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Rose Technic Staff
Rose-Hulman Institute of Technology

ROSE TECHNIC

FEBRUARY, 1946

MEMBER ENGINEERING COLLEGE MAGAZINES ASSOCIATED

With a general college dance in mid-March, Rose Polytechnic Institute again pays tribute to St. Pat, the patron saint of engineering. We hope many Rose men will be back from service in time for this affair.

ROSE POLYTECHNIC INSTITUTE

TERRE HAUTE, INDIANA

THE ROSE TECHNIC

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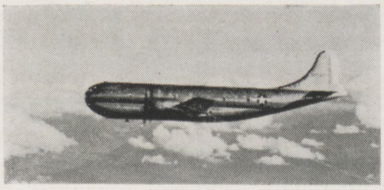

The Boeing C-97
—Courtesy Boeing Magazine

FRONTISPIECE

Weight-lifting Giant—Courtesy General Electric

CENTER SPREAD

Turbine Generator—Courtesy Westinghouse

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1846—GEORGE WESTINGHOUSE CENTENNIAL—1946

And suddenly—a wonderland of light...

It was an unforgettable sight that greeted the crowds at the Chicago Columbian Exposition, back in May, 1893.

For suddenly 250,000 incandescent lamps—more than there were in *all* the rest of *America* at that time—blazed in the night. They transformed the World's Fair Grounds into a gleaming wonderland of light.

George Westinghouse had done it again. Overcoming tremendous obstacles, he had accomplished the "impossible" . . . *in one short year.*

Using an entirely new principle, this great inventor-engineer had developed a completely *new type* of incandescent lamp—the famous "stopper lamp." And he had equipped a new glass factory to turn them out by the hundreds of thousands!

Here again, George Westinghouse in this historical light demonstration proved the vision and ability of a great engineer.

The lighting of the Columbian Exposition was a brilliant spectacle—and an important one, for it launched for all time the new age of electric lighting.

Westinghouse

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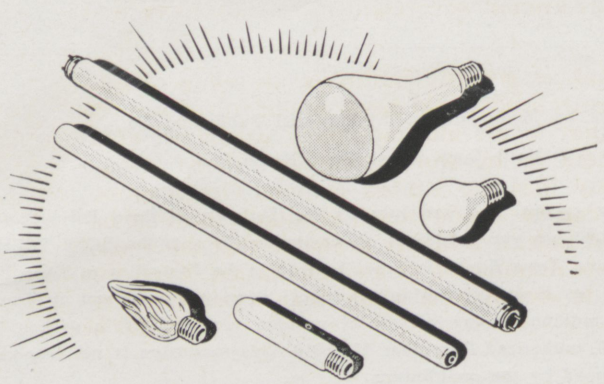

TODAY *— the Westinghouse Electric Corporation, one of many companies founded by this great inventor, makes incandescent lamps in all sizes, from tiny "grain of wheat" surgical lamps to high-power flood lights . . . fluorescent lamps that glow without flicker . . . high-intensity mercury lamps for industrial use . . . Sterilamps* that kill air-borne bacteria. In all, over 10,000 different types of lamps are made, each the result of skilled engineering—and over half a century of diversified experience.*

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Science Is Altering Our Views On National Sovereignty

One of the most remarkable consequences of the Scientific Revolution is the rapid antiquation of some of our most fundamental concepts concerning the political rights and independence of nations. Although the past fifty years have brought the full impact of the technological change which has been gathering momentum during the last few centuries, there has been no similar transformation of the world's social structure to conform to the realities of a scientific age. As a result of this inertia, the world retains many traditional concepts of international politics which are rapidly being reduced to anachromisms.

Science has irrevocably smashed the old barriers of time and distance. The fact that civilization has survived the countless wars of history is due to the fact that previous conquerors have lacked the instruments of global warfare; today we are directly imperiled by the hostile actions of others in all parts of the earth. Science has accentuated this situation by making possible the centralization of the power of the whole earth into a few areas of overwhelming force. In such a world small nations appear to be almost insignificant; yet it is notable that even the largest powers possess no real freedom, since they are incapable of preventing such disasters as world wars.

A marked centralization of world power has also taken place in the field of economics. Through the large-scale application of science in the development of industrial power, a handful of states with a relatively small total population are able to dominate the entire earth. Germany brought the small countries of Eastern Europe into her political and military sphere during the last decade by exerting economic pressure derived from her position as a financial power and a heavy-goods exporter. England has long exercised a disproportionately large influence in the world by virtue of her industries and shipping. Other small European nations which were once powerful have gradually been superseded by larger industrial powers. It is again notable, however, that no nation is entirely self-sufficient; for example, the whole world was directly affected by the recent depression in the United States.

What is the cause of the highly unstable state of our present-day society? Upon close inspection, it becomes apparent that the fundamental concept of national sovereignty is at fault —the doctrine that individual states are the final and supreme arbiters of their own destiny, regardless of the effect of their actions on neighboring peoples. History shows that all social units—tribes, cities, states, and churches as well as nations—have engaged in armed conflict when they were allowed to exercise unrestricted sovereignty. Only when sovereignty was transferred to a larger social unit was real peace established, although the original cause of the friction often remained unchanged.

The conversion of cities and states into sovereign nations was begun several centuries ago. As little as fifty years ago this type of sovereignty still served a useful purpose, since the various sections of human society were separated by such vast physical barriers that they were utterly incapable of effecting an interdependent system of government. The persistence of the tradition of national sovereignty into the present, however, has created artifical barriers to the diffusion of culture, engendering fear and hatred between large sections of people differing only in their language and customs. As the nations of the world are made increasingly more powerful by the discoveries of science and are brought increasingly closer together by the conquest of space, warfare due to unrestricted sovereignty becomes more and more destructive.

When considered over the long-range viewpoint of several centuries, it seems almost certain that civilization will eventually evolve a centralized world government to replace the present feudalistic structure of society. The transition to an internationally organized community can take place only by international agreement or by world conquest: there are no other alternatives. There seems to be some possibility that the United Nations Organization, while lacking real power as presently constituted, can be strengthened gradually until it becomes an effective power for peace. If this attempt fails, it is highly probable that the end of the next war will find the world under the complete domination of a single nation. Even this alternative would ultimately be more satisfactory to society as a whole than a perpetual recurrence of devastating world conflicts.

R. G. B.

IT'S LIFE FOR BEVERAGES *and death to fire*

To a raging fire, Carbon Dioxide gas means sudden, certain death. Yet this same gas puts "life" in beverages—tongue-tingling bubbles that make soft drinks sparkle. For fighting men it's a life saver in other ways . . . inflating collapsible life-rafts and "Mae West" life-jackets; creating synthetic "smoke screens"; shielding packaged foods against spoilage; processing blood plasma and penicillin.

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BRIEFS

Shipment of caustics has been made safer and more satisfactory by a simple process for giving metal drums and tank cars a lining of rubber. When ordinary containers are filled with the molten caustic, the resulting corrosion of the iron makes handling dangerous and also introduces impurities into the caustic. In the new process the inner surface of the container is coated with rubber latex incorporated with the proper vulcanizing agents. When the hot caustic is poured in, the heat is sufficient to vulcanize the rubber into an impermeable film.

* * *

Silver in waste photographic liquors may now be recovered by the use of a process developed for the U. S. Treasury. The new process utilizes lignin to absorb the silver salt from the solution. The lignin is then collected as a precipitate which can be dried and burned away, leaving the silver salt behind. For small quantities, the lignin process is much cheaper than the former electrolytic process.

* * *

The first helicopter designed specifically for air transport operations has recently been put into production. Built for the U. S. Navy, it has a fuselage 48 feet long and 12 feet high capable of carrying 10 passengers—the largest helicopter yet constructed. In the air it somewhat resembles a huge, center-sagging, flat-bottomed row-boat suspended from two rotors, one at each end. The craft has an accurate control system and unusually good stability in air. It is one of the fastest and most efficient helicopters yet built.

* * *

A recently devised process for descaling metals utilizes sodium hydride instead of acid. The process consists of three steps: (1) the metal is dipped in a solution of sodium hydride in fused caustic, reducing the oxide film; (2) the metal is then dipped into water, generating enough steam to clean off the remaining scale; and (3) a quick dip in dilute acid is made to brighten the surface of the metal. The process is said to have several advantages over the ordinary acid pickling process. These include a shorter descaling time, the elimination of pitting due to careless handling, and the saving of steel ordinarily dissolved during the pickling process.

* * *

A new type of synthetic rubber is made of GR-S-10 synthetic rubber stock with a rosin-base soap instead of fatty-acid soap as an emulsifying agent. Tires made of the new rubber are much better than other synthetic tires, giving longer wear, cooler running, and greater resistance to cracking. The new tire, claimed by one source to be as good as a natural rubber tire, will be available to the public fairly soon.

* * *

Vectolite is the name given to an entirely non-metallic magnet developed recently by General Electric. The chief ingredient of the new magnet is magnetite, a magnetic oxide of iron chemically known as Fe_3O_4. Cobalt oxide and other oxides are also incorporated in the mixture. The materials for vectolite are mixed in the desired proportions in the powder form and are then sintered together. Like other non-metallic substances, vectolite is a nonconductor and is extremely light. The magnet is hard to demagnetize, so that it may be used in high frequency magnetic fields with little eddy current losses. Vectolite has already found application in highly sensitive aircraft meters and other devices where its special non-metallic properties are useful.

A new turbo-charged gas-diesel engine has a thermal efficiency of 40%—a higher record than ever obtained by any engine now in common use. The thermal efficiency of an engine is defined as the amount of power developed in relation to the fuel consumption, which means that the new turbo-charged gas-diesel engine develops 40% of the maximum power which it could theoretically develop. The best previous engine on this basis was the diesel engine, with a thermal efficiency of 32 to 36%. The gas turbine develops up to 29%, gas and gasoline engines up to 25%, and steam engines only 5 to 18% of their respective maximum efficiencies.

* * *

An accurate method has recently been found to perform the difficult task of measuring the temperature inside gas turbines. The new method, accurate up to 900°C, utilizes a special alloy of cobalt and chromium. Upon heating, the alloy forms a thin film of oxide which increases in thickness about two and half billionths of an inch with every 25-degree rise in temperature. Interference colors from the alloy change as the thickness of the oxide film changes, until the oxide film becomes so thick or irregular that no color is transmitted through it to be reflected. Thus, the alloy develops a light straw color at 500°C which changes markedly with every 25 degree temperature change, becoming various shades of bronze, purple, and blue. At 700°C the alloy undergoes an unusual color transformation back to the original straw color, and then runs through the same sequence of colors again, becoming gray at 900°C. Turbine parts made of this alloy thus give an accurate indication of the temperature developed within the turbine, succeeding where other, more complicated devices have failed.


WHITING
350 TON

Valve Meters

By H. V. Fairbanks
and A. Edgar Kroll

Reprinted from *Industrial and Engineering Chemistry*

A VALVE meter is an ordinary commercial valve converted into a flowmeter by attaching pressure connections upstream and downstream from the valve to a manometer or any other suitable pressure measuring device, as shown in Figure 1. The difference between the pressures upstream and downstream from the valve, caused by the smaller valve opening, can be measured by means of the manometer.

The use of a valve as a flowmeter was recently suggested by one of the authors. Data were given on a single 2-inch globe valve which was calibrated and used successfully to determine and control the rate of flow in a pipe line. In continuation of this idea it seemed of interest (a) to obtain further information regarding the use of valves for determining and controlling the rate of liquid flow in pipe lines, (b) to determine valve flow coefficients for valves of different sizes, and (c) to investigate the feasibility of using commercial valves as flowmeters without calibration by virtue of predetermined flow coefficients.

Investigations in this field appear to be lacking, since a search of the literature revealed no information relative to the use of valves as flowmeters. This paper describes the results obtained with various sizes of brass globe valves manufactured by the Crane Company.

H. V. Fairbanks received his B.S. and M.S. degrees in chemical engineering and physical chemistry at Michigan State College. After studying metallurgy at M.I.T., he began teaching at the University of Louisville. He is now Assistant Professor of Chemical Engineering at Rose.

A. Edgar Kroll received his B.S. degree in chemistry at Temple University. He began work with du Pont as a chemist, but he became interested in chemical engineering and soon transferred to the engineering department. He is now working on his Ph.D. in chemical engineering at Lehigh University.

When this article originally appeared in INDUSTRIAL and ENGINEERING CHEMISTRY, it attracted wide attention among industrial engineers all over the nation.

Apparatus and Method of Testing

Figure 2 is a diagram and Figure 3 is a photograph of the apparatus. In all tests the valve was preceded by fifteen pipe diameters of straight galvanized steel pipe and was followed by fifteen pipe diameters of similar pipe and a gooseneck in which the rise was always greater than six pipe diameters. Some of the valves used are pictured in Figure 4.

The rate of water discharge was measured at various pressures and valve settings, taken as the number of turns open. For convenience in setting the number of turns open, only round valve handles were used and were equipped with a narrow strip of metal bent at a right angle, pointed on one end and having a hole in the other so that it could be fastened on the valve stem together with the valve handle as shown in Figures 1 and 3. The zero point was determined by first opening the valve wide, allowing water to flow for a few seconds, and then closing the valve slowly until the flow just stopped. The metal pointer was attached and the number of turns open were set from this point. The purpose

(*Continued on Page 22*)

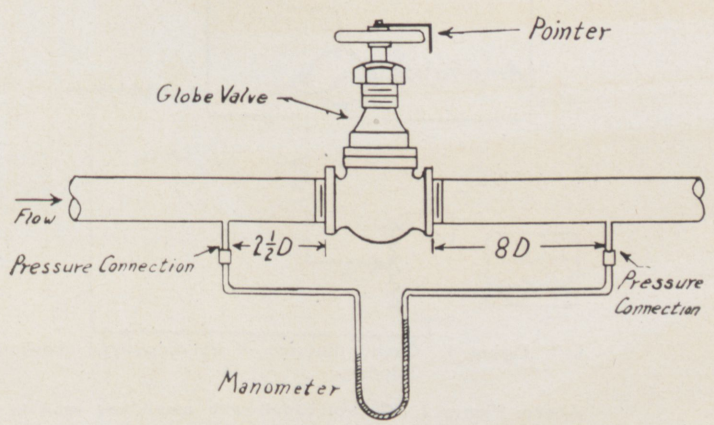


Figure 1. Diagram of a Valve Meter.

