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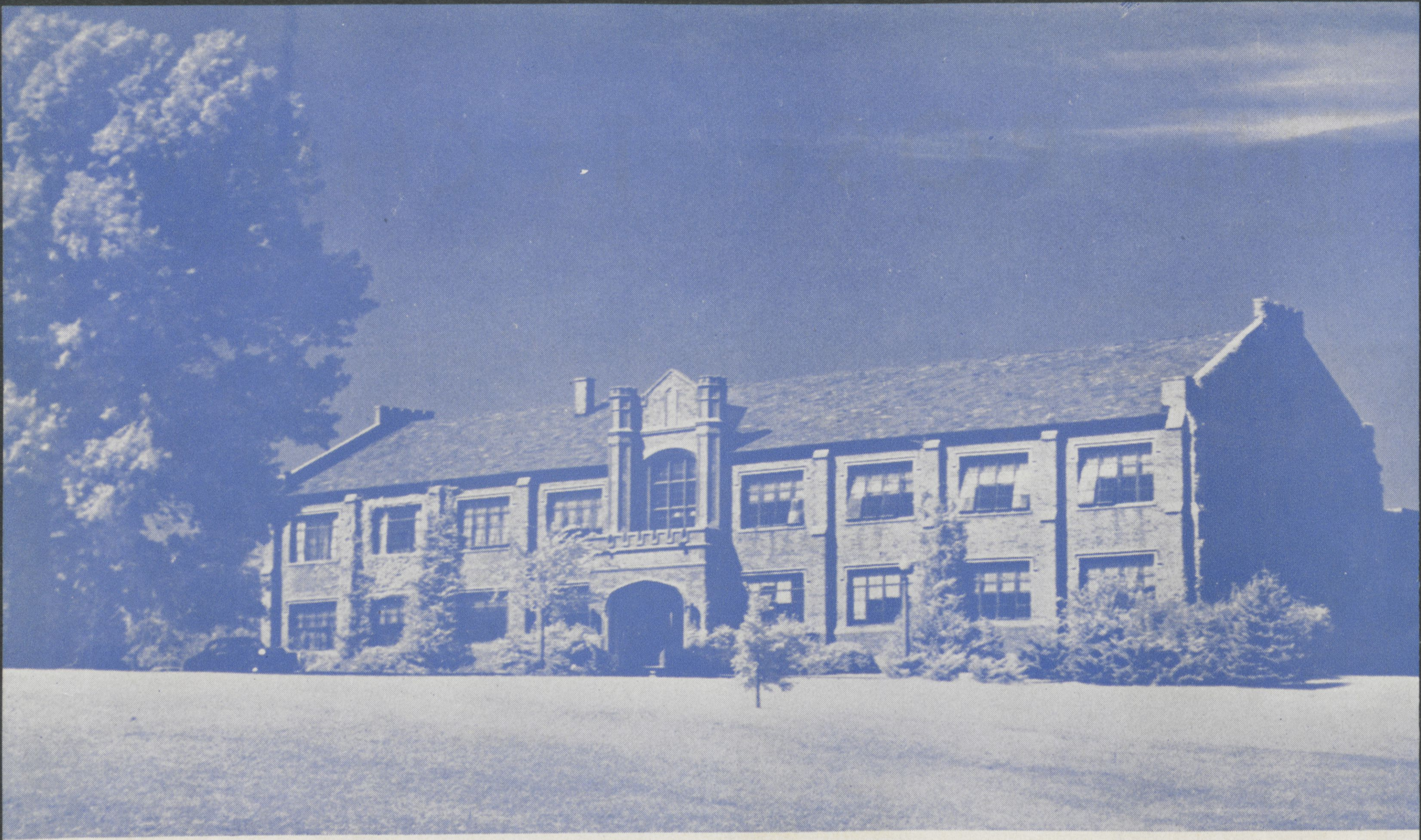
ROSE TECHNIC

APRIL, 1946

MEMBER ENGINEERING COLLEGE MAGAZINES ASSOCIATED



Within the next few weeks, friends and alumni of Rose Polytechnic Institute will have an opportunity to manifest their faith and interest in the growth and welfare of the college. The $600,000 Expansion Fund, outlined in this issue, deserves thoughtful reading and generous support by Alumni and friends of Rose.

ROSE POLYTECHNIC INSTITUTE
Terre Haute, Indiana

THE ROSE TECHNIC

VOLUME LVI, NO. 9 APRIL, 1946

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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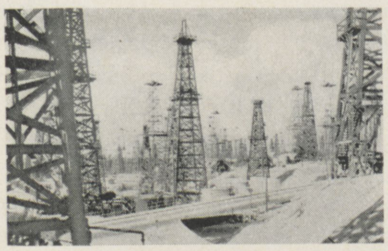
IN THIS ISSUE

COVER



A California Oil Field
—The Rotarian

FRONTISPIECE

Pumping station workhorses: 9,000 h.p. synchronous motors for centrifugal intake pumps.

—General Electric

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Veterans At Rose

THOSE of us who began our college careers during the lean years of war are pleased but a little bewildered by the hum of activity about Rose this year. The general revitalization of the school began last fall with the arrival of a sizable contingent of veterans, and each term since then has shown an acceleration of this trend. In January veterans comprised 68% of our student body; today the proportion has increased to 81%. The rapid influx of ex-servicemen has already brought the student enrollment to pre-war standards, with a record enrollment expected in July and an even higher registration predicted for September. Some difficulties have naturally been encountered in accommodating these men, but satisfactory adjustments have been made quickly and smoothly.

Like all special groups, veterans have their own characteristic problems. Nearly all have been away from school for a considerable period of time, and many have forgotten part of the elementary scholastic background necessary for continued study. Some have been away from books so long that they find it difficult to regain habits of concentration and efficient study techniques. On the other hand, most veterans seem to have a better appreciation of the value of higher education than the average student and make correspondingly greater efforts toward scholastic success. A considerable percentage now in school would have been unable to come without financial assistance from the G.I. Bill, and most of these are determined to capitalize on their opportunity. As a result of such industriousness, relatively few veterans are being flunked out of school. Many are maintaining enviable records.

There are many factors which tend to create a gulf between veterans and other students. The average veteran is considerably older and more mature than the average student who has just emerged from high school. About half of the veterans now at Rose are already married. For these reasons, many veterans have hesitated to enter into the extracurricular activites and social affairs of the school. Many feel that they have no time for extracurricular activities, and consider them as distractions from their primary goal of graduation. Others believe that they would feel out of place participating in such activities. A considerable number also resent, consciously or unconsciously, the fact that leadership in many such activities is still held by younger men.

It should be emphasized to these men that a college education consists of more than pure academic work. Much of the value of college life is derived from informal association with others in the various student activities. The many veterans who have already begun participation in such activities—including some of those who have the greatest outside responsibilities—are very enthusiastic about their work, and many are already assuming leadership in these organizations. It must be admitted, however, that the preponderance of veterans on the campus is still not proportionally reflcted in the various student activities. Since the majority of Rose students for the next two years or so will be veterans, it is to be hoped that the present trend towards veteran participation in campus activities will be continued.

R. G. B.

BRIEFS

by Ray Osburn

By the use of a relatively simple process developed during the war, pure oxygen can now be obtained from the air in a manner analogous to the absorption of oxygen by the blood in a human body. Developed by Dr. Melvin Calvin of the University of California, the process employs metallo-organic compounds similar to such naturally- occurring compounds as the green chlorophyll of plants and the hematin that gives the red color to blood.

In the new process, one of these chemicals, in the form of red crystalline granules, is placed in a tube and a stream of air is blown through it. As the red granules absorb oxygen, they turn black. Since the process evolves heat, the tube is cooled constantly to maintain a high rate of oxygen absorption. After the crystals have absorbed all the oxygen they can, the crystals are removed and heated, giving off oxygen and regaining a red color. The oxygen is collected in a storage tank, and the crystals may be reused thousands of times.

The process was used during the war to produce oxygen for welding and other repair work at isolated bases.

* * * *

The cotton boll weevil, scourge of the cotton crop, may be effectively controlled by a new British insecticide, benzene hexachloride. Field tests indicate that the new substance is more effective against the boll weevil than either DDT or calcium arsenate, the old stand-by. The new insecticide also killed more cotton leafworms, plant bugs, cotton fleahoppers, and cotton aphids than the standard insecticides. One weakness of benzene hexachoride is the fact that it is not as effective against bollworms as DDT or calcium arsenate.

* * * *

A 1500-mile-an-hour wind tunnel, designed to conduct tests upon models of guided missiles and jet- and rocket-propelled aircraft, has now been put into operation at Moffett Field, California. The new supersonic wind tunnel is designed to operate exclusively above the velocity of sound (approximately 760 miles per hour), which is the present limit of flight for airplanes which depend on the lifting properties of air. The tunnel will be used to conduct fundamental research to obtain knowledge of the design requirements for stable and controllable flights at the tremendous speeds made possible by newly developed methods of propulsion.

The test section of the supersonic tunnel is three square feet in cross-section. Air is forced through this channel by four three-stage centrifugal compressors driven by electric motors totalling 10,000 horsepower. Air pressure and humidity can be controlled over wide ranges. The actual tests will be carried out on accurately-made steel models.

Another supersonic tunnel now nearing completion will extend the available range of testing speeds to 3.6 times the speed of sound—over 2,600 miles per hour.

* * * *

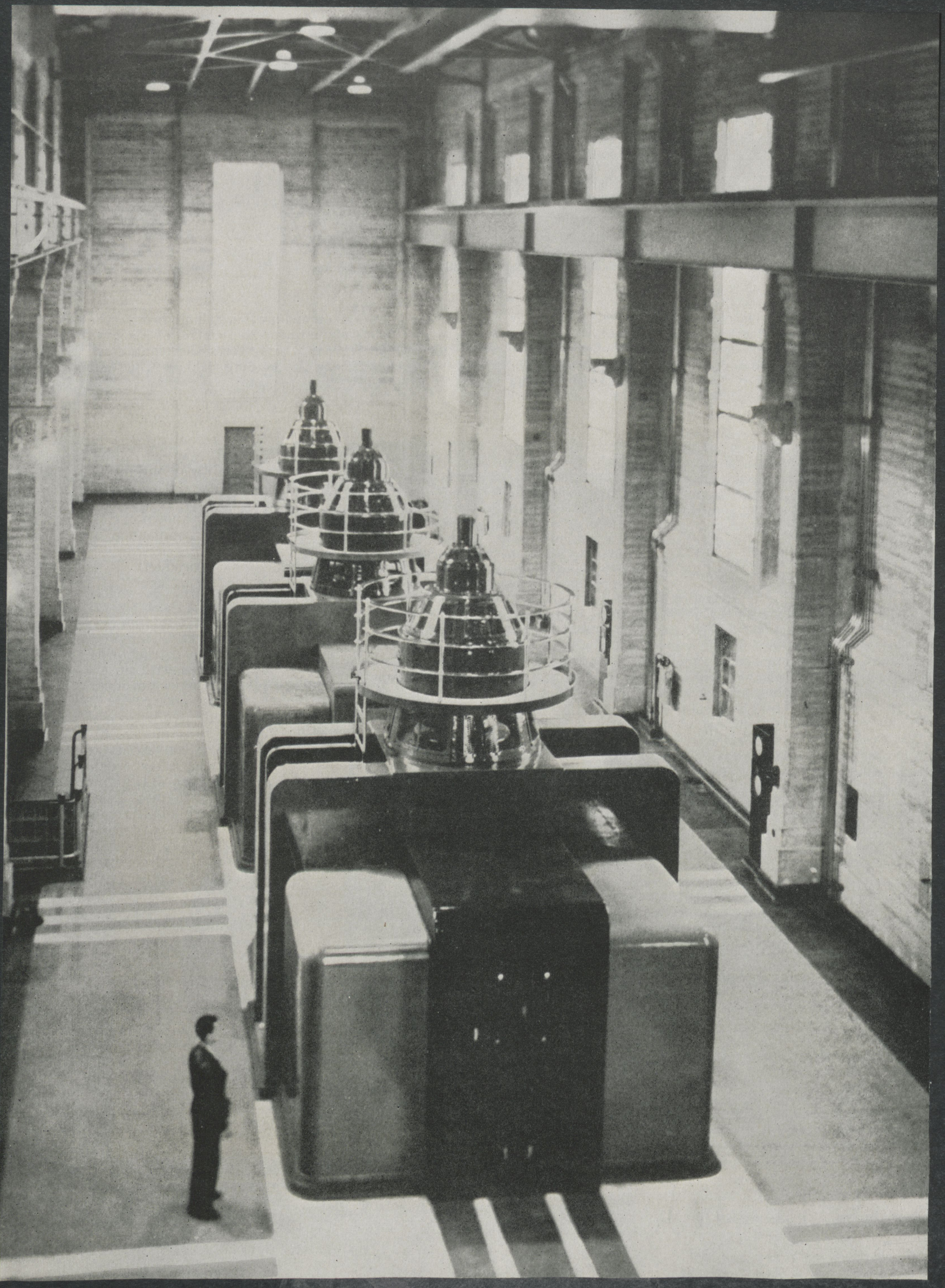
Blind landing in bad weather will be possible with relative safety for aircraft equipped with a new electronic device designed to guide planes to the airway automatically by means of very high frequency radio waves transmitted from ground stations. As an airplane approaches the airfield, the new device picks up radio waves from marker beacons and indicates this contact by a flashing light. The pilot then throws a switch on the autopilot which immediately puts the plane under control of beams being transmitted continuously from the airport. When the plane arrives at the landing strip, a second signal directs the pilot to throw a second switch which brings the plane under the control of a second beam which steers the plane down onto the landing field.

Metallic titanium may some day become as widely known and used as aluminum and magnesium because of methods recently perfected by the U. S. Bureau of Mines. Fourth in abundance among metallic elements suitable for engineering purposes, titanium is a strong, light metal formerly known chiefly for the use of its compounds as pigments and coloring agents for many varieties of products. It is also used as an alloying agent with other metals.

In the new process, titanium ores (chiefly titanium dioxide) are converted into titanium tetrachoride, which is then reduced with an excess of powdered magnesium metal at a temperature of about 800° C. Titanium is precipitated from the reaction mixture in granules, the magnesium being converted to magnesium chloride. After crushing and leaching, the titanium powder is compacted into small pellets at a pressure of 100 tons per square inch and heat-treated or simtered at 1000° C. in a high vacuum. After this treatment the titanium is ductile and fairly maleable.

