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FROM FANCY TO FACT

In the "Manchester Guardian," one of England's most famous newspapers, there has been a series of American sketches written by a travelling correspondent. His awe at New York's "giant skyscrapers" seems even to have surpassed the wonder which most Europeans feel when they first gaze upon that skyline. "But," he continues, "the electric lift made the skyscraper a fact."

In these words he has expressed very tersely a truth which many of us have come to take for granted.

Nothing could be more fantastic than the sight of those mighty towers climbing up through the many-colored mists of the great city; nothing could be more dream-like. And yet, nothing could be more useless were it not for the thousands of Otis Elevators which are busily plying within those high walls.

The skill of architects and engineers has created a vision, a mirage wilder than any of the "cloud-capt towers" of fancy. But the Otis Elevator has made the skyscraper a fact.

There are over 17,000 Otis Elevators operating in New York City, ranging from the lowly hand-power elevator to the 800 ft. speed automatic signal control elevator for intensive office building service. All elevators in New York carry more passengers per day than the combined subway, elevated and surface car lines, amounting to ten million people per day.

OTIS ELEVATOR COMPANY
Offices in all Principal Cities of the World
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ANNUAL ST. PAT’S DAY PROGRAM
March 17, 1926

12:00 School is dismissed for remainder of the day.
1:00 Students attend Indiana Theatre in a body.
2:30 St. Pat’s program is presented at the theatre by Rose students.
8:00 St. Pat’s parade, led by Max Sherwood, Grand Marshall, moves through
the down-town district.
10:00 St. Pat’s Ball is held at the Hotel Deming, with the music furnished
by “Winsteads” of Louisville.

ST. PAT’S COMMITTEE

Max Sherwood......General Chairman
E. Wayne Watkins....Chairman of Show  Edison White......Chairman of Dance
ACCOMPLISHMENTS IN THE STUDY OF COOLING ELECTRIC MACHINES

By C. J. Fecheimer

Under normal operating conditions the average electrical machine—be it motor, transformer, or generator—is a remarkably efficient energy transformer. Little energy is lost in either generation or utilization of electric power. But when the limit of the machine’s capacity is reached, the losses begin to mount by leaps and bounds; because enormous quantities of heat are generated, the insulation breaks down. If it were not for the excess heat, many types of apparatus employing wound coils would continue to do work even above their rating. Commercial research is now being conducted in this field in order to perfect better cooling devices for electrical apparatus. In this paper some of the problems attendant to such investigations are discussed.

It is easy to understand why a steam engine will not deliver more than a given amount of power at a definite speed; the steam pressure and cylinder dimensions determine its maximum delivery. In the electrical machine it is different; it is heating that is the principle limitation on the majority of generators, motors and transformers.

In many machines the insulation consists of fibrous materials, such as paper, cotton, linen, etc. If the temperature exceeds certain values for a sufficient time, the insulation becomes brittle, chars and fails; a short-circuit then takes place and the machine burns out. In many of the large machines non-combustible material, such as mica, is relied upon for insulation. With such materials the temperature may be higher than for fibrous insulation without endangering the life of the machine. Experience has indicated that with this type of insulation it is best not to run at too high temperatures, and the desire to secure safe operation has prompted engineers to fix upon certain values as the maximum for

![Fig. 1. A view of turbo model on which ventilation study was conducted.](image)

mica. It is therefore of great importance that the designers proportion the parts of the machine in such a manner that safe values of temperatures will not be exceeded. On the other hand, if the temperature rise is low, the machine may be larger than necessary and will not be marketable. Also, in the past, considerable changes in temperature rise have been effected by changes in the ventilating system.

Those problems associated with temperature in electrical machinery are of great importance, perhaps more than any others that confront the designer of apparatus. But they embody so many intricate relations that for many years the designer estimated the increase in temperature above the surroundings only by comparison with other apparatus. When he was called upon to design a machine that was to deliver considerably more power or was to operate at much of a departure in speed from the other apparatus previously built, he was unable to predict within a wide margin how far he might go. Only in the last few years have we begun to place this complex problem on a scientific basis. Many parts of the problem are still unsolved, but it is felt that sufficient progress has been made to warrant the giving of information regarding the manner in which the researches have been, and are being made.

It was recognized at the outset that it was hopeless to secure positive results, by attempting to analyze the results of tests on complete machines. The method finally adopted was to break the composite into its constituent parts and then to make a study of the heating problems of those parts. Such studies were to be made largely by experiment on models, but mathematical analyses were to be made whenever possible. Even such studies are usually difficult and a few of them have been fruitless. But enough of them have proved to be successful to justify the engineers who are conducting the researches to believe that they are on the right road. When solutions of the heating problems in models are obtained, the results, or suitable combinations of the results, are applied to machines as built.

To be more specific, the case of the large steam-turbine driven alternator will be considered. The number of cubic feet of air per minute needed to absorb the heat generated by the losses is readily calculated if the temperature increase of the air is assumed. But the distribution of the air between many parallel paths and the pressure required to drive the air through the ventilating passages were unknown, and the researches consisted in finding methods for determining them.

Accordingly, two models were built in which the stationary parts were made of hardwood with ventilating ducts as in a machine, and arrangements were made for measuring the total volume of air, the volume discharged through each vent duct, and the total pressure. The models were provided with a rotor that could be operated at speeds up to the peripheral speeds that obtain in large turbo-alternators. Each of the many factors that might influence the flow of air was investigated independently, which enabled the engineers to derive mathematical equations. With the use of these the pressure needed to drive a given volume of air and the distribution of the air can be predicted within a comparatively small percentage of error.
Most steam-turbine driven alternators are provided with fans on the shaft of the rotating part, which deliver to the generator the cooling air. Fans on the surfaces of the vent ducts depends upon the temperature differences between the surface and the air, upon the velocity of the air stream, and upon the character of the disturbances (eddies) in the air stream. The latter is one of the things that makes this research a difficult one, and it is necessary to imitate in small models the restrictions in the vent duct as they are in electrical machines, and thereby secure an approximation to the eddying condition. In this investigation the surfaces were heated electrically and the temperatures measured by thermocouples.

There are differences in temperature between the ventilating duct surfaces and those parts in the stack of iron stampings which are not exposed to the air streams. The heat generated in these stacks must be conducted to the cooling surfaces from lamination to lamination. Tests were made to determine the conductivity of such a stack and then, by applying a little mathematics, the temperature differences were readily calculated.

The heat generated in the copper is due to such eddies Fortunately have admitted of mathematical analyses, the accuracies of which have been achieved experimentally. All the generated heat in the copper must be conducted through the insulating wall, and a large number of tests were made to determine the values of the thermal conductivities of various kinds of insulating materials. From a knowledge of those values, and the losses in the copper, the difference in temperature between the copper and the outside of the insulating wrapper may readily be calculated. Heat is also conducted along the copper longitudinally, and a mathematical solution of this part of the problem and its bearing upon the temperature has been obtained.

Usually, the copper temperature is most vital and most difficult to predict. It is determined by a series of calculations, some pertaining to the losses, some to ventilation, some to heat dissipation from cooling surfaces, and some to heat conduction. Each has been secured by one or several researches. The studies have raised this very important and difficult problem from the empirical to the scientific state.

**MEASUREMENT OF THE TEMPERATURE OF MARS**

By Dr. W. W. Coblentz

U.S. Bureau of Standards

Since the intensity of radiant heat of a body varies inversely according as the square of the distance, the heat of the planet Mars must millions of miles away, be infinitesimal on our earth. Professor Coblentz here reviews the progress made in planetary heat measurement—particularly that of Mars, our nearest neighbor.

In beginning this talk to-night I can not refrain from expressing a feeling of awe and wonderment at the progress made in radio. I wonder how many of you who are listening in realize that the whole subject of wireless telegraphy is but little more than twenty-five years old. In the winter and spring of 1900 a fellow-student, Cartmel, and I transmitted electromagnetic waves from one building to another at Case School of Applied Science, Cleveland, Ohio. The receiving and the sending apparatus was so crude and uncertain in its action that when we were ready to send the wireless waves we first signaled to each other with bicycle lamps. No wonder the local papers came out in large headlines telling how "through a blinding snowstorm" two Case students had sent wireless messages from one building to another.

In the meantime has come all this wonderful development, even to radiotelephony.

Now here I am to-night, using the spoken word, transmitted in electromagnetic waves, across many miles of space, to tell you something about the measurement of the temperature of the planets, especially Mars.

Whether or not Mars is inhabited and whether or not the Martians attempted to signal to us with bicycle lamps or other means, during the past summer, we do not know. But we do have something definite regarding the temperature of the surface of Mars. Our measurements show that the temperature of the dark areas on Mars rises above 0° C. This shows that vegetation can exist on Mars. Whether vegetation does exist on Mars is an entirely different question, which depends upon the presence of oxygen.

Mars rotates on its axis once in twenty-four hours and thirty-seven minutes. Hence its day is about one half hour longer than ours. But its seasons are about twice as long as ours. As a result during the long summer season in the polar regions of Mars the temperature rises considerably, just as it does in Alaska and Siberia.

The temperatures of the planets are measured by means of extremely small thermocouples, made of two kinds of wire, the diameter of which is smaller than that of a human hair. The junctures of these two...
wires are flattened into little disks called receivers, which are about one one hundredth of an inch in diameter. These thermocouples are mounted in the eyepiece of a reflecting telescope. They take the place of the cross-hairs in the eyepiece and the temperature measurements are made by setting these thermo-junctions (instead of the cross-hairs) upon the bright and the dark spots on Mars, also on the craters of the moon. The heat rays emanating from these spots warm the little metal receivers, giving an indication of the temperature of the surface.

You are all familiar with the dark and bright markings on the moon, as viewed without a telescope. These markings have the appearance of the face of the "man in the moon." Similarly, but as viewed through a powerful telescope, the surface of Mars shows bright and dark areas, resembling somewhat the markings on the moon as viewed with the naked eye. Superposed upon these somber markings are the polar caps of Mars, which shine forth as bright as the frosted bulb of an incandescent lamp. But strange to say, these bright polar caps are cold. When the thermocouple receivers are placed upon the image of the polar caps they show no heating because the polar caps do not emit infra-red rays. The polar caps are no doubt composed partly of snow and ice.

The observations on the polar caps from some of the most interesting and fascinating parts of the work of measuring the heat radiated from Mars.

It was observed long ago by Schiaparelli and by Sir William Herschel that the polar caps wax and wane, which would be the case if Mars had seasons of winter and summer as we have on this earth. From the very nature of the growth, namely, in tufts, such as the pampas grasses, and the mosses and lichens which grow in the dry tundras of Siberia. The upper surface beneath has a low heat conductivity. Hence it seems evident that the temperature of Mars should rise almost as high as that of the earth.

The observed high local temperatures on Mars can be explained best by the presence of vegetation which grows in the form of tussocks or thick tufts, such as the tundra mosses may be up to 75°F., while the ground only an inch or two underneath was frozen.
THE calculation of short circuit currents that will flow due to a line fault on transmission networks is of great importance when applying relays or circuit breakers to a transmission system. Since it is the purpose of transmission net-works to supply power continuously to the customer with as little interruption of service as possible, naturally these networks must have the greatest protection that can be supplied. On the other hand it is impossible to protect these net-works unless definite data is at hand which will supply information as to what the network is to be protected against, namely how much power will flow in case there is trouble on the transmission system or in the generating stations that supply power to the transmission lines.

The amount of power that will flow for a fault at a definite place on any transmission system will depend upon the capacity of the connected synchronous equipment, the reactance, capacity and resistance of the circuits and the arrangement of the transmission parts. This power flow will not be a constant value; depending on the part of the voltage wave at which the fault occurs, the power flow may be a large value at the instant of the fault and then die down to a constant value or it may be of a medium value at the instant of fault and then die down to a constant value. In present transmission systems the time required for this initial power flow to die down to a constant value is not over three seconds at the most and in many cases much less than that. It might be well to mention here that modern turbo-alternators are designed so that the initial maximum symmetrical short circuit current that will flow in case of a short

at the generator terminals will be from three to four times normal full load current, and this will die down to about 2.5 times normal full load current in three seconds or less.