The Amplidyne

By Herbert Bailey, sr., ch.e.

THE amplidyne is essentially a direct current generator. Under normal operation in a D. C. generator the load current goes through the armature and divides, half going past the south pole and half going past the north pole. This current produces a flux at right angles to the field flux. Until a few years ago this secondary flux, which is called armature reaction, was considered only as a disadvantage. Through the amplidyne this armature reaction is utilized.

Consider first the conventional D.C. generator of 10 kw capacity. The normal excitation would be about 100 watts. The full load armature current would produce a certain armature reaction. Suppose that the excitation is then reduced to one watt, reducing the armature current to one percent of its usual value. Since the armature reaction is caused by the armature current, the armature flux would be reduced to one percent of its normal value.

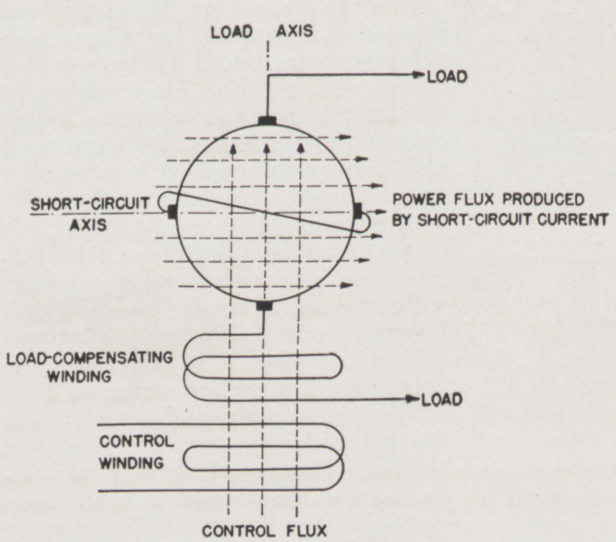
With these fundamentals in mind, consider now the armature short circuited and one watt field power. The armature current would be the full load value, even though the voltage is reduced. This full load armature current would produce normal armature flux. The problem now is to utilize this flux. This is done by inserting two brushes at right angles to the original brushes. The load is then connected to these new brushes and full voltage is produced by the armature flux. The flux produced by this current is reduced by installing a compensating winding in series with the load. This machine is called the amplidyne.

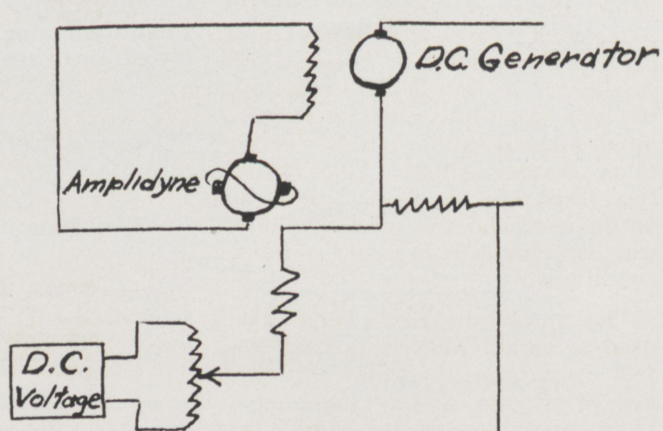
With the amplidyne, a very minute amount of power is able to control large amounts of power. This is the same function that many of the vacuum tubes perform. The field corresponds to the grid; a very small change in the amount of field power corresponds to a small change in the grid voltage of the tube.

This same amplification by conventional methods would require two generators and a corresponding time lag, one generator excited by the control signal and the second by the output of the first. The amplidyne combines these two into one, the armature reaction performing the function of the second generator.

The next step is to use this control. The circuit diagram of a typical control circuit is shown in figure 2. The circuit is set up so that a constant current output can be maintained. If for some reason the load resistance should go up, the load current will decrease and the voltage across the resistance in series with the load circuit will be decreased; this reduces the current to the field of the amplidyne, which in turn reduces the output current of the amplidyne, reducing the field of the main generator.

Other functions of the amplidyne are: accurate speed control, matching machine speeds to maintain continuous process control; limiting loads to protect electric systems and to prevent shock loads and destructive stresses on mechanical equipment; maintaining tension to improve product uniformity in winding, rolling, and drawing operations; speeding up acceleration and deceleration to increase production in high inertia machines; positioning precisely for fast and accurate setting of machine tools, arc-furnace electrodes, and other equipment; regulating current, voltage, power, and speed to maintain steady conditions and to improve power factor.





Left: Figure 1. Circuit diagram of an amplidyne showing flux relations.

Above: Figure 2. Control circuit with amplidyne used to maintain constant load.

These functions can be performed by other means, but the amplidyne has some advantages which cannot be duplicated by conventional means. These include simplicity, ease of maintenance, the ability to atttain amplifications as high as 10,000 to one, and an almost instantaneous response (within 1/10 of a second). Due to its lack of electrical inertia, the amplidyne boosts loads up to the operating boundary almost instantly, enabling machines to deliver smooth, peak performance even under rapidly changing conditions. The wide application of the amplidyne is due to its flexibility; it can be used with either A-C or D-C and can be used in conjunction with electronic tubes.

So far in this article the amplidyne has been shown as a two-stage amplifier responding to a single control field.

If several control fields, independently excited from signal devices, are placed on the same pole structure, the amplidyne will respond to their resulting action and amplify it in the same manner as for a single field.

The small space required by the individual coil makes it possible to have a normal complement of four fields, thus permitting many independent functions to control the amplidyne output. Each of these fields is easily adjusted by a small resistor or other means, and their action can be automatically blocked by small rectifiers as long as a certain operating condition or limit is not reached.

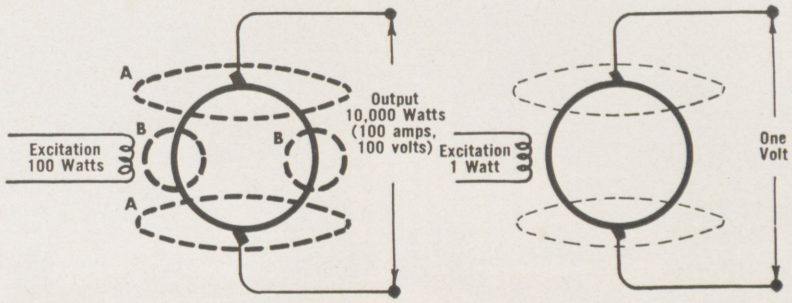
This use of multiple fields greatly reduces the number and size of control devices required to obtain a certain performance.

Also, because they are small, these fields are easily adjusted within a much wider range than conventional fields. Furthermore, because the smallness of the fields invites the use of a greater number of controls, automatic operation can be realized to a greater extent. Considerable flexibility can be built into this equipment, and the operating limits can be changed to meet required conditions.

The amplidyne has already been used to handle many industrial control requirements. Some of these are in the tin plating industry, in high speed planers, for shovel control, and for gun fire control. In one case it raised the capacity of a shovel more than 70,000 tons per year.

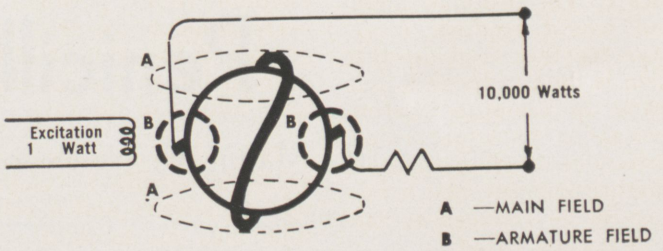
HOW THE AMPLIDYNE WORKS

Cuts Courtesy General Electric



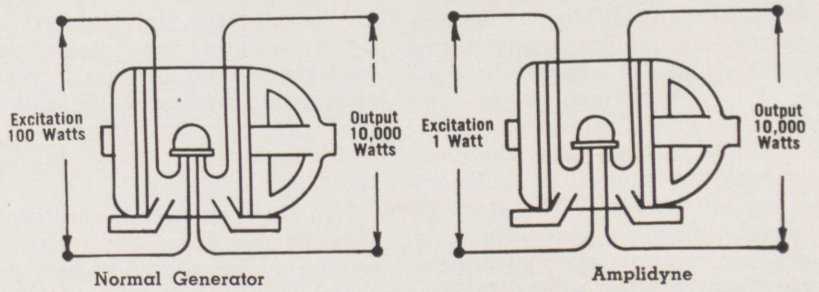
1. These are illustrations of normal D.C. generators, with dotted lines showing flux. The generator on the right has an excitation of one watt and generates one volt, requiring very little flux. The figure on the left shows the effect of loading this generator.

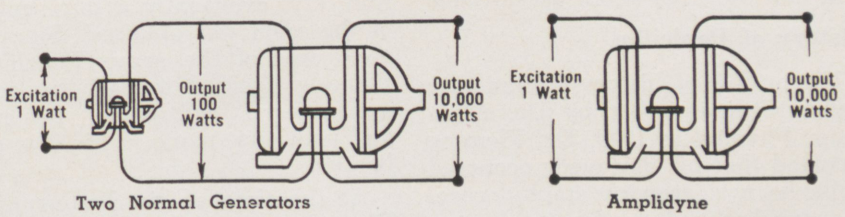
2. This figure shows the effect of shorting the output of a normal generator with an excitation of one watt. Note that normal full-load armature current and flux are thus maintained.



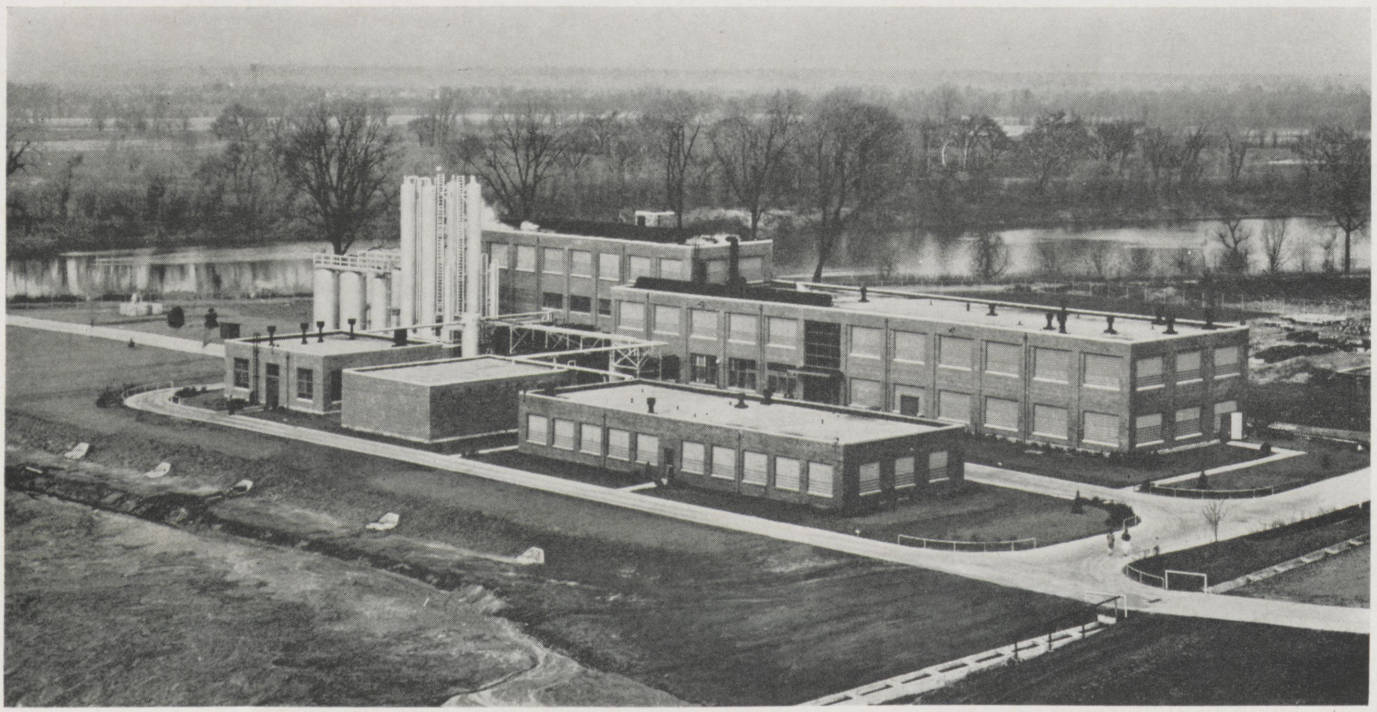
3. This armature flux is now utilized by adding brushes at right angles to the short-circuited brushes and using these new brushes to supply the load.

This machine is known as the amplidyne.





4. To produce the same power as the amplidyne, a normal generator must use a much higher excitation. Two normal generators are required if the initial excitation is the same as that of the amplidyne.



The Commercial Solvents Penicillin Plant at Terre Haute.

