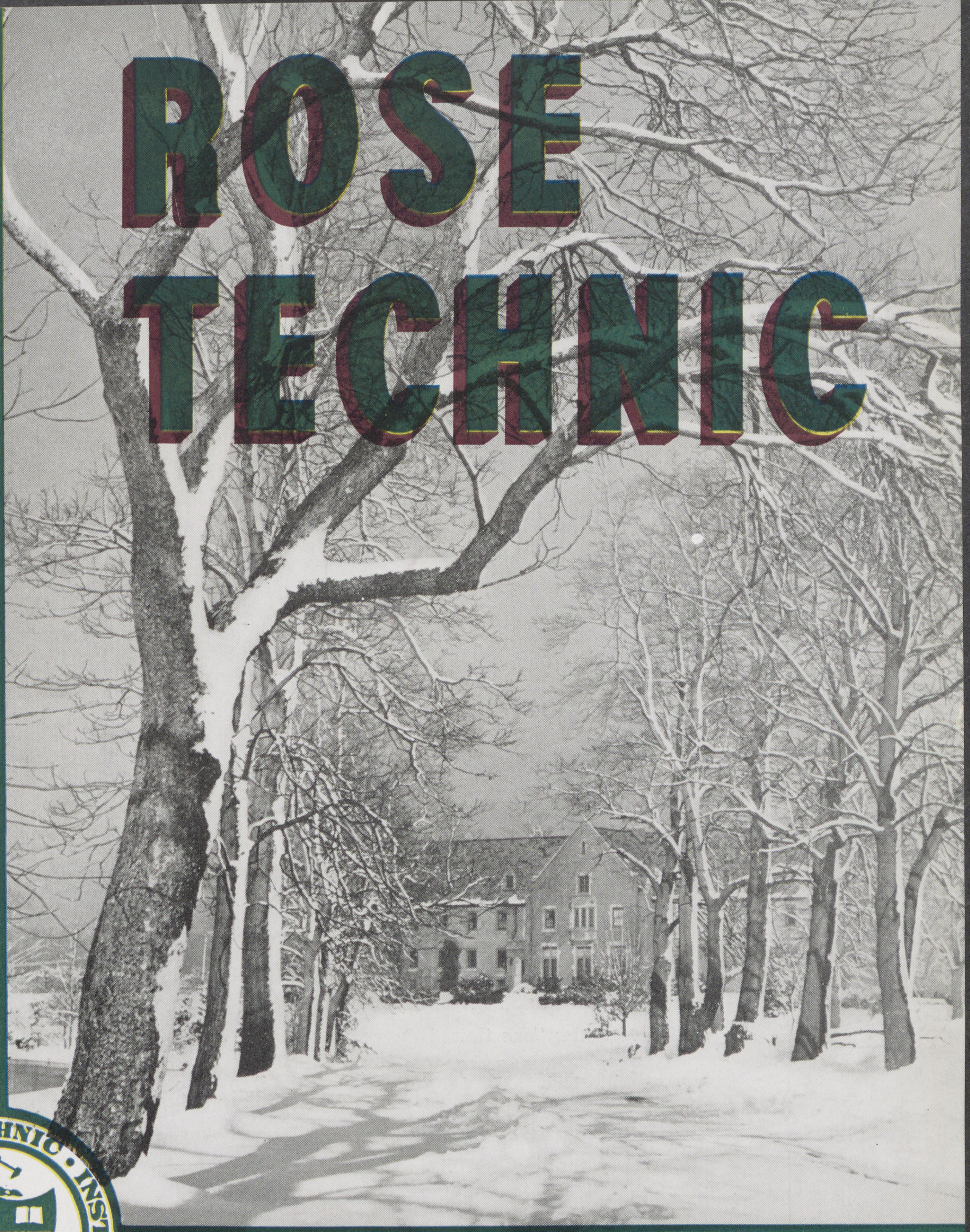
Winter 2-1939

Volume 48 - Issue 5 - February, 1939

Rose Technic Staff
Rose-Hulman Institute of Technology

ROSE TECHNIC



ROSE POLYTECHNIC INSTITUTE · LABOR ET SCIENTIA · 1874

FEBRUARY, 1939

STEELE '39

MEMBER ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Surveying This Issue

VARIOUS changes in national political and economic situations have had their effect on business policy. In some instances change of policy is desirable, while in others a rigid maintenance of time-tested principles has been more advantageous. "Some Observations on Business Management", this month's lead article, is a concise digest of what the alert business man is thinking about today.

PRIOR to the World War fiber glass was merely a scientific curiosity. During the war, however, Germany's asbestos supply was cut off, and fiber glass was developed on a commercial scale and used as an insulating material. Because of its superior qualities as an insulator, however, it has not only held its own but has greatly advanced in production. "Fiber Glass Electrical Insulation" describes production, properties, and application of this modern insulator.

ALUMINUM, known to exist for many years, became commercially feasible less than half a century ago. From its status as a precious ornamental metal fifty years ago, aluminum has developed into an indispensable engineering material of today. The story of aluminum is the story of cast aluminum, and "Cast Aluminum and Cast Aluminum Alloys" tells the story as the engineer wants to know it.

CREDIT for the pictures for both cover and frontispiece this month goes to "Howdy" White. We think they're the two finest campus photographs ever made at Rose.

—*R. S. K.*

THE ROSE TECHNIC

FEBRUARY 1939

VOLUME XLVIII — NUMBER 5

ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Tom A. Rogers, Chairman

McGraw-Hill Publishing Co.

Arkansas Engineer	Marquette Engineer	Purdue Engineer
Colorado Engineer	Michigan Technic	Pennsylvania Triangle
Cornell Engineer	Minnesota Techno-Log	Rose Technic
Illinois Technograph	Nebraska Blue Print	Tech Engineering News
Iowa Engineer	N. Y. U. Quadrangle	Villanova Engineer
Iowa Transit	North Dakota State Engineer	Washington State Engineer
Kansas Engineer	Ohio State Engineer	Wayne Engineer
Kansas State Engineer	Oregon State Technical Record	Wisconsin Engineer

ROBERT S. KAHN, *Editor*

WILLIAM A. REDDIE, *Associate Editor*

GEORGE W. SMITH, *Business Manager*

Subscription, per year, $2.00. Address all communications to THE ROSE TECHNIC, Terre Haute, Indiana. Entered in the Post-office at Terre Haute as second-class matter, as a monthly during the school year, under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized December 13, 1918.

Published Monthly from October to May by the Students and Alumni of Rose Polytechnic Institute.

FEBRUARY SHADOWS

THE ROSE TECHNIC

THE TECHNICAL JOURNAL OF THE ROSE POLYTECHNIC INSTITUTE

Volume XLVIII FEBRUARY, 1939 Number 5

SOME OBSERVATIONS on BUSINESS MANAGEMENT

by W. Arnold Layman, m., '92

IT would be interesting to discuss and roundly condemn in this article some of the recent tragic and criminal instances of business mismanagement. But that is not the writer's present purpose. Instead he desires to comment on a number of phases of business calling for clear crystallization of policies upon the part of the HONEST executive. It is important for the operating head of business to determine carefully the policies he will pursue and the ground of his defense if in opposition to management precedent or popular point of view.

To whom is the business executive responsible? The public assumes that he acts solely in the interest of CAPITAL, and that there are but two factors in business—CAPITAL and LABOR. Past management has too often justified this opinion. But the times have changed. There are in fact four factors—the BUYING PUBLIC, the PRODUCING WORKERS, the SUPPLIERS OF CAPITAL, and the OPERATING EXECUTIVE. The EXECUTIVE is responsible to the other three, and if he fails to assume a balanced perspective and strong neutrality between them his management fails.

W. A. LAYMAN

Mr. Layman, Rose, '92, has for some time been an industrial and financial consultant. As such he is well qualified to write on the problems of business management and their solution under present political and economic conditions.

Management must see that labor participates in profits. The day has not entirely passed when profits, generally speaking, have been selfishly awarded almost entirely to capital. Labor now demands and is entitled in equity to participation. The public is beginning to insist on this. But how shall it be done? A Congressional committee is playing with the idea of forcing it by law, but in the writer's opinion it is management's job to do it voluntarily. There are several demonstrated DON'TS. First, employees should not be encouraged to buy shares in their employer's business. Their labor and limited capital should not be risked in one basket. Second,

profit sharing should be genuine and not falsely tied into wage or production incentives. Third, the authority of management in determining profits should be absolute and not diluted by interference of either labor or capital. Fourth, safety provision for the business should be liberal against all temptation to swell profits by its limitation. This means large reserves against trade depressions, product and plant obsolesence, and other operating hazards. Right here enters a possible just complaint of labor. In the past when reserves have become excessive, the usual process of adjustment to normal levels has been through stock dividends to capital. Such dividends, in the future, should be pro rated fairly with labor.

What about management's use of secret service in the shop? Popular and especially political opinion is very hostile to ALL employment of secret service. But this attitude is wrong. Opposition should be to the type and manner of its use. For an executive to sit by supinely, uninformed, while subversive interests sabotage the business would be nothing less than criminal negligence. The executive must x-ray every phase of the business continuously for the protection of both stockholders and labor. Otherwise the business may gradually, perhaps suddenly, pass from his control. If secret service in some form—be it voluntary on the part of employees or otherwise—is used, management must carefully avoid abusive use of it.

This matter of collective bargaining with labor. Such bargaining has come to stay. But as practiced today and as supported politically under the Wagner act, it constitutes management's biggest problem. The "balance" between the four partners in business has been sadly disturbed. "Bargaining" has been too often "bludgeoning" by hostile and sometimes subversive elements. Time must cure this great difficulty in some manner. Perhaps the English way of collective bargaining with industry and labor *both* collectively organized and acting through collective representation will prove to be the eventual answer. Efficiency of management has been greatly impaired as matters now stand. While a cure is being found, the executive's powers of endurance and patience will continue to be sorely tried.

Difficulties with the patent laws. There is no doubt that careful attention to the intricacies and dangers of the patent situation is a major responsibility of the business executive. The proper protection of inventions within his own business and avoidance of infringement of inventions covered by patents to others is an ever present problem. Several phases of the law accentuate the difficulty, and there is much agitation for amendment of the law. The writer believes patents should date from day of application, with infringement, when subsequently proved, dating from day of application also. Such a rule would accelerate issuance of patents and also adjust interferences between rival applicants more promptly. The vast number of unused patents is also a difficulty, these serving very often to deprive the public of meritorious devices and also to obstruct competitive developments. Perhaps unused patents should be thrown open to general use after a reasonable period of disuse. There can be no question as to the correctness of the principle of monopoly under a patent, but the public is entitled to protection against all monopolistic abuse, including excessive price of patented article, disuse of inventions, improper pooling, and delayed issuance of patents. The wise executive will adjust himself to this trend of public opinion.

In the works of Karl T. Compton, noted educator and scientist, "——management is an essential attribute of decent group life. Without it there is chaos, discord, and ineffectiveness. Without it there is no security; and complete freedom from controls does not give liberty but rather the worst of all subjugations, anarchy without protection; but with management comes orderly procedure and directed cooperative effort so that the group becomes greater than the sum of the individuals which compose it. Undoubtedly the increasing complexities of modern life, due largely to technological progress, require a continually increasing degree and quality of group management."

The controversial situation as to business reserves. The political attack upon business reserves has made this phase of management one of lively public interest, with much suspicion that here again management has been caught in foul play. The charge is that reserves are very excessive. The political attack has been prompted, of course, for the purpose of broadening the base of corporate taxation, or, if reserves are distributed, the base of taxation upon the stockholder. What are the fair facts as to magnitude of these reserves? The writer's observation is that rarely are reserves too large for business safety, and rarely are they adequately "liquid." Examine balance sheets, and you will generally find cash is low, earned surplus almost completely invested in frozen assets, and emergency reserve, if really existent, so very non-liquid as to fail utterly of its purpose in real emergency. Managements have been very unwise, all too often, in tying their so-called reserves up tightly in the expansion of the business. This is especially true in small businesses. The very large corporation managements have been less open to this criticism. Witness their large cash balance, and gilt-edged bond investments. The wise executive of the future will expand rather than contract all his reserve accounts, and above all have a liberal part of them in actual cash or assets quickly convertible into cash.