* * * *

A supersonic reflectoscope, using sound waves to locate flaws in solid objects, has been developed at the University of Michigan and is now in commercial production. Using a quartz crystal coated with a film of oil to conduct the object being tested, the reflectoscope radiates sound waves into the material being tested. The radiated waves reflect back to the instrument and are magnified on an oscilloscope screen. The presence of flaws is revealed by variations in the wave patterns visible on the screen.



High Frequency Heating

by Brice Rumble, sr., e.e.

ELECTRONIC heating, or the application of a high frequency current to heat a material, is not a new idea. The earliest experimenters in electricity knew that materials could be heated inductively. Comparatively low frequencies were used rather early to heat charges of metal. Equipment capable of producing high frequency current has been available for well over 25 years.

It is only in the last five years, however, that high frequency heating has come into wide use throughout industry. Following the general trend towards acceptance of electronic devices, high frequency heating units have now assumed a role in industry of utmost importance. Remarkable applications of these electronic methods have already been demonstrated, and there is no doubt that many further possibilities remain to be exploited.

The subject of high frequency heating readily divides itself into two parts: induction heating and dielectric heating. Induction heating is confined to materials (usually metals) which are relatively good conductors of electricity and heat, while dielectric heating is used with nonconducting substances. Nonconductors differ greatly from conductors in that they do not transfer heat rapidly and are difficult to heat uniformly, while conductors diffuse heat rapidly and, in all but the largest objects, uniformly. In the face of such statements it is surprising to find that high frequency techniques are satisfactory for both types of materials; it is noteworthy, however, that the methods and the apparatus for the two types of heating are essentially different.

Induction Heating

It is essential in induction heating that the material to be treated, called the *charge*, is a relatively good conductor of electricity. The heating effects are produced by placing the object in or adjacent to a water-cooled induction coil carrying an alternating magnetic field thus produced induces eddy currents in the surface of the charge. The resistance of the object to these eddy currents causes the rapid production of heat. The depth of the layer in which most of the heat is produced is determined by the frequency of the current employed and by the specific resistance and magnetic permeability of the charge.

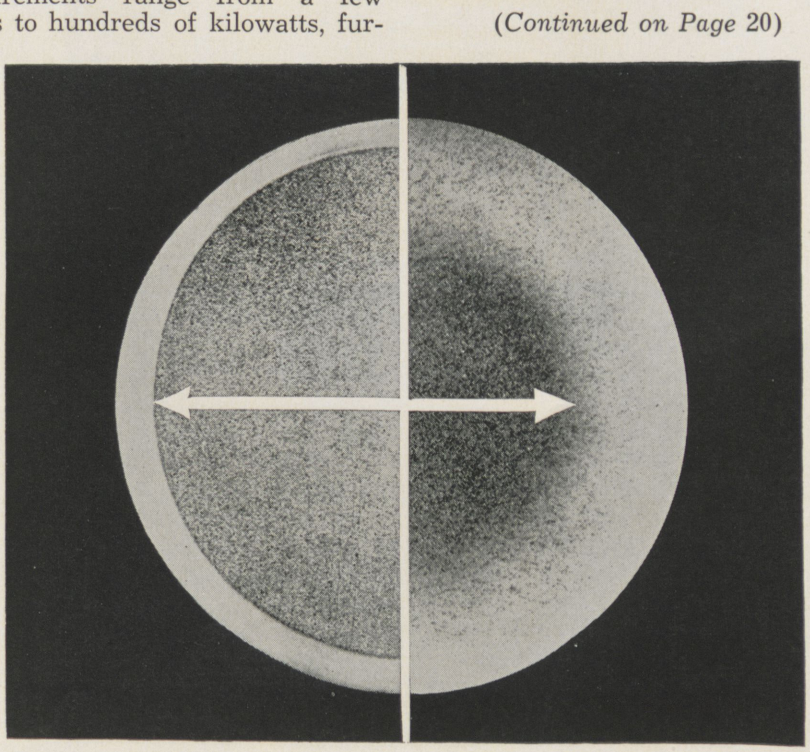
Inductive heating applications can be classified roughly by frequency. With very low frequencies, a considerable proportion of the heat is generated at the center, instead of the entire production taking place at the surface. By using these low frequencies, therefore, it is possible to heat metals rather uniformly. With higher frequencies, the production of heat is almost entirely concentrated at the surface. It is possible to bring the surface of the object to white heat before the heat can be appreciably diffused into the center of the object. The speed of heating and the degree to which the heating may be limited to the surface increases with an increase in the frequency of current employed.

Applications of induction heating with frequencies up to 1000 cycles include forging and melting steel and nonferrous metals, annealing, and deep surface hardening. The relatively low frequencies permit uniform heating throughout the object. Power requirements range from a few watts to hundreds of kilowatts, furnished by motor-generator sets. Production of specialized alloys for war equipment falls in this category.

Induction heating applications up to 12,000 cycles include surface hardening, forging, brazing, soldering, and melting. Power is almost entirely generated by rotating machines with ratings of 20 to 12,000 kw.

Induction heating operations with extremely high frequencies—up to millions of cycles—are usually concerned with very thin surface hardening, brazing, and soldering. In these frequency ranges it is possible to bring a sharply defined surface layer of an object to white heat almost instantaneously, while the core of the object remains relatively cool. After quenching, the surface of the object is hard and highly resistant to wear, while the unhardened core retains its toughness and elasticity. Generation in this frequency range is provided by vacuum-tube oscillators. Vacuum-tube oscillators for induction heating are usually built to operate at a recommended frequency within the range from 200,000 cycles to 3,000,000 cycles.

(*Continued on Page* 20)



CONTROLLED INDUCTION HEATING of king pin gives thin, hardened surface with a ductile core (left micro-photograph section) while conventional methods let heat penetrate into core (right) to make contact brittle and weak.
—*Allis-Chalmers*

Forest Conservation

by Frederick E. Mueller, soph., e.e.

Photos Courtesy American Forest Products Industries

AMONG the world's raw materials, wood ranks second only to food. Next to agricultural crops, forest crops have contributed most to human progress and security and, like agricultural crops, forests possess the unique advantage of being renewable. Throughout man's development forests have played an important role. He is never wholly independent of them.

Forests are the economic backbone of some of the world's most advanced and prosperous nations. Over 90 percent of the world's annual wood crop is used for domestic consumption. Ever-increasing uses of wood are being discovered. Wood substance is being used in fertilizer, molded plastics, and even explosives. It is now possibble to obtain rayon, sugar, alcohol, synthetic rubber components, and food of high protein value from the sawdust pile.

Along with these rapidly multiplying uses for wood, we are faced by the fact that our forests are steadily diminishing. Fire, ax, insects, and disease reap a tremendous toll annually. Far more wood has been wasted and burned than has ever been used, and yet forests are still being treated not as a renewable crop, but as a mine to be exploited and then abandoned.

A few far-sighted men have tried to warn us from time to time of the result of this vast wasteful destruction. Various forest agencies and organizations were set up by the states to promote forestry and timber culture. A nationwide consrvation movement did not get under way, though, until 1891 when the national forest system was started. The real beginning of a national forest conservation policy was the establishment of the United States Forest Service in its present form in 1905.

By an act of Congress March 3, 1891, the President was given power to establish forest reserves from the public domain. By 1898, forest reservations totaling 33,000 acres had been set aside. It was in this year that Gifford Pinchot, one of the most ardent advocates of forest conservation, was named head of the Forestry Division.

An act of February 1, 1905, provided for the transfer of forest reserves from the Department of the Interior to the Department of Agriculture. When the present Forest Service took charge of the forest reserves, they numbered 60, with a net area of some 56 million acres of land actually owned by the Government.

Direct administration of Forest Service field work was transferred from Washington to six district offices in 1908. Regionable headquarters were located at Missoula, Denver, Albuquerque, Ogden, San Francisco, and Portland. Forest experimental stations were established in Arizona, Colorado, Idaho, Washington, California, and Utah.

Interest in forest conservation grew by leaps and bounds, and measures were being enacted for the protection of forests while millions of acres of new reserves were being set aside. In 1930, the Forest Service started the first complete survey of forest resources and conditions on the nation's 630 million acres of forest land.

On March 21, 1933, President Franklin D. Roosevelt in his message to Congress asked for legislation to relieve distress, to build men, and to build up the nation's forest resources. Ten days later legislation was enacted providing for the establishment of the Civilian Conservation Corps (CCC). The first camp was established in the George Washington National Forest near Luray, Virginia, on April 17, with a quota of 25,000 men. More than two million men participated in the CCC program during the nine years that it was continued. A vast amount of forest protection and improvement work was accomplished. The CCC program was terminated in 1942 after the United States entered war. The shelterbelt program of the

A forest fire in Montana. The national loss from forest fires runs from 35 to more than 40 million dollars every year, and some years it has exceeded 100 million dollars. The greatest single cause of forest fires is human carelessness.

Here a forest fire has destroyed standing timber which might have provided seed for a new forest crop. If this fire had not occurred, this entire slope would be covered with new growth similar to that in the left foreground. Forest fires not only destroy existing timber, but they retard the growth of new timber crops.

These gaunt snags of ponderosa pine in the western pine region were killed by the western pine beetle which destroys millions of board feet of timber each year. Not only has the lumber content of these trees been ruined, but the dead snags create a serious fire hazard.

Prairie Plains Region provided an interesting project of the Forestry Service. In 1935, a project was started whereby the Forest Service cooperated with prairie farmers in planting protective strips of trees at right angles to prevailing winds on farms in the Dakotas, Nebraska, Oklahoma, and northern Texas. A total of 206 million trees were planted in 18,000 miles of shelterbelts in seven years. In 1942 the project was transferred to the Soil Conservation Service.

The war demands for wood were great. Wood was needed for barracks and cantonments, ships and docks, war plants and war housing, gun stocks, airplanes, boxes and crates for war supplies, and other numerous uses. The Armed Forces used a greater tonnage of wood than steel. The Forest Service was called upon for numerous special war jobs: surveys of war requirements and supplies for forest products; an emergency rubber project for production of guayule and other rubber bearing plants; a large-scale logging project in Alaska for production of urgently needed aircraft spruce; constant manning of lookout stations of the Army aircraft warning system; quinine, balsa, and other forest resource surveys in Latin America; emergency fire protection measures; and much other war work. Fire protection forces were severely depleted because of the large number of men serving in the Armed Forces. During the war years civilian conservation agencies cooperated in special war time fire protection campaigns.

Much has been accomplished through conservation in recent years, but millions of acres of forest land are still destroyed by fire every year and the processes of devastation and waste are still widely prevalent. In 1910 over two million acres of forest land in Idaho burned, taking the lives of 85 men. In 1938 a New England hurricane blew down millions of trees over wide areas. Forest fires now kill and average of three billion feet of timber annually and tie up enough labor to maintain 2800 miles of main-line railroads. The history of forestry is filled with records of numerous disasters, some due to carelessness and wastefulness and other due to natural causes.

Facts of forest depletion in the United States are best told in estimates of sawtimber volume. Over 300 years ago, when the colonies were first being settled, the United States is believed to have had at least 7625 billion board feet of standing timber. In 1909 a crude inventory placed the stand at 2826 billion board feet. Our latest estimate, made in 1938, showed only 1764 billion board feet, two-thirds of which was still classed as old growth. The United States must greatly increase its annual timber growth if its forest industries are to hold their place in the life of the nation. The great virgin forests that have supplied our needs for three hundred years have nearly reached the limit of their production. The time is rapidly approaching when we must grow as much as we use. Future demands indicate that we must plan a forest crop of twenty-one and a half million cubic feet annually, which is five billion cubic feet more than we took from our forests in the war years.

Mills all over the country are faced by serious shortages within the next fifteen years. Lack of timber will inevitably force the closing of many mills in the next few years.

The problem we face is not one of acreage available for forestry. Our 462 million acres of forest land is capable of producing all the timber we are likely to use. But these 462 million acres have not been kept productive. Over 70 million acres are virtually without tree growth as a result of fire and heavy cutting. Much of the remainder is only partially stocked and producing less than half of what it should. The crux of our problem lies in stopping destructive cutting and in building up and maintaining the productive growing stock.

Research is the key to better forestry. Forest cutting practices must be based on research. A few examples will illustrate this point.

In Wisconsin a stand of jack pine, periodically thinned, yielded ten times as much usable wood as a comparable unthinned stand, largely because in the latter much wood was lost through the death of overcrowded trees. After thinning, a hardwood stand in the Northeast grew twice as fast as a nearby untreated stand. In the southern Appalachians, improvement cuttings so stimulated the growth of trees chosen to remain that in thirteen years the original volume was regained. A nation-wide system of experimental centers is the present aim of forest management research.

Forests can play an important part in the postwar employment program. The forests of the United States now provide jobs for about 3,750,000 persons. If the productivity of our timberland and forest ranges were increased and if other resources of the forests were fully de-

(*Continued on Page* 24)

Rose To Seek $600,000

DR. JOHN WHITE, professor of chemistry and chemical engineering, who retired in 1936 after serving Rose Poly for 33 years, will lead the New Building Fund campaign for $600,000. Paul N. Bogart, president of the Board of Managers, announced Dr. White's acceptance as General Chairman of the campaign for funds to construct a new dormitory and a new field house on the campus.

In addition to serving on the faculty from 1903 to 1936, Dr. White was elected twice to the vice-presidency of the Institute, serving first in 1910-1911 and again from 1931 to 1936. He was elected Acting President of the school three times—1916-1917, 1919-1921 and 1930-1931.

Since his retirement from the faculty, Dr. White has been a member of the Board of Managers and has maintained an active interest in the school. Dr. Donald B. Prentice, Rose president, lauded the acceptance of the campaign leadership by Mr. White, saying, "It is inevitable that the partnership of Rose Poly and Dr. White should have been resumed at this time when the school needs his wise counsel and guidance. Alumni and friends of the school alike will not fail to assume their share of responsibility under his able leadership."

WHEN CHAUNCEY ROSE founded the institute which bears his name, he probably did not foresee the growth of the school from a faculty of six professors to the current staff of 22 professors, assistants, and instructors; nor could he contemplate the increase of enrollment from 14 students in 1883 to a current average of 100 freshmen students each term.

