Kornfeld 4, M. Daniels 4. Foul Goals—Barrett 5, McCaleb 4.

Central Normal at Terre Haute, February 9.

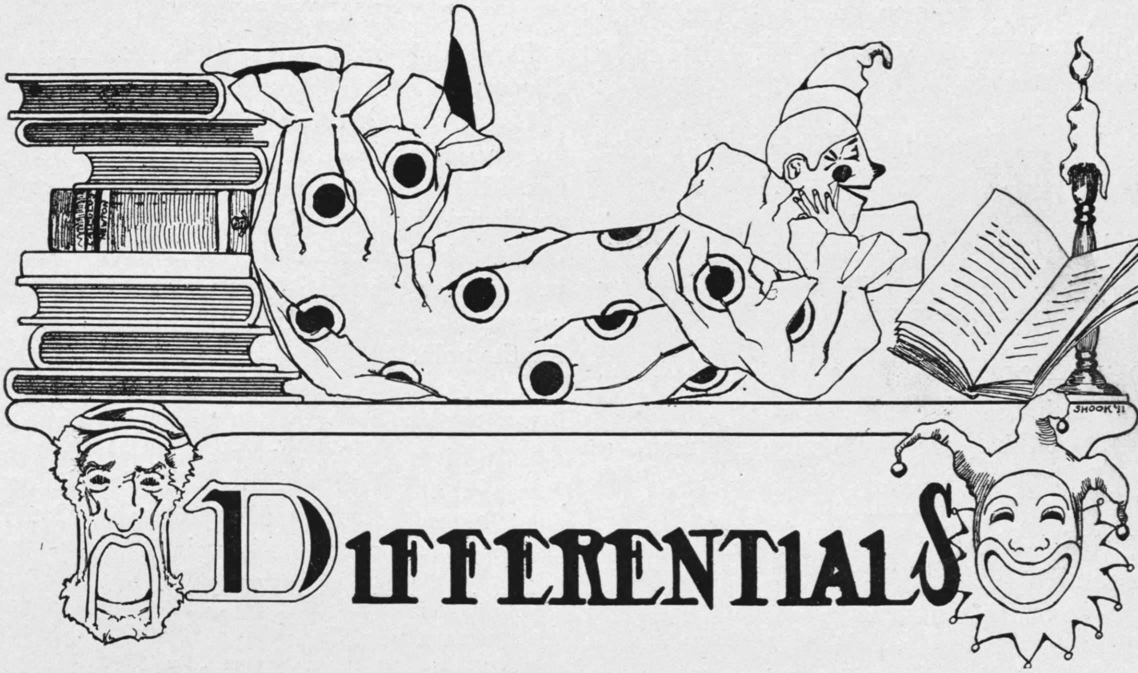
Rose 43.		Central Normal 32.
Barrett, Orr	F	Thomas
Hagerty, Brown	F	Helm, Peyton
Davis	C	Brown
Carter, Yatsko	G	Small
Kingery	G	Rohm

Field Goals—Small 2, Brown of C. N. 4, Peyton 3, Thomas 5, Kingery 2, Carter 4, Davis 5, Brown of R. P. I., Hegarty, Barrett 3. Foul Goals—Brown, Thomas 3, and Barrett. Timer—Hathaway. Referee—Maloney, Notre Dame. Time of Halves—20 minutes.

Indiana at Bloomington, February 23.

Indiana 64.		Rose Poly 15.
Maxwell, Frenzel	R. F.	Barrett, Orr
Dale, Porter	L. F.	Brown
Nash	C	Davis
Bushman, Whitaker	R. G.	Carter
Kirkpatrick	L. G.	Kingery, Yatsko

Field Goals—Indiana: Maxwell 10, Whitaker 5, Kirkpatrick 3, Porter 5, Bushman 2, Dale, Frenzel. Rose Poly: Davis 3, Brown, Barrett, Kingery. Foul Goals—Porter 3, missed 2; Kirkpatrick 3, missed 4; Barrett 3, missed 3. Umpire—Westover, Purdue. Time of halves—20 minutes.



THINGS WANTED AT THE NEW SCHOOL.

Civils that don't swear—Prof. Thomas.

Charts and working models in Thermodynamics—Bundy.

A small nail to hang my hat on—Prof. Knipmeyer.

