Copies of this issue will be sent free to all former Rose men—graduates or non-graduates—now in military service. Complete addresses, changes or corrections should be reported to the Business Manager.

THE ROSE TECHNIC

MARCH, 1918

LECTURES ON MANUFACTURING COSTS
Frank C. Wagner

THE DEVELOPMENT OF RADIO TELEGRAPHY
W. O. Hensgen, '06

ALUMNI
ROSE LEAVES
ATHLETICS
REVIEWS

ROSE POLYTECHNIC INSTITUTE

VOLUME XXVII No. 5
YOU

will be surprised to see how reasonable we can make your SPRING SUIT considering the advance in raw material.

ED SPARKS
Tailor and Haberdasher

Plattsburg and Sheridan Model Suits
Are the HIT of the season
They are made by Kuppenheimer.
For sale by
Carl Wolf
629 Wabash Ave.

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<th>Max Frank</th>
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<tr>
<td><strong>THE</strong> Swope-Nehf-Bloomer Jewelry Company</td>
<td>&quot;The Sole Saver&quot;</td>
</tr>
<tr>
<td>ESTABLISHED 1867</td>
<td>Rose Dispensary Bldg., Corner Seventh and Cherry</td>
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<tr>
<td>HEADQUARTERS FOR</td>
<td>The Only Goodyear Welt</td>
</tr>
<tr>
<td>CLASS PINS, SEALS, FOBS, WATCH BRACELETS, ELECTRIC CIGAR LIGHTERS, SOUVENIR SPOONS, FOOTBALL SPOONS</td>
<td>Shoe Repairing System in the City</td>
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<td>Watch and Jewelry Repairing Neatly Done and Fully Guaranteed</td>
<td>Shoes Called For and Delivered Promptly</td>
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<td>524 Wabash Avenue TERRE HAUTE</td>
<td>BOTH PHONES 1995</td>
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**BE PREPARED**

When Uncle Sam Calls you to the colors, by having your garments cleaned and repaired

**ERMISCH MY CLEANER**

For Quick Service

**FELLOWS!**

Show some of that famous Rose "Pep" and patronize these advertisers

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**Walking Over Shoes Are Best For Spring**

There is no less of quality or style in "Walking Over" Footwear this Spring, than in all the years these shoes for men have enjoyed first place as men's shoes. Outspoken merit calls you and practical style holds you to every pair—at a fair price

SPECIAL STUDENT’S SHOES, $4.00 UP

**Cheney’s Walking Over Boot Shop**

651 Wabash Avenue

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Always trade with our advertisers. Mention the Technic—it will help us.
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THE NEW SPRING SHOWING IS NOW READY !!!

Society Brand Clothes

The Suits that are not only up to minute, but a few seconds ahead.
Styles that will be copied by the other fellows next season.

COME IN AND SEE THE NEW MODELS

M. JOSEPH’S SONS, 512-14 Wabash Ave.

L. D. SMITH
NEWSDEALER and STATIONER

We Carry a Complete Line of
Baseball, Tennis and All
Kinds of Athletic Supplies

673 Wabash Avenue Terre Haute, Indiana
CITIZENS TELEPHONE 6

Best Hair Cutters In Town

Derringer’s Sanitary
Shave Shop
Basement
TERRE HAUTE TRUST BUILDING

NEW SPRING NECKTIES

65c

An almost endless variety of beautiful, new
Silk four-in-hands in rich floral and novelty
designs for the ultra-smart and conservative
dresser. Ready now—in our Men’s store.

See our wonderful showing of
New Silk Shirts at very low
prices.

Tables and chairs and dishes maketh not a
Lunch Room. There’s a Know-how
goes with them

The Colonial Dairy Lunch
F. F. Winslow, Owner

“The One White Spot in Terre Haute”
24 South Seventh St. Terre Haute, Indiana

ALWAYS TRADE WITH OUR ADVERTISERS. MENTION THE TECHNIC—IT WILL HELP US.
RUSHING season for 1918 is now a thing of the past—much to the satisfaction of all concerned. Although rivalry between all of the fraternities was as intense as ever, it is very gratifying to recall the manner in which the rulings of the Inter-Fraternity Board were kept in view as well as the general spirit of sportsmanship which prevailed.

Immediately preceding the rushing season, the V. Q. V. Fraternity passed from existence and following the announcement of the pledges, the local chapter of Beta Phi became inactive. This is the outcome of the crowded conditions which have existed for some time with reference to the number of fraternities at Rose. The Institute will feel the loss of these two chapters keenly however, the problem of existence of the remaining fraternities has been greatly simplified.

THE miniature model of the central tower of the group of buildings designed for the new Rose Polytechnic Institute has aroused much interest in an exhibit of art and architecture in New York. We are hoping to have in the near future for publication a picture and description of the tower by Mr. Van Pelt. The following comment was made by a New York paper:

“One of the interesting and new features of the exhibit is a miniature reproduction of the college tower of the Rose Polytechnic Institute of Terre Haute, Ind., designed by John V. Van Pelt with the layout of the buildings. This is a one-fourth inch scale model. Mr. Van Pelt has not followed the plain work-a-day models of similar buildings of the middle west in his designs. His architecture is along the lines of the Tudor or late English and the buildings suggest Cambridge and Oxford in England. He has given an individuality to each. The tower, 150 feet high at the entrance, is a central figure from which the other buildings radiate harmoniously.”

For the leading article of this issue, Professor Wagner has contributed his “Lectures On Manufacturing Costs” which were the foundation of a course in shop management given to the juniors the first term of this year. Long has the need of such a course been recognized by Rose alumni and the success and favor with which it met when put to trial more than insures it as a regular curriculum of the Institute.

The work of Professor Wagner is distinctive in that it forms the basis of a problem course and should prove of unusual interest to alumni as well as to the students who have already taken the course or will in the future.

For the alumni article of this month, Mr. W. O. Hensgen, ’06, has favored us with an article on the “Development of Radio Telegraphy.” This should prove of unusual interest to those students taking the course in radio communication now being offered at Rose under the direction of the Government. Mr. Hensgen is at present instructor of the radio work at the Institute.
THE ROSE TECHNIC.

Lectures on Manufacturing Costs

BY

FRANK C. WAGNER,
Professor of Mechanical and Electrical Engineering,
Rose Polytechnic Institute.

THE cost of a manufactured article is made up of a number of items, all of which must be taken into account if the true cost is determined. Some of these items such as material and direct labor are directly apparent and always taken into account. Other items, such as overhead expense, cost of power, etc., are apt to be overlooked with the result that the apparent cost is often less than the true cost. The only safe way to determine true costs in a going establishment is to keep an accurate account of all expenditures and distribute the same equitably among the articles manufactured.

Mr. Hugo Diemer recommends that a system of double entry accounts be kept, in which one account is debited and another account is credited whenever an article passes from the condition represented by one account to the condition represented by another account.

The following general accounts should be kept: Raw Material Account, Material Burden, Work in Process, Expense Burden, Labor Burden, Direct Labor, and Finished Stock.

Raw Material Account.—As material is received this account is debited with the amount of its cost as shown by the invoices. When material is withdrawn for work in process of manufacture, this account is credited and the Work in Process account is debited with the cost value of the material.

Material Burden Account.—This is a general account which is debited with the costs of carriage on materials received, including freight, express and drayage, cost of buying including purchasing department salaries and expenses, cost of storing and handling including storeroom salaries and expenses. This account is credited with the Material Burden amounts charged to Work in Process account. These charges are proportioned to the particular jobs in the ratio that the cost of raw materials used on the job bears to the total cost of raw materials.

Work in Process Account.—This account is charged with all materials drawn for work in process, which are then credited to the Raw Materials account. It is also charged with all Material Burden items corresponding to the materials drawn, which are then credited to the Material Burden account.

It is also charged with all direct labor expended upon work in process, as well as the corresponding expense burden. The Direct Labor and Expense Burden accounts are in turn credited with these charges.