Penicillin

By Martin M. Newman, soph., ch.e.

Photos Courtesy Commercial Solvents

PENICILLIN has been called the most remarkable antibacterial agent ever discovered. No other medicinal agent has such a powerful effect on so many different diseases; yet penicillin, unlike many other powerful drugs, is completely non-toxic. Four years ago there was hardly enough in all America to cure a single patient; today the drug is available in quantities sufficient to satisfy all demands. The story of the development of penicillin is a remarkable example of international co-operation between scientists. Future research will undoubtedly reveal that the story is not yet finished.

History of Penicillin

The published history of penicillin begins with a report by Dr. Alexander Fleming in 1929. Dr. Fleming reported that his discovery occurred while he was growing staphylococci in petri dishes. In order to observe the progress of bacterial growth, the lid of the dish had to be lifted from time to time. These repeated exposures to the air led to contamination on one of the plates, and a colony of mold developed. The presence of the mold was not surprising to the scientist, but he was astonished to find that staphylococcus bacteria around the mold were disappearing. He found a definite, clear fluid around the fleck of green mold: some thing was killing the bacteria.

Fleming pursued the subject further. Spores from the mold, which proved to be a well-known growth called *Penicillium Notatum,* were transferred to an appropriate medium, and eventually a pure culture of the mold was obtained. Since the mold was of the genus Pencillium, Fleming decided to call the active antibacterial substance *penicillin,* and used that name in his first publication.

At the time of his discovery, Dr. Fleming was working at St. Mary's Hospital in London. Born in Lockfield, Scotland, he had been a student at St. Mary's Hospital Medical School. Later, while attending London University, he was given honors in physiology, pharmacology, medicine, and pathology. As a licentiate of Royal College of Physicians he won the University's bacterial professorship. It was his interest in finding a non-toxic antibacterial substance that led him to the research of penicillin.

It was not until ten years later, however, that penicillin was actually subjected to detailed experiments. This indifference towards a new discovery was partly due to Gerhard Domagk's discovery of the sulfa drugs. Doctors were too busy learning about the sulfonamides to be able to concentrate on a new topic, particularly one which presented such obvious difficulties. A better, even more successful bacteria-destroyer was almost more than medical men could take.

The first group to investigate thoroughly the mold penicillium notatum were British scientists of Oxford, in 1939. The leader of the

reseachers was Dr. Florey, an Australian professor of pathology. He had remembered Dr. Fleming's discovery and realized the urgent demand for such a drug. The team of experts he organized included professors of chemistry, bacteriology and pathology, among them his wife and Dr. Chain, a brilliant chemist who shares with Dr. Florey the honors for developing penicillin.

The researchers began their work with penicillin with test tubes. They first established the fact that the filtrates from the culture tube could be diluted five hundred to eight hundred times and even then would completely inhibit the growth of staphylococci. The big jump now had to be the test on human beings. Might it not also kill blood-cells? Dr. Florey and his group wanted to make sure, so they first tried it on mice.

Into 50 mice researchers shot huge doses of streptococci bacteria. The mice were then divided into two groups. One was to go without further attention; the other one was to be subjected to treatment with penicillin. During the night all unprotected mice died. All the others, except one, survived. Hundreds of other mice experiments followed—all with similarly favorable results.

At last Florey was ready to carry his work from mice to men. In the summer of 1941, he chose victims of ravaging diseases, against which all other medical treatments had failed. This last step was the longest, most hazardous one. Even with almost all of the Sir William Dunn School at work, it took many months before there was enough penicillin to treat human beings. At the end of the first ten cases Dr. Florey had proved that penicillin did not harm man and had no toxic effect on him, but that it did stop the development of bacteria in his blood.

At first, the small amount of penicillin available limited the supply to the most severe cases of the Armed Forces. Throughout the whole winter of 1942, only enough penicillin was produced in the U. S. to treat about fifty patients. A few hospitals made penicillin by "kitchen-culture". By June, 1943, enough of this drug was coming through to the National Research Council's Committee to begin handing out penicillin to twenty-two hospitals.

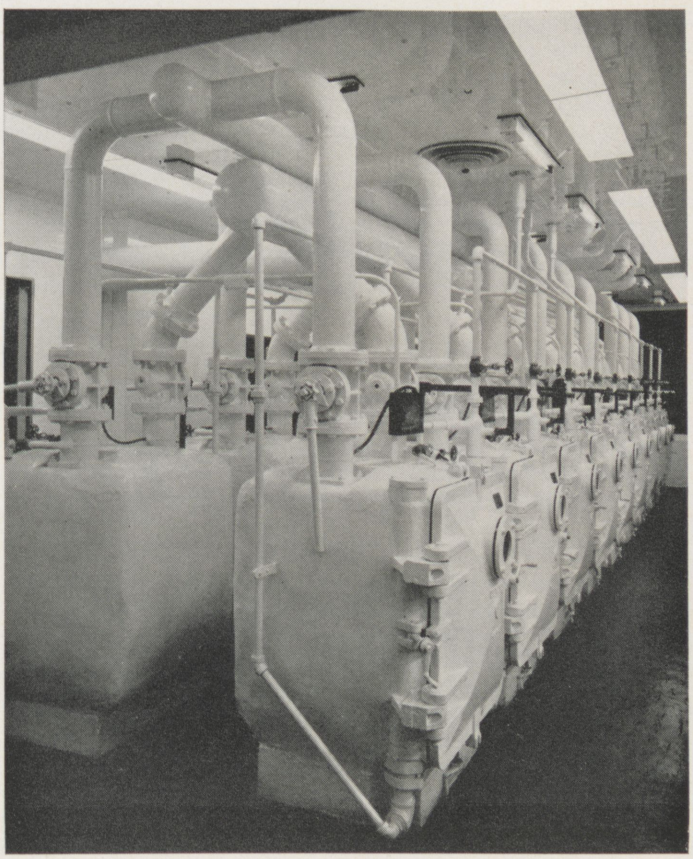
Production of Penicillin

One of the most remarkable sections in the story of penicillin concerns the rapidity with which the new drug was put into production. The main difficulty which blocked the development of large-scale plant production from laboratory processes was the fact that all operations had to be carried out under conditions of extreme sanity. In addition, the urgency of the project made it necessary to proceed with the construction and operation of full-scale plants simultaneously with research and pilot plant work. During normal times years would have passed by before an industrial process could be developed; under the pressure of war the whole job was accomplished in a matter of months.

The production of penicillin at the Commercial Solvents plant, the first full-scale plant to begin operations, is carried out in five steps: (1) fermentation of corn steep liquor with the mold, (2) filtration of the liquor and absorption of penicillin from the filtrate with charcoal, (3) purification of the penicillin with organic solvents, (4) freezing and high-vacuum dehydration, and (5) packaging, testing for toxicity, and storage.

The process begins with the inoculation of sterile feed liquor in vertical fermenters of 12,000-gallon capacity. The inoculating agent is a special mold strain especially suited for large-scale production because it is capable of growing submerged in vast tanks instead of being restricted

(*Continued on Page* 26)



Low-temperature, high-vacuum dryers for dehydrating penicillin.

The 12,000-gallon fermenters in which the penicillin is produced. Note man in lower left-hand corner.

Our Vanishing Mineral Resources

By David Templeton, jr., ch.e.

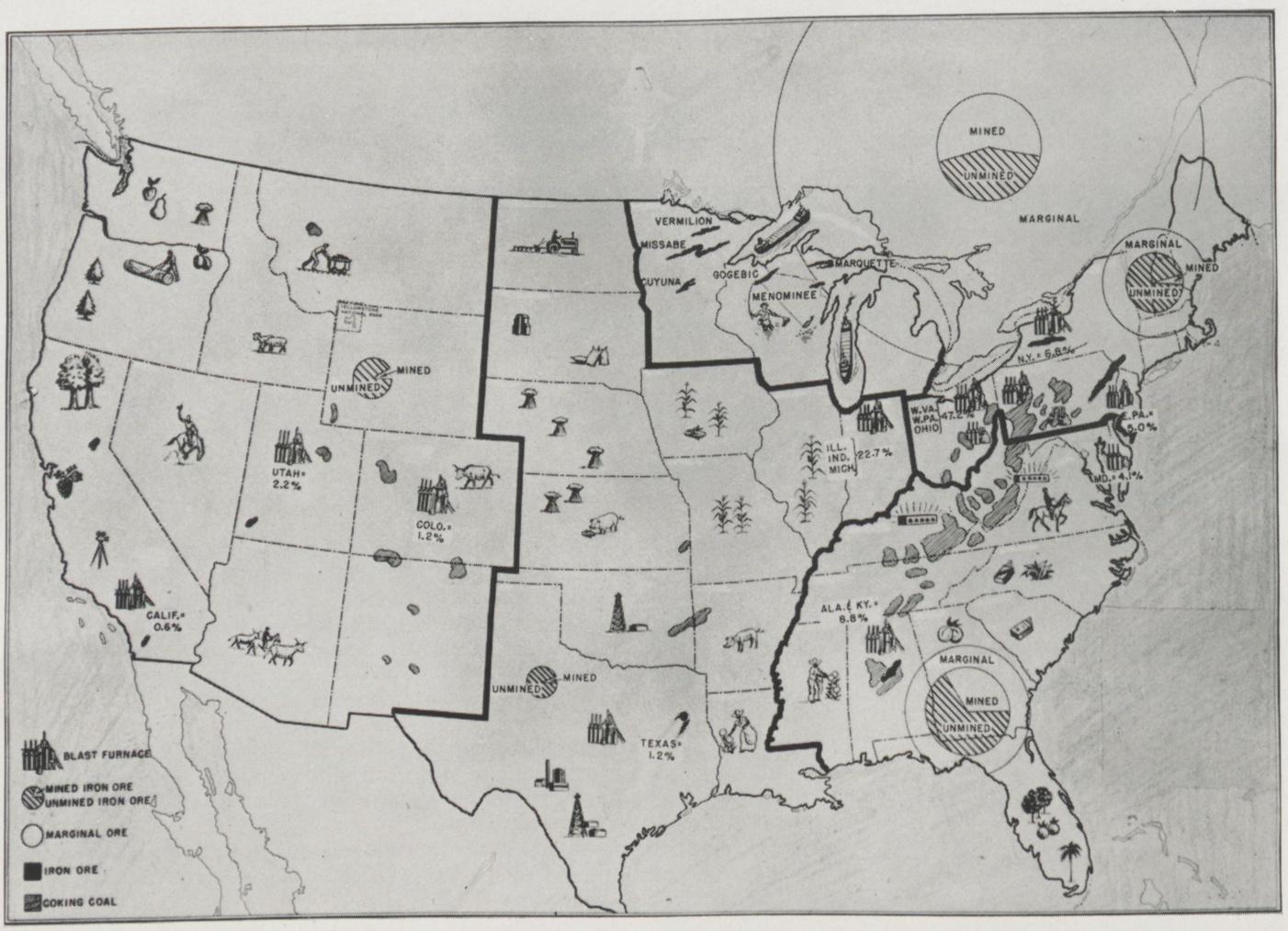
ALTHOUGH the United States has been traditionally known as a land of illimitable resources, the latest reports on our mineral supplies give some cause for alarm. Prepared by the Bureau of Mines and the Geological Survey, these reports show that supplies of high-class ores are being rapidly exhausted. The report strongly indicates that another war as debilitating as the one just completed will bankrupt the U. S. as far as mineral lodes are concerned.

During the first part of 1945 the above-named governmental agencies undertook an extensive survey to determine the amounts of mineral resources left in our country. The survey was instigated by the fear of another war finding the U. S. unprepared in regard to mineral resources. Statistics were calculated on the basis of the annual consumption rates for the peacetime years 1935-1939—an admittedly conservative basis.

The report revealed that only twelve out of thirty-three important minerals remain in sufficient abundance to supply the U. S. for more than 35 years. This length of time, it was pointed out, is little more than the average interval between recent large-scale wars.

The supply of many minerals is so low that imports already exceed domestic production. These include tin, manganese, nickel, tungsten, and antimony—many of which have never existed in the United States in large quantities. Others in this list are found only in low grade ores, which have not been exploited because it was cheaper to import high grade ores found in other parts of the world.

Several factors combine to make present estimates of ore potentials extremely unreliable, however. New deposits may be discovered, or known deposits may be found to be more extensive than is now realized. New processes may be found to utilize deposits of ores of such low quality that they cannot now be profitably exploited. Another pos-



This map gives an idea of the principal areas now producing iron ore, the coking-coal regions, and the concentrations of blast-furnace capacity as percentages of the U. S. total. Circles indicate quantities by regions of mined and unmined ore now considered commercial and rough estimates of marginal ore (data by E. W. Pehrson, U. S. Bureau of Mines). The amount of marginal ore in the Central and Western regions is thought to be small.

Westinghouse

sibility is the development of cheap substitutes, thus lowering the demand for many minerals.

Mineral supplies can never be eradicated, of course. By progressively lowering standards of quality, larger and larger quantities of minerals become available. The danger to our future economy lies in the rapid exhaustion of the cream of the ores—those ores which are most easily and profitably refined. The depletion of these ores will progressively increase the amount of labor required to produce basic industrial materials of a quality comparable to those now being used.

There is little danger within the immediately forseeable future that the U. S. will become a "have-not" nation. Fortunately, our supply of coal and iron ore, the basic raw materials in our present economy, is sufficient to meet our needs well into the future. In addition, many of the resources which are most depleted or missing in the United States are available in large quantities in Canada and other nearby countries in the Western Hemisphere. It is noteworthy, however, that many important subsidiary minerals are in such a state of exhaustion that we will be increasingly forced to depend on foreign sources if we are to maintain our present standard of living.