Three seconds seems to be a very short time but when it is a question of protecting expensive electrical equipment, three seconds is a long time especially when a short circuit occurs. It is, therefore, the duty of all protecting apparatus to clear the system of a fault in the least possible time; so the problem of transmission line protection is a problem of finding out how much power will have to be interrupted at the time the protecting apparatus trips out the circuit breaker.

Of course it is the relay in the circuit that trips out the breaker. It is possible to set this relay so that it will close its contacts at a definite time for a definite power flow. If the short circuit current calculations are made for relay settings the minimum current that will operate the relay must be found. This minimum value must be larger than the normal full load current. Often cases arise when the actual short circuit current will not be more than 1.5 times normal full load current and in such cases in order to insure positive protection it may be necessary to carry idle generating equipment to insure relay operation in case of a fault.

It is the circuit breaker that must interrupt the power that flows in a faulty line and naturally this breaker must be of such a capacity as to interrupt the maximum power that will flow. Since it takes most circuit breakers and relays together at least .2 of a second to clear a line after a fault occurs it is usually unnecessary to take into account the actual maximum peak value of short circuit current when making circuit breaker application for in .2 of a second the maximum peak value of short circuit current that might flow will have entirely died away. The circuit breaker application therefore calls for the actual KVA that must be interrupted at least .2 of a second after the fault occurs.
The question now arises as to how shall this maximum KVA be calculated, that is should a single phase line to line short be considered, a three phase short or a line of neutral short. Of course the short that would give the largest symmetrical short circuit current would be the logical one to consider. If all generators of a given transmission net-work were grounded the line to neutral short would give the largest symmetrical short circuit current. Of course all generators of a system are not grounded, therefore this would seem to be out of question, but since we are interested in a safe value, that is we want to supply a breaker that will clear the fault, we are sure to find the maximum short circuit current if we base our calculations on a line to neutral short. Most practical circuit breaker applications are based on line to neutral short circuit calculations.

Before making any calculations on any net-work a single line diagram of the system in question should be made, including all parts of the system, such as generators, transformers, transmission lines and any part of the system that will affect the short circuit current flow. The constants of each individual part should be listed on the diagram. Figure 2 represents a small typical net-work that may serve to illustrate the principles involved in making short circuit calculations.

The characteristics of transmission lines for various symmetrical spacings and for various size transmission wires have been conveniently tabulated in most books dealing with transmission net-work problems. However, there are many transmission lines that are unsymmetrically spaced and therefore these tables are of little value. Any unsymmetrically spaced transmission line may be given an equivalent symmetrical spacing; that is the equivalent symmetrical spacing of any transmission line is equal to the cube root of the product of the three distances between the unsymmetrically spaced wires. If the net work consists of various voltages as most net-work does, all calculations must be made on a common KVA or KV base. Figure 2 shows only two voltages, 6600 and 13200 and since there are more lines involved with 6600 volts the calculations may be made on the basis of 6600 volts.

Perhaps the easiest way to find the actual current that a breaker would have to interrupt at the point of fault would be to change the several delta connections to their equivalent star connections and thus find the total equivalent reactance to the point of fault. (It will be noticed that no account is taken of resistance or capacity of the various parts of the circuit. In many cases these values are so small in comparison to the reactance that they can be neglected).

If we have a delta connection as indicated in Figure 1 its equivalent star is found as shown or the equivalent delta of a star may be found as shown.

**Delta to Star**

<table>
<thead>
<tr>
<th>AxC</th>
<th>L = ( \frac{A+B+C}{AxB} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \frac{A+B+C}{AxB} )</td>
</tr>
</tbody>
</table>

**Star to Delta**

<table>
<thead>
<tr>
<th>LxM+MxN+NxL</th>
<th>A = ( \frac{N}{LxM+MxN+NxL} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \frac{N}{LxM+MxN+NxL} )</td>
</tr>
</tbody>
</table>

The generator reactances are all based on the total KVA of the system as here shown:

\[
\begin{align*}
\text{KVA} & \quad \text{% Reactance on own KVA rating} \\
6000 & \quad 6500 & \text{ohms at} \\
75000 & \quad 19.5 & \text{ohms at 6600V} \\
6000 & \quad 44 & \\
75000 & \quad .585 & \\
6000 & \quad .44 & \\
75000 & \quad .44 & \\
\end{align*}
\]

The sum of these currents will be the actual current the generators of a given transmission net-work were grounded to neutral short circuit. In many cases these values are so small in comparison to the reactance that they can be neglected.

\[
\begin{align*}
\text{Reactive per mile of 4/0 wire} & \quad 3 \text{ ft. spacing} = .644 \text{ ohms} \\
\text{Reactive per mile of 2500,000 C. M.} & \quad 3 \text{ ft. spacing} = .364 \text{ ohms} \\
\text{Reactive per mile of 300,000 C. M.} & \quad 3 \text{ ft. spacing} = .62 \text{ ohms} \\
\end{align*}
\]

\[
\begin{align*}
\frac{19500}{6600 \sqrt{3}} & = 1700 \text{ total full load current} \\
19500 \times 6 & = 11700 \text{ total full load current} \\
\frac{19500}{6600} & = 1210 \text{ amps. at 6600 volts} \\
\frac{19.5 \times 6600}{\sqrt{3 \times 1700 \times 100}} & = 44 \text{ ohms reactance at 6600V} \\
13200 \text{ volts to neutral} & = 3820 \text{ ohms reactance} \\
13200 \frac{1.5837}{3} & = 2410 \text{ amps. at 6600 volts} \\
13200 \frac{1.5837}{3} & = 1210 \text{ amps. at 13200 volts} \\
\end{align*}
\]

This is the instantaneous symmetrical short circuit current. In order to find the symmetrical short circuit current that the breaker would have to interrupt, say .3 of a second after the fault occurred it will be necessary to find the current supplies by each generator. The current supplied by a generator to a fault divided into the normal full load current of that generator will give the total per cent reactance of that generator to the point of fault. By use of decrement curves which have been plotted from test data based on different percent reactances in a circuit the actual current each generator will supply .3 of a second after the fault occurred can be found. The sum of these currents will be the actual current the breaker will have to interrupt.

To find the short circuit current for a fault on a large transmission net-work as are in practical use today one readily sees that it would be an endless job if the work were done as outlined above. In

(Continued on page 24)
THE SERIAL BOND AS A MEANS OF FINANCING PUBLIC IMPROVEMENTS

By R. E. Hutchins
Associate Professor Civil Engineering, Rose Polytechnic Institute

In recent years more and more construction work of public, semi-public, and private nature is being financed by bond issues. It was not however until the Liberty Bond appeared and was sold that the so-called common people really understood what a bond is.

In the financing of municipal and semi-municipal construction programs there has been developed a type of bond known as the serial bond. This type is becoming to be more and more popular. It consists of an issue, parts of which are retired each year—usually increasing in amount—until at the life of the issue the last payment retires the whole amount.

The serial bond on the other hand usually has a shorter maturity, therefore commands a lower price. By making the life of the bonds such that in the case of the average community, other than the great cities, there is usually no one in charge of the administration of the sinking fund who is really capable of handling it. In addition it generally costs the seller more than a serial issue in interest, though that is solely a question of price of sale and interest rate, determined upon at the time of sale between the seller and the purchaser.

In general, other things being equal, an investor prefers an issue of long term bonds rather than short term. He can wield his coupon shears at proper intervals and only occasionally has to look for new fields for his capital—consequently the second form mentioned above usually can be sold at a higher price.

The serial bond retired in such a manner that the sum of principal and interest each year is a constant quantity, is a geometric progression, the first term of which is

\[ a = \frac{p}{1 - (1+i)^{-n}} \]

where “a” equals the amount of the issue, “i” equals the rate of interest in 1/100, and “n” equals the number of payments. The terms are those of a geometric progression and each term will be greater than the preceding by the factor \((1+i)\).

In our particular example \(a = 1,000,000\); \(i = 0.05\); \(n = 21\).

Therefore \[ p = \frac{1,000,000 \times 0.05}{(1.05)^{21} - 1} = \$27,975. \]

It is customary in issuing bonds to have them in some round number unit as \$1,000 each, \$500 each, or \$100 each. It was not until the great war that bonds in units of \$100 and \$50 were issued to any extent; usually they were in units of \$1,000 and \$500.

It is obvious that in adhering to the arrangements the yearly payment of principal and interest be a constant is physically impossible of attainment exactly if the units are for \$500 each,—it is possible to closely approach it.

The first payment would therefore be \$28,000—the nearest multiple of \$500. Under the assumed arrangements nothing but interest would be paid the first four years. It will be convenient to arrange the computation in the form of a table.

### TABLE OF MATURITIES OF SERIAL BOND ISSUE

<table>
<thead>
<tr>
<th>Year</th>
<th>Principal on Payment</th>
<th>Principal Bonds</th>
<th>Interest Total Percent</th>
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</thead>
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<td>No. of</td>
<td>No. of</td>
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<td>1,000,000</td>
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<td>1,000,000</td>
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</tr>
<tr>
<td>25</td>
<td>165,300</td>
<td>165,300</td>
<td>7,500</td>
</tr>
</tbody>
</table>

Average maturity = \( \text{Total Cost} / \text{Total Interest} \) = 16.74 years
FIRE LOSS AND FIRE PREVENTION IN THE UNITED STATES AND ABROAD

By Emil J. Yansky, m. c. '27

Since the annual fire losses in the United States are increasing alarmingly with the development and population of this country, this continued waste of the nation's resources has opened up one of the greatest fields for improvement that ought to hold the attention of all, at the present time.

The three most destructive elements known to man are fire, water and wind. Cyclone and floods cannot be easily prevented, but there is no excuse for the great catastrophes due to fire. Glance over the following list of great fires that have occurred during the past eighty years and the full force of this danger can be realized. The table contains only fires which did over $10,000,000 damage.

Great Fires of the Past Eighty Years

<table>
<thead>
<tr>
<th>Date</th>
<th>Place</th>
<th>Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1825</td>
<td>New York City</td>
<td>$17,500,000</td>
</tr>
<tr>
<td>1842</td>
<td>Harrisburgh, Pa.</td>
<td>35,000,000</td>
</tr>
<tr>
<td>1848</td>
<td>Constantinople</td>
<td>15,000,000</td>
</tr>
<tr>
<td>1851</td>
<td>St. Louis</td>
<td>15,000,000</td>
</tr>
<tr>
<td>1861</td>
<td>Charleston, S. C.</td>
<td>10,000,000</td>
</tr>
<tr>
<td>1866</td>
<td>Portland, Me.</td>
<td>10,000,000</td>
</tr>
<tr>
<td>1870</td>
<td>Constantinople</td>
<td>25,000,000</td>
</tr>
<tr>
<td>1871</td>
<td>Chicago</td>
<td>165,000,000</td>
</tr>
<tr>
<td>1872</td>
<td>Boston</td>
<td>70,000,000</td>
</tr>
<tr>
<td>1876</td>
<td>St. Hyacinthe, Can.</td>
<td>15,000,000</td>
</tr>
<tr>
<td>1877</td>
<td>St. John, N. B.</td>
<td>15,000,000</td>
</tr>
<tr>
<td>1882</td>
<td>Kingston, Jam.</td>
<td>10,000,000</td>
</tr>
<tr>
<td>1892</td>
<td>St. John, N. F.</td>
<td>25,000,000</td>
</tr>
<tr>
<td>1896</td>
<td>Guayaquil, Ecuador</td>
<td>22,000,000</td>
</tr>
<tr>
<td>1900</td>
<td>Ottawa, Canada</td>
<td>10,000,000</td>
</tr>
<tr>
<td>1901</td>
<td>Jacksonville, Fla.</td>
<td>10,000,000</td>
</tr>
<tr>
<td>1904</td>
<td>Baltimore</td>
<td>60,000,000</td>
</tr>
<tr>
<td>1904</td>
<td>Toronto, Can.</td>
<td>12,000,000</td>
</tr>
<tr>
<td>1906</td>
<td>San Francisco</td>
<td>350,000,000</td>
</tr>
</tbody>
</table>

(From "Fireproof Construction" by Fitzpatrick & Condron.)