When work is finished, its value is credited to the Work in Process account and charged to the Finished Stock account.

Expense Burden Account.—Several methods of handling this account have been used.

(1) Percentage of Wages Method. In this method the sum total of indirect labor, fixed charges, and all other expenses for a given period are divided by the Direct Labor costs for the same period and the percentage thus obtained is added to the Direct Labor charge. Fixed charges include such items as rent, depreciation, interest, insurance, taxes, general officers’ salaries, etc.

(2) Man-Hour Rate. In this method the sum total of all indirect labor, fixed charge and expenses is divided by the sum total of direct-labor hours for corresponding periods, and this rate applied in proportion to the Direct-Labor man-hours for each job.

(3) Separate Charge Method. In this method there is established (a) an hourly charge rate for each machine, (b) an hourly rate for each department in addition to the machine rate, and (c) a general hourly shop overhead rate.

In establishing the hourly machine rate, the following items are included: (1) interest and depreciation on the purchase price of the machine; (2) annual cost of repairing the machine and supplying it with cutting tools, lubricants, waste, etc.; (3) the value of the floor space occupied by the machine and the stock being worked upon; (4) cost of power consumed by the machine.

The hourly departmental rate will include that portion of the general expense of the department, such as superintendence, clerical work, tool room care, etc., as is properly charge-
able to the particular machine considered.

The general hourly shop overhead rate will include similar items of general expense pertaining to the whole factory and not included in the departmental rate. This should be prorated to the different departments and then to the particular machines.

In a small factory the general hourly overhead rate and the departmental rate would probably be merged into one.

Labor Burden Account.—This account includes general labor about the shop, as janitor's work, helpers for transporting materials, etc., and should be prorated to the different machines.

Finished Stock Account.—This account is charged with the total cost of finished work, which at the same time is credited to the Work in Process account. When goods are sold, the Finished Stock Account is credited with the Manufacturer's Cost price, which in general should be equal to the sum of the Raw Material, Material Burden, Direct Labor, Labor Burden, and Expense Burden charges against the particular job.

Direct Labor Cost.—Direct Labor Cost is obtained by having each workman make out a time card giving the exact time spent upon each job. It is often desirable to be able to determine in advance the probable cost of work so as to be able to make a bid upon some work in prospect. Also it is wise to compare the actual labor cost with what it should be under the most favorable conditions. For this purpose a study must be made of the amount of metal that can be removed in a given time upon various machine tools.

Mr. F. W. Taylor has made a very extended study of the size and shape of tool and the best depth of cut and rate of feed for the economical removal of metal. His results are given in Volume 28 of Transactions of American Society of Engineers.

The speed at which metal may be cut depends upon the quality of the steel from which the cutting tool is made. Of recent years special steels have been developed which retain their hardness even up to a red heat, and much deeper cuts and higher cutting speeds are used than were formerly thought possible. In order to get rid of the heat developed with heavy cuts and high speeds, it is common to use a stream of oil or some cutting fluid playing upon the work and tool.

In the old styles of machine tools, such as we still have in our shops, only 3 or 4 different rates of feed are provided, and for screw cutting it is necessary to change the gears,—which requires considerable time and trouble. The number of speeds, at which the work could be moved was also quite limited. As a result, much time was lost in making the proper adjustments of feed and cutting speed, and frequently the workman would not use the proper speed because of the trouble of changing. Many modern machine tools are supplied with so-called "Quick Change Gearing" which permits the workman by a quick movement of a shifting lever to set the gearing for any one of a large number of speeds. On lathes where a large number of thread pitches are required, the "Quick Change Gearing" enables the operator to set the machine to cut any thread by two simple movements not requiring more than ten seconds. On a particular lathe which I have in mind, as many as 32 different threads can be cut and as many different rates of feed may be imparted to the tool carriage.

Mr. Taylor recommends the following practical cutting speeds in feet per minute for high speed steels, the tools to last one and one-half hours before regrinding.

<table>
<thead>
<tr>
<th>Depth of Cut ins.</th>
<th>Feed ins.</th>
<th>3/32 in. Tool Soft</th>
<th>Medium</th>
<th>Hard</th>
<th>1 in. Tool Soft</th>
<th>Medium</th>
<th>Hard</th>
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The above speeds are for roughing cuts where the object is to remove the metal in the shortest possible time. The depth of cut and feed to be used in any given case depend upon the power of the machine and also upon the size and stiffness of the piece worked upon. A large stiff piece will evidently stand a greater cut and feed than a smaller piece that is likely to spring under the pressure of the tool, but it will require a smaller cutting speed. An inspection of the above tables will show that a heavy cut at slow speed will remove more metal in a given time than a lighter cut at faster speed. The proper cut and speed will evidently be determined by the rigidity of the piece worked upon and the strength and power of the machine.

Mr. Charles Robbins, in the Transactions of the American Society of Mechanical Engineers for 1910, gives the results of numerous experiments upon the power required to remove metal as follows:

Cutting tools may be divided into three general classes: (a) lathe tool type; (b) drills; (c) milling cutters.

For the lathe tool type Mr. Robbins found that the power required to remove metal was directly proportional to the amount removed, and did not vary with the depth of cut, feed or cutting speed. With the cutting tools ordinarily employed, he found that the horse power required to remove one cubic inch of metal per minute for various metals was as follows:

- Brass and similar alloys.............. 0.2 to 0.3
- Cast iron.......................... 0.3 to 0.5
- Wrought iron...................... 0.6
- Mild Steel (0.30% to 0.40% carbon) 0.6
- Hard Steel (0.50% carbon)......... 1.0 to 1.25
- Very hard tire steel............. 1.50

For drills the power required may also be considered as proportional to the cubic inches of metal removed per minute. The friction of the drill and chips on the side of the hole increases the power requirement as the hole becomes deeper. Also the variable cutting speed from the center toward the outside affects the action. Ordinarily, the power required per cubic inch of metal removed per minute may be taken as twice that for lathe tools.

For milling cutters the power required varies according to the particular class of cutter. A rough estimate for milling mild steel is 1.6 horse power per cubic inch of metal per minute on a horizontal miller and 1 horse power per cubic inch per minute on a vertical miller.

Mr. Robbins gives actual meter records of the time and power required to machine a shaft of machinery steel of the accompanying dimensions from 3.5-8-in. stock of the accompanying dimensions:

The power was measured by recording the amperes taken by a 220-volt motor driving the lathe, and was as follows:

<table>
<thead>
<tr>
<th>Horse Power</th>
<th>Amperes</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing piece</td>
<td>2.36</td>
<td>8</td>
</tr>
<tr>
<td>Cutting AB</td>
<td>8.25</td>
<td>28</td>
</tr>
<tr>
<td>Cutting B-C</td>
<td>7.66</td>
<td>26</td>
</tr>
<tr>
<td>Reverse</td>
<td>7.07</td>
<td>24</td>
</tr>
<tr>
<td>Cutting E-D</td>
<td>1.77</td>
<td>6</td>
</tr>
<tr>
<td>Cutting D-C</td>
<td>2.36</td>
<td>8</td>
</tr>
</tbody>
</table>

Total time........... 29.6
Average power........ 4.70
From the above data the direct labor charge for doing the machine work on the given piece is determined at once when the wages of the machinist are known. To this must be added the machine hour rate. Mr. Robbins gives the following table as a sample of the factors entering into the computation of the machine hour rate and of reasonable values for the same.

The fixed charges are determined as follows: First, find the fixed charges against the entire factory, including interest, depreciation, taxes and insurance on buildings, grounds and accessories. Then divide this amount among the different departments according to the value of each. For each department add to its portion of the total factory fixed charge the interest and depreciation on auxiliary apparatus located in the particular department, not including machine tools.

