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OF ROSE POLYTECHNIC INSTITUTE

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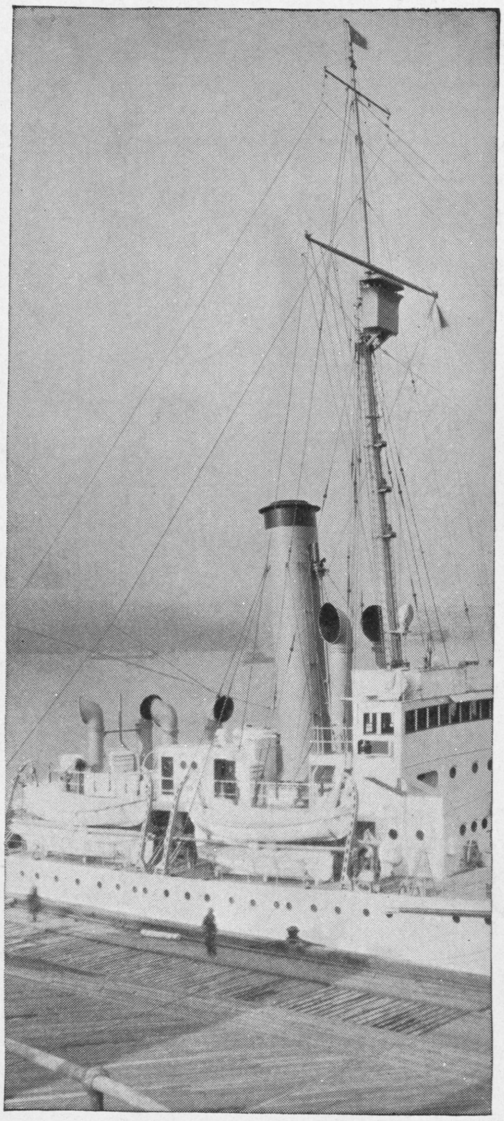

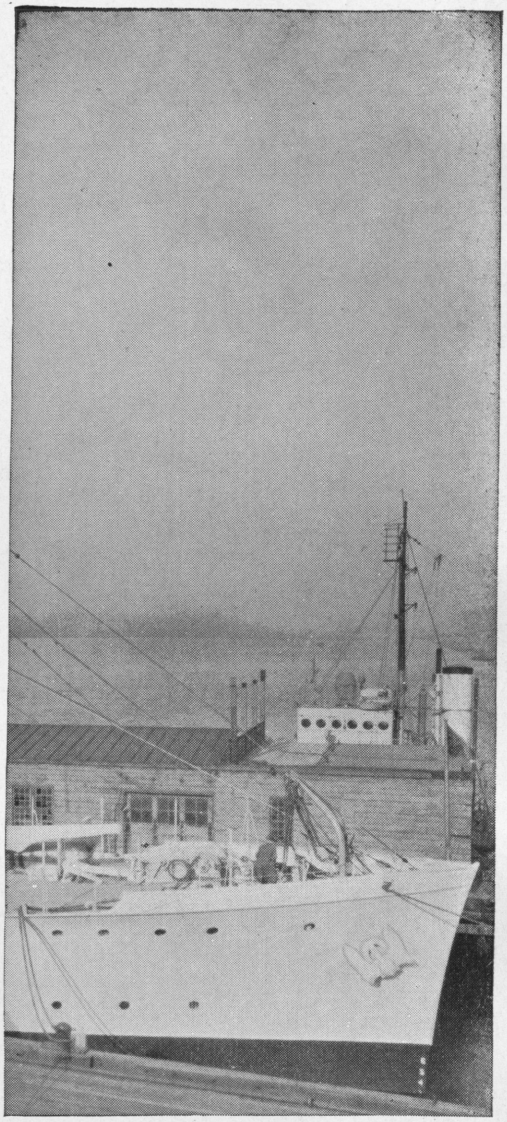

THE ROSE · TECHNIC

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VOL. XXXIX — FEBRUARY, 1930. — Number 5

TABLE OF CONTENTS

Engineering College Magazines Associated

Mr. Williard V. Merrihue, Chairman, 1 River Road, Schenectady, N. Y.

MEMBER MAGAZINES

Armour Engineer
Auburn Engineer
Colorado Engineer
Cornell Civil Engineer
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas Engineer
Kansas State Engineer
Marquette Engineer
Michigan Technic
Minnesota Techno-log
Nebraska Blue Print
Ohio State Engineer
Penn State Engineer
Princeton News Letter
Purdue Engineer
Rose Technic
Sibley Journal
Tech Engineering News
Pennsylvania Triangle
Oregon State Technical Record
Wisconsin Engineer

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If you succeed in life, you must do it in spite of the efforts of others to pull you down. There is nothing in the idea that people are willing to help those who help themselves. People are willing to help a man who can't help himself, but as soon as a man is able to help himself, and does it, they join in making his life as uncomfortable as possible.

---E. W. Howe

THE ROSE TECHNIC

The Official Publication of the Students of The Rose Polytechnic Institute

Volume XXXIX | FEBRUARY, 1930. | Number 5

Characteristics of Photoelectric Tubes

Professor R. G. Hieber

IT will be interesting to review briefly the outstanding discoveries of some of the earlier investigators—discoveries which led to our present conception of the photoelectric phenomenon.

In 1887, while using a spark gap to measure the energy of the electro-magnetic waves emitted from an oscillating circuit containing a gap, Hertz noted an unusual effect. His method was to adjust the two circuits to resonance, as when tuning a radio receiver, and then to measure the maximum separation of the points of the gap for which sparking could be produced in the receiver. In an attempt to lengthen the spark, a cardboard shield was placed around the gap. This, however, produced just the contrary to the desired effect, requiring the terminals to be brought more closely together. He next used glass, but the result remained the same. When quartz was used no diminution of sparking or sparking distance occurred. Since quartz will transmit ultra-violet light, whereas cardboard and glass are alike opaque, Hertz concluded that it was the ultra-violet of the light which in some manner facilitated the production of a spark in the receiving circuit.

Hallwachs, in 1888, allowed the radiation from an iron arc, rich in ultra-violet, to fall on a negatively charged zinc plate that was well insulated and connected to an electroscope. The electroscope leaves collapsed, showing that the zinc gradually lost its charge. A neutral body showed a slight tendency to become positively charged.

Elster and Geitel found that those metals which

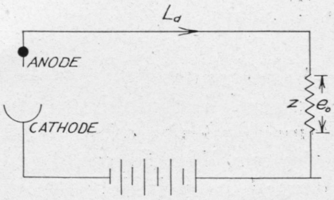


DIAGRAM — A

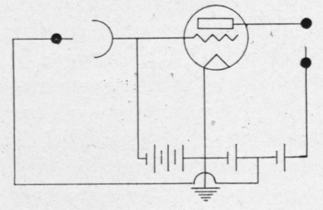


DIAGRAM — B

are highest in the electromotive series, showed the effect under consideration most strongly. Alkali metals were in fact acted upon by light wave length in the visible portion of the spectrum. They also found that the effect took place in a vacuum.

Stoletow, as early as 1890, devised the first photoelectric cell—a device which produced a photoelectric current when illuminated. A zinc and platinum plate were mounted side by side, air intervening. When a high potential difference was established between the plates, the zinc plate being illuminated strongly with light rich in ultra-violet, a galvano-

(Continued on page 134)

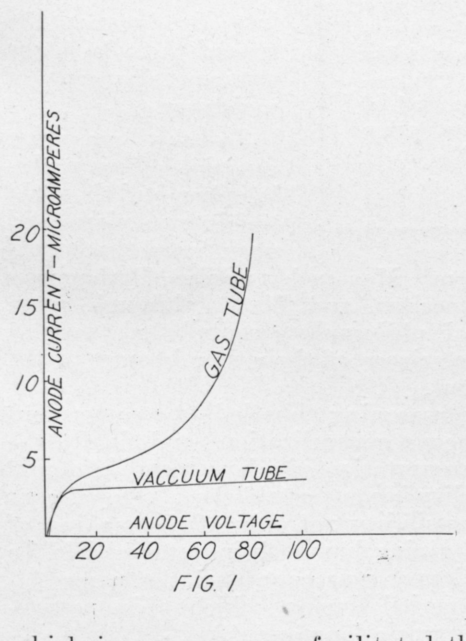
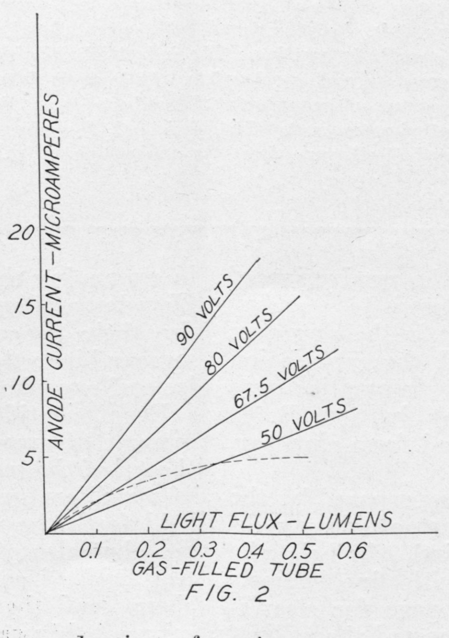


FIG. 1



GAS-FILLED TUBE
FIG. 2

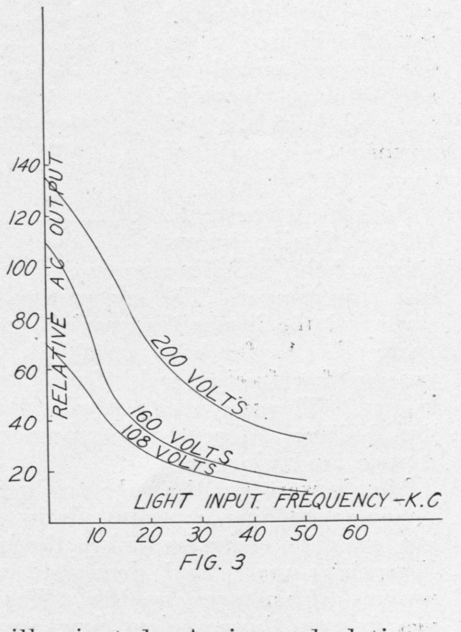


FIG. 3

A real Rose man is a real Showman.

Chemical Engineering—Where Did It Come From?

Morris T. Shattuck, ch., '30

AT the very dawn of history the foundations of science were being laid. Yet if one thinks of science as a systematized knowledge then it was centuries after Christ that its foundations came into existence. Nevertheless the beginnings of Chemistry date back to pre-historic times and can be traced through stages of development something like this:

1. Pre-alchemistic Period.
2. Alchemistic Period.
3. Era of Pharmaceutical Beginnings.
4. Period of the Rise of Analytical Chemistry.
5. Development of the Atomic Theory and Theoretical Chemistry.
6. Era of Engineering Chemistry.

The knowledge of many metals is as old as history itself. The Old Testament speaks of at least six different metals: Gold, Copper, Tin, Silver, Lead and Iron. These metals occured in rich deposits in Egypt, Asia Minor, and India and by means of simple processes were extracted from their ores. It is interesting to read the theories explaining the occurrence of such deposits. Artistotle, the great mind of his day, explained that the metals were formed by the penetration of the air into the earth. Thus, when the ore was mined the air followed the miners and kept the ore formed ahead of them.