Think of it, in only nineteen fires a total loss of about a billion dollars. But the United States alone spends more than this amount every year due to fires. The average direct loss per year is about $550,000,000, $400,000,000 more is spent in putting out fires and maintaining fire apparatus and over $316,000,000 is handed over to insurance companies in the form of premiums. This makes the fire cost per capita in the United States amount to about $11.00 a year. In Europe it is only 51 cents.

The loss of life due to fires in the United States is almost as great as that due to automobiles and railroads. On an average of 250 persons are killed every year and about 10,000 are seriously injured. The lives of 50,000 people are in actual peril daily due to the burning of the firetraps which are all over the country.

Every week in the United States the flames destroy 3 theatres, 3 public halls, 12 churches, 10 schools, 2 hospitals, 2 asylums, 2 colleges, 6 apartment houses, 3 department stores, 2 jails, 26 hotels, 140 flats and 2500 private homes. But this is no great wonder when it is considered that out of 12,000,000 structures in the country only 8,000 are fireproof. Even this is no excuse though for such tremendous losses, when 999 out of every 1000 fires can be classified as preventable and due to carelessness and ignorance. Children playing with matches, defective flues, defective wiring, overheated stoves and furnaces, sparks, explosions, ashes, cigarettes, gasoline and oils, incendiarism, and many other causes contribute to the toll. About one-fourth of all fires are due to unknown causes. The only fires which could be considered excusable are those resulting from earthquakes, lightening, and tornadoes, but even these could be eliminated if most buildings were fireproof.

The way in which buildings are constructed in this country is a crime. Hollow walls and floors furnish a veritable flue for the flames to pass through. Fires starting in the basements of houses have been known to reach the roofs in less than four minutes. Once on the roof with its flimsy shingles, and with a good start from below, the fire can finish the house in about fifteen minutes. And yet people will gamble with their lives and their fortunes to save about 25 per cent more in the original cost of a building. Most people are unwilling to spend this extra amount in putting up a fireproof structure amid a nest of firetraps; old buildings endanger new and thus the "let 'er burn" and the "take a chalice" ideas hold full sway in such localities. That is why our fire cost per capita is $11.00 and Europe's only 51 cents.

The people of Europe regard a fire almost as a crime. All their fires are investigated more thoroughly than are fires in this country. In England a man cannot collect insurance for a fire which starts on his property and damages his neighbor's. All the insurance he carries goes to pay the neighboring loss and if he does not carry insurance he is directly liable to the full extent of the damage. Quite a contrast to this country where a "hard up" business man can have a good fire and thus "get on his feet" again—and get by with it too.

All Europe was shocked recently over a $750,000 fire in London. Fires like that get only a brief mention in the United States. As a whole the people of Europe are more careful and conscientious regarding this matter. Their buildings are mostly of stone and brick and are put up more carefully. Time is not the big element in their building programs. The high cost of lumber in Europe also accounts for the scarcity of wood in their buildings. In most instances the fires in leading European cities are confined to the floor on which they originated and it is rarely that they pass beyond the building.

In the United States fires spread from floor to floor and building to building as if they had been constructed with that end in view. Just think, if only

(Continued on page 25)
WANTING IN THE BALANCE?

A fairly representative report on the costs of engineering education has been compiled by a committee of the Society for the Promotion of Engineering Education which is conducting an investigation under a grant by the Carnegie Corporation. Their figures before us indicate that the actual cost per student per year to the college or university ranges from $582 in the endowed universities to $293 per student in land grant colleges. It is interesting to note that the average figure for the annual cost per engineering student in the seven Polytechnic Institutes of the survey shows $551 with an average investment of $7,854 per student in buildings and equipment. Of course all this unusual expense is not borne by the student; not even the half of it in most cases. We might take our own Institute for an example. Dividing the $100,000 per year gross expenses by the average number of students enrolled each year we obtain an actual cost per student of from $450-$500 per year. The student pays near $175, leaving quite a large deficit to be met by revenue from other sources, endowments, interest, and etc.

It is within the phase of evaluation that we ask ourselves if this yearly financial expenditure is augmented by any other media which are costs as well as those figures already given. What about the labor cost to the student himself - a waiting cost, if you please—a denial cost too (for it is not supposed that the average student has any such thing as capital)? Yes, there are many costs which, when four years are taken into account, become very large indeed. Now let us be perfectly fair. Are you getting value received? Is the Institute getting value received?

It is important for every young man to have a definite aim in life. He who sees beyond the immediate present and places his goal in the more distant future, and patiently and persistently prepares himself to meet its requirements, will not only find it attainable, but will often be surprised to find that it is only a stepping stone to even greater opportunities and responsibilities.

—H. P. Davis.

FROM OUR SIDE OF THE FENCE

A pleasant surprise was afforded the other day when it was brought out that Rose alumni stand preeminently ahead of many contenders for the honors as regards their estimation of and placing of graduates. Out of the average university class only 9.9 per cent were placed in positions by alumni, while Rose alumni at the same time placed 20 per cent of her graduates in positions.

This is a significant fact and well bespeaks the high respect which exists among Rose men in industry. Trowling beneath the surface we find ample reason for such a condition. The trust and faith of Rose alumni of their school and its standards is unshaken for it is a known fact that a high standard of scholarship will be maintained. To the men in school it may seem a "hard row to hoe" but has it not been said that school is a proving ground? It must not be any less a proving ground than life.

YOU ARE CHARGED WITH . . .

We people of the United States are a careless lot. Untold accidents each day are the direct result of neglect or chance-taking. In speaking of the steps toward accident prevention in the United States the proceeding of the Fourth Safety Congress says, "In recent years the American people have become aware of the menace of excessive accident prevalence in the United States. A number of well conceived programs have been developed. In respect to the study and prevention of automobile accidents, the National Safety Council was among the first of the public-spirited organizations to realize the significance of a rising automobile accident death rate and to plan for the effective study of conditions and circumstances. . . . This committee wishes to direct the attention of leaders of public opinion to the best of the available facilities for collecting information on highway accidents and for making such effort as will bring about effective results in the control of fatalities on American highways."

Further in the same report, which was characterized by quite thorough investigations and data, there occurs the statement of reasons for accident, applying to the "driver" of the car. In most cases, the only reasons which could be given were, "did not have right of way", "exceeding speed limit", "on wrong side of road", or "intoxicated". As for the pedestrian, 1000 cases of accident at crossings were reported as compared with 1809 cases between intersections, or walking or running in the street thus showing the great importance of pedestrians keeping out of the street except at intersections and then crossing only with the signal. Other parts of the same report show that defects of the vehicle were relatively unimportant and that a great majority of the accidents occurred on a dry roadway, in clear weather and by daylight.
To further the solution of the problem of accidents the report concludes, "There seems to be no more promising opportunity for the betterment of our national accident than through the active development of the accident reporting plan proposed by the National Safety Council and which is now in successful operation in a number of our leading cities. Apathy and indifference to the facts and to methods of collecting facts will only lead to further increases in the toll of injury and death on our American highways. The experience of the American population with other problems in life conservation shows that when the American people become aware of specific situations, remedies are soon applied and marked progress results. We have only to review the distinguished record of the American public health movement during the past three decades in in controlling such menaces to life and happiness as typhoid fever and tuberculosis. No concerted attack upon these scourges of life-waste was possible until the facts were collected and studied. It was only through the close study of the vital statistics of American communities that the full significance of life-waste from the controllable diseases became effective. When the facts were brought to the attention of the people, health officers were given adequate support, ameliorative measures were adopted, and sickness and death rates were reduced. Forward looking students of the public accident problem feel that when adequate information is available, proper steps will be taken to prevent some of the tremendous losses which are now occasioned by accidents on our public highways."

CRASH!

Perhaps no other event has happened this year that has been commented upon and discussed as much as the little rush party sponsored by the Engineers at the Rose-Normal game February 24. And since that game marked the severance of all athletic relations between Rose and Normal for some time to come the gate-crashing has been regarded by many as a very untimely act. But to the men of Rose it is very significant for it means that the old fight and scraps were a part of the daily routine. In order to regard it from both sides, we must first of all consider public opinion. Terre Haute is proud of her two colleges, proud of Rose Polytechnic for the far-reaching name she has established for herself through the successes and abilities of her numerous graduates who are leaders in the various fields of engineering, and proud of that great institution—the Indiana State Normal School, where young men and women are trained in the art of modern intellectual fundamentals in order that they may impart to others a better educational training. Looking students of the public accident problem feel that when adequate information is available, proper steps will be taken to prevent some of the tremendous losses which are now occasioned by accidents on our public highways."

Unfortunately there are some of us in which the inward satisfaction gleaned from peaceful routine life has become such a pleasant habit that we dislike to be disturbed by a group of spirited young fellows who have the determination to carry on to a successful close, regardless of the opposition, whatever they may undertake. And because it is, perhaps, a bit unusual to have a peppy bunch of Engineers "rush the gate" in order that they might back to their utmost a team regarded by all as the underdog and which sorely needed their support and where those victims of complacency among us who do not hesitate to brand the members of that party as rough-necks and hoodlums. And so it happened. But let us get on with the story.

It would seem that the rushing party had been somewhat deliberated upon before the night of the game. At about 7:30 the young Engineers could be seen gathering around the north side of the Wiley gym, talking and laughing in subdued tones about the game perhaps, or of the excitement which was soon to come. Then the leaders held a consultation and two fellows were sent to look in the windows and choose the route. There wasn't much choice however, as two stern guardians of the law stood at each portal. But the two cops on the north stairway looked as though they might bear acquaintance, and it was planned to launch the attack there.

Nonchalant Engineers strolled in pairs, in small groups, and in bunches toward the front of the building and into the lobby. Calmly and deliberately, it seemed as though he might sends a signal that would signify the opportune moment in which to launch their attack and carry the stronghold of the enemy. The north stairway was empty and all was in readiness. Then came the command of the leaders, "Let's go gang!" and up the stairway swarmed the Engineers, quiet until they neared the top of the stairway when they announced their presence as all good gentlefolk should. But wait! It was not so easy as that, for there stood the two policemen flanked by several rawboned Teachers! But why bother with a couple of cops and bunch of dumbbells? Just a slight unpleasantness, but as one of the fellows remarked, "Well really, don't you know, I couldn't be bothered."

One tiny Engineer was the first man up the stairs—in fact he was just about two jumps ahead of the main body. He hit the top with a bang and looked around. And there was a gigantic policeman, arm drawn back in readiness to start a regular old-fashioned hay-maker! The blow started, but the worthy Engineer decided that he couldn't be bothered either and besides the seats looked very inviting and he was tired from running up the steps. So he sat down calmly and mopped his perspiring brow, while the rest of his colleagues came pouring up the steps and into the gym. But in justice to them and with all due respect to their efforts, it must be said that the policemen did manage to black an eye and a half.

A section of seats on the east side was empty, and into this portion of the stands went the Engineers, who were just about two jumps behind the main body. He hit the top with a bang and looked around. And there was a gigantic policeman, arm drawn back in readiness to start a regular old-fashioned hay-maker! The blow started, but the worthy Engineer decided that he couldn't be bothered either and besides the seats looked very inviting and he was tired from running up the steps. So he sat down calmly and mopped his perspiring brow, while the rest of his colleagues came pouring up the steps and into the gym. But in justice to them and with all due respect to their efforts, it must be said that the policemen did manage to black an eye and a half.