Variable charges are treated in the same way. The variable charges against the entire factory include repairs and renewals on buildings and accessories; charges against the store room and tool room; defective design, material or workmanship; printing and stationery; lubricants and general manufacturing supplies. To its portion of the variable charges of the entire factory are added similar charges pertaining exclusively to the department.

Salaries are treated in a similar way, and include cost of superintendence; engineering and drawing; clerical force, including office boys, and general laborers.

The fixed charges, variable charges and salaries are then divided in suitable proportion among the productive machine tools of the department.

The interest item is the interest on the first cost of the particular tool, commonly figured at 6%.

The method used in figuring the depreciation is to charge off 10% of the first cost of the tool the first year, leaving the value at the beginning of the second year as 90% of the first cost. For the second year 10% of this reduced value is charged off and so on for succeeding years. At the end of 6 years the depreciation charge will be 6% of the original cost and that value has been used in the table. If tools are designed for special work then such an amount should be charged off each year that at the conclusion of the job, the entire first cost less the scrap value of the tool will have been charged off.

The allowance for power given by Mr. Robbins seems small. A more accurate way would be to determine or estimate the power requirement for the particular job and charge accordingly. It is seldom that a horse power hour costs less than one cent, and in many plants it will cost 2 or even 3 cents.

Referring back to the problem of machining a shaft, the power requirement is seen to be $4.7 \times 29.6/60 = 2.32$ horse power-hours, which at 2 cents per horse power hour will cost $4.64$ cents. If the machine hour cost be taken at 47 cents and the direct labor cost at 40 cents an hour, then the entire cost of machining the shaft will be $29.6/60 \times 87 + 4.6 = 47.5$ cents.

If the work were done in the larger sized lathe for which the machine hour rate is 98 cents, the cost would be 72.6 cents.

On planers it is not customary to use such a wide range of cutting speeds as with lathes.

<table>
<thead>
<tr>
<th>Type of Machine</th>
<th>Fixed</th>
<th>Variable</th>
<th>CHARGES PER HOUR</th>
<th>Salaries</th>
<th>Interest</th>
<th>Depreciation</th>
<th>Power</th>
<th>Total Machine Hour Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical Boring Mills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40&quot;- 60&quot;</td>
<td>$0.02</td>
<td>$0.25</td>
<td>$0.15</td>
<td>$0.05</td>
<td>$0.05</td>
<td>.01</td>
<td>$0.53</td>
<td></td>
</tr>
<tr>
<td>72&quot;-100&quot;</td>
<td>.04</td>
<td>.45</td>
<td>.25</td>
<td>.08</td>
<td>.08</td>
<td>.01</td>
<td>.91</td>
<td></td>
</tr>
<tr>
<td>10'- 14'</td>
<td>.05</td>
<td>.80</td>
<td>.40</td>
<td>.15</td>
<td>.15</td>
<td>.02</td>
<td>1.57</td>
<td></td>
</tr>
<tr>
<td>16'- 24'</td>
<td>.08</td>
<td>2.00</td>
<td>1.00</td>
<td>.30</td>
<td>.30</td>
<td>.03</td>
<td>3.71</td>
<td></td>
</tr>
<tr>
<td>Ave. per cent of total</td>
<td>3%</td>
<td>52%</td>
<td>28%</td>
<td>8%</td>
<td>8%</td>
<td>1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial Drills, 5'</td>
<td>.02</td>
<td>.30</td>
<td>.20</td>
<td>.03</td>
<td>.03</td>
<td>.01</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>Radial Drills, 10'</td>
<td>.04</td>
<td>.60</td>
<td>.35</td>
<td>.09</td>
<td>.09</td>
<td>.01</td>
<td>1.18</td>
<td></td>
</tr>
<tr>
<td>Ave. per cent of total</td>
<td>3%</td>
<td>51%</td>
<td>31%</td>
<td>7%</td>
<td>7%</td>
<td>1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine Lathes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30&quot;-40&quot;</td>
<td>.02</td>
<td>.25</td>
<td>.12</td>
<td>.04</td>
<td>.04</td>
<td>.01</td>
<td>.48</td>
<td></td>
</tr>
<tr>
<td>40&quot;-60&quot;</td>
<td>.03</td>
<td>.50</td>
<td>.25</td>
<td>.10</td>
<td>.10</td>
<td>.01</td>
<td>.99</td>
<td></td>
</tr>
<tr>
<td>Ave. per cent of total</td>
<td>3%</td>
<td>51%</td>
<td>25%</td>
<td>10%</td>
<td>10%</td>
<td>1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36&quot;-56&quot;</td>
<td>.04</td>
<td>.55</td>
<td>.30</td>
<td>.05</td>
<td>.05</td>
<td>.01</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>7'-10'</td>
<td>.06</td>
<td>1.10</td>
<td>.60</td>
<td>.15</td>
<td>.15</td>
<td>.02</td>
<td>2.08</td>
<td></td>
</tr>
<tr>
<td>12'-14'</td>
<td>.15</td>
<td>2.60</td>
<td>1.40</td>
<td>.25</td>
<td>.25</td>
<td>.03</td>
<td>4.68</td>
<td></td>
</tr>
<tr>
<td>Ave. per cent of total</td>
<td>3%</td>
<td>55%</td>
<td>30%</td>
<td>5.5%</td>
<td>5.5%</td>
<td>1%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The tool cuts only on the forward stroke. In order to reduce the time lost by the return stroke, the speed on the return is made from 2 to 5 times as great as on the cutting stroke. Consequently, the amount of metal removed is only 2/3 to 5/6 what it would be if the actual cutting speed were maintained without interruption.

The following cutting speeds on planers are recommended by The Cincinnati Planer Co.:

<table>
<thead>
<tr>
<th>Material</th>
<th>Cutting Speed, ft. per min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast Iron, roughing cut</td>
<td>40 to 50</td>
</tr>
<tr>
<td>Cast Iron, finishing cut</td>
<td>20 to 25</td>
</tr>
<tr>
<td>Steel Castings, roughing cut</td>
<td>30 to 35</td>
</tr>
<tr>
<td>Steel Castings, finishing cut</td>
<td>20</td>
</tr>
<tr>
<td>Wrought Iron, roughing cut</td>
<td>30 to 45</td>
</tr>
<tr>
<td>Wrought Iron, finishing cut</td>
<td>20</td>
</tr>
<tr>
<td>Bronze and Brass</td>
<td>50 to 60</td>
</tr>
<tr>
<td>Machinery Steel</td>
<td>30 to 35</td>
</tr>
</tbody>
</table>

**Finishing Cuts:** The above data applies to roughing cuts, where the object is to remove metal as rapidly as possible and to bring the piece to approximate size. For many purposes this is all that is needed. When, however, a good fit is required, or the part considered is to be used as a bearing surface, the roughing cut leaves tool marks and exact size is not maintained throughout the length of the cut owing to a possible spring of the piece or to variations in the hardness of the material. Then a finishing cut should be taken after the piece has been brought to approximate size. Such a cut should have a depth of about 1/64 inch or less and a feed of about the same amount.

Referring back to the shaft of machinery steel, if all portions of the shaft are to be finished either to fit another piece or to form bearing surfaces, then the additional time required for finishing is found as follows: Referring to the table of cutting speeds for soft steel, a speed of 465 feet per minute is allowable. The circumference of a 3 1/2 in. circle is 11 in. Hence the lathe spindle should make 465 divided by 11/12 or 507 revolutions per minute. The total length of the shaft is 46 1/4 in. Hence the time required to make the finishing cuts will be 46 1/4x64 divided by 507=5.8 minutes. To this should be added the time for adjusting tool so as to produce the exact size. Allowing two minutes for each of the four adjustments gives a total of 8 minutes. If the ends and shoulders are to be faced, additional time must be allowed for this,—say 2 minutes for each operation, or a total of 10 minutes. This makes in all 23.8 minutes required for finishing. The power requirement given by Mr. Robbins when taking light cuts was about 1 1/2 horse power. Taking the direct labor cost at 40 cents, the machine hour cost at 47 cents, and power at 2 cents per horse power hour, we obtain for the cost of finishing operations: 23.8/60x(40+47+3)=35.7 cents.