No Spanish, German, or French— Prof. Wickersham.

Somebody to do the Shop's typewriting—Tom Tygett.

A place to get a drink of real, unmedicated water when an honest man is compelled to work in the chem. lab.—Stevens.

An orchestra, a mandolin club, anything!—Weinhardt.

A well founded reason for the existence of the Scientific Society.—R. M. Smith.

A faculty dinner every month.—Everybody.

A motor bus to take the professors to and from school.

A few more hooks in the cloakrooms.

A warm phys. lab. and two pairs of pliers.—Jo Jo.

A rest room like Doc's.—Sam.

THE WORLD'S BIGGEST LIE.

Mr. Sage to Freshman class—"I'm just as lazy as you fellows are."

Freshman Wagner, translating French—"At what age was he born?"

Francois—"Ah, when we have won the war, what shall we do with Berlin as a punishment to Germany "

Jacques—"Let us leave her as she is."

Casey Stoltz, in Economics—"The use of motor trucks was found to save the brewers thirteen cents a barrel on beer."

(Loud applause from McKeever.)

WHY FRESHMEN FLUNK.

C. Wagner, in Mechanics—"If you throw a stone 600 feet into the air, how far will it go "

Knippy—"Now, if R is real, and L is real, and C is real, what will we have?"

Brown—"Keystone Comedy in three reels, professor."

"Wicky," in freshman French—"What English derivatives have we from morte "

Buchalter—"Mortar."

Dailey, in Economics—"These statistics are from the 63rd Congregational report."

Knippy, reading the absences in Electricity—"Mr. O'Brien has four. Mr. Newhart,—well, he's been here several times."

Dailey—"My magnet radiates 60 watts per square inch."

Stone—"What are you designing, man, a stove?"

Hartough—"Guess I'll give a talk on coal mines in English class."

Lee—"Aw, that's too deep."

1st test-tube-juggler—"I'm going to make some barium carbonate to poison rats; but what will I do with the rats after I've killed them "

2nd test-tube juggler—"Barium."

Plott (in Gas Engines)—"Time for class to begin; here comes Pat and Lead."

Millicent—"Oh, how I envy you that diamond ring!"

Mildred—"You should not, for Ruel says I've either got to marry him or give it back."

A Dutchman had a cart from which he peddled wienerwurst sausages. One day, he saw on a baker's wagon, "Uneeda Biscuit," which struck him as a good advertisement, so he painted on his cart, "You need a biscuit, but you need a wiener wurst."

COURT ENTRY.

Rose Polytechnic Institute vs. Millette. Damages.

The above suit refers to the recent senior revolver celebration. A dumdum bullet struck Mr. Millette on the head, glanced, and broke an electric bulb on the bulletin-board. The faculty charges that the coefficient of rebound was greater than the Institute feels bound to recognize, and that Mr. Millette should settle for the bulb.

AN ECHO FROM THE HOME COMPANION.

A fair bit of feminism at the first basketball game—"O look at Hezzy Clark! Doesn't he just look like a little kewpie!"

O'Brien—"Well, Elmer, did you go to any shows exam. week?"

Gadberry (sleepily)—"Yaas."

O'Brien—"Did you see Nat Goodwin?"

Gadberry—"What good one?"

Doc White—"Let's put a whistle on the shop."

Doc Mees—"What fur?"

Doc White—"So you can hear the Institoot."

ADVERTISED LETTERS.

Leach, Mr. R.

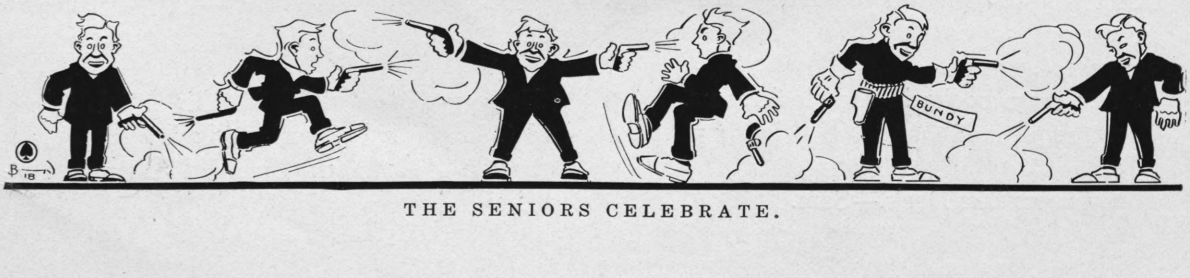
Stoner, Mr. Samuel.