Chemistry is indeed one of the most useful of all the sciences. To obtain a thorough comprehension of the subject its history must be studied. No other science could suffer more from being separated from its history. The story of the futile struggle of the alchemists to make gold from lead is a fascinating tale, but the trend of modern chemical achievements is equally interesting. The industrial chemists of today are engineers as well as chemists. It is their duty "to control the gamut of manufactured products from the steel of the tallest skyscraper to the fabric of the sheerest rayon hosiery, and it all came from the ancient alchemist."

Several centuries before Christ knowledge of the puddling process for the production of iron was known. The ore was reduced to a pasty state and the impurities worked out in the slag over an anvil. As far back as 200 B. C. the cuppelation process for freeing gold from its impurities was known. Theophrastus records that in 300 B. C. liquid silver (Mercury) was prepared from cinnebar, copper, and vinegar.

Metals were not the only products prepared by the Ancients. China contributed the art of glass making, and five centuries before the birth of Christ the Egyptians made and decorated with fine enamels pottery of no mean quality. The urge for cleanliness in even those ancient times promoted the utilization of a very complicated process of Organic Chemistry—that of the saponification of a fat in the manufacture of soap. They used Alkali (NaOH or KOH, although they did not know it) which they prepared from the water solution of wood ashes and burnt limestone. The resulting Alkali was then made to act on a fat and the result was soap. This same procedure, somewhat improved, is in use today in the manufacture of our "99.44 percent pure" etc. soaps.

These things and many others were known in the dim past but nothing was ever done to work out a logical explanation of the phenomena until centuries later. In fact, the idea was prevalent (as it is to a great extent today) that to work was to disgrace oneself. The Philosophers would sit about the market place and pass judgment on all natural phenomena but never did they attempt to prove their assertions by experiment. Their only proof consisted in further reasoning.

For example, Empedocles of Agrigent was the propounder of the theory that there were four elements—fire, water, earth, and air. He held the view that each could be transformed into the other for, he explained, "Any two of them have a common property through which transmutation can be affected." That is to say, Fire is Warm and Dry; Air, warm and moist; water, moist and cold; and earth, cold and dry. Thus by heating water it is transmuted into air because the two of them have the common property of moistness.

So the reasoning ran riot. Every philosopher had the right to his own views and none were backward in expressing them. Men such as Solon, Pythagoras, Herodotus, Democritus, and Plato, although noted for their general philosophy, contributed only a meager bit to the science of their time because of the lack of experiment.

Poor scientific reasoning thus led to an enormous amount of erroneous generalizations and finally the theory of the transmutation of a base metal into gold of matchless quality became established. This theory held forth the possibility not only of the making of gold but also of giving human being eternal life. In this field of endeavor was connected the name Alchemy and the period during which this pseudo-science held sway was a long one.

The first person connected with this work was the Egyptian *Hermes Trismegistes (three times great). He lived in the second century and was in one, the god of strength, the spirit of wisdom, and founder

* Hermes Tris—was the Egyptian God Toth. Hardly could be called a historical character.

of the arts and sciences. Roman and Greek columns have boon found that bear inscriptions of the wisdom of this famous Hermes.

The fruits of Hermes' toil were taken by thte Arabs and carried across Northern Africa into Spain and Europe. The sacred art of Alchemy spread Northward into Constantinople, the center of Byzantine learning. The priests and princes took up the work and many excavations of ruined temples show the remains of rooms once used by them as laboratories.

With the beginning of the eighth century came the noted Arab, Geber, who should be considered one of the first Chemical Engineers. He built and used well constructed apparatus for filtration, crystalization, sublimation, and distillation. His work was the best of his time and had he not been hampered with the preconception of transmutation, he might have made great advances in Chemistry. Like many of his day he claimed to have found the true philosopher's stone, the elixir of life. His writings contain the following formula for its production which is a very clear and lucid explanation compared with many writings of his contemporaries:

"*When the sun is in the Aries and the season good and equable, take calcined salts pure in color and thin plants from the mountains, and sal-ammoniac which has no equal; choose the white for thy work.*

Three parts make complete with full measure without deviation. Then powder them well so that they may become like clay when it is kneaded.

Dissolve them if thou wouldst reach to the perfected knowledge of the Philosophers. They will give a liquid beautiful in appearance and as red as blood when it flows. With this liquid moisten pure gold and carefully chosen cinnebar and melt them to a wax with a light fire—thou wilt attain thy desires and hopes—

Do this three times and be wise—the way to perfection is clear.

Geber worked on the assumption that the metals were mixtures of sulphur and mercury. The less the sulphur, the better was the metal. The more the mercury, the nearer the metal was to god. So unusual was the work of this Arabian, that his influence lasted for centuries. The best minds of the time followed the reasoning of Geber, even down to the fifteenth century. When another man came into prominence.

This man was Basil Valentine, a Benedictine monk of the latter part of the fifteenth century. He was the last of the true alchemists. His work was climaxed by his discoveries and preparation of antimony and its compounds. He prepared and recognized as separate compounds, antimony tri-chloride, basic chloride of antimony, antimony tri-oxide, and potassium antimonate. He made sulphuric acid by burning sulphur and saltpeter; hydrochloric acid from common salt and green vitriol, and nitric acid from Saltpeter, copper vitriol, and alum. With hydrochloric and nitric acids, he prepared aqua regia.

Valentine and his contemporaries also knew of many salts, such as volatile alkaline salts (ammonium carbonate), sal ammonicum, (ammonium chloride), silver nitrate, mercuric oxide, mercury almalgams, mercuric sulphate, mercuric nitrate, and so forth. However, when we consider that at that time the conception of elements molecules, compounds, combining weights, valence, etc., were not even thought of, it is a wonder that advancement was made at all.

Chemistry as a science was still a long way off in the fifteenth century. When Columbus made his famous voyage, the alchemists were still searching for their marvelous elixir. But the sixteenth century had in store the revolutionary spirit of a man—although a vagabond and tramp—who was destined to begin another period in Chemical history. His name was Phillipus Theophrastus Aureleous Bombastus von Hoenheim, or in short, Paracelsus. Paracelsus chose his own nick-name, which means "superior to" (para) celsus, the ancient sage. This man was a physician and teacher of medicine. He taught in several universities of central Europe, but the wanderlust was in his soul ,and he always found excuse (or his superiors requested him) to leave his scholarly atmosphere, and travel the highways as a wandering physician. He departed from the ways of his contemporaries and used his own methods of cure, which were oftentimes quite effective. His big argument was that the alchemists job was not the production of gold, but the preparation of medicine.

Pharmacy had its big stimulus and alchemy saw its decline, when Paracelsus in his crude way preached his doctrine over the continent of Europe. Tradition has it that this physician died in a drunken brawl at a little inn in southern France, but nevertheless, he left his mark on chemical development.

Paracelsus broke away from alchemy but there still remained the big job for someone to found the science proper. This was done, not by one man, but by a large group of unusual thinkers, among whom were Robert Boyle, (Boyle's Law), George Stahl (Phlogiston Theory), Joseph Priestley (discoverer of Oxygen), Karl Scheele (discoverer of Chlorine), and Henry Cavendish (discoverer of Hydrogen).

The development of the science of Physics, the organization of scientific societies, such as the Royal Society of London, (1665), publications of scientific investigation, and public arguments on various theories changed the goal of chemistry again. From preparing medicines the interest turned to pure investigation.

Robert Boyle expressed the new viewpoint thusly: "One of the most considerable services that the scientist could do to the world is to set himself diligently to make experiments, and collect observations without attempting to establish theories upon them before they have taken notice of all the phenomena that are to be solved."

In such a choice of purpose lay the foundation which these men prepared for Lavoisier, the father of Chemistry. The conclusions arrived at were oftentimes faulty, and sometimes, as in the case of Stahl's Phlogiston Theory, they were really stumbling blocks. Yet the object to which they strove was correct, and the result was a successful science.

Lavoisier took up the work, overthrew many false doctrines, and put chemistry on the map as a science. He formulated the Law of Conservation of Mass. Richter and Proust announced the Law of Definite

(Continued on page 135)

The Modern Trend of Architecture

Harry E. Stock, a., '30

IN our architecture of today we are seemingly leaving tradition and precedent far behind, letting the emotions of our jazz age dictate to us in our design. But is this really true, or has our architecture been one of gradual development and application to our present day needs of all that is good in our past art of building? One author has defined architecture as frozen music; perhaps a little of our jazz and syncopation has stolen into our modern architecture but not enough to influence its trend. Some of our more exotic types exert their influence for a short time and are then forgotten in the appreciation of more permanent types of art. The new supplements the old and does not supplant it. We have taken the old accepted styles and developed them by modification, refinement, and additions brought about by our present environment.

Association with a thing of art is the basis of appreciation of beauty but too much familiarity breeds contempt and the appeal to beauty disappears. A study of the history of architecture shows that novelty and changes must be introduced. But are not these changes and novelties tempered by tradition and precedent and necessitated by our present mode of living?

Architecture is a fine art and fine arts are greatly influenced by tradition. At first thought our modern skyscrapers with their set backs and block-like masses seem to be entirely new creations but if we compare them with the spires of the fifteenth century Gothic churches we will see a striking resemblance. The trend of architecture is now as it always has been and will be, a gradual development of the best of its predecessors, based on our ever changing emotions, and environment.

With the advent of the steel frame, masonry walls were suddenly called upon to express tension in addition to compression. How was the architect to meet this challenge? Did he leave tradition and precedent by the wayside and suddenly create a new art founded upon the mathematics of engineering or did he gracefully yield to the will of precedent and develop his art by indiscernible additions? The modern high office building is the answer.

At first thought our modern skyscrapers with their set backs and block like masses seem to be entirely new creations but if we compare them with the spires of the fifteenth century Gothic churches we will see a striking resemblance. Our tall buildings then are merely a development and modern application of what has gone before. These buildings reflect our mode of living, our emotions and in a measure predict what is to come.

Reinforced concrete as used today is another problem which the architect has successfully met. Some very beautiful buildings have been done and finished in this medium. But the trend is not toward a new art but rather a development of the old adapted to new materials. Our use of brilliant color is also a very significant and recent development on our modern buildings. We are by its use overcoming the drabness of ordinary stone and brick, but here again we find precedent in the Byzantine and the Classic, the Moorish and in the Aztec.

In the field of ornament there has been the creation of two distinct types, one by Louis Sullivan which is geometric but also very pleasing, the other by Bertram Goodhue wherein statuary figures seem to grow out of and be a part of the building. This latter type is possibly the forerunner of a new style, but a creation of this sort is necessarily rare and can have very little influence on the trend of present day architecture. Its general use is in the future.

New materials and new environment have made themselves felt also in our church architecture but here again the trend is toward a development of past examples to fit our more modern mode of life. The architect is constantly called upon to design buildings to house new and never before heard of industries and either consciously or unconsciously reverts to precedent in his design.

Since the average man is beginning to grasp more fully the need for architectural service and is employing the architect more and more in the realm of domestic architecture our residences have tended to take on a definite style and are gradually emerging from the dark age of the "Contractor's" house. Here again it is the influence of precedent combined with present day needs and conditions.