If the shafts are to be turned out in large enough quantities, it would probably be economical to use a turret lathe, in which a number of tools are set in a revolving turret-shaped tool post and brought into action successively. Each tool is then set so as to produce the exact diameter of one portion of the finished piece, and tool adjustment is required only to allow for the wear of the tool. Similarly, the use of suitable stops will cut down the times required for facing the ends and shoulders.

**Example:** Find the cost of planing an angle plate of the dimensions of the sketch, assuming one roughing and one finishing cut on each finished surface, the material being medium cast iron. Take the roughing cut 3/16 in. deep and 1/8 in. feed. The proper speed for a 1 in. tool would then be 36.9 feet per minute. The Cincinnati Planer Co. gives 40 to 50 feet per minute. Assume that the planer is geared to give a cutting speed of 40 feet per minute and that the speed of return is 80 feet per minute. Then 2/3 of the time is occupied with cutting, and the effective cutting speed will be 40x40 or 1600 feet per hour. Allow a total overtravel of the tool of 1 inch.
used the time required will be 42 minutes. Time should also be allowed for setting up the piece and for changing. Faces (a) and (b) can be planed at one setting, likewise faces (c) and (d). A third setting will suffice for faces (e) and (f). Allow 2 minutes for each setting. The total time for machining the piece will then be 21 + 42 + 6 = 59 minutes.

For planers the power requirement does not vary greatly with the actual work of cutting unless very heavy cuts are used. A 36 in. by 12 ft. planer will take 6 or 7 horse power in ordinary work. At 7 horse power for 59 minutes at 2 cents per horse power hour, the power cost of the above job will be 14 cents.

Taking the direct labor cost at 50 cents an hour and the machine hour rate at $1.00, the total cost of machining the angle plate will be (50 + 100 + 14) x 59/60 = 161 cents.

Drilling: The proper speeds and feeds for drilling vary greatly according to the material drilled. The following are probably limiting values for carbon-steel twist drills of the linear speed at the circumference of the drill.

Bronze or brass............. 150 ft. per min.
Cast iron, annealed....... 85 ft. per min.
Hard cast iron........... 40 ft. per min.
Mild steel ................. 60 ft. per min.
Drop forgings ............ 30 ft. per min.
Malleable iron .......... 45 ft. per min.
Tool steel ......... 30 ft. per min.
Cast steel .......... 20 ft. per min.

Using these speeds, the table below shows the revolutions per minute at which different sized drills should be operated:

For high speed steel the speeds given in the table may be doubled.

The power required for drilling cast iron varies from 1.1 horse power per cubic inch of metal removed per minute with a 1/4 in. drill to .45 with drills 3 and 4 inches in diameter. For steel of medium hardness the power required is about double that given for cast iron. Some tests with .70 carbon steel gave about 4 horse power per cubic inch of metal removed per minute.

Problem—Find the shop cost of drilling 12 3/4 in. holes to a depth of 1 1/2 in. in hard cast iron on a 5 ft. radial drill.

Referring to the table, the proper speed is 204 r. p. m. and the feed is .012 ins. per rev. The time required to drill a depth of 1 1/2 in. is 1.5 (.012x204) = .53 min. Allowing 10 seconds for the time required to shift from one hole to another, gives .70 minute per hole, or 8.4 minutes for 12 holes. The machine hour rate for a 5 ft. radial drill is given as 50 cents. If the direct labor cost is 40 cents an hour, then the shop cost of drilling the 12 holes is 90x8.4/60 or 12.6 cents.
The Development of Radio Telegraphy

W. O. Hensgen, '06.

Radio telegraphy had its inception in the laboratory experiments of Hertz, who in 1887 discovered the progressive propagation of electro-magnetic action through space and was able to measure the length and velocity of the electro-magnetic waves, and to show that in the transverse nature of their vibration, and their susceptibility to refraction and polarization, they are in complete accordance with the waves of light and heat. His resonator was the first and simplest form of a receiver. Marconi while reproducing Hertz's experiments, after making some improvements, sought to make practical application of these principles and first succeeded in transmitting and receiving signals by means of the new space telegraphy at his father's home in Italy. In 1896 he proceeded to England, at which time he applied for his first patent and after a demonstration before various government officials in which a distance of four miles was covered, he secured their co-operation and assistance. The following year the English Marconi Company was formed and by 1899 various improvements had been made enabling him to effect communication over a distance of 85 miles during the naval manoeuvres of that year. In the same year the New York Herald made use of radio telegraphy as it is now called, for reporting the international yacht races. By 1900 the apparatus had been so perfected and its use deemed of sufficient importance that the Nord-Deutscher Steamship Company equipped their principal vessels with radio apparatus which was at that time considered quite an innovation. Early in 1901 a radio telegraph service was inaugurated between the five principal islands of the Hawaiian Islands where radio had a unique application because of the close proximity of the islands to each other, the greatest distance in the system being about 185 miles. In the same year Marconi had sufficiently completed his two stations for transatlantic experiments and soon thereafter effected communication between Cornwall, England and Newfoundland, a distance of 1,800 miles.

In 1906 the International Radiotelegraphic Conference was held at Berlin and the convention signed by the majority of the principal countries of the world, whereby the transaction of business via radio was systematically arranged and thereby received official and universal recognition.

Further advances were made about 1914 in this country by making use of improved receiving apparatus, particularly the vacuum tube or receiver which permits an amplification of the received signals to ten thousand times its incoming value; and also an extension of the possible sending range was accomplished by making use of the undamped type of generator, in this country particularly the Poulsen type of arc generator which in the later type absorbs two hundred kilowatts of energy into the high frequency generator, less than half of which is converted into high frequency energy and therefore supplied to the antenna. It is interesting to note that in one of the present so-called high power stations making use of a two hundred kilowatt arc generator with a wave length of eight thousand meters the effective resistance of the antenna circuit was two one-half ohms, and the effective capacity was twelve thousandths microfarad. On reflection one will be impressed with the remarkable fact that twelve thousands of a microfarad is a pretty small value to use to absorb 100 kw. of energy whereby a reliable daylight range of 3,000 miles can easily be accomplished overland. Receiving possibilities have also been extended as it is no longer unusual to hear Japanese stations at night at Arlington, Va., the distance involved being practically one-half the earth's circumference.

In the present European war, radio has found almost universal application for field uses, in
fact supplanted some of the previous forms of communication as in the case of an advanced line which could only with difficulty maintain wire communication because of its destruction by shell fire. In the modern form of warfare where so much depends on the aviation section of the army, radio is practically the only possible method of maintaining communication with the various flying and observational units, in fact as in the case of fire control has been found to be of immense value. Radio communication from ship to ship and ship to shore has long since become a commonplace necessity for which reason every sea-going ship is now so equipped.

It was originally hoped by some and feared by others that radio telegraphy would become a serious competitor of the ordinary landline or wire telegraphy, however it has since developed that such is not the case, that on the other hand, it has developed into an indispensable feeder and extension for the wire telegraphy and telephone systems particularly in the case of the marine end. Nor has its competition where it exists been a detriment to the cable companies because in the transatlantic branch the cables are always very much overloaded although for particular inter-island applications as for instance, the Hawaiian and Philippine Islands where submarine cables can only be maintained with difficulty, radio has taken the place of the cable—usually at much less expense. The wireless telephone has still only a very limited application and has therefore found only applications of minor importance, although made use of occasionally for special short distance work.

The phenomenal growth and rapid expansion of radio telegraphy is shown by its evolution from the demonstration set of Marconi used on Salisbury Plain in 1897 for covering a distance of four miles involving a power input of about one-fifth kilowatt, to the modern arc set having a rating of two hundred kilowatts input into the arc whereby a daylight range of 3,000 miles overland can be accomplished. The original demonstration set may have had a value of five hundred dollars while a modern high powered station complete with towers and real estate represents an investment of more than one million dollars. The first radio set aboard ship was installed in 1900; at the beginning of the war four thousand and forty ships were listed as being equipped with radio apparatus and on the same date seven hundred shore stations were in operation.

