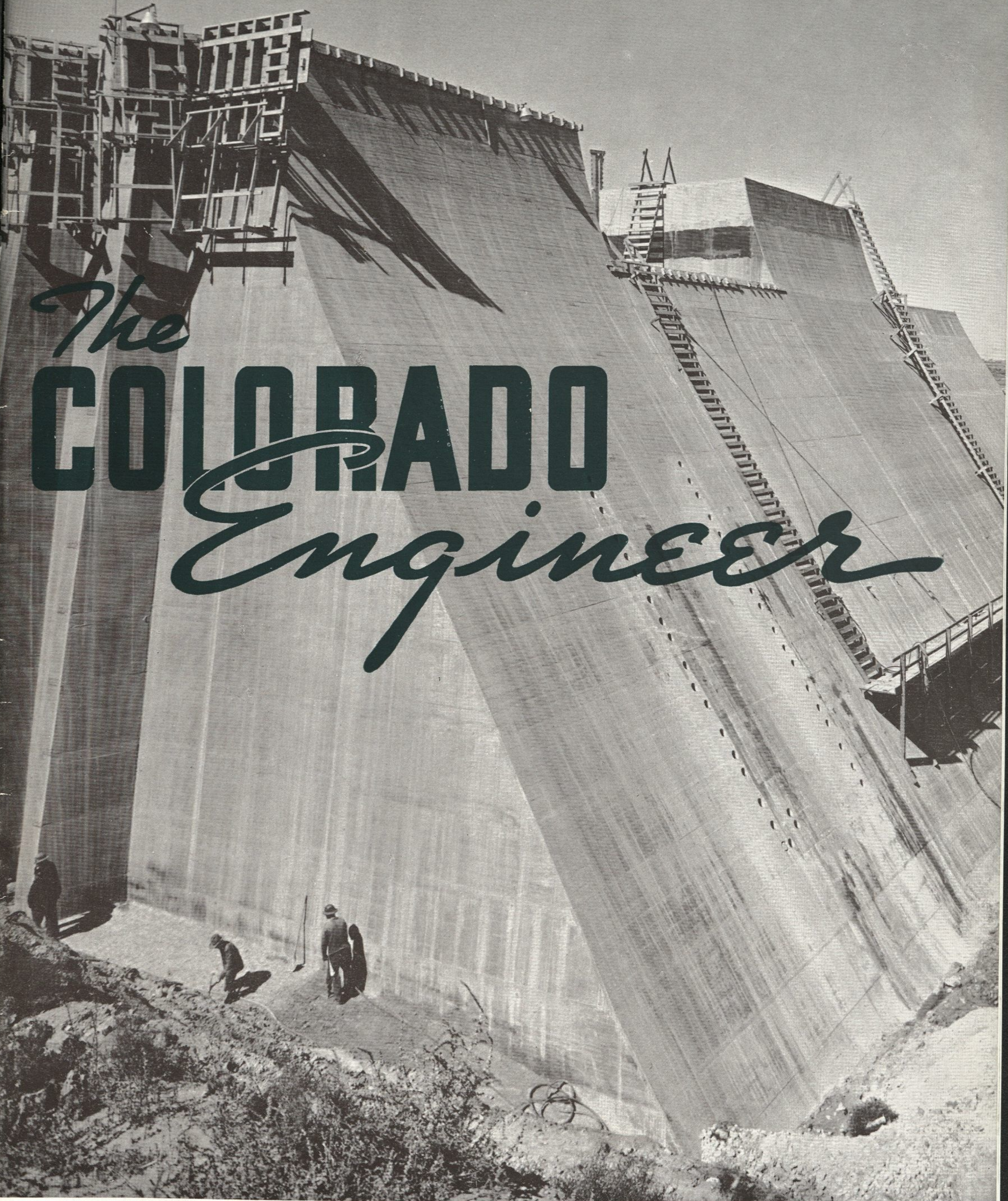
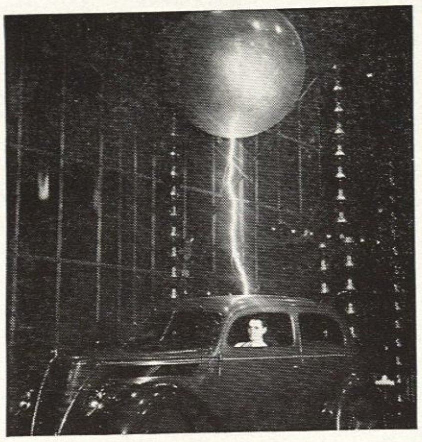
# The COLORADO Engineer



UNIVERSITY OF COLORADO ✦ NOVEMBER, 1941

# What do you know about electricity?

**Check the correct answers to the questions below and see how many of these Westinghouse engineering activities you know**



**LIGHTNING EXPERIMENT**

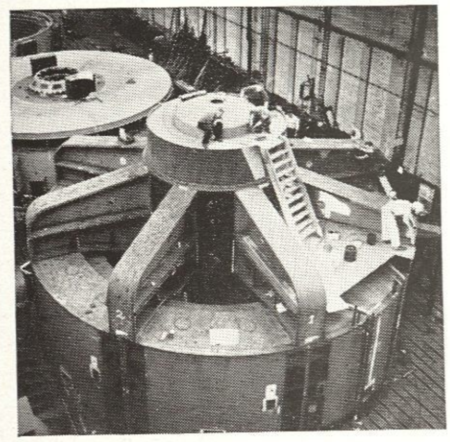
Recently, a Westinghouse engineer sat in his car while a 3,000,000-volt bolt of artificial lightning struck it. He was safe because the car body acts as:

1. *A Helmholtz bell*
2. *A Faraday cage*
3. *A Maxwell's demon*
4. *A Wilson cloud chamber*

**MASS SPECTROGRAPH**

This mass spectrograph, used by engineers at the Westinghouse Research Laboratories, performs one of these functions:

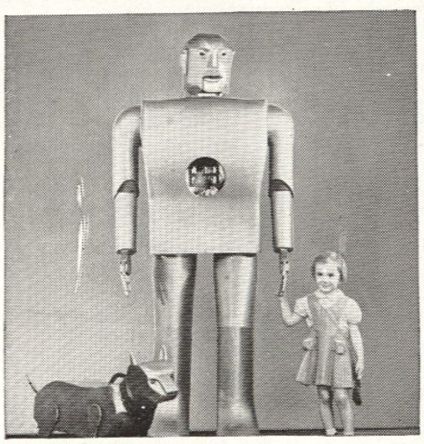
1. *Sorts atoms according to mass*
2. *Reveals spectra of stars*
3. *Produces U235*
4. *Measures amount of oxygen in air*



**BIGGEST GENERATORS**

Pictured above during construction is one of the three largest water-wheel generators in the world. All three are Westinghouse-built. Each will produce 108,000 kva, and is made for:

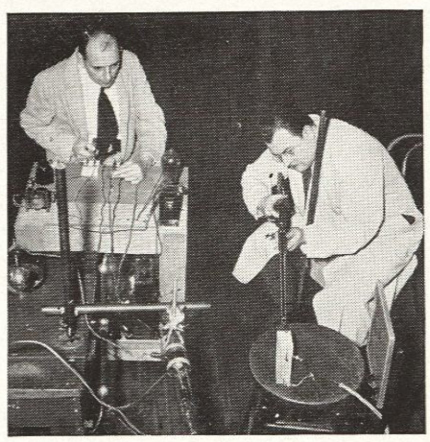
1. *Boulder Dam*
2. *Passamaquoddy*
3. *Dnieperstroy*
4. *Grand Coulee*



**MECHANICAL MAN**

This is the latest of a series of mechanical men made by Westinghouse engineers. He walks, talks, smokes cigarettes, raises his arms, counts on his fingers, distinguishes red and green lights. His name is:

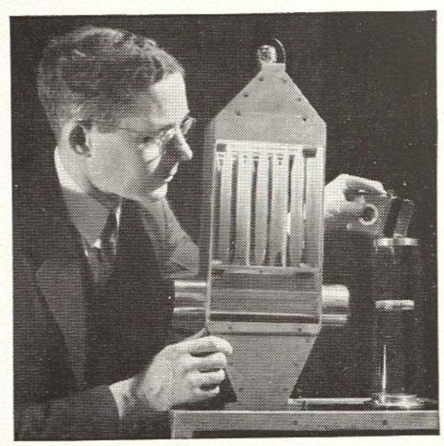
1. *Volto*
2. *Mephisto*
3. *Elektro*
4. *Sambo*



**FAST X-RAY**

Westinghouse research engineers have developed a motion-stopping X-Ray that operates in:

1. *200th of a second*
2. *40th of a second*
3. *100,000th of a second*
4. *1,000,000th of a second*



**PRECIPITRON**

The Westinghouse Precipitron removes 95% of the solid matter from the air, including particles as small as pollen, microscopic dust, and smoke. It works by:

1. *Law of inverse squares*
2. *Capillary action*
3. *Infiltration*
4. *Electrostatic attraction*

## HOW DID YOU DO?

Here are the answers. If you got 4 out of 6 of these Westinghouse activities right, you did O.K. If you got 5 out of 6 right, you deserve a cum laude. If you got all of them right, you're amazing.

**Westinghouse**

**"THE NAME THAT MEANS EVERYTHING IN ELECTRICITY"**

WESTINGHOUSE W

*Lightning Experiment* . . . A Faraday cage
*Mass Spectrograph* . . . . Sorts atoms according to mass
*Biggest Generators* . . . Grand Coulee
*Mechanical Man* . . . . Elektro
*Fast X-Ray* . . . 1,000,000th of a second
*Precipitron* . . . Electrostatic attraction

# *The* COLORADO *Engineer*

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*Engineering College Magazines Associated*

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Minneapolis, Minnesota

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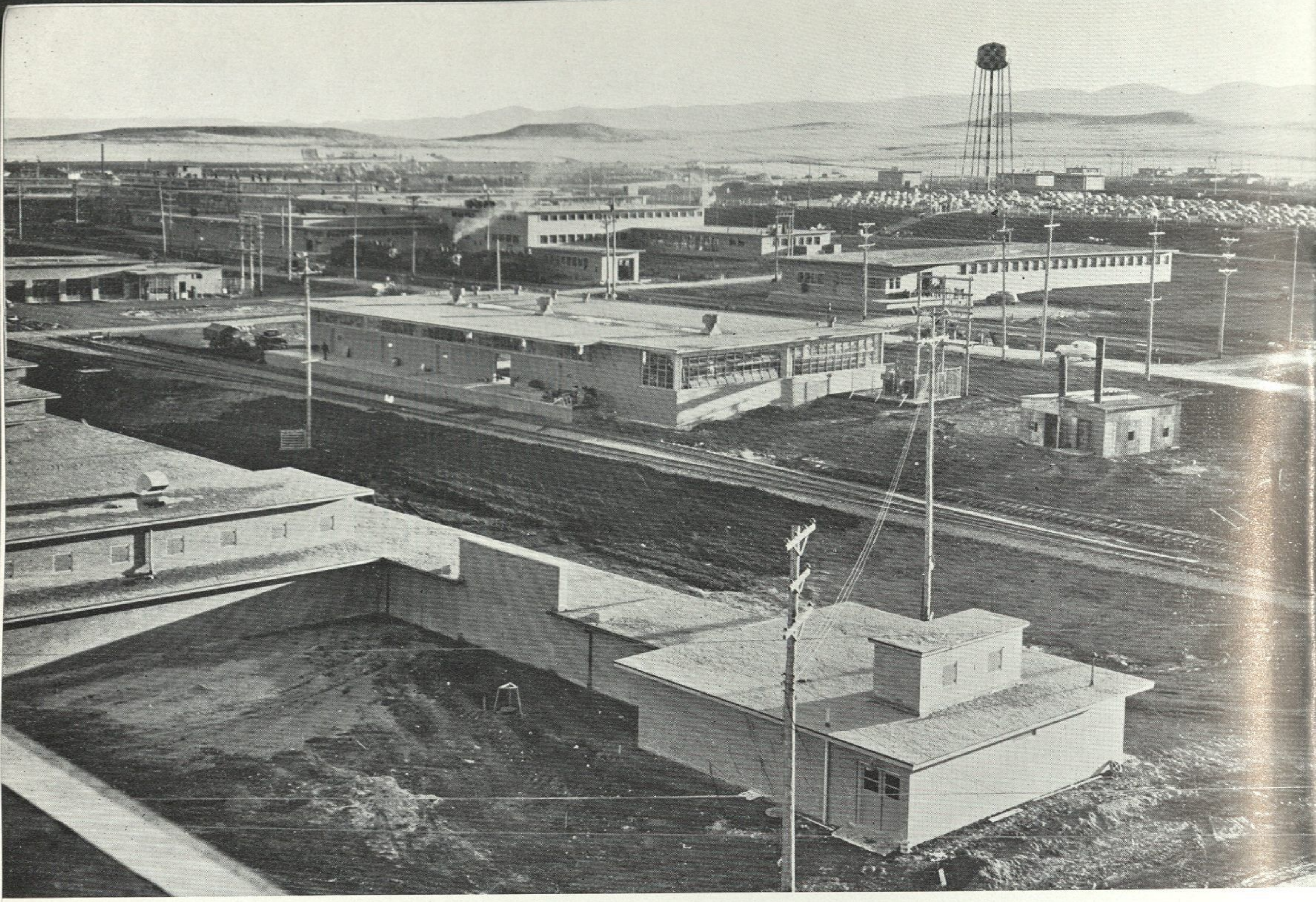


# Denver Ordnance Plant

THE UNITED STATES GOVERNMENT'S new thirty-three million dollar small arms ammunition factory, just west of Denver, was dedicated October 25, when one of the sixteen production lines of the huge plant was on regular production. The plant is of ultra modern design, providing light, airy working quarters for the eight thousand employees who will work there when the plant reaches its capacity. The buildings are all of steel, concrete, and glass construction. The plant consists of four separate and independent production units, each with four separate production lines. The factory will manufacture ball, tracer, and armor-piercing ammunition, all of 30 caliber. The plant was built by the army ordnance department and will be operated for the army by the Remington Arms Company.

# A Plea for Honesty . . .

THE Colorado University College of Engineering, like most other colleges and universities, is faced with the problem of cheating.

Aside from the moral issue involved, cheating is actually an impediment to a successful engineering career, because in actual operation, the engineer must depend upon his own ability rather than that of others to cope with the problems at hand. The far-sighted student realizes that he must learn the fundamentals of the subject if he is to be able to successfully contend with the difficulties of his work. The student who depends upon cheating to pass his examinations seldom masters the fundamentals so necessary to success in his profession.

The situation of dishonesty in quizzes has developed to such an extent in our college that a definite stand must now be taken by students and faculty alike. For years, the Colorado engineering school has operated under a system in which cheating has flourished. Because of a lack of uniform policy and in general a haphazard approach to the problem, plus an uncooperative attitude among the students, the system of professor-supervision of examinations has achieved no appreciable success in curbing cheating.