The use of bank credit. The conservative business executive is cautious today in the use of bank credit. Examine the financial statements of practically all the large corporations and you will find cash balances very large and bank lines either non-

existent or small. Their borrowings, if any, are generally in debenture or long term bond issues, and maturities are so timed as to be handled without strain. In effect, the management of these businesses makes sure of adequate financing aside from bank credit, and if bank credit is used at all, it is for very short term seasonal periods or is retired as soon as possible through some form of "permanent" financing. The small business does not finance itself as easily or as safely. The executive of the small business, more so in the future than in the past, should be conservative in expansion of operations, avoid borrowing on short term for fixed investment, and carefully avoid entering a period of trade depression with extended bank lines. Banks are trustees of depositors' funds and cannot be sentimental toward business, large or small, when loans become frozen through excessive optimism of management. The writer has had occasion to examine a large number of moderate sized businesses in need of capital, during the last few years, and in very few have reserves for emergency existed at all, while all forms of surplus account have been tightly invested in business expansion. Bank loans have been impossible of liquidation except through some form of permanent or semi-permanent financing, and this has been difficult to effect in the majority of cases under trade depression conditions.

Keeping the business vitalized. There is no responsibility of the executive more continuously pressing than that of keeping the business vitalized—which means looking ahead. In this day of rapid technical advances and volatile public favor, the prosperous business of today may be the victim of sudden obsolesence tomorrow. Reliance on one product or on a few large customers is courting disaster. The executive who insures his management with some diversity of product and a long list of active customer accounts may enjoy peace of mind. But even he must look ahead, and have a card or two up his sleeve. New lines of products are not easy to find, and perfection of them for marketing takes time, money and patience.

However prosaic the business may be, there is always room for play of the imagination in keeping it vitalized. Especially is this true in creating individuality of product or methods. Individuality, once established in public favor, is a highly valuable asset. Somewhere down the line there should be a staff member with lively imagination and creative instinct. Fortunate indeed the chief executive with enough of this quality within himself to appreciate its value and yet with enough calm judgment to discriminate wisely in its play. What astonishing commercial innovations have come from the laboratories of Westinghouse and General Electric, Bell Telephone, Union Carbide, and other great organizations through the free rein given dreamers in their research divisions! Even in the small business there is need of some of this initiative.

The judicious size of business. The inevitable trend of healthy business is toward increase in size, and if size is to be limited, the limitation must be deliberate. The dominant notes in character of the American business man are COURAGE, OPTIMISM and AMBITION. What should be the limits of safe expansion? In the writer's opinion the choice, in strictly competitive fields, should be between "big" and relatively "small" business. There is real danger, and great managerial responsibility, in an intermediate position. As a small competitive business enters the zone of mass production, it faces the serious problem of stable, national distribution. To hold volume with national distribution calls for liberal advertising, vigorous salesmanship, warehousing stocks in strategic cities, and a quality product unless lines are protected by sound patents. But under most favorable conditions and with good patent protection, there is real risk in growing into mass production. Farflung financial connections play a big part in big business, and the growing small business begins to discover this about the time it has taken on a few large customer accounts.

However, the small strictly competitive business has one advantage in distribution so long as its geographic sales range is limited. This is the ability of its top executives to know its buyers and give them personal service. But with increasing size this advantage gradually fades, and in the absence of strong patent protection competition from big producers makes the going difficult, and the cost of distribution excessive. It pays the small business to specialize and seek the trade the big business cannot handle expeditiously or at equivalent cost. But even big business does not rest content in competitive fields, for bigness does not remove the danger of cumulative competition from a wide diversity of small units when there is a large market unprotected by patents. Witness the continuous diversification of many of the large corporations, their vast advertising appropriations, the build-up of trade marks as indicative of superior products, and the great stress placed on patent protection. As evidence of the hazard of intermediate size in competitive fields, note the absorption of these units by the big fellows that goes on all the time. The public is under the impression this steady gobbling up of rapidly growing businesses is evidence of attempted monopoly on the part of the big units, but very often the real facts are just the reverse—the intermediate unit has run into marketing difficulty with expansion of operations, and sells to the big competitor on the buyer's terms to safeguard its capital investment.

Rose's future business executives. A very substantial percentage of the present Rose student body will advance to executive authority in due time. The limited number of subjects discussed in this paper represents but a few of the live problems to confront them as they take up the reins of management. This contribution to the Technic is offered in the hope the observations will be suggestive to them.

Fiber Glass Electrical Insulation

by Joseph W. Dreher, e., '41

Fiber glass is the only artificial textile fiber coming from nature without first having passed through an animal or vegetable form. Its ability to resist corrosion and combustion, its high tensile strength, and its good dielectric properties make fiber glass an ideal electrical insulator. Although it has yet to reach the popularity of silk and cotton, it is rapidly gaining in importance.

THE recent history of glass fibers dates only back to the beginning of the World War when it became necessary for Germany to develop other insulating materials to replace asbestos, which they could not import. Some experimenting had been done by Micheal J. Owens in 1893 to attempt to use the fiber glass cloth for clothing. But it was not until Germany began its necessitated manufacturing that the glass fiber material displayed its real importance.

Today, fiber glass production is rapidly increasing, and this siliceous insulator is readily replacing asbestos, cotton, and other forms of insulation. This article centers around its manufacture and application in order to show the relative merits of glass insulation over other older types of insulation.

Fiber glass is a mineral fiber, the only artificial textile fiber to come from nature without passing through an animal or vegetable form. Because it is resistant to mildew, rot, combustion, and to all acids, except hydroflouric, it has become an important textile of glass.

The two types of fiber glass, staple and continuous, are made from melting pure glass marble into fibers measuring .0002″ in diameter. The staple fibers, resembling cotton, range from eight to fifteen inches in length while the continuous fibers are continuous and are very similar to rayon and silk. The staple material is fuzzier and impregnants bond to it better; heavier materials can be made from it. The continuous fibers are much finer and can be woven very easily into tapes. Materials made from the continuous fibers are much stronger and smoother than those made from the staple fibers.

Two processes are used in making the yarns.

In producing the staple material a special glass is first compounded and moulded into marbles. These marbles are very carefully inspected before they are used. Any marbles containing gas bubbles, imperfectly melted raw materials, or pieces of refractory materials are not allowed to pass. Then the satisfactory marbles are remelted at 2400°F in a carefully controlled furnace, about the size of a cigar box. The melted glass runs through small holes in the bottom of the furnace and is pulled down and collected on a rotating drum after being passed through a jet of high velocity steam. The fibers, caught on the face of the drum, are drawn off, as the drum revolves, in the form of a webbing called sliver; the sliver is then wound onto tubes. If a heavy yarn is wanted, the sliver is taken to standard cotton twisting machines and twisted; if a fine yarn is desired, the sliver must be transferred to a special spinning or drafting frame where it is stretched before it is spun into yarn. A special solution of 2% oil is sprayed on the fibers during handling and fabrication. The yarn is now ready for weaving.

In making continuous material the same marbles used in making the staple yarn are melted in a similar furnace. At this point the process is changed. In the base of the furnace are one hundred and two holes through which run one hundred and two streams of molten glass. They are collected together, lubricated, and wound on a rotating package. The speed at which the fibers are pulled and wound is well over a mile a minute and because of the pull of this rapidly rotating machine extremely fine continuous fibers are formed. This one hundred and two fiber strand is 90,000 yards long, per pound of glass. After combining and twisting, the yarn can be woven into any form by the same process used for cotton, silk, or rayon.

Electrical insulation is rated in four classes: organic insulating material the Class O group; these same materials, when impregnated or immersed in oil, constitute Class A insulation; insulating materials that are mainly inorganic, such as asbestos and mica held together with an organic material, are in the Class C division; a Class D insulation is one which is completely inorganic, such as glass and porcelain.

Fiber glass tapes are, therefore, a Class C insulation, but because they are impregnated with organic compound during manufacture, they are identified as a Class B insulator.

These tapes are electrically important because of their high tensile strength, permanence, resistance to high temperatures, low space factor, and low moisture absorption. Therefore they can be readily used where a good insulator and dielectric are needed, especially in transformers, motors, and generators.

For instance consider the space factor. Glass tapes offer a thinner insulation; therefore, the size of coils and the amount of copper wire used in making motors or generators are greatly reduced. It has been found in actual practice that the size of these motors and generators can be reduced to half by using glass insulation. Figure 1 shows the thickness of materials that are considered good insulators from a space factor standpoint.

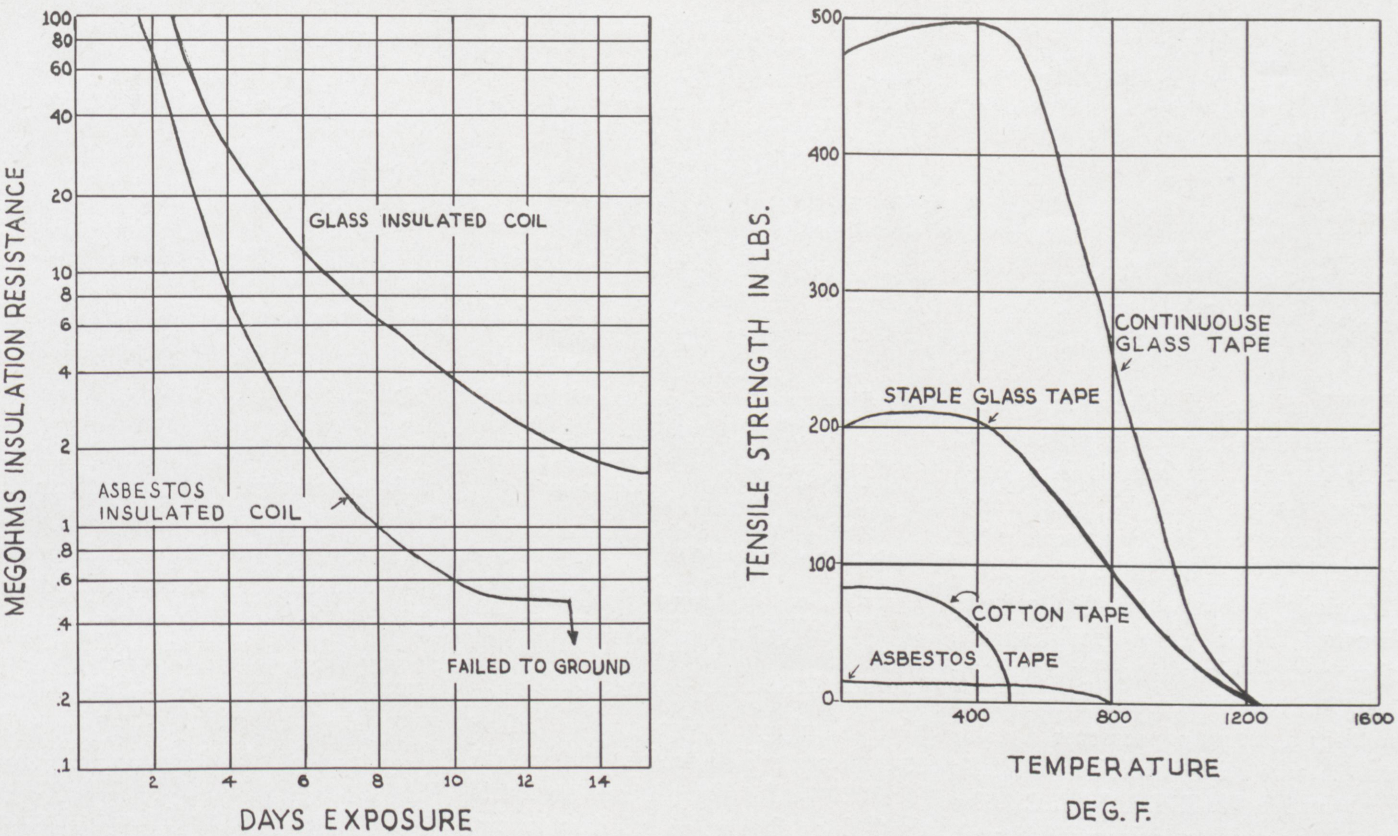


Figure 2

Material	Minimum Tape Thickness	Minimum Thickness Wire Insulation
Silk	.003″	.0025″
Cotton	.005″	.0045″
Paper		.0015″
Asbestos	.010″	.008″
Glass tape	.005″	.004″

Figure 1.

It can be seen that glass fiber insulation has a lower minimum tape and wire insulation thickness than the other materials, with the exception of silk, and, therefore, is an outstanding dielectric from this point of view.

Now consider the temperature. Any electrical equipment, when put into use, tends to heat up, and, therefore, in considering an insulation something must be known of its temperature resistant qualities. Motors and such equipment have had to be constructed large enough to allow the heat to escape and to keep the insulation from burning out. Heretofore, asbestos was the only material to use, since silk and cotton would burn out at slightly elevated temperatures, but the trouble with using asbestos was that it required twice as much space as the other materials. Glass tapes duplicate the thinness of cotton or silk, thus reducing the size of the equipment, and are still even more resistant to excessive temperatures than asbestos, cotton, or silk.