To operate the various ship stations approximately seven thousand operators were employed while the shore stations would involve fifteen hundred more men. Considering then, that today probably at least fifteen thousand men are directly employed in radio work involving operation, manufacture, installation and maintenance of radio apparatus we have a splendid illustration of the economic value aside from the utilitarian, of the practical application of a new scientific principle and the remarkably short time needed for a phenomenal expansion.

The following problems remain for solution and will doubtless be the paths of future improvements: first, development of a comparatively simple, reliable form of high frequency generator along the line of the Alexanderson machine; second, a method permitting greater speed in sending and receiving and possibly recording the business; third, reduction of interference difficulties particularly atmospheric disturbances. Unfortunately, along the line of improvements of a practical nature, little is to be expected until some time after the close of the war.

ALUMNI NOTES.

Mr. and Mrs. C. A. Dulton announce the birth of a daughter on March 3, 1918. Mr. Dulton is a member of the class of 1914.

First Lieut. Robert Keith Offut, Machine Gun Company, One Hundred Fifty-second Infantry, spoke to the Rose Battalion on Saturday, March 2nd, on his experiences at Camp Shelby. Lieut. Offut is of the class of 1916.

Maj. R. K. Rochester, '01, has been made general manager of a railway in France.

J. Robert Wisely, '15, is Chief Draftsman for the Pittsburgh & Conneaut Dock Company at Conneaut, Ohio.

Mr. John Nelson Van Patten announces the marriage of his sister, Dorothy Van Patten Torrey, to Mr. Henry St. Clair Putnam, on Tuesday, the Nineteenth of February, 1918. New York City. Mr. Putnam is a member of the class of 1886.

Frank N. Hibbits, '87, who has been Assistant General Superintendent of the Baldwin Locomotive Works, Philadelphia, is now General Superintendent of M. P. Lehigh Valley R. R., S. Bethlehem, Pa.

Henry L. Yingling, '12, is with the Dayton Engineering Laboratories Company, Dayton, Ohio.
Just why engineers have come to recognize St. Patrick as their patron saint is hard to say. However that may be, all courses, yea even the chemists and mechanicals bury the hatchet and bow their heads reverentially in worship of the original engineer. Altho the noble Hibernian is chiefly famed for his ability as a charmer of snakes, there can be no doubt that old St. Pat was the original dam constructor and that he had it on all the other brothers in every way being a Hathi, when it came to the Calculus.

On Saturday, March 16, the noble Rose elephant sounded its fourth trumpet to summon all of the clan to the worship of their venerable chief and from all directions came the faithful to join in the festivities. All preparations for the celebration were made by a committee composed of the following Juniors: A. N. Barnes, D. P. Cromwell, L. S. Stinson, H. W. Streeter and R. F. E. Wiedeman. These men deserve much credit for the splendid way in which the work was done.

Anyone passing the Heminway House about one-thirty would have rushed for their calendars to make sure that it was still March for the Freshman caps were just budding, in fact judging from the perfume from them, we might even have said that the moth-ball bush was in full bloom. Of course everyone was feeling rather blue (?) over having missed drill in the morning but after the march to the Hippodrome, where the legend “St. Patrick was an engineer, so am I,” proved an “open sesame” to the whole place, their spirits rose.

As soon as everybody had picked the nearest exit in case of fire, the program began. No, not the regular program but a real entertainment which everyone thoroughly enjoyed. Of course our little lily of the field, James S. King, modestly consented to act as master of ceremonies and to start the ball rolling and remove any embarrassment, he sang a song. We do not know what song it was for it started like “Onward Christian Soldiers” and ended somewhat on the order of “Drunk Last Night,” but it was all about rambling all around town and about Crawfordsville and Hell and other places like that. Then of course little Jimmy led us in some yells. After we had waited ten and a quarter minutes for the rafters to stop vibrating from the last “YEA ROSE,” the next on the program was introduced.

It was none other than George Brown who romped over the ivories so well that the regular pianist turned green with envy which was quite an asset to the appropriate color scheme. Then the original jazz band, presented for the first time in these parts, rendered such classics as “Over There” and “They Go Wild” which seemed easily possible. This famous organization consists of Brown, Hill, Greenbaum and Rosenbaum and when it comes to music these boys are right there.

After ’Fessor had told some jokes about a man who lost three legs and four arms not to mention two heads and we had lost the point if there was one, the orchestra found courage enough to crawl out of their dug-out into the trenches and start the battle. But there was no battle for the Rose contingent acted just like they do in Calculus which is as everybody knows like perfect gentlemen. Eh, ’Fessor?

After the show the crowd dispersed to study their lessons for Monday and to wait until it was dark enough to venture out in their cos-
tunes without being arrested. At six-thirty a few of the bolder spirits gathered courage enough to lead the march on the Heminway House clad mostly in thought and green cheese cloth and as the more timid straggled in the festivities started.

From the west porch of the Heminway House, the degrees in Ye Ancient Order of the Elephant were distributed by the fitful light of torches. The juniors received the third degree that of Embryo Blacks, the sophs being White Elephants and the lowly frosh being designated as Followers of the Elephant. As soon as all had taken their degrees from High Priest Barnes the parade formed itself and commenced its circuitous route to do honor to St. Patrick the “Wild Irish Rose” man.

And the parade! Never has that old Rose spirit blossomed out into such a bewildering display. In fact, Terre Haute has never seen anything to equal it, nay, even to compare with it in splendor, originality, cleverness or pep. Old Rose had certainly done itself proud. As it swept into Wabash Avenue, a near-sighted person might have taken it for the Kaiser leading his troops into battle but as it draws nearer we see that it is no other than our old friend Drum Major Engelbaum (Terre Haute Tribune), who as a march king has John Philip Sousa beaten to a frazzle. Behind him comes his faithful corps armed with little drums, medium drums, and big drums and all making but one kind of noise.

After this bunch of virtuosos came the tank, not a live one but one like they use in the war. Of course this one was made at the R. P. I. shops and Major Zimmerman was in charge of its construction. We take off our hats to Zim. for he is some little constructor. This tank was certainly the real thing, caterpillar tractors and all, and it is rumored that it will be sent to the front to take part in Field Marshal Coles’ spring drive. Nor was it the only offering from the Juniors who also had the body of the late Rose Jinx and strange to say as the cortege proceeded there were no tears shed.

Following the Juniors came the elephant escorted by the class of Twenty. The noble beast looked as never before in a brand new coat of paint with new lights shining brightly from his eyes, his retreat also being illuminated as required by law. The orchestra led by Jakey Reinking gave voluptuously forth music, more or less, and in spite of several of the pans being off key the effect was all that could be desired. A cavalcade under the command of Captain Stone pranced sedately before “The Only Two Girls In School,” Rose and Polly who were none other than our own Ray and Reinmann, and thus formed a guard of honor for these two maidens who by the way were no mean feature in themselves.