This problem can be remedied in our school as it has been in several other educational institutions in the United States through installation of the Honor System. Contrary to popular opinion, the Honor System does not mean that the individual student is solely responsible for his own honesty. Instead, the plan is based on the assumption that the offenses of the dishonest student will be reported by his classmates. An example of the Honor System in successful operation may be found in the Engineering College at the University of Michigan. There the examination questions are given to the class by the professor, who then leaves the room. Students may see the professor in his office during the quiz in order to ask any questions which may arise. They may also leave the room at any time during the examination, either singly or in groups. After the examination, each student signs a pledge stating that he has neither given nor received aid on the examination. If at any time a student sees one of his classmates cheating, he taps his pencil and says, "Someone in this room is cheating." If the offender persists in cheating he is reported to the Honor Council. The Honor Council is a body of students selected from the classes plus various members of the faculty who together consider the offenses. The first offender is in most cases placed on probation. A second offense means expulsion from school.

In view of the success of the plan at Michigan and other schools, we feel that at least an experiment along these lines is merited. Pride of the students of the College of Engineering in their own school should prompt them towards an active interest in the problem. We think that a concerted effort on the part of the faculty and students toward control of cheating through the Honor System will, to a great extent, solve the cheating problem in the University of Colorado Engineering College.—*Kuntz.*

# Naval Science at the University of Colorado

By Lieutenant Commander J. W. HIGLEY

**● The Naval R.O.T.C. unit at the University of Colorado is already becoming a familiar part of the school. In his article, Lieutenant-Commander Higley outlines the courses offered and the purposes and advantages of the unit to the student.**

STUDENTS at the University of Colorado were aware of a change in the Engineering Administration Building when they returned to school this fall.

Various rooms which formerly had been used for regular academic courses now bear official-looking names such as "Navigation, U.S.N.," "Ordnance and Gunnery, U.S.N."

The United States Navy has come to the University of Colorado in the role of a Naval Reserve Officers' Training Corps.

This Naval R.O.T.C. was established to instruct men in naval subjects so that they may be available as commissioned officers in the event of an emergency.

The purpose of this article, then, is to outline the courses of study for Naval Science students at the University of Colorado.

There are twenty-seven Naval R.O.T.C. Units in the United States today, representing a good cross section of the countrty. And many of these Units, as Colorado's, are isolated from the sea; for example, such Units are at Notre Dame and at the University of Minnesota and the University of Oklahoma. All such universities can and will pursue the course of study equally as well as their neighbors of the Atlantic and Pacific Coasts—after all, even at Annapolis, the greatest part of the Midshipmen's training takes place on land.

What, then, will this Naval R.O.T.C. Unit do?

MISSION.—The mission of the Naval Reserve Officers' Training Corps is to provide systematic instruction and training in essential naval subjects for a selected group of students in order that they may be available as officers of the Navy in the event of a national emergency. To accomplish this, the Naval R.O.T.C. is organized as an integral part of the University, known as the Department of Naval Science and Tactics. It is expected that commensurate credit toward a degree will be given on the same basis, hour for hour, for practical and theoretical instruction as is given in laboratory and classroom work in other departments. In other words, naval officers' training is not something done outside university work—it is *part* of university work.

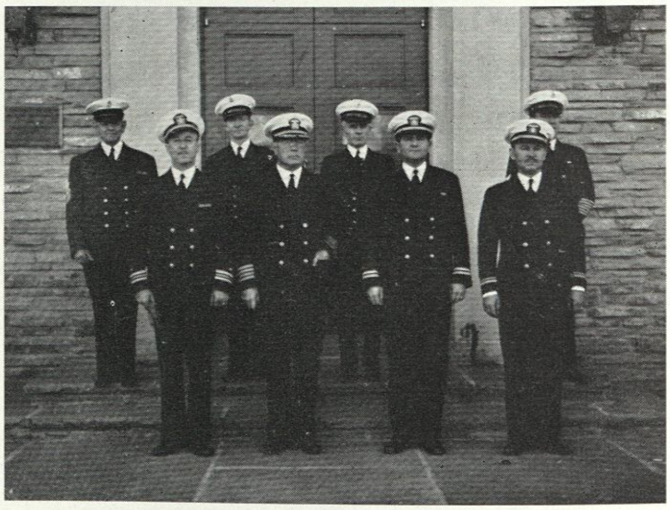
NAVAL SCIENCE COURSE.—And now to the course itself—a four years' curriculum divided into a *Basic* and an *Advanced* Course.

The Basic Course comprises the first two academic years of service, and must be satisfactorily completed as a prerequisite for admission to the Advanced Course, which occupies the undergraduate during his junior and senior years. Students completing both Basic and Advanced Courses will have received about one-sixth of the total credit necessary for the regular B.A. degree, and will have devoted five hours per week to Naval Science during their four college years.

The Basic Course for the freshman year includes the subjects of elementary navigation, seamanship, naval history, ordnance and gunnery, administration, communications, and drill. Three hours a week are assigned to classroom work and two hours a week to drill which includes infantry drill, gunnery drill, instruction in torpedoes, guns, and navigational equipment, and signal drill.

NAVIGATION starts with the subject of piloting, which is the art of safe conduct of a ship past dangerous shoals and through narrow waters. This subject requires the study of the various instruments used, Hydrographic Office publications, and the study of charts and of the magneto, the gyro, and the radio compasses.

The study of Navigation is progressive and includes celestial navigation, which has to do with the determination of a ship's position on the earth's surface by the aid of celestial objects—the sun, moon, planets, and stars. It also includes the laws of weather and storms, and the study of ocean currents and ports of the world. Theoretical and practical work are combined in a manner to make the student capable of navigating a ship on the high seas.



PERSONNEL OF NAVAL R.O.T.C.
*Front Row, Left to Right:* Lieutenant Commander Higley, Captain Welch, Lieutenant Foster, Lieutenant Long
*Back Row, Left to Right:* J. W. Maxwell, C.B.M.; W. A. Gurgin, C.Y.; J. B. Bush, C.Q.M.; R. W. Webb, C.G.M.

SEAMANSHIP covers the various types of ships, steering gear, anchor machinery, construction and preservation of hulls, and the art of ship handling.

ORDNANCE AND GUNNERY is elementary the first year but is advanced in the sophomore and junior years. The student is taught the various types of guns used by the Navy, from the rifle and pistol to the 16-inch guns carried by the latest warships; the details of construction, operation, and care of these weapons; the method of protecting ships from gunfire, bombs, and torpedoes by construction and armor; and the construction and use of projectiles, torpedoes, and mines. The students are required to become proficient in all infantry and gunnery drills, thereby gaining benefits in posture, carriage, and well-ordered discipline.

COMMUNICATIONS.—This subject continues for three years and includes all methods of sending, receiving, and handling messages between ships via radio and flag signals. It also includes the study of strategy and tactics.

NAVAL HISTORY AND NAVAL ADMINISTRATION are designed to give the student a good knowledge of the history of our Navy and sea affairs and of the organization of the Naval Reserve and Navy Regulations.

After the first year, four hours a week will be devoted to classroom lectures in the Naval Science subjects and one hour drill per week. By the end of the third year the students will be well prepared to put all their information to practice when they make the required Practice Cruise of the Advanced Course. Subjects to be complete the last year are Seamanship; Navigation, Military and International Law; and Aviation; which includes instruction in the use of aircraft, theory of flying, tactics, and ground school work.

The average layman may wonder just how the naval officer puts to practice the theoretical knowledge obtained in studying all these naval subjects. The attention of the reader is invited to an article in the August 11 edition of *Life Magazine*, entitled "The Bismarck's End." In this article, the torpedo officer aboard the H.M.S. Dorsetshire describes the final sinking of the Bismarck; he tells how the radio communications were used to advise of the disposition of the British ships and the Bismarck; how the Navigator used this information to intercept the Bismarck, which was being trailed by a British destroyer; of the gun fire battle between the British battleship, King George, and the Bismarck; of the final sinking of the Bismarck with torpedoes; and of the excellent seamanship used in handling the Dorsetshire. Incidentally, the Bismarck, after sinking the Hood, was tracked constantly by a large naval patrol plane which had an American naval observer aboard.

*Four-inch Fifty-caliber Breech-loading Rifle, Used Principally on Submarines and Destroyers*


*Putting Propeller Locks on the Propellers of an Eighteen-inch by Eighteen-foot Torpedo*

CRUISES.—During the summer vacation, juniors, some sophomores, and freshmen will be given a training cruise of about four weeks' duration on a battleship or destroyer. The Junior cruise is of great importance and is required. Students signing for the Advanced Course must agree to take the Junior cruise. At least one other cruise is considered essential. The number of sophomores and freshmen who make the cruise is limited by the availability of ships, as determined by the Navy Department.

All transportation costs and subsistence expenses for students taking these cruises are defrayed by the government. Juniors, while on the cruise, are paid at the rate of 70 cents a day. Sophomores and freshmen receive subsistence and transportation only.

These cruises are to train the students in shipboard life and navy work. The student performs a regular part of the ship's work and stands watch in various officer and petty officer capacities under the supervision of regular naval officers. The Navy Department endeavors to arrange the cruise so as to include visits to one or more foreign ports, where liberty is given, and to include a target practice in which the students man the guns and control the firing.

ADVANTAGES.—Now, as to some of the advantages of this four-year cruise with the Navy at Boulder . . . Upon enrollment in the Advanced Course, the student enters upon a pay basis, getting what is called a "commutation of subsistence" of about $7.50 a month, provided he maintains satisfactory standing. During the cruises, while actually embarked upon a naval vessel, the Advanced Course student receives the pay prescribed for enlisted men of the seventh pay grade, $21

(Continued of Page 22)

# *Keep 'em Flying...*

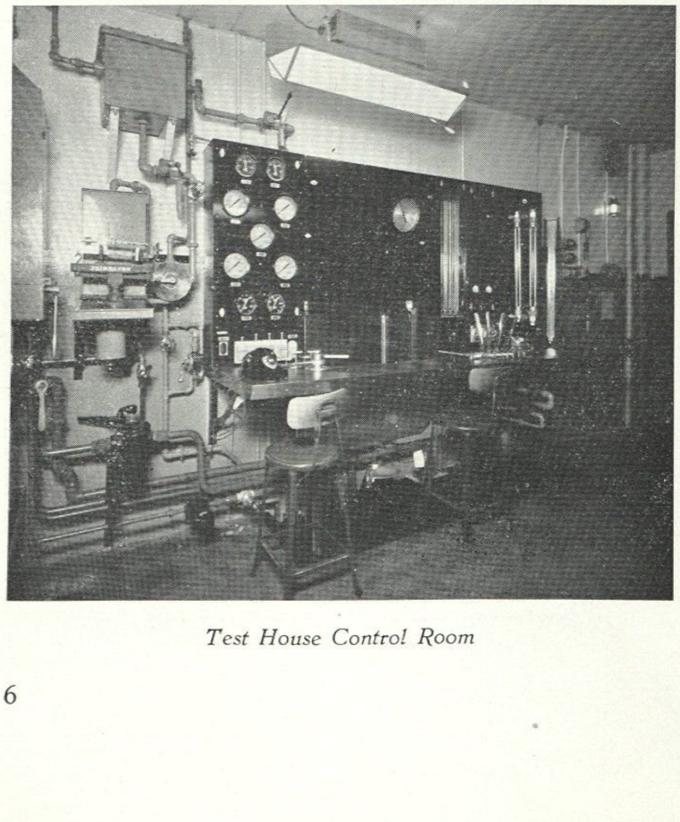
By LLOYD GARDNER, m, '42

• The propeller of an airplane is exposed to a great variety of conditions that may in some way cause the propeller to fail. Mr. Gardner's article tells just how much a propeller must be able to "take" before it is considered satisfactory for use on an airplane.

—Pictures Courtesy of Hamilton Standard Propeller Co.

AS WE READ this expression we picture shining planes high overhead, cast against a deep blue sky; and we seem to hear the drone of their high-powered motors. Maybe our imagination stops there, but if we mentally wander farther we see thousands of men in factories throughout the country working behind enormous machines that do in a few seconds the day's work of a dozen men, and with a precision unknown to even the most deliberate human hands. We see mechanics skilled in the art of aircraft engines whose duty it is to "keep 'em flying," mechanics who check every part to see that there is no chance for a plane failure, mechanics who work in close contact with the men who fly the planes, all helping to make our flying force indestructible and unconquerable should ever the test come.

But let's imagine even more. If we examine the whole picture we must see men behind rows of desks originating ideas; ideas which are to change the very jobs that the thousands of factory workers and skilled mechanics are now doing. These men are the engineers of the aircraft companies from the Atlantic to the Pacific. 'Twas they who undertook to make a change in the airfoil structure, or introduced a new design for the landing gear so that several miles per hour could be added to the top speed of the plane. It was a result of their work that we read in the newspapers and technical magazines that a new plane, soon to be produced, can maintain level flight at greater than 400 m.p.h., another plane can fly 7,000 miles non-stop, and still another can climb at an unbelievable speed. These and many more are the achievements of the engineering personnel in our aircraft industries.



*Test House Control Room*

To better understand the engineers' work, we should limit our picture to that of a smaller industry, say, the manufacture of propellers. Although the propeller is produced in larger numbers than either the fuselage or the aircraft engine, still the propeller industry is many times smaller than that of either of these. However, the present propeller is a result of just as much engineering work, part for part, as any other plane assembly. In fact, the engineering work done on the modern propeller is so great that most authorities claim it to be the nearest to engineering perfection ever attained in the aircraft industry. The propeller is, then, a fit subject upon which to base a discussion of modern engineering practice.

Propeller engineering started with the origin of the first motor-driven plane. At that time, as now, the propeller was the only satisfactory means of converting the engine power into a thrust force which would cause the plane to move. Modern propellers, or airscrews, as they are called in many foreign countries, resemble the earlier ones only in general appearance. Gradually the light metal propeller has replaced earlier wooden propellers in all but the smaller sizes. Whereas the first propellers were made in one piece, today well over a thousand parts are incorporated into the current Hydromatic full-feathering propeller of the Hamilton Standard Propellers Division of United Aircraft Corporation. Today, due to advanced testing methods, the specific weight (propeller weight to horsepower transmitted) is 0.25 or less as compared to a ratio several times that only a few years back. Finally, the efficiency has been increased much more on the propeller than on any other comparable assembly found in today's airplanes.

But how, we ask, is all this possible? We can soon understand if we take a look at the testing methods and equipment used by the engineers of Hamilton Standard Propellers, the largest propeller manufacturer in the world. There we see how the propeller is brought forward from an idea, or a group of ideas, originated by engineers, through blueprints, manufacture, assembly, and testing, to be a propeller of such high quality that it is used on the country's larger planes, even on the largest, the Douglas B-19.