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F. R. Fishback, who is vice president and secretary of the Electric Controller and manufacturing Company of Cleveland, visited the school on February 12th. Mr. Fishback gave an illustrated lecture on "Electric Controllers and Their Installation" at one of the assembly periods.

Leon J. Willien has taken a position as Gas Engineer with the H. M. Bylesby Company of Chicago.

E. F. Jaenisch has returned to the Louisville Gas and Electric Company.

Leslie C. McPeak is with the North-Raffin Company at Hollywood, Florida. Address Box 365.

Herbert M. Corban paid the school a short visit February 9th, en route from Denver to Knoxville, Tenn., where he is to work for the Knoxville Gas Company.

H. H. Merrill is with Brown and Mick, Inc., 226 East Michigan Street, Indianapolis, Ind.

Orville M. Dunning, who is with the General Electric Co., has been sent to New York City for a few days to take charge of some special testing.

The Schnectady Tech Club took part in the Intercollegiate smoker program which was broadcast from station W. G. Y. on Saturday, February 27th. The program of the Rose group consisted of several of the favorite school songs. The Tech clubs of several other schools who are well represented in Schnectady also took part in this program.

The St. Louis Rose Tech Club held its second 1925-26 season meeting at the American Hotel, February 4th, 1926 at noon with the following present:


Letters of regret were received from Benj. McKeen and W. O. Layman on account of inability to be present at the meeting owing to conflicting engagements.

The Pittsburgh Tech Club held a meeting and dinner at the University Club, Pittsburgh, Pennsylvania, on the evening of January 7, 1926. The following men were present:


After a most enjoyable dinner, a business session was held, at which subjects of interest to the Alumni, and the activities at Rose were discussed. Unfortunately, representatives from the school could not be present. Mr. Fisher and Mr. Reifenberg, however, of the class of 1925, gave an account of recent activities at Rose.

In discussing the matter of Rose publicity, Mr. Reddie, secretary of the Pittsburgh club says:

"We have one suggestion to lay before you, in an informal way. This is not a part of the minutes, of the meeting, and concerns a subject in which the student body might be interested. In a discussion of various ways and means, through which the alumni might help in promoting the welfare of Rose, someone brought up the importance of the St. Patrick's Day celebration as a means of getting the name of the Institute before the public. It was felt that the Alumni could not do much on this, and that if it were worth anything at all, the student body itself would have to promote the idea. You know, of course, that many colleges and universities have celebrations that are of a special significance to the school itself, and of general interest to the public. You have frequently seen these celebrations, covered in the newspapers and news feature reels. In the St. Patrick's Day celebration, the Student Body at Rose has a feature distinct, and one which is undoubtedly of sufficient general news interest, to attract the attention of some of the large metropolitan newspapers and news reel feature people.

This thought is passed on to you, for what it may be worth. Anything of course, that could be developed, from the idea, would depend upon what the fellows right in school, could do with it.

The Pittsburgh Tech Club sends sincere regards to the Faculty and Student Body."
Master of Icebergs
—a new kind of college degree

MASTER all the intellectual icebergs you sight at college, and your degree will mean something.

The cold facts you learn, like $a^2 - b^2 + c^2$, are but the visible tops of these icebergs. Underneath, as with floating ice, lie the other eight-ninths.

Facts are of little importance till you see them in relation to their great underlying principles. The facts of mathematics strike deep into the other sciences. The facts of history strike deep into sociology, ethnology, geography.

That is why an engineer who learned Ohm's Law can develop a great telephone exchange and control its fascinating forces.

Viewed thus, the endless array of dry facts and dull figures that seem to crowd the years brighten and beckon with a challenge—to look deeper, ever deeper.

Published for the Communication Industry by
Western Electric Company
Makers of the Nation's Telephones

Published in the interest of Electrical Development by an Institution that will be helped by whatever helps the Industry.
ENGINEERS DEFEAT VINCENNES UNIVERSITY

In a game that was full of thrills and not won until the final gun, the Fighting Engineers defeated the Vincennes University team in a game played at Vincennes, February 4, by a score of 28 to 25. Vincennes defeated Rose Poly a year ago and the Clarkmen played a brilliant brand of ball and were on their toes throughout the game to avenge themselves from Coach Alwood's quartet.

The game started fast and remained so through the first half. The Engineers displayed a good offensive and worked the ball in for a total of seven field goals, Kasameyer and Berry scoring twice and Goddard, Alexander, and Taggart each scoring once. Vincennes also played good ball but their scoring was done from far afield, the Rose defense being very effective. Lenahan was the outstanding player for Vincennes. At the half time Rose was leading by a 15 to 8 score.

The play in the second half was faster than that of the initial period and Davis and Kilfoil thrilled the rosetta by their long range shooting. Alexander hit the basket three times for Rose, and Wilson also scored for the Engineers. Davis, however, kept his team in the running with long shots and gradually closed down on the Engineers' lead. As the score tightened, Coach Clark shifted his lineup sending Berry back into the game, and the play became more intense, the ball being passed up and down the floor at great speed. Vincennes found it impossible to get past the guarding of Taggart and Goddard for short shots but they made good on their long ones. The Engineers worked the ball close in before shooting. Berry scored twice on short shots. Rose scored twice on foul goals and Vincennes once.

Lee Berry pulled the game out of the fire for the Engineers in the final minutes of play. With three minutes to play, Davis looped a long one in for Vincennes, to tie the score at 23 all. After some clever passwork Goddard shot the ball to Berry close in under the basket and the Rose center made good the attempt. Then Davis came back with another sensational long shot and again tied the score at 25 all. With but a minute to go Taggart grabbed the ball off the Vincennes backboard and started a rally that ended when Berry again slipped the ball through the draperies. Thirty seconds before the final gun Goddard cinched the win for Rose with a goal from the foul line and Rose had won, 28 to 25.

The victorious Engineers were met at the station on their return to Terre Haute by a delegation of 25 Rose students who welcomed the 'varsity with rose yells and cheers for the team. They also furnished automobiles in which the players were taken to their homes and to their fraternity houses. It was this spirit of support that helped make Rose Poly athletes feared in the Central West a few years ago, for as one of the players said, it sure makes a fellow feel like playing the old game when he knows that the boys back home are behind him.

Lineup and summary:

**ROSE POLY, 28**

Alexander, 4; Dick, 4; Kasameyer, 2; Goddard, 1; Taggart, 1; Wilson, 1.

**VINCENNES U., 25**

Davis, 4; Kilfoil, 3; Lenahan, 2; Brian, 1; Ray, 1; Dick, 1. Foul goals—Rose: Goddard, 2; Vincennes University: Davis, 4; Kilfoil, 3; Lenahan, 2; Brian, 1; Ray, 1; Dick, 1.

Substitutions: Rose: Wilson for Berry, Berry for Wilson, Wilson for Alexander, Alexander for Kasameyer, Reinking for Goddard. Vincennes University: Davis for Dick, Dick for Brian, Brian for Kilfoil. Field goals—Rose: Alexander, 4; Berry, 4; Kasameyer, 2; Goddard, 1; Taggart, 1; Wilson, 1. Vincennes University: Davis, 4; Kilfoil, 3; Lenahan, 2; Brian, 1; Ray, 1; Dick, 1.

In a game played at North Manchester, February 13, the undefeated Manchester college quintet took the Engineers into camp by a 51 to 25 score. The Manchester team uncorked an offense that the Engineers were unable to halt and after the first eight minutes of play took the lead and maintained it throughout the entire game. This is the twelfth win of the season for Manchester, it being the only undefeated college team in the state.

Manchester men hit their stride and the score started to pile up. Coach Clark sent in Lahti in an effort to halt the onrush but the tall athletes were too big for the Engineers. Manchester was leading at half time by a 32 to 12 count.

Five substitutes replaced the Manchester team at the start of the second period and they remained in the game only seven minutes. During this time Rose closed up on the big lead with Alexander hitting the basket from all over the floor and Lahti and Wilson each caging a field goal. Then the 'varsity was hurried back into the game and the Engineers fought hard but the score piled up.

The play of Bob Alexander featured the offensive of the Engineers. Alex looped the ball into the basket from all over the floor and he was the high point man of the game, caging eight field goals and one foul goal. Lahti played a strong defensive game and Goddard covered the floor in great style for the Engineers, but the lack of height on the part of the Engineers proved a big handicap in guarding under the basket.

For Manchester the passing of McCann, Winker and Kraning was very effective and these athletes used their height to good advantage in working the ball close in under the basket for short shots. Wine and Bryan also added to the final score by looping the ball in from far afield.

**LINEUP AND SUMMARY:**

**MANCHESTER, 51**

Winger, Capt.; McCann, 1; Bryan, 1; Reinking, 1; Bauman for Bryan; Specher

**ROSE POLY, 25**

Wilson, Capt.; Kranein, 1; Bauman for Bryan; McCann, 1; Reinking, 1; Wine, 1.

Substitutions—Manchester: Deardorff for Winger; Evans for Kraning; Grim for McCann; Bauman for Bryan; Specher (Continued on page 16)
Timken Steel for Timken Bearings

The world’s largest producer of electric furnace steel is the Timken Roller Bearing Company. A complete steel mill is part of the marvelously self-contained Timken Bearing plant.

Timken Tapered Roller Bearings are produced on a scale so large, because of their large importance throughout manufacture, construction, mining, agriculture, transportation, and every field in which machinery is used.

Timken Bearings are being designed into every sort of machinery to eliminate excess friction, to save labor, power and lubricant, to increase quantity and quality of output, and to lengthen machine life.

These economies are so important to all the industries that 132,000 Timken Bearings are being added daily to the 150,000,000 Timkens already successfully applied. Each day—each year—Timken Bearings become of still greater interest to all concerned with machinery. As a potential engineer you have a direct interest in obtaining the valuable little book on Timken Bearings. It will be sent free on request.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO
for Wine: Winger for Deardorff; Kraning for Evans; McCann for Grimm; Bryar, and Baum; Wine for Speaker; Kindy for Sawyer; Schlicht for McCann. Rose Poly: Kasameyer for Wilson; Sawyers for Reinking; Lahti for Taggart. Field goals—Manchester: Manchester, 6; Worsham, 4; Goddard, 3; Baum, 1; Wine, 1. Rose Poly: Alexander, 1; Reinking, 1; Lahti, 1. Referee—Geller, of Ft. Wayne.

ENGINEERS TRIM E. I. S. N.

In a game played at the Rose gym on February 17, the Fighting Engineers defeated the Eastern Illinois Normalites by a 29 to 21 score, thus evening up the season for, E. I. S. N. defeated Rose two months ago in a game played there. Coach Clark used Sawyers, freshman, at center in place of Lee Berry who was ill, and the lanky freshman proved to be a worthy understudy of the regular center.

It was evident throughout the game that Rose had scoring power for, whenever the Engineers needed points the team play brought the ball well down the floor where a Rose man would drop the ball into the draperies. Eastern Normal fought hard but the Engineers started out with a four point lead which they maintained throughout the game. Rose led at half time, 15 to 9. Kasameyer slipped the ball into the basket three times during the twelve minutes he played. He too, had been sick and Coach Clark replaced him by Wilson who played good ball during the remainder of the game. The floor guard position was held down by Goddard and Reinking, each man playing half the game. Goddard played a good passing game and contributed two points to the cause. Art, or "Little Eva," as he is known about school, played a fast, clever game over the floor and put a lot of speed into the Rose team.

Foreman was the Normal player most feared by the Rose athletics, but he was held to one lone field goal. However the Illinois Captain played a fast floor game and was an important factor in the team play of the Normal aggregation. Meurlot, forward, played a strong defensive game for the Teachers besides snagging a pair of field goals. Credit must be given to the E. I. S. N. players for the spirit they showed during the entire game, but it was simply a case of too much Engineer for them.