Immediately behind the ponderous elephant came the lowly followers working busily. Not to be outdone the “Frosh” were all dressed up in green nighties, which gave them the appearance of string beans but which showed that their hearts beat right. They seemed to be doubly divided between the worship of old St. Pat and the mourning for the approaching April second, when Indiana and possibly Terre Haute will be likened unto the broad Sahara except that the latter has oases. They had a submarine so true to life that old Von Tirpitz himself could not have told that it was not the real thing. Proudly perched upon a water-wagon rode several freshmen but they emphatically declared that it was just for the period of the parade. The old sprinkling cart was all posted up with signs, one of which read, “The End of a Perfect Day” and another, “Eventual-
ly, Why Not Now," and we all know that they did not mean the flour. Other young artists tried their hands at signs of various kinds; such sentiments being prevalent as, "We Will Have an Irish Kaiser in 1921," "A Dream of '21" (a large stein containing, you can imagine what.) After a march over the entire business section, the parade ended by showering attentions on the traffic cop which we did because "he was so good to us." As soon as the parade disbanded everybody rushed for home to put on their green neckties and boiled shirts and beat it for the Phoenix. The hall was decorated in green and white with elephants all around, (we mean, hanging on the walls, you know.) The dance was chaperoned by Doctor and Mrs. White, Doctor and Mrs. Johonnott, Professor and Mrs. Wischmeyer, Professor and Mrs. Coles and Professor and Mrs. Thomas. A three-piece Poly orchestra, Brown, Phillips and Hill, furnished excellent music until the clock struck twelve and the biggest and best St. Patrick's Day Celebration became a thing of the past.

MINUTES OF STUDENT COUNCIL MEETING, FEB. 6, 1918.

Meeting caller to order at 7:55 P. M. by President Crapo.

All members present. Gilbert present. Stinson was present to represent Technic.

Minutes of previous meeting read and approved.

Gilbert reported that owing to action taken by Dr. Mees it was unnecessary to borrow $500 as proposed but instead it was loaned by Mr. Gilbert on his salary, adjustment to be made later.

Reported by Mr. Gilbert that Faculty had voted favorably for compulsory Gym.

Moved by Gray and seconded by Engelhard that Wiedeman be advanced $187 for the purpose of settling for the hand-book, the same to be taken by the Y. M. C. A. as a loan; that the collections for the advertisements in the hand-books be turned over to the Student Fund. Motion carried.

Manson appointed to assist Wiedeman in collecting for the advertisements.

The following committee appointed to assist the High Schools in holding the Wabash Valley Tournament: Engelhard, Barnes, Manson, Gray, Floyd, Brophy, Stinson, Owens, Reinking, Reinhard, Streeter, Pence, Zimmerman, Wiedeman, Osmer, Maxwell, Cromwell, Bixby, Erwin, Froeb, Kremer, Rolshausen, Self, Skinner, Rawlings, Burns, Krausbek.

Skinner and Wiedeman excused at 8:30 P. M. Moved by Engelhard, seconded by Stinson, that Gilbert’s report on January budget be accepted. Motion carried.

Moved by Stinson, seconded by Engelhard, that $300 be advanced to THE TECHNIC for current expenses. Motion carried.

Moved by Engelhard, seconded by Pence, that meeting be adjourned. Motion carried.

Meeting adjourned at 9:10 P. M.

A. N. BARNES, Recording Secretary.

FRATERNITY NOTES.

The P. I. E. S. Fraternity entertained their pledges with an informal dancing party on Friday evening, February the twenty-second. The house was decorated in accordance with Washington’s birthday. Refreshments were served at the end of the evening. Seventeen couples were in attendance.

On Saturday, March 9, the Alpha Tau Omega Fraternity gave an informal dancing party at the Chapter house on North Eighth Street. The guests of honor were the pledges of the fraternity and about twenty-five couples were present. Punch was served throughout the evening while a three piece "jazz" band instilled the dancers with the necessary "pep."
MINUTES OF STUDENT COUNCIL
MEETING, MARCH 6, 1918.

Meeting called to order at 7:45 by President Crapo. All present. Mr. Gilbert present.

Minutes of last meeting omitted.

Wiedeman excused at 8:00 P.M.

Minstrel report read by Mr. Gray showed a net gain of $172.20. Complete report to be made by Gray and turned over to Gilbert.

Moved by Gray, seconded by Rawlings, that Gilbert’s monthly report be accepted. Motion carried.

Election of St. Patrick’s day committee for 1918. Barnes (Chairman), Stinson, Cromwell, Streeter, Wiedeman.

Sub-committees:

Construction of Aeroplane—Zimmerman (Chairman), Cain, Probst, Hearn, Richardson, Schlaman.

Elephant Committee—Pence (Chairman), Osmer, Maxwell, Stockmaster, Bryan, Lauterbach, Huston, Woodling.

Freshman Committee—Walker (Chairman), Rosenbaum, Haley, Biller, Owens, Ronald.

Moved by Barnes, seconded by Gray, that all taking part in the St. Patrick’s celebration must hold a ticket costing 70 cents to cover expenses. Motion carried.

Moved by Pence, seconded by Gray, that meeting be adjourned. Motion carried. Meeting adjourned at 10:15 P.M.

A. N. Barnes,
Recording Secretary.

OFFICIAL SCHOLARSHIP RECORDS.

The following figures show grade averages for the first term of this year:

Senior Class ...........................................77.1%
Junior Class ...........................................78.0%
Sophomore Class .....................................73.0%
Freshman Class .......................................70.4%
All students ...........................................74.1%

FRATERNITIES.

Beta Phi .................................................79.5%
Alpha Chi Sigma ...................................76.4%
P. I. E. S. ..................................................75.5%
Alpha Tau Omega ...................................74.7%
Theta Xi ...................................................74.6%
Sigma Nu ...............................................78.8%
All Fraternities .....................................75.2%

FRATERNITY PLEDGES.

ALPHA CHI SIGMA.

Homer A. Clark.
William H. Merry.
John M. Moser.
Fred R. Owens.
Donald M. VanBuren.
Charles R. Voges.

SIGMA NU.

Ray L. Biller.
Harry E. Bolt.
Edwin H. Carnarius.
Jesse E. Down.
Gilbert R. Epps.
Lloyd Greenbaum.
Hermon J. Krausbek.
Arthur G. Rosenbaum.
Milton H. Steffen.

ALPHA TAU OMEGA.

John G. Burns.
Earl W. Haley.
Edward R. Ronald.
Robert E. Sewell.
Milton F. Vianna.
Robert C. Walker.

THETA XI.

Karl Arleth.
George R. Armstrong.
Arthur D. Hill.
Edward F. Jaenisch.
William H. Junker.
Roland G. Rawlings.
Robert E. Skidmore.
Winfield C. Skinner.

P. I. E. S.

James R. Benham.
Homer A. Clark.
Carl J. Dedert.
William R. Dedert.
Max A. Faucett.
Samuel J. Minar.

John M. Moser.
Fred R. Owens.
Carl W. Schroeder.
Irvin Wier.

Other recent pledges are:

Alvin N. Barnes, ’19, to Alpha Tau Omega.
John R. Cain, ’19, to Sigma Nu.
Jerome Farmer, ’20, to P. I. E. S.
Adolph A. Geiger, ’19, to Sigma Nu.
Herschell Hearn, ’19, to Sigma Nu.
Kenneth Huston, ’20, to P. I. E. S.
Ronald C. Manson, ’20, to Alpha Tau Omega.
Adolph Reinhard, ’19, to Alpha Tau Omega.
John C. Zimmerman, ’19, to Theta Xi.
THE 1918 Basketball Season, while more successful than last year’s, could have been better. Of fourteen games played, Tech came out victor in six. Eight were lost, which makes it clearly a 50-60 affair. The Normal games were decided by the “break.” The Teachers played twice on their own floor and won twice. Tech won the battle on her floor. The scores were close. All of which is substantial evidence of our “break” theory. Other I. C. A. L. contests were few. Two victories were chalked up over Butler. The Dentals and Louisville U. split with Tech, each team winning on her own floor. Our other victory was that over a Camp Taylor five of former local stars.

Prospects for next year are bright. There are no Seniors in school, so graduation will not hit the squad. Assuming that neither Uncle Sam nor Old Man Ivory interferes, this year’s material will remain intact. Then, too, there is always the hope directed to the Freshman class. Rose should go well in 1919.

ROSE-LOUISVILLE.