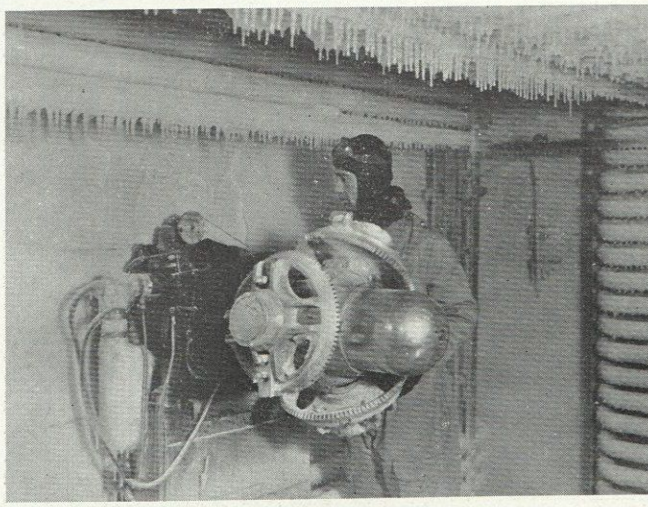
Initially, the idea is set forth in sketches and discussion. From then on it follows a definite plan. First come drawings, drawings totaling many hundreds in number. There must be at least one for every part, and numerous assembly and sub-assembly drawings. This work, representing several months of labor, is done by a large staff of designers, layout men, and draftsmen, who are constantly putting ideas conceived by the engineers, both for changes and new parts, into blueprint form.

It is from these blueprints that the skilled machinist armed with calipers, scales, micrometers, and years of experience, sets forth to build the part to the most exacting dimensions. Meantime his fellow workers who have at their disposal specially designed equipment, are gradually shaping other parts which are to be incorporated into the final propeller assembly. Bearings, packings, shims, and washers need not be machined as these are secured from the several independent manufacturers.

Once a related group of parts is finished, a subassembly is made. This is done by a group of men who work two shifts a day to assemble propellers and sections of propellers for experimental tests. As soon as the assembly is completed, tests are started by the engineers to determine whether it operates properly; so that once it takes its place in the final assembly, no failure can occur with that group of parts. These tests are conducted in the many test houses and rooms available for that work. Tests on such sub-assemblies as the piston, dome, distributor valve, governor control, packing, blade and barrel, and cam assemblies are made to determine whether each will function independently as it should in the assembled propeller. If failure occurs, dismantling follows, and corrective machining is applied. Again the parts are assembled, and finally the unit is made to work satisfactorily. Then, and only then, is it desirable to have the propeller completely assembled.

Immediately upon the assembly of the propeller, there is begun a series of tests so strenuous that only a propeller made under the most exacting requirements can pass. These start with oil tests designed to stress the controlling parts of the propeller. Special oil sumps are used which can build up sufficient pressure to change the pitch of the blade, a feature which allows the engine to maintain a constant r.p.m., keeping the engine at its most economical speed or at any other desired speed. A further increase in pressure, normally by the governor but experimentally by a pressure system, causes the blade to feather; that is, the edge of the blade can be turned into the wind under flight conditions so that destructive windmilling will not occur. This feature was incorporated as a safety device to allow the operator to stop engine rotation in case of engine failure. Finally, the propeller is given oil tests to determine its ability to unfeather; i.e., to change the blades to flying position again after feathering, should the engine be repaired. After successfully passing these oil tests, the propeller is taken to the vibration department.

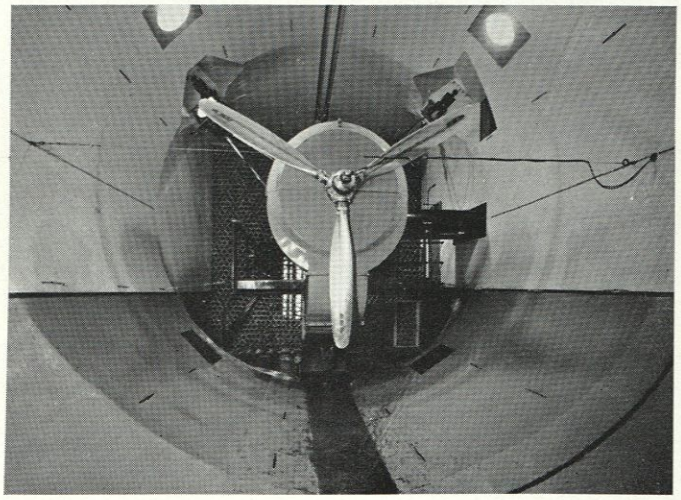
Hamilton Standard's vibration department is a vital part of their large propeller company. Every type and size of propeller must be given stress tests sufficient to prove that it will not fail under flight conditions. Laboratory testing equipment includes several vibrators, both mechanical and electrical, designed to vibrate the propeller assembly under static conditions. These vibrators will give to the blades in a few hours, vibrations equivalent to many weeks of severe running. These vibrator tests are continued until failure of the blade. Also in this department blades are equipped with "pick-up" units. These units are about two inches long and are made of a material which changes in electrical resistance as the stress varies. By securely fastening these units to the blades and running very fine wires to and from the units, a small current can be maintained. Slip rings are used to carry the electrical current from the units on the rotating propeller to portable recording equipment placed in the fuselage of the plane. This electrical flow is amplified greatly and measured automatically in an oscillograph with attached equipment for photographing the wave forms. Once a film is exposed, it is developed and analyzed by a staff of men who study the wave forms and corresponding data taken at the time of filming, finally determining the true stress in the blade at different points under varying conditions of r.p.m. and power transmission. It is mostly through the work of the vibration department that it was possible to decrease failures so greatly that in 1940 there was not a single failure of Hamilton Standard propellers in service use.



*Cold Room Interior Showing Hydromatic Propeller Hub With Counterbalances in Place of Usual Blades*

Not long after its assembly, the new propeller is taken to the test houses where the majority of the testing is done. Here is provided a large one-story building containing two 18-foot diameter chambers and two 24-foot chambers, a large accessory laboratory with workbenches and auxiliary testing equipment, and additional engineering office space. The semi-streamlined test houses are equipped with cable suspended aircraft motors of various horsepower ratings. To eliminate turbulent flow commonly caused by baffling the air, Hamilton's houses are open on both ends, thus allowing the air to pass straight through. Supporting I-beams are shrouded with a streamline section to prevent irregular flow. At engine height, platforms are provided to facilitate working on the engine. Telescoping or retractable sections permit working on the propeller and the forward portions of the engine. On each end of the chamber are vertical absorbing baffles to reduce engine and propeller noise. Between the test chambers are two sound-proofed, air-conditioned control rooms. From his desk, the operator can look through a double sound-proofed window to watch the propeller and engine in operation. The operator has above and around him a group of instruments, switches, and valves with which he is able to control oil flow, governor action, air volume, and other factors affecting propeller and engine operation. With this arrangement tests can be run which are very nearly those encountered under actual flying conditions. Here vibrational tests are made on blades equipped with pick-up units. For the first time the propeller performs with the engine and a definite check on all parts can be made.

The accessory laboratory, besides having numerous benches and auxiliary testing equipment, has a large "cold room" in one corner and a "whirl rig" in another. The cold room is capable of maintaining a temperature of --50° F. At this temperature the oil flow and propeller behavior are studied. From test information gathered here, valuable predictions can be made concerning propeller action under stratospheric conditions. The "whirl rig" consists of a large automobile engine mounted within the main room having a shaft extending out into a sound-proofed chamber where hubs and stub blade assemblies are whirled at excessive speeds, as high as 4,000 r.p.m. Water, gravel, cinders, and other corrosive material can be thrown at the blade by a jet arrangement. In this chamber, blade cuffs and fairings can be tested at temperatures up to 150° F. by piping the exhaust through a radiator. To control the temperature further, an air duct with built-in blower opens into the circular chamber, the air leaving through an opening in the top. Inside, near the engine, is a control desk with an array of instruments which aid the operator in controlling test conditions. From the desk he can look through a sound-proofed window and observe the propeller in motion. With this whirl rig and the cold room it is possible to duplicate most conditions encountered in flight over a temperature range of 200° F.



*Propeller Wired for Vibration in Eighteen-Foot Test House*

To test the propeller further, Hamilton Standard has built a dynamic testing stand where propellers can be tested to determine the propellers' ability to remain balanced even when acted upon by air forces produced during flight conditions. The stand will handle all sizes of propellers and gives a basis for further engineering in the dynamic balancing field. The stand was built after extensive model tests and experiments showed that as a result of a more complicated propeller necessary for reversibility and feathering, greater dynamic unbalance might occur. Although this unbalance was not critical, it did cause unpleasant effects to passengers and operators in the larger planes.

Other testing equipment includes apparatus for testing feathering pumps and governors. Some equipment can test the maximum flow through valves; other equipment builds up pressure sufficient to test oil leak tendencies of oil seals. Benches are provided for endurance runs on governors and another for calibrating and checking gauges necessary for equipment operated by a hydraulic medium.

Engineering in the propeller industry is more widespread than is indicated here. After successful tests have been completed, it is necessary to tool the plant for efficient manufacture of the new propeller type. New equipment must be installed and some must even be designed. Even after production has started on a new product, minor changes must be made from time to time. In the complete picture, the engineer is behind every change, whether minor or of such major proportions that a new propeller is introduced. The engineer originates the ideas and works with them for several months until he has achieved a good product which he then turns over to the factory personnel who turn it out in large quantities.

Here again there is always the engineer checking and "okaying" every operation so that we can always "keep 'em flying."

# Engineering Defense Training

By WARREN RAEDER,
*Professor of Civil Engineering*

**Colorado University does its part in national defense by preparing men for jobs in defense industries. In this article, Professor Raeder gives us some idea of what and how much is accomplished by the University defense courses.**

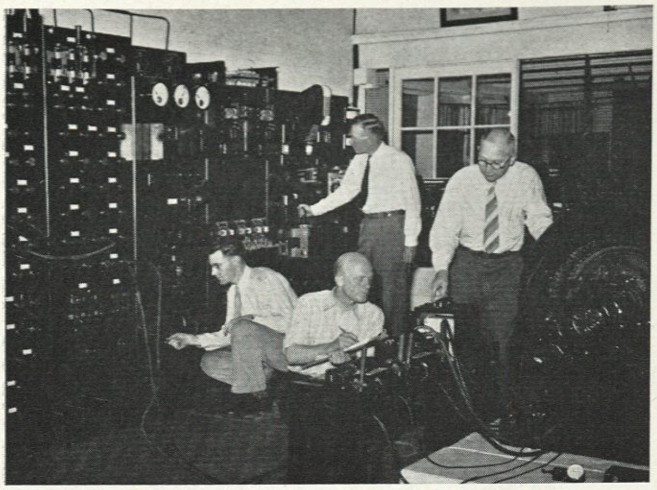
FROM the early beginnings of the defense training program of the United States Office of Education, the Engineering School of the University of Colorado has been actively cooperating in achieving the ends of that program. Scarcely was the ink dry on the President's signature June 29, 1940, authorizing an appropriation of $15,000,000 for this training, when the College of Engineering was busy organizing summer courses. Speed was possible because of the foresight of President Stearns of the University and Dean Evans of the Engineering School in appointing a committee of the faculty early in June to study the demands of the emergency and make plans to meet it. This was *vocational* training, and on July 8th instruction was started in nine classes to train mechanics in the fields of tool-and-die making, repair and calibration of electrical instruments, care and operation of electrical machinery, heat treatment of steel, and material testing. One hundred and ten men were enrolled in these classes and instruction continued for ten weeks. Training was planned to be of two types: (1) "refresher" courses to recapture for useful work in the skilled trades men who, due to the depression, had drifted into the ranks of the unskilled or the unemployed, and (2) "supplementary" courses designed to upgrade men already employed and prepare them for more effective work.

Training on this rather large scale was possible, of course, only during the summer months when laboratory equipment and the time of the regular University staff was available. With the opening of undergraduate engineering classes, vocational training was of necessity curtailed. It was not dropped entirely, however, for the University's policy is to keep this important training going as long as men are available, and equipment can be used without interfering with the regular work of the Engineering School. This is particularly true in the training of tool-and-die makers, and one or more classes in this field were carried on continuously all through the past winter and summer. At present training is being given to sixteen men for thirty hours per week, the work of instruction being distributed between three instructors.

The demand for machinists has probably been more persistent than in any other skilled trade. We are not turning out journeymen machinists; that would take many months if not years. But the need for men is so acute that as soon as a trainee can perform a single operation reasonably well he finds himself with a job in some defense plant. Men are thus "graduated" with varying degrees of proficiency, but they have found useful employment, not only in the Rocky Mountain region, but in government arsenals and shipyards, airplane factories of the Pacific Coast, and in various other defense activities.

Even more important in the present emergency has been the Engineering School's role in the training of men on the college level. A year ago it was becoming very apparent that a serious bottleneck was developing due to lack of engineers skilled in such fields as drafting, design, inspection, supervision and production. Among the first to realize that the entire defense program was dependent upon adequate technical and supervisory engineering talent were the Army, Defense Council, and Civil Service Commission. Largely upon the recommendation of these agencies, the college level Engineering Defense Training Program was organized. "EDT" called upon engineering schools or "universities of which the engineering school is a part," to give "courses designed to meet the shortage of engineers with specialized training in fields essential to the national defense." The sum of $9,000,000 was appropriated for this purpose, and the United States Office of Education was assigned to put the project into effect.

The administrative machinery is simple and has functioned exceedingly well. Dean Roy A. Seaton of Kansas State College was named director with a staff of assistants. There is an advisory committee composed of regional advisers, twenty-two in number, each of whom acts as liaison officer between the colleges of his region and headquarters at Washington, and who assists in co-ordinating the training program with the needs of industry and government. The engineering colleges of Colorado and Wyoming comprise Region 19, with President M. F. Coolbaugh, of the Colorado School of Mines, as regional adviser.



*Advanced Electrical Machinery Laboratory*

The program of the University of Colorado under EDT has consisted of two series of courses. The first started in January, 1941, and ended approximately with the close of the academic year in June. The second was somewhat shorter, covering twelve weeks during June, July and August. The objective of this program is to help industry carry the tremendous additional load brought about by the emergency. Time is too short to develop full-fledged engineers from high school graduates. That is the normal function of the engineering schools. This training consists of short intensive courses covering specific detailed engineering needs. For example, airplane draftsmen have been in great demand and, along with other schools, the University of Colorado has given intensive training in this field. For seventeen weeks men with some elementary drafting experience were taught sufficient airplane drafting technique to enable them to go to work as draftsmen in airplane factories. Many who have completed these courses have done just that. Engineering Drawing and Machine Design has been a very popular course as evidenced not only by the demands of industry but by the interest of young men (and women) in obtaining this free training. EDT courses have been given in the fields of civil, mechanical, electrical, chemical, aeronautical engineering, each course designed to fill a specific need.

The rearming program found this country extremely unprepared in many fields. One of these was the manufacture of powder. It has been estimated that today's requirements are fifty times what they were eighteen months ago. To meet the need for proprly trained men in this field, EDT courses were set up at certain universities. Previous to this, however, the instructors in these courses were themselves given a three-weeks intensive course at Washington University, St. Louis. Dr. George O. G. Löf of the chemical engineering department has participated in this project, and to date fifty-seven men have been trained for this work. Some of these are now engaged in filling this serious breach in our line of industrial defense.