The present status of individual minerals may be summarized as follows:

NITROGEN is inexhaustible. All nitrogen-containing fertilizers, explosives, dyes, and other nitrogen-containing compounds can be synthesized from ammonia, which is manufactured from the nitrogen of the air cheaply and in large quantities.

SALT exists in enormous deposits in many areas of the U. S.

MAGNESIUM is now being commercially extracted from sea water, so that inexhaustible supplies will be available even if its abundant ores are completely depleted. It is noteworthy that nearly every mineral is contained in sea water, although most substances are present in such weak concentrations that commercial extraction is not now feasible. The future production of other minerals from sea water is a definite possibility.

COAL will be no cause for worry for a long time to come. Although we have used up a substantial portion of our anthracite, we still have large deposits of bituminous coal which have hardly been touched. The United States still has the world's largest known reserve of coal.

IRON ORE is extremely plentiful, although the best grades of ore will soon be gone. The Mesabi iron range, remarkable for its large quantities of easily accessible, high grade ore, will probably be stripped of its best ore within two decades. By reducing the standards for acceptable ore —with the consequent decrease in-industrial efficiency—this area will continue to furnish ore for hundreds of years. Many other areas in the U. S. contain workable deposits of iron ore.

PETROLEUM will not last much longer, with present forecasts ranging from 12 to 40 years. Petroleum reserves in the past have been notoriously underrated, but it is believed that present predictions are more accurate due to an increased knowledge of petroleum technology. Large petroleum reserves in other parts of the world will probably be increasingly exploited to supply our needs. With the exhaustion of her cheap reserves, America may turn to her deposits of oil shale, which are difficult to work but almost inexhaustible in extent. Motor fuels will also be synthesized from coal and natural gas.

COPPER, LEAD and ZINC are well depleted. After a few years of production at current levels, these minerals will begin a gradual decline to exhaustion.

An indication of the known potentials of many other important minerals is given in the chart above.

Minerals for which we will have to depend increasingly on foreign markets include zinc, lead, copper, cadmium, mercury, bauxite, vanadium, tungsten, platinum, and mica.

Minerals for which we already depend almost exclusively on foreign markets include asbestos, nickel, chromite, tin, industrial diamonds, quartz, and graphite.

With a degree of conservation the U. S. will be able to supply most of its minerals for a number of years yet. New ore discoveries and the development of substitutes may help the situation considerably.

SURVEY OF U.S. MINERAL RESOURCES

The following statistics give an indication of the length of time our known resources will last if present rates of consumption are maintained:

Mineral	*Percent of original supply remaining*	*Supply in years*
Magnesium	100	Indefinite
Nitrogen	100	Indefinite
Salt	100	Indefinite
Bituminous Coal and Lignite	98	4300
Phosphate Rock	92	805
Molybdenum	90	422
Anthracite	65	195
Potash	91	117
Iron Ore	68	111
Sulfur	58	55
Natural Gas	65	48
Fluorspar	55	40
Copper	40	34
Zinc	33	19
Petroleum	42	18
Gold	20	14
Lead	16	12
Silver	16	11
Bauxite	27	9
Vanadium	27	7

Antimony, tungsten, platinum, mercury, asbestos, manganese, chromite, nickel, tin, industrial diamonds, quartz crystals, and flake graphite resources range from a 4-year supply down to nothing.

Research and Development

Recent Advances in the World of Science

Research On Corrosion

What happens in the microscopic film formed on the surface of a metal when it is exposed to air? This is a serious question for chemists and metallurgists, since back of it lies the cause of rust and corrosion. To answer this question, research workers are now employing three important tools of modern science: the electron microscope, the electronic diffraction camera, and the vacuum microbalance.

The electron microscope makes possible the visual examination of the film by magnifying it about 50,000 times. This is accomplished by passing an electron beam through the sample or a collodion replica of its surface and then passing the beam through electromagnetic "lenses", obtaining a highly magnified image.

The diffraction camera also employs an electronic beam. In this instrument electrons are beamed to the target at an angle, so that they will be deflected from the surface to a strip of photographic film. The pattern formed by the electron beam on the film yields valuable chemical information as to the nature of the film.

The vacuum microbalance is a highly sensitive instrument enclosed in a vacuum chamber. The sample of metal to be tested is placed on the balance and counterweights are added. A small amount of oxygen is then added to the chamber. The balance then registers the small gain of weight due to oxidation on the surface of the metal.

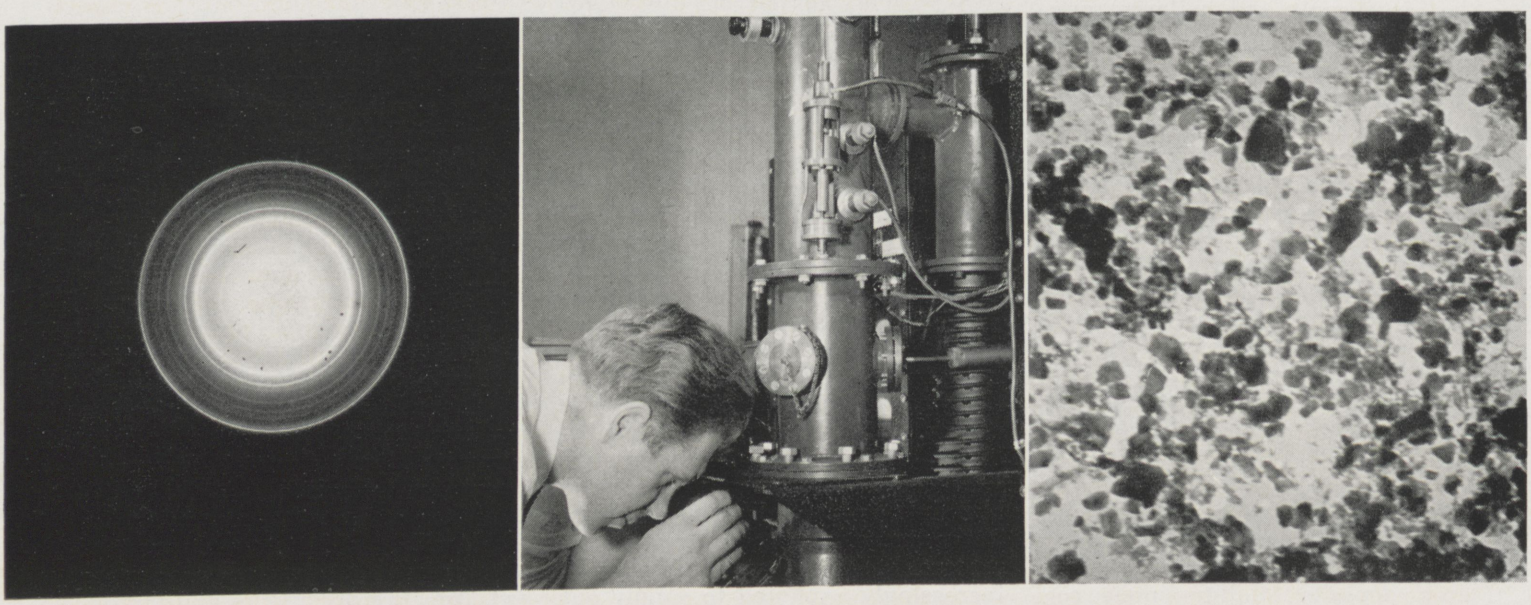
By studying the causes of rust, corrosion, and tarnish, scientists hope to provide the metallurgical know-how for producing metals and alloys resistant to such attacks, replacing trial-and-error methods of developing alloys. The studies may eventually be successful in producing better tin plate, cheaper stainless steel, stronger gas-turbine blading, and longer-wearing bearings for engines.

Advances in High-Vacuum Technique

The development of vacuum technique within recent years has made possible the production of pressures as low as 15 billionths of a pound per square inch, as compared with ordinary atmospheric pressures of about 14.7 pounds per square inch. At such pressures each cubic inch contains only about 150,000,000,000 molecules—a staggering number in ordinary life but very small in terms of molecules. The development of large-scale equipment has been carried out simultaneously with laboratory developments, so that extremely good vacuums can also be produced on a large scale. For example, it is now possible to construct equipment capable of evacuating a volume of 1000 cubic feet to a pressure of 15 billionths of a pound per square inch within one hour.

Practically all electronic tubes depend on high vacuum, from the smallest radio receiving tubes to giant 100-kilowatt tubes used in broadcasting. This is due to the fact that electron streams can be controlled accurately only when the number of molecules per cubic inch is less than one millionth of the number present at atmospheric pressure. Many instruments used in advanced scientific research would not be possible without the use of high-vacuum tubes—such as the betatron and cyclotron.

High-vacuum technique has proved indispensable in obtaining certain valuable chemicals by low temperature distillation. For example, high vacuum makes possible the extraction of extremely low concentrations of vitamins in fish oil without the use of high temperatures, which would destroy the vitamins. Likewise, the dehydration of penicillin and blood plasma are carried on under high vacuum to avoid the use of potency-destroying high temperatures. Applied to foods, the high-

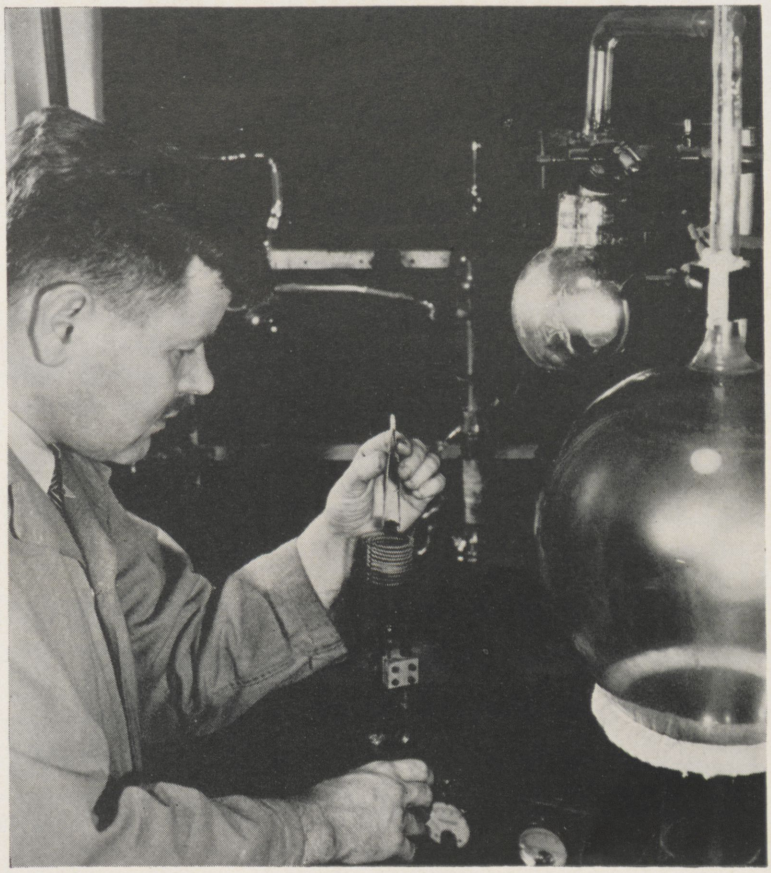


Left: An oxide film on stainless steel as it appears to the diffraction camera at a temperature of 1100 degrees F. Center: Operation of an electron microscope. Right: An electron micrograph of an aluminum oxide film (29,000 diameters. *Westinghouse*

All the pure uranium that was available to scientists at the outset of the atomic bomb project was made in this equipment at the Westinghouse Laboratories. The original purpose was to provide uranium for research on lamp filaments, but production was later maintained to supply the demands of scientific institutions, which had no other source of supply.

Then came the all-out atomic bomb program and the resulting demand for uranium. The laboratory was converted into a factory and production was begun immediately. Within a few months, daily uranium output was increased from eight ounces to several hundred pounds, and the cost dropped from $1,000 a lb. to $22.

By 1943, a much simpler and more efficient process for producing uranium had been developed. But the makeshift had supplied the large amounts of uranium needed for the construction of the first atomic pile.



vacuum dehydration process made possible a large-scale business. High vacuum has also been applied to metallurgy to effect the separation of pure magnesium and other pure metals from mixtures of low boiling alloys.

Bad News for Rats

Rats are more dangerous and destructive to man than any other animals except insects. One authority estimates that rat-borne diseases and plagues have caused more human deaths than all the wars in history. The direct property damage which they inflict throughout the world amounts to billions of dollars annually, and indirect damage is perhaps much greater. The control of these pests is usually based on poisons, none of which has been wholly satisfactory in the past. Recently, however, two new poisons have been developed which are capable of effecting complete eradication of rats within a given area in a relatively short period of time. These preparations are popularly known as ANTU and 1080, respectively.

The word ANTU is formed of the initial letters of the poison's chemical name, alpha-naphthyl thiourea. The substance is a fine, gray powder with very little odor or taste. Its efficacy as a rat poison was discovered accidentally in routine studies on phenyl thiourea, a related compound which has been used in inheritance studies on a large number of people. In attempting to extend these studies to rats, scientists were surprised to find that the rats quickly died from dropsy of the lungs, a condition in which the animals drown in the fluid from their own bodies. Since phenyl thiourea has a rather bitter taste, it was replaced by the tasteless but equally effective alpha-naphthyl thiourca.