The Rose team journeyed to Kentucky on February 23 and lost an exciting game to Louisville University by a score of 28 to 26. Tech took the lead in the first minute of play and held it to the last of the game when two consecutive baskets gave the Colonels the victory. The feature of the evening was the bout staged by Bat Burns wherein he almost wrecked the Louisville team. Reinking starred for the Engineers while Referee Reverse played well for Louisville.

Line-up and summary:

Rose (26) U. of L. (28)
Reinking          F    Morgan
Burns, Krausbek   F    Herzer
Reinhard         C    Daniels
Streeter        G    Grimes
Floyd           G    Morris

Field goals—Reinking, 3; Reinhard, 2; Krausbek, 2; Floyd, 2; Streeter, 1; Morgan, 5; Herzer, 1; Daniels, 3; Grimes, 2; Morris, 1. Poul goals—Reinking, 6; Morgan, 2; Daniels, 2. Referee—Converse.

ROSE-NORMAL.

In the second Normal game Tech came back strong. By playing a hard fighting game and passing the ball as had never been done heretofore, Rose won a 30 to 26 victory. The contest was one of the most exciting seen in the city in years and was featured by good basketball on the part of both teams. Godfrey, of Ohio State, was guardian of the whistle and he kept the game well in hand. He called fouls close enough to prevent unnecessary roughness but still the game was not slowed up.

Shortly after the whistle Normal took the lead on a free throw by Grose. He registered another foul shot before Reinking scored for Tech. The Teachers forged ahead, however, when their forwards each scored from field. Baskets by Burns, Floyd and Reinking evened things up and the scoring was even for the rest of the half. At time Rose held a one point lead—16 to 15. In the second half Tech exhibited some of the prettiest teamwork seen this season and the Teachers were lost. Only poor basket shooting made the score close as it was. At one stage of the half, the Engineers poured shots on the basket but the ball would not fall through the netting. Rose held her lead, however, and the final whistle announced a Tech victory of 30 to 26.

Reinking lead his team-mates in points with a total of four baskets from the field. “Gloomy” played the floor well and with Reinhard was a big factor in the Engineer teamwork. Capt. Floyd, Burns and Streeter each scored three field baskets.
Line-up and summary:

Rose Poly (30) Normal (26)
Burns..................F..................Grose, Sharp
Reinking...............F..................Shipley
Streeter, Floyd........C..................Conover
Floyd, Streeter........G..................Glenn
Reinhard................G..................McBrayer
Field goals—Burns, 3; Reinking, 4; Streeter, 3; Floyd, 3; Grose, 3; Shipley, 1; Conover, 3; Glenn, 1; McBrayer, 1. Foul goals—Reinhard, 4 out of 14; Grose, 8 out of 14. Referee—Sergeant Godfrey, Ohio State. Timers—Hathaway and Doyle. Scorers—Morphet and Phillips.

ROSE-INDIANA.

TECH was no match for the Indiana University five and went down in defeat, 44 to 7. The Crimson was at home on their rink and passed and shot in a spectacular manner. Rose fought but the Hoosier's accuracy in hitting the net from all angles proved fatal.

Line-up and summary:

Indiana (43) Rose Poly (7)
Easton..................F..................Reinking
Zeller..................F..................Burns
Jeffries................C..................Reinhard
Phillips................G..................Streeter
Stahr..................G..................Floyd
Field goals; Indiana—Zeller, 6; Phillips, 4; Easton, 4; Jeffries, 1; Bowsher, 1; Vontress, 3; Stahr, 1; Rose Poly—Streeter, 1; Reinhard, 1. Foul throws—Zeller 3, missed 3; Floyd 3, missed 1; Reinhard missed 2. Substitutes—Vontress for Easton, Bowsher for Jeffries, Ingles for Stahr, Krausbeek for Burns, Richiey for Phillips, Huxford for Zeller. Referee—Berndt, Indiana. Time of halves—20 minutes.

ROSE-DEPAUW.

TECH lost to the Tigers on their own floor by a 39 to 13. The Rose five has yet to learn to play basket ball on a mile straightaway. DePauw took the lead early in the game and was never in danger although Tech put up a stubborn fight. The Engineer teamwork was good, but they could not work the ball close enough to the Methodist's goal for many successful shots. The game developed no stars.

Line-up and summary:

DePauw (39) Rose Poly (13)
Kriner..................F..................Burns
McClure................F..................Reinking
Smith..................F..................Conover
Billingsley.............G..................Reinhard
Royse..................G..................Glenn
Field goals—Burns, 2; Reinking, 2; Reinhard, 2; Floyd, 4; Conover, 2; Glenn, 3; McBrayer, 2. Foul goals—Grose, 4; Glenn, 1; Floyd, 3; Reinhard, 4. Scoring—Hathaway and Glenn. Scorers—Walker and Jensen. Referee—Godfrey. Time of halves—20 minutes.
Interesting Technical Articles of the Month

Journal American Society Mechanical Engineers, March, 1918.

Problems of Crankshaft Design.
By Otto M. Burkhardt. A paper in which mathematical deductions from examples from prevailing practice are utilized to derive factors of safety and other specific values.

The Offensive Against the Submarine.
By Joseph A. Steinmetz. With annotations to the suggestions to inventors made by the Naval Consulting Board of the United States regarding the submarine and kindred problems.


Los Angeles Water Department Appliances.
By C. W. Geiger. In this article a number of appliances and methods that have been developed by the department are described.

War Time Disposal of Garbage.
The conclusion of an article the first part of which appeared in the Feb. 9th issue. The practices of eight large cities are described, including the hog ranch at Denver.

The Gas Engine, March, 1918.

Reasons Behind the Liberty Motor.
By Major Jesse G. Vincent.

Power, March 5, 1918.

Conditions in the Power Industry.
By Ludwig W. Schmidt. A digest of the reports of the United States Consuls on the power situation in various parts of the world and the influence of the war on this important industry.

Walnut Plant, Columbus Railway, Power and Light Co.
This plant will have a capacity of 31,250 kv.-a. The boilers are arranged on the unit system, each unit consisting of two boilers, one economizer, two stokers, one induced—and one forced draft fan. The plant was designed and built by the E. W. Clark and Co. Management Corporation.

American Machinist, Feb. 28, 1918.

Manufacture of Electric Tool Steel.
By E. A. Suverkrop. This article tells in a general way the methods by which tool steel is manufactured in the electric furnace. The information was secured at the plant of the Ludlum Steel Co.

Machinery, March, 1918.

Manufacture of the United States 75-millimeter Shell.
By Eric Oberg. The first of a series of articles describing approved methods employed by the American Shell Co. in the making of United States artillery ammunition.

Graphic Method of Generating an Involute Gear Tooth.
By Douglas T. Hamilton.

Electric Railway Journal, March 2, 1918.

Six-motor Multiple-unit Trains for Montreal.
By Keith MacLeod.

The Electric Journal, March, 1918.

The Engineering Evolution of Power Plant Apparatus.
By Francis Hodgkinson. A historic review of steam turbine progress.

BOOK REVIEW.


A very timely book in which the author aims to acquaint the reader with the uniforms, insignia, and customs of the principal fighting forces of the world. He has laid special stress
on and has shown in great detail, the insignia of rank. In the first seven chapters he deals with the organization and composition of the army, army etiquette, and customs. In the second seven chapters he takes up the organization and composition of the navy, both ashore and afloat, and naval etiquette and customs. The marine corps, coast guard, light house service, and coast and geodetic survey are dealt with, each in a short chapter. A chapter is devoted to the strength and organization of the principal foreign armies. Twelve chapters are descriptive of the uniforms of armies and navies of the nations now at war and two chapters deal with United States war medals and badges. The book should be as interesting for the layman as for the man in or about to enter the service. It is fully and clearly illustrated and fills its purpose completely.

THE WAR DEPARTMENT DISCOVERS THE CHEMIST.

From the time the United States entered the war to the present day there have been a few people who realized the importance of the chemist in the general scheme of industrial affairs. And when it was proposed to take him from his tasks and make a soldier of him, there were a few voices raised in opposition.