Altogether under the EDT program the College of Engineering completed fifty-seven courses, giving specialized instruction to 1,085 trainees in five centers: Boulder, Denver, Colorado Springs, Pueblo and Grand Junction. The entire cost of the program has been borne by the government, the students being under no expense except for text books. From the trainee's point of view, an unusual opportunity is being offered to graduate engineers to review technical courses or to add to their knowledge through graduate study. Perhaps of even greater importance is the opportunity afforded that large group of men, who, although they are working in the engineering field, have not had the chance to complete their technical education. These men, by taking "upgrading" courses, build up their own engineering education and at the same time perform a much needed service to the cause in which this country is not only busily but one might well say frantically engaged.

EDT died a fiscal death on July 1st of this year, but the program is continuing through ESMDT—Engineering Science Management Defense Training. Due to the demand for more scientists as well as for men trained in business management, the program has been enlarged to include these fields. Thirty-six classes are currently being conducted in thirty-two courses with a registration of more than six hundred men. Of these courses, two are in the field of business management. Just now plans are being made to conduct another series of courses starting in late January to run into June. Whether the government desires this program to continue after July, 1942, has not yet been decided.

One of the most interesting developments in ESMDT is a plan to give special training to seniors in electrical engineering and in physics later this year. The instruction would be in the field of ultra high-frequency radio waves, and the course would carry academic credit. About forty engineering schools have been in-

(Continued on Page 24)

*Engineering Drawing and Elementary Machine Design Class*

# The Birth of the Airacobra

By JESSE A. WILSON, JR., m, '41

**● The design of a new and better fighting plane is a difficult job, especially since present airplanes have reached such an advanced stage of development. Mr. Wilson tells in his article how the Bell Aircraft Corporation has developed the Airacobra, a superior interceptor-type airplane.**

THE Bell "Airacobra" is considered by many of the men who know a great deal about airplanes to be one of the fastest and most heavily armed of all American fighter planes. There has been a great deal of discussion about this airplane as compared with other American interceptors. A large part of this is false or, at least, greatly exaggerated. This article reveals the background of the conception and design of the new Bell "Airacobra" fighter plane.

First of all, the engineers at the Bell Aircraft Corporation tried to analyze the job of the fighter plane. They tried to determine exactly what it would be called upon to do, and what it should be able to do. They realized that it would be impossible for them to build a plane with a speed, or ceiling, or maneuverability, or climb that would exceed these characteristics of other planes to any great extent. The reason is, obviously, that the same engines and airfoil shapes are available to all large airplane manufacturers. Hence, the planes developed by all these large manufacturers would have about the same characteristics. With this in mind, the engineers turned to the best current fighters to determine what they lacked and how they could improve them. They finally decided that the fighter of the future needed better ground and landing characteristics, a larger vision area, and greater fire power. In order to attain these three goals, innumerable engineering problems had to first be solved—some of which seemed at that time almost impossible.

The problem of landing and ground-handling characteristics was an important one because the high landing speeds on the conventional landing gear were dangerous even on large smooth fields where conditions were ideal. In time of war, the engineers knew full well that there would be very few facilities such as the great airdromes that are now used. The planes would be called upon to take off and land under the most extreme conditions. It would be necessary for them to take off and land across wind, on rough, pitted fields, without lights, and in all kinds of weather. The engineers decided that the only good solution to this problem was a tricycle landing gear.

Since tricycle landing gears had never been used on a single-engined pursuit plane, many elaborate and exacting tests had to be made before a dependable nose wheel could be designed properly. A "test cart" was designed which would give results similar to those expected from the actual airplane. That is, the balance and weight distribution were made to be as nearly like those of the completed plane as possible. Also, the tread and wheel base were made to be the same as those proposed for the "Airacobra." Upon completion the "test cart" was put through all kinds of tests at speeds up to a maximum of 70 m.p.m. It was tried on rough and smooth terrain, on soft and hard surfaces, on dry, muddy and snowy fields, over obstacles and ruts. From these tests, the ability of the nose wheel to withstand all conditions of operation was determined. Compilation of the test data taken during the several months of test runs gave the answers to the problems. The two main wheels have high-pressure tires and hydraulic brakes. The nose wheel is not equipped with brakes, and it has the same type of tire as the tail-wheel tire of large planes. The nose wheel has in the strut a hydraulic mechanism which automatically eliminates shimmy and vibration by dampening the swivel action. This device solved the problem of shimmy, which had before been a jinx to tricycle landing gear on ships of this type. The nose wheel can swivel through one hundred and twenty degrees. This is enough to allow for very good ground maneuverability because very tight turns may be made easily. Shock absorbing mechanisms of the air-oil type are incorporated in each wheel strut to absorb shocks caused by terribly hard landings. The wheels can be retracted in eighteen seconds and lowered in twelve seconds by an electric motor. When the wheels are retracted, fairings are automatically raised flush with the lines of the plane to cover all wheels. In case of a failure in the retracting mechanism, the wheels may be raised and lowered by manual operation from the cockpit.

Having solved the problem of a suitable landing gear, the engineers turned their attention to the next problem. How can greater vision be obtained? If they left the fuselage design of the plane practically the same, the only way they could attain greater vision would be to move the engine back. They found that they could attain just the desired results by moving the engine to a position behind the pilot. This would mean that they must design a drive shaft ten feet long. This was a sizable problem in itself, but the engineers were not discouraged in the least. Since the Airacobra was designed to carry a liquid-cooled Allison engine, the Bell engineers called upon the Allison Division of the General Motors Corporation for aid in designing such a drive shaft. Working together, they set out to design a ten-foot drive shaft to meet the rigid requirements. They found that their first problem would be to analyze every possible loading condition, and then second, to design a shaft that would withstand all these loads successfully. They realized that it would be necessary to take into account deflections of the fuselage under all types of landing, because of the extreme length of the drive shaft. Consequently, every loading condition that might possibly be encountered was studied thoroughly. Loading conditions were studied at take-off, level flight, acrobatics, and landings. During their tests they discovered that in pulling out of a 12g dive (no pilot can withstand such a pull-out) the nose of the plane was deflected one and one-half inches. Therefore, the drive shaft had to be able to withstand a deflection of two inches. Curves were drawn for all these loading conditions and any possible combination of them. From these data, the fuselage structure was designed. The shaft was so designed that during normal level flight, there would be no deflection of the shaft. Their deflection tests showed, however, that at any other condition of flight, there would be some deflection. This deflection would range from a fraction of an inch to almost one and one-half inches. At any condition, though, it was designed so that there would be no bending moments or end loads on the shaft. This was done by means of three universal joints. The universals were placed at the shaft connection of the engine, at the intermediate support bearing, and at the shaft connection to the reduction gear box. Incidentally, the reduction gear box is not a part of the engine in this ship, but, unlike most airplanes, it is located in the nose. Because of the remarkably thorough and precise job of engineering, coupled with long, grueling tests in the air and on the ground, this shaft has functioned even better than the engineers had hoped.

The problem of making a fighter plane that was more heavily armed was introduced by actual experience in the present war. Modern aerial battles showed that fighters must carry more powerful arms than the machine guns carried in the last war. They must carry arms capable of bringing down the largest of bombers. They must be able to cope with torpedo boats and tanks. The answer to this, as the engineers saw it, was a cannon. The placement of the engine behind the pilot, and the extension drive shaft made the problem a much easier one. It made possible placing a cannon in the nose of the ship which could fire through a hollow propeller hub. It also gave an abundance of room in which to install the cannon on its rigid platform. Although German aircraft carry a 20 mm. cannon placed between banks of cylinders, American airplane manufacturers had been unable to do this successfully. The arrangement of the "Airacobra," however, made possible the installation of, not a 20 mm. cannon, but a 37 mm. cannon to fire through the propeller hub. This cannon, as shown by tests conducted by the United States Air Corps, with its projectile weighing 1.25 pounds, far exceeds the destructive power of the 20 mm. cannon.

Details of the aiming and other mechanisms of the armament of this plane are restricted by the government; however, the essentials of the process may be told. The target is spotted in the telescope, and by means of this, the range may be found. All adjustments of the gun are made by electrical devices working through an automatic computer which makes corrections in the pointing of the gun. Corrections are also made for the position of the plane at the time of firing, and for the correct "lead" to allow on a moving target.

Besides the heavy cannon carried on this aircraft, there are machine guns which add much to the fire power. Information regarding the number and size of these guns is, of course, restricted.

Other things that the aerial battles of the present war taught American aircraft manufacturers are many. They found that radio equipment, armor plate, self-sealing gas tanks, and self-sealing oil and fuel lines were necessary. Hence, the Airacobra carries all of these newest developments. The weight that is added by these devices is amazing. Five hundred pounds have been added to the weight of modern fighters by installing armor plate and protection of fuel tanks. Furthermore, more than fifteen hundred pounds of ammunition and guns are carried by this fighter. A few years ago, this added weight would have seemed not only impractical, but impossible.

In order to provide for production of this ship, the engineers designed parts as much in units as possible. That is, wing tips, wing panels, and fuselage parts are designed so as to be nearly a unit in themselves, with their own sub-assemblies. These sub-assemblies are made on their own branch assembly line and are fed into the main assembly line in their proper order. As few hand operations as possible are involved in the manufacture of the "Airacobra." In this way, a maximum of interchangeable parts is attained.

Very few of the thousands of engineering problems involved in the design and manufacture of this outstanding fighter were narrated in this article. To completely cover a feat such as this, would mean to write books—volumes and volumes. From this short article, however, one can see the magnitude of the problems facing an engineer. But most of all, one can see the ingenuity and courage with which the American engineer faces the problems he encounters. This not only pertains to the engineers in the aviation industry, but to the thousands of engineers working for our country. These men form the foundation for our defense—"the men behind the men behind the guns."

# Campus News

By WALTER APPEL, c, '43

## Mechanicals Modernize

A keynote of modernization and extension marks the increased activity which is evident this fall in the mechanical engineering department. Both curriculum and laboratories in the mechanical department are scheduled to bear the brunt of a streamlining program which is going forward under the direction of Norman A. Parker, head of the department.

An incentive for this program of modernization and extension is the record enrollment chalked up by the department. With more students majoring in mechanical engineering than in any other branch of engineering, the department boasts of the greatest enrollment in its history; 30 per cent of all senior engineers, 33 per cent of all junior engineers, and 42 per cent of all sophomore engineers are taking the mechanical course. Approximately half of this number are taking the aeronautics option.

An array of motors and the nearly completed wind tunnel share honors in the aeronautics laboratory. Newly installed are a Curtis Challenger 185-horsepower air-cooled radial engine and water-cooled 400-horsepower 12-cylinder Liberty of World War days. These two motors are installed and in running condition. Horsepower tests are being made with the General Electric dynamometer installed last year. The Liberty engine is cooled by a Dodge motor driving a blower. The unit has been equipped with a sheet metal baffler system to facilitate air circulation about the motor.

Conversion of a nine-cylinder Pratt-Whitney Wasp engine to a one-cylinder engine with an output of 35-40 horsepower is expected to be completed next spring. Work on the project is going forward under William L. Hull, instructor in mechanical engineering, and Walter Shaw, a senior mechanical engineering student. Hull explained that the conversion was being made because tests on the single cylinder engine would be easier and more economical than on the multi-cylinder type.

Additional engines which are used only for teardown purposes include a 450-horsepower Pratt Whitnew Wasp, a 400-horsepower Liberty, an eight-cylinder, liquid-cooled, 150-horsepower Hispano Suisa, and a 90-horsepower Curtis OX-5.

The dynamometer, a machine designed to absorb and measure the horsepower output of an engine, is a 200-horsepower inductor type unit capable of 2,000 to 4,000 r.p.m. The resistors are all located on the inside of the water-cooled unit which uses a 125-volt direct current for excitation.

Installation of flywheels on the test motors was completed last month. It was found necessary to add flywheels to the motors without propellers, to obtain smoother performance.

Designed in the summer of 1939, and scheduled to see final completion in the spring of 1942, the wind tunnel is a return flow unit with either open or closed test section. The tunnel is similar in design to tunnels which have been designed by the National Advisory Council on Aeronautics at Langley Field, Virginia. The wind tunnel represents an investment of about $4,000, considerably less than the cost of similar models at other schools. Professor Parker designed the wind tunnel and has taken an active part in its construction.

Maximum wind velocity at the test section will be about 200 m.p.h., although student tests will usually be run at 150 m.p.h., wind speed. The propeller is an adjustable-pitch, six-blade type made to order as are the double surfaced guide vanes. Specially designed balances are not yet completed. Some of these are being turned out in the machine shop while others are being made specially to order. Under the direction of Professor Parker, calibration tests are being made by Hull and David Wong, a graduate student in aeronautics.

In the heat treatment and metallography laboratory a 20,000-lb. capacity tensile testing machine has been installed. The latest type of machine for polishing specimens for micrographic examination is also a recent addition. New fluorescent lights are a modern touch.

The wood shop has been completely remodeled and when work is completed within the next few months, the former complexity of belts and pulleys will be replaced by a series of individual drive machines. These units include band, jig, and circular saws, routers, planers, shapers, lathes, and other woodworking equipment.

New equipment acquired for the heat transmission laboratory includes a commercial room-type air-conditioning unit and a commercial type beverage cooler.

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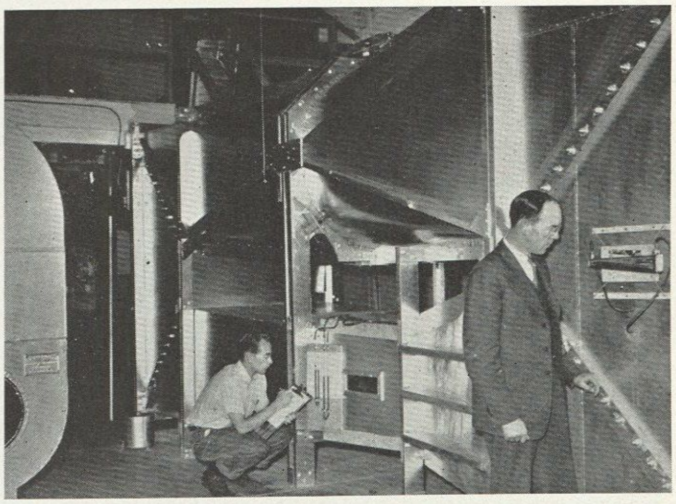


*Recording Data From a Wind Tunnel Test in the Aeronautics Laboratory*

# Presenting the Presidents

By REX ELLINGTON, ch, '43

● **We present the presidents of the honorary engineering fraternities and the societies of the various branches of the engineering school. These personalities may give you an idea of the balanced combination of studying and activities desirable to fit one for work in the engineering profession.**

## Everett Gilbert—*Tau Beta Pi*

Everett Gilbert was born September 20, 1920, in Montrose, Colorado. While he was in Montrose High School, he played both football and basketball, became a member of the National Honor Society, and spent his spare time tinkering with radios. From this hobby came his ambition to be an electrical engineer. Besides keeping a 2.8 average, Everett has engaged in many activities. He is president of Tau Beta Pi, member of Eta Kappa Nu, Sigma Tau, Sumalia, and the Viking Club. He was intramural manager for two years and has hashed in the dormitory for three. He attended the national convention of Tau Beta Pi at the first of this year and managed to sell the idea of having the convention at Colorado University next year.