Rose has grown with the times in its standards of instruction and the high calibre of men on its faculty. It has always attracted above-average scholars from all parts of the country. The scholastic and economic "health" of the school is excellent.

To keep pace with the increasing growth of its student body, Rose was moved from its downtown site to its present location just east of the city where the 125-acre campus provides adequate living space as well as an ideal atmosphere for study.

Today Rose finds a new problem to be met—the housing of the scores of students from distant cities, and the establishment of a Field House with adequate athletic facilities to carry out a diversified program of physical education and recreation. To provide these vitally needed improvements to the physical plant, the Board of Managers have undertaken to raise $600,000 this spring for the construction and equipment of the two new buildings.

New Dorm Needed

Deming Hall, originally planned to house 52 resident students, has accommodated as many as 75 students—but that is its maximum capacity. The increasing number of out-of-town students coming to Rose each year—and the present shortage of housing facilities in the community—makes it absolutely essential for the college to provide additional student living quarters.

The proposed new Dormitory, located on the crest of the hill opposite Deming Hall and overlooking the lake, will take care of a minimum of 90 additional students. Separate fraternity quarters will be provided as well as a Joint Chapter Hall for meetings and ceremonies. A main dining hall and a private dining room, guest room for parents or visitors to the school, study and recreation lounges will help meet the present urgent need for additional housing.

Will Build New Field House

Lessons in physical fitness learned in the training of 5,000,000 men and women in the armed forces in World War II focus attention on the lack of proper athletic and recreational facilities at Rose. The present gymnasium does not, in any sense of the word, provide suitable facilities for intramural sports. It is not adequate for intercollegiate basketball games, nor does it contain adequate spectator space. Alumni will recall from their own undergraduate years that use of the gymnasium was restricted to certain hours when the chemistry classes on the floor below were not in session. The gymnasium is still restricted in utility to one or two

Proposed new dormitory.

For Expansion Program

JOHN E. BERNHARDT, class of '08, four-time member of the Board of Managers and past president of the Rose Alumni Association, has been named Chairman of the Alumni Division of the New Building Fund campaign by Dr. John White, general chairman of the drive.

Mr. Bernhardt, who is Bridge Engineer of the Chicago and Eastern Illinois Railroad, has long been identified with Alumni activities and has served as secretary and as president of the Chicago Rose Tech Club. He was given the degree of Civil Engineer in 1929.

He is a member of the American Society of Civil Engineers and the American Railway Engineering Association; for the past five years chairman, committee on Iron and Steel Structure, AREA; member, committee on Welded Steel Bridges of the American Welding Society; member, committee on Fatigue Testing of the Welding Research Council. During the war Mr. Bernhardt was a member of the War Production Board's committee on Emergency Specifications for Steel Bridges and Simplification of Structural Steel Shapes, and the AREA's committee on Emergency Specifications for Structures.

sports. Until additional dormitory facilities are available, a portion of the gymnasium has been partitioned off and furnished as a temporary dormitory for thirty resident students. This further restricts the utility of the gymnasium.

The second phase of the $600,000 building program will include construction and equipment of a new Field House adequate in size and facilities to insure the operation of an athletic program designed to meet the needs of Rose students. An intercollegiate basketball court with ample space for spectators will be one of the best in Terre Haute. Handball courts, an indoor track, drill and athletic field for shot put, high jump, broadjump, and similar field sports will permit year-round athletics of all types. Student locker rooms and showers, varsity and visitors' locker rooms, a trophy room, and offices for athletic director will give Rose an athletic department of which the undergraduates and alumni can well be proud.

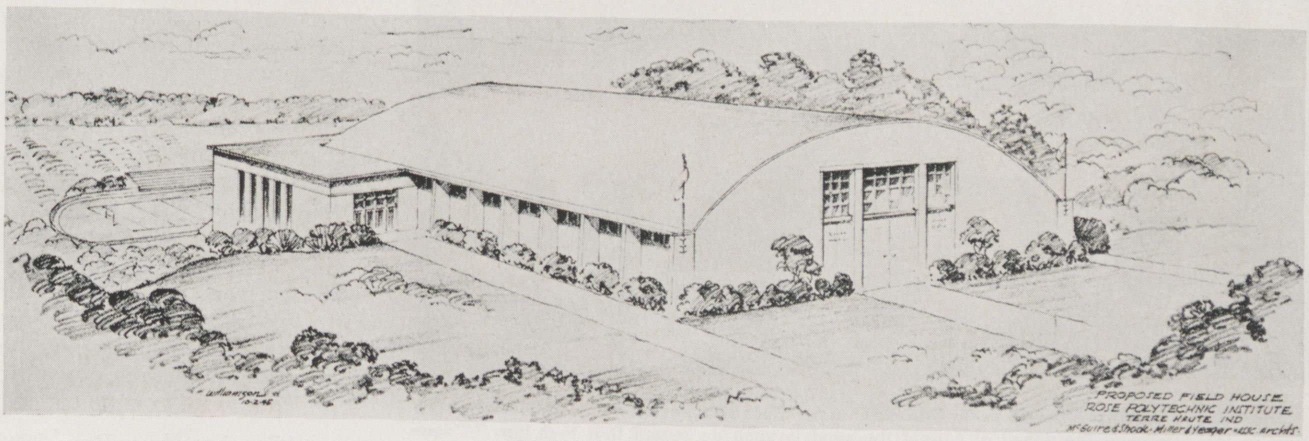
Also of immediate concern is an auditorium or assembly hall which can be utilized for lectures, student assemblies, and graduation exercises. The present gymnasium can be readily and economically converted into an auditorium. The present assembly room, which is too small to hold more than a small portion of the student body, will be made into faculty offices. The limited office space at present requires as many as four professors to share a single small office. Conferences between professors and students are consequently difficult—if not impossible.

Plans for the concerted effort to secure the needed funds for this expansion are being formulated by the Board of Managers and a campaign committee, composed of leading citizens of Terre Haute and alumni in cities throughout the country. Alumni and friends of Rose Polytechnic Institute will be asked to contribute to the New Building Fund to make possible these essential improvements to the school's physical plant. Committees of local citizens are currently being organized. Many gifts—which will be announced later—have already been made by local individuals and alumni. Enthusiasm already is beginning to mount and early and complete success is expected if everyone will give and work for it.

Alumni committees are being organized and meetings will be held in May and June for all Rose graduates to hear more about the detailed plans.

This is the first time in twenty-five years that Rose has asked for outside financial assistance to improve its physical equipment. Rose faces a bright future, but its building plans are not predicated on future possibilities. They are based on very real and present needs. These needs must be met if Rose is to maintain its position of leadership among engineering schools.

Alumni will be asked to make their pledge or contribution through their Alumni Chapter Campaign Committees which will be announced within the next few weeks.



Proposed new field house.

Tungsten

by William Maddock, jr, ch.e.

Photos Courtesy Carboloy Co.

Tungsten is a very minor metal from the standpoint of annual production in tons, but its importance to our industrialized civilization can hardly be estimated. Tungsten steel, because of its hardness, is used for high speed cutting tools which retain their cutting edges even at red heat. Tungsten carbide is one of the hardest substances known. Tungsten is more satisfactory than any other element for use in filaments in electric light bulbs and many electronic instruments. The importance of tungsten for waging war was emphasized during the recent war by the frenzied scramble of all major pawers to gain control of the tungsten ore resources of the world.

History of Tungsten

Tungsten and tungstic acid were first recognized in the minerals *wolframite* and *scheelite*. Torbern Bergman analyzed scheelite and found the oxide of tungsten, although he did not recognize it. He concluded in 1781 that the oxide must be related to white arsenic and that is should be possible to prepare the metal from its oxide.

Scheelite, named after Karl Scheele, the Swedish chemist who discovered it, was the first mineral known to contain the oxide of tungsten. Later the D'Elhyar brothers, Don Fausto and Don Juan, found that the mineral wolfram contained wolframite, then supposed to be an ore of iron and tin. In 1783, the brothers collaborated in a research on scheelite and wolfram and found that both ores contained tungstic acid. They then went on to produce the first metallic tungsten by heating strongly an intimate mixture of tungstic acid and powdered charcoal. After cooling, they removed the dark brown, metallic button, which crumbled easily in their fingers. When they examined the powder with a lens, they saw globules of metallic tungsten, some of which were as large as the head of a pin.

In 1785 Rudolph Erich Raspe showed that the metal obtained from scheelite and wolframite was identical, and that it hardened steel.

Sources of Tungsten

Ores of tungsten were first found in the United States in 1898, and in China as late as 1915. Today China is the leading producer of tungsten concentrates, with Bolivia and the United States ranking second and third, respectively. A few of the other countries producing tungsten concentrates are Peru, Brazil, Portugal, Canada, French Indo-China, and Burma.

Tungsten is usually found in rock formations containing mainly iron and tin, although other metals are present at times. The minerals most commonly used for a source of tungsten are wolframite, $(Fe, Mn)WO_4$. Wolframite with a high content is called ferberite, and with a high manganese content is called huebnerite.

Detrimental impurities most commonly found in tungsten concentrates are sulfur, phosphorous, copper, tin, arsenic, antimony, bismuth molybdenum, lead, tantalum, and columbium. Silica and alumina are minor impurities.

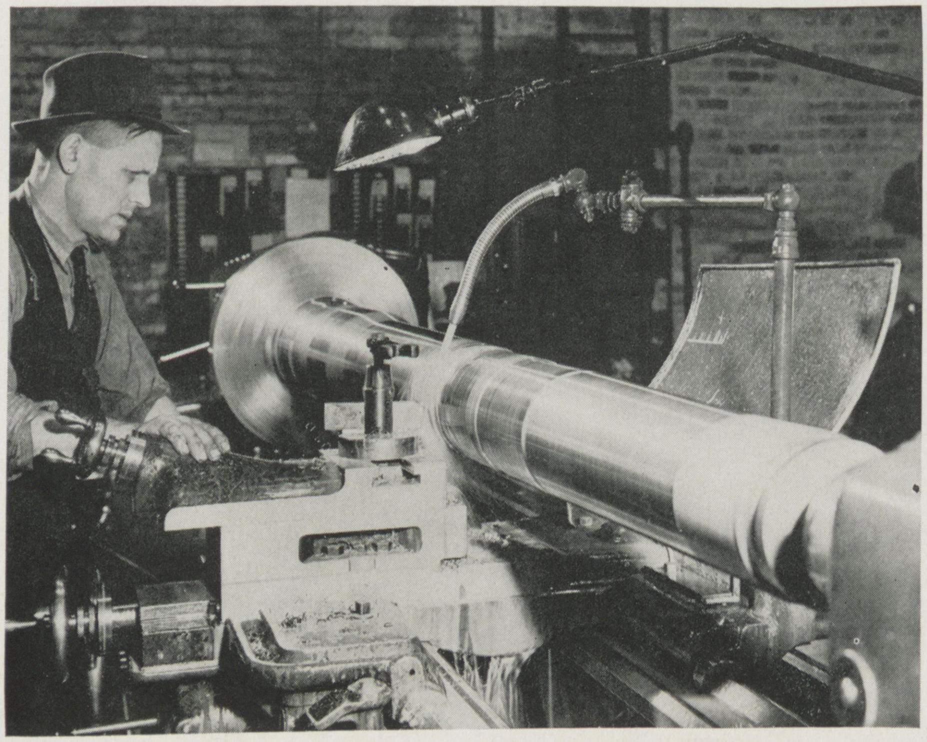
Processing of the Ores

Much of the ore is mined in countries where labor is cheap. In such areas refining methods are poor due to the lack of machinery. The ore is concentrated as highly as possible by washings, jigging, and fravity methods. It is then dried and packaged in burlap bags and shipped to the refining mills in the United States, where it is concentrated to about 99.98 percent tungsten trioxide.

When the ores arrive at the processing plant, they are analyzed for impurities to determine the type of process that will be used on each particular batch, since the ores are from many different places and will have varying impurities and concentrations of tungsten trioxide. The plant consists of (1) a magnetic-separation plant, (2) an electrostatic separating plant, (3) a roasting plant, (4) a leaching plant, (5) a flotation plant, (6) a drying plant, (7) a fusion plant, and (8) a sizing and crushing plant.

Plant design is such that each department is a separate and completely integrated unit. Finished products from a single lot of concentrates may be made in any one department or the lot may have to go to all departments, depending upon the complexity of the concentrates

(*Continued on Page* 28)



Machining a howitzer barrel with Carboloy tools. Use of tungsten carbide tools on this particular job increased the speed of cutting the steel to such an extent that four barrels were machined in the time ordinarily required to machine one barrel with conventional steel tools.

Alumni News

By William Blount, fresh.

According to a survey recently conducted in connection with the recent financial campaign, Rose graduates are scattered in 37 states and 10 foreign countries. This count does not include alumni in the armed forces serving overseas.

The three largest alumni concentrations are found in the Terre Haute, Chicago, and Indianapolis areas, with 311, 197, and 132 graduates, respectively. Areas in which more than fifty graduates reside include New York City, Pittsburgh, Cleveland, Detroit, Cincinnati, Louisville, and Los Angeles.

Four Rose graduates reside in the Canal Zone, three in Mexico, and two in Hawaii; others have established permanent homes in Alaska, Brazil, Canada, Honduras, Puerto Rico, Newfoundland, and New Zealand.

Rose Tech Clubs have been established in 15 cities throughout the country. Periodic meetings are held to keep abreast of developments and activities at the school. Dr. Prentice is now attending Rose Tech Club meetings throughout the country to renew contacts with alumni and to discuss the school's financial campaign and other details of the expansion program.

Here is a list of the Rose Tech Clubs, together with their presidents:

Chicago, B. G. Witty, '26
Cincinnati, H. W. Knox, '17
Cleveland, John Richardson, '31
Detroit (inactive at present)
Indianapolis, J. M. Rotz, '06
Louisville, G. L. Barrick, '39
New York, F. P. Butler, '32
Peoria, E. H. Scofield, '30
Philadelphia, C. L. Davidson, '16
Pittsburgh, H. M. Leathers, '14
St. Louis, S. S. Forsythe, '24
Schenectady, G. H. Pfief, '05
Terre Haute, Richard Aitken, '17
So. California, Frank Mansur, '34
Washington and Baltimore,
R. E. Biller, '31

The Grads Advance

'25 Theron A. Yager, m.e., '31, has taken a position as General Manager and Treasurer of the Vermont Talc Co.