Now comes the Adjutant General of the Army, however, with official recognition of the importance of the chemist in industry. Through an order of the Adjutant General, provision has been made whereby manufacturers of essential war materials who have lost chemists through the first draft may again obtain the services of these men, and those now threatened with the loss of chemists through the present draft may retain them. The request for exemption must come from the manufacturers; applications from the men will not be considered. Manufacturers thus affected should apply to the Chemical Service Section, N. A., New Interior Building, Washington, D. C., for the regulations governing the transfer of men already drafted or the possible reclassification of men not yet called.—Metallurgical and Chemical Engineering.

STUDENTS FORGE CANNON.

Students in the engineering shops at Georgia have presented to the 321st Field Artillery a cannon which they themselves had constructed.

BUY THRIFT STAMPS.

Remember, the Thrift Stamp campaign is still going on and that every quarter helps to win the war.

ANNOUNCEMENT

Owing to the increased cost of publication, after April the first, the yearly subscription price of THE TECHNIC will be advanced to two dollars a year while the cost per single copy will be twenty-five cents.
Differentials

Worth His Best.

A young engineer went to a minister's home to get married. After the ceremony the bridegroom drew the clergyman aside and said in a whisper: "I'm sorry I have no money to pay your fee, but if you'll take me down into the cellar I'll show you how to fix your gas meter so that it won't register."

R. P. I.

JoJo in Light (after making an elaborate figure in colored chalk)—"Now—what will those rays be?"
"King, '19—"Pink."" (And they were.)
R. P. I.

Hock the Watch.
"Your watch doesn't keep good time."
"No, but it has redeeming qualities."
R. P. I.

A Good Sine.
She (soulfully)—"Oh, George! I just love to sit here with you by the fireplace and listen to the crackling logs! They almost seem to be whispering a tuneful melody to us, don't they?"
He (of the mathematical mind)—"Sort of a logarithm, I suppose."—Widow.
R. P. I.

Very Odd Indeed.
"Who are you rooming with this year?"
"Oh, I'm rooming alone."
"How singular!"—Tiger.
R. P. I.

Who takes the pleasure out of life and makes existence hell?
Who fires a real good-looking one because she cannot spell?
Who substitutes a dictaphone for coral-tinted ear?
The penny-chasing, dollar-wasting efficiency engineer!
—Metallurgical and Chemical Engineering.

Slight Mistake.

Female passenger in airplane some thousands of feet up—excitedly, "Please, oh, please, won't you go down? I've just dropt my pearl cuff-button!"
"Calm yourself, madam—that's not your cuff-button, that's Lake Erie."—Puck.
R. P. I.

The following are extracts from examination papers at several of the large universities:

A blizzard is the inside of a hen.
Sixty gallons make one hedgehog.
When the British got up in the morning and saw the Americans on the opposite hill they threw up their breakfast (breastworks).
Climate is caused by the emotion of the earth around the sun.
Pompeii was destroyed by an eruption of saliva from the Vatican.
Geometry teaches us how to bisect angels.
Achilles was dipped in the River Styx to make him immoral.
A vacuum is a large empty space where the pope lives.
A mountain pass is a pass given by the railroad to its employees so that they can spend their vacation in the mountains.
A mountain range is a large cook stove.
The stomach is just south of the ribs.

R. P. I.

A student of the University of Nebraska in a contest to perform the "darndest nervy" stunt, stopped a trolley car in order to use the step as a foot rest while tying his shoe.

R. P. I.

"The women of the Fiji Islands don't wear any clothes," remarked the globe trotter.
"Gracious!" exclaimed the Mere Man. "I wonder what they find to talk about."—Judge.
**His Modesty the Kaiser.**

The Kaiser is a violet,
As modest as they grow.
Like Goldsmith's Man, the Kaiser wants
But little here below.
Should we delay the joyous day
Of butchery's surcease,
When they're so dog-gone moderate,
The Kaiser's terms of peace?

What does he ask of Belgium?
Nothing that isn't fair—
A few big forts, a lot of ports,
The only army there,
Control of all the commerce,
The railroads and the wires;
Aside from which there's not a thing
His little heart desires.

And if he wants so little
From a land of Belgium's size
He'll certainly go easy
On the rest of the allies.
Let's see if we can figure out,
Let's see if we can guess
What all the cuss will ask of us
Before he'll end the mess.

Of course, he'll wish for Poland;
He'll claim Alsace-Lorraine;
That part of Portugal which lies
Between the sea and Spain;
Roumania and Serbia
In toto and intact;
Not very much of Russia—
One-half, to be exact.

R. P. I.

**MUST HAVE HAD PRACTICE.**

Bab—"Did father strike you favorably?"
Bob—"Well, not so favorably, but very accurately."—*Chaparral.*

R. P. I.

**ALGEBRA.**

Let \( x = \text{boy}. \)
And \( y = \text{girl}. \)
Then:
\[
\begin{align*}
    x + y &= \text{love}. \\
    2x &= \text{gossip}. \\
    2y &= \text{jealousy}. \\
    x - y &= \text{sorrow}. \\
    2x + 2y &= \text{rough house}.
\end{align*}
\]

R. P. I.

He: "I could die dancing with you, dear."
She: "I am."—*Froth.*

R. P. I.

Of Italy, say, Venice
And Florence, yes, and Rome;
The choicest site in Naples,
Where he'll build a winter home.
Of France, the whole of Paris,
Versailles, Calais, Bordeaux,
And all the rural districts,
Where the champagne makin's grow.

Of Britain, O not very much:
Merely some guarantees
That English ships will make no trips
Without first saying "Please!"
And that the Teuts be given
Exclusive right of way
Between the unimportant ports
Of Dover and Calais.

Of our U. S. he'll ask much less
Because we started late:
Possibly New York Harbor,
Besides the Golden Gate,
The Capitol, the White House,
Our railroads and our mills,
And just sufficient change to pay
His and his sidekicks' bills.

The Kaiser is a violet,
As modest as they grow.
Like Goldsmith's Man, the Kaiser wants
But little here below.
They say he's been that way since birth:
Shy as a young gazelle.
The Kaiser only wants the Earth—
But what he'll get is Hell.

—Ring W. Lardner (Chicago Tribune)

R. P. I.

Mr. Hen Peck: "I don't like to butt into your affairs, dear, but what am I going to do this evening."

R. P. I.

"I beg your pardon. I didn't mean to step on your foot."
"That's all right. I walk on 'em myself."
—Ohio Sun Dial.

R. P. I.

Optimistic Mother: "I'm glad you got this car John. Baby likes the rattle."

R. P. I.

Clarence: "Would you scream if I kissed you?"
Clara: "Do you flatter yourself that I would be speechless with joy?"
Drug Clerk—"Now what kind of a toothbrush do you want?"

Ole Olson—"It must be a strong wan; dere bane seven ave ma famlee."—Widow.

R. P. I.

A certain rector called to the vestibule just before a service was to meet a couple who wanted to be married. He explained that there was no time for the ceremony then, but said that if they would remain until the close of the ceremonies he would give them a chance to come forward at that time.

The couple agreed and at the proper moment the minister said: "Will those who wish to be united in the holy bonds of matrimony please come forward."

Whereupon thirteen women and one man proceeded to the altar.

Before leaving the good old United States with some Military Organization have a good

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"Those Germans are certainly efficient," said father at the breakfast table.
"How so? How?" asked mother.
"Why," said father, "I see they have put the whole question of the food supply into
the hands of the Minister of the Interior."

R. P. I.

"I want some powders for insects."
"How many sir?"
"Oh millions."

"Is this the lawyer who is going to defend me?" asked the murderer as he looked at the
young lawyer.
"Yes," answered the judge, "he's your law-

yer."
"If he should die," asked the murderer,
"could I have another?"
"Certainly," answered the judge.
"Well," said the murderer, "can I see him
alone for a few moments?"

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