From this repeated use of the word precedent the idea in mind is not plagiarism but that precedent promotes the development of an indigeneous style. Precedent though is very bad where it stifles healthy changes and normal growth of a new style and prolongs the life of one that has lost its appeal to beauty.

Thus we see that the trend of architecture is now as it always has been and will be, a gradual development of the best of its predecessors, based on our ever changing emotions, and environment.

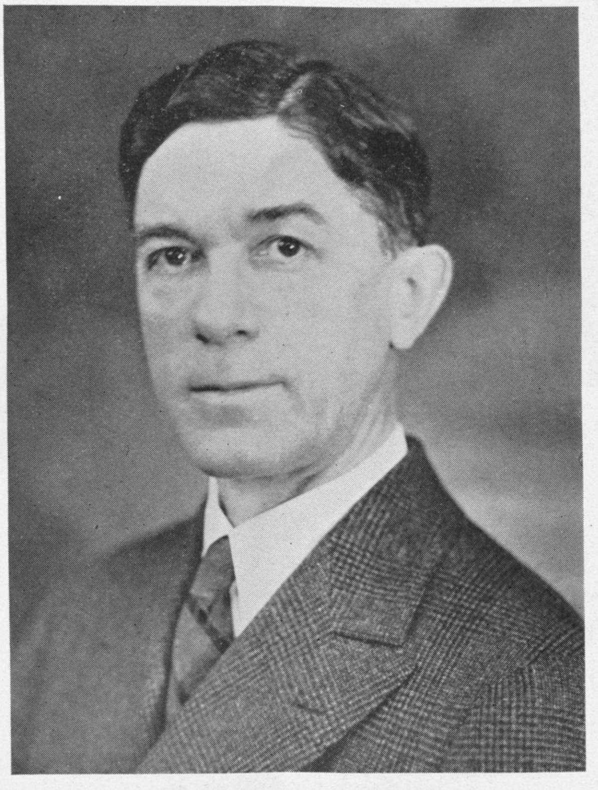
Some people have a perfect genius for doing nothing, and doing it assiduously.—Thomas C. Haliburton.

What a hit this show will make!

BRENT WILEY, '98

BRENT WILEY, Assistant to Industrial Sales Manager, Westinghouse Electric and Manufacturing Company, was graduated in electrical engineering from the Rose Polytechnic Institute in 1898. In 1920, he received his masters degree from the same institution, and has since been continuously engaged in electrical engineering work.

He always has been a firm believer in an adequate practical experience to follow a technical education, and immediately upon graduation started to work with this point in view. His first business connection was with the Ohio Works of the Carnegie Steel Company, Youngstown, Ohio, where he spent the year 1899 in the electrical department. Here he secured a wide range of practical experience in operation and maintenance, his duties involving the inspection and general repair of motors, controllers, and other electrical apparatus found throughout a steel company. It was here, too, that he became proficient in the actual operation of electrical machinery as applied to industry.



BRENT WILEY

After a year spent at the Ohio Works he was transferred to the Homestead Works where he was located until the end of 1904. The practical experience he gained in his stay at Youngstown was of very considerable value to him in his new duties, for at Homestead he had supervision of the drafting room and machine shop, which duties included supervision of engineering work, both mechanical and electrical. In this position he was responsible for the design of controllers, electric brakes, electrical overhead traveling cranes, charging machines, and other electro-mechanical machinery used in the manufacture of steel. In connection with this work many new applications of motors to machinery formerly driven by steam or hydraulic power were worked out, and numerous tests of motor-driven machinery made. Resigning in 1904 from the Carnegie Steel Company, Mr. Wiley accepted a position as electrical engineer with the Wellman-Seaver-Morgan Company, Cleveland, Ohio. In this position he had charge of all matters concerning the application of electrical apparatus to various classes of machines, including cranes, charging machines, car-dumpers, unloaders, ore bridges, larry cars, and numerous other machines necessary for the mechanism of iron and steel plants.

Leaving the Wellman-Seaver-Morgan Company in 1906, Mr. Wiley came to the Westinghouse Electric and Manufacturing Company. In the position of Commercial Engineer, he undertook the task of bringing the view of the steel industry into the company. His intimate knowledge of the processes of the industry and their detail requirements were a great aid in helping to design proper electrical apparatus and obtaining the most effective results. At that time, a rolling mill of the Edgar Thompson Works of the Carnegie Steel Company was the only electrically-driven steel mill in the country and had been in operation for less than a year. There was, therefore, little or no information concerning operating and mechanical conditions to be had. Early designs were almost wholly dependent upon theoretical calculations.

It wasn't long before the customer's needs for the future were studied and plans made to meet this demand. This, an entirely undeveloped service at that time, has interwoven itself into the Company until it now is the greatest aim of the organization. Mr. Wiley soon took charge of commercial development of the paper, rubber, textile, cement, glass, and leather industries, along with that of the steel industry. His success in this position earned for him in 1926 the title of Assistant to Industrial Sales Manager. His responsibilities are largely concerned with the successful development of industrial business with direct users such as the manufacturing plants and mining companies.

He has been identified with engineering work of pioneer installations, of motors in main rolls and many developments of auxiliary machine drives for steel mills. Also, he contributed to the development of the well-known "mill type" motor and magnetic control. The Westinghouse Company recognized the help which properly applied motors would be to the steel industry and were pioneers in furnishing electric motor drive for the main rolls. Original applications both to auxiliary machines and to the main rolls were not accomplished easily or readily. Very little information was available regarding the load and operating conditions. This led to an exchange of

(Continued on page 139)

Asbestos Insulation for Motors

Robert M. Clark, m., '32

A FORTY degree motor is considered a standard rating for electric motors. A 40 degree rise seems small, but the Electrical Engineer's thermometer reads in degrees centigrade and 40 degrees centigrade means 72 degrees fahrenheit. There is also an addition of 15 degrees centigrade (27 fahrenheit) for internal hot spots that cannot be reached for measurement. Therefore the actual guaranteed rise is 99 degrees F.

Suppose the motor is located in a factory with a comfortable room temperature of 70 degrees F, ideal conditions, then the temperature affecting the insulation of the 40 degrees motor is 169 degrees F, which is enough to start carbonization.

Where hot atmospheric conditions prevail, say above an open hearth furnace with a temperature of 120 degrees F., and the motor is subjected to an overload which causes the rise to go above its guarantee and reach 115 degrees F., this motor would then be operating at a temperature of 235 degrees F., and carbonization of the insulation would become acute.

The life of any motor is proportional to the life of the insulation protecting the windings. As carbonization progresses, the insulation chemically and physically changes from an insulator to a conductor, and the very thing that was originally designed to protect the windings threatens their destruction—the steel In the stator heat originates from two sources—core and the windings. It is therefore necessary to provide a barrier shield of insulation between the windings and the core. This barrier should be designed primarily for heart resistance and mechanical strength. The problem is heat, not voltage. This insulating shield is sandwiched between the two heat sources, and buried in the hottest part of the motor with no chance for ventilation. It is hidden and cannot be inspected. So if this barrier carbonizes, the insulation value is gone.

Rewinding motors costs approximately 60 percent of the price of a new motor and the interruption to service is often more costly than rewinding.

Materials commonly used for insulation include varnished cloth, oiled linen, press-board, fiber, and insulating varnish. But all of these will carbonize and not one is fireproof. Any of these materials, even the best, will deteriorate under temperatures at which motors are often called upon to operate. The many repair shops rewinding motors furnish proof of continuous carbonization of insulation.

While there is no way of protecting motors to insure perpetual life, there is a method of insulating the windings so that their life will be very greatly increased.

Electric motors are so widely used and are so necessary to the industrial processes of today that research for the purpose of their development has reached tremendous proportions. Overheating of a motor by overloading is a common occurrence and until recently this consideration has restricted the use of a motor for loads larger than the rated capacity. The use of asbestos for insulating the windings of motors has recently come into use. With such an insulation the motor may operate at a temperature of 30 Deg. Centigrade higher than was heretofore permissible. Motors constructed in this manner will, therefore, require less maintenance and can adjust themselves to a wider variation in load and overload.

PRODUCTION OF ASBESTOS INSULATION

Pure asbestos is first treated to render it moisture proof. Sheet asbestos is cut and molded to conform to the perimetrical shape of each stator slot, and die cut shapes are made to fit between the coils. An impregnating compound of asbestors is produced by reducing asbestos to a fine powder. This base is held in colloidal solution by highly volatile dilutants which are driven off after the compound permeates the windings.

To place in position the individual wires inside the stator slots so that the compound may be introduced around each wire, the following method is used. An interrupted current is passed through the windings while the compound impregnates them. The individual wires of the windings oscillate and vibrate, which accomplishes two results. The movement agitates and churnes the compound into the windings, and each wire is separated from its neighbor becoming completely incased.

The rules of the A. I. E. E. approve asbestos insulation in motors for a 70 degree C. rise. The insulation is generally used in a standard 40 degree C. motor giving a very high safety factor.

New Apparatus

The mechanical engineering department has received as a gift from the Wheeler-Schebler Carburetor Co., of Indianapolis, a Model S cut section carburetor. This is a regular Model S carburetor with parts cut away so that the inner workings can be clearly seen.

The ladder of life is full of splinters, but they always prick the hardest when we're sliding down. —William L. Brownell.

How do you measure up? The Show will show.

Published Monthly by the Students of the Rose Polytechnic Institute

The Rose TECHNIC

A Magazine Pertaining to Engineering and Allied Sciences

Member of Engineering College Magazines Associated

How Great Is Your Mathematical Power?

A cup of wine is suspended over another cup containing an equal quantity of water. Each cup has a hole in its bottom, and wine is flowing from the upper cup at the same rate that the mixture is flowing from the lower cup.

If the mixture of wine and water in the lower cup is kept homogeneous by stirring, what part of the contents of the lower cup is water when the wine cup is empty?

What is volume of water in lower cup at any instant?

(1) Solution by Clarence Hoff

Let us suppose first that the liquids come from the cups by drops and let n be the number of drops in each cup at the start.

Then, the ratio of water to wine in the lower cup is

$$n:0$$

After the first drop of wine has fallen into the lower cup this ratio has changed to

$$(n-1):1$$

The second drop, when it falls from the lower cup, contains water and wine in the ratio of $n-1:1$ as determined above. Therefore the lower cup loses $\frac{n-1}{n}$ drops of water and $\frac{1}{n}$ drops of wine. But it also gains one drop of wine from the cup above, so the ratio now is

$$(n-1)-\frac{(n-1)}{n} : 1-\frac{1}{n}+1$$

This expression reduces by alegbra to

$$(n-1)^2 : n^2-(n-1)^2$$

By similar reasoning we find the ratio after the third drop has fallen to be

$$(n-1)^3 : n^3-(n-1)^3$$

When the upper cup is empty n drops have fallen. The ratio is then

$$(n-1)^n : n^n-(n-1)^n$$

Considering this expression as a fraction and dividing both terms by $(n-1)^n$, the ratio of water to wine in the lower cup is

$$\frac{1}{\left(\frac{n}{n-1}\right)^n-1} \text{ which is equal to } \frac{1}{\left(1-\frac{1}{n}\right)^{-n}-1}.$$

This is the result if the flow of the liquids is by drops. If n increases indefinitely we arrive at the idea of a continuous flow, and since the limit of $\left(1-\frac{1}{n}\right)^{-n}$ as n approaches infinity is e (=2.71828) the ratio would then be $1:(e-1)$.