## Gordon Hungerford—*Sigma Tau*

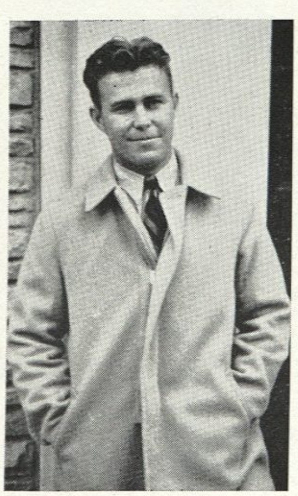
Gordon P. Hungerford, president of Sigma Tau, was born in Scottsbluff, Nebraska, April 19, 1921. He attended East High School in Denver, where his high scholastic average earned his membership in the National Honor Society. During his freshman year at Colorado University, he was given the Sigma Tau award for the highest scholarship among the freshman engineers. This high scholastic average has been maintained through the years at a 2.7 level. He is president of Sigma Alpha Epsilon social fraternity, a member of Alpha Chi Sigma, Tau Beta Pi, and Pi Mu Epsilon honorary fraternities. Gordon is on the A. S. U. C. commission, and has had a leading part in A. I. Ch. E., the Rhythm Circus, and other school activities. He has also been an active participant in intramurals.

## Joe L. Byrne—*Pi Tau Sigma*

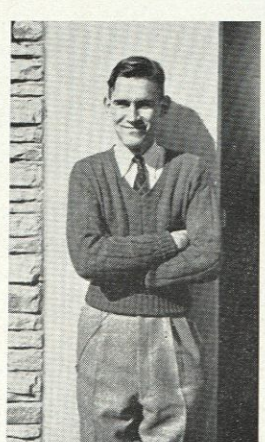
In presenting Joe L. Byrne, we give you the balanced blend of brain and brawn that all admire. Joe, senior mechanical and president of Pi Tau Sigma, was born in Clay Center, Kansas, on April 19, 1920. He later moved to Denver and graduated from East Denver High School in 1938. Joe's 2.4 average shows definitely that he was wise in following his mechanical abilities. He is an all-around athlete, having been three times runner-up in the 175-pound intramural wrestling meets. He was also high-point man in the 1941 C. U. day track meet. Joe is president of Pi Tau Sigma, member of Sigma Tau, Pi Mu Epsilon, A. S. M. E., and Pi Kappa Alpha social fraternity.

## John Hopkins—*Alpha Chi Sigma*

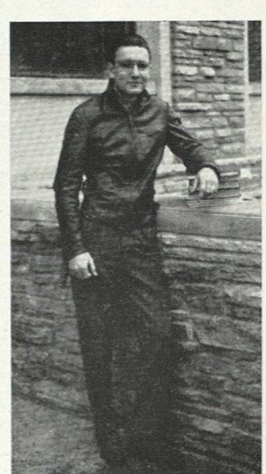
John Hopkins was born in Bisbee, Arizona, May 30, 1920, but he soon moved to Rodeo, New Mexico, where he spent the most of his first seven years. John then moved to Douglas, Arizona, where, in high school, he became the president of the senior class, business manager for the year book, member of the dramatics society, the debating team, and the rifle team. After attending the University of Arizona his freshman year, he came to the University of Colorado and enrolled in the chemical engineering department. John has maintained a better than 2-point average in the University. In addition he has become president of Alpha Chi Sigma, a member of Sigma Chi social fraternity, a member of A. I. Ch. E., and a participant in intramural sports.



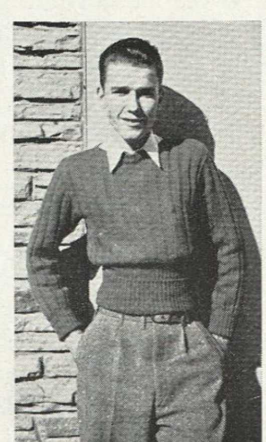
EVERETT GILBERT



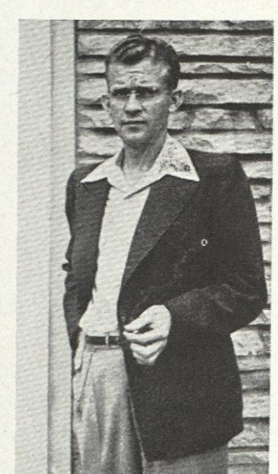
GORDON HUNGERFORD



JOE BYRNE



JOHN HOPKINS



VICTOR MILLER

### *J. Victor Miller*—*Eta Kappa Nu*

J. Victor Miller, president of Eta Kappa Nu, honorary electrical engineering fraternity, was born in Fowler, Colorado on October 19, 1909. He received his early education there, and was graduated from the Fowler High School. "Vic," a senior electrical this year, has maintained a 2.87 scholastic average. He is a member of Tau Beta Pi, and is active in the Colorado University Chapter of A. I. E. E. In addition, he is employed by the Public Service Company of Colorado.

### *Charles Dwyer*—*Chi Epsilon*

For Charles Dwyer the whole thing started in Wheatridge, Colorado, where he spent his early years and graduated from Wheatridge High School. Since irrigation and flood control were his chief interests, he decided to major in Civil Engineering upon entering the university. Throughout his college career Charles has maintained his standing in the upper fourth of his class. To pay for his education, Chuck took a job with the Public Service Company as a sub-station operator.

### *Jack Allen*—*A. I. E. E.*

Jack Allen, president of A. I. E. E., was born in Denver on August 22, 1920. After graduating from East Denver High School, Jack chose to continue his education at the University of Colorado rather than in some eastern college. Since mathematics was his favorite subject, he decided to major in electrical engineering. His record at the University both scholastically and in student activities proves that he chose wisely. Besides holding a 2.5 average and being president of A. I. E. E., Jack is president of the inter-fraternity council, a member of Eta Kappa Nu, electrical honorary, an A.S.U.C. commissioner, and on the A.S.U.C. board of publications. While maintaining this splendid record in scholastics and in student activities, Jack has also found time to take part in intramural sports. He is affiliated with the Beta Theta Pi social fraternity, of which he is president.

### *Carl Perko*—*A. S. M. E.*

Carl J. A. Perko, president of A. S. M. E., was born in Winton, Wyoming, on October 14, 1920. He moved to Rock Springs, where he attended grade school and high school. While in high school he was elected to the National Honor Society. Carl is an ex-"ham," his call letters being W-7-BMU. Among his hobbies are classical music and rifle shooting. Perko's parents hoped he would be a lawyer; but when he came to the University of Colorado in 1938, he decided on aeronautical engineering. He hopes to be an airplane designer when he graduates.

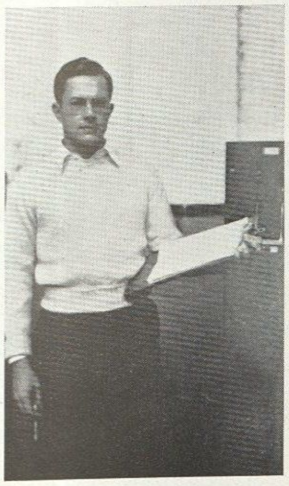
### *Tommy Punshon*—*A. S. C. E.*

Tommy Punshon was born in Burlington, Colorado, in 1920, and there he went to school through the first nine grades. His parents then moved to Boulder, where he went to high school and became president of the band and a member of the National Honor Society. He came to the University with a scholarship to study Architectural Engineering and has maintained a 2.7 average for three years. Obviously, Tom does not believe in making a drudge out of his school work, for he is a member of Tau Beta Pi, president of A. S. C. E., a member of Chi Epsilon and Alpha Phi Omega, and has earned his letter in the University Band.

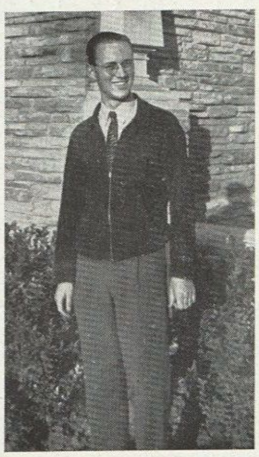
### *Robert Lund*—*A. I. Ch. E.*

Robert Lund, president of the Colorado University student chapter of A. I.Ch. E., was born in Roswell, New Mexico, on June 6, 1920. Possessing an aptitude and a liking for chemistry, Bob decided to make a career of chemical engineering. He came to Boulder in 1938, and since then his record at the University has been outstanding both scholastically and in student activities. He has managed to keep his scholastic average in the upper third of his class while being affiliated with A. I. Ch. E. and the Viking Club, participating in intramural football and basketball, and serving as a staff assistant on THE COLORADO ENGINEER. Last summer, to help pay for his school expenses and to gain some practical experience, Bob worked in the research department of a large zinc plant in Pittsburgh.

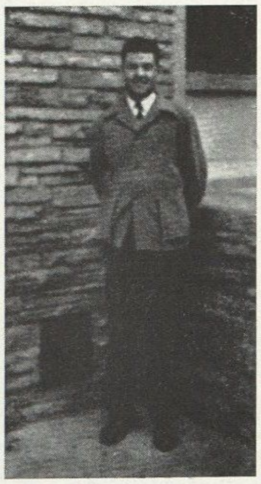
CHARLES DYWER



JACK ALLEN

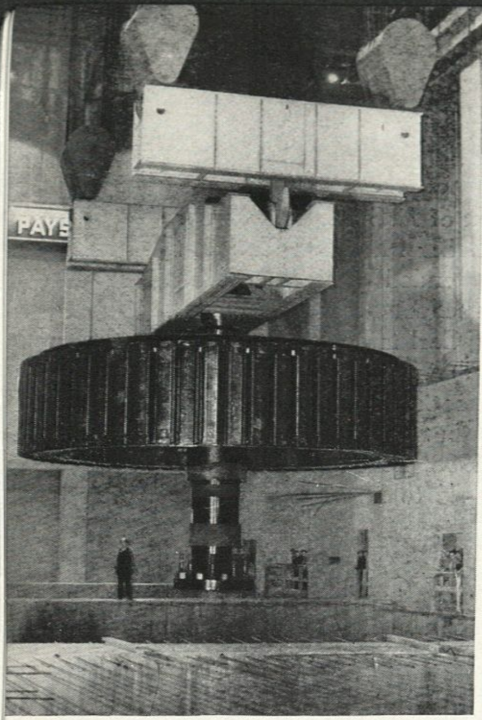


TOMMY PUNSHON



CARL PERKO

ROBERT LUND



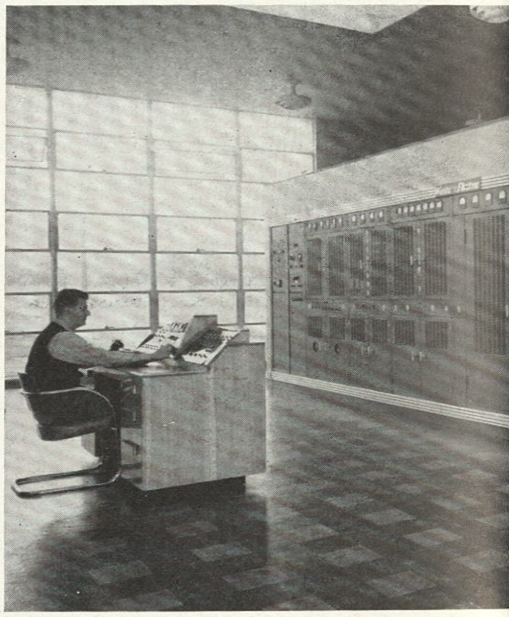
Courtesy Westinghouse

# News

By Earl L.

## GIANT ROTOR

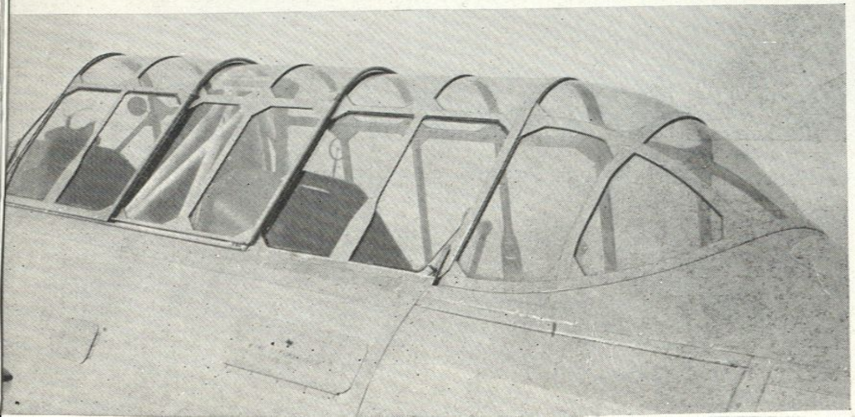
This view shows a rotor for one of the gigantic 108,000-kva generators being installed at Grand Coulee Dam. These generators are the largest ever built, the rotor alone being thirty-one feet in diameter and weighing 565 tons. When the project is completed, the dam will be equipped with eighteen of these generators which will store up power for the purpose of jumping water for irrigation to a natural reservoir 280 feet above the dam. Grand Coulee takes first rank above other hydroelectric projects of the world. Not only are its generators individually the largest ever built but also it has the greatest eventual total capacity, 1,944,000-kw, half again as much as Boulder Dam with its fifteen 82,500-kw and two 40,000-kw generator.



## ACRYLIC PLASTICS

Cast acrylic plastics are now being used very extensively by the aircraft industry for transparent cockpit inclosures, machine gun blisters, and observation turrets. These sheets are actually clearer than glass, and they can be cut with ordinary saws, machined, carved and drilled with the usual metal working equipment and cemented in strong transparent joints. The use of acrylics on America's bombing planes is giving today's pilots the important tactical advantage of all-around visibility. Other uses of this material include covers for switch boxes and resin pipes to illuminate dials.