Woven glass is one of the strongest textiles known, and therefore, it can be used in thinner fabrics than other materials and permits easy application and workmanship. To show this characteristic more clearly are these specific examples.

The tensile strength of 1″x.025″ staple material tape tests 309 lbs. while the asbestos tape of the same size tests only 130 lbs., which shows that the glass tape is almost three times as strong. On 1″x.015″ tape, the glass tape is twelve times as strong as asbestos, and on 1″x.010″ tape, the glass tape is about twenty-five times as strong. It will be noted that the staple and continuous tape increase their strength through 300° F. At this point the continuous tape is twice as strong as the staple material, over six times as strong as cotton tape, and twenty-five times as strong as the asbestos. At 500°F. the cotton tape burns out and at 900°F. the asbestos loses its strength. Even at 1100°F. the continuous tape is six times stronger than the asbestos tape is at 700°F., and the staple tape is twice as strong at 1100°F. as the asbestos tape is at 700°F.

In considering dielectric strength and insulation resistance of glass tape, its properties are more easily shown by charts, where the glass and other insulators are compared. The data in Figure 2 compare the strength of glass tapes to other tapes and shows its superior dielectric qualities.

Fiber glass has yet to exceed or even reach the popularity of asbestos, cotton, or silk insulation; its high production cost has made it too expensive for popular use. However, this material offers great promise for the future if properly applied within its limits, and it is apparent that fiber glass has become a significant development in the electrical industry.

Cast Aluminum and Cast Aluminum Alloys

by John E. Bartmess, m., '41

Aluminum, first an oddity and later a semi-precious metal, is today a potent tool of the engineer. When properly alloyed and heat treated, its characteristic "strength with a minimum weight" is exhibited.

The metallurgy of aluminum has been studied in great detail, and by carefully controlling alloying ingredients, melting, casting, and heat treating, an alloy for almost any purpose may be produced.

"THE color of aluminum is a beautiful white with a slight blue tint, especially when it has been strongly worked. Being put alongside silver, their color is sensibly the same; however, common silver, and especially that alloyed with copper, has a yellow tinge, making the aluminum look whiter by comparison. Tin is still yellower than silver, so that aluminum possesses a color unlike any other useful metal." So said Joseph W. Richards, A.C., of a metal that today is known so well by all that no one needs to have the metal described to him. Mr. Richards made this statement in 1886 in his treatise, *Aluminium*, the first book on aluminum to be printed in English. He also describes in the same book the sodium process of reduction of aluminum, the only practical process of the day. The basic formula of the reaction was—

$Al_2Cl_6.2NaCl+6Na = 2Al+8NaCl.$

By refinements in this process the price had been successfully dropped to $8 a pound. However, in February of the year that Richards book was published, Hall had discovered his electrolytic process of refining the metal. He then offered aluminum on the market at the amazing price of $2 a pound. These prices, which we would today consider enormous, were really "drops in the bucket" compared to the prices that had been paid for aluminum earlier in its career. The metal had first been isolated in 1825. The price had been set at $272 a pound in 1854 when Napoleon III became interested in it. He planned to use it for his soldier's equipment, but because of its price changed his mind and used it for trinkets. He also had some made into dishes—the privileged guests were permitted to eat off of the aluminum plates, the other guests ate off of gold ones. As late as 1879, a Pittsburgh man in Paris had his choice of buying opera glasses of either silver, or aluminum —at the same price he bought the aluminum ones.

History of Early Castings

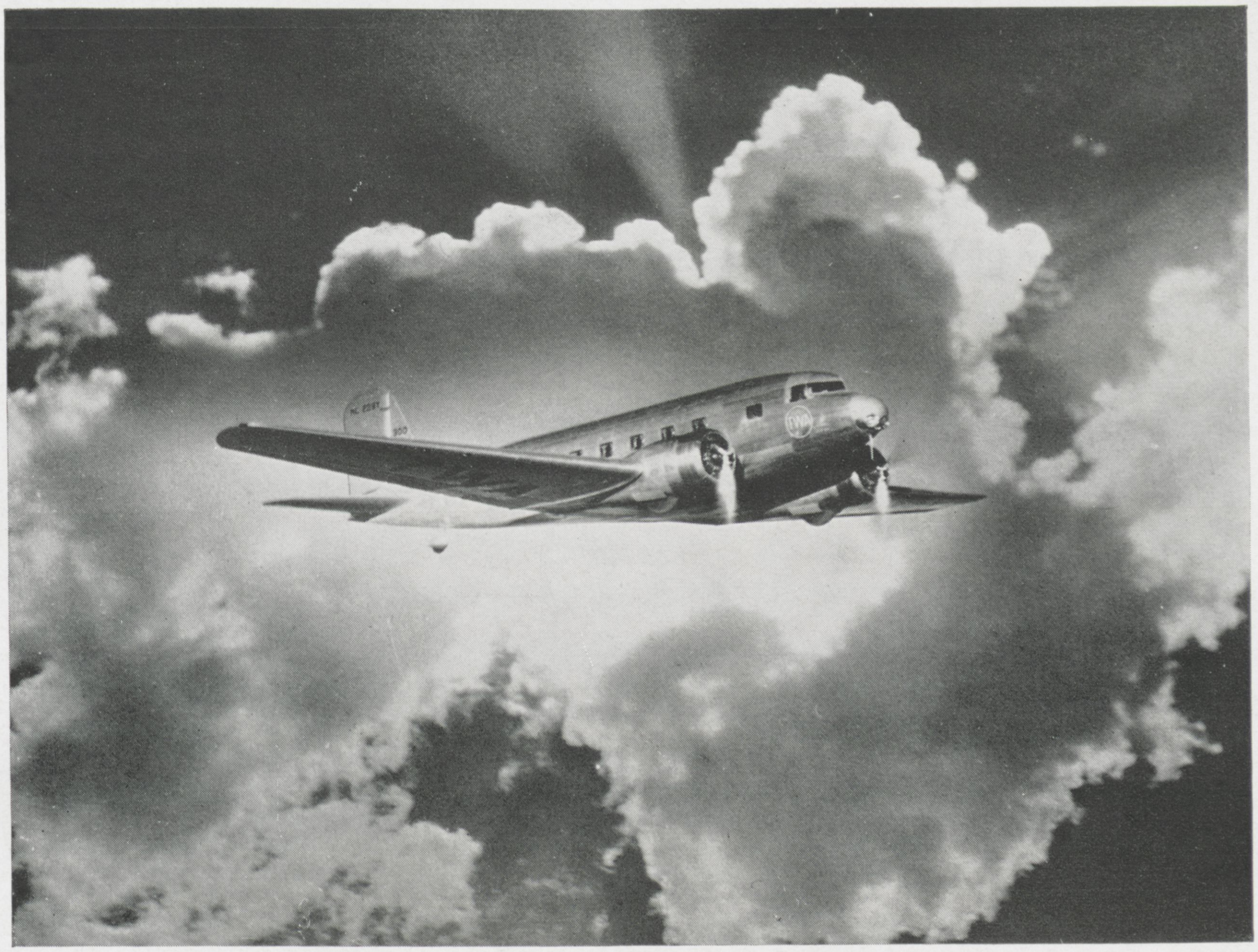
Aluminum was originally cast in the forms of novelties such as the buttons Napoleon III produced. Later came the watch fob, ash tray, and junk period; the metal was too expensive to be used commercially for anything except novelties to be made of a semi-precious metal. Then too, the wonderful properties were not fully known, or realized, by those in a position to buy and use aluminum. The first big casting, weighing 8½ pounds, was cast by Col. Frishmuth in Philadelphia in the year 1884. This casting was a pyramid cap to top the Washington Monument. The school children of the United States contributed their pennies, and the cap was bought at a price higher than if the monument had been capped with gold. In defense of this, the cap was inspected in 1934 and found to be in perfect condition. The casting was in reality an alloy and not the pure metal. It consisted of Aluminum, 97.75 percent; iron, 1.70 percent; and silicon, 0.55 percent.

Mixing Alloys

When zinc and tin are alloyed with aluminum, the aluminum is melted in a crucible to a temperature of about 700°C., and then the zinc and/or the tin are added by simply stirring. The stirrer used is a disk drilled full of holes that is lowered slowly in the crucible and raised more rapidly, thus stirring the aluminum without breaking the surface and stirring in the dross. Magnesium is alloyed in a similar manner, except that the stirrer is conical shaped, and when the magnesium is added it is first forced to the bottom, and there it is melted. If the magnesium were allowed to melt on top it would burn before it could melt. Copper, nickel, and silicon, because of their high melting points, are added to the aluminum melt in the form of 'key' metals. The copper key metal is an alloy of 50 parts of copper to 50 parts of aluminum; the nickel key metal is an alloy of 20 parts of nickel to 80 parts of aluminum; and the silicon key metal is made in a ratio of either 20:80 or 50:50.

Melting

In the melting of aluminum, the type of furnace must first be considered. The furnace must have some method of controlling the heat of the metal, because if the metal is brought to above 700°C. it oxidizes readily. The metal also absorbs hydrogen, which causes pin holes in the casting. The hydrogen comes from either moisture or the fuel used (oil or gas). To cut down the moisture present, the aluminum is generally melted in carbon (plumbago) crucibles. Iron pots may be



Aluminum—Conqueror of the Sky!

used, but when the metal is kept in solution for a period of time, or often remelted, as is necessary in die casting, undue amounts of iron are absorbed by the aluminum. Coke or electric ovens are used instead of gas ovens because of the hydrogen content of the gas. Tilting furnaces are also of advantage because they cut down the amount of oxidation taking place in distributing the metal from the furnace to the mold.

There are a few basic rules to follow in the melting of aluminum. Do not overheat the metal; it will cause undue oxidation, large crystals (of the alloying metals) and in general, poor castings. Do not stew the metal; it will enlarge the crystals and cause oxidation. Do not disturb the surface of the molten metal except when pouring, and then the dross must be cleaned off the surface. The oxidized surface acts as a protective coat; if it is removed, a new coat will be formed and thus more metal will be wasted. When pouring, do not empty the melting pot because the minor impurities go to the bottom of the pot. If the metal is reclaimed, use a flux to clear it of dirt and other impurities.

Some foundrymen rely on the appearance of the molten metal to tell its temperature, but this, unless the foundryman has had a great deal of experience, will lead to poor castings. It is, therefore, advisable to use a pyrometer. The best type of pyrometer for this purpose is the iron couple without a protective covering. The protective covering is left off because it slows the action of the meter, and time is important during the pouring process of aluminum. The iron-constantan couple is also economical because, if the ends are melted off, they may be welded together again without damage to the accuracy of the readings of the meter. In using the couple care must be taken to dip only the point into the liquid because if more is placed in the metal, the gauge will be short circuited, and the gauge will read inaccurately.

Temperatures of the metal should never be raised above 800°C. and very seldom over 700°C.

Casting

Since the metal tends to absorb gases, since the average aluminum alloy shrinkage is one percent for each 100°C., and since the stronger and sounder castings are those which solidify rapidly (high-temperature pouring heats the mold and prevents rapid solidification), the best castings are made by pouring at as low a temperature as possible. The pouring temperature should be about 700°C.

Sand for molds used in aluminum castings must be fine enough to give a smooth surface to the casting and at the same time coarse enough to permit steam and other gases to escape. The American Foundrymen's Association states that "a good

Duralumin Girder Exhibits Unusual Strength

moulding sand for aluminum alloys will generally have: Compressive strength, lbs. per sq. in.—5-9; Permeability (A.F.A. standards)—4-8; Clay content—20-35%; Fineness number—175-250."

A good core is made of 30 parts of sea-sand (silica sand) to one part of binder. The sea-sand may be diluted with as high as about 30 percent of ordinary molding sand if necessary. The binder may be linseed and other oils, rosin, dextrin, pitch, flour, or combinations of these substances. The British Aluminum Co., Ltd., recommends one made of equal parts of linseed oil and molasses, diluted with water to suit varied requirements.

Because aluminum alloys are generally "hot short" (contraction just after solidification), and because of the shrinkage of the metal in the liquid state, aluminum and aluminum alloys are not easy to cast. The liquid shrinkage takes place just before solidification and amounts to about seven percent of the molten metal poured. These characteristics cause 90 percent of all cracks, draws, porous patches, and local weaknesses. To counteract for the solid contraction, the pattern maker's scale averages a ratio of 1 to 80 for the range of alloys most used. To remedy the cracking, molds should be rammed only lightly, and the cores should have binders which will cause the cores to crush readily when heated by the incoming metal.