In the second half, Alexander "got hot" and bamboozled the basket from all angles. All in all he looped the ball in five times during the game. Red Taggart, back guard, put up a wonderful defense and his play was all that a coach would want it to be. His passing was perfect, and just to make things interesting Red took two shots at the basket and the ball went in both times. The Rose team as a whole played a top-notch brand of ball and with the team improving as it has been doing the past few games, the outlook for a successful wind-up for the season is brighter than ever. Let's get behind the Engineers.

ROSE POLY (29) E. ILLINOIS (21)

Field goals—Manchester: Manchester, 6; Worsham, 4; Goddard, 3; Baum, 1; Wine, 1. Rose Poly: Alexander, 1; Reinking, 1; Lahti, 1. Referee—Geller, of Ft. Wayne.

Substitutions—Rose Poly: Wilson, Reinking. Eastern Illinois Normal: Worsham, Meuriot. Foul goals—Manchester: Kasameyer, 2; Alexander, 1; Taggart, 2; Sawyer, Gooddard, Anderson, 3; Worsham, 2; Meuriot, 2; Foreman, 1. Rose Poly: Gooddard, 2; Winger, 2; Kraning, 1; Sawyer, Thompson, 3; Foreman, 3. Time of halves—Twenty minutes. Referee—Birch Bayh.

(Continued from page 14)

ENGINEERS WALLOP PHY-EDS

Avenging themselves for an early cage upset, the Fighting Engineers took the measure of the North American Gymnastic Union players in a game played at the Rose gym on February 20, by a score of 37 to 31. The Engineers uncorked an offense in the first half that the Physical Wrecks could not stop, and this early lead was more than the Indianapolis athletes could over-come. Rose was on the long end of a 21 to 12 score at half time. Early in the second half the Engineers increased this lead to 28 to 13, but N. A. G. U. staged a long range bombardment of the basket and excellent goal shooting closed up the wide margin that separated the two teams.

Bob Alexander was the high score man of the game, caging ten field goals and one foul goal, for a total of 21 points. However, it was the passing of Goddard, Sawyers, Wilson, and Lahti that gave Alex his chances to score and his eye was good as the results of the game showed. The Rose offense as a whole was far faster than in any other game this season. The passing too, was excellent and the defense was of the caliber that kept the N. A. G. U. sharpshooters far out on the field.

Rose started when Wilson dropped in two free chances. Alexander and Sawyers each added a field goal and Rose was out in front 6 to 0. However two field goals and five foul goals put the Phy-eds out in front 9 to 7. Then the team play of the Engineers started and they passed the ball around and through their opponents and the score rose steadily. From then on the Engineers were never headed. Reinking, who substituted for Goddard in the first half, put up a fast game, and his passing was an important factor in the team play of the Rose team. Lahti, freshman back guard for Rose, played the best defensive game he has shown this season, intercepting passes and keeping the Phy-eds away from the basket. Sawyers at center played a good game.

Overman was easily the star of the Indianapolis team. His goal shooting, coupled with three field goals by Duerr, was the feature of the N. A. G. U. team's rally near the close of the game. The guards however had a hard time handling the speedy offensive trio, who time after time passed the ball close in and cut under the basket for close range shots.

Rose halted the goal shooting rally during the last two minutes of play by getting the ball and playing a clever stalling game, passing the ball around and in that manner keeping the N. A. G. U. sharpshooters from shooting. Rose scored 16 field goals to their opponents' 11.

Lineup and summary:

ROSE POLY (29) N. A. G. U. (31)

THE EXPLOSIVES ENGINEER, now in its fourth year, is taking a higher place every month in the industrial press of the country and of the world. Its circulation is spreading wherever there is mining, quarrying, or construction. Each issue contains practical, usable information for the man who expects to take his place in the explosives consuming industry.

In February, for instance, there is an authoritative article on blasting in the construction of the Philadelphia subway. Another article describes a new seismograph which, with explosives, is used in determining geological structures. From his twenty-four years of explosives' experience around mines, the author of "Advice to Coal Blasters" has compiled some practical blasting information. "Road Building Above the Clouds" tells why and how Continental Divide highways are drilled without the aid of modern equipment. There is a portrait and a biography of S. A. Taylor, the next president of the American Institute of Mining and Metallurgical Engineers. And, of course, a Blaster Bill cartoon and the usual bibliography of all articles on drilling and blasting and a list of new patents, digested from the technical press of the world. You can see it in the college library, but you will want a complete file of your own. Send in your subscription on the coupon.

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WILMINGTON

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FRATERNITIES

ALPHA CHI SIGMA

On the evening of February 19 the Grill Room of the Terre Haute House was the scene of one of the most interesting and well-attended pledge banquets which the present members of the fraternity have been privileged to enjoy. That the affair was interesting from several points of view was easy to see: an excellent repast—quips from the toastmaster—pithy speeches—and around all, a professional solidarity which emphasized both the intents and purposes of the membership.

Undergraduates who responded to the toastmaster were Ernest Pifer, Clarence Corban, Rex Adams, and pledge, Morris Shattuck; while alumni Ray Cooke, Russell Corban, and Everett Gosnell gained the floor for the industrial group. Honorary members of Alpha Chi Sigma, Dr. John White, and Dr. Carl Leo Mees, President Emeritus of the Institute, gave talks outlining the broad phases of the occupation both in school and in life. A view of the evening’s entertainment would hardly be complete without mention of the paramount manner in which toastmaster John Sanford presided. His come-backs were sometimes keen, but quite jovial withall so that everyone was kept wondering what sly proposal he would produce from his inexhaustible supply of “good ones”.

After formalities were dispensed with, the last remaining late hour was devoted to informal conversation and exchange of greetings. Dr. Mees carried a goodly corner of the remaining groups into the devious realms of philosophy and the intricacies of metaphysics only to bring them back into the practical present with a message and a lesson. We appreciate very much the kindness of Dr. Mees and Dr. White in their attendance and constructive criticism which they so willingly give.

Brother Russell Corban was beaming from ear to ear the other day when we met him. He was rightfully so for he reports a recent addition to their family—a healthy Miss of near seven pounds.

ALPHA TAU OMEGA

Following its yearly custom Gamma Gamma gave its dance in honor of the new pledges at the chapter house on February 20. Les Shepherd’s orchestra furnished the music which kept everyone in high spirits until midnight. The entire chapter was out in force to welcome our new pledges, as were also some of the alumni. Brother Easterday of Oregon Gamma Gamma Phi and Brother Joe White, ’25, also Pledge brother Murphy, Illinois Gamma XI, Chicago University, were guests of the evening.

Joe White ’25, who visited us over the week-end, has been transferred to the research department of the Delco Ignition Company at Dayton, Ohio. His particular problem is the development of a voltage regulator for trucks and busses.

Brothers McIntosh and Hall, Indiana Delta Alpha were visitors over the week-end of February 13. Mac is with the Engineering Department of the city of Louisville and reports that he likes his job fine but for some reason he is always very glad to get back to Terre Haute.

Brother Ron. Manson ’22 dropped in on us for a few days while on a trip through Terre Haute. Brother Manson is a partner in an Independent Oil Company.

SIGMA NU

The Sigma Nus at Rose Tech are anxiously awaiting the arrival of the year’s most vivid and memorable day, St. Pat’s. They are centering their efforts with the other fellow students to make this day of green the greatest in the history of the school.

Brother Al Suttie, who was formerly employed by the Commercial Solvents Company here in Terre Haute, is now employed by the Du Pont Powder Company at Kenvil, New Jersey.

Brother Bob Henderson, who was recently married, is also at Kenvil, New Jersey, in the employ of the Du Pont Powder Company. He was formerly located at Emporium, Pennsylvania.

Brother Derby McArgh, who is in the employ of the State Highway Commission has been staying at the house for the last part of February, since business kept him in this section of the state.

Brother Ed Hauer’s frequent visits to Terre Haute from Chicago, in the interests of the Illinois Central Railroad, have given him the opportunity to pay the chapter several visits.

THETA KAPPA NU

Indiana Gamma entertained with a Wild West party at the chapter house on Wednesday, February 17th. All of the actives, the pledges, and their guests appeared in outfits rivaling those of Tom Mix and Cowgirl Nell. Huge six-shooters and bowie knives played an important part when the party got rough and started drinking,—root beer, Thomas A. Edison, R. C. A. (Radio Corporation of America) and “Deacon” Mayrose’s orchestra afforded the accompaniment for the many intricate pedasties. The intensity of the dance was echoed in the fervor with which the pledges waded the floors the next day.

Betta Lambda, at the University of Illinois, the chapter which was recently granted a charter in Theta Kappa Nu, was installed Saturday March 13th. The degree team from Indiana Gamma performed the work and practically all of the actives were on deck for the installation. The degree team was composed of Ray Davis, Ed. Dunning, Donald Fenner, William Hillis, John Fairhurst, and Walter Davidson.

The actives of the chapter honored the pledges with a dance at Edgewood Log Cabin on Friday night, March 5th. The cabin had been appropriately decorated under the able supervision of Brother Dunning, and when everyone had safely transported his “heavy” to the place of merriment, Theta Kappa Nu programs of unique design were distributed, and Adah Campbell started the evening with an orchestration, indicative of her muddling vivacity. Fraternity colors, chapter banner, illuminated badge, and fraternity skins featured the decorations. Brothers from neighboring chapters at DePauw, Hanover, and Franklin represented their respective chapters.

(Continued on page 22)
Don't Expect Hyatt Performance From Any Old Bearing

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AND although he could hardly resist the temptation to eat his concoction he put it in a pail and started for the center of the city. And then: lo and behold all the snakes followed the aroma of the corn beef and cabbage and being Irish snakes flocked after Pat in great droves. The Irish in the snakes was so strong that every reptile followed Pat so indiscreetly as to notice the path Pat was following and which led directly into the sea. Pat walked on swinging his pail gaily, the sea apparently unnoticed to him, although he was aware that if his scheme failed he too would go to the bottom of the sea with the snakes for he could not swim a stroke and disliked water for the simple reason that prohibition at that time was unheard of and even unthought of and also wherever there was water there also was soap. Well, Pat walked right into the sea still clinging to his pail and the snakes followed right after Pat, and the pail with the Irish Dish in it.

To make a long story short, Pat kept walking till all the snakes had followed him into the water and had been drowned only to find that he was in water over his head at his next step. Pat yelled for help and waved but all the time holding on to his pail and then he noticed that he no longer sank but floated on top of the water and that the pail containing his concoction also floated and even seemed to hold him up. Finally after much struggle and weary paddling, Pat regained the shore and lay down to rest for he was very tired. He opened his pail and there he saw the answer to his mysterious floating on the water. There in the pail were three large onions and two small ones. Now you know of course that onions float, at least Irish onions float and these had been strong enough to hold Pat above the water when he was in dire danger of drowning. Pat arose after his rest and went back to his home to tell the news of the destruction of the snakes and found that everyone bowed down and saluted him for had he not ridded the land of snakes and had he not floated on the water when the entire population knew that he could not swim a single stroke?

So Pat became to be known as St. Pat and being an engineer he took it as best he knew how for you see he was unconceited and fond of good company and was not desirous of losing any friends over the swell head. Just to show the population that he was not ridded of all the snakes for he could not swim a stroke and disliked water for the simple reason that prohibition at that time was unheard of and even unthought of and also wherever there was water there also was soap. Well, Pat walked right into the sea still clinging to his pail and the snakes followed right after Pat, and the pail with the Irish Dish in it.

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So Pat became to be known as St. Pat and being an engineer he took it as best he knew how for you see he was unconceited and fond of good company and was not desirous of losing any friends over the swell head. Just to show the population that he was a real sport, St. Pat invited the entire populace to help him celebrate. He chose the day of March 17th. on which to throw his party and the entire populace helped him celebrate.