Courtesy Product Engineering

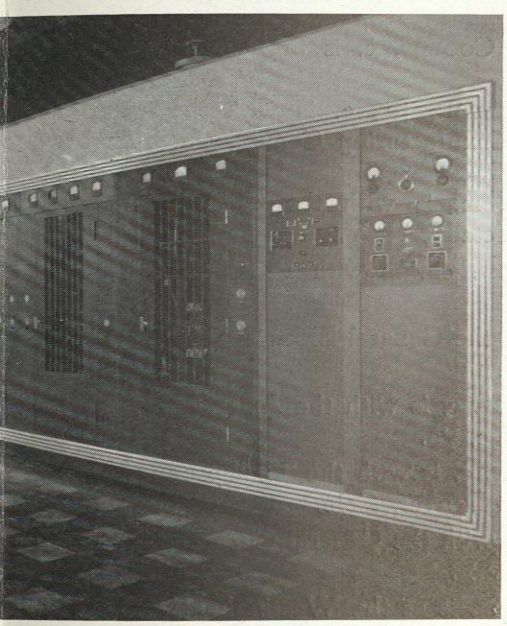


## KIRO TRANSMITTER

This panel is part of the new 50,0
tion KIRO at Seattle, Washington. Th
ern Electric equipment, and space has b
equipment. The connections to the tra
concealed behind a movable panel wh
along the base. The plant is wired for
economical installations. To produce
130,000 watts of electrical power are co
cost more than one-fourth of a million

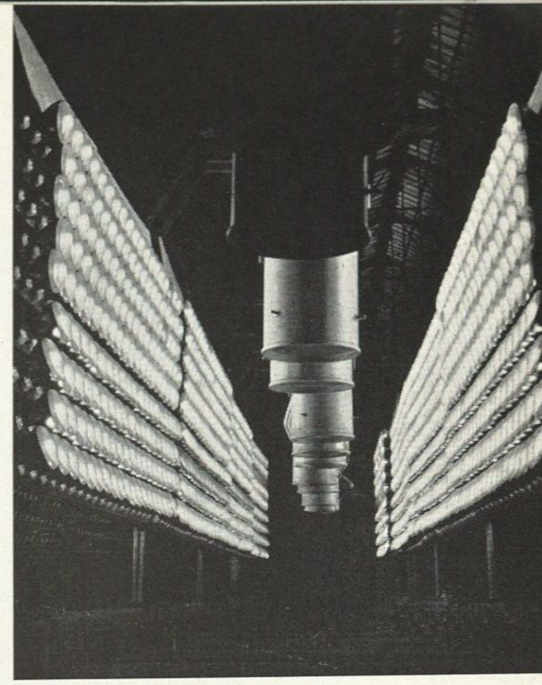
# Briefs

**ake, c, '43**



Courtesy Western Machinery and Steel World

)0-watt transmitting plant of Radio Sta-
e transmitter is the latest type of West-
oeen left for the installation of television
nsmitter, as well as the whole plant, are
nich runs the length of the equipment
460 volts rather than 220 to permit more
the 50,000 watts of radio signal about
nsumed. The transmitter is estimated to
dollars.



Courtesy Westinghouse

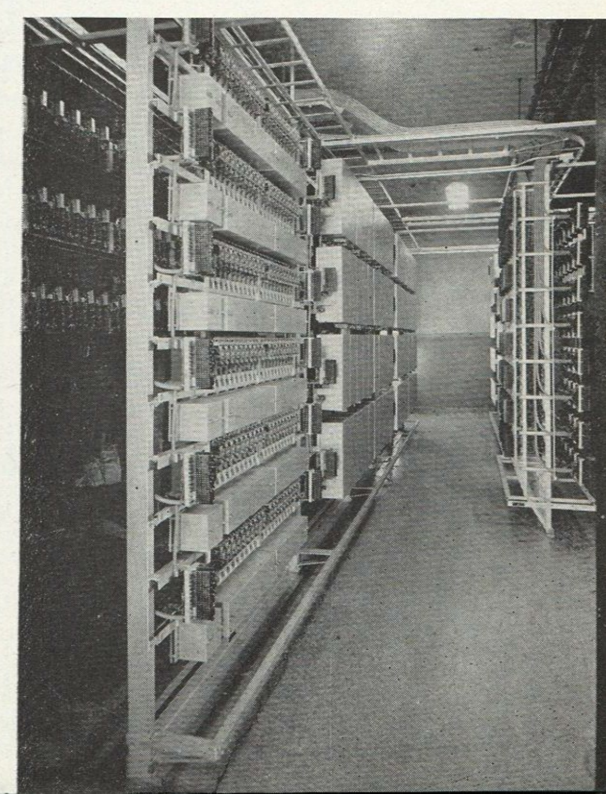
## DRY IN EIGHT MINUTES

A dry transformer tank is removed from the production line at the Westinghouse transformer division eight minutes after it is given a fresh coat of paint at the other end of these two batteries of infra-red drying lamps. Traveling at four feet a minute, the tanks first pass a workman who paints them inside and out in a few seconds with a spray gun. Then the tanks take their eight-minute ride between the two banks of drying lamps where infra-red radiation dries the paint by raising its temperature quickly to about 300 degrees Fahrenheit. Consuming a total of 342,000 watts of electricity, the lamps dry paint six to eight times as fast as the steam-heated ovens formerly used, thus helping to speed production of national defense power equipment.

## DIAL TELEPHONE

A bay of register-selectors and register-senders recently installed in Mansfield, Ohio, is used in changing the present type of telephone exchange from automatic to dial operation through a bay-to-bay conversion. This conversion, involving one of the most interesting and difficult of recent telephone engineering problems, was successfully effected with a minimum of expense to the company and without interruption of service to its 16,000 subscribers. The new register-senders are used to transmit a dial tone to the customer and to convey dialed numbers by electrical impulse over the existing switch train. Telephone company officials believe that this is a successful conclusion to an outstanding piece of engineering.

Courtesy Telephony



# With Our Alumni

By FRED VENDITTI, e, '42

1941

WAYNE ALEXANDER ALFORD, m, is with the Ingersoll-Rand Company at Pittsburgh, Pa.

BENJAMIN THOMAS ALLISON, ch, is with the American Smelting and Refining Company of Leadville, Colo.

ROBERT CLAY AYER, ch, is employed by the Westinghouse Electric and Manufacturing Company in Pittsburgh, Pa.

ROBERT REESE BAINS, ch, has found employment in Baytown, Texas.

DONALD SHEARON BARRY, arch, has accepted employment with Boeing Aircraft in Seattle, Wash.

ANTHONY JOSEPH BARNISH, ch, is in New Philadelphia, Pa.

JACK EDWARD BARTH, me, is with Boeing Aircraft Company at Seattle, Wash.

HOWARD CHARLES BEABER, c, is with the United States Government Service in the New Customhouse at Denver, Colo.

LEWIS ALFRED BECK, e, has gone to General Electric at Schenectady, N. Y.

HENRY ROSS BENSON, ch, is with E. I. duPont de Nemours & Co.

ROBERT EDGAR BONER, arch, is with Giffels & Vallet, Inc., in Detroit, Mich.

VITHA CHRYSTAL BOWERS, ch, is employed by the Michigan Alkali Company of Detroit, Mich.

RICHARD LADD BOYD, e, is with the Westinghouse Electric & Manufacturing Company at Pittsburgh, Pa.

DAVID MILTON BOYD, ch, is with the Barrett Chemical Company in Philadelphia, Pa.

ARTHUR EDWARD BRAINERD, ch, is with the Dow Chemical Company at Midland, Mich.

JOHN DOUGLAS BRAWNER, arch, is at the Massachusetts Institute of Technology in Cambridge, Mass.

LYLE BRAY, ch, is with the Phillips Petroleum Company located at Phillips, Texas.

RALPH C. BRENDLE, arch, is in Dallas, Texas.

WILLARD WALDO BROCKWAY, m, has accepted employment at the Remington Arms Company in Bridgeport, Conn.

WILBUR CLYDE BROWN, e, is with the General Electric Company in Erie, Pa.

HOWARD CRIFFIELD BRYAN, e, is with the American Bridge Company at Ambridge, Pa.

WILLIAM LENNOX BUDGE, m, has gone to Westinghouse Electric & Manufacturing Company at Pittsburgh, Pa.

GAIL ARNOLD CAMPBELL, m, is with the General Electric Company at Washington, D. C.

DOUGLAS CASE, c, is with the American Rolling Mill Co. at Middletown, Ohio.

ROBERT BRUCE CHAMBERLIN ch, is at the University of Minnesota at Minneapolis, Minn.

LESLIE ALLISON CLAYTON, c, is with the American Bridge Company at Ambridge, Pa.

DONALD ERNEST CLARK, m, is in Aircraft Squadron Officers' Training.

JAY EVERETT COMBS, m, is with the Carnegie-Illinois Steel Company at Gary, Ind.

WILLIAM RALPH CONKLING, c, has accepted a position at the International Filter Company at Chicago, Ill.

HEBERT WILLIAM CONN, e, is at the Westinghouse Electric & Manufacturing Company at Pittsburgh, Pa.

HAROLD VICTOR COOK, m, is in Aircraft Squadron Officers' Training.

T. FOWLER HAMILTON COOPER, c, is in Denver, Colo.

HERBERT MURRAY COULSON, JR., e, is with the Westinghouse Electric & Manufacturing Company at Pittsburgh, Pa.

JOHN GERALD CUMING, m, is with the General Electric Company at Schenectady, N. Y.

EARLE WALDO DEVALON, ch, is with Proctor & Gamble in Ivorydale, Ohio.

IRA JAY DILTS, e, is with the General Electric Company at Schenectady, N. Y.

EUGENE WILSON DOCTER, c, is with the American Bridge Company at Ambridge, Pa.

STANLEY LEROY DODSON, c, is with the Thompson Manufacturing Company at Denver, Colo.

BEN KING DUFFY, ch, is with the General Chemical Company in New York, N. Y.

PAUL CLIFTON DUKES, m, is at the Westinghouse Electric Company at Pitttsburgh, Pa.

HARRISON ALLEN DUNLAVY, m, is with the Curtiss-Wright Aircraft Corporation at Buffalo, N. Y.

HERBERT MICHAEL EDMONDS, e, is with the Public Service Company at Denver, Colo.

LYLE ELMER EATON, m, is with the General Electric Company at Erie, Pa.

RAYMOND AUSTIN EATON, e, is with the United States Bureau of Reclamation in Denver, Colo.

CHARLES JOSEPH ELZI, m, is with Giffels & Vallet in Detroit, Mich.

JAMES STANLEY ENGLUND, m, is with the General Electric Company at Schenectady, N. Y.

WOODROW ALFRED ERICKSON, c, is with the Public Service Company of Colorado at Denver, Colo.

JOHN MILTON FIRTH, e, is with the Sperry Products, Inc., at Hoboken, N. J.

STANLEY RAY FITZMORRIS, e, is with the General Electric Company at Schenectady, N. Y.

JOHN JOSEPH FLEMING, ch, is with the United States Rubber Company at Detroit, Mich.

JOSEPH WILLIAM FOUNTAIN, arch, is with the American Bridge Company at Gary, Ind.


Enough to make
your hair
stand on end!

LEONARD EICHOLTZ GEMMILL, ch, is with the Stearns-Roger Manufacturing Company of Denver, Colo.

CHARLES MAURICE GEORGE, m, is employed at the Wright Aeronautical Company at Paterson, N. J.

HUGH SUMMERS GRAHAM, ch, is at the Massachusetts Institute of Technology at Cambridge, Mass.

WILLEY MERRILL GUE, e, is with the Westinghouse Electric & Manufacturing Company at Pittsburgh, Pa.

JOE LEWIS GULINSON, e, has accepted a position with the Federal Power Commission at Fort Worth, Texas.

ANGELO THOMAS GURMATAKIS, ch, is with the United States Rubber Company at Detroit, Mich.

WERTH CARL HAGE, e, is with the Commonwealth Edison Company in Chicago, Ill.

HAROLD HOWES HAGUE, arch, is with the Curtiss Wright Corporation at Buffalo, N. Y.

WILLIAM BIRCH HARRIS, ch, is with the National Aniline & Chemical Co. in Buffalo, N. Y.

HAL MCDOUGALL HARRISON, ch, is employed by Chrysler Motors at Detroit, Mich.

EARL FREDERICK HARTER, e, is with the Westinghouse Electric & Manufacturing Co. at Pittsburgh, Pa.

EARL LANDIS HECKMAN, m, is at the University of Colorado.

HUGH WILLIAM HEMPEL, c, is with the R. Hardesty Manufacturing Company at Denver, Colo.

JOHN HUTCHINSON HESTER, JR., e, is with the United States Bureau of Reclamation at Denver, Colo.

JOSEPH THOMAS HOBBS, JR., ch, is in the Research Laboratory of the Aluminum Company of America at New Kensington, Pa.

WALTER ROBERT HOGUE, arch, is with Giffels & Vallet, Inc., at Detroit, Mich.

HAROLD FRANCIS ISEMINGER, arch, is with the American Bridge Company at Trenton, N. J.

OSCAR BAYARD JACOBSON, c, is with the Standard Oil Company of Indiana at Whiting, Ind.

NORMAN WILLIAM JENSEN, me, is with Ingersoll-Rand in New York.

CHARLES PHILLIP JOHNSON, JR., m, is with the Westinghouse Electric & Manufacturing Co. at Pittsburgh, Pa.

WILLIAM EVERETT JORDAN, JR., ch, has a position with the Texas Oil Company at Port Arthur, Texas.

FRED ANDERSON KELSALL, arch, is with the American Bridge Company at Trenton, N. J.

ROBERT WARREN LAUTH, e, is with the General Electric Company at Schenectady, N. Y.

HAROLD LEROY LAWLER, ch, is with the Hercules Powder Company at Wilmington, Del.

ROBERT WARREN LAWLER, e, is with the Engineering Division of Operation and Maintenance on the Panama Canal in the Canal Zone.

MARCUS CALVIN LEH, JR., e, is with the Public Service Company of Colorado at Denver, Colo.

AUBREY GLENN LEONARD, arch, is with the Boeing Aircraft Company at Seattle, Wash.

Benard Barclay Levitt, m, is with the U. S. Army Flying Corps.

Donald Albert Littlejohn, e, is employed by the Magnolia Petroleum Corporation at Dallas, Texas.

Chalmers Albert Loughridge, ch, is employed by the Atlas Power Company at Tamequa, Pa.

Edwin McCrillis, ch, works for the General Chemical Company at Denver, Colo.

James George McDonald, m, works with the Colorado Fuel & Iron Co. in Pueblo, Colo.

John Levis McNeil, c, is with the Remington Arms Co., Inc., of Bridgeport, Conn.

Daniel Joseph McQuaid, c, is working for the United States Bureau of Reclamation at Denver, Colo.

Warren Merrill Mallory, e, is working for the Magnolia Petroleum Company at Dallas, Texas.

John Stanley Marshall, c, is employed by the Colorado State Highway Department in Denver, Colo.

John Donald Mayer, arch, is with the Boeing Aircraft Company at Seattle, Wash.

Edward John Meikel, Jr., ch, is in Kersey, Colo.

Gerald Draper Morehouse, e, has been transferred by the Lockheed Aircraft Corporation to Burbank, Calif.

George Herbert Morgan, c, works with W. D. Morgan & Son at Ladysmith, Wis.

Euthan Vane Mullins, m, is with the Babcock & Wilcox Co. in New York, N. Y.

Henry Ransome Nash, m, is now at the Lockheed Aircraft Corporation in Burbank, Calif.

George Nelson, c, works for the R.S.B.R. at Denver, Colo.

James Phelps O'Hara, c, is now working for the Illinois State Highway Department in Effington, Ill.

Edward Frank Pearson, m, is employed by the Colorado Fuel & Iron Co. in Pueblo, Colo.

Richard Barron Snodgrass, m, is now at the Boeing Aircraft Company at Seattle, Wash.

Carroll Lee Stoecker, m, is in Denver, Colo.

Charles Milton Stone, ch, is employed by the Texas Oil Company at Beacon, N. Y.