A casting made of a light-weight metal must be well vented, but a light-weight metal tends to send its gases out through the metal and the mold, rather than through improvised vents. This, therefore, is another reason for light ramming. A casting, with a core half way through it, should have the core hung from the top, even at added expense, to fully permit the escaping gases to escape. A good rule to remember is, "Ram lightly and vent freely: better a porous mould than a porous casting; better a costly mould than an unsalable casting."

The light weight of aluminum has at least two advantages in the foundry: it is easy to transport for pouring; and snap flasks may be used, thus, saving money by the use of molding boxes. These molding boxes in aluminum foundries are always made from aluminum cheaply run from scrap.

Gates should be placed so that they feed either the thick sections or the thin ones. The extreme is necessary, for if the gates are placed so they feed the intermediate sections, poor castings will result. Gates should also be placed so that the metal will not splash or cause disturbance in the mold.

The metal should solidify the moment it reaches the section of the mold in which it is to remain. For this reason practice generally puts the gates leading into the thin sections and risers leading out of the thick sections. In making risers care should be taken to make them large enough so that they will be the last part of the casting to solidify. Chills may be used to hasten the solidification of thick sections, but because of faults occurring from chills, risers should be used instead, if possible.

Cores are usually knocked out as soon as the metal has solidified sufficiently to handle. Owing to the weakness of most aluminum alloys when hot, this practice may cause more cracks than if the cores were left alone, unless the foundryman is experienced in handling hot aluminum.

Castings are dressed of runners, risers, and flashes by band saws operating at 2,000 to 5,000 feet per minute. Pneumatic or hand chisels are used to get at otherwise unaccessible points. Then the castings are finished by filing or grinding with carborundum wheels. Sand blasting and wire brushing impart a good matte surface for high grade castings, and small castings are polished by tumbling them in a barrel with steel balls and soapy water.

Gates, risers, and scrap castings may be used as part of the entire melt. Turnings and borings may be used to a limited extent by adding them slowly to the heel of the molten metal and stirring them in. When scrap is used in this way, fluxing is necessary to get rid of the dross. In using scrap care should be taken so

as not to mix the various alloys with one another.

In die and permanent mold castings the processes of heating, cleaning, and reclaiming all are practically the same as in sand casting. The molds, of course, make the big difference. In die casting the molten metal is forced into high-quality steel molds under pressure; in permanent mold casting the molten metal is poured into cast iron molds. These metal molds are covered with a mixture of whiting and water glass once a day to keep the aluminum casting from absorbing the molds.

Heat-Treating

Pure aluminum, like other pure metals, cannot be heat-treated, but many of the cast alloys undergo a remarkable increase in strength if subjected to suitable thermal processes. To have this process effective there must be present in the alloy either an element, or, as in aluminum compounds, an intermetallic compound, whose solubility in the solid alloy increases with increasing temperature. The compounds in almost all heat-treatable aluminum alloys are $Cu.Al_2$ and Mg_2Si.

There are three important steps in the heat-treatment of aluminum alloys. First, the metal is given the high temperature treatment, which consists of raising the temperature of the metal to as near the melting point as is deemed safe. This treatment is designed to take as many of the constituents into the solid solution as possible. The second treatment is the quenching of the piece from the soaking temperature. Here it depends on the alloy and the dimensions of the piece as to whether it should be quenched in water, oil, spray, or allowed to cool in air. The third, or low temperature treatment, is to give hardness, as after the high temperature treatment and quenching, aluminum alloys are left soft and ductile—just the direct opposite of the tempering process in the ferrous metallurgy. It might be noted here that alloys that contain both $Cu.Al_2$ and Mg_2Si, such as Dural-

HEAT TREATMENT OF CAST ALUMINUM

Chief Alloying Metal	*Solution Heat-treatment*	*Quenching Medium*	*Precipitation Heat-treatment*
Cu 5-6%	8 to 24 hours in 520°-540°C.	Boiling water or oil	2 hours at 100° C. NOTE: 3 hours at 175°C. gives higher tensile strength but greatly reduced elongation.
(Hiduminium) Cu 0.8-2.0% Ni 0.8-1.75% Mg 1.4-1.8% Fe 1.2-1.5% Si up to 2%	A high temperature treatment is not ordinarily applied.		10-20 hours at 160° to 170°C. Quench in cold water.
(Hiduminium) Cu 0.8-2.0% Ni 0.5-1.5% Mg 0.3-0.8% Fe 0.8-1.4% Si 2.0-3.0%	Sand castings— 2 hours at 525°-535°C. Die castings at 510°-535°C.	Water, at from 70°-100°C.	10 to 20 hours at 165°C to 175°C. Quench in cold water.
Mg 1.25% Si 0.6%	6 hours at 550°-560°C.	Cold water	6 to 10 hours at 175°C.
("Y" alloy) Cu 3.5-4.5% Ni 1.8-2.3% Mg 1.2-1.7%	6 hours at 500°-520°C.	Boiling water	5 days at room temperature or 1 to 2 hours at 100°C.

ALUMINUM CASTING ALLOYS

Chief Alloying Metals	*Form of Test Specimen*	*0.1% Proof Stress Tons/Sq. In.*	*Ult. Tensile Strength Tons/Sq. In.*	*Elongation % on 2"*	*Brinell Hardness*
2½-3% Cu	Sand Cast	3.5-4.0	9.01-1.0	2.0-4.0	60-65
12½-14½% Zn	Chill cast	3.5-4.0	11.0-14.0	3.0-8.0	65-70
6-8% Cu	Sand cast	3.5-4.0	7.5-9.0	1.5-2.5	60-70
	Chill cast	3.5-4.0	9.0-11.5	3.0-5.0	65-70
11-13% Cu	Sand cast	4.5-5.0	7.0-8.0	0.0-1.0	75-90
	Chill cast	4.5-5.0	9.0-11.0	0.0-1.5	80-90
10-13% Si	Sand cast*	3.5-4.0	10.5-11.0	5.0-8.0	50-55
	Chill cast*	4.0-4.5	13.0-14.0	8.0-15.0	55-60
7½-8½% Si	Sand cast	3.0-3.25	9.0-10.0	6.0-11.0	42-47
		3.0-3.25	11.0-12.0	13.0-11.0	45-50
12% Si 0.5% Fe	Sand cast**	Approx. same as	10.5-11.5	nil-0.5	120-140
1.0% Cu 1.0% Mg 2.5% Ni	Chill cast**	Ult. strength	16.0-17.5	nil-0.5	120-140
6-8% Cu	Sand cast	5.5-6.5	8.5-9.5	0.5-1.5	65-75
2% Si	Chill cast	5.5-6.5	10.0-12.5	1.5-3.0	65-75
3½-4½% Cu	Sand cast**	13.0-14.0	14.0-15.0	0.0-1.0	95-105
1.8-2.7% Ni 1.2-1.7% Mg	Chill cast**	14.0-15.5	18.0-20.0	2.0-4.0	95-105
1¼% Mg	Sand cast**	10.5-12.0	12.0-13.0	2.0-3.0	70-80
0.6% Si	Chill cast**	11.5-13.0	16.0-17.5	12.0-20.0	75-85
12% Si	Sand cast**	13.3-15.5	15.5-18.0	0.0-1.0	95-105
0.35% Mn 0.4% Mg	Chill cast**	16.0-18.0	19.0-22.0	0.5-1.5	100-115
5-6% Cu	Sand cast**	7.5-8.5	14.0-15.5	2.0-3.0	75-85
	Chill cast**	7.0-8.0	19.0-21.0	8.0-13.0	80-90

* Modified (fluxing the melt before casting with metallic sodium).
** Heat-treated.

umin and "Y" alloy, are so unstable that the low temperature treatment will take place at room temperature in about 4 days.

Important Casting Alloys of Aluminum

Copper and zinc are added to aluminum to increase its hardness. One of the better copper-zinc-aluminum alloys is approximately 13½% zinc, 2½% copper, and the balance aluminum. Although there are today many stronger alloys, this alloy is often used because it has sufficient strength for many castings and because there is a heavy supply of it as a secondary metal resulting from past popularity. It has, however, disadvantages in that it is too "hot short" for metal mold castings; it does not maintain its strength at high temperatures; it is not as resistant to corrosion as other aluminum alloys; and it has a higher specific gravity than many of the other aluminum alloys.

A straight copper alloy is more easily handled than the copper-zinc-aluminum alloy, but this is at the expense of some of the hardness. The most common of the copper-aluminum alloys is one made of 6% to 8% copper with the balance aluminum. If a small percentage of silicon is added to this, an alloy results which is excellent for difficult die castings. If an alloy of copper and aluminum has the copper percentage raised, the alloy has greater hardness, but no greater strength. A piston alloy with 12% copper was at one time in use, but it is no longer used for anything except special cases.

A silicon-aluminum alloy, containing 10% to 13% silicon, which has been fluxed with metallic sodium or certain salts before being melted, has a great degree of ductility, a high mechanical strength, and a large elongation; but its elastic limit is no higher than that of other aluminum alloys, and the metal is soft, necessitating special care in machining. The alloy is used on ship board, however, because of its high resistance to corrosion. The alloy has a higher fluidity than other aluminum alloys, but even silicon-aluminum alloys are not foolproof. A lower percentage of silicon may be added to the aluminum, forming an alloy whose characteristics are halfway between that of the high percent silicon alloy and the copper alloy.

There is also an alloy of an entirely different class which contains 3¼% to 4¼% magnesium and the rest small quantities of other metals, and aluminum. This alloy has a tensile strength of about the same as that of the silica-aluminum alloys, but its elongation is much larger than either of the silica alloys. It also has the advantage that it may be used in casting in permanent molds.

One of the hardest and toughest cast aluminum alloys is "Y" alloy, which is heat-treatable. The "Y" alloy contains 4% copper, 2% nickel, 1¼% magnesium, and the rest aluminum and natural impurities. Although this alloy has excellent properties, it is by no means easy to cast, and other heat-treatable alloys are often substituted for it. A simple 5% to 6% copper and aluminum alloy, when properly heat-treated, will obtain the same tensile strength, but will fall far short of "Y" alloy in its elastic limit. Still another heat-treatable alloy is one made of 1¼ percent of magnesium, 0.6 percent of silicon, and the balance aluminum. This alloy is not as strong as "Y" alloy, but has a higher elongation and a very good elastic limit. It can, however, only be used in comparatively simple castings, because it is very difficult to cast.

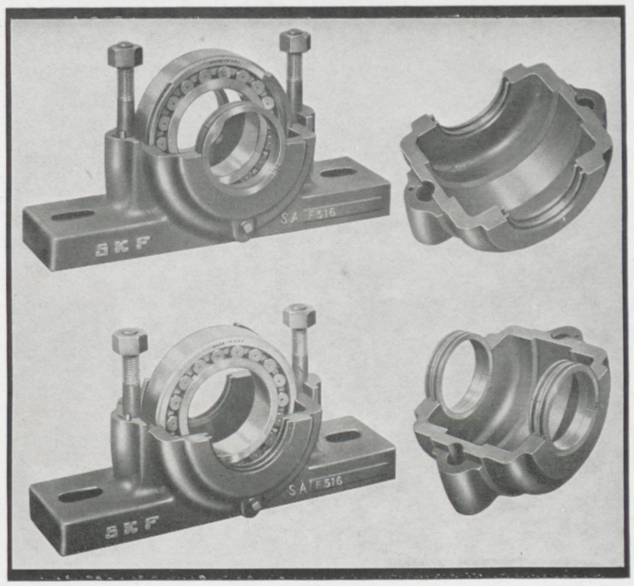
Alloys used for piston manufacture must have a high strength and hardness at working temperatures, and a low expansion. Working temperatures are taken from 250° to 300°C. As most of the aluminum alloys lose their strength at such temperatures, special alloys had to be developed. "Y" alloy was originally developed for this use and is still used for pistons to some extent. Other alloys used are copper-iron-aluminum alloys, which have honeycomb structures of needle-shaped, iron crystals, and the heat-treatable, copper-iron-magnesium-aluminum alloy. Still other types of alloy used in this are the silicon-aluminum alloys which have added to them the same honeycomb iron structure. The iron is necessary in this case because, although the silicon alloys have a very low coefficient of expansion (about 0.000019 per degree C. when heat treated), they are not strong enough for pistons without the addition of iron.

Ever since 1888 when Hall, the young genius who two years before had first discovered his electrolytic process of reducing aluminum from the ore, first made commercial aluminum in the Pittsburgh Reduction Company (since 1907 the Aluminum Company of America), aluminum has had to fight to win and to keep its markets. Aluminum is just a "youngster" when it is compared with zinc, copper, iron, and tin. Aluminum, the metal that is less than sixty years old, has already become fifth in the world's production of metals, being led only by iron (and steel), copper, lead, and zinc.