So now you see just why we celebrate St. Pat's day on March 17th. St. Pat was the greatest engineer of all times for didn't he engineer all the snakes out of Ireland and did he not live up to the greatest desires of all good engineers?
"Hain't love and chocolate carmels wonderful," thought our hero, whom you will probably remember as Abiather Launcelot Philander, Alp for negative long. This thought has been prompted upon Alp by circumstances for, and this a secret not to be told to any human being so listen, Alp has a girl. The unusual phenomena of thinking has come upon him slowly but surely and as you saw at the beginning, he has really had a thought, although I can't vouch much on its originality. Another reason that perhaps some would say that he is allowed to think is because he is now a none-smarter-than-I Sophomore at Rose Polytechnic Institute. Any Sophomore will tell you, or the world, that he is a man of the world, and that a lowly freshman is to look up to him with awe and wonder, yes, wonder how he could ever reach such a state of super-intelligence. Now, I believe that it is quite clear how Alp feels towards himself, so you will see as you continue to read (it is taken for granted that you haven't given up and turned to campus notes as yet) that our own dear little hero, Alp, has been estranged by the wiles and designs of a pretty little maid by the name of Betty Jane Anderson. Descriptions of girls resembling this little maid can be found at the beginning of any novel, so in case you desire to picture this young lady turn to one of those novels and read up on what kind of looking creature you are to read about. It is stated, however, that Betty is far from being homely, yea very remote. The only thing that can be said against Betty is that she goes to a school in Terre Haute that is not so popular among the fellows at Rose Polytechnic Institute, but that can't be held against her for isn't she a girl? If careful notice is taken at this point it will be seen that the plot starts.

Alp is now seated near the telephone and is talking into same.

"Betty," says Alp, "One of the big social events of the year is coming off tonight and you said that you would let me know whether you would go with me or not. Are you going to the St. Pats dance with me?"

"Alp, I will be glad to go, but I haven't a thing to wear," replies Betty Jane.

"That is fine," replied Alp, meaning, of course, that she could go, "I will be down about nine."

So Alp puts a clean handkerchief in his right hip pocket and starts after his girl at eight-thirty. He is still using the motto 'Be Prompt'. He had written home and told his father that he needed a couple of arc cosines, so he was readily supplied with money, for arc cosines cost about ten dollars. Buzz. Buzz. went the door bell, thanks to Ben Franklin for inventing electricity. The door was opened and an elderly lady told him to be seated and Betty would be down in a few minutes. A few minutes amounted up to 2,430 seconds and Betty appeared. From her general appearance, Alp deduced that she had approached a falsehood when she told him she didn't have a thing to wear. She looked as though she might be a queen, or a moving picture actor. Our hero looks
at her, drinking her rapturous beauty in with a sigh and says, "Let's Go." They did.

They arrived at the dance about the same time that the rest of the bunch was arriving, and the brief pre-dance formalities of cloak checking, and program making were soon over.

"Alp, I could die dancing with you," purrs Betty into his ear, "And I think I will if you step on my foot another time."

"Let's Charleston," growls Alp seeing that he was getting himself in bad by trying to dance the fox trot. An explanation seems to be in order. Alp is a very good Charlestoner, much to the chagrin of his landlady who has varnished the floor of his room three times in as many months. Alp has practiced the Charleston day after day, and now considers himself very proficient. Betty doesn't know this.

"No," she says, "Let's go over and sit down a few minutes."

"We will not do anything of the kind," pipes Alp, making a bigger and better hero of himself. "We are going to Charleston." Betty saw her mistake, and they began to 'put it on'.

Why, Alp, you are good," she squeals with delight. Alp breaks down and confesses that he is not so bad. They continue the dance with Betty really enjoying herself. This dance is soon over and they go to trade partners with another couple for the next dance. Alp, as he is dancing with the strange new girl notices Betty, and how sweet she is talking to her new partner. Tough luck for he isn't much better looking fellow than Alp, and as the dance goes on Betty and this other fellow seem to be enjoying themselves immensely. This fellow is a classmate of Alp's, and he seemed like such a fine fellow too, but Oh, what a fool ball he has turned out to be. At last the dance is over and Alp goes to get his girl from the clutches of the home-wrecker. He and the other fellow's girl search high and low, but not a trace of either his girl or her fellow can be found.

The next dance starts, and still they do not reappear. Alp not being very experienced in such affairs didn't know what to do, but his new girl, the fellows partner, evidently had had experience similar to this before so she said, "Lets start dancing." All this time our hero was thinking whether a black eye looked worse than a split lip, or not. He finally decided on both and began the next dance with the strange girl. He completes the dance with her, and goes again in search of his fair one.

At last he finds her, and where do you think she was? She had been seated in the dance hall all the time talking to the other fellow. Alp's temper had reached the point of 212° F. or 100° C., and he was mad. "Betty, where have you been this last dance," he bites off at her.

"I have been talking to this fellow here for the last dance," she says, with a twinkle in her eye. "You haven't minded, have you? He says things the nicest way."

"Bill, how come you to stay away a complete dance with my girl, I dare you to come outside, and if you do I will cave that roman nose all over your face. I will make it roam all right. Come on I dare you out." Bill sees that trouble is ahead if he goes outside, and I will state that he will get the worst of it if he goes out, although I can't make up my mind whether to let them fight it out or argue it through. Argumentation seems to be the best way. So they argue a dance. Bill finally saw that he was arguing with a hero from fiction and lost the argument, and promised that he would never try to beat Alp's time again.

The evening wears away, and it is stated here that for the remainder of the evening Alp and Betty outwardly enjoyed themselves. On the way home Alp started to 'bawl Betty out,' and Betty listened to his outbursts for a time and then began to laugh. This made Alp all the angrier, and he was about to say something desperate when Betty says, "Do you know what Bill's last name is?"

"Anderson", growls Alp, "but what has that to do with his trying to vamp you." Reference is made here to the first of the story where it was stated that Alp is just a Sophomore, and is not supposed to know everything, although he may think he does. Now go on.

"Well he is my brother," says Betty about to have another outburst of laughter.

This is the close of this episode of our hero's life as far as we are concerned. There are many solutions as to just what Alp did when he learned that Bill Anderson was Betty Jane Anderson's brother. A few of these solutions are listed here, and if none one to suit yoursely. What Alp could have done: of these suit you, you have our permission to pick shot her, kissed her, choked her, bought her a box of marbles, killed himself (by poison, hanging, knifing, razoring, drowning), left for home, or in such a crucial moment said, "BETTY." If you want this solved you had better solve it yourself for if any more of these murderous articles are written they won't be on Love. Seems as though Alp ought to be an athlete, we will see.

THETA XI NOTES

(Continued from page 18)

Kappa of Theta Xi, which has for the last six weeks been located in its temporary home at 1012 North Eight St., has returned to its own chapter house at 1201 South Seventh St.

The house, after the recent fire, has been completely redecorated and refurnished, and the added conveniences which have been installed makes it an ideal fraternity home. The downstairs has been remodeled and neatly decorated giving a very attractive and pleasing appearance.

The sixty-second annual convention of the Fraternity was held in Chicago, February 19 and 20 at the Blackstone Hotel and at the Alpha Gamma chapter house. Brothers Kelly, Trautman, Fisbeck, Dorsey, Davy, and Shaw made the trip. They were well pleased with the results of the Convention business and reported an exceedingly enjoyable visit. A goodly number of Kappa's Honoraries were present. Among them were Brothers Bergman, Hild, Turner, Bledsoe, Newton, Swartz, Fox, and Voris.

Initiation of the pledges is being planned for the first of April.

Brothers J. Wells, H. Dorsey, J. Pellum, and W. Leake; Pledges L. Pellum and H. Corp also J. Leake motored to Louisville the week-end of Feb. 27th and 28th to witness the Rose Tech-U. of L. basketball game.

Brother Fox of Louisville payed us a recent visit.
You can shave more easily when you tilt the razor

When you shave you tilt the razor so that the blade will shear off the hairs. It cuts a great deal more smoothly that way than if you drew it straight down on your beard.

The Brown & Sharpe engineers built this easier cutting, shearing principle into a milling cutter by "tilting" the cutting edges of the teeth, with the result that they shear easily into the metal.

To further improve the efficiency of the cutter they alternated this "tilt" or spiral angle and "staggered" the teeth. Also, the teeth were well undercut and furnished with a rugged backing. The result is a cutter with plenty of chip clearance that will take easily and rapidly deeper cuts, especially in steel.

This cutter is called the Brown & Sharpe Staggered Tooth Side Milling Cutter. It will remove a large amount of metal without destructive vibration and chatter, the enemies of high production milling.

There is considerable information about cutters and their design in the New No. 30 Small Tool Catalog. A copy will be sent free at your request.

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In an address delivered before the members of the Western Pennsylvania Division of the National Safety Council, Pittsburg, Pa., March, 1918, by C. W. Price, the importance of good lighting in industrial establishments was discussed, and the disadvantages of poor lighting were clearly shown by some figures mentioned by Mr. Price.

A large insurance company analyzed 91,000 accident reports, for the purpose of discovering the causes of these mishaps. It was found that 10% was directly traceable to inadequate lighting and in 33.8% the same cause was a contributory factor. The British Government in a report of the investigation of causes of accidents determined that a close parallel to the findings of the insurance company was found. The British investigators found that by comparing the four winter months with the four summer months, there were 29.5% more men injured by stumbling and falling in winter than in summer.

Mr. John Calder, a pioneer in safety work, made an investigation of accident statistics covering 80,000 industrial plants. His analysis covered 700 accidental deaths, and of these 45% more occurred during the four winter months than during the four summer months.

Mr. C. L. Eschleman, in a paper published in the proceedings of the American Institute of Electrical Engineers several years ago, reported the result of an investigation of a large number of plants in which efficient lighting had been installed. He found that in such plants as steel mills where the work is of a coarse nature, efficient lighting increased the total output 2%; in plants, such as textile mills and shoe factories, the output was increased 10%.

In an investigation of the causes of eye fatigue, made by the Industrial Commission of Wisconsin, it was found that in a large percentage of industries, such as shoe, clothing and textile factories, the lack of proper lighting (both natural and artificial) resulted in eye fatigue and loss of efficiency. At one knitting mill, where a girl was doing close work under improper lighting conditions, her efficiency dropped 50% every day during the hours from 2:30 to 5:30 P. M.

The above mentioned incidents indicate how important a factor lighting is in the operation of the industrial plant. It has been well said, "Light is a tool, which increases the efficiency of every tool in the plant." Glare or too much light is as harmful as not enough lighting, and in no case should the eyes of the workers be exposed to direct rays, either of sun or electric light.

Windows and reflectors should always be kept clean; that is, cleaning them at least once a week, for where dust and dirt are allowed to collect, efficiency of the light is decreased as much as 28%.

Good lighting, in addition to its other marked advantages, is a strong incentive towards keeping working places clean, for it clearly exposes any place where dirt or other material has been allowed to collect. White walls and clean windows glazed with Factrolite Glass will eliminate the sun glare and increase the illumination 25 to 50 feet from the window from 38% to 72%, as compared with plain glass.

Lighting is of primary importance to every employer and fully warrants a careful investigation of the subject, for there is no substitute for good lighting, and if it is not supplied the efficiency of the entire working force must suffer a serious reduction.

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St. Louis. New York. Chicago
practice all the constants of the system are found in the above manner and changed to a common KVA or KV base, but the computations are made by use of a short circuit calculating board. The short circuit calculating board is nothing more than a system of plugs, cords, jacks and switches so arranged as to permit a miniature transmission system net-work to be set up just like the actual transmission system. This miniature transmission system is connected to the positive side of a D. C. generator and each part of the actual system is represented by a resistance on the board that can be adjusted so as to correspond to the actual reactance of the transmission system. Now if the short circuit current is wanted at any part of the system all that is necessary is to plug in the negative side of the D. C. generator at the point of the system where the value of the short circuit current is wanted and then read the D. C. current that flows. This value multiplied by the ratio of the actual system to the miniature system gives the actual instantaneous symmetrical short circuit current that would flow on the actual system should a fault occur at that point.