However this is the ratio which the amount of water bears to the amount of wine in the lower cup. The ratio which the volume of water bears to the total volume of the lower cup is therefore $1:e$.

---

(2) Solution by Dr. Sousley

Let V be the volume of liquid in each cup and let kV (k being greater than zero and less than one) be the volume that flows from each cup in a unit of time. The amount of water that flows out of the lower cup in the first small interval of time t will be kVt and the amount left is $V(1-kt)$. Assuming that the mixture is homogeneous during the second small time interval t, the amount of water left at the end of the second interval is $V(1-kt)^2$. Continuing as above we find that the volume of water left in the lower cup at the end of the n^{th} interval is $V(1-kt)^n$.

Let T be the whole time needed to empty the upper cup, and let V be the volume of water in the lower cup when the upper cup is empty.

Then $T=nt$, and $t=\frac{T}{n}$

Therefore v is equal to the limit of $V\left(1-\frac{kT}{n}\right)^n$ as n approaches infinity, or $v=Ve^{-kT}$

Research and Progress

Conducted by Lee C. Kelsey.

Wasp 300 h.p. Engine

A NEW model nine cylinder 300 h. p. engine, air cooled, has been recently tested and will be put on the market soon. This new motor which has a 985 cubic inch displacement, weighs less than 550 pounds and is 45¾ inches in diameter over all. It will be rated at 300 h. p. at 200 r. p. m. The bore and stroke is 5 3-1 inches. The engine incorporates all the features of the larger Wasps and the design is standardized. Eighty percent of the parts are interchangeable in this small motor.—*Abstract Automotive Industries.*

New Chromite Cement

BECAUSE of the chromite base, this new cement is chemically inert, and is also hard, dense and highly refractory. It employs a bonding agent which is said to be efficient at high temperatures. The material is suited for making either dipped or troweled joints. It is recommended by the manufacturers for laying up fire clay brick, silica brick, chrome, high alumina brick and also for laying up the magnesite brick under certain conditions. It is also adaptable for use as a surface coating material, and as a binder in the mixture for repairing burned-out sections of refractory constructions.

Airplane Brakes

A NEW multiple disk brake has been developed which is going to be used on all Sikorsky amphibians, enabling them to land in a space of 300 feet.

The brakes contain three stationary plates, the two outside plates having lining applied to one side only, while the center plate is lined on both sides. The arms of the stationary plates support the brake lining and carry the braking torque inward toward the axle. These plates are 0.062 inches thick, but they are said to be able to transmit safely more than 25,000 lb.-in. of braking torque, due to the fact that the stresses are entirely within the plane of the disks and none transverse thereto.

In the cockpit of the plane will be two hydraulic cylinders operated by the brake pedals. These cylinders connect by flexible hose to brake cylinders on three sets of cylinder arms, making three brake cylinders per wheel. All cylinders on one wheel are interconnected and when pressure is applied to the pedal in the cockpit, the pistons in the brake cylinder are forced outward. Both the cylinders and the pistons are connected up through locking levers, and the outward forces exerted by them result in an inward pressure tending to clamp the three stationary arms and the two rotating disks together. Rotation on the wheels causes the rings to turn, and the rings being clamped between the brake lining on the stationary members, set up a strong resistance to rotation of the wheels. Excessive braking effort would result in nosing the ship over, and this has been provided against by moving the wheels slightly forward, thus increasing the weight on the tail of the ship.—*Abstract Automotive Industries.*

World's Largest Shovel

A MINING company in Illinois has recently purchased an electric shovel capable of lifting a weight equivalent to that of a locomotive or roughly about 100 tons. It can lift this weight to a height of a seven story building. The scoop was originally designed for a capacity of 20 cubic yards but for its present use the dipper has been reduced to a 15 cubic yard size. In one bite it can scoop up a load of material sufficient to fill a bathroom or enough coal to furnish the heat for a large house for one year—about 16 tons. Scooping, lifting and dumping such a quantity of material takes less than one minute.

One man can operate the massive piece of machinery. It weighs approximately 1,600 tons and is just twice the size of any previously designed shovel. A relative estimate of its size can be had when it is compared to the ordinary shovel used in excavating work which will weigh about 30 tons. The large shovel's electrical equipment has a capacity of 4,500 horsepower. A twenty ton crane is used in handling the machinery of the shovel.

By the use of this shovel and other modern equipment for mining the Illinois company expects to handle 1,500,000 tons of coal a year.—*Abstract Popular Science.*

Double Track Bore

AFTER ten years of continuous work the world's longest double track tunnel, burrowing through the Appenine mountains which form the backbone of Italy, has just been completed. This new bore is second in length to the Simplon tunnel through the Alps, but the latter is a single track tunnel. The Appenine tunnel is 11.3 miles long and in the middle of it is a station 500 feet long called the Station of Providence. Two tunnels run off from the station to provide side tracks.

What the tunnel will do for railroad traffic will be seen from the fact that it will eliminate 22 miles of travel and will reduce the maximum height of the old road bed from 2,002 feet to 1,036 feet, which means that traffic will be considerably speeded up. The bore also eliminates several dangerous curves that have always been a menace to mountain traffic.

The construction of this bore has been a tremendous feat, involving thousands of men and costing in all $60,375,000. Work was begun in 1920. In February, 1924, two shafts were sunk as a start on the station of Providence. From then on steady work was done. 1,488,000 cubic meters of earth and rock were removed from the bore, and 967 tons of high explosives and dynamite were used to blast out the rock formations.—*A. P. News.*

The Nature of Dielectric Loss

HYSTERESIS loss in iron is commonly attributed to the internal friction associated with the rotational motion of molecules under the alternations of the electrical field. A necessary basis for this idea is a polarized condition of the magnetic molecules. An explanation of dielectric loss difficulties have always been difficult due to the fact that a permanent polarization of dielectrics has never been definitely recognized. Recently evidences of the permanent polarization of dielectric molecules have been found in the changes encountered in the value of the dielectric constant over a range of temperatures and as related to the viscosity of the material. This dielectric constant has been attributed to a shifting of the electrons within the atoms. If, on the other hand, the larger molecule is polarized, then within a certain range of frequency the oscillation of the polarized molecule should add something to the normal dielectric constant. Research has proven just this fact. The explanation is referred to as the Debyr theory of polar molecules. All dielectric molecules are not polar, however, and the property is supposed to be due to an unsymmetrical arrangement of the positive and negative charges in the complex molecule. It is assumed that the so-called "electrits," in which fluid dielectrics are allowed to solidify under a constant electric field, are another manifestation of polar molecules.

The oscillation of polar molecules in an alternating electric field would, under certain conditions, cause the same type of loss as that of hysteresis in iron. There would be naturally a range of frequency in which the loss is greatest, and that range will be associated not only with the viscosity of the material, but especially with temperature as related to the normal kinetic activity of the molecules. So far there is good evidence that much of the dielectric loss in very high ranges of frequency may be accounted for in this way. There is some evidence that a portion of the loss at lower frequencies may also be attributed to this cause. Definite proof of this hypothesis, however, is yet wanting and the matter is still under discussion and experiment. It seems reasonably certain that so far as concerns the commercial range of frequency, and the usual dielectric losses in high voltage power circuits, by far the greatest portion of these losses arise in what is usually referred to as dielectric absorption.—*Electrical World.*

A Copper Alloy Capable of Being Hardened

TEMPALOY was patented early in 1928 by M. G. Corson and is controlled by the American Brass Company. Nickel and silicon are present in the proper proportions to form nickel silicide; when heated to 750 deg. cent. or above, the nickel silicide is in solid solution in the copper. It may then be hot rolled or forged. When this alloy is quenched from above that temperature, it is ductile and may be cold-worked. The silicide is precipitated from solid solution when heated for a few hours at 450 deg. cent., causing the alloy to become hard and strong. Annealed Tempaloy can be forged to shape, welded with Tempaloy rod, and then age-hardened to secure increased mechanical strength in the weld as well as in the base metal.

Generally speaking, it is best to use a welding rod of the same composition as the base metal, but Everdur can be used in welding Tempaloy. A fused boric acid flux may be used, but for best results add 10 per cent of sodium fluoride. A backing bar is usually necessary. The flame should be slightly oxidizing to concentrate the most heat upon the weld, and its length must be governed by the thickness of the metal.

Effects of Tetraethyl Lead on Flame and Pressure Propagation

THE effect of tetraethyl lead, both in the vapor phase and thermally decomposed, on flame speeds and rate of rise of pressure following ignition, was determined for explosive mixtures of benzene, pentane, isohexane, and heptane in air. Tetraethyl lead vapor was ineffective in retarding combustion until decomposed by the burning mixture, whereas decomposed tetraethyl lead, introduced before firing the charge, retarded both flame-speed and rate of rise of pressure.

A hot surface was introduced into the bomb to secure autoignition of the charge ahead of the advancing flame. This autoignition produced an unusually high rate of rise of pressure.

Decomposed tetraethyl lead prevented or delayed the autoignition and retarded the resulting combustion.

High-frequency pressure waves ordinarily present in the explosions were eliminated by decreasing the number of sparks in the igniting discharge. Their effect of these waves on the combustion and on the initiation of a violent "shock wave" was determined.

The shock wave observed differs markedly from a true detonation wave. It is apparently developed only after auto-ignition of the explosive mixture ahead of the flame or after complete inflammation, and is reflected back and forth through the completely inflamed gases with the velocity of sound.—*Industrial and Engineering Chemistry*, December, 1929, p. 1261.

A faint heart never made a Showman.

H. A. SCHWARTZ AWARDED PENTON GOLD MEDAL

HARRY A. SCHWARTZ, '01, manager of research, National Malleable & Steel Castings Co., Cleveland, has been selected to receive the 1930 major award of the American Foundrymen's Association, the John A. Penton Gold Medal. This award, which is made to Mr. Schwartz for his outstanding contributions to the foundry industry, has been approved by the Board of Awards and will be presented at the 1930 convention the week of May 12.

Mr. Schwartz is especially noted for his contributions to the field of research on malleable iron. He has been closely identified with the A. F. A. for many years as a contributor of papers, as a member and chairman of committees and as chairman of convention sessions. One of these papers was the 1928 A. F. A. exchange paper to the Association Technique de Fonderie de France.


H. A. SCHWARTZ

At present he is chairman of two important committees of the malleable division, namely, those on specifications and on recommended practices. He also represents the A. F. A. on A. S. T. M. committee A-7 on malleable iron and on the ferrous metals committee advisory to the U. S. Bureau of Standards.

Mr. Schwartz' first paper before an A. F. A. meeting was in 1918, on the subject of "Malleable Iron as a Material for Engineering Construction." Practically every A. F. A. convention since that time has had some contribution from him in the form of a paper or written discussion.

Altogether he has prepared, since 1917, seven authoritative research papers on malleable iron for annual meetings of the A. F. A., serving also on several occasions as chairman of convention sessions. In addition, the active part he has taken in the discussion of the various papers read has contributed materially to the value of the sessions for all attending. The subject of his contribution to the 1929 convention in Chicago was "Shrinkage of White Cast Iron."