And the story of aluminum is also the story of cast aluminum. The first large casting, the cap on the Washington Monument, would almost be a symbol of the heights that cast aluminum would reach. Cast aluminum and its alloys are today used in structural work, fighting their way against iron and steel alloys. What steel gains in strength, it loses in 'dead' weight; but aluminum alloys can approximate the same strength as steel, and dispense with much of the weight. Today aluminum competes with steel in bridges, in railroad cars, in complete trains, in trucks, in shovel buckets, in towers and in airplanes. But aluminum has won no fight against steel that she can consider permanent. Steel has retaliated with stainless steel, and other alloys. Looking across the rails of the country today, on one track we see an aluminum "streamliner", and on another we see one of stainless steel.

Research and Development

edited by Lloyd O. Krause, e., '40



Two split rings on each side of the housing form both an internal and external seal.

Bearing Protected by Triple Seal

This special bearing seal recently developed by SKF, consists of two split piston rings grooved on the outside diameter to form a labyrinth seal with the end bores of the housing. Each ring has an inward tension tending to keep it in close contact with the shaft. They are at the same time sufficiently free to locate themselves axially under varying expansions and contractions of the shaft; consequently close clearances are maintained between the rings and the housing at all times. The rings are placed with the splits 180° apart to keep the lubricant from flowing directly out. The inner ring acts mainly as an internal flinger, throwing the lubricant back into the housing, while the outer ring serves mainly to keep dirt and other foreign matter from gaining entrance to the bearing housing.

The rings are made of cast iron and are hammered on the outside diameter to give them the inward tension. Any lubricant that should escape past the first ring is fed back into the housing through a hole located in the center groove of the bottom half of the housing, being returned at a point below the oil level.

An Electric Piano

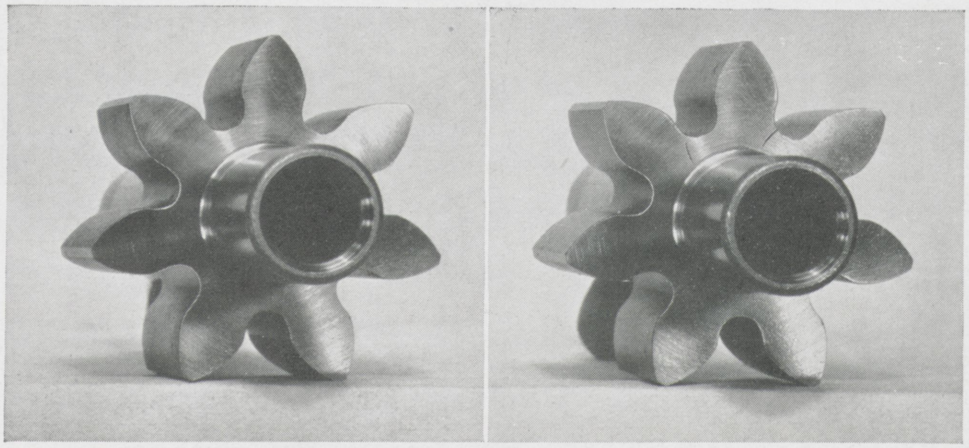
There has been, during the past forty years, without any complete success, considerable attempt to produce a musical instrument that would be fundamentally new. New applications of the vacuum tube have enhanced the research, and a recent product is the Electone, developed by Maurice K. Bretzfelder of Krakauer Brothers piano company.

The Electone is fundamentally a piano in that it employs strings, hammers, and keys; but its distinction lies in its ability to produce the tone characteristics of various other plucked string and reed instruments. The instrument resembles a modern console piano, but it does not have a sound board, the latter being replaced by pick-ups, amplifiers, mixers, loudspeakers, and other electrical devices.

To briefly describe its operation it may first be considered as a piano, and then the complications may be progressively added. The strings of the instrument are actuated in an entirely normal manner, but the lack of a soundboard makes the sound of the vibrating strings practically inaudible. The mechanical energy of the vibrating strings, instead of being directly converted into sound energy by means of a soundboard, is converted into electrical energy by means of pickups, and this energy is then amplified and reproduced by means of a loudspeaker.

Certain immediate advantages of this method of reproduction are that the volume range is limited only by the range of the amplifying system, and the volume within this range can be simply controlled by means of a conventional volume control; that the tone can likewise readily be regulated by means of treble and bass control such as are found in the ordinary radio receiver; and that the piano, by means of its controllability, can be played to suit the acoustics of most any size room. A further refinement is the inclusion of a headphone jack. With a pair of crystal headphones plugged in, the pianist can listen to himself play without disturbing the neighbors, though they be in the next room, for the loudspeaker is then automatically cut out. The relative volume of the instrument depends on the touch of the player on the keys as in an ordinary piano; but the instrument is also furnished with a special "swell" pedal, which, when pushed in, causes the volume of a note to increase after the key has been struck, rather than to decrease.

For straight piano reproduction only a single electro-static pickup would be required at the bridge end of each wire, for then the fundamental and harmonics would be picked up in proportion to their production. For the reproduction of tones of various other instruments, however, the relative ratio of certain harmonics to the fundamental must be controlled, and to accomplish this



Cuts Courtesy *Machinery*

The apparently satisfactory gear at the left was found by the Magnaflux Process to have two serious cracks, as seen in view at right.

three tiny plates are placed along each string. The first group of pickups is located near the end of the string, and consequently near a node as far as fundamental vibration is concerned, but not so near, comparatively, to the nodes of the harmonics, and the higher the harmonic the nearer the pickup is, relatively, to the antinode. Thus the combined effect is quite a rich proportion of harmonics plus a weak fundamental. The second set of plates is placed at about one-sixth length, and the third at one-quarter length of the strings. These two sets of plates pick up about equal amplitudes of fundamental, much greater than the first set, while the amplitudes of the harmonics differ considerably at these points, and various combinations are obtained. There are 88 strings in the instrument, and consequently 88 first sets, 88 second sets, and 88 third sets of pickup plates. The combined output from each of the 88 pickups of the first, the second, and the third sets is fed into a separate preamplifier, and the output of these three amplifiers is fed into a phasing network, by means of which the outputs may be made to buck or aid each other, and by the setting of three knobs, this action is controlled. Thus the fundamental may be accentuated or depressed, and with the same control over the harmonics, a characteristic tone of most any type can be produced.

The immediate pickup sensitivity depends upon under what polarizing voltage the string exists. Thus for organ effect the delayed voltage would need to be predominant, for then the response would come on gradually some time after the key had been struck. For plucked effect, the delayed voltage would have to be subordinate, for then the response would be immediate and surging. For piano effect, the two voltages are made equal. Knobs are provided for the control of the normal and delayed voltages, to produce any desired effect.

Hidden Flaws Detected by Magnaflux Process

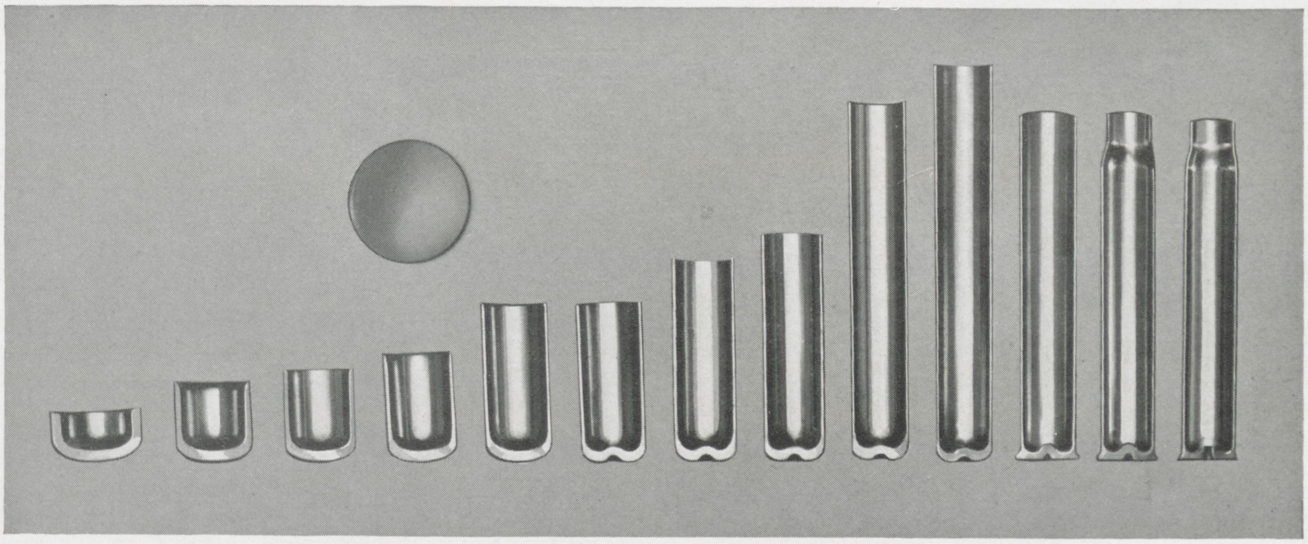
The new Magnaflux process is capable of detecting flaws to a depth of 2 inches, and surface cracks only 0.0002 inch deep. Magnaflux inspection is used for exposing fatigue cracks, grinding cracks, rolling mill-developed seams, etc. Cracks invisible under a 20 power microscope can be made visible to the naked eye by the use of this process. In fact it is so sensitive to irregularities in the structure of steel parts that there will be Magnaflux "indications" of so little consequence that they could not possibly have any bearing on the future strength and serviceability of the product. Intelligent judgment is required to sift out the indications that spell danger and those that represent irregularities of no consequence.

The Magnaflux principle is quite simple both in theory and application and consists essentially of magnetizing the product to be inspected, so that polarity is set up between the faces of any crack or break that might be on the surface or to a depth of approximately two inches. The magnetized sample is then immersed in an oil bath in which are suspended finely divided magnetic black iron oxide particles. The particles will adhere to the surface of the object whenever polarity exists, and these particles form a black line that is immediately visible to the observer.

Magnaflux inspection has been universally adopted by the aircraft industry. It can be practically said that every steel part that goes into an airplane is inspected by this method, whether it be in the engine, propeller mechanism, or in the plane itself. Many of the pieces are checked several times during manufacture.

The Magnaflux method is very advantageously applied in numerous industries also. It comes to the fore for the inspection of cylinders and tanks that carry gas under high pressures. The containers can be checked anytime, through the paint or whatever coating they may possess, for the iron filings will still form lines where the polarity between flaw faces occurs. Some automobile manufacturers also apply the method to the inspection of diaphragm clutch springs.

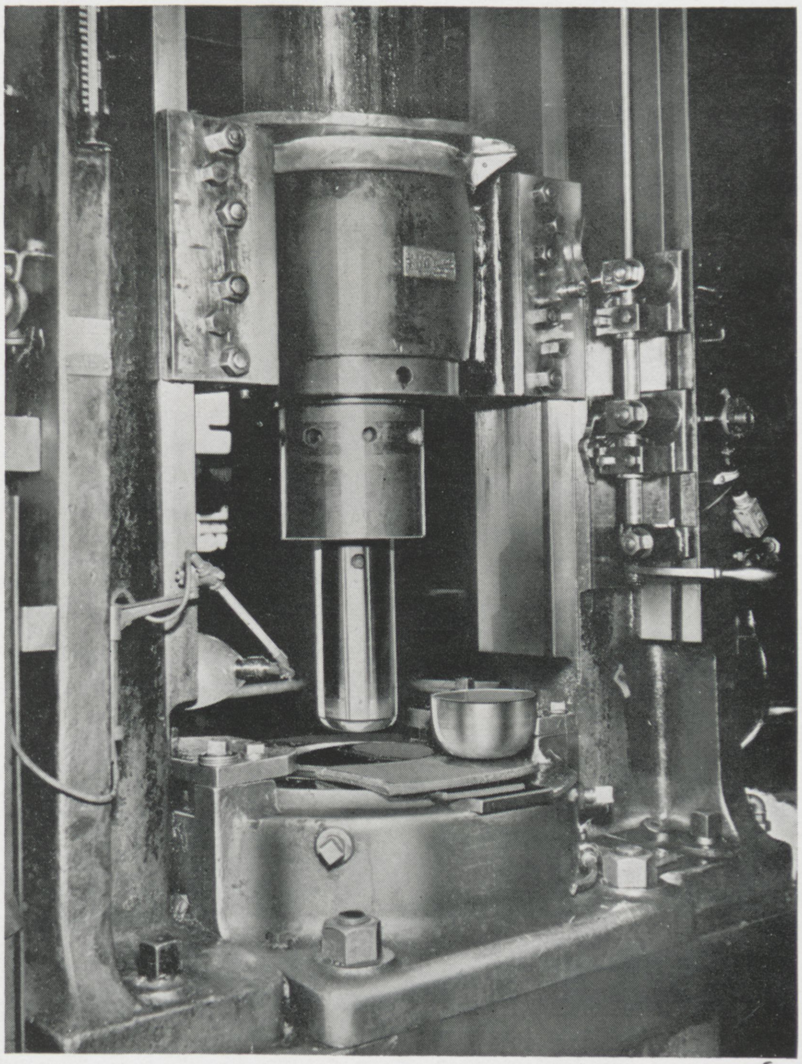
For every large piece of equipment that must be tested "on the field" a special dry process has been developed, which is readily portable. Magnetization is accomplished by winding several turns of heavy wire around the part and passing a large current through it. Dry, white Magnaflux powder is then sprinkled on the object and any flaws are immediately revealed. Many locomotive parts have been inspected thus. This dry process is more often used for the inspection of gas cylinders than is the wet process. One pound of powder is sufficient for the inspection of from 100 to 150 cylinders.