By inserting an ammeter in any branch of the circuit the current in that branch of the circuit due to the short can be found.

This method of making short circuit calculations is very simple, relatively accurate and eliminates lots of long tiresome work. Many of the larger power companies have a short circuit calculating board with their entire transmission system set upon the board permanently.

---

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Export Representatives: United States Steel Products Co., New York City

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one fireproof building had stood in the path of the flames during the San Francisco fire, a different and by far less costly story could be told today.

But most of our cities have passed through the stage of early and temporary development, and attention is now being turned to the permanent and fire-
resisting protection of property which has heretofore been improved only according to the inefficient standard of non-fireproof eras. Insurance will not remedy the evil; nor will increasing the insurance rates. The insured must cooperate with the underwriters in bringing about a better class of building construction. Frequent inspection of buildings and remediying of all hazardous conditions will help greatly toward a betterment. Get at the factors which aid the spread of fire, and you are getting at the root of the trouble.

Up to the present time fireproofing methods have been confined generally to buildings of a public nature, such as theatres, hotels, warehouses and office buildings. The zoning plan is also a good step in the development of this matter. All industries of a hazardous nature should be confined in such a district that in case of fire, a great disaster will not result. Dry cleaning plants, for instance, should not be allowed in residential or built-up business districts.

The relative difference in the cost of fireproof and non-fireproof buildings is very small. The present low cost of building materials, the cheapness and facility for obtaining structural steel, stone, concrete, brick and tile should do much to cause fireproofing to be applied to all classes of structures. The term “fireproof” is very generally misunderstood. A building to be thoroughly fireproof, must not only be free from inflammable materials, but must be able to withstand a great deal of heat. Steel beams will buckle and cause the collapse of buildings if they become only mildly heated. All steel work should be heat insulated with tile or brick. Concrete will collapse if the reinforcing rods are too near the surface so as to become overheated, thus expanding excessively.

In contending with fire, a little effort toward prevention may save thousands of dollars later. Except in rate cases, conflagrations usually result from very small fires. The fireman’s slogan is that “all fires are the same size at the same time—the start.” If discovered at this stage, either by the use of automatic alarms, sprinklers, or other mechanical devices, the danger of the spread of the flames may be entirely obviated. The principle auxiliary aids in caring for fire through equipment consist of automatic alarms, automatic sprinklers, open sprinklers, standpipes and hose reels, accessibility and elevator service, inspection of apparatus provided, and discipline of employees.

Many companies endeavor to save money in building by using what is known as slow-burning or mill construction. This method consists of using large timbers throughout the structure—the theory being that a log will not burn as quickly as an equal amount of timber in small pieces. The fallacy of this idea has been shown in many actual cases where large buildings of so-called slow-burning construction were entirely consumed by fire in thirty or forty minutes.

The only safe and sure way to combat this evil is to build for permanence under all conditions, and cause the individual to realize what a proposition of this reckless waste he is made to bear. There will always be carelessness among some people, that alone should cause others to use fireproofing methods more freely. Build so that it cannot burn, and it will not burn. Above all, be careful.

Fifteen hundred fires occur in the United States every day. Every minute a fire breaks out somewhere. Right this minute another fire has started.
NORMAL JINX PREVAILS
(Continued from page 16)

After the final gun had sounded, and after the smoke of battle had cleared away sufficiently to enable the blood-thirsty hordes of frenzied spectators to see the score board, it was seen that the old Jinx had once more left its stamp on Rose, for our "Dear" Teachers of that most glorious and far-famed institution of Kitchen Mechanics had 26 points while Rose had only 24. That game marked the severance of athletic relations between Rose and Indiana State Normal for, as Coach Strum of Normal said, Normal can get along very well without having to play games with Rose Poly. His statement is reciprocal.

The Wiley gym was the scene of the bitter struggle between the rival teams on February 24, and the game was one of those nip and tuck affairs in which the winner was the team that happened to be in the lead when the final gun sounded. But it was Normal who was leading when that time came although two minutes previous Rose had been leading. The game was a splendid exhibition of basketball and was cleanly played. Each team made ten field goals. Normal scored six foul goals in eight chances, and Rose scored four foul goals in six chances. These figures show how equally the two teams were matched.

The game was a splendid exhibition of basketball and was cleanly played. Each team made ten field goals. Normal scored six foul goals in eight chances, and Rose scored four foul goals in six chances. These figures show how equally the two teams were matched.

Van Horn, (26) ................ F ................ Wilson
Dorsett  ................. F ................ Alexander
Lammeey  ................ C ................ Goddard
Piety  ................. G ................ Reinking
Albright  ................. G ................ Taggart

Field goals—Normal: Dorsett, 3; Piety, 3; Van Horn, 2; Lammeey, Eder, Rose: Alexander, 5; Wilson, 2; Goddard, 2; Reinking. Foul goals—Normal: Dorsett, 2; Piety, 2; Eder, Albright. Rose: Reinking, 2; Alexander, Taggart. Referee—Jefferies. Umpire—Pike.

FINA L GAME IS VICTORY FOR ENGINEERS

Playing the last game of the season on February 27, the Engineer cagers closed with a second victory over the University of Louisville on the floor of the St. Xavier gymnasium at Louisville. Backed by the Rose alumni of that city, the team outpassed the Louisville lads.

The first half was closely played and ended with Rose leading 14-13. The Rose men again proved their superiority in the second half and the final score was 38-26. With this game captain Wilson closed his basketball career. His game was of the usual high order that characterizes his play. Bob Alexander, the sharpshooter of the team, kept up his reputation by dropping in 9 field goals; Kasameyer contributed two while he was in the game. Goddard connected four times, and Reinking twice. The guarding of the team was fully up to standard, Goddard, Reinking, and Taggart being fully able to take care of the Kingmen.

The Louisville team put up a clean game and fought hard, but Rose outmatched them and closed their season with another victory.
Engineers were taken out of the gym by the irate coppers. Of that nine however, only seven came back up.

Some of the fellows missed Art Kaiser and Ferris and extended questioning only brought back the same reply, "They're in the jail-house now." But of course an Engineer feels at ease wherever he goes. So everyone was at ease as soon as it became known where they were.

The State Normal men were very courteous to the men of Rose. About ninety of them came over in a group and sat down in the aisles alongside their rivals. Then, after exchanging a few pleasanties with the Engineers, they very thoughtfully left—

After the game the Engineers went down to the jail-house after their unfortunate companions, and they were delighted to find them in the midst of a hot poker game with the warden and his assistants. And there it was that the Engineers realized the value of a "college education," for the worthy disciples of St. Pat won their freedom with the greatest of ease when the warden saw that he couldn't beat that "full house."

And so, even though the game was lost, the fellows feel that they all came out just a little ahead of Normal, and what is the more important, that revenge was obtained against the Sycamores for the destruction of old Rosie. The following statement show how the account was balanced.

**FINANCIAL REPORT OF STUDENT BODY, ROSE POLYTECHNIC INSTITUTE**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 Full fare tickets to Rose-Normal game, @ 50c each</td>
<td>$27.50</td>
</tr>
<tr>
<td>6 Reserve seats to same, @ 75c each</td>
<td>4.50</td>
</tr>
<tr>
<td>3 Seats for Rose 'varsity freshmen (who were not allowed to play) @ 50c each</td>
<td>1.50</td>
</tr>
<tr>
<td>4 Half-fare tickets to game (for those who left before the game was over)</td>
<td>1.00</td>
</tr>
<tr>
<td>1 Riot call (amount to be put in Police Pension Fund)</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>Total Assets</strong></td>
<td><strong>$39.50</strong></td>
</tr>
<tr>
<td><strong>Cost of &quot;Rosie III&quot;</strong></td>
<td><strong>$37.50</strong></td>
</tr>
<tr>
<td><strong>Cost of 1 Cap (lost at game)</strong></td>
<td><strong>1.98</strong></td>
</tr>
<tr>
<td><strong>Total Liabilities</strong></td>
<td><strong>$39.48</strong></td>
</tr>
<tr>
<td><strong>Total Assets</strong></td>
<td><strong>$39.50</strong></td>
</tr>
<tr>
<td><strong>Total Liabilities</strong></td>
<td><strong>$39.48</strong></td>
</tr>
<tr>
<td><strong>Total Deficit</strong></td>
<td><strong>$0.02</strong></td>
</tr>
</tbody>
</table>

**BIBLIOGRAPHY OMISSION**

For lack of space the list of literature citations was omitted at the end of an article by Prof. A. T. Child appearing in the December issue of this publication. The article represented a thorough review of the subject of commercial methods of nitrogen fixation and much of the material was obtained through correspondence with Dr. Frank Cottrell, Director of the Nitrogen Fixation Laboratory at Washington, D. C. Other sources of material were as follows:

- Chemical and Metallurgical Engineering, McIlvrie, vol. 32, p. 791, 1925.
- Chemical and Metallurgical Engineering, Braham, vol. 32, p. 862, 1925.

**CRANE VALVES**

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Crane recognizes that the future of engineering depends upon you engineering students of today. Everywhere Crane men desire to keep in constant touch with your new ideas and fresh viewpoints. The manufacturer and the engineer must always march together, and the sooner the acquaintance begins the swifter will be the progress of both. You will be cordially welcomed at the Crane Exhibit Rooms, located in 103 cities in the United States, where the latest developments in piping materials are on display. For mutual information, Crane men are glad to discuss the technical points of valves fittings and specialties.
MEASUREMENT OF THE TEMPERATURE OF MARS
(Continued from page 5)

I think that the assumption of the presence of vegetation growing in tussocks is a reasonable explanation of the observed high temperatures which show changes in the dark areas with changes in the seasons. But the term high temperature is merely relative. With noonday temperatures of only 40 to 60° C. even on the hottest spots on the equator and with exceedingly low temperatures at night it seems evident that any vegetable or animal life that may exist on Mars must be adapted to withstand great extremes in temperature and humidity. From the way animals and plants adapt themselves to conditions on our deserts it seems possible for life to adapt itself to conditions on Mars.

Life on Mars can not be very pleasant, especially in the equatorial region where it would be a continuous process of thawing out and limbering up in the forenoon and a reversal of the process in the afternoon. In the Martian polar regions, where the summer day is almost six months long, temperature variations would not be so extreme, and living matter, if present, would not be subjected to such short periodic changes in activity as occur on the equator. The cycle of reproduction and development of the living cell would not be subjected to such extreme temperature conditions. Similarly, the quiescent period during the prolonged winter would be free from interruptions.

Thus ends my story of temperature conditions on Mars. It was my good fortune to be the first to measure the temperature of Mars. "Sic volvere pracas"—thus spin the fates.

THE SERIAL BOND
(Continued from page 8)

7.8% of the principal for 21 years; also that the total cost of hiring this capital sum is approximately 83.7% of it.

If the same capital sum is retired in a single payment at the end of the 25 year period the total amount of interest which would have been paid is $1,250,000. It is also necessary to lay aside a sum each year which, at compound interest, will equal the principal at the end of 25 years—that is create a sinking fund. At 5% the annual sum necessary to accomplish this purpose is $20,952.40, making an additional cost of $523,812.00—or a total principal and interest cost of $1,773,812. The total cost of the serial issue is $1,837,175.00 or $63,363 more. If, however, the sinking fund can be maintained at 4% only the annual sinking fund payment is $24,012.06 or a total of $600,301.50. This with the bond interest totals $1,850,301.50, or slightly more than the serial issue.