In addition to his membership in the A. F. A., Mr. Schwartz is a member of the American Society of Mechanical Engineers, the American Chemical Society—serving as the first secretary of the Indianapolis chapter—the Cleveland Engineering Society, American Society for Testing Materials, Society of Automotive Engineers, American Institute of Mining and Metallurgical Engineers—serving as vice-chairman of the Northern Ohio chapter in 1924-1925—the Iron and Steel Institute (British), the Research Committee of the Malleable Iron Research Institute and the American Society for Steel Treating.

Mr. Schwartz is the author of an outstanding book on malleable iron, the first edition of "American Malleable Cast Iron" being published in 1922. In addition to his contributions to the A. F. A. sessions, he has presented numerous papers before meetings of the A. S. S. T., American Ceramic Society, A. I. M. E., S. A. E., American Welding Society, World Engineering Congress at Tokio, Japan, in 1929, and has prepared many articles for the technical press.

At present he is advisor on malleable iron for *The Foundry* and is serving as a special lecturer on metallurgy of cast iron at the Case School of Applied Science, Cleveland. In recent years the company with which Mr. Schwartz is connected has been producing steel castings, and he has been doing research work on alloy steels, especially in connection with problems of wear and with oxidation-resisting products.

His formal technical training was obtained at Rose Polytechnic Institute, Terre Haute, Ind., where he received three degrees: Bachelor of Science in 1901, Master of Science in 1903 and Mechanical Engineer in 1905. He also served as instructor at Rose Polytechnic Institute in 1901-1902 and has retained an active interest in the school. He served for one year as chairman of the Rose Alumni Association, and for five years has been chairman of the Cleveland chapter and a member of the executive committee of the national body.—*Article and Photo courtesy American Foundrymans Association.*

'29

Raymond Harris has taken a position with the Doer Company, Inc., Engineers, New York.

You are only as good a Showman as you try to be.

'96

Walter L. Decker is an industrial engineer in New York City. He was formerly with the White Sulphur Springs, Inc., of West Virginia.

'00

Herbert F. Madison, physician, has opened an office in Sullivan, Indiana.

Jesse H. Loofbourow, formerly with the Oregon Short Line R. R., has taken a position as assistant engineer with the Vinta Pipe Line Company of Salt Lake City, Utah.

'03

Irving J. Cox of the class of '03 is president of the Eastern Alcohol Corporation of Wilmington, Delaware.

Earl C. Metzger, formerly with the Polar Wave Ice and Fuel Company of St. Louis, Mo., is now power engineer with the General Steel Castings Company of Eddystone, Pa.

'07

Warren W. Kelly, with the Atchison, Topeka and Santa Fe Railway, has been promoted to be chief engineer with headquarters at Amarillo, Texas. Before being promoted he was district engineer at Los Angeles, Calif.

'09

Carl W. Piper is with the General Electric Vapor Lamp Company of Cincinnati, Ohio.

'11

William E. Baker is supervisor of Commercial Motors Division, Delco Products, of Dayton, Ohio.

Henry R. Voelker, with the Ingersol-Rand Company, is now their representative in Chicago, Illinois. Before going to Chicago he was stationed in St. Louis, Mo.

'12

August H. Albrecht, with the Standard Oil Company of California, has been moved to La Habra, where he is Electrical Engineer.

'13

E. Joseph O'Connell with the American Radiator Company, has been transferred from Los Angeles, California, to Chicago, Illinois.

Claude E. Reese, formerly with the International Filter Company, of Chicago, Illinois, is now Indiana Sales Manager for Zenith radios, with headquarters at Chicago.

Thomas A. Novotney, manager of National Radiator Corporation in Buffalo, New York, has been transferred to Johnstown, Pa.

'14

George M. Derr, with the Truscon Steel Company, has been transferred from Youngstown, Ohio, to Los Angeles, California.

Kenneth E. Lancet is with the Engineering Metal Products Corporation of Indianapolis, Indiana.

'15

Charles E. Dowling has taken a position with the Patoka Coal Company of Petersburg, Indiana.

Lynn H. Reeder is with the H. S. Ferguson and Company, Consulting Engineers, of New York City.

'17

Chester A. Williams is Southeastern Sales Manager for the Union Metal Manufacturing Company at Atlanta, Georgia.

'18

Wayne C. Woodling is Production Manager and Superintendent for the Concrete-Trope Manufacturing Corporation of Indianapolis, Indiana.

'20

Whitcomb W. Moore, with the American Telephone and Telegraph Company, has been transferred from Chicago, Illinois, to Denver, Colorado, where he is Division Plant Supervisor.

'21

Samuel J. Minor, with the Western Electric Company, has been transferred from Chicago, Illinois, to Kearny, New Jersey.

'22

D. Lester Reinhard, formerly with the Youngstown Sheet and Tube Company, is now with the National Tube Company at Gary, Indiana.

Alfred J. Suttie is Biological Chemist for the Spreckels Sugar Products Laboratory at Yonkers, New York.

'24

William Dowen, with the Wagner Electric Corporation, has been transferred from St. Louis, Mo., to Dallas, Texas.

George Y. Jean is chief engineer with Waypoysett Manufacturing Company at Pawtucket, R. I.

Howard C. Hocker is with the Vanderkloot Steel Works of Chicago, Illinois.

William H. Waltman, Commercial Engineer with the General Electric Company at Chicago, Illinois, is to be transferred to St. Louis, Mo., the first of February.

G. Raymond Fitterer is now Assistant Director of research in the physical chemistry of steel making, at the United States Bureau of Mines at Pittsburgh, Pa.

'25

John W. Moorhead, formerly with the Consolidated Expanded Metal Company of Chicago, is now in the Building Division, Aluminum Company of America, at Chicago, Illinois.

Henry L. Maury, Jr., is valuation engineer for F. C. Hamilton at New York, N. Y.

Howard L. Newton is engineer with the Pressed Steel Tank Company of Milwaukee, Wisconsin.

Charles C. Withrow, formerly in South America as civil engineer, is with the Wabash Railway Company at St. Louis, Mo.

'27

William A. Harris is in Camden, New Jersey, as engineer with R. C. A. Victor Company. He is in the receiver development section.

Fred L. Trautman is Air Conditioning Engineer for B. Offen and Company of Chicago, Illinois.

'28

Guy S. Mahan is with Graham-Paige Motors Corporation in Detroit, Michigan.

John I. Mendenhall, with the duPont Company of Wilmington, Deleware, is supervisor with the duPont Dye Works at Deepwater, Point, New Jersey.

Kenneth Metcalfe is Metallurgist with the Crucible Steel Company of America, at Pittsburg, Pennsylvania.

(Continued on page 130)

Do your Show jobs and help the other fellow with his.

ATHLETICS

Claude R. Nicholson

CHARLESTON 32—ROSE 24

IN the last basketball game before the Christmas holidays, Dec. 19, Rose lost a hard game to Eastern Illinois State Normal by the score of 32 to 24. The game was close all the way through with Rose trailing at the half 19 to 10.

Eastern Illinois grabbed an early lead before the Engineers could become accustomed to the strange gym and held onto this lead throughout the game.

For Rose Poly, Gillette, a freshman guard, was the high-point man with 11 points. Gillette played a bangup game and was a constant threat to the Teachers.

Hall of Eastern Illinois scored 11 points to tie Gillette for high-point honors. Hall and Fenolio looked the best for Charleston, with Gillette and Batman starring for the Rose team.

Line-up and summary:

Rose Poly (24)—	F.G.	F.T.	P.F.
Alexander (C), f	1	0	2
Batman, f	2	0	0
Sawyers, f	0	0	1
Broadhurst, f	1	2	3
Allen, c	0	1	1
Gillett, g	5	1	1
Spangenburg, g	1	0	3
Totals	10	4	11

Charleston (32)—	F.G.	F.T.	P.F.
Fenolio, f	3	3	0
Hance, f	0	0	1
Sarver, f	0	0	2
Hall, f	5	1	1
Dappert, f	0	0	0
Wasem, c	1	1	0
Haire, g	0	0	1
Buckler, g	0	0	1
Walch, g	0	0	1
Roberts, g	0	0	1
Van Bahlend, g	2	2	3
Totals	11	10	11

Referee—Warner.

HANOVER 32—ROSE 27

ROSE POLY lost a roughly played game to Hanover Jan. 11, at the Rose Gym. Led by Alexander, Rose jumped into an early 8 to 4 lead, but the superior height of the Hilltoppers was too much of a handicap for the smaller Poly team. When only two minutes remained to be played, and Hanover leading by the score of 29 to 15, the Engineers got together and started a rally that netted them 12 points before the gun stopped the game.

Alexander and Sawyers looked the best for Rose, while Wallin and Telle looked the best for the Hilltoppers.

Line-up and summary:

Hanover (32)—	F.G.	F.T.	P.F.
Cooprider, f	2	0	1
Wallin, f	5	1	1
McNulty, f	0	0	0
Rockwell, f	2	0	0
Telle, c	2	1	2
Nicely, c	0	1	1
Fuller, g	0	0	1
Nabb, g	2	1	1
Garriott, g	0	2	2
Totals	13	6	9

Rose Poly (27)—	F.G.	F.T.	P.F.
Alexander (C), f	5	1	3
Sawyers, f	1	2	3
Batman, f	0	0	2
Allen, c	1	0	2
Sanford, c	0	0	0
Gillett, g	1	1	1
Dowen, g	1	0	0
Spangenberg, g	2	1	2
Totals	11	5	13

Referee—Adams, DePauw.

ROSE 27—VINCENNES 26

THE Alices of Vincennes College defeated the Rose Poly Engineers at Vincennes in a game that was played in spurts. At times the teams would display some classy basketball ability and at other times each slumped and played ragged ball.

Vincennes took the lead at the start and only once did the Engineers hold the lead. The last half was somewhat faster than the first, with the Vincennes team holding a comfortable lead all the way. Rose started a rally in the final minutes of play but the time was too short.

Both coaches made numerous substitutions in order to find a smoothly working combination. Captain Alexander, Gillett and Spangenberg led the Rose attack and each connected from the field three times. Spangenburg put up a whale of a game at back guard and finally trailed to the bench with four personals to his credit.

The shooting of Everett, Vincennes forward, and the defensive work of Stocker were the high lights of the Vincennes team.

The ability of the Vincennes team to sink its foul shots was a deciding factor in their victory. The Alices made 12 out of 14 foul shots as compared to 1 out of 6 for Rose.

(Continued on page 138)

How many hours per week are you giving to the Show?

FRATERNITIES

ALPHA CHI SIGMA

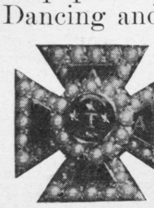
AS the old semester ends and the new one begins, Iota of Alpha Chi Sigma is happy to note the big swing to Chemical Engineering. After several weeks of selection and rushing the following men are now wearing the ancient symbol as pledges. We heartily welcome them and wish them success fraternally and professionally.