Sullivan, Mr. John.

Tech, Miss Rose.

Dennis—"Good mornin', Mrs. Murphy, an' is Pat at home, sure "

Mrs. Murphy—"Sure, now, where are your eyes Isn't that his shirt fornenst ye, hangin' on the line!"



THE SENIORS CELEBRATE.

He—"Could you learn to love me?"

She—"I learned to speak Chinese."

Waitress—"How did you find the apple pie, sir?"

Diner—"I moved the bit of cheese aside, and there it was."—*Pennsylvania Punch Bowl.*

Two college students were arraigned before a magistrate, charged with hurdling the low spots in the road with their motor-car.

"Have you a lawyer " asked the magistrate.

"We're not going to have a lawyer," answered the elder of the two. "We've decided to tell the truth."—*New York Times.*

"At last, I am at the end of my troubles," said the Optimist.

"Which end?" asked the pessimist, gloomily. —*Life.*

"Do you think only of me?" murmured the bride. "Tell me that you think only of me."

"It's this way," explained the groom, gently, "now and then, I have to think of the furnace, my dear."—*Louisville Courier-Journal.*

Andre Fretin, a lively Gaul, has contributed to a London paper the following translation of a well-known song:

Longue est la route de Tipperary,
Longue pour y aller;
Longue est la route de Tipperary,
Ou demeure ma bien-aimee.
Au r'voir, Piccadilly,
Adieu, Leicester-square,
Longue, longue est la route de Tipperary,
Mais la-bas est mon coeur.

—*Ex.*

The Governor's wife was telling Bridget about her husband.

"My husband, Bridget," said she, "is head of the state militia."

"Oi thought as much, ma'am," said Bridget, cheerfully. "Ain't he got the fine malicious look "

Mrs. DeStyle—Ole, have you ever heard of Omar Khayyam

Ole (a grocery clerk)—No, ve ainta got dat. But ve ban having strawberry yam an' peach yam.—*Anoka Union.*

"I don't know what to give Lizzie for a Christmas present," one chorus girl said to her chum. "Give her a book," suggested the other. And the first one replied mediatively, "No, she's got a book."

A street Arab stood on the weighing machine,
In the light of the lingering day.
Then a counterfeit penny he dropped in the slot,
And silently stole a-weigh.—*Harvard Lampoon.*

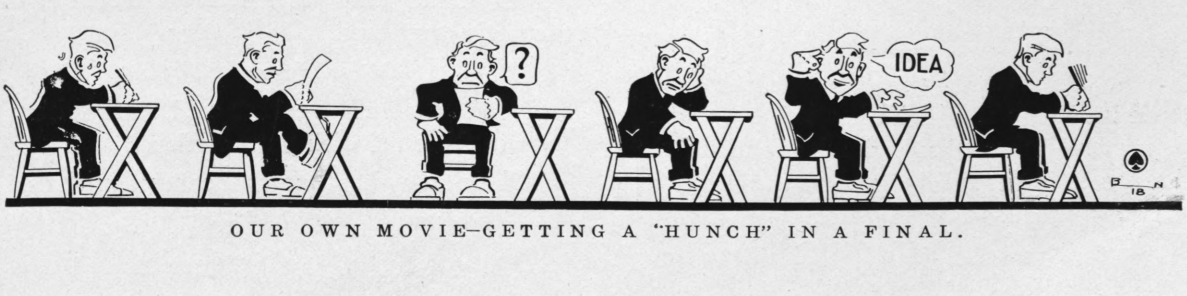
"Anyway, there's some advantage in having a wooden leg."

"What's that " asked his friend.

"You can hold your socks up with thumb tacks."—*Columbia Jester.*

Landlady—I'll give you just three days to pay your rent.

Stude—All right, I'll take the Fourth of July, Christmas and Easter.—*Williams Purple Cow.*



OUR OWN MOVIE—GETTING A "HUNCH" IN A FINAL.

A SECRET.