1080 is a white compound with a very slight odor which seems to attract rats. The substance received its popular name from the fact that it was the 1080th compound tested by the Fish and Wildlife Service in their search for a new rodent exterminator. Their investigations revealed that a weight of poison equal to only 1/200,000 of the rat's weight is fatal to the animal. They also found that 1080, unlike ANTU, is extremely lethal to other animals, only 1/50th of an ounce being required to produce death in the case of a human victim. When prepared for actual use, however, 1080 will be diluted so much that it will actually be safer than most poisons formerly used. 1080 is now sold only to professional pest exterminators, but it is expected that it will eventually become available to the general public under restrictions and regulations guaranteeing its safe use.

ANTU was recently tested in large-scale field trials in Baltimore, which showed that the poison was capable of producing rapid results when properly used. In an emergency, such as a rat-borne epidemic of typhus or plague, the rat population of a city could probably be 95% eradicated with ANTU within a day or two, providing trained personnel were available to distribute it. Although ANTU is somewhat harmful to dogs, it is innocuous to human beings and most domesticated animals; hence, it may be applied almost indiscriminately. ANTU is most effectively applied as a dust, either pure or mixed with grain or flour. It may be left on floors or in bins

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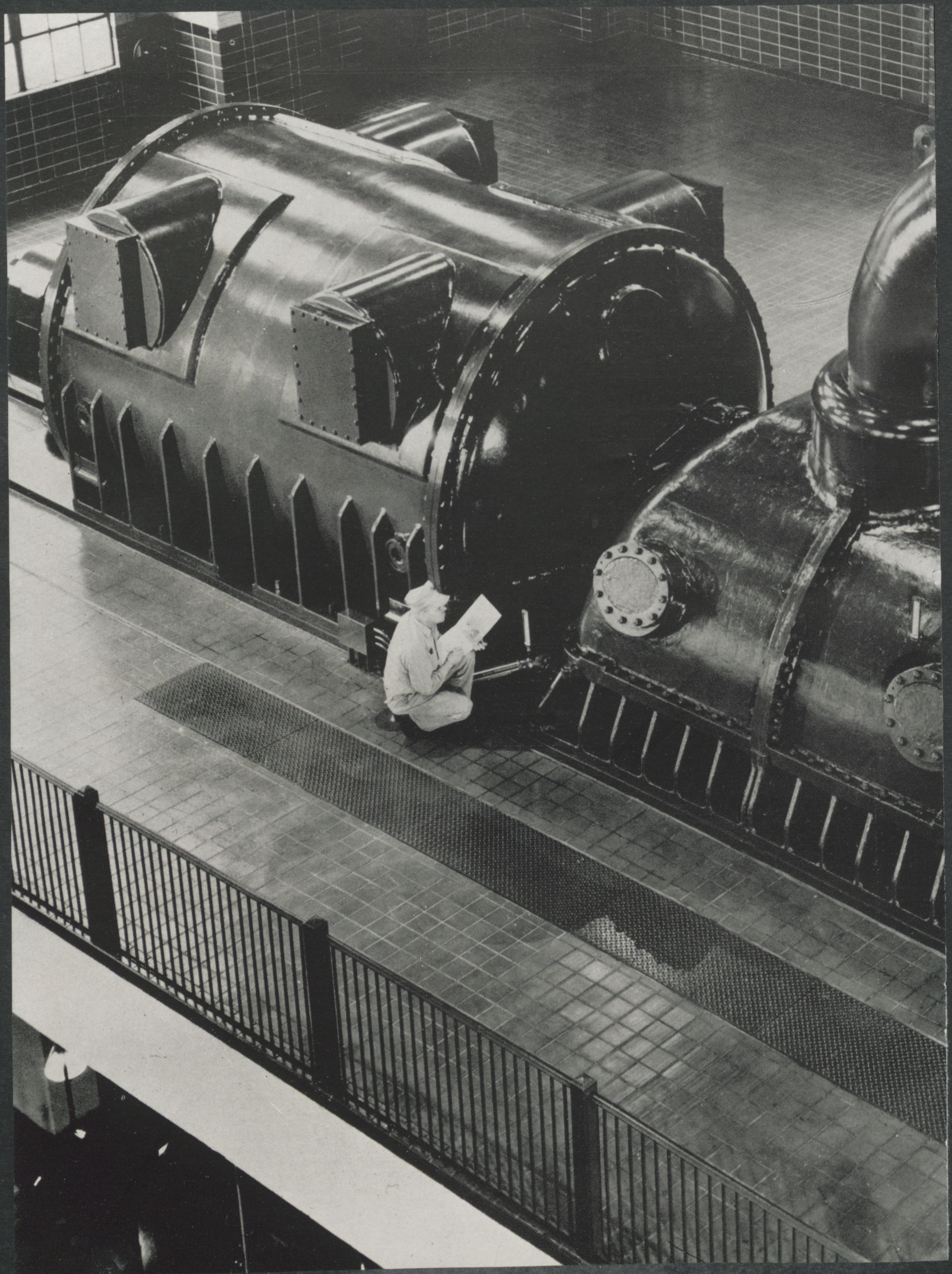
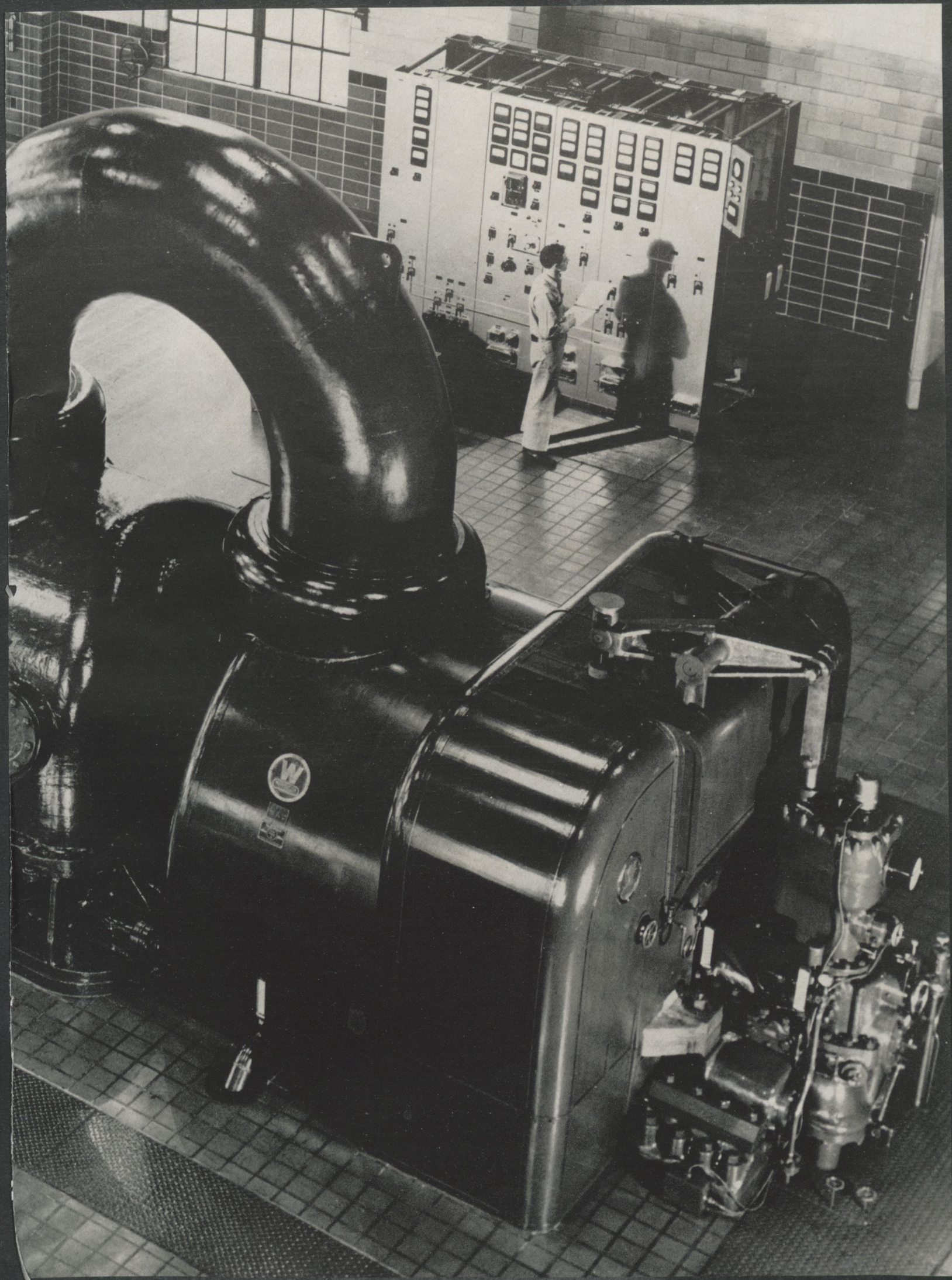




Alumni News

By William Blount, fresh.

Dave Demaree, '42, (concerning whom see news below) has suggested that we list the names of former Rose men now re-entering school to complete their courses. Nearly all these men, of course, are former service men.

The division of students as freshmen, sophomores, etc., is a little complicated to make as a result of the accelerated program, so we are listing the men according to classes in ascending order of scholastic credits. Here goes the list, together with the date at which each man left school:

Class M

David M. Diehl, 9-44
Richard L. Wodicka, 3-38

Class L

Edwin J. Booth, 6-43
Jesse W. Cook 10-43
James E. Fields, 12-41
William C. Hamrick, 6-43
David Leach, 1-42
John W. Norwalk, 6-40
Daniel F. Rice, 2-43
Joseph E. Wells, 6-42

Class K

Roy R. Baker, Jr., 6-41
Elmer F. Cooke, 2-43
William C. Egloff, 6-38
William D. Fowle, 5-42
Howard O. Hambrock, 1-41
William H. Harris, 12-41
Francis A. Heinz (ASTRP)
James C. Hoskinson, 2-43
William H. Jarret, 6-43
Kenneth E. McAbee, 10-41
John W. Martin, 1-43
Charles E. Maudlin, (ASTRP)
Robert J. Nash, 6-41
John W. Price, 6-41
James T. Rogers, 6-40
Allen E. Smith, 11-42
Carl E. Snodgrass, 9-43
Merrill P. Strong, 2-43
Anthony P. Tucciarone, 7-42
Robert A. Vance, 6-43
Standau E. Weinbrecht, 2-43
Preston A. White, 6-40

Class H

Francis M. Drury, 6-40
Thomas A. Duwelius, 1-43
Lyndon E. Eberly, 6-41
Jack R. Fehrenbach, 5-42
J. Richard Hawkins, 4-44
John F. King, 10-42
Robert R. Lafollette, 4-44
Alfred M. Lawson, 1-42
Robert K. Morse, 1-41
Emil A. Oprisu, 3-43
Herman W. Prust, 6-41
Richard F. Rieman, 10-43
Robert L. Voges, 2-43
John R. White, 6-43
William P. Woolsey, 2-43

Class G

Carl F. Kottler, 2-43
Robert W. Leathers, 6-43
Graham C. Weibel, 3-44

Class E

Harold E. Campbell, 4-44
W. Merritt Noel, 6-39
William D. Wolf, 6-38

The Grads Advance

'28 J. Rex Adams, ch.e., has taken a position with Stein, Hall and Company, Inc., of New York City as manager of their development department. During the war Mr. Adams, a major in the Chemical Warfare Service, was stationed at the Edgewood Arsenal.

'36 Francis M. Blair, e.e., is at Wright Field (Dayton, Ohio) working on airplane propeller design.

'38 Thomas G. Reed, m.e., is taking graduate work at the University of Maryland.

'40 David M. Huggins, m.e., has been discharged by the Army and has gone back to work for the Erie R. R. as special appliance foreman at the Meadville, Penna. roundhouse.

'41 John E. Bartmess, m.e., has been discharged from the army and has returned to his old job in the Cincinnati sales office of Westinghouse. Mr. Bartmess was overseas for three years with the Corps of Engineers.

'42 David M. Demaree, m.e., was recently transferred from the Goodyear Aircraft Corp., Litchfield Park, Arizona, to the Engineering Staff of the Goodyear Tire and Rubber Company, Akron, Ohio. Mr. Demaree became the father of a son, David Ross, on Nov. 25, 1945.

'43 Frank W. Peak, e.e., having received his honorable discharge from the Army, has returned to Westinghouse Electric in East Pittsburgh.

Marriages

Lt. (jg) Martin J. Cavanaugh, ch.e., '42, recently married Miss Kathleen Manion, of Terre Haute. After a honeymoon in Cincinnati the couple returned to Norfolk, Virginia, where Lt. Cavanaugh is stationed.

Deaths

Ferdinald Elbert Smith, e.e., '96, founder of the Gamma Gamma Chapter of Alpha Tau Omega, died at his home in Birmingham, Alabama on December 29. Mr. Smith retired in 1929 after being associated with the Continental Gin Co. of Birmingham for thirty-three years. At the time of his retirement he was the general superintendent of the factories.

Mr. Smith was active in civic work as a Trustee of the Avondale Methodist Church, Member of the Board of Trustees of the Masonic Lodge, Member of the Board of Directors of the Title Guarantee Trust and Loan Co., and President of the Alabama Motorist Association.

Edward H. McFarland, e.e., '04 (M.S., '06), died at his home in Orlondo, Florida on October 14, 1945. Mr. McFarland was the retired manager of the Ohio Power Co., Philo, Ohio.

William E. Fisher, ex-'42 (e.e.), was killed in an automobile accident on January 25. Mr. Fisher had just been discharged from the army and was planning to return to school next term to complete his course.

What's behind this symbol?

This is the familiar symbol of the Bell Telephone System that provides nation-wide telephone service—the best in the world.

The American Telephone and Telegraph Company, through advice and assistance, coordinates all Bell System activities.

The 21 Associated Companies provide telephone service in their respective territories.