Carl Kraemer, Paris, Ill.; James F. Guymon, Vermillion, Ill.; James Dunlap McNair, Mattoon, Ill.; Roger C. Peugnet, Adamstown, Md.; Charles B. Sipple, Logansport, Ind.; Robert H. Swoboda, Cairo, Ill.; Edwin J. Withers, Brazil, Ind.; Tom H. Batman, Louisville, Ky., and Ottobert V. Axton, Chester A. Cromwell, William C. Heidenreich, Robert A. Koerner, all of Terre Haute.

No season of the year is so thoroughly enjoyed as the rush season and the Chapter for the month just passed has experienced good fellowship smokers which will be hard to match in the future. Following the pledge banquet of January 24 the year will be full of things fraternal for the Neophytes.

ALPHA TAU OMEGA

INDIANA Gamma Gamma enjoyed another of their popular house parties on the night of January 19. Dancing and bridge were the main diversions of the evening, and everyone proclaimed the affair a success. Professor and Mrs. Hutchins, and Professor and Mrs. Wischmeyer chaperoned the affair. Refreshments were served and the gaiety of the party continued until a late hour.



The annual state dance and banquet of the four chapters of Alpha Tau Omega in this Province is to be held in the Claypool Hotel in Indianapolis on March the first. Something novel in the way of entertainment is planned for the banquet. All of the brothers are looking forward to the dance with much enthusiasm as it has always been one of the outstanding social events of the year, and this is to be no exception.

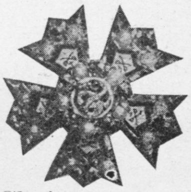
The Terre Haute Alumni Association has presented to the Chapter a beautiful silver loving cup. Upon this cup is to be inscribed the name of the freshman having the highest scholastic standing. The Chapter wishes to express their appreciation of the gift.

The brothers have all been studying hard and hope to maintain first rank in scholarship among the Greek letter fraternities which A. T. O. has held the last three semesters.

Several of the alumni have visited the house recently. Among them were Brothers Max White, George Hadley, Ed White, Buford Tyler, Ed Booth, Theron Bell, Wayne Dodson, and Richard Garmong. Brother Garmong is returning to school this semester.

SIGMA NU

WITH the final exams a thing of the past and the new term on its way, Beta Upsilon is beginning to look forward to the next thing on the calendar, the Pledge Dance, tendered annually to the prospective brothers. The dance will probably be held on February 28, at the Terre Haute House. The orchestra has not yet been definitely decided upon, but we have faith in Chairman Dean securing music worthy of a Sigma Nu dance.



The Mothers' Club had planned an open bridge party for Friday evening, February 21, at the Chapter house, but due to the Military Ball out at school, on that date, the party has been postponed until February 28. All alumni and friends of Sigma Nu are invited to be present. The mothers have also planned an informal "get-together" party for the actives, pledges, alumni, and their parents to be held at the house the early part of March.

Some of the alumni who have visited us in the past month are: Valentine Mitch, John C. Cooley, Richard Brown, Robert Thompson, Jack McDargh, William Dowen, and Claude Sweeney.

THETA KAPPA NU

ON January 14 and 15, we were privileged to have the traveling secretary of Theta Nu, Bruce Musick, with us. Bruce came on a formal inspection trip, but found plenty of time to get together with the fellows. He brought us greetings from all other chapters of Theta Nu and the Grand Council. We are looking forward with pleasure to his next visit.

At the present, all the eyes of Theta Nu are pointed towards the next Grand Chapter in June, at Richmond, Virginia. Each chapter is striving to have a large percentage of its members there, besides their delegates. The convention promises to be the biggest and best yet, with formal dinners and the formal ball and the side trips to historic spots in Virginia. Indiana Gamma is to be represented by five or six members besides the delegates.

With the track season not far off, several Theta Nus are already out working out the kinks. We will

(Continued on page 130)

Ten jobs for each Showman. Have you your ten?

CAMPUS NOTES

Chester C. Stock, ch., '32

Assemblies

January 9

AT this assembly Dean Edgell, of the school of architecture of Harvard University, spoke on the subject "Why We Study the Fine Arts." It was a fine speech and was appreciated by all.

Dean Edgell answered the question, "Is an architect an engineer, or is an engineer an architect?" by saying an architect is an engineer when he does a good job, and an engineer is an architect when he constructs something well. An ocean liner and an automobile, products of engineering, are works of art. In speaking of the arts he mentioned music. Everyone whistles or sings. Dean Edgell traced a crusader's dirge of the twelfth century down to the present, "We Won't Go Home Until Morning." He said that the difference between the truly fine art and art that is not fine is whether it lives or not.

Mr. Edgell spoke about the fallacies of architecture and in that connection mentioned four main theories in architecture. They are: the biological theory, mechanical theory, romantic theory, and the truth theory. He stressed the importance of not pushing a theory too far. The purpose of fine arts is to make life agreeable rather than to glorify God, although often the arts do the latter. Every one must get something of the fine arts to get fullest enjoyment of life.

Dean Edgell is one of the finest speakers the students have heard, and the comment upon his speech has been most favorable. May we have more like him.

January 16

THE advance agent of the Ben Greet Shakespeareian players spoke a few minutes about the coming of the players to Terre Haute, Feb. 2. Due to the probable demand for tickets he advised all wishing to see the plays to reserve tickets.

The rest of the time was taken up with matters pertaining to the show. Dr. Howlett then announced about the assignments. He suggested that any man very dissatisfied with his assignment should ask to have it changed. Andy Davy, who is general chairman of the students, in his talk asked everyone to put forth his greatest efforts to make the show a success. After Davy the senior chairman of each department was called on for a few words. Maurice Shattuck said that the chemical department has its men assigned to exhibits and that more exhibits have been suggested than the number of men could take care of. George Kessler of the civil department stated that there must be work and plenty of it. He said that as the testing machinery seemed to draw a large amount of attention in the civil exhibits of the former show, it is planned to feature that this year. John O'Mara of the architects drew the laughs of the day. Seriously, he mentioned that all would soon have the show fever and the only cures were work or irresponsibility. Joseph Sperotto stated the electricals had at least forty exhibits which were enough to keep them all busy. Glen Sampson of the mechanical department advanced reasons for working in this show. It is a chance to pay back a little of what we owe Rose. Moreover, we shall have the honor of helping put the show over, we shall get in contact with the public, and we can get quite a "kick" out of the whole thing. We shall advertise the school greatly by this. Royer Blair is chairman of the physics department. He described several exhibits that should prove to be hits of the show. Milo Dean, chairman of the military department, said the fifth area corps headquarters had promised its cooperation in securing exhibits. There will be between forty to fifty exhibits, and no exhibit will be a duplicate of the previous show. Prof. Chinn, chairman of the publicity committee, outlined the plans of his committee and said the show is to tell what the engineering profession is doing. The publicity methods to be used are many and various. Friends are to be told, students are to go to high schools to carry the news, faculty members are going to tell luncheon club members about it, and the newspapers will tell the world. The show will be attended by prospective students, parents of prospective students, and by prospective backers of Rose. Thus the value of the show can be clearly seen.

Prof. Stock, chairman of the poster committee, asked that students submit designs for posters. The designs should be of size 14x20 and handed in by Feb. 10, when a committee will judge them. Help is desired for the large task of making signs. He asked that all copy for signs with their size be in just as soon as the copy is ready. A design is also needed for the program cover.

January 23

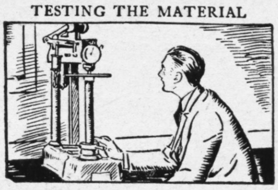
COACH BROWN made three football awards at this assembly. Two awards were given by him, and the third was presented by him for Wayne Bigwood. To Andy Spence was awarded a silver football for showing the best spirit of those men not receiving a letter. John Tonetti was given the Bigwood gold football for being the most valuable player. To "Spud" Kruzan, Coach Brown gave a miniature of a football player, designating him as the hardest hitting player.

Prof. Knipmeyer then gave a talk on talking pictures. He had a sound film projected on a screen to illustrate some of his points. The talk was interesting and easily understood.

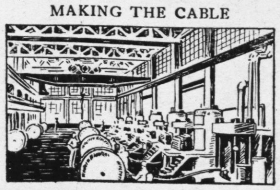
(Continued on page 132)

Be Show-minded! Exercise your talents!

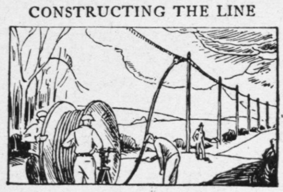
TESTING THE MATERIAL



MAKING THE CABLE



CONSTRUCTING THE LINE



Winning the war against weather

In the telephone business, research man, manufacturing engineer and construction supervisor are carrying on a successful war against the unruly elements, enemies to service.

Cable, for example, housing many circuits and covered with protective coatings of proved strength, withstands storms which might seriously threaten open wire lines.

Thus in the Bell System growth is intensive as well as extensive, improving present facilities as well as adding new ones. And there is no end to all this development.

BELL SYSTEM

A nation-wide system of inter-connecting telephones

AMERICAN TELEPHONE & TELEGRAPH CO. AND ASSOCIATED C... BELL SYSTEM

"OUR PIONEERING WORK HAS JUST BEGUN"

Fraternities

(Continued from page 127)

be represented on the track this year by Baker, Spence, Hughes, Templeton, and White. The first three made their letters last year and are expected to crash through again this year. Hughes, ineligible last year, should "go to town" this year in the distance events. Baker and Spence also run the distance events, with Templeton in the hurdles and broad jump.

The Mothers' Club is planning another of their popular bridge parties for the near future and everyone is looking forward to a good time.

We are always pleased to welcome back "old grads." Some of our recent visitors include L. A. Wilson, Fred Andrews, Gilbert Knott, Harold York, Marion Houston, Jim Lawyer, Harold Carson, Walter Davidson, Lee Berry, and Allen Reeves.

KAPPA OF THETA XI

THE sixty-fifth annual convention of Theta Xi is to be held at St. Louis about the middle of February. From the reports of our delegates to past conventions a real treat is in store for our delegate, Bro. Blake. Several Brothers of Kappa are going along to help him have a good time.

Bro. Jerome "Jerry" Pellum was united in marriage with Miss Treva Roach of Paducah, Ky., during the holidays. Although we miss Brother Pellum, we extend to him and his bride our best wishes.

Several bob-sled parties were held by the Brothers during the holidays, Brother Blake and his Buick furnishing the motive power. Although some of the boys were pretty much the worse for their sledding, they were always ready for more.

Visitors during the past month were Brothers Matson, Swartz, Nancrede, Lyons, Joslin, Johonnott, Hauer, and Rader of Purdue.

Brother Wells has already started plans for the annual pledge dance to be held in the latter part of February. Brother Wells always has something new in the way of entertainment up his sleeve and he assures us that this is to be no exception.

Alumni

(Continued from page 125)

J. L. Montgomery is working in the Photophone department of General Electric Company in Schenectady, N. Y. He is working on the news-reel truck which makes a sort of portable studio for recording sound-movies of news events. As this department is being moved to Camden, N. J., Mr. Montgomery will be transferred there in about six weeks.

Guy H. Stallard is with the Detroit Metal Specialty Company of Detroit, Michigan.

Morris Wesley, with the American Telephone and Telegraph Company, has been transferred from Springfield, Ill., to Chicago, Ill.

TIME—THAT TOUGH OLD TESTER....