The plebe, sitting on the monument beside the first-class man, looked across the river from West Point to Constitution island. The plebe was inquisitive. He wanted to know what the government intended to use Constitution island for. The first-class man coughed discreetly, blushed, and looked around him carefully for eavesdroppers.

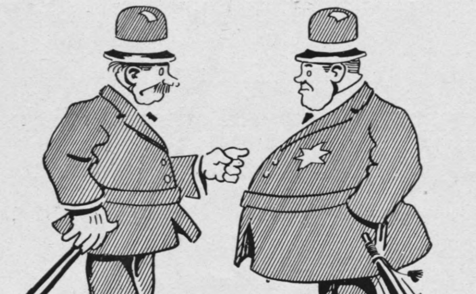
"It isn't generally known," he said, "but you're a cadet now. If the signal corps experiments go through successfully, they'll use it as an aviary." His voice dropped mysteriously.

"For birds, eh " said the plebe. "Carrier-pigeons?"

"Not exactly," answered the knowing one. "They'll be pigeots, as they call 'em—cross between a carrier-pigeon and a parrot, to carry verbal messages, you know. Don't tell."

And the plebe didn't—until this last commencement.

A LITTLE LOCAL COLOR



First Terre Haute cop—"Oi hear they're goin' to buy motorcycles for the whole force."

Second Terre Haute cop—"Wot for?"

First cop—"So we can get away quicker when we smell trouble."

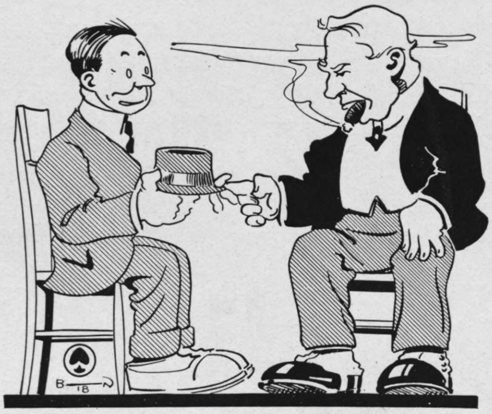
Our definition of absent-mindedness:

A man who thinks he has left his watch at home and takes it out of his pocket to see if he has time enough to go home and get it, is absent-minded.—*The Crimson.*

The class was studying weights and measures.

"Why is it," said one pupil, "that the avoirdupois system, unlike the Troy system, has no scruples?"

"Because, my boy," said the professor, who was a married man, "it is used to weigh coal and ice."—*X.*



Boss—"Do you use tobacco in any form?"
Applicant—"No, I smoke cigarettes."

THE REASON.

Picking her way daintily through the grime of the locomotive works, a young women visitor viewed the operations with visible awe. Finally she turned to a young man from the office who was showing her through and pointing asked:

"What's that big thing over there?"

"That's the locomotive boiler," the young man replied.

She puckered her brows.

"And what do they boil locomotives for?" she asked.

"To make the locomotives tender," he modestly answered.

Didn't you find it rather cold as the thieves were making off with your clothes

"Oh no, they kept me well covered with their revolvers."—*Red and Black.*

Technical Notes

The proceedings of the American Society of Civil Engineers for January contains papers on the following subjects: Rivers and Railroads in the United States, by William W. Harts, and Reconstruction of the Norfolk and Western Railway Company's Bridge Over the Ohio River at Kenova, West Virginia, by William G. Grove and Henry Taylor.

The proceedings also contains papers and discussions on the following subjects: Huncal Dam, Senora, Mexico; Reinforced Concrete Docks; Foreign and American Structures. Failures, Costs and General Considerations; some Principles Relating to the Administration of Streams; The Construction of the Klondike Pipe Line; The Constant-Angle Arch Dam; External Corrosion of Cast Iron Pipe; The Stereoscopic Method of Surveying and a First Trial of its Application to a Railway Survey in China; A Method of Determining Storm-Water Runoff; Reinforced Concrete Viaducts at Fort Worth, Texas; The Clarification of Sewage by Fine Screens; Water Supply of the San Francisco-Oakland Metropolitan District; The Lock 12 Development of the Alabama Power Company, Coosa River, Alabama; Fundamental Principles of Public Utility Valuation; The Valuation of Public Utility Property; Investigation of the Performance of a Reaction Turbine; The Differential Surge-Tank Problems; Sumberged Pipe Work at Portland, Oregon; History of Little Rock Junction Railway Bridge of the St. Louis, Iron Mountain and Southern Railway Company Over the Arkansas River at Little Rock, Arkansas; Proof of Assumption in the Theory of Concrete Beams; Depreciation of An Element for Consideration in the Appraisal of Public Service Properties; The Water Proofing of Solid Steel Floor Railroad Bridges; Momographic Solutions for Formulas of Various Types; Report of the Special Committee on Materials for Road Construction and on Standards for Their Test and Use; Progress Report of the Special Committee on Steel Columns and Struts, and Progress Report of the Special Committee to Investigate the Conditions of Employment of, and Compensation of, Civil Engineers.