The Long Lines Department of A. T. & T. Company furnishes Long Distance and Overseas service.

The Bell Telephone Laboratories, through constant research, develops new and improved communications apparatus.

The Western Electric Company manufactures telephone equipment, purchases and distributes supplies, and installs central office apparatus for the Bell System.

Communications is the business of the Bell System—to transmit intelligence quickly, clearly and at the lowest possible cost.

BELL TELEPHONE SYSTEM

Campus Survey

By George Staub, soph., e.e.

The Duration

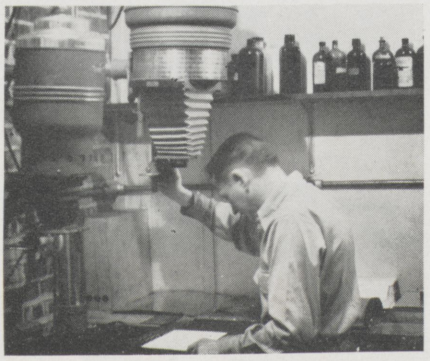
Is the war over; did another one start; or what? Some fellows are coming back from the service and some are still going. Its hard to tell which are in the majority.

In addition to the large number of veteran freshmen, many veterans are returning to the upper classes. For a list of these, see the Alumni News on page 18.

Soph's vs. Freshmen

Well! the sophomores (as has been the custom for years) are at it again. In one instance, one of the more worldly freshmen thought that he could outsmart the "Sherlocks" of class K, and ended up running the cinder path, barefoot.

The traditional opening of the laking season is Saint Pat's day, March 17. Due to the rather small number of non-veteran freshmen, the lake will probably not become crowded until summer. (Veterans are not subject to hazing.)



Camera Club

Behind that bulletin board just north of the Machine Design Room is located a room where, to the eerie amber light of the photographer, one may discover the hidden wonders and pleasures of the culmination of the process started when he leisurely snapped the shutter of his "Speed Graphic", or Pin Hole camera.

Photography is a very useful art to the modern engineer. Many of the larger companies insist on a photograph of all their new designs and in many cases maintain a staff for just this purpose. Therefore, it is quite expedient that we know the proper lighting effects, development processes, etc. Photography also offers many opportunities for pleasure, like recording that first smile Junior gives his proud poppa (or are you going to be a bunch of bachelors?) Now you wouldn't want to spoil that picture because of a lack of "know how", would you?

The Camera Club holds weekly meetings and its darkroom is available to members at any time. Its members furnish photographs of special interests to the "Technic" and "Modulus" and hold contests (among the membership) at frequent intervals. Watch the front bulletin board for meeting announcements.

Editorial room on a busy day.

The Technic

The *Rose Technic,* our campus magazine, has been publishing continuously since 1891. A large and active staff is required to keep things running smoothly, and openings for new personnel are cropping up constantly. Students interested in this type of work should stop in at the *Technic* office during any noon period.

Copies of the *Technic* are free to Rose students. Watch the bulletin board for publication notices each month.

Enrollment at Rose gradually rises back to normal—Scenes from the parking lots.

Glee Club

One of these days we'll have to have the Glee Club perform for us (sort of a recital or something—I think that if enough requests were made to Glee Club officers, this might be arranged.)

The Glee Club is a very active organization, meeting once a week, and performing in public quite often. For definite information regarding their meeting night watch the front bulletin board, or ask any member. (To find a member just watch any group singing "Dear Old Rose". He'll be the one that appears to be caressing each word.)

Rose Tech Debate Club

The Debate Club is still in there pitching. Anyone looking for a lot of fun, interesting competition, and a chance to improve his speaking technique should see Ted Blickwedel. Incidentally, each active member receives two scholastic credits per season, two honor points for every intercollegiate debate participated in (not more than 10 honor points per season), and a Rose Tech Debate Club Key, upon the completion of two seasons with the club.

Student Council

At the close of last term the members of the Student Council elected Jack Doerffler as their Financial Secretary, and by the time you read this, they shall have elected the balance of their officers. In case you're in the dark about the Student Council, it is the executive element of the student body, made up of the president of each active class (or his representative) and a representative of each active student organization recognized by the Student Council.

Radio Club

If you're interested in radio, be sure to attend the meetings of the Rose Radio Club. Jack Doerffler, the President of the club, promises a very active season.

Other Clubs

The above-mentioned clubs are among the more active clubs on the campus at the present time. If you are interested in any field not covered above, consult the Student Handbook or see Miss Gilbert.

The January crop of freshmen (Class M).

VALVE METERS

(*Continued from Page 7*)

of this method of determining the zero point was twofold: The valve was flushed clean of any foreign material which might obstruct the flow until the valve was fully opened, and any error due to slack in the valve stem was eliminated.

The taps for determining the pressure drop across the valves were made by first welding on a ¼-inch half-coupling, screwing in a short nipple, and then drilling holes with a ¼-inch drill two and a half pipe diameters upstream and eight pipe diameters downstream from the valve. Great care was taken to remove all burrs from the edges of the holes on the inside wall of the pipe. These openings were connected to calibrated Bourdon pressure gages for large differential pressures and to a mercury manometer for small differential pressures. Readings on the pressure gages were taken to the nearest 0.5 pound per square inch on the upstream gage and to the nearest 0.2 pound on the downstream gage. The manometer readings were taken to the nearest 0.1 cm.

The quantity of water discharged was determined by weight on Fairbanks platform scales of 1000-pound capacity. In determining the rate of discharge, the time was measured by a Kodak timer. The Reynolds number, referred to the pipe, for all runs varied from 30,000 to 150,000. The source of water supply for the investigation was a blow case which furnished the various pressures, ranging from 10 to 40 pounds per square inch. During any one run, constant pressure was maintained.

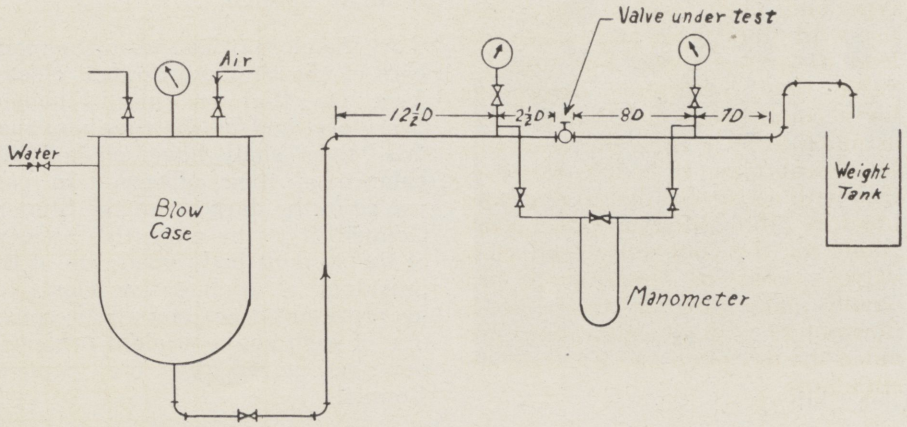


Figure 2. Diagram of Apparatus.

Discussion and Results

The working equation for computing the actual rate of liquid flow through an orifice, adopted by the A.S.M.E. Special Research committee on fluid meters, is

$$(1) \qquad w = KA\sqrt{2gd\ (P-p)}$$

For this study Equation 1 was modified to

$$(2) \qquad w = K_1/12\sqrt{2gd\ (P-p)}$$

where K_1, the valve flow coefficient, as defined here, differs from the standard orifice flow coefficient only in that it includes the cross-sectional area of the discharge opening and is not dimensionless. Simplifying Equation 2,

$$(3) \qquad K_1 = 1.496\ w/\sqrt{d\ (P-p)}$$

Globe-valve flow coefficients calculated from data obtained in this study are shown graphically on logarithmic paper in Figure 5. These valve flow coefficients were calculated from Equation 3 using values obtained by measuring the rate of water discharge and differential pressure at various valve settings.

The average deviation from the mean value of the flow coefficient is usually rather small. One valve reproduces the results of another, usually within less than 5% on the ½-, ¾-, and 1-inch valves; results on the 1¼-inch valves varied less than 3%. The largest deviations were obtained at ¼ turn open, which were probably due to variations in the valve settings or flow characteristics at close throttling conditions. The valve settings are less critical as the opening increases. There is also danger of wiredrawing the seat when the flow is throttled down to ¼ turn open. For these reasons use of the ¼ turn open setting is not recommended.

Even with the favorable agreement shown above, it should be pointed out that valve flow characteristics are influenced considerably by manufacturing variations, design details such as type of disk, contour of body, etc., and direction of flow through the valve orifice, so that use of the flow coefficients giv-

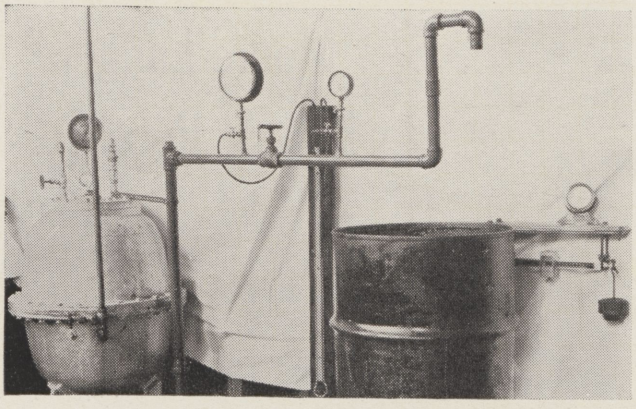


Figure 3. Photograph of Apparatus Used in Determining Globe-Valve Flow Coefficients.

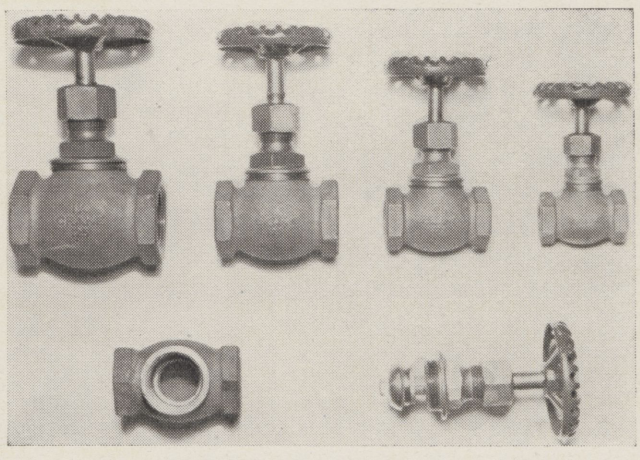


Figure 4. Photograph of Globe Valves.

en here should be restricted to the type and make tested, since their use with other types and makes may lead to serious error. For example, valve flow coefficients determined for a composition disk valve varied as much as 30% from the brass-disk bevel-seat type. It is felt, however, that with consistent design and manufacture the average flow coefficients for the commonly used globe valves could be determined; this would make possible their use as flowmeters without calibration, provided the deviation and accuracy are stipulated.

The valve flow coefficient curves given in Figure 5 may be used for computing rates of flow through these Crane valves without calibration, where the above maximum deviations are permissible. The pressure taps should be installed according to Figure 1, the direction of flow is upward through the orifice, and the weight rate of flow, w, is calculated from Equation 3. While it is known that there is little variation in orifice flow coefficients with Reynolds numbers above 30,000, it should be noted that the valve flow coefficients presented here were determined with Reynolds numbers, referred to the pipe, between 30,000 and 150,000.

Figure 6 shows the flow characteristics of the globe valves used. The values for percentage of total flow and percentage of total turns open were calculated from the mean values of the flow coefficients, assuming a constant pressure drop.

A comparison was made between valve flow coefficients obtained in this study with those calculated from data obtained by Corp and Ruble and the Crane Company for loss of head through fully open Crane globe valves. The present data compare favorably for the ¾- and 1-inch valves tested by Corp and Ruble in 1919, being 0.5% higher and 2.9% lower, respectively. The ½-inch valve is 20.5% higher. This unfavorable agreement may be due to the fact that the ½-inch valves were tested by Corp and Ruble with Reynolds numbers less than 20,000. The Crane Company's value for the ½-inch valve flow coefficient was calculated from k = 10.0 in the equation $H = kV^2/2g$. Agreement within 3.1% in shown here.

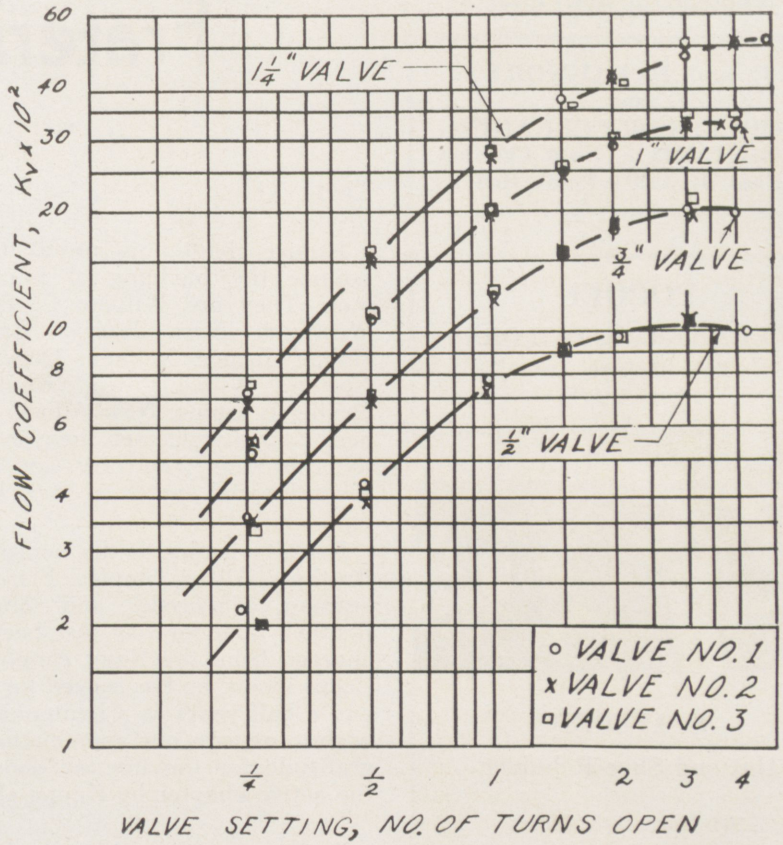


Figure 5. Globe-Valve Flow Coefficients at Various Valve Settings.