President of the Alumni Association for 1946

STERLING H. PITTMAN, '22
Terre Haute, Indiana

Mr. Yager succeedes John B. Aikman, m.e., '87, who had held the position for many years.

'28 James D. Goddard, c.e., with high honors, is now field investigation sections chief for the Hydraulic Data Division of TVA. Mr. Goddard was recently discharged from the Army with the rank of Lt. Col. He was with TVA about eight years before he entered the service.

In the Army for five years, he was overseas three and a half years in England, Africa, and France. He was awarded the French Medal of Honor, including the Croix de Guerre, with silver Gilt Star for "exceptional military services rendered in the course of operations of the liberation of France." Col. Goddard took part in the Tunisian, Sicilian, and Italian campaigns. He left the Mediterranena Theater and went to England to prepare for the Normandy invasion. It was his staff who helped perfect the intelligence data for D-Day, actually recommending the hour of attack.

While in France Col. Goddard worked with the French armies, supplying them with maps, intelligence data, technical equipment, and trained technicians.

'40 Frank G. Pearce, ch.e., Heminway Medal, with high honors, has received his Ph.D. from Massachusetts Institute of Technology. His paper was written on the absorption of poison gases. He was a Captain in the Chemical Warfare Service. Mr. Pearce became the father of a daughter, Judith Mourine, last November.

'42 Clifford E. Roberts, e.e., was recently promoted to Major in the Signal Corps. Major Roberts is now assigned to the Signal Section, Theater Special staff, India-Burma Theater. A graduate of the Command and General Staff School, Fort Leavenworth, Kan., Major Roberts was called to active duty as a second lieutenant in May, 1942 and has been stationed at New Delhi, India since June, 1943.

Leon L. O'Dell, ch.e., has received his discharge from the AAF with the rank of Captain.

ex'43 George Staples has received his discharge from the Navy.

ex'44 William Morris has returned from the Philippines and has been discharged from the Army.

Deaths

Arthur M. Hood, e.e., '93, M.S., '98, died at his home in Indianapolis February 2. Mr. Hood was one of the founders of the *Rose Technic*.

Mr. Hood was president of the Alumni Association for two terms and vice president for two terms. He was secretary-treasurer of the Alumni Association for nine years. He served as Alumni Representative on the Board of Managers of the Institute for ten years.

Mr. Hood was a patent attorney and senior member of Hood and Hahn of Indianapolis. In addition to his degrees from Rose he had a degree of bachelor of laws from Columbian (now George Washington) University, Washington, D. C. He was a member of the bars of federal district and appellate courts throughout the country, and of the supreme court of the United States.

Mr. Hood was born in Indianapolis December 25, 1871.

Research and Development

by Orville Stone, fresh. and Dale Jeffers, soph., m.e.

Push-Button Flying

ROBOTS, long an object of man's imagination in comic books and funny papers, are again in the news—this time in the form of a push-button airplane.

The robot pilot has been hailed by aviation as a most significant development in flight engineering. Its operation does away with all human work, except determining what direction and course the plane will take, and the pushing of the button. The push-button plane is not a version of the radio-controlled plane, but is actually automatically flown. The new plane is not intended to put more men out of work; it is another step toward conquering "old man weather".

Now that the robot has worked in airplanes there is a possibility that some day trains, busses, and cars will carry them. The robots working with radar might even solve the complex traffic problems in the United States.

Engineers make no predictions about the robot-plane future and also say that the plane is not ready for commercial use. The first unit was installed in a giant C-54 "Skymaster" at the AAF's all-weather flying center, Columbus, Ohio.

The flying of the robot plane is completely automatic. The plane is taxied into take-off position on the runway. The brakes are locked, the engines idled, and the plane is placed in a correct position for the take-off. The button is then pressed and the rest of the flight is automatic. When the button is pushed the flight controller adjusts the throttle. After eight seconds the brakes release and the plane rises in correct flight technique.

A pressure guage moves back the throttle at 800 feet, retracts the wheels, raises the flaps, and the plane climbs to its cruising altitude. When the plane reaches its altitude, the pressure gauge again operates and cuts the throttle to cruising speed. A magnetic head control keeps the plane on its course while the flight controller's air log registers the air mileage.

When the destination is reached the air log runs out and the automatic pilot picks up the beam from that station. As the plane passes over a cone of silence marker, the throttle cuts back and a down signal is fed to the elevator control circuit.

The landing operation is the reverse of the take-off operation. At 880 feet the landing gear is lowered and the flaps are adjusted. When the plane passes over the outer beacon, the elevator control is operated by the glide path signal. When the plane touches the runway, the throttle cuts out and the brakes are applied after three seconds. A differential braking system controls the ground direction until the plane is stopped.

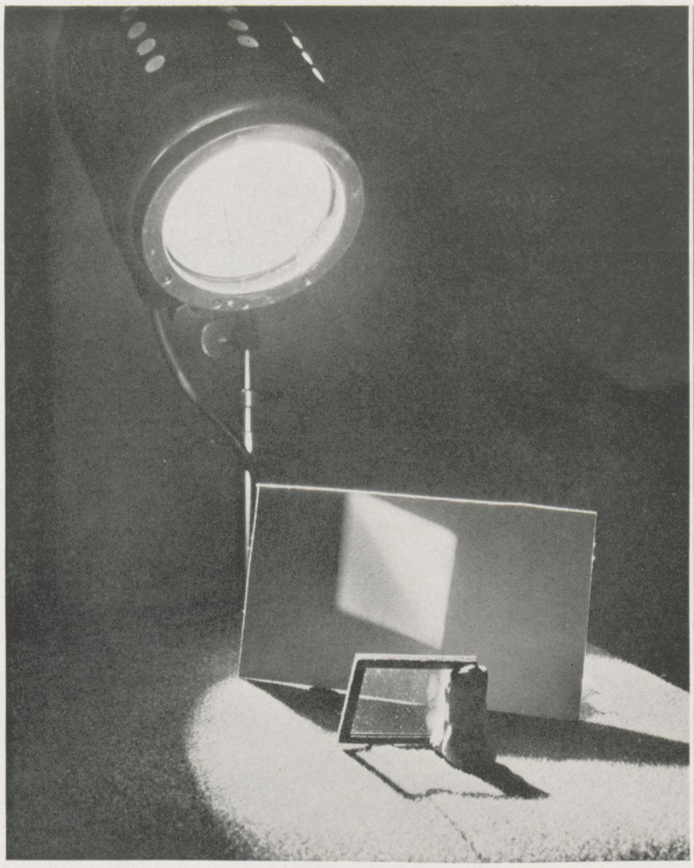
The variable factors of altitude, direction, and distance are fed to the brain or nerve center of the unit. From these factors received from automatic recording devices, the flight controller automatically directs the plane by impulses that activate the mechanical parts.

The robot in its present stage of development is practical only for military purposes. Officials say it is too bulky for ordinary planes. It could be used very efficiently in rockets and Kamikaze planes, however.

Officials predict extensive future development of automatic flight control instruments. Lessons learned during the war about the production of extremely compact electronic instruments will be applied in the development of compact flight control instruments. It may soon be possible to apply such instruments in all types of aircraft.

With the coming of the robot planes all-weather air travel is possible. The AAF is formulating plans for an all-weather airline to be used for experimental purposes only. It is hoped, however, that within a few years commercial as well as military aircraft will be able to fly under all weather conditions safely.

Giant C-54 "Skymaster" plane, equipped with an automatic flight controller, shown on the runway of the Air Technical Service Command's All-Weather flying center at Columbus, Ohio.
—*Science Service*



Left: Light from the lamp is reflected from the glass onto the cardboard behind it. The faint triangle of light was reflected from the chemically coated portion of the glass, while the bright portion was reflected from untreated glass. Right: Lenses at the Eastman Kodak Company are shown getting a coating of fluoride 0.000004 inch thick in a vacuum glass bell jar. —*Science Service*

Chemical Films Reduce Glare from Glass

ONE of the newest discoveries in optical science is that of coating glass with a very thin film of certain chemicals so that, paradoxially, more light will pass through. When light passes through ordinary glass, 4% to 6% of the light is lost each time it passes from air into glass or from glass into air. This means that in an optical instrument with many lenses the major portion of the light is lost by the time it passes through the instrument. However, by coating glass surfaces with a transparent film of magnesium fluoride of approximately one light wavelength in thickness (.000003 to .000004 inches), less light is reflected and there is a similar increase in light transmitted. In optical instruments with many lenses the amount of light transmitted through the instrument has been increased as much as 200% to 300% by coating the surfaces of the lenses.

Science has been trying for many years to perfect the process of coating glass in order to increase light transmission through it. Over fifty years ago an Englishman, H. Dennis Taylor, discovered that lenses which had been exposed to the elements for a great length of time became tarnished and actually transmitted more light than new lenses. He experimented with certain chemicals in an attempt to leach the glass and thus create the same kind of tarnish artificially. The Bausch and Lomb Optical Company developed a method whereby glass was soaked in dilute nitric acid to create a single etched layer from the action of the acid upon the glass. In 1936 Dr. John Strong of the California Institute of Technology showed that a film of calcium fluoride on a glass surface would increase the amount of light transmitted. Physicists Dr. C. Hawley Cartwright and Dr. A. F. Turner at the Massachusetts Institute of Technology improved upon the discovery by finding that the film could be made harder by baking the glass after it was coated. However, the coating was still not hard enough to withstand ordinary handling without becoming scratched.

In 1941 Dr. Dean A. Lyon, then at the Naval Gun Factory, Washington, D. C., perfected the one-coat process with the discovery that a film of magnesium fluoride, when deposited upon glass which had first been heated to a temperature of about 200 degrees Centigrade, resulted in a film nearly as hard and durable as the glass itself.

In this process the coating is applied within a vacuum in a large bell jar. The glass is placed in frames about one and a half feet above a tungsten filament and under the filament is placed powdered magnesium fluoride. The glass is heated while air is being pumped from the bell jar. Then when the desired vacuum is attained the filament is heated. The heat from the filament causes the magnesium fluoride to vaporize at 1400 degrees Centigrade. The molecules of magnesium fluoride fly off and strike the lenses with such force that they create a permanent coating on the glass. The desired thickness is attained when the glass has a redish purple color when viewed from a certain angle.

It is possible to transmit even more light through glass by applying two or three films. Dr. E. D. Tillyer and Dr. H. R. Moulton of the American Optical Company developed a process in which two films are used. This method is more flexible than the one-coat process since the two films may be varied to obtain desired results. The order in which the films are applied determines whether

(*Continued on Page* 26)

Campus Survey

By George Staub, soph., e.e.

Registered Professional Engineers

Professor Harry E. Nold, head of the Mining Engineering Department of Ohio State University and Past President of the National Society of Professional Engineers, spoke to the student body on March 18 on "Registered Professional Engineers". His lecture included the code of ethics of the Professional Engineer, the work done by the National Society in obtaining Engineering-Recognition laws in 47 States, and the potentialities of future work in this field.

The National Society of Professional Engineers is composed entirely of registered Professional Engineers. Each State has a registration law for the licensing of engineers which is administered by the Registration Board of that State, just as similar boards control the licensing of physicians and lawyers. The purpose of the engineer's registration law is to safeguard life, health, and property, and incidentally to raise the standards of engineering practice.

Prof. H. E. Nold

The Administrative Board for Indiana consists of the following members:

Prof. C. C. Knipmeyer, Chairman, Rose Polytechnic Institute.

Prof. Harry Solberg, Mechanical Engineering, Purdue University.

Guy Stinchfield, County Surveyor, Valparaiso.

Walter Walb, Gen, Mgr., American Steel Dredging Co., Ft. Wayne.

R. V. Achatz, Gen. Mgr., Southern Indiana Telephone Co., Aurora.

Faculty

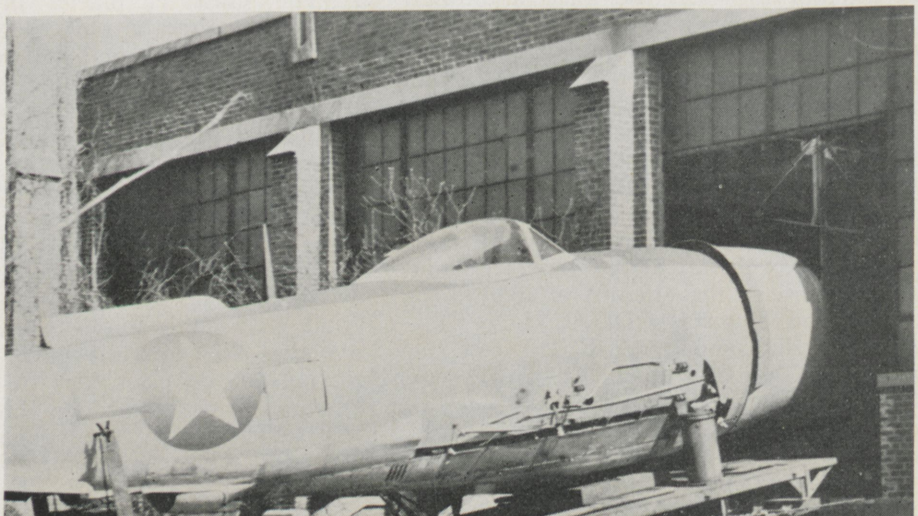
Staff Sergeant Carl F. Lutz, who has been Instructor in basic Military Science and Tactics at Rose for the past five terms, was recently granted an honorable discharge by the U. S. Army.

Sergeant Lutz came to Rose as a Finance Officer with the A.S.T.P., and when this program was discontinued he was assigned to remain as Instructor. Under Sergeant Lutz's supervision the R.O.T.C. unit at Rose maintained its high rating in the annual military inspection. Due to his quiet military termination many of us didn't realize he was departing till too late; therefore we would like to say here, good luck and thanks for all you've done in keeping Rose tops in military training.

The Advanced Military course (dropped during the war) was reinstated this term. The staff, so far, consists of Lt. Col. Otto J. Rohde and Staff Sergeant Combs.

Captain Herman A. Moench, alias Professor Moench, of the Electrical Engineering Department, is back on the campus this term. Professor Edward A. MacLean, of the Civil Engineering Department, has also returned.