CENTRALIZATION OF LONDON ENERGY SUPPLY.

At a meeting of the London County Council on November 10 the special committee on London electricity supply presented a second report on the subject of a unified system of electrical supply for London. It is proposed to establish the London Electricity Authority to deal generally with the question of supply in London and to have full powers of control over the new undertaking. The proposed area comprises the counties of London and Middlesex and parts of Essex, Hertford, Kent and Surrey. The county and county borough councils within the area would be represented on the authority, which would establish a "technical committee" to advise on technical and certain administrative matters.

The committee adheres to the principle of a combination of municipal control and private operation, and believes that the undertaking should be worked for a term of fifty years by a statutory company subject to control by the authority. To the authority would be given power to acquire by agreement or lease the undertakings of any company and local authorities in the area and to merge the undertakings. It would have power to take over the proposed undertaking at the end of fifty years on payment of a sum equal to the capital provided by the company for the purposes of the undertaking and also to take it over if the company failed in its statutory or contract obligations. Maximum charges for energy would be prescribed, but rates could be revised by the Board of Trade upon application.

The committee considers it an essential part of the scheme that a considerable portion of the capital should be furnished by the company. It proposes that the proportion in which capital is raised should be a matter of agreement between the authority and the company. The net revenue would be divided as follows: (1) Interest at the assumed rate of 4 per cent on capital furnished by the authority; (2) sinking fund, to be owned by the authority at the rate of about 2 per cent per annum on the whole capital of the undertaking; (3) interest on the capital furnished by the company at the assumed rate of 4 per cent; (4) reserve fund calculated at one-half of 1 per cent per annum on the whole capital of the undertaking. Surplus profits above interest, sinking fund and reserve provisions would be divided equally between authority and company until the latter had received enough to pay a further 4 per cent interest upon its capital expenditure, making a total of 8 per cent. Further profits would, as regards 75 per cent, be utilized in rebates to consumers, while the remaining 25 per cent would be divided equally between authority and company.

The finance committee of the County Council concurs in the recommendation that a sinking fund of 2 per cent is adequate and has taken under consideration the provision of a reserve fund of one-half of 1 per cent. It concludes that necessary capital for extensions could be borrowed more cheaply by the new authority or the company than by the present owners. The estimated new capital expenditure is £5,000,000 for the first period of five years, and thereafter about £1,000,000 annually. —*Electrical World.*

TECHNICAL-SCHOOL INSTRUCTION FOR DETROIT EDISON EMPLOYEES.

More than 250 employees of the Edison Electric Illuminating Company of Detroit are taking advantage of the company's offer to let them attend afternoon courses one day a week at the Cass Technical High School on the company's time. Special courses have been arranged which will be of value to employees in their work for the company. Candidates for this special instruction are named by the foremen and heads of departments, and every effort is made to encourage the men in their studies. Mr. S. C. Mumford, controller of the company, is a member of the Detroit school board and has taken a leading part in arranging the special curriculum, which includes courses in physics, chemistry, general science, accounting, etc. From the accounting department alone sixty employees are attending the once-a-week afternoon courses. At an electrically cooked dinner held at the Delray station of the company on Jan. 19 the high school faculty and officials of the company conferred together on future plans for the employees' courses.—*Electrical World.*

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The 66th meeting of the American Association for the Advancement of Science held at Phiadelphia, Penn., Dec. 28, 1914, to Jan. 2, 1915, was attended by 1500 to 2000 members and guests coming from every part of the United States. Nearly every university, Federal department, state or city government which employs scientific investigators was represented and the Philadelphia meeting recently brought to a close was undoubtedly the most successful in scope of subjects and in point of attendance of any since the organization of the association in 1847.