This illustrates the need for a skilled financier at the helm of the sinking fund. The average community does not have this kind of person available—not withstanding popular opinion to the contrary. The cost to the community for the serial type is very nearly the same as for the single term bond. There is no need for a trained man to administer the fund and it therefore appeals to the writer that in many cases the serial bond offers the safest and least expensive means for financing municipal and semimunicipal projects.
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TERRE HAUTE, INDIANA
JUST ANOTHER USE FOR THE CRANE

By abandong the old manual labor or small derrick method, and by substituting several full-arch traveling and revolving cranes, a really convenient method, the capacity of a large pier may be increased from between 300 and 400 per cent.

The crane had rarely been put to this use until the management of the West Shore Pier along the Hudson at Weehawken, N. Y., by experimenting, found its great practibility. Formerly, to load 200 tons was considered a good days work; now it is but an ordinary occurrence to load 700 tons in one day.

As with practically all new apparatus, reconstruction was necessary at the time of installation, so that the cranes could be used efficiently. Increased storing space was necessary, the pier needed to be widened and additional railroad tracks installed.

In construction, the cranes depended upon a screw luffing arrangement for raising the boom. One, a twenty foot crane, with a 53 ft. overall length, a 34½ ft. span, and provided with two 2-wheel trucks at each corner of the base, makes possible a maximum wheel load of approximately 36,000 lbs. Some cranes of this type have the hoist ropes leading directly from the drum to the sheaves at the end of the boom, a type in which there is no reaction of the load tending to raise the boom. In these new cranes, however, a mast is an additional feature. The hoist ropes are laid over sheaves at the top of this mast, before reaching the sheaves at the outer end of the boom. This arrangement gives a reaction that helps to lower the boom, and to minimize the load on the screw luffing mechanism. Smaller cranes, also in use at this pier, are of like construction, having a maximum wheel load of 48,000 lbs.

Magnetic control is provided for the motors; arrangements of interlocking devices are included; the hoist and controllers are so arranged that one operating lever governs both motions. These, with various other improvements, tend to increase the perfectness of the modern pier crane.

The smaller cranes are equipped with 62-in. magnets for loading metallic freight. Another electrical advantage are the hand operated rail clamps, which, with the application of the electric current, interlock, making it impossible to move the crane.

The mere outlined description of these cranes readily presents their advantages and the almost super-manner in which they work at the pier. It is but another example of scientific engineering knowledge and visions practically adopted in a money and labor saving practice.

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BUSINESS PRINCIPLES ENUNCIATED BY THE CHAMBER OF COMMERCE

1. The foundation of business is confidence, which springs from integrity, fair dealing, efficient service, and mutual benefit.
2. The reward of business for service rendered is a fair profit plus a safe reserve commensurate with the risks involved and foresight exercised.
3. Equitable consideration is due in business alike to capital, management, employees and the public.
4. Knowledge, thorough and specific, and unceasing study of the facts and courses affecting a business enterprise, are essential to a lasting individual success and to efficient service to the public.
5. Permanency and continuity of service are basic aims of business, that knowledge gained may be fully utilized, confidence established, and efficiency increased.
6. Obligations to itself and society prompt business unceasingly to strive toward continuity of operation, bettering conditions of employment, and increasing the efficiency and opportunities of individual employees.
7. Contracts and undertakings, written or oral, are to be performed in letter and in spirit. Changed conditions do not justify their cancellation without mutual consent.
8. Representation of goods and service should be truthfully made and scrupulously fulfilled.
9. Waste in any form—of capital, labor, services, materials, or natural resources—is intolerable, and constant effort will be made toward its elimination.
10. Excesses of every nature—indebtment of credit, over-expansion, over-buying, over-stimulation for sales—which create artificial conditions and produce crises and depressions, are condemned.
11. Unfair competition, embracing all acts characterized by bad faith, deception, fraud, or oppression, including commercial bribery, is wasteful, despicable, and a public wrong. Business will rely for success on the excellence of its own service.
12. Controversies will, where possible, be adjusted by voluntary agreement or impartial arbitration.
13. Corporate forms do not absolve from or alter the moral obligations of individuals. Responsibility will be as courageously discharged by those acting in representative capacities as when acting for themselves.

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BOOK REVIEWS

Elements of Chemistry by Wm. Foster, Van Nostrand Co., New York, 1925. Full page plates, photographs, diagrams, tables; 53½x8½ cloth, 594 p., $2.00.

This textbook was written especially for students beginning the study of chemistry and no previous knowledge of the subject is essential to its understanding. The author has had many years’ experience in instructing beginners and teachers as well, so he is doubly able to select and present essential material for a general elementary treatment of the subject. The method of treatment is easily grasped and exhaustive discussions are wisely omitted.

The introduction treats of the origin of chemistry, its early history, and present usefulness to man. This is followed by a study of matter and its properties. From this basis the beginner is systematically led through the subjects of elements, mixtures, and compounds, and shown their differences. A more extensive study of the elements and their compounds is then presented, followed by a careful explanation of acids, bases, and salts; their formation and differences. A notable feature of the text is the section of two chapters dealing with organic compounds. This seems a valuable addition to a general elementary treatise of the elements, it being recognized that the differences between organic and inorganic compounds is not well established in the average beginner’s mind.

By the device of showing plates of commercial operations it is thought that the student will more readily connect the commercial side of chemistry with the class-room course.

There are also several plates of noted scientists by whose researches and discoveries the science developed. The latter part of the book contains an excellent discussion of radium and radio-activity. At the end of each chapter may be found a complete summary of the subject treated therein, together with questions, problems, and references. Aside from these helps there is a more extensive list of problems towards the last of the text to be used as the instructor may elect. A complete appendix and index are found at the close of this carefully prepared text. The author is Professor of Chemistry in Princeton University.

Laboratory Exercises in General Chemistry: Wm. Foster and Harley W. Heath., Van Nostrand Co., New York; 5½x8¼ cloth, 192 pp., $1.25.

These laboratory exercises were compiled to accompany Professor Foster’s “The Elements of Chemistry” and so furnish the student who has had no previous training in chemistry with the outline of a well-rounded laboratory course. The book contains fifty-two experiments the first 37 exercises given will fulfill the requirements for college entrance, and deal with the inorganic aspect of the subject. The remainder of the exercises deal with carbon derivatives, preparations, and analyses. Two points in favor of the book which strike the reviewer as quite significant are first, that a strong plea is made for the entering student to learn to do everything correctly—without the hanger-on, “that’s good enough”, and a second feature that the treatise contains about two pages of “Treatment in Case of Accident”. Many a dangerous injury may be avoided if a proper first-aid method is known. There are many notes throughout the work which enable the student to more thoroughly understand the experiments. Many of the exercises are optional and have been prepared for students showing a greater interest and ability in the course. The manual is a fitting compact for the text mentioned above.

Bacteria in Relation to Soil Fertility: Joseph E. Greaves and Ethelyn O. Greaves, Van Nostrand Co., New York, 1925; Full page plates, charts, tables, 5½x8¼ cloth, 257 pp., $2.50.

This book presents in non-technical language the fascinating story of the class of micro-organisms which inhabit the soil, of special importance to all agriculturists because the productivity of the soil is intimately associated with the activity of these beneficial bacteria. The book is valuable to the general reader as well as to tillers of the soil.

Contents: Development of Soil Bacteriology; Bacteria and Their Role in Nature; Shape and Structure of Micro-organisms; Classification of Bacteria; The Chemistry of Bacteria; Food Requirements of Bacteria; Factors Influencing Bacterial Growth; Soil Formation; Soil Texture, Structure, and Composition; The Carbon, Nitrogen, Sulphur, and Phosphorus Cycles; Organic Matter and Its Transformation by Bacteria; Nitrification; Denitrification; Non-symbiotic Nitrogen Fixation; Symbiotic Nitrogen Fixation; Legumes and Soil Fertility; Cellulose Fermentation; Influence of Soil Alkali on Bacteria; Influence of Host and Poisons on Soil Bacteria; Manure; The Influence or Irrigation Water on Soil Fertility.

The States of Aggregation: Gustav Tammann, translated from the Second German Edition by Robert Franklin Mehl, Ph D., Van Nostrand Co., New York, 1925; Diagrams, charts, and tables, 6x9¼ cloth, 308 pp., $5.00.

Textbooks of chemistry and physics commonly state that matter can assume three states: the solid, liquid, and the gaseous. This enumeration is, however, neither complete nor unequivocal for every scientist is familiar with the possibilities of a diversified existence, for example, the same solid existing in a variety of crystalline forms.

This book discusses the states of aggregation and the relations between states of matter in exhaustive detail. The determinations of Regnault, Andrews, Professor Bridgman of Harvard, and others who have contributed original investigation to the subject are covered in detail.

The author himself is so well known in scientific circles that little comment upon his abilities as a scientist or as an author seems necessary here. As the leading German authority on the subject, he is fully qualified to present authentic data, and experimental study of this particular subject, the results of which are presented in clear and logical form in this volume.

The translator has made no effort to enlarge the original text in any way. It is presented as given in the original German with only the remodeling necessary for smooth translation. It makes available in American research one of the most important German books of recent years.
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THE MODULUS

The Annual of Old Rose

To Alumni—Your School Today
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To Students—A Publication you have helped make possible.
To the Faculty—Reminiscences.

The Year Book will be published the latter part of May.

Advertising in the Modulus is a means by which results may be obtained
The question is sometimes asked: Where do young men get when they enter a large industrial organization? Have they opportunity to exercise creative talents, or are they forced into narrow grooves?

This series of advertisements throws light on these questions. Each advertisement takes up the record of a college man who came with the Westinghouse Company after graduation and within the past ten years.

Engineer!
Arrest that Bolt

The Sales Department was talking in emphatic and easily understood language. It was saying, “We want action.”

At Westinghouse, action in many cases is another word for research. And research works toward selected goals. In this case the goal was for new apparatus to make unchained lightning more respectful of power plants, lines and equipment.

Today, as a consequence, the electrical industry is the beneficiary of the “Autovalve Lightning Arrester”, perfected to a degree of efficiency, long service and universal utility never dreamed of before. Behind that picture you find Joseph Slepian. With two degrees from Harvard, he started training in our East Pittsburgh Shops in 1916. A year later he entered the Research Department.

This was the lightning arrester situation which Slepian took into the research camp: There were two different types of apparatus. One, called the multi-gap, was used chiefly on poles of distribution circuits. When lightning struck, it frequently caused transformer troubles and damaged equipment. For high-voltage application there was the cumbersome electrolytic arrester. Its performance was good enough. But it required constant attention; was costly of upkeep; and could not be used on poles.

When Slepian perfected the Autovalve Arrester, the demand was so great that orders could not be filled. It was entirely new. One type of apparatus solved the whole problem—no more costly care. It stands up indefinitely, whether used on poles or on the ground—sufficient reasons for yearly sales exceeding $2,000,000.

Such results may depend as much on a phase of an engineer’s past training as on his immediate research. Take the radio horn which gives the natural tone to Radiola sets. It was Slepian’s mastery of mathematics, in which he specialized at Harvard, which contributed toward that big advance in the early days of loud-speaker popularity.

The man with “hidden reserves” is constantly finding them called upon to “climb peaks and cross mountains” in institutions like Westinghouse.
The World's Loudest Voice

On the rolling plains of South Schenectady, in several scattered buildings, is a vast laboratory for studying radio broadcasting problems. Gathered here are many kinds and sizes of transmitters, from the short-wave and low-power sets to the giant super-power unit with a 50- to 250-kilowatt voice.

Super-power and simultaneous broadcasting on several wave lengths from the same station are among the startling later-day developments in radio. And even with hundreds of broadcasting stations daily on the air throughout the land, these latest developments stand for still better service to millions of listeners.

Only five years old, yet radio broadcasting has developed from a laboratory experiment into a mighty industry. And alert, keen young men have reaped the rewards.

But history repeats itself. Other electrical developments will continue to appear. And it will be the college man, with broad vision and trained mind, who will be ready to serve and succeed.