Col. Bennett, who has been teaching Applied Mechanics and Mathematics for the last several terms while on terminal leave from the army, has regained his civilian status as of January 18. As is typical of Professors returning from the armed forces, Col. Bennett has an exuberant vitality that has caused his students to burn a lot of midnight oil. I'll swear that if given another two weeks, he'd have had us building bridges in our first-term Applied Mechanics class.



No door at Rose was big enough to accommodate this airplane (surplus government property), so a new one was cut at the wood shop. Plane is shown here being brought in through the new door.

White Elephant??

It appeared for many months as if we had acquired a second "Rosie," but the wheels of progress were finally engineered into performance

and our experimental airplane was moved into its new home (see cut). There must be a farmer on the C.A.A. board—they clipped off a wing to make sure it stayed out of the air.

St. Pat's Dance

Sparkling — Gay — Festive — Successful — The St. Pat's dance, one of the remaining high spots in our somewhat neglected social program, was thoroughly enjoyed by students, alumni, and faculty.

Scene from the St. Pat's dance March 15 at the Mayflower Room.

Camera Club

As we promised in the last issue, the three winning entries of the Camera Club's latest contest are reproduced on page 18. Two more contests are being planned for the near future. One is to accept the members best photographic effort, irregardless of time at which it was expended. The second contest is to have a time limit, which will probably cover the time that has elapsed since the closing date of the last contest. Watch the Camera Club bulletin board for further information.

The club is sponsoring a series of talks by its more experienced members on various phases of photography. The last talk was given by the club's president, F. M. Albertson. His topic was "Film Developing", and covered various aspects of developing such as; time of development, tank and tray development, types of developers, etc. The next topic is "Photo Enlarging" and will cover use of the enlargers, developing enlarged prints, etc. The speaker will be Robert La Follette.

Evicted

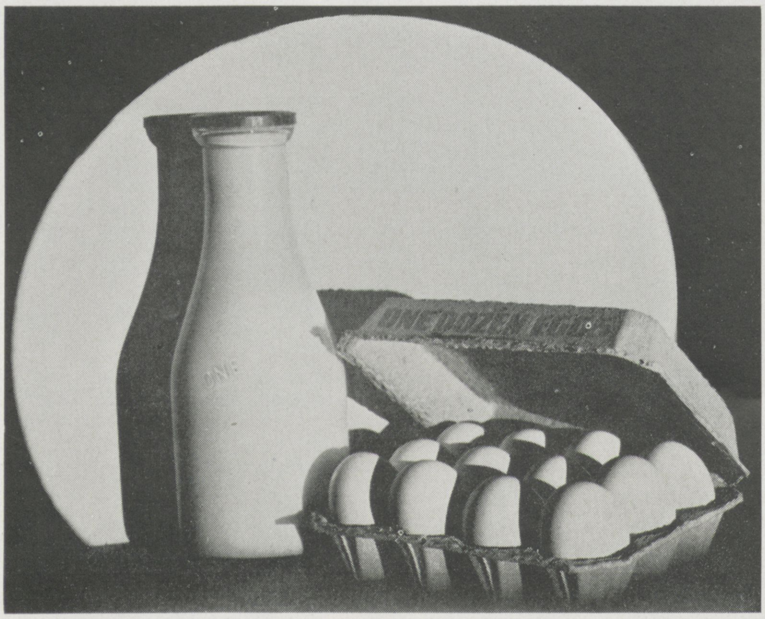
The O.P.A. refused to do anything to assist Professor Bennett when he was evicted from his office to make room for members of the firm of Ketchum, Inc., that are working on the campaign mentioned on page 10 of this issue, so he quietly moved to the hall in utter dispair. Lucky for him, though, his good neighbor Professor Hutchins, across the hall, threw out the welcome mat.

When questioned by your reporter about this unusual procedure, Mr. Ralph K. Bishop, of Ketchum, Inc., stated that it was only temporary, pending the opening of their downtown office. Incidentally, he also introduced the other two members of the Ketchum staff now at Rose as Mrs. Nancy Foraker and Mr. Al Heck.

Final exams finish up the winter semester at Rose. Left: part of the students taking exams in the gym. Right: students taking an exam in the Machine Design Room. Man at right center is thoroughly bored.

Camera Club Winners

The pictures on this page are the winning photographs in the contest sponsored recently by the Rose Camera Club. Judges were Professors Stock, Bloxsome, and Fairbanks.

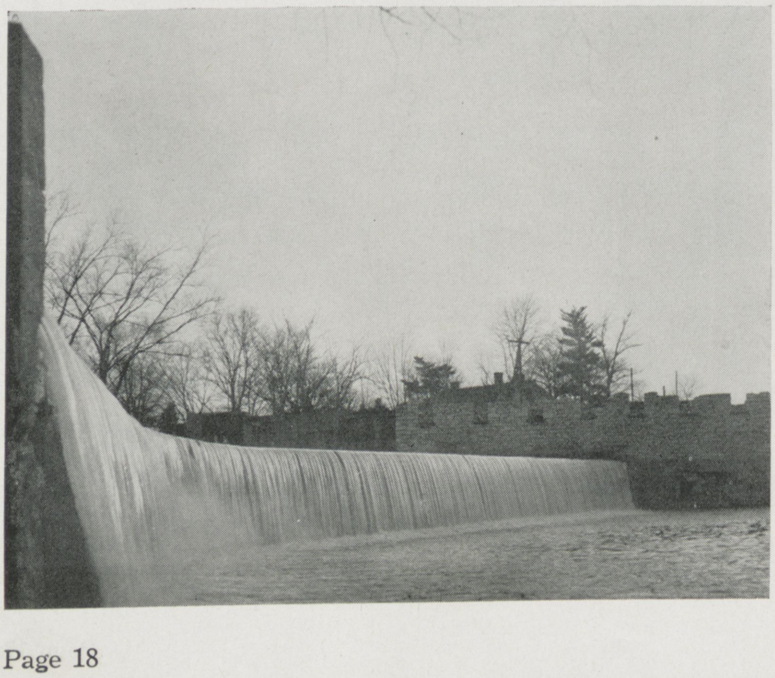


First: Vitamins Plus.

Taken by F. M. Albertson with a Voigt Lander 2¼x3¼ camera using Verichrome film. Exposure: 3 seconds; f-16.

Second: Bridge at Highland Lawn.

Taken by W. J. Kirchner with a Zeiss-Ikon camera using Verichrome film. Exposure: 1/75 second; f-9.



Third: The Old Mill.

Taken by Edward Valenzano with a 2¼x3¼ Watson Press camera using Superpan Press film. Exposure: 1/10 second; f-5.6.

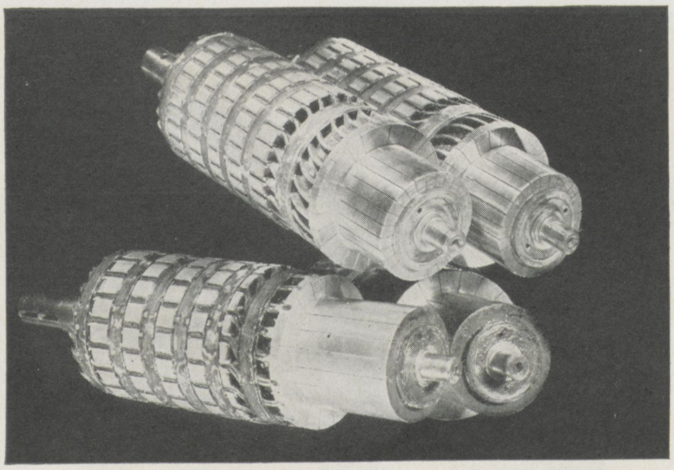
AWARD FOR SERVICE

A sleeping village in the path of a raging flood . . . at her switchboard an operator makes call after call to alert the community and summon aid. She leaves only when rising waters reach the board and the building itself becomes flooded.

For this and similar acts of public service, more than 1,200 telephone men and women have received the Bell System's most coveted award—the Theodore N. Vail Medal.

Service to the public has long been a tradition in the Bell System. The thought "service first"—day by day as well as in emergencies—has helped give this nation the best communications service in the world.

BELL TELEPHONE SYSTEM



Starting Motor Armatures have proved to be better, both electrically and mechanically, when joints between armature coil and commutator bars are brazed by induction heating. Segments, brazed one at a time, require 15-20 seconds each.

—Allis-Chalmers

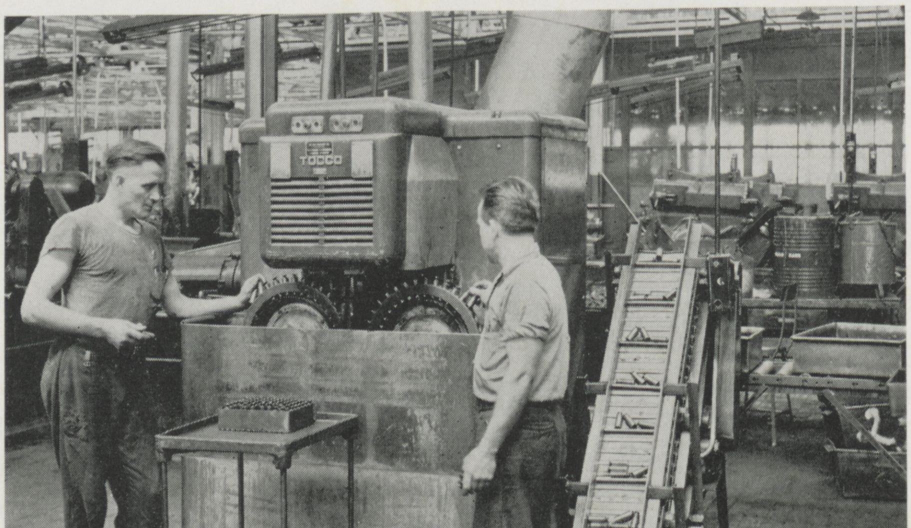
HIGH FREQUENCY HEATING

(*Continued from Page* 7)

Induction heating possesses a number of concrete advantages over other heating methods which insure it a well-defined place in industry. The chief feature, of course, is its rapid (within a few seconds) and extremely accurate production of heat in the object to be treated. This makes possible the production of uniform products, which are usually freer from distortion and less prone towards cracking and chipping than objects treated by more conventional sources of heat. Other features include the ease of installation and the relative portability of induction heating apparatus, together with its smooth, noiseless operation and ease of maintenance. The greatest disadvantage of induction heating is the cost of its operation, particularly the high initial cost of installation. The concensus of opinion among manufacturers is that this disadvantage is more than compensated by the advantages for work with many types of equipment.

Dielectric Heating

Dielectric heating is employed with substances which are relatively good insulators. The material to be treated is placed between two electrodes and an alternating high frequency electric current is applied, producing a high frequency electric field between the electrodes. The alternating field produces agitation among the molecules of the material, thus producing heat. Heat is thus



1500 Degrees In Three Seconds is reached in this high frequency 3000 cycle induction heating machine used to harden metal parts at the rate of 70,000 a day. *—Westinghouse*

FM radio receivers are more static-free and less costly—thanks to research at RCA Laboratories.

Stuart William Seeley, Manager of the Industry Service Laboratory, RCA Laboratories Division, perfected this new FM circuit. It not only operates equally effectively with strong or weak stations, but lowers the cost of receivers by eliminating additional tubes and parts that were formerly considered necessary in Frequency Modulation receivers.

NEW FM - noiseless as the inside of a vacuum tube!

Now, FM, or Frequency Modulation reception, provides still greater freedom from static and interference caused by storms, ignition systems, oil burners, and domestic appliances.

It's radio at its finest—making your living room a part of the concert hall itself. You've no idea of how marvelous music can sound over the radio until you hear the golden perfection of FM reception developed by RCA.

Moreover, through this new RCA development, FM receivers can be made at a cost comparable to that of standard-band broadcast receivers. FM is no longer expensive! "Better things at lower cost" is one of the purposes of RCA Laboratories — where similar research is constantly going into *all* RCA products.

And when you buy anything bearing the RCA Victor name — from a television receiver to a radio tube replacement—you know you are getting one of the finest instruments of its kind that science has yet achieved.

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

RCA RADIO CORPORATION of AMERICA

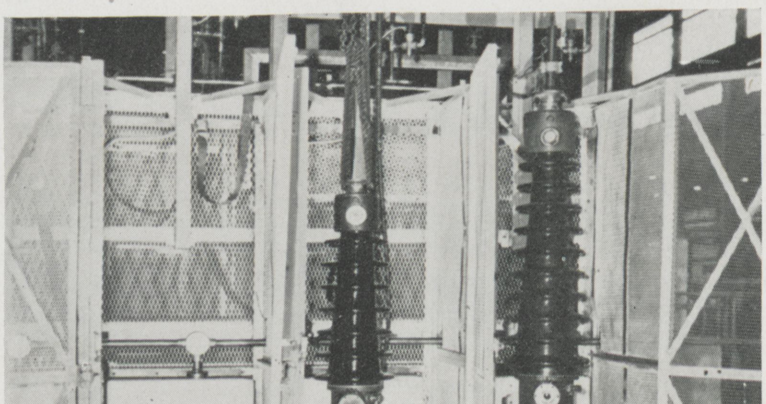
generated throughout the material under treatment by electrical losses from the alternating high frequency field.

Dielectric heating apparatus requires careful design for each specific job. The shape of the electrodes influences the character of the electrical field between the electrodes. In most cases, a uniform generation of heat throughout the material being treated is desired, and by careful design an approximation to this may be attained.