There are 12 sections of the association, comprising mathematics and astronomy, physics, chemistry, engineering, geology and geography, zoology, botany, anthropology and psychology, social and economic science, physiology and experimental medicine, education, agriculture.

The programs of the different sections each included anywhere from five to one hundred addresses and communications in their respective fields of scientific research. The sections and 24 affiliated societies held their principal sessions in the various halls, lecture rooms and laboratories of the University of Pennsylvania, which afforded admirable accommodations. Dr. Charles W. Eliot, president emeritus of Harvard University, was elected president of the Association for the ensuing year. At the first general session the retiring president, Dr. Edmund D. Wilson, in delivering his annual address, said that "the scientific method is the mechanistic method which produces practical results. The moment we swerve from it by a single step we set foot on a foreign land."

Frederick W. Taylor, one of the vice-presidents of the association, presided at the sessions of the engineering section which were held Dec. 30 and 31 in the Engineering Building of the university. Seventy-five papers and addresses were presented on various subjects of industrial, hydraulic and civil engineering, the latter including 30 papers on highway construction and pavements.

The next regular meeting of the association will be held at San Francisco, Calif., Aug. 2 to 7, 1915. As this will be during the Panama-Pacific Exposition, it is expected that the meeting will be largely attended.

RESEARCH FELLOWSHIPS AT ILLINOIS UNIVERSITY.

To extend and strengthen the field of its graduate work in engineering, the University of Illinois has since 1907 maintained ten research fellowships in the engineering experiment station. These fellowships, for each of which there is an annual stipend of $500, are open to graduates of approved American and foreign universities and technical schools. Appointments are made and must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the master's degree will be granted. Not more than half of the time of the research fellows is required in connection with the work of the department to which they are assigned, the remainder of the time being available for graduate study.

Nominations to fellowships, accompanied by assignments to special departments of the engineering experiment station, are made from applications received by the director of the station each year not later than the first day of February. These nominations are made within the month of February by the station staff, subject to the approval of the faculty of the graduate school and the president of the university. Appointments are made in March, and they take effect the first day of the following September.

Nominations are based upon the character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Preference is given those applicants who have had some practical engineering experience following their undergraduate work. Research work may be undertaken in architecture, architectural engineering, chemistry, civil engineering, electrical engineering, mechanical engineering, mining engineering, physics, railway engineering, and in theoretical and applied mechanics. The work of the station is closely related to that of the college of engineering, and the heads of departments in the college constitute the administrative station staff. Investigations are carried on by the members of the staff and other members of the instructional force of the college of engineering, by special investigators employed by the station, and by the research fellows. Four vacancies are to be filled at the close of the current academic year. Additional information may be obtained by addressing the director of the engineering experiment station, University of Illinois, Urbana, Ill.—*Power.*

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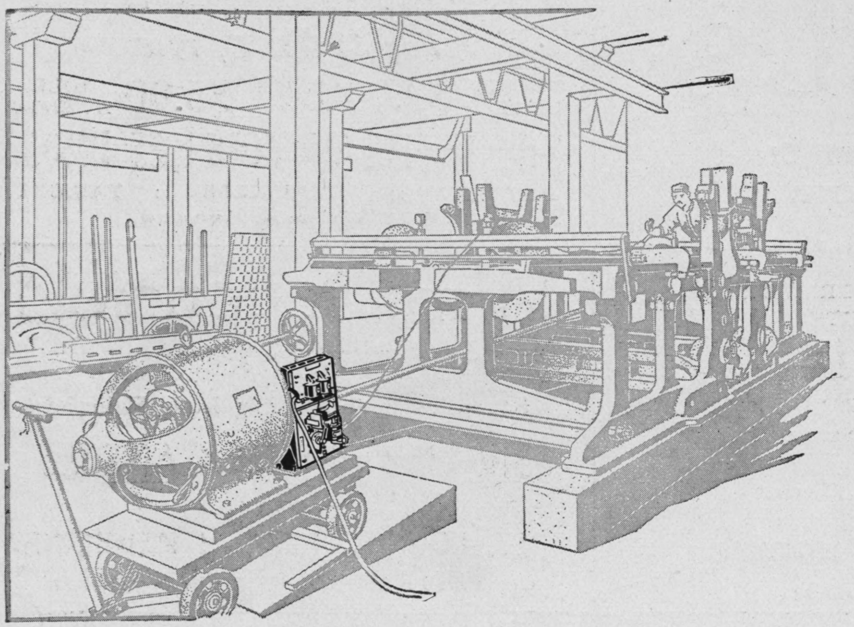