Disk from which a typical Cartridge Case is drawn and cross-sectional views which indicates the sequence and number of operations required for its production.

The Making of Large Cartridge Cases

In guns with calibers above six inches, the explosive is placed in the powder chamber of the gun after the projectile has been placed in the bore. For guns with a caliber under six inches, however, the explosive is contained in a cartridge case, to which the projectile is sometimes attached, although in some cases the projectile is left unattached. Cartridge cases of all sizes are made in the United States Navy Yard, Washington, D. C., under high-production methods. Slabs of brass cast in the Yard foundry are rolled to the required thickness in the cartridge case plant, and are then blanked into disks of pre-determined diameter. The blanking operation is done with hydraulic presses.



Cartridge cases consist of long shells drawn in successive operations from brass disks. Here the disks are shown being formed by a hydraulic press.

These disks, usually on the order of twelve inches in diameter and one-half inch thick, are next placed in a die under a specially rounded plunger which "cups" them to a depth of about six inches. These cups, partially formed cartridge cases, are next subjected to a series of drawing operations in horizontal presses hydraulically actuated. These drawing operations are accomplished by placing the successive cups over long punches and forcing the whole through a die smaller than the original outside diameter of the case. The drawings are continued until the case is of the desired length and thickness. The closed end of the case is then headed in a special hydraulic press, and any further formation of the open end is also carried out in hydraulic presses.

THE ROSE TECHNIC

Member Engineering College Magazines Associated

More Forgotten Men

It has been said with justification that the college years are a most critical period in the life of the student. The individual who enters college is faced with a problem of major proportions. He must demonstrate successfully that he is at least on a par with the intellectual standards which must exist at any institution of higher learning, and his ability to cope with this problem will influence the course of his future life. If he is able to arrive at a satisfactory solution to the problem, it is well and good, for it is the purpose of the college to develop the students who display the qualities which the college is primarily interested in developing. But what about the individual who is incapable of working out, as every student should, his own design for education?

The mortality rate existing among engineering students especially is high enough to warrant the construction of a policy of guidance for the students who, for honorable reasons, must leave college before they have completed the prescribed course. The frustration experienced by students who fall short of attaining their most coveted goal, graduation, may have a very destructive effect on their character. It might seriously retard, or even prevent, their ultimate adjustment to the conditions under which they must live.

A method of aiding the so-called failure students is employed at a few schools and should be advocated more strongly. It consists of presenting to these students a document on which is enumerated the satisfactory work accomplished by them. This tangible evidence that all their efforts were not in vain lessens the disappointment and is likely to be a valuable factor in their progress in other fields. Additional aid should be administered in the form of a constructive criticism to each case, and these students should be assured that the college stands ready to give reference for them.

From the sociological point of view, the college, as an institution responsible for the building of character, is obliged to perform these missionary services. —*J. E. T.*

Comments

It seems that if this school has roads meandering around the campus they should be roads that reflect the sort of training offered at the school. Why is it not possible for the civil department to find some kind of a road base that will hold up under the small amount of traffic that these roads are subjected to?

Maybe too many professors base too much of the final grade in a course upon the final examination. A number of factors may contribute to the failure of a student to do his best upon one particular day upon one particular set of questions. Most of the faculty have a grading sytem that is most fair, but some professors do not seem to even know of the possibility of having other tests.

Recently two more of the chairs in the social room have been broken. Of course, we all realize that there is no excuse for this breakage. It is due only to a little thoughtless action because no one would purposefully break his own property. Let's do our roughhousing in the open where it won't hurt anyone or anything but ourselves, and when you sit down in a chair learn to lower yourself gently and gracefully.

The first student forum meeting, which was held in January, showed the fact that engineers do have interests besides engineering. A discussion was held upon the problem of government spending to stimulate business. Some quite heated arguments were held among the some thirty faculty members and students there. Another meeting is planned for the month of February. It is hoped that a permanent forum club may be formed on the campus as a result of these discussions.

No matter how many disparaging remarks we may cast at Rose, it's a darn swell school and we're proud of it. —*E. A. C.*

From The President's Pen

In the issue of "This Week" for January 15th, Dr. Neil Carothers, Professor of Economics and Dean of the College of Business Administration at Lehigh University, presents a statement of the economic fallacies on which many of the current federal activities are based. Dr. Carothers enumerates the principles which he considers unsound, and these may be stated in condensed form as follows:

1. Scarcity economics. The standard of living can be improved by limiting production.
2. Spending economics. The depression can be brought to an end by borrowing against the future for immediate expenditures.
3. Inflation economics. Higher prices will cure our troubles, and these can be secured by tampering with the currency and diluting credit.
4. Regulation economics. Decreasing the hours of work and increasing wages will raise purchasing power.

Some of these fallacies are absolute; that is, the desired results will not be accomplished regardless of the method used and the accompanying economic changes. Some of the fallacies are contingent; that is, the desired results might be secured under the existing legislation but only if certain other economic conditions obtain, conditions which are beyond the control of our government.

Dr. Carothers is an economist of recognized ability and acknowledged standing. His statements merit careful consideration by everyone interested in the problems of economic recuperation, and that should mean every citizen. Certainly young men who are preparing for careers as closely dependent on industry as is engineering should be especially thankful for a statement of fundamental principles as concise and clear-cut as this article by Dr. Carothers.

Braintwisters

by William A. Reddie, ch., '39

The editor of this column is pleased to acknowledge a correct solution to the problem which appeared last month under the heading "How's Your Geometry?" This solution was turned in by Mr. H. B. Sperry, class of '92. Mr. Sperry stated in his letter that the quickest and most practical method of solving this problem is by the "cut-and-try" method. Although there are other methods of solution, the editor is inclined to agree with him.

Let us see more evidence of interest in this column. Send in your solutions. Credit will be given for each correct solution received.

Cow Grazing

A cow is tied to a rope 90 feet long which is fastened to the corner of a barn 40 feet square. Determine the grazing area of the cow in square feet, counting any overlapping areas only once.

An Algebra Slam

A street is bounded on each side by vertical buildings. A ladder 40 feet long extends from the street level on one side of the street to the side of a building on the other side of the street. Another ladder 60 feet long extends from the street level on the opposite side of the street to the side of a building on the side of the street which was first mentioned. The distance from the point at which the two ladders cross each other to the street level measures 20 feet. Find the width of the street.

—Photo by Thacher

Around The Campus

with

Chuck Howlett, e., '41

Camera Club

At the last meeting of the camera club, the members were introduced to the new faculty adviser, Mr. Howard White. Mr. White is a camera enthusiast and has done some excellent work. The cover picture of the November Technic was a fine example of some of "Howdy's" work. The members are very glad to have his excellent and timely advice.

During the past few weeks the dark rooms have been reconditioned to make them more attractive. A new Argus enlarger has been installed, and a new adjustable film tank, some new trays, and other equipment have been added to the already well equipped dark room. The club is looking forward to some interesting talks on photography by members of the faculty as guest speakers.

Radio Club

The members of the Radio Club have been engrossed in recent days in the occupation of their new club room. It was decided at a meeting held on Wednesday, January 11, that the club room should be painted before the equipment be moved in, and Joe Dreher was placed in charge of the work.

At the next meeting held on Thursday, January 19, the club voted unanimously that letters of thanks should be written to Mrs. Krog and to the Archer and Evinger Radio Supply Shop. Mrs. Krog presented the club with a fine short wave receiver, and Archer and Evinger donated a metal name plate for the club room which has the club's call letters, W9NAA, in silver on a black background.

It was reported at this same meeting that the school would paint the metal work and would furnish the paint for the rest of the room. As a result the painting and other work was done in the mid-year vacation. At this meeting George Schull made a report and was appointed chairman of a committee to purchase the necessary equipment to put the 40 meter radio set in operation. It is planned that this set be in operation as soon as the new mast is erected.

Radio Program

Recently the National Broadcasting Company has been presenting prominent speakers discussing some controversial subject; and this has been followed by a local discussion. Thursday, February the second, Rose was asked to take charge of the discussion over WBOW.

The first of the program was presented by several speakers in New York, and the second part was given over to the Rose delegation. The topic was "Can War be Prevented in Europe?"

President Donald B. Prentice spoke first followed by Reverend LeRoy Brown and Professor John L. Bloxsome. Robert S. Kahn and Edward A. Coons were the senior debators who took part in the discussion, and Hulit Madinger and Eugene McConnel, freshman debaters, materially aided in completing the program.

Newman Club

The Terre Haute chapter of the Newman Club has been continuing with their usual activities. The outstanding activities for the year have probably been the initiation services held last October, and the Christmas party.

The initiation ceremonies were held at the Women's Department Club and featured the attendance of the Vincennes University chapter, which brought its pledges to Terre Haute to take advantage of the initiation. Twenty-five new members were initiated.

On December the fourteenth the members of the club gathered at the Saint Benedict's Hall for a Christmas party. An enjoyable time was had throughout the evening dancing and playing games. Refreshments were also served.

Rose Rifle Club

The Rose Rifle Club is now affiliated with the National Rifle Association. Having revised the constitution of the club to comply with the regulations and submitted application for membership, the club was admitted to the association, and received its charter. Membership is an advantage for the club members in that it enables the men to fire for their qualification awards, the reg-

ular army badges being awarded; it opens several matches both for the team and the individuals; and it provides for a standard set of match regulations as well as making available for the club the magazine, *The American Rifleman.*

In the Wabash Valley Rifle League Rose finished the first period of their competition in ninth place, having won 2 matches and lost 7. The second period is now under way and the team is behind by virtue of three losses; to the Coke plant (874-843), the Paper Mill (862-843), and the Commercial Solvents team (880-849), respectively.

A. I. E. E.

The first meeting of the A. I. E. E. for the new year was held Wednesday evening, January 11, in the Physics lecture room. There were about twenty-five members present to hear the very interesting program of talks presented by the students.

Mr. Krause first presented a lecture on phonograph pickups, explaining the principles involved in both electrostatic and electromagnetic pickups. The greatest advantage of electric pickups is the light pressure on the needle which, Mr. Krause explains, greatly lengthens the life of the record.

The next address was presented by Mr. Pies. He spoke on the principles of the vacuum tube voltmeter which the senior electrical class built in the high frequency laboratory. The explanation included the theory of the operation of the tube and some of the practical applications of the apparatus. A novel part of Mr. Pies' display was the projection of the dial of the instrument on a screen, showing the dial to be about five feet in diameter and making it easily visible to the entire audience.

Mr. Marasco then spoke on class A amplifiers. In addition to the talking Mr. Marasco drew diagrams of the single stage and 2 stage amplifiers, explaning how a very small signal was amplified. He had built up a 2 stage amplifier for the demonstration, and used the vacuum tube voltmeter to show the amplification factor. He also presented an explanation of the distortion in the tube.

The talks, accompanied by the demonstrations, were decidedly interesting, and were well received by those who attended the meeting. These men were complimented for their excellent work, and the meeting was adjourned after the request was made for anyone with ideas for future programs to speak to Mr. Pies.

A. S. M. E.

The American Society of Mechanical Engineers started the new year by launching a contest for the best paper of the remaining school year. The author of the paper will represent the chapter at the sectional A. S. M. E. meeting at Chicago in March. An expensively bound engineering handbook by Westinghouse is also to be awarded to the winner.

At the chapter meeting Thursday, January 12, George Smith presented a paper on "Practical Applications of Photo Elasticity"; Gene Petty, "Oil Pipe Lines"; and Fred Thodal, "Diesel Airplane Engines".