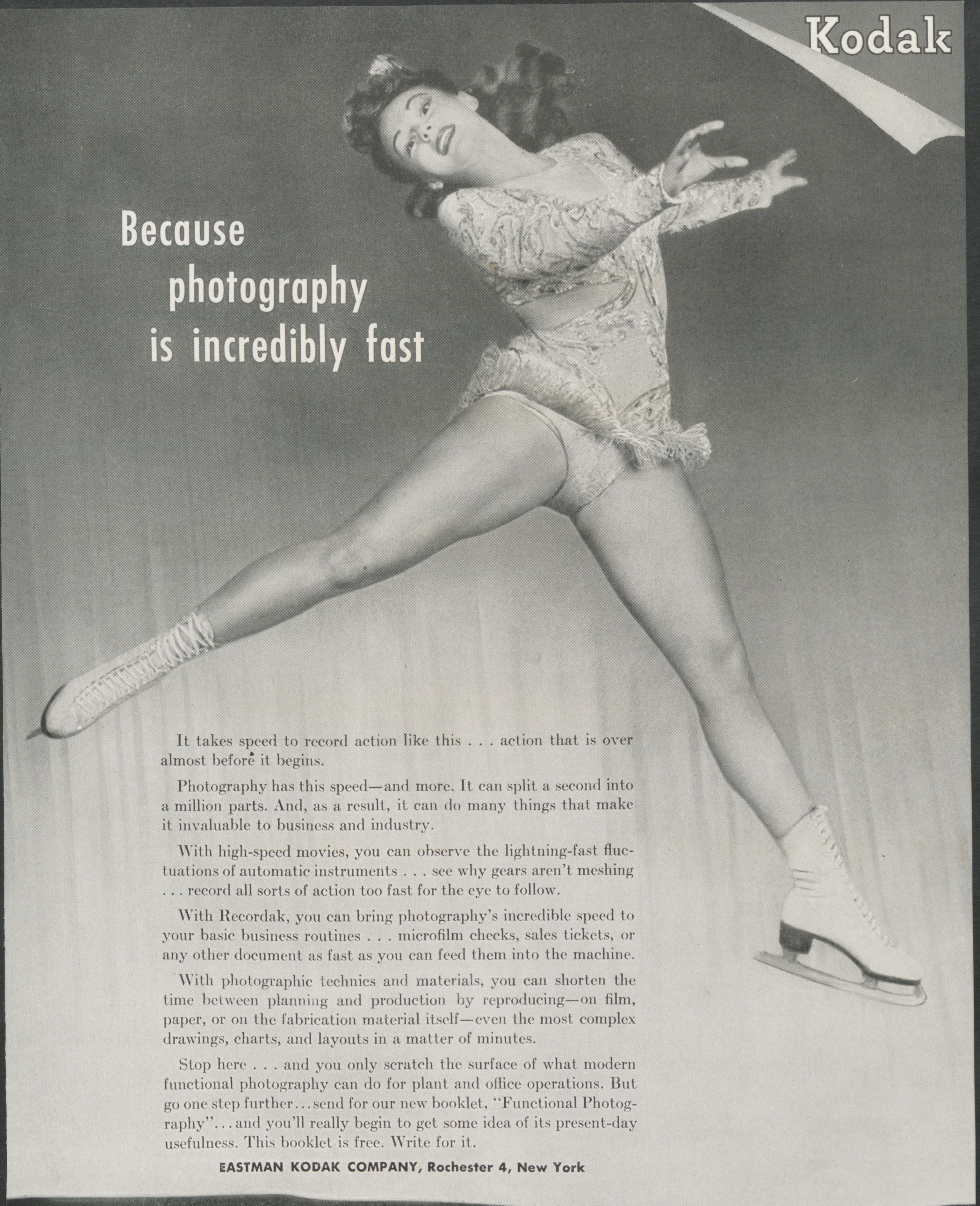
Electrical insulators are usually poor conductors of heat. Conventional heating methods, in which all the heat is supplied at the outside of the material being treated, are therefore handicapped by the necessity of allowing heat to penetrate from the surface into the center. Temperatures high enough to effect uniform heating of the material within a reasonable length of time are often so high that decomposition or other undesirable effects take place in the material being heated. The long production time required by such conventional heating methods at safe temperatures is therefore rather expensive.

Dielectric heating units, on the other hand, generate heat uniformly throughout the material being treated, eliminating heat conduction as a factor. Production time is reduced from hours to minutes. Accurate control of the heat throughout the entire volume of material is accomplished, eliminating overheating of the surface of the material with its accompanying destructive effects. Additional advantages of dielectric heating include ease of operation (including the abrupt beginning and end of the period of application of heat), compactness of the heating units, and ease of maintenance. Due to the fact that no physical contact is required between the heating unit and the material being treated, the product may be inserted and removed quickly and easily. Because of the higher cost of installation and operation of dielectric heating units, however, uses will be restricted to fields where the many advantages of dielectric heating overshadow the cost factor.

The major applications of dielectric heating are drying, gluing, and hot molding processes. Drying applications include the curing and seasoning of wood and rubber, the drying of tobacco, leather, chemicals, and other products, and dehydration of food. The gluing and cementing of plywood, shoe leathers, and other products by the application of dielectric heat and pressure has brought about an enormous reduction in time over the previous steam-heat processes, while at the same time the quality and uniformity of the product has been improved.



Dielectric heat treatment of these large condenser type transformer bushings generates heat directly within the insulation, driving out all moisture. —*Westinghouse*



Because photography is incredibly fast

It takes speed to record action like this . . . action that is over almost before it begins.

Photography has this speed—and more. It can split a second into a million parts. And, as a result, it can do many things that make it invaluable to business and industry.

With high-speed movies, you can observe the lightning-fast fluctuations of automatic instruments . . . see why gears aren't meshing . . . record all sorts of action too fast for the eye to follow.

With Recordak, you can bring photography's incredible speed to your basic business routines . . . microfilm checks, sales tickets, or any other document as fast as you can feed them into the machine.

With photographic technics and materials, you can shorten the time between planning and production by reproducing—on film, paper, or on the fabrication material itself—even the most complex drawings, charts, and layouts in a matter of minutes.

Stop here . . . and you only scratch the surface of what modern functional photography can do for plant and office operations. But go one step further... send for our new booklet, "Functional Photography"... and you'll really begin to get some idea of its present-day usefulness. This booklet is free. Write for it.

EASTMAN KODAK COMPANY, Rochester 4, New York

ADVANCING BUSINESS AND INDUSTRIAL TECHNICS— **Functional Photography**

Here is one method by which a forest is harvested, yet which also provides for a new crop of trees. This is called block cutting, a practice followed chiefly in the even-aged, old growth forests of the Douglas Fir region of western Washington and Oregon. While the land is clear cut, large blocks of trees are left to reseed intervening areas.

FOREST CONSERVATION

(*Continued from Page* 9)

veloped, the employment directly and indirectly furnished might be stepped up to as much as 6,250,000 persons. A comprehensive forest work program should be undertaken immediately to help bring our forests and ranges into condition to sustain such an increase in the basic level of industrial employment.

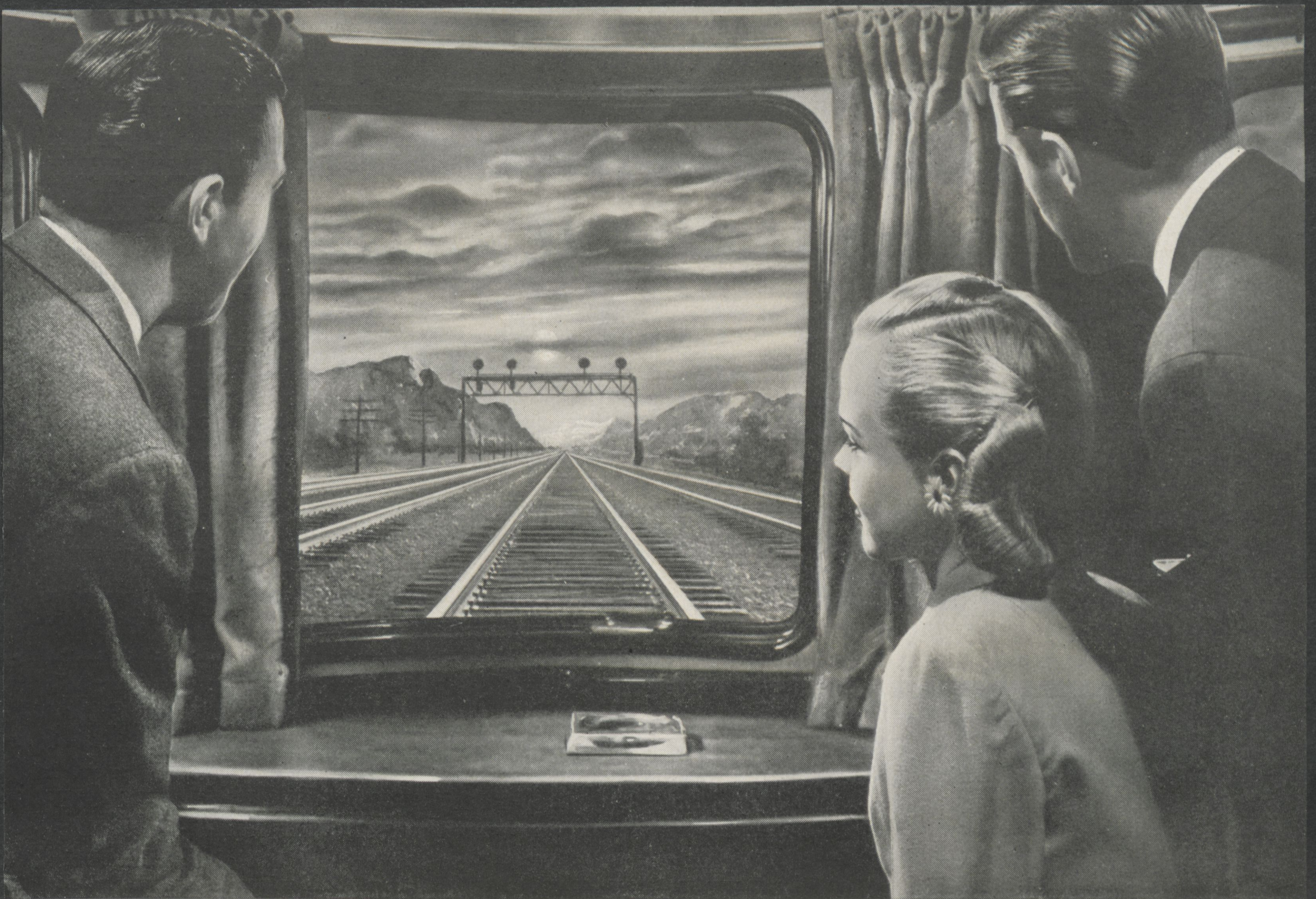
Besides being vital to industry and playing an important potential part in postwar employment, forests also possess other important assets such as wildlife and recreation. The recreational assets of the national forests are available to people in all walks of life. To preserve and enhance the natural assets of the national forests, simple facilities for camping and picnicking have been installed. Winter sports make national-forest recreation a year-round activity. Now that gasoline, tires, and new automobiles are becoming available, more people than ever before will seek vacations in the forests.

Wildlife is a major recreational attraction of the national forests. When national forests in the West were first established, wildlife had been rather generally depleted. Since then, range forage has been restored and the wildlife habitat appreciably improved by timber cutting.

Elk and deer are the chief species of the two and one-fourth million big game population in the national forests. Forage crops needed to maintain these animals are being improved to provide for the increase in the wildlife population.

In the past forty years the Forest Service has had a significant record of achievement. It spearheaded the conservation movement in America. It has developed sound forestry techniques applicable to American conditions. But the biggest jobs remain. The downward trend of our forest resources has yet to be reversed. Few forest industries have an assured supply of timber for sustained operation. Forest employment rests on a precarious base.

On its fortieth anniversary, February 1, 1945, the Forest Service pledged itself to renewed effort in a program of forestry that will make the forests play their full part in serving the nation's agriculture, industry, and people. Such a program will be a vital factor in meeting the most critical need our country faces in the years ahead—full employment.



RESEARCH & DEVELOPMENT

(*Continued from Page* 15)

light will be reflected or transmitted. If the process for transmitting more light is reversed the result is a transparent mirror, a glass which acts as a mirror on one side, but which is transparent to a person on the other side.

In this process the films need not be applied in a vacuum. The glass is dipped first into one chemical, then into the other, and then baked. This method has an advantage over the one-coat process in that larger areas may be coated more easily. Glass coated in this manner is just as durable as that coated with magnesium fluoride. The exact chemicals used inthis two-coat process have not yet been disclosed, since patents are still pending.

Reducing reflection by adding a film to glass seems strange when considering the fact that a film on a glass surface actually creates more reflections. Besides the reflection from the top layer there is also a reflection at the boundary between the glass and the film which returns to the top of the film and is again partially reflected. The idea is to control these reflections and make them perform to advantage.

When only one film is used it can be shown mathematically that if the thickness of the film is equal to one-quarter of the wavelength of the light to be eliminated, then the reflection from the glass-film boundary will be 180 degrees out of phase with the reflections from the top surface of the film. If the amplitudes of these two reflections are equal they will cancel each other and no light will be reflected. The amplitudes of these two reflections will be equal if the index of refraction of the material in the film is equal to the square root of the index of refraction of glass on which the film is deposited. However, no durable material known has such a low index of refraction; in fact, it is theoretically impossible to make a single film which will completely eliminate reflection.

Multiple films, though more complicated mathematically, promise to be the future means of transmitting most of the visible light through glass.

The application of these discoveries is not limited to complex instruments. For example, eyeglasses, camera lenses, store windows, automobile windows, rifle sights, and aircraft cockpit canopies are now being coated to reduce reflection or to increase their transmission of light.

Degaussing Systems for Magnetic Mines

DURING the early months of World War II a new German weapon, the magnetic mine, extracted such a heavy toll of shipping in the waters surrounding the British Isles that the nation was almost shut off by sea from the rest of the world. The mine lay on the ocean floor until it was actuated by the magnetic field around a ship. This magnetic field, which was produced by the hull, machinery, and other metal parts of the ship, attracted a dip needle in the mine. As the ship approached, the dip needle tilted and started the mechanism which sent the mine shooting to the surface to explode against the bottom of the ship. The minesweeper, heretofore the most effective method of combatting mines, was useless against magnetic mines because they law far below the surface.

Allied scientists solved the problem by fitting the inside of the hulls of ships with coils of electric cable. This system, called degaussing, reduced the magnetic field around a ship by 80% or more. The weak magnetic field which remained was strong enough to explode only highly sensitive mines which were located near the surface of the water. However, these mines were easily picked up by minesweepers.

The first degaussing systems were installed in ships after they were launched, but this method was very costly in both time and money. Then scientists began to use scale models of ships under construction to determine the type of magnetic field the finished ship would produce. The metal parts of ships were reproduced in the models on a scale of about one inch to every eight feet of the ship. The magnetic field of the model was determined and from that information the type of degaussing equipment for the ships was calculated. The use of models saved a great amount of time by making it possible to install the degaussing equipment while ships were under construction.