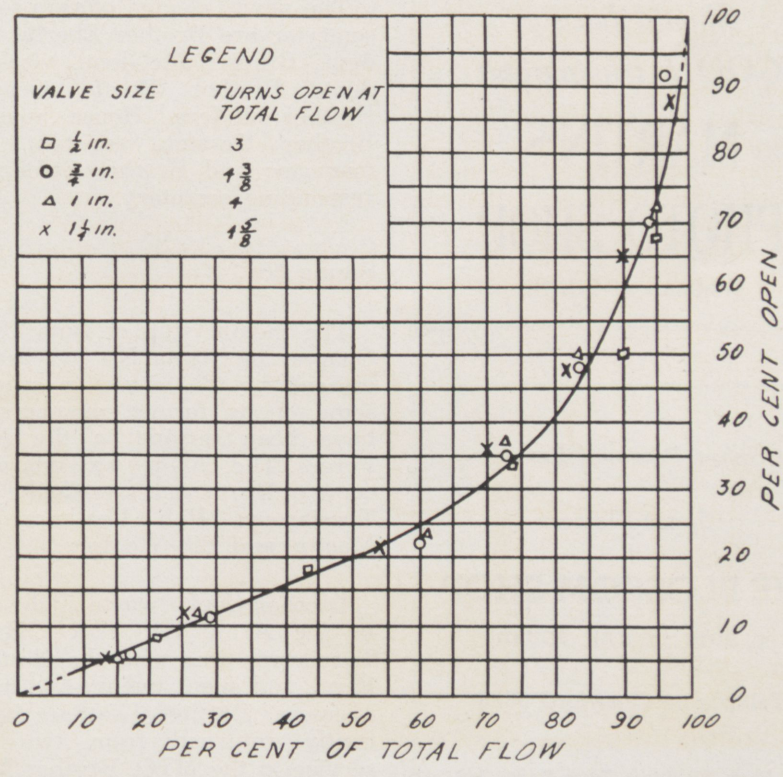


Figure 6. Flow Characteristics of Globe Valves with Flow Upward through the Orifice and Based upon a Constant Pressure Drop.

Fraternity Notes

Theta Xi

Kappa chapter is proud to announce the pledging of four new men. They are William C. Blount, Westfield, New Jersey; Ray C. Haller, Jasper, Indiana; Darwin G. Norton, Williamstown, Kentucky; Orville L. Stone, New Albany, Indiana. Kappa welcomes them into the folds of the fraternity and plans several social events in their honor.

Recent visitors to the house were Brothers Albon, Staples, Frigo, Silverman, Nancrede, and Zhender. Brother Zhender has just been discharged from the Navy Amphibious Corps where he has served for three and a half years as a lieutenant. We wish to express our appreciation and gratitude for the interest shown in the active chapter by Kappa alumni.

Active members who attended the recent Theta Xi alumni dinner at Indianapolis were Brothers Booth, Penno, and Eberly. Brother Liddle, who graduated last semester, and Brother Fischer, who shall be back in school soon, also attended.

The newly elected officers for this semester are Brother Eberly, President; Brother McGlone, vice-president; Brother Booth, treasurer; Brother Jeffers, House manager; Brother Kersten, assistant house manager; and Brother Strong, corresponding secretary.

Sigma Nu

The membership of Beta Upsilon Chapter of Sigma Nu has been increased by the return to school of some of its former members who have been serving in the Armed Forces. The chapter extends a welcome to Brothers Elmer Cooke, Tony Tucciarone, Bob Leathers, John Martin, and Bill Woolsey.

Brother Cooke was a flight officer in the Army Air Force. Brother Tucciarone was with the Ninth Air Force and spent twenty-five months overseas. Brother Leathers has recently returned from two years service in the MTO. Brother Martin was a pilot in the Eighth Air Force and served thirty-nine months in the ETO. Brother Woolsey recently returned from three years service in the Navy Air Corps.

At the meeting held January 7, plans were discussed for the coming rush party and social events to be held in the near future.

Alpha Tau Omega

Indiana Gamma Gamma of Alpha Tau Omega has received word of the death of its founder, Brother Ferdinand Elbert Smith, who passed away December 29, 1945. The loss of Brother Smith has been deeply felt by the entire chapter. He founded Indiana Gamma Gamma at Rose on January 8, 1894, and was one of the key men in the building of Alpha Tau Omega. In tribute to Brother Smith, the chapter brothers have draped their pins for a period of thirty days from January 21 to February 20.

The chapter held a rush party on Saturday, January 19, at 2:30 P. M. The rushees were entertained at the chapter house with various activities, games, and refreshments. On the following Monday, four men were pledged. Those taking the pledge were William J. Kirchner, Terre Haute; Charles E. Maudlin, Jr., Lebanon, Indiana; David M. Mullen, Jeffersonville, Indiana; and James E. Snider, Jr., Terre Haute. Following the formal pledging ceremony, the new pledges were welcomed into the chapter by the actives at a party held at the house.

The chapter attended the services of St. Benedict's Catholic Church on the morning of January 27. In the afternoon of the same day, a formal initiation ceremony was held. The men who were initiated into active membership are as follows: Willis Hudson, Lawrenceville, Illinois; Robert Liggett, Terre Haute, Indiana; and William Stutz, Terre Haute, Indiana.

Indiana Gamma Gamma now has 25 active members attending Rose as well as four pledges. The chapter has almost reached its prewar status and will do so in the near future.

Radio relay towers, about 50 miles apart, will gradually replace thousands of miles of telegraph poles and wires.

Now, telegrams "leapfrog" storms through RCA Radio Relay

With the radio relay system, developed by RCA, Western Union will be able to send telegraph messages between principal cities without poles and wires.

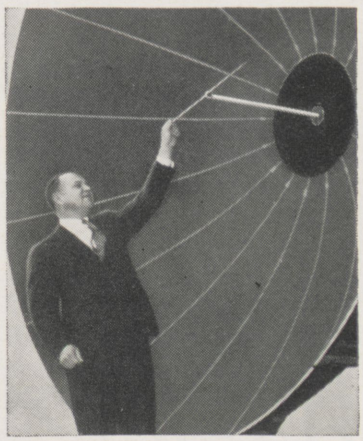
"Wires down due to storm" will no longer disrupt communications. For this new system can transmit telegrams and radiophotos by invisible electric microwaves. These beams span distances up to fifty miles between towers and are completely unaffected by even the angriest storms.

When large numbers of communications circuits are required, these automatic radio relay systems are more efficient than the pole and wire system . . . are less costly to build and maintain. They'll be particularly useful, too, in areas such as China and South America where distances are great and long-line services have not been developed.

This revolutionary stride in communications was made possible by research in RCA Laboratories—the same "make it better" research that goes into *all* RCA products.

And when you buy an RCA Victor radio or television set or a Victrola* radiophonograph, you enjoy a unique pride of ownership. For you know, if it's an RCA it is one of the finest instruments of its kind that science has achieved.

Radio Corporation of America, RCA Building, Radio City, New York 20, N. Y. . . . Listen to The RCA Victor Show, Sundays, 4:30 P. M., Eastern Time, over the NBC Network.



Research in microwaves and electron tubes at RCA Laboratories led to the development by the RCA Victor Division of this automatic radio relay system. Here is a close-up view of a microwave reflector. This system holds great promise of linking television stations into networks, as well as relaying other forms of electric communications.

RCA **RADIO CORPORATION of AMERICA**

*Victrola, T. M. Reg. U. S. Pat. Off.

PENICILLIN

(*Continued from Page* 11)

to the surface of the culture medium, like most strains. The culture medium is corn steep liquor, a cheap industrial by-product enriched with lactose—a mixture which gives maximum yields. The temperature is held carefully to about 75°F, and sterile air is blown through the fermentation tank to promote the growth of the mold.

If the proper conditions are rigidly maintained at all times, and if no contamination has been introduced, the fermented liquor will contain a minute concentration of penicillin after about a week. At the end of this period the mold is filtered off and discarded, while the penicillin-containing filtrate is agitated with activated charcoal. The charcoal absorbs more than 90% of the penicillin, together with certain other constituents.

The purification of the crude penicillin is effected by a number of extractions with various solvents to remove impurities. At the end of this process the penicillin is converted into a sodium salt, which is very soluble in water. After a final filtration to remove bacteria and pyrogens (fever-producing substances), the penicillin salt solution is pipetted into small bottles, which serve as the final containers.

Since the drug rapidly loses its potency in solution, it is converted into powder before storage. This is accomplished by freezing the solution at a low temperature and dehydrating it under extremely high vacuum until the water content is less than 1%. (Evaporation under normal pressures would require the use of potency-destroying high temperatures.) Although the final product contains a high percentage of harmless organic impurities (up to 80%), it assays very high in potency. Each lot is tested for toxicity and pyrogens by injecting samples into white mice and rabbits. The finished product is stored at a temperature of 40°F.

Medical Aspects of Penicillin

The medical action of penicillin seems to consist of preventing the multiplication of bacteria, thus allowing the body to dispose of the limited number of bacteria in the usual manner. The drug is usually administered by intramuscular or intravenous injections, which must be given frequently (two or three hours apart) if the concentration of penicillin in the body is to be maintained at a high level. It was believed at first that oral administration of penicillin would be totally ineffective, due to the fact that the acidity of the stomach destroys most of the drug before it can be absorbed. Recently, however, it has been found that large doses of penicillin in capsule form are effective when administered orally.

Penicillin has proved effective against a large number of bacilli, many of which are resistant to the sulfa drugs. A partial list of bacteria against which penicillin is a powerful weapon includes streptococci, staphylococci, gonococci, gas gangrene bacilli, and pneumococci. The drug is also effective against many cases of syphilis, particularly with the early cases. Diseases which do not respond to penicillin include tuberculosis, malaria, typhoid fever, infantile paralysis, yellow fever, flu, and the common cold. Of course, penicillin is also ineffective against such organic diseases as cancer and non-infectious heart disease.

The development of penicillin has naturally stimulated research upon related drugs which may be present in other molds. Many claims of the discovery of drugs even more powerful than penicillin have been put forth, although none of these drugs have been investigated sufficiently to make definite predictions of their future use. An extensive chemical investigation of penicillin has also been made, and it has been announced that the chemical structure of the drug has been determined, although the details have not yet been released. By synthesizing chemicals with structures similar to that of penicillin except for slight modifications, scientists may be able to create new drugs of even greater potency.

Whatever new developments may come, however, the world will remember Dr. Alexander Fleming's discovery as one of the great events of the twentieth century.

RESEARCH & DEVELOP.

(*Continued from Page* 15)

infested with rats, dusted on the surface of water where rats are likely to drink, sprayed on fruits and vegetables, or blown directly into rat holes and burrows.

1080 has undergone much more extensive testing than ANTU. Since it is such a deadly poison to human beings and other animals, great precautions must be taken with it. One effective method is to dissolve about ½ ounce of 1080 in a gallon of water and set it out in paper cups in places where only rats can reach it. Curiously enough, rats seem to prefer the poison solution even when fresh water is available. Another method is to poison rat-infested areas with grain mixed with 1080 in the ratio of about one pound of 1080 per ton of grain. The concentration of 1080 in this mixture is so small that the grain is relatively safe to use where sheep and cattle are grazing. It has recently been found that birds can be protected from such grain by coloring the grain green. Since rats are color-blind, they do not show a similar aversion to the green dye.

Although 1080 is extremely poisonous to humans, it will probably find wider application than the non-poisonous ANTU because it is more effective in controlling many pests. For example, ANTU is very poisonous to the Norway rat, which is common in the U. S., but it does not have a satisfactory effect on the Alexandrine rat found in many other parts of the globe. On the other hand, 1080 is effective against not only all species of rats, but also mice, squirrels, and all other rodents. In the future it may also be used in Australia to check rabbits which infest the continent.

Counter-Radar

Much publicity has been given to the story of the development of radar. Less well known, however, is the story of counter-radar—an elaborate system of scientific tricks and devices used during the war to render the enemy's radar useless. The U. S. alone spent more than 300 million dollars for research on this subject. The success of the Allied bombing campaign and the saving in lives was well worth the price.

The development of counter-radar started with radar's fundamental weakness: radar waves reflected from a target are so feeble that they can be blotted out easily by a weak or distant transmitter on the same frequency. This effect is analogous to "jamming" ordinary radio signals. The device which achieved this effect required three years to develop and was so large that seven big army trucks were required to transport it. The principal part of the device is a pair of powerful, 500-pound tubes, called Resnatrons. Each tube transmits a continuous wave of static at the rate of 50 kilowatts—about the same as is used in many radio stations. One of the most difficult problems encountered in the development of the device was getting the tube to send out its ultra-short waves in a continuous flow instead of in the bunches or pulses of a radar beam.