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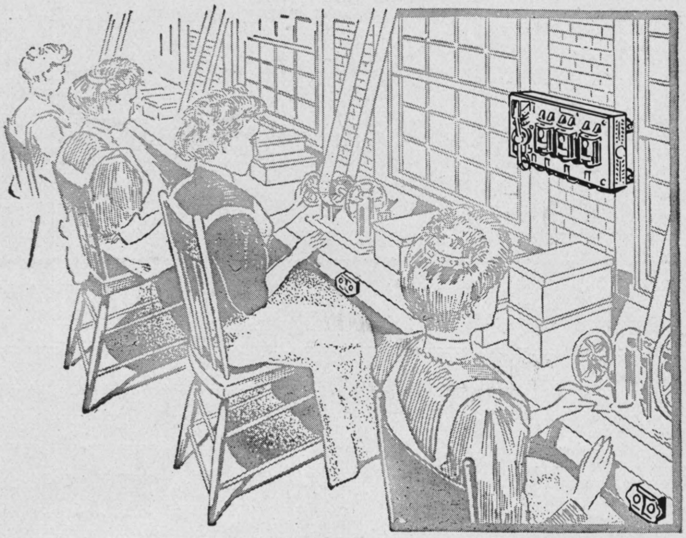

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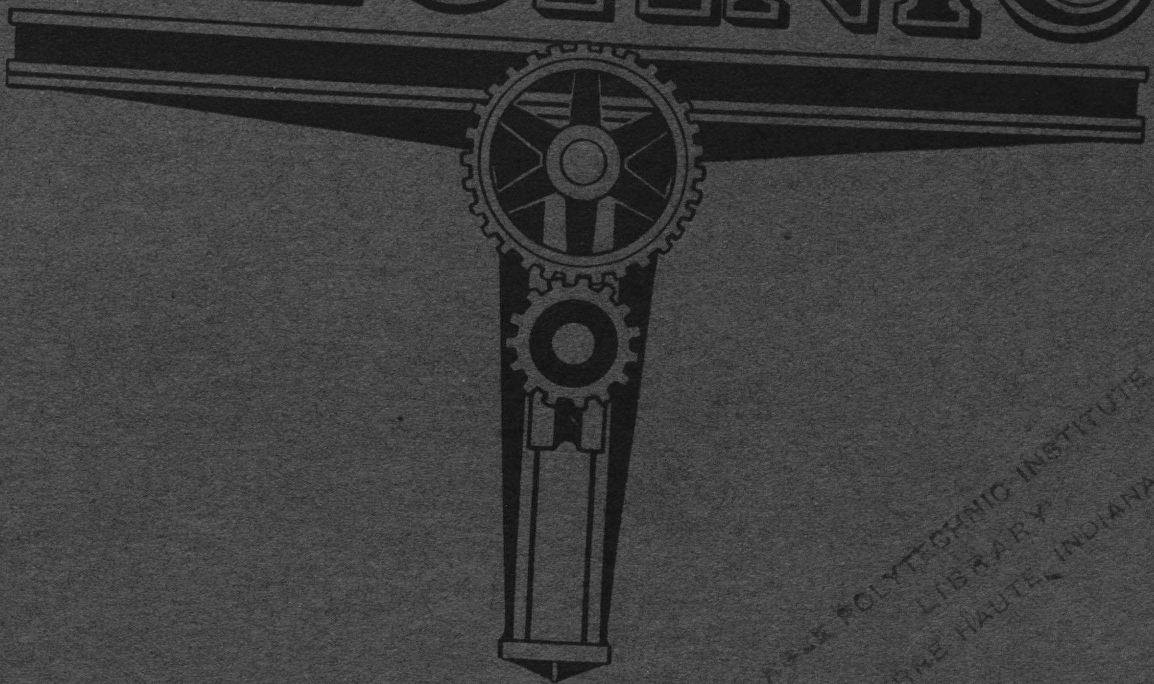

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