## MARRIAGES
### 1941

Robert Towse, ch, was married to Miss Marilyn Miller of Colorado Springs soon after graduation. The couple will make their home in Alton, Illinois, where Towse is employed. The bride has a degree from the business school at the University of Colorado.

Harry Mayer, m, and Miss Ruth Lauck of Lafayette, Colo., both graduates of the University of Colorado, were married this summer. The happy couple will be at home in Lynn, Mass., where the groom is employed.

Warren Mallory, e, ex-editor of the Colorado Engineer, and Miss Eleanor Jean Hall, of Boulder, took the marriage vows in August. Mrs. Mallory was a student in the College of Arts and Sciences at the University of Colorado. After a wedding trip the couple went to Eagle Lake, Texas, where Warren has accepted a position with the Geophysical Department of the Magnolia Oil Company.

## NAVAL SCIENCE AT THE U. OF C.

(Continued From Page 5)

a month. Transportation and subsistence is furnished to and from the port of embarkation—which for students in this area would probably be San Francisco, San Diego, or Seattle.

Uniforms are furnished at government expense to Basic Course students, and for the duration of the summer cruise special additional clothing is issued. When the student enrolls in the Advanced Course, a second blue service uniform is issued him, which has been made to order at government expense. There is, finally, no tuition in the Naval Science Courses, and necessary books are furnished free by the government.

Finally, the question of eligibility to membership in the Naval R.O.T.C. This is very important, but need not be exhaustively handled now, other than to say that the course is limited to unmarried male students who are citizens of the United States, of the required age, and who can meet the physical standards required of candidates for appointment as midshipmen at the U. S. Naval Academy. Physical fitness is determined by a board of naval medical officers; and it is worth while pointing out that they are authorized to accept students who, in their opinion, will, upon graduating four years from now, meet the minimum requirements for physical stature as laid down for Annapolis midshipmen upon graduation.

So much for the bare outline of the course itself, which is, in a sense, viewed from the professional point of view. But there is a good deal more to it than that from the point of view of a young man who is planning his career and mapping out his future life.

This Naval R.O.T.C. course can be viewed somewhat in the light of a basically sound investment with high speculative possibilities. With the distressing state of world affairs, no one can predict when and how normalcy will return. Like a bolt out of the blue, it may return tomorrow or be long delayed. Against this uncertainty, the R.O.T.C. student pursues his elected course of study at the University in preparation for taking his place in the peaceful pursuits of life upon the termination of the emergency. At the same time, mindful and aware of totalitarian methods and its challenge to the democratic way, the student is not only equipping himself to become a citizen sailor for duty in his country's cause, if need be, but he is also, by taking the Naval R.O.T.C. course with the University course, contributing to making himself a self-confident and good all-around man.

For young men in this country—almost last of all the countries in the world—there is a dynamic future in the field of leadership. The country needs—the country must have—leaders. And the Naval R.O.T.C. training at a university offers the component parts of the training a future leader will need. There is, first, the general knowledge which serves as a background and foundation, on which the young Naval or Marine Corps officer can build for the future. There is, second, the well-disciplined mind and body developed by holding Naval R.O.T.C. students, while under Naval jurisdiction, to the highest standards of bearing and conduct. There is, finally, the alacrity to assume intelligent responsibility and initiative, which will be fostered by giving R.O.T.C. students every practical opportunity to develop as aggressive, self-reliant leaders. The opportunity to exercise command will not be vested in a selected few, but all will participate, and additional supervised instruction in leadership will be given students naturally backward in such ability.

In a word, whether it is war or peace for America, young men just out of high school want to make a place for themselves in the world; the Naval R.O.T.C. fits them admirably, for either of two places—a career in the Navy, as an officer rises steadily in rank, or a career in civil life, with a solid background of training in mind and body and leadership to raise them to the level they want and deserve in the everyday service of their community and their country.

Graduates of high school who have not enrolled in the University, and who are interested, are urged to make inquiry of the Naval R.O.T.C. at Naval Headquarters, University of Colorado. Attention is invited to the fact that enrollment in the Naval R.O.T.C. does not constitute enlistment in the United States Navy. The Navy wants energetic young men of high character, potential leaders who will become fit to command. They must be men who are able to assume great responsibility.

## ENGINEERING DEFENSE TRAINING

(Continued From Page 10)

vited to participate in this highly important project, and, as this is written, Professor John Cage is making preparations for attending a preliminary conference at Massachusetts Institute of Technology similar to the conference in explosives earlier this year. The MIT training will continue for three weeks, and on his return Professor Cage will start organizing his class.

Mr. Knudsen of the OPM has stated that war materials must be produced to the very limit of the nation's resources and in the shortest possible time. As Dean Seaton has pointed out, the limit may be reached in some necessary strategic material or in the supply of skilled mechanics or trained engineers. Engineering defense training is being carried out to keep the supply of engineers adequate, and so avoid that bottleneck. This is a challenge to the engineering profession which must be met.

At the University of Colorado this training is only one of many activities through which the University is working to meet its responsibilities during this critical period. This particular program is under the immediate administration of a faculty committee composed of Dean Herbert S. Evans, ex-officio member, Professors Bauer, Cage, Campbell, Eastom, Parker, Underwood, and Raeder, chairman. In general, the committee formulates policies and handles the administration while the Extension Department of the University handles details of class organization and instruction.

(Continued From Page 13

These units will be used to illustrate the principles of mechanical refrigeration. Included in the list of new equipment is a large capacity fan equipped with both multi-blade rotor and high speed turbo-blade for use in standard fan tests.

At the present time a cupolo, an iron melting foundry, is being installed in the foundry. When installation is complete, the foundry equipment will be so complemented that it will be possible to make worthwhile changes in the mechanical engineering curriculum. For example, it will be possible to combine a number of one, two, and three hour courses into a single two-quarter course in engineering processes.

Meanwhile, the mechanical department continues to administer the pilot training program under Coordinator Wayne S. Beattie. Three hundred students have been taught to fly, involving over 1,000,000 miles of flying.

## Chemicals Add Equipment

A new coke oven, used to heat coal and oil shale to high temperatures electrically and decompose them into gas, tar, oils, and coke, has been installed in the chemical engineering department.

The coke oven was put into use this summer; students have been running tests this fall to determine its adaptability.

(Continued on Page 26)

## CAMPUS NEWS

(Continued From Page 25)

Additional new equipment in the chemical laboratories includes a copper still, a glass extractor column, and various items in the oil and fuel laboratory. The copper still was purchased this summer but has not been set up yet. The unit is a batch still for distilling organic mixtures, consisting of a copper still and condenser. It will be set up in the near future.

Most of the parts for the new glass extractor column have arrived, but installation has not been begun. The column will be used to investigate the process of extracting a certain material from a liquid by means of another liquid.

In the oil and fuel laboratory a quantity of gas analysis equipment has been purchased, in addition to a new outfit for determining the heating value of fuels such as coal and oil.

Many improvements have been made on old equipment in the chemical laboratories, some of the units having been entirely rebuilt. The dryer unit has been improved, and work which was in progress all of last year is nearly complete. Work on the dryer has been done entirely by students.

A great deal of new equipment is contemplated for the new practice school which will be started in January at the Johnstown plant of the Great Western Sugar Company.

### Engineering Convocation

To acquaint engineering students with the many organizations and honoraries with which they may become affiliated, a general convocation of engineering students was held Friday, October 17, in the University Theatre. The president of each honorary and professional group was called upon to say a few words concerning the setup of his organization or honorary and to outline the requirements for membership.

Included among those who spoke were Victor Miller, Eta Kappa Nu; Everett Gilbert, Tau Beta Pi; Gordon Hungerford, Sigma Tau; Benjamin Griffith, Pi Mu Epsilon; Joseph Byrne, Pi Tau Sigma; Charles Dwyer, Chi Epsilon; and John Hopkins, Alpha Chi Sigma.

Jack Allen spoke for A. I. E. E., Carl Perko for A. S. M. E., Robert Lund for A. I. Ch. E., and Tom Pushon for A. S. C. E. Ted Kuntz, editor of THE

Colorado Engineer, and Eugene Light, business manager, made short speeches.

Officers of the Combined Engineers who handled convocation details were: Henry Gregory, president; Benjamin Griffith, vice-president; Norman Rockwell, secretary; and Berlin Boyd, treasurer. Gregory acted as master of ceremonies.

### Three Instructors Added

Three new men have been added to the engineering faculty this fall, replacing three instructors, two of whom have resigned in favor of military duty.

W. L. Menoher received his B.S. in civil engineering at Colorado University in 1926, and graduated from Simpson College at Indianola, Iowa, with an A.B. degree in 1932. He will replace Leo C. Novak, instructor in civil engineering, who has taken up military duties as an instructor in the engineering school at Fort Belvoir, Virginia.

In the electrical engineering department is M. J. Smith who graduated from Rice Institute with a B.S. in electrical engineering. Mr. Smith replaces Lieutenant Veldon O. Long, instructor in electrical engineering, who has assumed duties as a gunnery officer in the NROTC.

Taking over both laboratory and lecture work in the chemical engineering department is Charles Prien. Mr. Prien obtained his M.S. in chemical engineering from Purdue University and is working on his doctor's degree at the present time. He replaces N. A. Agapetus, who has accepted a position in New York with the Kellogg Company, designers of petroleum equipment.

### Colorado Engineer Heads Attend Convention

Ted Kuntz, editor of The Colorado Engineer, and Eugene Light, business manager, attended the Engineering College Magazines Associated convention held November 14 and 15, at the University of Illinois in Urbana. The Engineer chiefs left Boulder on November 12, expecting to return soon after the conference closed. The purpose of this convention is to discuss the problems which confront engineering publications.

(Continued on Page 28)

## CAMPUS NEWS

(Continued From Page 27)

### Slide Rule Presentation

The annual A.S.C.E. slide rule award was made to LeRoy Jacox, sophomore civil engineer, at the regular A.S.C.E. meeting on October 15. Jacox achieved the highest scholastic average of any freshman civil or architectural engineer last year. He hails from Fort Morgan, Colorado, where he has lived all his life. A member of the University band, Jacox is a pledge to Kappa Kappa Psi, honorary band fraternity.

### Engineers Mark 39th Annual Applefest

As The Colorado Engineer went to press early in November, it was impossible to record the traditional observance of the Engineers' Applefest, held on November 5 this year. At least 800 engineers trooped to the Fieldhouse for the 39th annual observance of the engineering bull session. Following prescribed rules, the engineers were treated to corn cob pipes and tobacco and a program featuring farce athletic bouts, with greetings from Dean Herbert S. Evans and other notables. Tau Beta Pi and Sigma Tau called new members into their ranks as a highlight of the evening's entertainment.

Members of the 1941 Applefest Committee were John Hopkins, chairman; Rex Ellington, Paul Yewell, Eugene Negro, Ben Donsky, Lawrence Brown, Harry Fry, and Charles Drexal.

### Enrollment

Dropping slightly from last year's record of 867, an enrollment of 862 was chalked up this year by the engineering department. Of this number 170 are seniors, 155 juniors, 217 sophomores, and 320 freshmen. In 1940 the recording department cataloged 160 seniors, 188 juniors, 209 sophomores, and 310 freshmen.

### Electricals Take Field Trip

On Monday, November 3, the senior electricals inspected the new high-speed turbo-generator unit now being assembled at the Valmont power plant. The field structure, rotor, and turbine casing and blading were carefully studied.

### Tau Beta Pi

Tau Beta Pi, honorary engineering fraternity, started the new school year with the following officers: Everett Gilbert, president; Benjamin Griffith, vice-president; Jack Sanders, recording secretary; Sheridan Crooks, corresponding secretary; and Professor Wayne S. Beattie, treasurer.

The annual national convention of Tau Beta Pi was held in Philadelphia, October 2, 3, and 4. Representatives from Colorado University were Berlin Boyd and Everett Gilbert. Activities at the convention included business meetings, smokers, a formal dance, and inspection trips. While at the convention, the Colorado representatives carried on a successful campaign to have the 1942 convention held in Boulder. The convention will be held some time in October of 1942 and will bring an estimated 150 representatives from all sections of the country.

## Sigma Tau

The officers of Sigma Tau, general honorary engineering fraternity, are Gordon Hungerford, president; Lloyd Gardner, secretary; Richard Kellogg, treasurer; and Benjamin Griffith, historian.

The first meeting of the year was held on October 21. Plans were discussed for the printing of the Applefest programs and new members were voted on.

## Pi Tau Sigma

The officers of Pi Tau Sigma, mechanical engineering honorary, for this year are Joe Byrne, president; Ben Griffith, vice-president; Robert Brace, treasurer; Lloyd Gardner, recording secretary; Richard Kellogg, corresponding secretary.

The first meeting of Pi Tau Sigma was held on October 10. The purpose of the meeting was to decide on the student delegates to the national convention that was held in Pittsburgh, Pennsylvania, on October 30 and 31, and November 1. The five men who went were Robert Brace, Lewis Crumley, Lee Hall, Walter Shaw, and Richard Kellogg.

A meeting was held on October 22 for the purpose of electing the new pledges. There were eight in number. The pledges named were Martin Baker, Charles Drexel, Frank Durham, Edward Greer, Robert Harding, Jack Schultz, William Simmons, and Arthur Valiton.

## Chi Epsilon

Chi Epsilon, honorary civil engineering fraternity, entertained eligible men at a dinner on October 16. On October 21 the following men were pledged: Harry Fry, Gordon Potter, Bill Curtis, David Fleming, and Don Hartquist.

The officers of Chi Epsilon are Charles Dwyer, president; Douglas Wood, vice-president; Lee Alden, secretary; William Wright, treasurer; and Tommy Punshon, associate editor of the *Transit*.

## Alpha Chi Sigma

Alpha Chi Sigma, professional chemistry fraternity, held its first meeting October 15, and outlined plans for the coming year. It was decided to vote on juniors and seniors eligible for membership in the near future.

A second meeting, in the form of a smoker, was held October 29. Eligible students were entertained at the smoker and members discussed summer job experiences. Plans for future meetings include a number of movies dealing with chemical subjects and a dinner meeting.

John Hopkins is president of Alpha Chi Sigma; Don Walsh, vice-president; Dick Dawson, treasurer; Rex Ellington, recorder; Lawrence Farrell, master of ceremonies; and Victor Kalcevic, reporter.

(Continued on Page 30)

## CAMPUS NEWS

(Continued From Page 29)

### Eta Kappa Nu

Eta Kappa Nu met for the first time on October 15, and members discussed plans for a smoker for juniors eligible to Eta Kappa Nu membership. Also discussed was the treasurer's report for last year.

On October 28, the smoker was held for eligible junior electrical engineers.

Officers of Eta Kappa Nu are J. Victor Miller, president; Robert Cunningham, vice-president; Raymond Allen, secretary; Raymond Robertson, treasurer; Robert Emigh, corresponding secretary; and Lawrence Brown, *Bridge* correspondent. Professor C. M. McCormick is faculty adviser.

Pledging of Eta Kappa Nu took place Thursday, October 30. The junior pledges are Earl Sheldon, George Baroch, Charles McKeever, Harold Wish, Bill Hanna, Bob Isaak, and Phil Spaulding. The senior pledges are Herbert Reno, Daniel Davidson, and Edward Ketch.