Meet Time, that tough old tester of everything in this world. To his aid, Time calls all the destructive forces of the universe. Years come and go, storms and sunshine, heat and cold make their accustomed rounds, while Time, the tough old tester, broods over the world, trying, testing, destroying.

Yet Time, the tough old tester, does have his troubles. Against one material devised by man, Time and his serving-men falter. That material is genuine Puddled Wrought Iron—the metal of which Reading 5-Point Pipe is made. Watch for the next coming of Time, the tough old tester—you can learn about pipe from him.

READING IRON COMPANY, Reading, Pennsylvania

For Your Protection, This Indented Spiral Forever Marks All

DEFIES VIBRATION
RESISTS CORROSION
5 POINT PIPE
READING
GENUINE PUDDLED WROUGHT IRON
WELDS BETTER
HOLDS COATINGS
THREADS EASILY

GENUINE PUDDLED WROUGHT IRON

READING PIPE

DIAMETERS RANGING FROM 1/8 TO 20 INCHES

Science and Invention Have Never Found a Satisfactory Substitute for Genuine Puddled Wrought Iron

Assemblies

(Continued from page 128)

There are two kinds of sound reproduction. One is that in which the sound is recorded on phonograph records. The other is the recording of the sound on the film. It is the latter type that was discussed. There are two types of the sound record on the film. They are the saw-tooth type and the line type.

The saw-tooth process was first described. Sound is received in a microphone which reproduces it as variable electrical waves. These feeble waves are amplified from two to three billion times. This current operates an electromagnetic shutter of minute mass. The shutter has a natural frequency of about 7000 vibrations per second. Since sound waves have frequencies of from 60 to 6000, we can understand that all sound waves would be reproduced. The shutter follows the variations caused by the sound. The shutter shuts out a beam of light in line with the shutter and the film, this apparatus of course being in the camera. The shutting and opening of the shutter lets the light make a ragged uneven track or exposure along the edge of the film. When the film is developed, it is all ready to reproduce both sound and visual entertainment or instruction.

There is one necessary addition to the projection machine. This necessary attachment has a small straight line filament lamp in it, which throws a small beam of light upon the sound track. A varying light passes through to fall upon a photo-electric cell, an interesting recent development that is having ever-increasing applications. It is so constructed that no current passes through it until light strikes it. Thus when the variable light through the sound track strikes the cell, a variable current is set up. This current is a reproduction of the original current making the sound track. This current is now amplified and sent to a loud speaker back of the screen. It is interesting to note loud speakers have been improved from a 1 percent to a 50 percent efficiency.

Prof. Knipmeyer next discussed the line record. This is in some parts like the saw-tooth method. Both may be used on the same equipment. In the line method the amplified current is fed into a lamp similar to neon lights. This lamp responds quickly to changes of voltage. Neon lights can go on and out millions of times a second. These changes register as lines on the edge of the film. Prof. Knipmeyer demonstrated a neon lamp of 60 cycles. He also showed the tract of a pure note, middle C, which might be compared to actual sound. The mechanical movement of the film in the camera was explained. To further clarify the talk a discussion of electrons, radio tubes, and the photo-electric cell was given.

Prof. Knipmeyer used simple, non-technical language which everyone could understand, and his talk was thoroughly enjoyed and appreciated.

"In time of trial, what brings us the greatest comfort?" inquired the speaker.

"An acquittal," interrupted a man at the back of the hall.

Photoelectric Tubes

(Continued from page 115)

meter inserted in the circuit registered a small current flow. Under the action of the light, photoelectrons were given off by the zinc plate, and being negative charges, moved to the positively charged plate. Thus, the action went on under the stimulus of the light.

The photoelectric tube, as we know it today, is a device very sensitive to light and is finding innumerable applications. The response to light fluctuations is practically instantaneous. However, the current output under intense illuminations is about 1/10,000 milliampere, so that a powerful and well designed amplifying system is necessary.

From the viewpoint of performance and characteristics there are two distinct types of photoelectric tubes: the vacuum tube and the gas-filled tube. The first, as the name implies, is highly evacuated, while the second contains an inert gas at pressures in the order of 20 to 100 microns. The anode voltage-anode current characteristics of a typical vacuum photoelectric tube with a constant value of light flux incident on the cathode is shown in Fig. 1. This characteristic is similar to thermionic emission when limited by the filament temperature. When an inert gas at low pressure is present the characteristics change to that of the gas tube shown in Fig. 1. In this case the anode-current consists of an ionization current plus the photoelectric current.

If the anode voltage is kept constant and the light flux is varied, the current is proportional to the amount of light. A typical family of curves for this type is shown in Fig. 2.

The photoelectric emission of electrons from the cathode responds to light variations of radio frequency, as is shown by the horizontal line in Fig. 3, for a vacuum tube. However, the amplification due to the gas does not follow such high frequency variation as is shown by the upper three curves of Fig. 3. This property of the gas-filled tube is utilized in the separation of objects having different colors. This particular type of tube has been found to be most sensitive in red and weakest in violet.

The majority of the applications of the photoelectric tube fall into one of three classes. The first is D. C. relay operation. In this class the tube is used to actuate a relay to either an "on" or "off" position. The second is D. C. linear operation. The photometry of lamps or the recording of daylight intensity is representative of this group. The third group may be called A. C. linear operation. That is, the response must be linear and uniform throughout a definite frequency range, as required, for example, in television and talking pictures.

The elementary circuit of the photoelectric tube is shown in diagram A. The following notation will be used for the development of the circuit equation:

l—instantaneous value of light flux on the cathode

i_0—anode current

S—sensitivity, which is the slope of the light flux-anode current curve at a given point, or,

$$S=\frac{di_1}{dl}$$

G—conductance per lumen,* which is the slope of the anode voltage-anode current curve divided by the light flux, or,

$$G = \frac{di_1}{de_1} \frac{1}{l}$$

Z—load circuit impedance

e_0—output voltage

From the figure it is seen that the current is composed of two components. Let i_1 be the component which flows due to the constant battery voltage E, and i_2 be the component due to the anode voltage. Thus

$$i = i_1 + i_2$$

By reference to the definitions of sensitivity and conductance it will be seen that,

$$i_1 = Sl$$
$$i_2 = (lG)e_0$$

then
$$i = Sl + (lG)e_0$$
$$e_0 = iZ$$
$$i = \frac{sl}{1 - lGZ}$$

finally
$$e_0 = \frac{slZ}{1 + lGZ}$$

The dotted line in Fig 2 shows the variation of anode current with light flux when a five megohm load resistance is used.

Diagram B shows the use of a vacuum tube amplifier in connection with a photoelectric tube.

* The lumen is the unit of luminous flux. It is equal to the flux emitted in a unit solid angle by a uniform point source of one international candle.

Chemical Engineering

(Continued from page 117)

Proportions. Dalton advanced the Laws of Multiple Proportions and Combining Proportions, and finally, he proposed the Atomic Theory, explaining the constitution of matter.

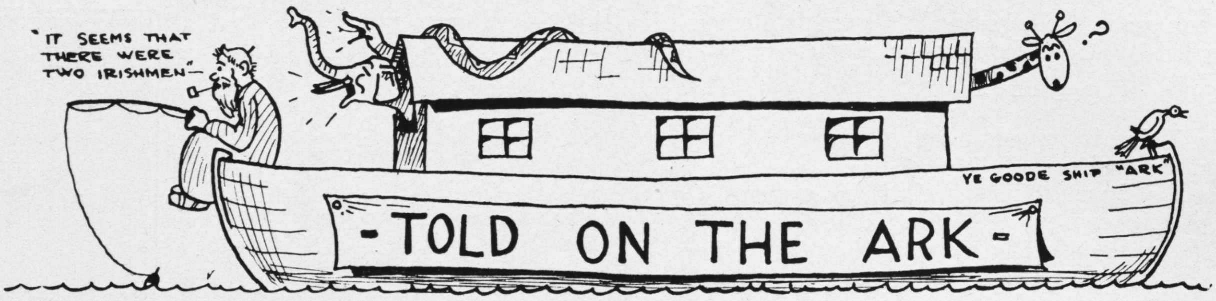
Atomic weights were then worked out, means of analysis were improved, errors in theory were discovered and corrected, and the science advanced by leaps and bounds during the first half of the nineteenth century.

Since that time each new discovery has added its impetus to the speed of advancement, until at the present time it is impossible for one person to keep up with the new developments of even one division of the subject. But lately a new turn has developed which is of great importance. Engineering Chemistry is receiving more and more emphasis, and the applications of the pure science to practical problems is bringing great changes in every phase of industry.

Today the Chemical Engineer controls the gamut of manufactured products from the steel of the tallest skyscraper to the fabric of the sheerest rayon hosiery, and it all came from the ancient alchemist who sought after the philosopher's stone.

Fair saleslady: "Could I interest you in a Studebaker?"

Youth: "Lady, you could interest me if you were in a second-hand flivver."



"Hey Rastus! Lemme present my wife to yuh."
"Naw, suh! Boy! I's got one of mah own!"

First Cook: "What do you do with yourself now that the ice man is out of a job?"

Second Cook: "Well, the man who collects installments on the electric refrigerator ain't such a bad sort."

Judge: "Your wife accuses you terrorizing her."
Prisoner: "Well, your Honor—' '
Judge: "Stop! What I want to know, as man to man, is how did you do it!!!"

"Was Maude in a bright red frock at the dance?"
"Some of her, big boy, just some of her."

"Did you tell when you proposed that you were unworthy of her? That always makes a good impression."

"I was going to, but she told me first."

Six year old Mark awoke at two o'clock in the morning.

"Tell me a story, mama?" he pleaded.

"Hush, dear," said the mother, "daddy will be in soon and tell us both one."

Stranger: "I represent a society for the suppression of profanity. I want to take the profanity out of your life."

Jones, to roommate: "Hey, Stanley, here's a man who wants to buy your Ford."

The local church was making a drive for funds, and two colored sisters were bearing down hard on Uncle Rastus.

"I can't give nothin'," exclaimed the old negro. "I owe nearly everybody in this here ol' town already."

"But," said one of the collectors, "don't you think you owe the Lord something too?"

"I does, sister, indeed," said the old man, "but he ain't pushin' me like my other creditors is."

"Madam, is your husband home?" inquired a book salesman, "I'd like to have him look at this book, 'What to do in case of an accident'."

"Just wait till I look and see," replied Mrs. Peck grimly, "and if he isn't home he's going to need that book."

"How's this?" asked the lawyer of the contractor. "You've named six material dealers in your will as pallbearers. Would you not rather choose some of your friends with whom you are on better terms?"

"No, Judge, that's all right. Those fellows have carried me so long that they might as well finish the job."

He was extracted from the ruins of his automobile and carried to the nearest doctor's office.

"I can do nothing for him," said the doctor. "I am a veterinary surgeon."

"You are the right man, Doc," spoke up the victim. "I am a jackass to think that I could run the darn thing."

"She's a very nicely reared girl, don't you think?"

"Yeah. She don't look so bad from the front, either."

The train had finally emerged from the blackness of the long tunnel. The conductor noticed a young couple, both of whom were apparently flustered, and the young girl was nervously rearranging her disheveled hair. Thinking to put them at their ease, the conductor remarked pleasantly:

"Did you know that the tunnel we just came through cost $12,000,000?"