Degaussing was further complicated by the fact that magnetism on the earth's surface varies somewhat irregularly. This irregularity necessitated different magnetic settings in different areas of the world. Elaborate charts were drawn up to aid in keeping the proper setting at all times.

Regular tests on the equipment were conducted by running ships between magnetically charged buoys which measured the magnetic fields of the ships. With that information all adjustments could be made.

Brain Twisters

(Answers on request)

1. Imagine a pulley over which there is a rope with a weight at one end. At the other end hangs a monkey of equal weight. The rope weighs four ounces per foot. The combined ages of the monkey and its mother is four years, and the weight of the monkey is as many pounds as the mother's age in years. The mother is twice as old as the monkey was when the mother was half as old as the monkey will be when the monkey is three times as old as its mother was when she was three times as old as the monkey was. The weight of the rope and the weight of the weight combined is one-half as much again as the difference between the weight of the weight plus the weight of the monkey and the weight of the weight. What is the length of the rope?

---

2. One glass is half full of water and another glass (of the same capacity) is half full of alcohol. A spoonful of alcohol is taken from the second glass and put into the glass of water. A spoonful of this mixture is then taken and put into the glass of alcohol. As a total result of these transactions, which is greater: the quantity of water in the glass of alcohol or the quantity of alcohol in the glass of water?

---

3. Arrange the ten digits in such a manner that they will add up to 1.
In a similar manner, use the ten digits to form the number 100.

---

4. Two cities are 15 miles apart. Inter-city buses set out from each city every fifteen minutes, proceeding at constant speed. A hiker leaves one city just as one bus is arriving and another leaving. He arrives in the second city several hours later just as one bus arrives and another leaves. Including these four, he saw 42 buses on the way, 19 going in the same direction and 23 in the opposite direction. What was his speed, and what was the speed of the buses?

---

5. A wealthy Frenchwoman who escaped to Spain during the occupation made arrangements to stay temporarily with a Spanish family. She agreed to pay the family each day one link from a gold chain of 60 links which she had in her possession. Due to the temporary nature of her visit, she did not wish to pay in advance or fall into debt. Since she wished to recover the chain after the war, what was the least number of cuts she could make in the chain?

Why not sent in your pet problem to our Brain Twisters Department.

TUNGSTEN

(Continued from Page 12)

and the impurities contained.

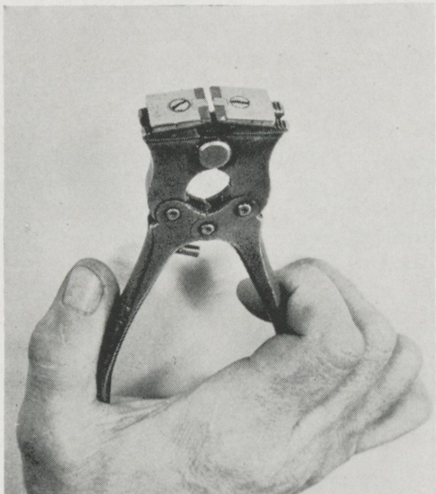
The fact that wolframite ore is somewhat magnetic makes purification somewhat easier. Most of the ores originally separated by gravity concentration can be further concentrated by magnetic separation. Scheelite ores usually carry fewer sulfides but frequently have them in relatively large amounts plus phosphorous, arsenic, antimony, and molybdenum.

The chief tungsten-bearing ore in Canada is scheelite, which is mined along with gold and copper. The tungsten concentrates are usually removed by gravity, but if metallic sulfides are present a combination of gravity and flotation processes is used. After removal from the other metals with which it is usually found, the ore is ground in ball mills in closed circuit with classifiers. Gold taps or jigs are placed in the grinding circuit to recover any metallic gold. The gold-bearing sulfides are floated in standard machines to recover any metallic gold and the flotation tailing is refloated to recover scheelite, using a soap reagent as a collector. In most cases 90 percent or better of the tungsten oxide content is recovered by this method, even when the ore contains as low as 0.5 percent tungsten trioxide.

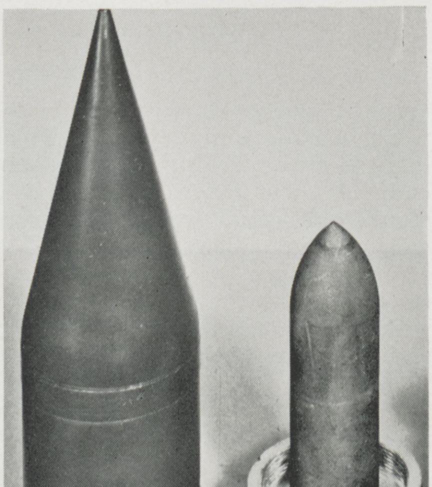
Producing the Metal

The first step in producing metallic tungsten from the concentrates is to extract pure tungsten trioxide by chemical treatment. This action consists of fusion with sodium carbonate, forming sodium tungstate (Na_2WO_4), which may then be dissolved out in water. Addition of an acid to the solution precipitates tungsten trioxide as a yellow powder, which is filtered off. It may be purified by redissolving in ammonia and reprecipitating with acid. Before reduction to metallic form the finely-powdered precipitate is sometimes sintered to coarser particles by heating to about 1100° C.

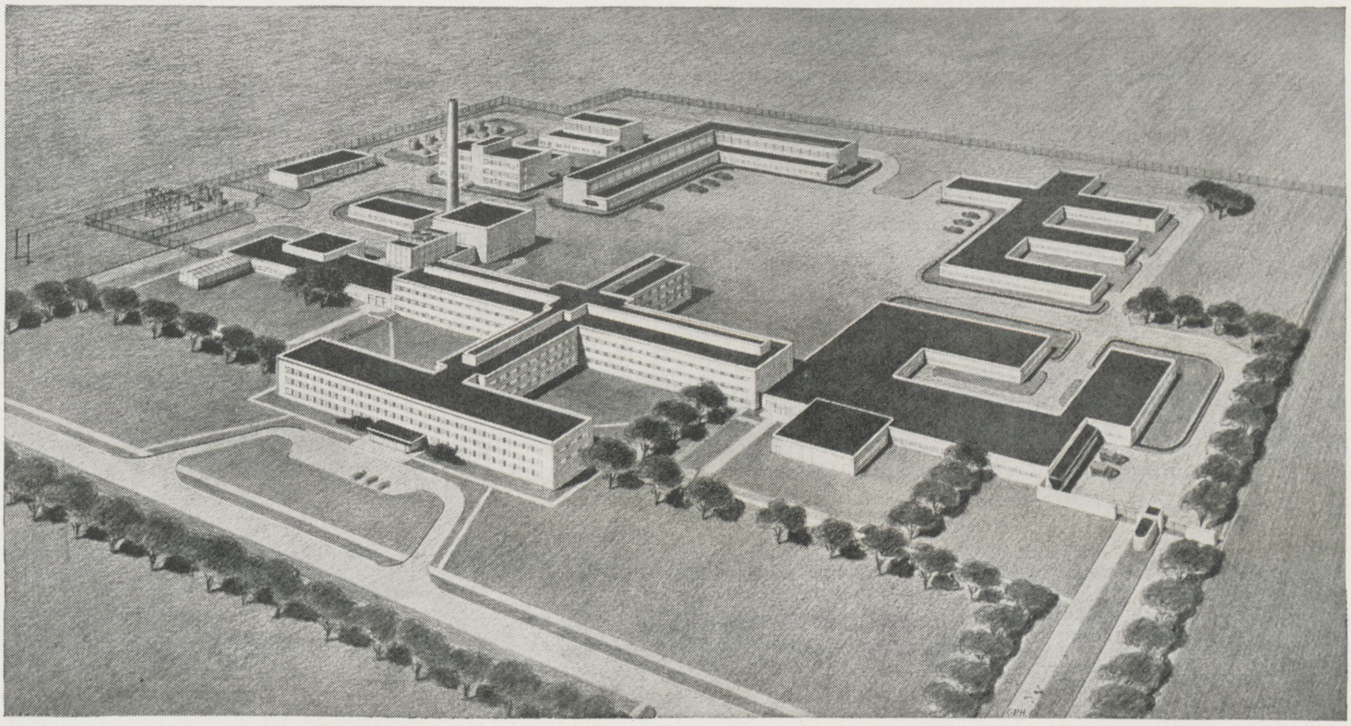
The reduction of the tungsten trioxide is accomplished with hydrogen. The operation is carried out at about 1000° C., yielding metallic tungsten powder. Since metallic tungsten has a higher melting point (3382° C.) than any other metal, it is not practicable to cast the tungsten into bars. Instead, the powder is moulded under pressure into the form of a small rod or briquet and baked at a temperature of 1000° to 1300° C. in an atmosphere of hydrogen, producing a porous slag which cannot be broken easily. This slag is then clamped between two electrodes in hydrogen, and a high current is passed through which heats it to a temperature of 3000° to 3200°



The four dark rectangles on the faces of these nippers are Carboloy cemented carbide inserts. The nippers are used to cut tempered steel wire springs. These nippers have been in constant daily use for several years without having to be re-sharpened. The plain steel nippers formerly used on this job had to be sharpened every two days.



This picture shows the Carboloy cemeted carbide core used in the armor-piercing shells which were used so effectively against Nazi tanks during the Battle of Germany. The carbide core penetrated the armor and then broke into heavy, jagged pieces which acted as shrapnel inside the tank.



Great new research laboratories being built by Standard Oil (INDIANA)

will provide every modern facility for about 1200 research workers

War activities revealed hitherto undreamed-of possibilities that lie in petroleum . . . found many new products that can be made from it . . . widened the entire horizon of organic chemistry.

So, the Standard Oil Company (Indiana) started building these new research laboratories at Hammond, Indiana, near the famous Whiting refinery. Here the Company's able scientists will work their magic . . . taking hydrocarbons apart and putting them together . . . turning aliphatics into aromatics . . . developing amazing new methods for carrying out chemical reactions.

From these laboratories will come fuels for new cars and new diesels, for gas turbines, for jet-propelled planes. There will appear new lubricants, insecticides, cutting oils—and an increasing number of new chemicals and plastics.

Some of the scientists will work with flasks and beakers, some will operate pilot plants. Others will carry out complicated chemical analyses electronically by the flick of a switch. Still others will design huge new refinery units, or help run these towering steel giants. Chemical engineers with a flair for economics will watch crude supplies, costs, markets. They will decide when, if ever, the Company ought to start making gasoline from natural gas or from coal.

All this and more will go on in these new research laboratories.

STANDARD OIL COMPANY (INDIANA)

C. for ten to fifteen minutes, forming a rod that is dense but very brittle. The metal is then worked so that its structure is changed from grains to fibers. In this form the tungsten is ductile enough to be drawwn into filaments.

Tungsten of high purity may be produced by an electrolyte cell. The tungsten trioxide is dissolved in fused alkali borates and alkali phosphates. The bath is a good conductor of electricity, and produces pure tungsten at the cathode at relatively high current efficiencies.

Uses of Tungsten

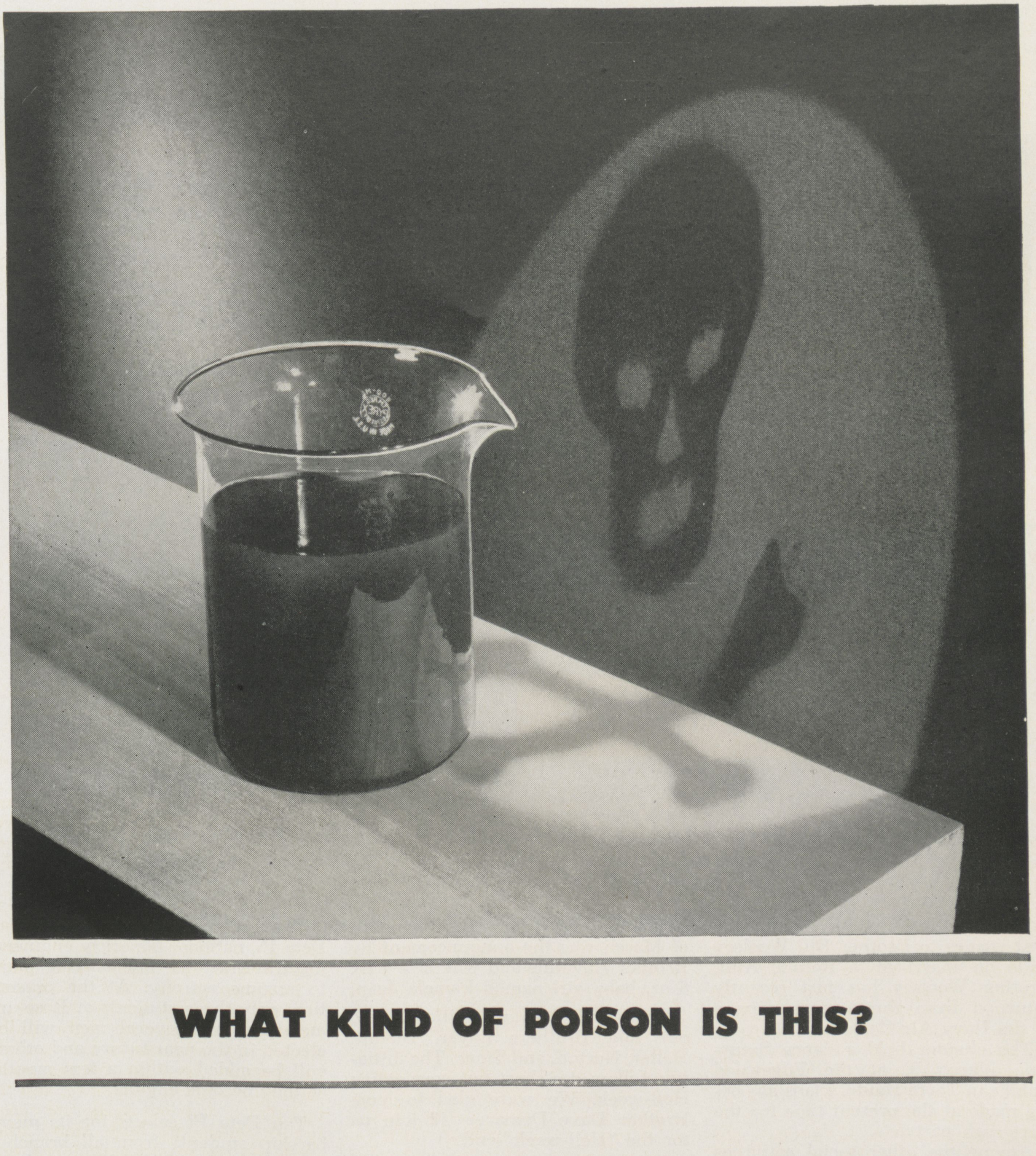
The consumption of tungsten has increased considerably in the last twenty years, due largely to its increased use in hard alloy steels. A combination of physical properties make tungsten very desirable as a component of high speed steel in the tool industry. Its tensile strength, hardness, extremely high melting point, ductility, and corrosion and erosion resistance make it very suitable for service in high speed steel. Ordinary carbon steel loses its hardness at 200° C.; it is impossible to use this steel for metal cutting at high speeds, since the friction of cutting warms the tool to the point where it loses its hardness. Steel containing as little as 18 percent of tungsten, however, retains its hardness even at low heat (up to 600° C.). This characteristic, plus the natural extreme hardness of tungsten, makes tungsten steel almost ideal for the construction of cutting tools.