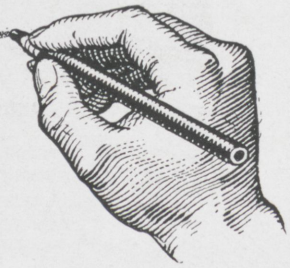
Tentative plans were made for the next meeting, which will be a dinner meeting, at which more papers are to be presented.

A. I. Ch. E.

The Rose student branch of the American Institute of Chemical Engineers has conducted two field trips recently. On December 15 the group, accompanied by Dr. Strong, inspected the Terre Haute plant of the Smith-Alsop Paint Company. Superintendent R. F. Fisher personally guided the tour and graciously gave a great amount of information. For its next project, the group, accompanied by Dr. Strong, Dr. Baker, and Professor Mann, visited the huge Greencastle plant of the Lone Star Cement Corporation on January 11. This plant is said to be the third largest in the United States.

—*Photo by White*

Fraternity Notes



Theta Xi

A formal initiation service was held on Sunday, December 11. Those initiated into the chapter were Vernon Whitehouse, '40, Louisville, Ky.; Edward Klecka, '41, Plainfield, N. J.; William Loman, '41, Cutler, Ind.; Thurber Morrison, '41, Milwaukee, Wis.; Albert Klatte, '41, Indianapolis, Ind.; and Fred Wehle, '41, Louisville, Ky.

Following the initiation, the entire active chapter went to Stevens', where the new initiates were guests of honor for dinner.

During the regular meeting following the initiation, plans were completed for a dinner meeting which was held on December 13. Mrs. Grove served a very tasty dinner. Guest of honor was Professor Gray, Theta Xi faculty adviser, who has done much to aid the chapter since his appointment.

Kappa of Theta Xi wishes to take this opportunity to thank its alumni, friends, and well-wishers for the cards received during the past holiday season.

Theta Kappa Nu

Indiana Gamma Chapter of Theta Kappa Nu Fraternity held its weekly meeting on Tuesday night, January 20, at Mr. D. Balsley's house on Chestnut Street. Plans for rushing were discussed and regular business was taken care of. Mr. Balsley, who is an amateur photographer, showed some very interesting moving pictures he had taken on a recent trip in the state of New York.

On Sunday, January 15, members of Theta Kappa Nu and Alumni members held a dinner meeting at Mother Eaton's. After the dinner Mr. Balsley gave an interesting talk and moving picture on his trip through Canada.

Alpha Tau Omega

The Gamma Gamma chapter of Alpha Tau Omega attended the St. Stephens Episcopal church on Sunday, January 8. This is the continuation of the plan that the chapter attend church on the second Sunday of every month. Almost the entire chapter of A. T. O. was present, and after church the men went to the fraternity house where a group picture was taken.

On the following Tuesday night the first dinner meeting of the new year took place. The excellent dinner was prepared by the mother's club and Mrs. Srofe, house-mother. The guests of the evening were two representatives of the Civil Department, Professors McLean and Hutchins. Following the dinner meeting the regular meeting took place.

On Thursday morning, January 12, several Junior A. T. O.'s were initiated into the Tau Nu Tau military fraternity. The A. T. O.'s initiated were Jack Appel, Maurice Cannon, Robert Colwell, James Ducey, Maurice Fleming, Frank Pearce, Ed Taylor, and Allen Wilson.

On Saturday, February 4, a group of A. T. O.'s went to the Delta Alpha chapter at I. U. where they attended that chapter's winter formal.

Sigma Nu

Beta Upsilon chapter held a "Pin Party" at its house Friday, January 13. The brothers, eight in number, whose pins now adorn members of the fairer sex, were hosts for the remainder of the chapter.

During the Christmas holidays the fraternity house was refurnished with a new heating and air-conditioning system. This system will not only make it possible to have a more comfortably heated house in the winter but a cooler house in the summer.

New chapter by-laws have been drawn up since the beginning of the year. Charles Fuller and Richard Mullins were in charge of this work and they cooperated with the general offices to work out the best possible by-laws for the chapter.

Tau Nu Tau

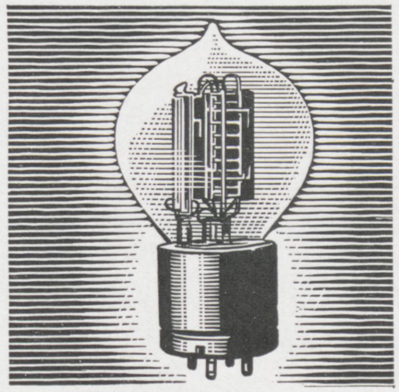
On Thursday, January 12, Tau Nu Tau held its annual initiation. The formal initiation at sunrise followed an all-night session in which the pledges were given practice in drilling and were taught to obey the commands of their seniors. Tau Nu Tau is pleased to announce the initiation of the following men: J. G. Appel, M. W. Cannon, E. G. Christiansen, R. H. Colwell, J. E. Ducey, N. G. Eder, M. C. Fleming, M. W. Johns, F. G. Pearce, E. O. Swickard, J. E. Taylor, V. E. Whitehouse, and C. A. Wilkinson.

RIGHT OR WRONG?

A 2-minute test for telephone users

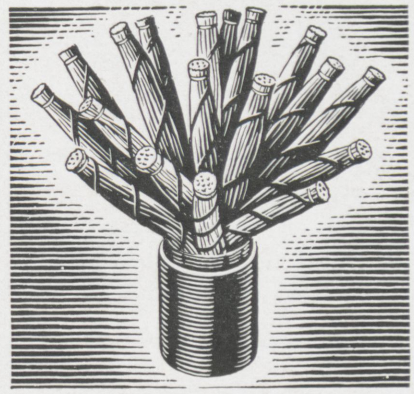
1. The Bell System handles about 48,000 telephone calls per minute, on the average.

RIGHT ☐ WRONG ☐



2. One of the first uses of vacuum tubes was in telephony—years before commercial radio telephony.

RIGHT ☐ WRONG ☐

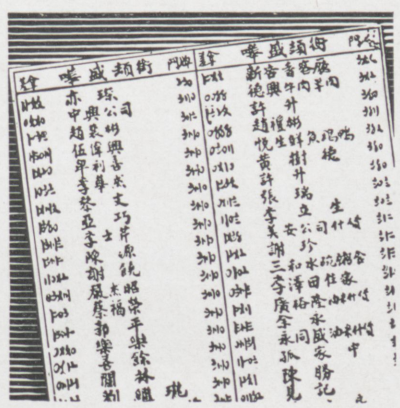


3. The largest telephone cable used by the Bell System contains 2424 wires.

RIGHT ☐ WRONG ☐

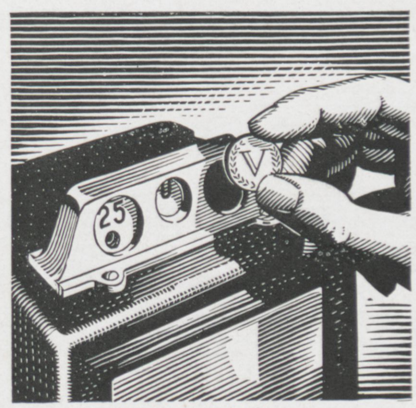
4. The Bell System employs about as many people as live in the city of Dayton, Ohio.

RIGHT ☐ WRONG ☐



5. This is part of a page taken from a telephone directory published in the United States.

RIGHT ☐ WRONG ☐



6. Lowest rates to most out-of-town points are available every night after 7 P. M. and all day Sunday.

RIGHT ☐ WRONG ☐

ANSWERS

1. *Right.* In 1938 the average number of calls per day was about 70 million.
2. *Right.* The repeater tube, which makes possible long distance telephony, was first used in 1913.
3. *Wrong.* 3636 wires are packed into a cable about the size of a man's wrist.
4. *Wrong.* The population of Dayton is about 200,000—while there are nearly 300,000 telephone employees.
5. *Right.* It is from San Francisco's Chinatown telephone directory.
6. *Right.* Why not telephone family and distant friends oftener?

BELL TELEPHONE SYSTEM

Sports

edited by

Robert N. Ladson, ch., '39

Rose vs. Taylor

On January 6, 1939, Rose opened the new year against Taylor University of Upland, Indiana. Displaying a world of fight and spirit, the Engineers outplayed Taylor on the floor, but lost the game 36-30. Near the end of the game Rose initiated a rally but did not start it soon enough.

As the game opened it looked like Rose would win easily as the first two shots attempted were good for four points. However, a lull set in and the Engineers were able to score only two foul shots in the rest of the first half. In this interlude Taylor scored seventeen points to lead 17-6 at the half. Taylor made a very good percentage of their shots during this half. Rose had trouble with the backboards in this game as they were of steel construction and much more lively than the ordinary types.

In the second half Rose came back with a great deal of determination. Inspired by a sudden revival of ability to score, the team settled into a semblance of organization and began to work a fast break. Unfortunately for the Engineers, however, Taylor replaced the regular team with fresh substitutes who became defensive minded and were content to protect their lead. Time after time, also, Rose missed shots and was never able to overcome all of the first half lead. Near the end of the game the play became very rapid and, of course, pretty rough. In this type of play the Engineers, being rougher by nature, more than held their own. The score at the end of the game stood Taylor 36, Rose 30.

Meurer, bright freshman prospect, stood out in the Rose offense, scoring nine points, while Colwell scored five.

Rose vs. N. C. A. G. U.

On January 14, 1939, Rose traveled to Indianapolis, Indiana, to play Normal College of the American Gymnastic Union. In a high scoring game, the Engineers emerged victorious by a score of 63-58. This great amount of scoring seems incredible, but an explanation can be made. An inexperienced timer took time out for each held ball and out-of-bounds, thus prolonging the game past its normal limits.

The game opened with both teams breaking fast and making each shot count. Neither team would be outdone in the speed of its fast break and the accuracy of its shots. As a consequence the score mounted rapidly and any attempts at defense failed. Fortunately for Rose, Colwell was at his best and all members of the team played good basketball. The scoring was even on both sides and Rose was never ahead more than five points. The half closed with the Engineers leading 27-25.

In the long second half things really began to happen, and the game practically got out of the hands of the lone official. He did his best, but at that speed it would have necessitated three officials to properly handle the game. Immediately after the half opened, N.C.A.G.U. tied the score and then went into the lead. However, the Engineers would not be bested and they took the lead at 31-29 and were never again headed. At one time Rose led by fifteen points, but in the waning minutes of the game, N.C.A.G.U. crawled up somewhat. The score at the end stood Rose 63, N.C.A.G.U. 58.

Colwell led the sparkling Rose offense with twenty-two points. Incidentally, this is a new scoring record for a Rose team.

Rose vs. Joliet

On January 20, 1939, Joliet College from Joliet, Illinois, a newcomer on the Rose schedule, visited Rose for a game. Employing a remarkable

one-hand shot the visitors led for most of the game but faltered in the second half and Rose won 35-32.

As the game opened the one-hand shot artists scored six points before Rose was able to chalk up a score. This all occurred in the first few minutes of the game, and, peculiarly enough, the Joliet cagers maintained that lead for the remainder of the half. Meurer and Colwell were the only Rose players to tally in this half, but their accuracy kept Rose in the game. At half time Joliet led by a margin of six points, 17-11. Rose was definitely not up to form in this half as will be shown in the results of the second half of the game.

Holding Joliet scoreless for the first five minutes of the second half, Rose scored four baskets to take the lead 19-17. From this point on the battle was really nip and tuck as the score was tied five times before the final whistle sounded. Colwell and Bowsher were the main guns in this drive as they pushed aside any defensive attempts of the tiring Joliet team. Near the end of the game Joliet took the lead at 32-29. Rose was not to be denied, however, and Colwell and Bowsher scored six points in short order to give the Engineers a 35-32 victory. Bowsher's last basket came just before the final whistle and put the game away.

Colwell led the scoring with fourteen points while Meurer and Bowsher, with nine and eight points respectively, accounted for most of the rest of the points.

Rose vs. Wabash

On January 31, 1939, the Rose Engineers, after a week's layoff because of final examinations, traveled to Crawfordsville, Indiana, for a game with Wabash College. They showed the effects of the enforced vacation and lost the game 41-35.

In this game, as in several games before, the margin of victory came in the first half. Wabash started the game in high gear and scored several points right away. After this splurge Rose settled doggedly to lower the Wabash lead. However, they were unable to cut the lead to less than six points, and Wabash led at the half, 21-15.

In the second half Rose again came out determined to chop the lead down and was somewhat successful. At one time in the game Wabash was only two points ahead, but two successful long shots further established its lead. Near the end of the game Rose initiated a rally, but it fell short by six points of winning the game. The margin of victory was in foul shooting. Both teams scored the same number of field goals, but Wabash connected for eleven of twenty-two free throws while Rose made good on five of eleven attempts.