"Did it?" inquired the girl. "Well, it was worth it!"

The wife: "This is news—someone has invented a shirt without buttons."

The husband: "Nothing new about that. I've been wearing them like that ever since I was married."

"This is a skyscraper," announced the guide.
Old lady: "Oh, my! I'd love to see it work."

Lady: "Isn't it wonderful how a single policeman can dam the flow of traffic?"

Boy: "Yes, Miss, but you ought to hear the buss drivers."

Prof.: "Name some production in which the supply exceeds the demand."

Student: "Trouble."

There's nothing strange in the fact that the modern girl is "a live wire." She carries practically no insulation.

Are you loafing on the Show job?

Athletics

(Continued from page 126)

Line-up and summary:

Rose Poly (21)—	F.G.	F.T.	P.F.
Alexander, f	3	0	1
Dowen, f	0	0	0
Broadhurst, f	0	0	0
Gillett, f	3	0	3
Allen, c	0	0	0
Sanford, g	1	0	1
Sawyers, g	0	0	3
Spangenburg, g	3	0	4
Rockwood, g	0	1	2
Totals	10	1	14

Vincennes (26)—	F.G.	F.T.	P.F.
Everett, f	5	3	1
Hodgers, f	0	0	0
Menke, f	0	0	1
Gilmore, f	0	1	0
Brent, c	1	4	1
Schultz, g	1	4	3
Stocker, g	0	0	0
Totals	7	12	6

Referee—Fellmy.

ROSE 25 – CONCORDIA 36

UNLEASHING a fast offensive in the first half and again in the closing minutes of play, Concordia College of Ft. Wayne swept the Engineers off their feet and won a fast basket ball game, 36 to 25, at Ft. Wayne, Jan. 18. The game was featured by the shooting of Cahl and the guarding of Bredemeir. Allen played the best game for the Engineers.

Line-up and summary:

Concordia (36)—	F.G.	F.T.	P.F.
Gahl, f	6	1	2
Zeigler, f	0	0	0
Moellering, f	2	1	0
Meyer, f	1	0	0
Bredemeir, c	1	0	3
Thieme, c	0	0	2
Beyer, g	1	5	4
Scheist, g	1	0	0
Werling, g	2	1	1
Totals	14	8	12

Rose Poly (25)—	F.G.	F.T.	P.F.
Alexander, f	2	0	4
Bowen, f	0	1	1
Fisher, f	1	1	1
Broadhurst, f	1	0	0
Allen, c	4	2	0
Sawyer, g	1	2	2
Gillett, g	0	1	2
Spangenberg, g	0	0	3
Totals	9	7	13

Officials—Referee, Geller; umpire, Elliott.

Brent Wiley, '98

(Continued from page 119)

ideas resulting in co-operation between manufacturers and steel companies.

This, in 1907, caused the Westinghouse Company to invite a number of steel mill engineers to participate in a discussion of engineering problems relating to the design and application of electrical apparatus for steel mills. This conference proved so successful that someone asked the question, "Why not organize?" The Association of Iron and Steel Electrical Engineers was the result. Mr. Wiley visioned and helped to promote this conference and was an active founder of the Association which in twenty-two years of existence has been a very effective factor in furthering the electrification of steel mills. It has also had a broadening influence on its members, has widened their contact with men of various steel companies and with representatives of manufacturing companies, and has extended the scope of their activities and responsibilities, and, as a result, the electrical engineers are occupying more prominent positions in steel industry today than ever before.

He has been actively interested also in the American Iron and Steel Institute and the American Institute of Electrical Engineers. He does not ride his hobby too hard, but finds time for considerable golf, being a member of the Edgewood Country Club and the Pittsburgh Athletic Club.

Third International Congress of Applied Mechanics

THROUGH its Applied Mechanics Division The American Society of Mechanical Engineers will participate in the Third International Congress of Applied Mechanics to be held in Stockholm from August 24 to 29, 1930.

The Division has appointed a special committee, of which Dr. S. Timoshenko is chairman, to take care of the details in connection with its part in this Congress. The field of interest of this coming convention lies in hydrodynamics and aerodynamics, theory of elasticity, and rational mechanics. It is desired to give special attention to the following questions:

Session I—Theory of Propulsion; Problem of resistance.

Session II—Stability and Strength of Thin-Walled Constructions; The Beginning of Failure; Theory of Plasticity.

Session III—Vibration of Ships and Vehicles; Acoustics.

Although the interests of science will be best promoted by concentrating on the subjects listed, other papers will be received.

The Applied Mechanics Division of the Society is also arranging a tour of the most important European laboratories in mechanics. Those who are interested in using the organization of the Division to enroll either with the Congress or to take the tour are requested to send papers or applications to the Secretary, A. L. Kimball, Research Department, General Electric Co., Schenectady, N. Y.

An Obstacle to Progress

MENTAL inertia is one of the heaviest handicaps of American industry. Constructive imagination is rare, easily discouraged or frightened, and too prone to be bluffed by conservative boards of directors. These points were brought forcibly to the front in the discussion at a recent engineering meeting in Detroit.

In this meeting instance after instance was cited of suggested improvements which had been coolly waved aside with the remark: "That might do very well for such and such an industry; but, you see, our business is different." Failure to discern wherein A's experience might benefit B, even in industries similar in operations, has blocked a step which might have meant many thousands in added profit.

An outstanding citation of an important improvement "imported" from another industry was that of the continuous rolling of steel sheets, which was credited in the Detroit discussion to the paper industry. Several papers were read to show how the manufacturing methods so characteristic now of the automotive industry have been applied successfully to others: plate glass, electrical appliances, gas stoves, washing machines.

Businesses are essentially interdependent with regards to products, financial success, sales efforts, manufacturing schedules, control of operations. With great profit they can be made similarly interdependent in the promulgation of ideas. C can learn from D how to handle his product with least effort and at lowest cost. E can teach F worthwhile tricks in heat treating. And D can profit from F's experience with a difficult machining operation. None of the group has a "corner" on valuable information in any of these lines.

Adaptability must be practiced. One man's highly effective method may not fit precisely into his neighbor's needs. But with a little alteration here and there, it can often be made to function and to give exceptional service. What is most needed is an open mind, ready and eager to use what is usable, even though another man's brain or another man's organization did happen to see it first.

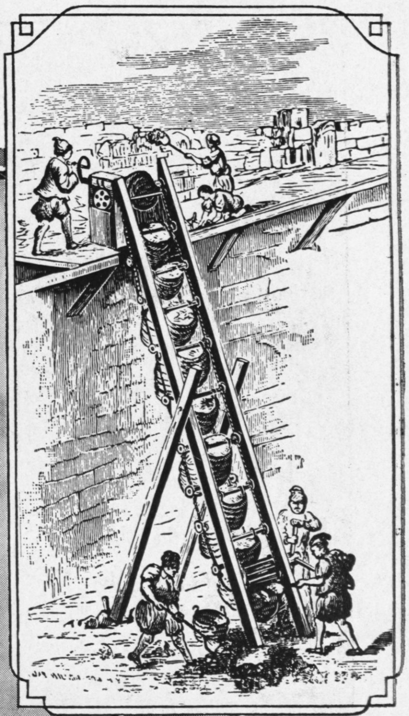
And there is no room for the refrain, "But our business is different."

That man looks familiar.
He is.

Doc.: "How many natural magnets are there?"
Stude: "Two."
Doc.: "Name them."
Stude: "Blondes and brunettes."

Mother: "In my day we never thought of such things."
Flapper: "Well, don't you wish you had?"

Him: "And why do you call me Pilgrim?"
Her: "Well, every time you call you make a little progress."



One of the early phases of Vertical Transportation

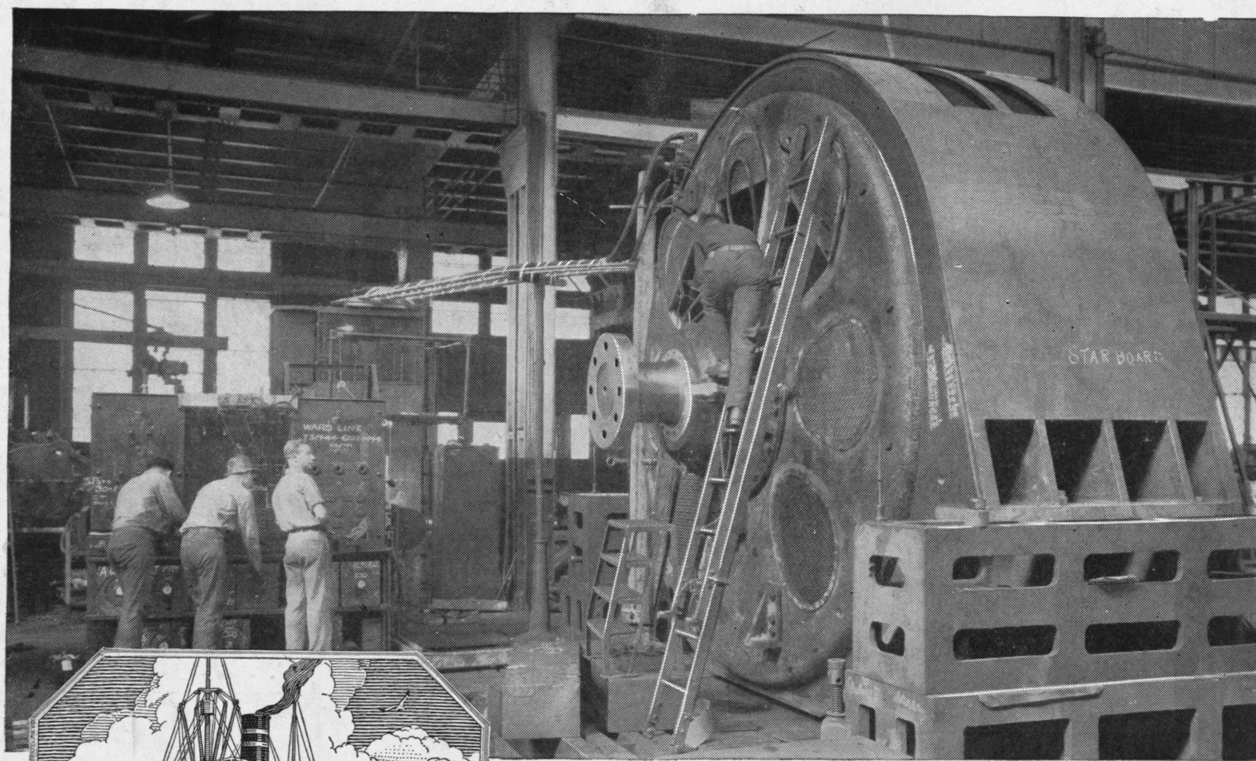
FOSHAY TOWER—MINNEAPOLIS, MINN.
Magney & Tusler, Architects

Unusual Design Feature of Twin City Skyscraper

THE Foshay Tower, Minneapolis, Minn., is designed along unusual lines. It will be one of the unique landmarks of the Twin Cities for many years.

The builders of this novel building have provided for the most advanced form of Vertical Transportation by installing Otis Signal Control elevators, which will provide high speed intensive service throughout the life of the structure.

OTIS ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD


STAR BOARD