### American Institute of Electrical Engineers

A. I. E. E. met October 8 to hear W. W. Lewis of the General Electric Company speak on "Standardization of Insulation Levels."

On October 22, the electrical students met for the second time to discuss summer job experiences and elect a new vice-chairman.

Jack Allen, former vice-chairman, will act as chairman in place of Robert Fleming who did not return this fall. Raymond Allen was elected vice-chairman, and Robert York and Robert Emigh will hold positions of secretary and treasurer, respectively.

### American Society of Mechanical Engineers

For the coming year the officers for the A. S. M. E. will be Carl Perko, president; Lloyd Gardner, vice-president; Lee Hall, treasurer; and Robert Brace, secretary.

The first meeting for A. S. M. E. members was held on October 8. Walter Shaw, a Colorado University student and summer employee of the Pratt and Whitney airplane engine plant, gave a talk on the manufacture of Pratt and Whitney engines. The new members, fifty-five in number, were signed up at this meeting.

At a scheduled meeting of the A.S.M.E. on October 28, Mr. C. W. Cole from the Wright Aeronautical Co. addressed the group and showed moving pictures depicting the construction of aircraft engines in the Wright factory.

Several inspection trips have been planned for the fall quarter.

### American Society of Civil Engineers

The A. S. C. E. held its first meeting on October 1. At that time a motion picture film on timber plywood by the Douglas Fir Plywood Association was shown.

On October 15, several of the students gave talks on their experiences with engineering jobs this summer. Most of the men had either worked with the highway department or with various defense projects. Speakers for the evening were Walton Colwell, Elton Fry, Leroy C. Jacox, Harold G. Haddon, Norman J. Whyte, and Leonard O. Nordeen. On the same evening, Leroy Jacox was presented with a slide rule for having maintained the highest scholastic average among freshmen civil and architectural engineers.

On October 29, Howard E. Putnam spoke on "The Pennsylvania Turnpike," and Harry Bashore, on the "Alcova Dam." Professor C. L. Eckel discussed the Manual for Student Chapters.

On November 12, Jacob C. Warnock, member of the A. S. C. E. in Denver, spoke on the "Laboratory Approach to Hydraulic Design." Coming speakers include several practicing engineers, as well as students.

Officers of the A. S. C. E. are Tommy Punshon, president; Leonard Nordeen, vice-president; Allen Ziegelmeier, secretary; and Lee Alden, treasurer.

### American Institute of Chemical Engineers

A. I. Ch. E. will be represented this year by Robert Lund, president; Elbert Michaels, vice-president; William Dobbs, secretary; and Morton David, treasurer.

Seventy-five members gathered at the first meeting, October 8, to discuss summer experiences and play cards. Cider and doughnuts closed the meeting.

A dinner meeting was held October 22, at LeBaron's Sunken Gardens. The purpose of this annual meeting was to interest sophomore chemical engineers in the functions of the A. I. Ch. E. Lieutenant Commander John W. Higley, U. S. N., executive officer of the N.R.O.T.C. unit, spoke on "Naval Problems in the Far East."

Additional A. I. Ch. E. programs for the remainder of the quarter have not been decided upon.

### New Defense Course Open To Electrical Seniors

John M. Cage, assistant professor of electrical engineering, is spending three weeks in intensive study at the Massachusetts Institute of Technology in preparation for a defense course in the field of microwaves, which will be given winter and spring quarters. The University of Colorado is one of forty universities throughout the nation which will offer this training. The course will be open to senior electrical engineers and physics majors. In contrast with the many defense courses which are being given in Denver and Boulder at the present time, the new course will be open to students already enrolled in the University and will provide for regular college credit. Men who take this course and pass a physical examination will be offered commissions in the U. S. Army Signal Corps.

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A new arc welder is equipped with a self-indicating current control, which results in greater convenience and accuracy in welding. The operator can adjust both the slope of the volt-ampere curve and the amount of welding current to suit the job requirements.

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About 1½ million tons of lignin, the substance that holds the cellulose fibers of wood together, are produced by the paper and rayon industry annually. This has always been a waste product but research has discovered that a small amount makes cement stronger; it can be used to remove iron from industrial water supplies and by the hydrogenation process it can be converted into wood alcohol and other solvents.

On the market now is a magnetic separator for separating brass and iron turnings which is suitable for use in smelter plants.

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There are about 875 passenger trains in the United States which bear names, many of them world-famous, and of these there are three American passenger trains named for women—the "Nellie Bly" (Pennsylvania-Reading Seashore Line), the "Ann Rutledge" (Alton Railroad), and the "Pocahontas" (Norfolk & Western Railway).

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The fastest train run ever recorded on an American railroad was made by the Pennsylvania Special (now the Broadway Limited) on the Pennsylvania Railroad, when that train covered three miles near Ada, Ohio, in 85 seconds, or at the rate of 127.2 miles per hour.

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A new metallizing gun is designed for operation on propane gas. It produces extremely fine coatings at production speeds. Two speed ranges are available. Spraying speeds are equal to those obtained with hydrogen, and slightly lower than with acetylene.

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The steepest grade on a standard steam railroad in this country is 5.89 per cent, and is located on the Pennsylvania Railroad at Madison, Indiana, where the railroad ascends the Ohio River bank. The grade extends about 7,000 feet and the climb is approximately 400 feet. Saddle-tank locomotives are operated on this track.

# OIL CAN

THE HONORARY SOCIETY OF LUBRICATION ENGINEERING

DOWN WITH FRICTION

Lubricity shall lack no champion . . .
Friction shall not thrive unopposed

**By DON HARDIN, ch, '43**

Another fall is here and so the old Oil Can is once more brought out for extensive use. Here in our own university many students are expounding new theories, ideas, and new interpretations of scientific phenomena; and now as in the past, their colleagues are laughing at them. But who can tell what potential Newtons or Edisons are in our midst? That these brave pioneers of engineering may not become discouraged, the Oil Can endeavors to lend a helping hand by publishing their theories and ideas so that the public may understand them. Think twice before you laugh at these brave children. And so to our new champions of lubricity and our neophytes of the Honorary Society of Lubrication Engineering, we offer this humble toast:

*Hail to thee, blithe frosh,*
*Thou unravished child of Nature's sweetness.*
*Hail to thee.*

*Hail to thee, innocent child,*
*Thou unspoiled object of a sorority's wiles.*
*Hail to thee.*

*Hail to thee, ambitious engineer,*
*Thou illustrious scion of worthiness and trust.*
*Hail to thee.*

* * *


Professor (after a very bad recitation): "Class is dismissed; don't flap your ears as you go out."

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While not new, the petrographic microscope, which not only magnifies but produces polarized light, is being used to an increasing extent in the cement, lime, refactory, glass, ceramic and industries using slag. Crystalline materials are identified by measuring optical constants. Examinations can be made on powder immersed in oil, on thin sections by transmitted light, or on polished surfaces by reflected light.

PROBLEM OF THE MONTH

How long would it take a rooster sitting on a brass door knob to hatch a hardware store?

Give up? . . . So did the rooster!

* * *

A college student is one who enters his alma mater as a freshman dressed in green and emerges as a senior dressed in black. The process of decay is known as a college education.

* * *

We don't know whether or not Dawson still thinks he is a fire warden in Organic Lab. . . . Oh, well, he looks better without any eyebrows anyway.

* * *

You can lead an engineer to water, but why disappoint him.

* * *

Exclaimed the freshman engineer in Chemistry Lab as he lit his Bunsen burner, "I Don't Want to Set the World on Fire, I just want to boil some water."

* * *

*Prof.: Are you lecturing to this class?"*

*Student: "No, sir."*

*Prof.: 'Well, then sit down and stop acting like an idiot."*

* * *

We hear some freshmen engineers think that a neckerchief is the president of a sorority.

* * *

*Anderson: "Let's cut classes and play a game of golf."*

*Carver: "Sorry, I have to go to my classes and catch up on my sleep."*

* * *

CONFESSION

Half of these jokes I've seen before, and the other half I don't see yet.—The Editor.

* * *

*I like an exam*
*I think they're fun*
*I never cram*
*I never flunk one*
*I'm the professor.*

* * *

Professor: "Are you cheating on this examination?"

Student: "No, sir. I was only telling him his nose was dripping on my paper."

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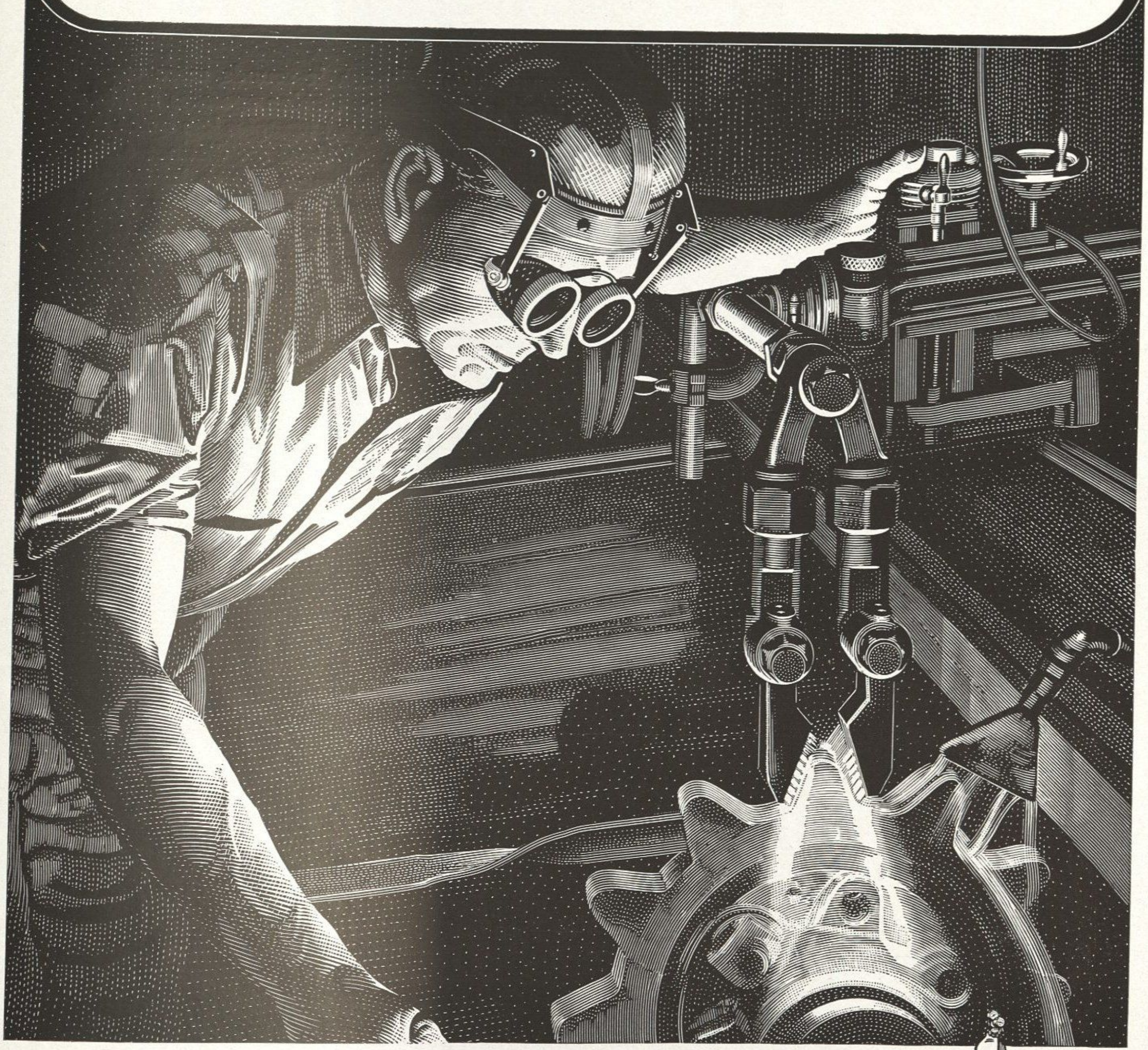
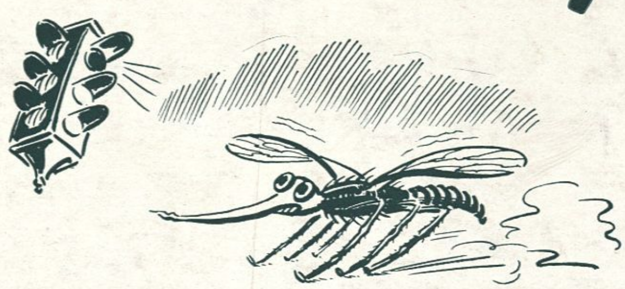
A dressing tool for spot welding electrodes is air-operated. It is useful in reshaping electrode points after they have become worn, without removing them from the machine. Cutters are designed to run freely after electrode is dressed to proper shape.



# G-E Campus News



## MOSQUITOES DON'T LIKE RED LIGHTS

OUT in Cleveland, Ohio, a group of engineers and entomologists has been spending a lot of warm summer evenings sitting around under a string of colored lights. But any passerby who got the impression that they had joined the rocking-chair brigade would be very much mistaken. They were conducting a scientific experiment to determine what color lights attract, and what repel, night-flying insects.

Results: mosquitoes and most other night-flying insects don't like red lights, prefer blue. But since red is not a very satisfactory color to work under, the scientists suggest that if you must work under a lamp outdoors, yellow light provides the maximum advantages to human beings with the minimum attraction to insects.


## LEFT-HANDED BUCKETS

UNLIKE the famous fellow who wanted a left-hand monkey wrench, the young man at the window is perfectly in the right if the buckets he wants are the buckets for a steam turbine. For a double-flow turbine for ship propulsion has both right- and left-hand buckets.

There's an important reason for using this construction. Though it sounds more complicated, a double-flow turbine operates at higher speed, weighs less, and occupies less space than a single-flow one. All these are distinct advantages when the equipment has to be installed in a ship, where space is at a premium. And in times like these, when turbines must be turned out in a hurry, the smaller metal parts required represent an advantage in manufacture, too.

General Electric, which has probably built as many naval and marine turbines as any other single manufacturer, is right now making more of them than at any time in its history. And by taking advantage of every engineering and manufacturing advance, it is turning them out on what approaches a mass-production basis.


## WANT A BOOKLET?

NOT required reading in any course we ever heard of. But if lightning should strike you some day, you'd be glad to know what hit you. This booklet explains the whys and wherefores of lightning. Tells you how to recognize lightning when you see it, how to catch it if you should want to take some home to play with, etc. In fact about the only thing missing is a "lightning" index to enable you to thumb to your favorite passage in less time than it takes to say "blitz."

And if you have just been on a textbook-buying binge, you may be interested in the fact that this 24-page pamphlet is free.

If you *are* interested, write to the General Electric Company, Dept. 124E, Schenectady, N. Y., and ask for "The Story of Lightning," based on the work of Dr. Karl B. McEachron author of the book, "Playing with Lightning."

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