Approximately ninety percent of the tungsten is used in the steel industry. Some of the products containing an appreciable tungsten content are stainless steels, railroad rails, car springs, sounding plates for pianos, grinding rolls, cutting blades of all types, watch springs, electrical resistance wire, and valves and valve seats for internal combustion engines. Wartime uses of tungsten include armor plate, armor piercing shells, and the linings for the barrels of rapid-firing guns.

Another major outlet for tungsten is tungsten carbide. Tungsten carbide is the hardest known metallic substance—hard enough to cut the hardest steels. It cannot be obtained in coherent lumps except when sintered with some tough metal, usually cobalt. The combination of tungsten carbide and cobalt is known as Carboloy, which combines the tremendous hardness of the carbide for cutting and wear resistance properties and the toughness of cobalt to keep the hard, brittle, carbide in one piece during service. Carboloy is used for high speed tools for cutting steel in the fabrication of airplane engines, artillery, motor parts, gears, crankshafts, and many other parts.

Tungsten is the most satisfactory element yet found for use in making filaments for electric light bulbs. Factors contributing to this use are its ductility, its high melting point, its high electrical resistance, and the fact that it does not evaporate rapidly and darken the bulb. Many other types of electronic equipment employ tungsten filaments and other parts. Tungsten is used for cathode targets in X-ray tubes and for electrical contacts which must not corrode easily.

Tungsten has a limited number of chemical uses. Sodium tungstate is used in the production of certain types of lakes and mordants, in the making of white leathers, in flameproofing cloth, and in the weighing of fabrics. Oxide and several other compounds are used as pigment in paint and ceramic wear. Cadmium tungstate is used in X-ray screens.



WHAT KIND OF POISON IS THIS?

SOME POISONS ARE KILLERS. Others are preservatives. Creosote is one of the "others" . . . a protective agent which preserves timber against the attacks of decay, termites, and marine borers. Those destructive agents cause millions of dollars worth of damage every year . . . but when wood is pressure-treated with creosote, it becomes toxic to them.

Koppers pressure-treats about 50,000 carloads of lumber and other forest products every year. Its creosote treatments baffle decay, termites, and water worms. Other specialized treatments make wood resistant to acid and abrasion, as well as to decay and fire.

The result is that wooden structures of all kinds . . . bridges, farm buildings, railroad ties, telephone poles . . . all last more than three times as long as they used to. And this, in turn, helps to conserve America's invaluable forests.

Wood preserving is only one Koppers activity. Koppers also makes paving and roofing materials, designs and builds coke ovens, manufactures piston rings, couplings, chemicals from coal and engages in many other activities. That's why Koppers is known as "the industry that serves all industry." Koppers Company, Inc., Pittsburgh 19, Pa.

The industry that serves all industry . . . KOPPERS

Fraternity Notes

Sigma Nu

Beta Upsilon chapter extends its best wishes to Brother Bill Woolsey upon his marriage to Rosalie Ault. Brother Woolsey has just recently returned from three years service in the Navy Air Corps.

The chapter held a dance Saturday, March 9, at the Edgewood Cabins in Terre Haute. Plans are being made at the present time for the next rush party.

Among the other social activities being planned for the summer months is the trip to Chicago by some of the members to attend the thirty-second Grand Chapter. The Grand Chapter is to be held at the Edgewater Beach Hotel in Chicago June 26, 27, 28, and 29. Since this is during the vacation between terms here at Rose, several of the members plan to attend.

Recent visitors to the chapter included Pvt. Bob Brown and Dick Mullins. Brother Brown is stationed at Camp Atterbury. Brother Mullins graduated with the class of '41.

Theta Xi

Headlining the news for the month of March was the announcement by Brother Hawkins and wife of a 7 lb. 6 oz. baby girl named Pamela Jean.

On March 10th we initiated into our fold Brothers Layer, Blount, Haller, Norton, and Stone. The initiation followed a short but very active Hell-week. We were glad to have Brother Dave Demaree '42 join us for the "Hell-week"-end.

March 1st nine of our members attended an alumni banquet and lecture on "Jet Propulsion" given in Indianapolis.

February 16 eight couples traveled to McCormick's Creek for a picnic. After a long hike through the woodlands these eight couples enjoyed a good old fashioned sing and weinie-roast in a log cabin.

We welcome Brothers Sommers, Milner, Steiff, and Bolle, who will soon be back with us after service in the armed forces.

Tau Beta Pi

The Indiana Beta chapter of Tau Beta Pi, national honorary engineering fraternity, is now making plans to resume activity. At the present time only three students at Rose are members, but several men will be elected in the near future and others will be added within a few months as they become eligible.

Tau Beta Pi selects for its membership students from all branches of engineering. Only those students in the upper eighth of the junior class and the upper fifth of the senior class are eligible for membership. In addition to their high scholastic record, members must have proved their ability and high character by active participation in extra-curricular activities.

New students in particular are advised to adopt high standards at the beginning of their scholastic careers to insure future election to this society.

SLY DROOLINGS

Women's faults are many,
Men have only two—
Everything they say,
And everything they do.

* * * *

She: "Your one arm driving gives me a pain in the neck."

He: "Why, are you scared?"

She: "No, I'm being choked."

* * * *

He: "You say there is a guarantee with this hair restorer?"

She: "Well, sir, we give away a comb with each bottle."

* * * *

He: "Last night I dreamed I married the most beautiful girl in the world."

She: "Were we happy?"

* * * *

He: I'm trying to make my mind up about going to a wedding tomorrow."

She: "Who's getting married?"

He: "I am."

* * * *

Wife: "My husband is the only one who has ever kissed me."

Friend: "Are you bragging or complaining?"

She: "When we're married I'll give you two nights a week to go out with the boys."

He: "What about the other nights?"

She: "I'll go out with the boys."

* * * *

He: "My wife is very hard to please."

Friend: "She must have just gotten that way."

He: "Why do you say that?"

Friend: "She married you."

* * * *

The proud groom struts his best with his new bride in his arms. He swings her over the threshold and announces:

"I've been practicing this for a month, honey, with a two-hundred pound sack of onions."

* * * *

Housewife (finds the plumber taking a bath in her home, tools all over the floor):

"And what the Devil are you doing now?"

Plumber (brushing away nonchalantly): "It works fine now, Mrs. Jones."

Al:"Do you think Ellen is true to me?"

Pal: "Of course. Don't worry about that, old man. F'r instance, last night she asked me not to kiss her on the lips because that was your favorite place."

* * * *

Wife: "I was a fool when I married you."

Hubby: "That's true. But I was blinded with love at the time and didn't notice."

* * * *

Wife: "Goodness, Tom! This isn't our baby. This is the wrong carriage."

Hubby: "Hush up! This is a better carriage."

* * * *

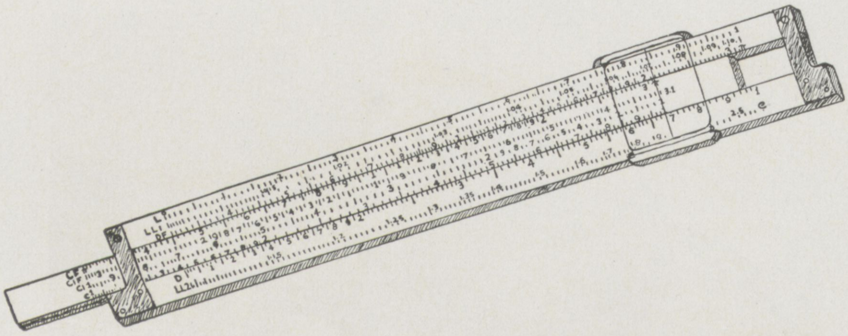
Her eyes were as black as jet,
The most charming girl I knew,
I kissed her and her husband came,
Now mine are jet black too!

* * * *

Izz: "Did you hear the big news?"

Whiz: "What, spill it."

Izz: "My dog visited a flea circus and he stole the whole show."



Sly Droolings

by Derald Heady, fresh.

Friend: "My, what a charming baby! And how he does resemble your husband."

End: "Gracious, I hope not. We adopted him."

* * * *

She: "If you knew me better, you'd like me more."

He: "If I liked you more, I'd know you better."

* * * *

"Help!" came a frantic scream from the dark, dismal forest. A traveling salesman, motoring by, heard and investigated. He found a beautiful, disheveled girl tied securely to a tree.

"A man tied me up here and kissed be, the brute!" she explained.

"Couldn't you even kick him?" asked the traveler.

"No," she replied. "He tied me up so well I can't even move a muscle!"

The traveler examined the knots that bound her very carefully.

"Well," she snapped, "aren't you going to cut me loose?"

"Heck no, baby! I'm going to kiss you myself!"

* * * *

He: "Sir, you've insulted a lady. Come outside."

Him: "Aw, fergit it, will you?"

He: "No, come outside. My mother-in-law is out there and I want you to insult her."

* * * *

Moe: "I wouldn't want my worst enemy to go through what I went through at the hospital."

Joe: "Heck, I thought you said you were kissing the nurses all day long."

Moe: "I know, but I wouldn't want my worst enemies to have so much fun."

She: "What would you say to a girl that went around kissing all the men she meets?"

He: "Pleased to meet you."

* * * *

Traveler: "What's the use of having a timetable if your trains don't run to it?"

Porter: "Now you're all excited. How could you tell they was runnin' late if you didn't have a timetable?"

"But surely you'd rather have a nice shiny yacht than a world revolution!"

"What's that around your neck?" a GI asked the hostess at a high-priced restaurant.

"It's a ribbon, of course," she said. "Why do you ask?"

"Well, baby," he grumbled, "Things are so high around here I thought it might be your garter."

* * * *

He: "Has your mother ever told you what every girl should know?"

She: "Yes, a millionaire bachelor."

1st Dancer: "I'm going to do something different in my fan dance. I'm going to use a hat instead of a fan."

2nd Dancer: "What will be so remarkable different about that?"

1st Dancer: "Oh, I intend to wear the hat."

* * * *

"Getting plump is just a routine matter."

"All you have to do is fill out a form."

* * * *

June: "My new boy friend isn't the kind of a fellow who goes around eyeing legs."

Moon: "Gosh, I never thought you'd take on a blind man."

* * * *

"He's the type of a guy who thinks that a blind date consists of watching the windows at a girl's dormitory before they pull down the shades."

* * * *

He: "Would you mind if I tried my hand at a bit of kissing?"

She: "I'd rather you tried your lips."

* * * *

Were I in the mood to make merrie
Looking for fun and a snack
With maybe a dance
Light talk and romance
I'd choose me a fun loving WAC.
But when contemplating marriage
And peace and contentment I crave;
If then I am ready
To settle down steady
I'll get me a permanent WAVE.

* * * *

Neighbor: "Do you pick your husband's ties and shirts?"

Wife: "No, only his pockets."

Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD

LIGHTING AT GENERAL ELECTRIC

The amount of knowledge accumulated in lamp making is enormous. Some of this knowledge is committed to paper, but some of it is only to be found in the heads of technical and production men in the laboratories and in the factories. Among these men are scores who, on leaving their technical colleges, have since directed their special training to developing better lamps for less money.

The manufacturing operations of G.E.'s Lamp Department are far-flung, its 36 plants being scattered about the country in 17 cities. Of these, one plant makes machines and other special equipment for making lamps; ten plants are glass works; eight make parts, tungsten wire, gases, chemical products, bases); and 17 are lamp factories. Altogether they add up to 94 acres of floor space roughly equivalent to an eight-story, mile-long factory a hundred feet wide.

The huge workshop of the Cleveland Equipment Works of General Electric's Lamp Department, for example, employs men with a great variety of skills, among them design and mechanical engineers—and they devote all their time and energy to creating, simplifying, and perfecting machines for lamp making which are truly marvels of ingenuity.

IMPROVING THE PRODUCT

The goal of G-E Lamp Research has always been to produce the best possible lamps for every lighting service—at the lowest cost.

Over the years, lamp prices have been repeatedly reduced while lamp efficiency has steadily improved. For example, the present 60-watt lamp bulb is 56 per cent brighter than its ancestor of 1923; yet it costs only one-quarter as much.

G-E Fluorescent lamps, first introduced only eight years ago, have followed the same pattern. Today they cost only about 40 per cent as much as in 1938. They last longer and are far brighter. In fact today they are eight times better value for the user than originally.

Seat of Learning

Years ago someone coined the phrase, "University of Light" as applying to Nela Park, Cleveland headquarters of the Lamp Department of General Electric. The men who work there have taken the lead in developing the art and science of better lighting, as well as new and better lamps.

This advertisement is one of a series discussing opportunities for young men in fields in which General Electric has made important contributions. General Electric Company, Schenectady, N. Y.

963-112C-211

GENERAL ELECTRIC


Happy Birthday Dad
We Know Your
ABC's
Chesterfield
Chesterfield
CIGARETTES
LIGGETT & MYERS TOBACCO CO.
CHESTERFIELD
A ALWAYS MILDER
B BETTER TASTING
C COOLER SMOKING
All the Benefits of Smoking Pleasure
THE RIGHT COMBINATION OF THE WORLD'S BEST TOBACCOS Properly Aged
ALWAYS BUY CHESTERFIELD