The teams were evenly matched as the score indicates, and, except for some wildness on the part of the Rose team, the score might have been different. Colwell and Meurer led the team with ten and eight points respectively.

Here and There With the Grads

edited by

Nick Smilanic, e., '40

Chicago Engineers' Club Honors Condron

On Tuesday, October 25th, over 92 members and guests attended a luncheon given in honor of Mr. Theodore L. Condron, Rose, '90, who was presented with a certificate of Honorary Membership in the Club.

Presentation of Mr. Condron for Honorary Membership was made by Mr. Alonzo J. Hammond, Rose, '89. Following is the presentation address given by Mr. Hammond to Mr. Condron:

"Mr. President, Members of the Engineers' Club, and Distinguished Guests:

I am very happy to have been requested by President Mann to introduce to you today, one of our distinguished engineers who will receive Honorary Membership in this club, as our friendship has spanned a long period of years.

During a very cold February of 1887, a railroad locating party started a survey across Southern Illinois and, as practice, some of the students of Rose Polytechnic Institute held responsible positions; Mr. Condron, being a freshman, was head of the transit party, and I, as a sophomore, was running the level. Condron attracted my especial notice by breaking through the ice and getting his boots filled with water at every stream, and we had to find oats to dry them at night, so he was the stellar attraction of the party, as a liability.

Theodore Lincoln Condron, born in 1866 in Washington, D. C., of Civil War parentage, came by that middle name logically as his father, a minister, helped organize a regiment at Wilmington, Delaware, and served throughout the war as Chaplain with the rank of Major. Mr. Condron's early education was in private and public schools in Washington, with an added seven years of mercantile employment.

In 1886 he entered Rose Polytechnic Institute, graduating in 1890 with the degree B.S., receiving the degree M.S. in 1894 and C.E. in 1918.

Immediately following his graduation, Mr. Condron was assistant for a year to the Resident Engineer for George S. Morrison on the Burlington Bridge over the Mississippi River, and then came to Chicago with Cole, Alvord, and Shields. He used excellent judgment in picking his employers as they were leaders in their profession. Following the last engagement, he was instructor in engineering at Washington University for two years.

Having attracted the attention of A. E. Hunt of the Pittsburgh Testing Laboratory, he was offered and accepted the position of Resident Manager in Chicago in 1894 and retained this connection until 1901, developing the office from a one-man job to several assistants and a large force of inspectors.

Later a detailed report on all of the bridges on the Mobile and Ohio Railroad gave Mr. Condron an opportunity to inaugurate an independent practice, which developed into a partnership with F. F. Sinks.

An engagement to present designs for a multi-story freight building for the Chicago and Eastern Illinois Railroad brought the firm into contact with the corrugated bar people and pioneers in reinforced concrete, which led, the following year, to the invention of the two-way flat slab, later called the "Akme System", the original idea and calculation by Mr. Sinks, but developed in detail and in use by the Condron Company.

The first building of the "Akme System" was the Studebaker Building at 21st and Michigan Avenue, followed by one for Peck & Hills on Goose Island. After Mr. Sinks left in 1911, the Condron Company, as then called, designed the ten-story Sharpless Building in Chicago; a ten-story building of 600,000 square feet floor area in Seattle; a large building for Sears, Roebuck & Company in Kansas City and several buildings for the same company in Chicago.

The Condron Company has acted as engineers for the Ford Motor Company in the design of 20 service buildings over the United States and the million dollar power house at Highland Park, Michigan.

One of Mr. Condron's most interesting engagements, no doubt, was the rehabilitation of the reinforced concrete building of Thomas A. Edison, West Orange, New Jersey, which was nearly destroyed by fire; one which afforded a fine field for original and novel engineering design and construction. An interesting sidelight on Mr. Condron's personal characteristics is illustrated by this incident. Mr. Edison had explained how he proposed to make the repairs and asked Condron's opinion. He said the scheme was probably all right but that it was not the way he would do it. The next question was "How would you do it?" The reply was, "That is what I have been thinking about for several hours, but I am not yet prepared to say how I would proceed." Mr. Edison said, "You're like all the other damned engineers, you don't agree with anybody else and have no ideas of your own."

The Condron Company and its successor, Condron & Post, have carried on an extensive practice in building design and construction, numbering among their clients, besides the Ford Motor Company and Sears, Roebuck & Company, the General Electric Company, Western Electric Company, the Wagner Electric Company, etc. A viaduct over the Illinois Central tracks at 23rd Street, designed for the South Park and Illinois Central Railroad, which is one of unusual beauty of design and proportions, reflects great credit on the ability of the Condron Company.

Mr. Condron has been a frequent contributor to the technical press and societies, the Western Society of Engineers alone showing eleven titles, pioneering in reinforced concrete.

His society connections are the Western Society of Engineers, joining in 1894, Vice President in 1899, winning the Chanute Medal in 1905, and now life member.

He joined the American Society of Civil Engineers in 1899 and was Director for Illinois, the 8th district, during 1923-25 and is now a life member. He was a charter member of the American Society for Testing Materials and American Concrete Institute. His further associations are of the Republican Party, the Congregational Church, the Union League and Oak Park Clubs. It gives me great pleasure to present to this club, one whom you all know and honor, Mr. Theodore Lincoln Condron.

Mr. Theodore Lincoln Cnodron, I am greatly pleased to present to you this certificate, certifying that the Board of Directors of the Chicago Engineers Club, by unanimous vote have elected you an Honorary Member of this club."

Editor's note: The above speech is a direct reprint from the *Engineering News off the Record* which is the official publication for this organization.

Rose Tech Club Meetings

The Louisville Rose Tech Club held a dinner meeting on January 11, 1939 at the Canary Cottage in downtown Louisville. Election of officers was in order for the evening, and the nominating committee selected one group of new officers. The following men were elected unanimously: L. D. Gwinn, '15, President; J. H. Brinton, "24, Vice-President; A. L. Ahlers, '32, Secretary-Treasurer. Doctor Prentice, who was the guest of the evening, gave an interesting talk about Rose events for the past few years, explaining quite thoroughly the Rea sewer fund affair. Tentative plans were made to hold another meeting shortly before graduation date so as to encourage a spirit of wanting to go to Terre Haute for that event.

The following Alumni living in or about Louisville were present for the meeting: Ahlers, '32; Armstrong, '21; Baines, '13; Brinton, '24; Brownell, '86; Baylor, '07; Clore, '11; Connelly, '23; Crutcher, '27; Creal, '36; Greenebaum, '21; Gwinn,

'15; Hadley, '29; Carpenter, '17; Kuersteiner, '10; McIntosh, '25; Mayrose, '35; Pickel, '26; Royer, '22; Shaw, '35; Stilz, '15; Tetzel, '23; Watson, '24; Welsh, '35; Wischmeyer, '06; Wolff, '23; Walker, '35.

On the 11th of January the Southern Rose Tech Club of California held a dinner meeting at the Mayfair Hotel in Los Angeles. Following the election of officers for 1939, a few reels of educational films were shown. The notice of this meeting was sent in by H. E. Holmes, '28.

Rose Alumnus Writes on Engineering Astronomy

Dr. Jerry H. Service, professor of mathematics and physics at the Michigan College of Mining and Technology, and author of several scientific works, has recently had published another volume titled "Essentials of Engineering Astronomy". The book, published by the Prentice-Hall Company of New York, deals with the applications of astronomical observations to engineering, and according to authorities it meets a definite demand for comprehensive data in this field, the treatise being of particular value to civil engineers.

Dr. Service, whose home is in Carlisle, Indiana, was graduated from the department of electrical engineering at Rose Polytechnic Institute in 1912. He was awarded the Ph.D. degree at Ohio State University and later he was junior hydrographic and geodetic engineer for the United States Coast and Geodetic Survey. He is also listed in *Who's Who in Engineering.*

What They're Doing

'94 James C. Holding is with the Robert N. Hunt Company in New York, N. Y.

'08 Charles N. Lammers, fuel service engineer for the C. & E. I. Railroad Company, has been made Director of the new coal exhibit which has been opened in Chicago.

'11 L. Ross Wyeth is chief engineer of the Wilson Supply Company in Houston, Texas.

'25 Hubert H. Merrill has been made chief engineer at the Quaker Maid plant in Terre Haute.

'26 Harvey H. Mayrose, with the Texas Company, has been transferred to New York.

'27 John B. Wilson is construction engineer for the Lewis S. Finch, Consulting Engineers, of Indianapolis.

'28 Hubert W. Swartz, with Pennsylvania R. R. Co., is stationed at Oil City, Pa.

'31 Clarence W. Hoff has been appointed Engineering Aide with the U. S. Geological Survey. He is working out of Terre Haute on topographic maps.

'32 Henry L. Pfizenmayer has been transferred to the CCC camp at South Bend.

'34 H. Loren Thompson is an instructor in the department of civil engineering at the University of Idaho.

'35 E. Ewing Carrico is a special agent for the American Insurance Company at Bowling Green, Ky.

John A. Bradley is with the Sun Oil company in the industrial department of the Detroit Plant.

'36 Jack Roberts is working for the Indiana General Service Company at Marion, Indiana.

'37 Rhiman Rotz is employed as Owner's Inspector on a PWA project at Plainfield, Indiana.

'38 Richard E. Dennis is with the American Machine & Metals Corporation at East Moline, Ill.

Robert D. Prewett has taken a position with the Ohio Oil Company in Marshall, Ill.

Claude J. Zinngrabe is teaching in Chicago at the Washburne Trade School in the day and at the Fenger High School at night.

Cracked Gas

edited by
John E. Bartmess, m., '41

Henrietta: "Do you love me?"

Ed.: "Yep."

Henrietta: "Then why doesn't your chest heave like in the movies?"

Cop: "No parking here. You can't loaf along this road."

Smoocher Smith: "Who's loafing?"

—quoted

Spahr: "What's your roommate like?"

Kahn: "Damn near everything I own."

—hooked

Prof. Hutchins: "Hello! Is this the Indiana Bridge Commission?"

Voice: "Yes, what can I do for you?"

Prof. Hutchins: "How many points do you get for a little slam?"

—picked up

And then there was the guy who was so damn egotistical that he would kiss his girl goodnight and say he was the second happiest person in the world.

—taken

And then there was the man who decided to name his sons for the vowels. The first one he called Arin, the second Erin, and then came Irin, Orin, and Charlie.

—begged

Once upon a time there were two Irishmen. There are lots of them now.

—copied

NURSERY RHYMES

Dillar a dollar a ten o'clock scholar
Why do you come so late?
I used to come at ten o'clock,
But now I'm a senior chemical—

John and Mose went up to ROSE
To get a little knowledge.
Mose fell down (tripped on the finals) and broke his crown.
So he went to Normal.

Little Si Gary sat in a corner
Eating a lunch room pie.
He put in his thumb
And looked kinda dumb
And said, "What a sucker am I!"

—at least the names are new

Then there was the young bride who casually commented that her husband never snored before they were married and couldn't understand the roar that followed.

—sponged

DO TELL

A shoulder strap is a piece of ribbon worn to keep an attraction from becoming a sensation.

—taken

"Surprise! Surprise! I've made dates with a couple of girls for you and me this evening. One is a good girl, and the other is kind of naughty."

"Well, good for you."

—made way with

"My gal's legs are without equal."

"You mean they know no parallel."

—lifted

Her: "I think dancing makes a girl's legs too big, don't you?"

Him: "Yeah." (pause)

Her: "I think swimming gives a girl awfully big shoulders, don't you?"

Him: "Yeah. . . . (pause) . . . . You must ride a lot, too."

—copied

Dr. Baker: "Did you test this stuff, Newgent?"

Newgent: "Yeah, I poured some in a beaker."

Dr. Baker: "Did it turn green?"

Newgent: "I don't know, I can't find the beaker."

—borrowed

"See that girl? That's my girl."

"Uh-huh—good looking fur coat she's wearing."

"Yeah, I gave her that."

"Pretty hat, too."

"Yep, I gave her that."

"Boy, what a sparkler she's wearing."

"Sure it is. I gave it to her."

"And say, that's a cute little boy she has with her."

"Yeah, that's her little brother."

—dug up

Mother: "Now remember, while I'm away dear, that if you pet, drink, and smoke, men will call you fast."

Sweet young thing: "Yes, indeed, just as fast as they can get to a telephone!"

—well, it's not ours

Honest, fellows, I was only joking—all these jokes are original—*The Joke Ed.*

Nothing else will do—

Chesterfields give me more pleasure than any cigarette I ever smoked

A HAPPY COMBINATION OF THE WORLD'S BEST TOBACCOS