The static produced in the Resnatron was piped through a coaxial cable into a wave-guide pipe and then into a huge antenna—a 30-foot parabolic mirrow which fanned the beam out so that it was effective several hundred miles away. The static appeared on the fluorescent screen of the enemy's radar set as a confusion of luminous spots which completely blotted out the fainter spots produced by Allied bombers. Although it was obvious to the operator that the signals were created by static and not by planes, the knowledge was useless to him because he was unable to separate the target indication from the brighter blobs transmitted by the more powerful Resnatron. Furthermore, it was useless to switch the radar set to a new frequecy, since the Resnatron emitted a continuous wave of static at all wavelengths used in German radar systems.

The Resnatrons were of little aid to the U. S. daylight bombers, which penetrated deep into Germany in tight formations which aided defense against enemy fighters but allowed easy detection by enemy radar. For protection of these planes small transmitters were developed to be carried on each plane. Like the Resnatrons, these transmitters send continuous waves of static to make accurate antiaircraft fire impossible. These devices cut our daylight bomber losses by 50%.

Another effective counter-radar trick was to toss strips of aluminum foil from the planes. Two ounces of such foil reflected enough waves to the enemy's radar sets to produce the effect of a whole bomber. The total effect of the trick was to produce hundreds of luminescent spots on the fluorescent screen, completely blotting out the bombers. Although this trick was cheap and very simple, it was so satisfactory that the Nazis never found an answer to it.

Brain Twisters

(Answers on request)

1. The following problem represents a sum in arithmetic in which the numbers are replaced by letters. A given letter represents the same number throughout the problem, and likewise a given digit is always represented by the same letter:

S E N D
M O R E

M O N E Y

There is only one possible solution to the problem.

Psychologists have given this problem to many classes of college students. Only a very few have been able to work out the correct answer without aid. However, we trust that Rose students will not find it too difficult.

2. A butcher uses a balance to weigh meat for sale to his customers, but unknown to him one arm of the balance is slightly longer than the other arm. On the average, he uses each pan with equal frequency as a container for the meat. Does he gain, lose, or break even because of the inaccuracy of the balance?

3. A tramp was crossing a long railway bridge. When he was 2/5 of the way across, he heard the whistle of a train in the distance. By hard running he was able to reach the opposite bank just in time to avoid being killed by the train. He later calculated that he could also have escaped just in time by running back to the other end of the bridge. If the tramp runs at the rate of 12 miles per hour, what is the speed of the train?

This problem can be solved by the use of logic and arithmetic, without any data on the length of the bridge or the original distance of the train.

4. A certain type of bacteria double themselves every hour under favorable conditions. When one of these bacteria was placed on a plate of culture medium in a warm place, a colony developed which grew until it had covered the whole plate at the end of 30 hours. How long will it take to cover the plate under similar conditions if the colony is started with two bacteria?

5. Three philosophers lay down under a tree for a nap one warm summer day. As they slept a practical joker smeared their faces with dirt. After a short time they were awakened simultaneously by a noise, and each began to laugh at the other two. Suddenly one of them stopped laughing, for he realized that his own face was dirty. What was his reasoning?

Why not send in your own pet problems to our Brain Twisters Department?

You just THINK you're touching aluminum, mister!

Pick it up . . . in your bare hands . . . anything made of aluminum. Your cigarette box. A saucepan. The foil on a chocolate bar.

You're not touching aluminum. You *never* have, never will.

The reason is very simple. Aluminum is constantly covered with the thinnest of thin "skins". It is Aluminum Oxide. You can scrape it off, but it re-forms immediately. In a split second.

This—the scientists at Alcoa's Aluminum Research Laboratories learned many years ago . . . but they didn't stop there. They wanted to know what could be done to this "skin" . . . how it could be made thicker, thinner, harder, porous . . . so that Aluminum products could be more useful and serviceable.

Out of this Alcoa research on the "skin" of aluminum have come many new things. Aluminum pistons of porous "skin", to hold oil. Aluminum trays of lush lustre that won't tarnish—ever. *Colored* aluminum—the color dyed right into the "skin".

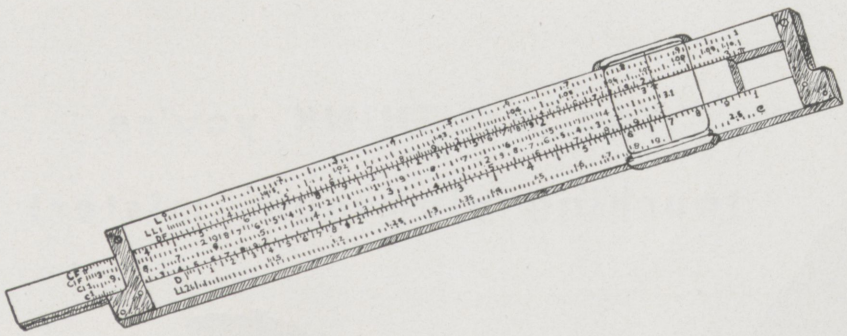
Yes, Alcoa has found many ways of not only controlling this "skin" but also of making aluminum better and more versatile in many, many ways . . . *but the search still goes on* and always will.

This *search* calls to young men of science and engineering . . . and spells new opportunity to salesminded men of tomorrow.

The next time you pick up . . . in your bare hands . . . anything made of aluminum, say to yourself, "What *new* could I make this light, strong, durable metal do for man . . . some day?"

ALUMINUM COMPANY OF AMERICA, Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN **ALUMINUM**



Sly Droolings

by Derald Heady, fresh.

We have just received word from K. T. Martin that things are so dry in Texas that the trees are going to the dogs.

* * *

And the old maid said: "Don't put 'Miss' on my tombstone when I am gone, for I haven't missed as much as you think I have."

* * *

"I'm losing my punch", she moaned as she departed hurriedly from the cocktail party.

* * *

Down around Muncie, Indiana, they grow 'em tough. Not long ago the truant officer was working on the other side of the tracks when he spotted a small boy seated on the steps of his home.

Officer: "Why aren't you in school, young man?"

Boy: "Hell, mister, I ain't but five damn years old."

* * *

He: "Did you bake these biscuits with your own little hands?"

She: "Yes, why?"

He: "I was just wondering who in the hell you got to lift them down off the stove for you."

OUTRAGED HUSBAND

A man who had not kissed his wife in years shot and killed a man who did.

* * *

Doctor: "You must avoid all forms of excitement."

Pvt.: "Can I look at them on the street?"

* * *

Wife: "Wake up, John. There's a burglar going through your pockets."

Husband: "Oh, you two fight it out between you."

* * *

"Another fellow and I were shipwrecked on a glamorous South Sea Island with the most luscious looking blonde."

"How did you get along?"

"Just fine. I was the one who always found her every time she hid."

* * *

A Hollywood child was asked if she had a momma and papa.

"I should say I have," came the repliy. "I have three papas by my first momma and two mammas by my second papa."

"I'm sure that, under the circumstances, you would be justified in spending a little money instead of fighting inflation by vacationing at home." *Westinghouse*

No wonder the little duckling
Wears on his face a frown,
For he has just discovered his
First pair of pants are down.

* * *

Definition of a baby: An alimentary canal with a loud voice on one end and no sense of responsibility at the other.

* * *

They say the King of Siam has a herd of 100 sacred white elephants and over 1,000 wives. That sure is a lot of white elephants.

* * *

"You are an apt boy. Is your sister apt, too?"

"Oh, yes, if she gets a chance, she's apt to."

* * *

Three gentlemen appeared at the railroad station, alcoholically propelled. As they reached the platform, the train began to move, and all three staggered for it. The station cop and a porter managed to bundle two of them aboard—one on the last car—but by this time it was going too fast for the third gent. He stood sadly on the platform watching it disappear.

"Too bad, mister," the cop said. "Wish you could have gone aboard."

"Yes," replied the man, "and my frens'll be sorry too. They were seeing me off!"

* * *

A doctor who was superintendent of the Sunday School asked one of the boys this question:

"Willie, will you tell me what we must do in order to get to heaven?"

"We must die," said Willie.

"Very true," replied the doctor, "but tell me what we must do before we die?"

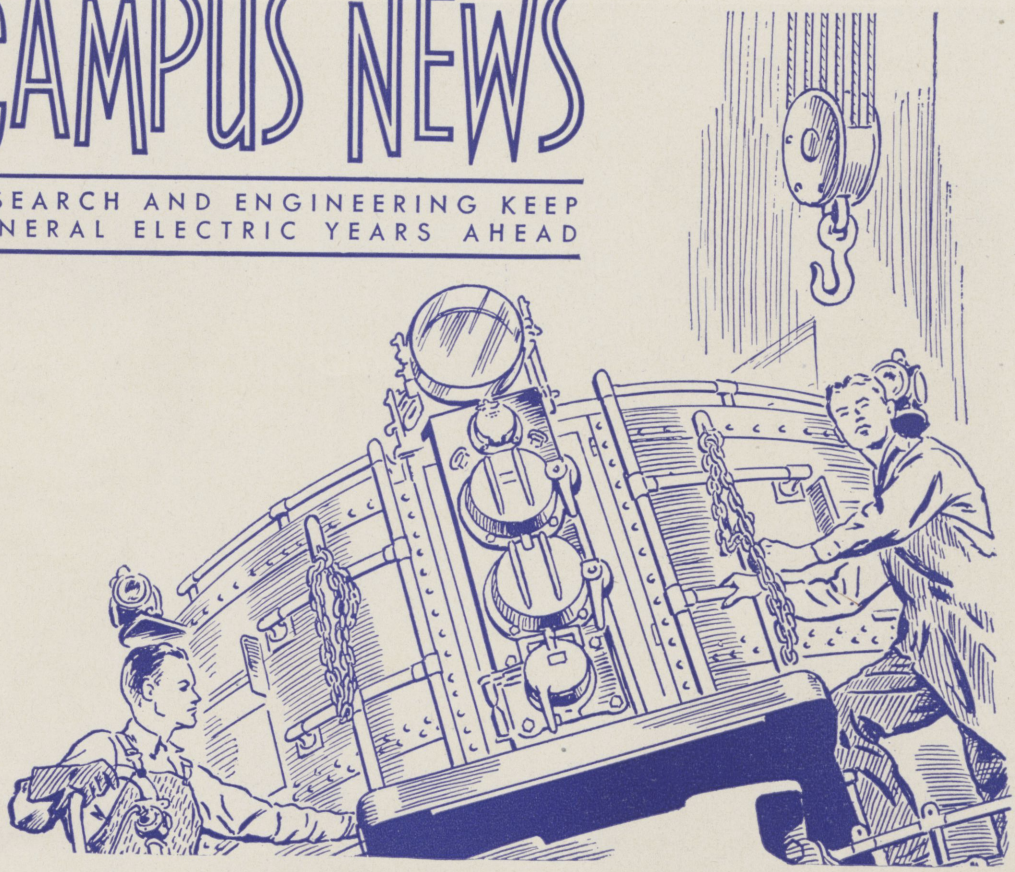
"We must get sick," said Willie, "and send for you."

* * *

They tell me the inside of the earth is a molten mass of rock and flame. Now, ain't that hell?

CAMPUS NEWS

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD



"ON TEST" AT GENERAL ELECTRIC

EACH year General Electric selects graduates of engineering colleges and assigns them to the Testing Department. For a period of 12 to 15 months they transfer from section to section, obtaining broad experience with a variety of apparatus, broad training in classroom and factory—to equip them for research, development, application, and manufacturing in the engineering field of their choice.

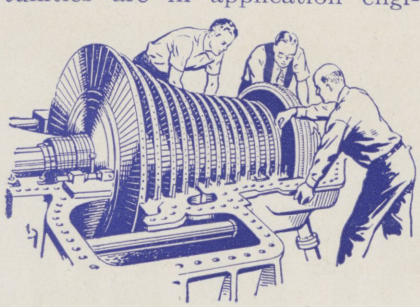
In formal parlance these men are members of the Student Engineering Course, but to them they are "on Test." And when they have graduated to join a large alumni body, they will speak of the days when they were Test men.

The Test man is constantly coached and advised in every way possible. He gains his first experience in assisting others in Testing equipment. As he assumes more responsibility, he may be placed in charge of testing a piece of apparatus with newer Test men as his assistants—or be selected to take charge of a complete line of equipment.

THE CLASSROOM COURSES

The General Course, open to all Test men, consists of a Business Section and four Engineering Sections: Electrical, Mechanical, Electronics, and Engineering Fundamentals.

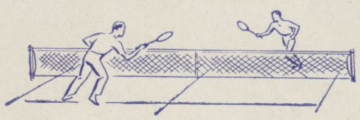
Sales Engineering is a special three-year program of practical experience and classwork. The men who take this course are selected from Test; and when they complete the program, their opportunities are in application engineering, general office sales, and in various Districts of the Company.



Another special program—for men with desirable qualifications—is design engineering. This program consists of Advanced Engineering and Creative Engineering, highly theoretical courses for a selected group of men. The Mechanical Design course helps to develop qualities of ingenuity and originality.

WELL-ROUNDED PROGRAM

Far from feeling lost in an impersonal company, the Test men have always been encouraged to join clubs that promote dances, hikes, tennis matches, golf, swimming, and other forms of recreation, as well as engineering societies in towns in which they work.



Many men who now hold key positions at General Electric and other companies started on G-E Test. And the Test courses are only part of the Company's educational program—the Business Training Course, for example, is another program to prepare employees for better opportunities.

General Electric Company, Schenectady, New York.

GENERAL ELECTRIC

953-110C-211

CLAUDETTE COLBERT starring in International Pictures' "TOMORROW IS FOREVER"

THE RIGHT COMBINATION OF THE WORLD'S BEST TOBACCOS *Properly Aged*

ALWAYS BUY CHESTERFIELD