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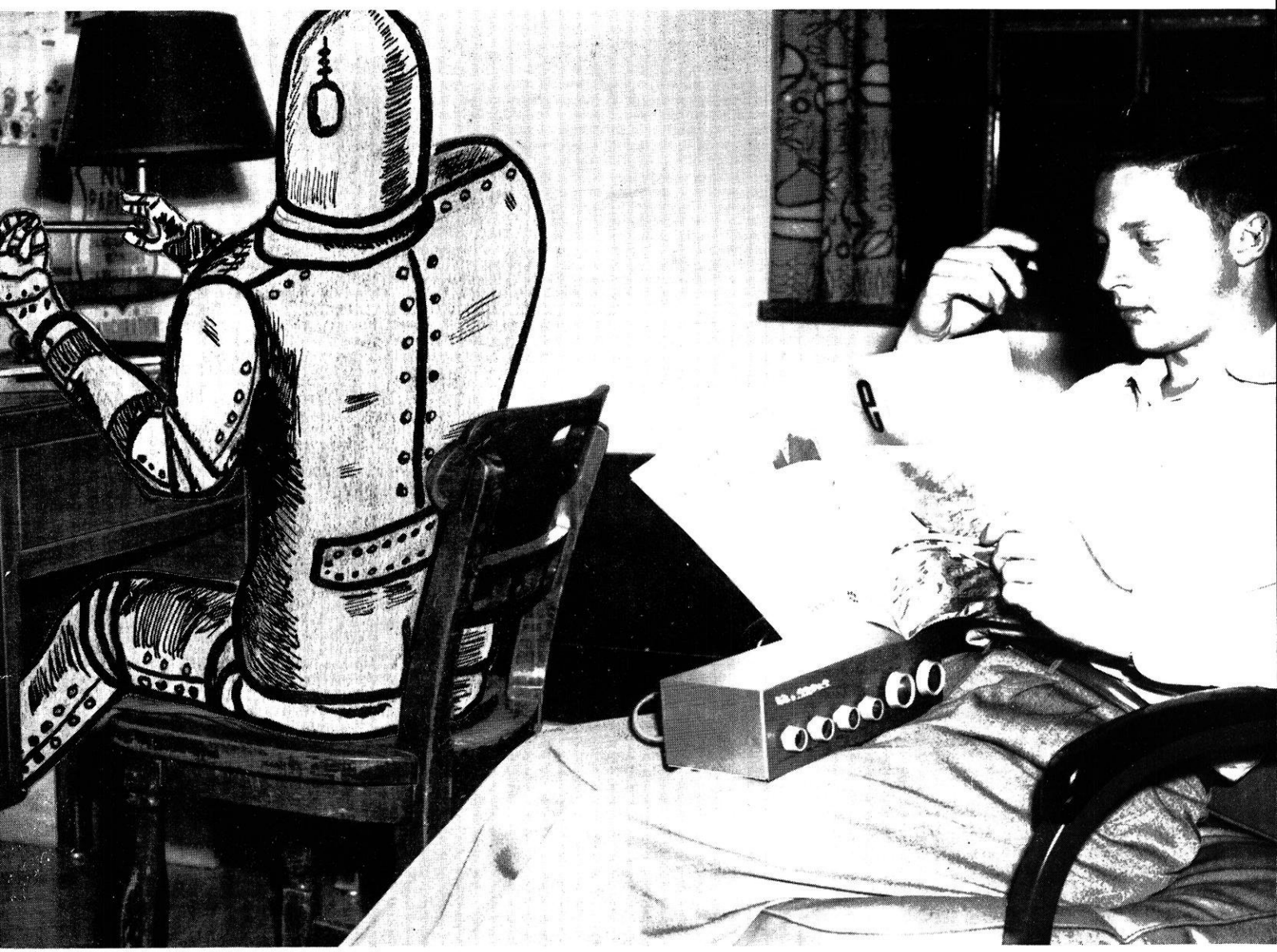
The Wisconsin

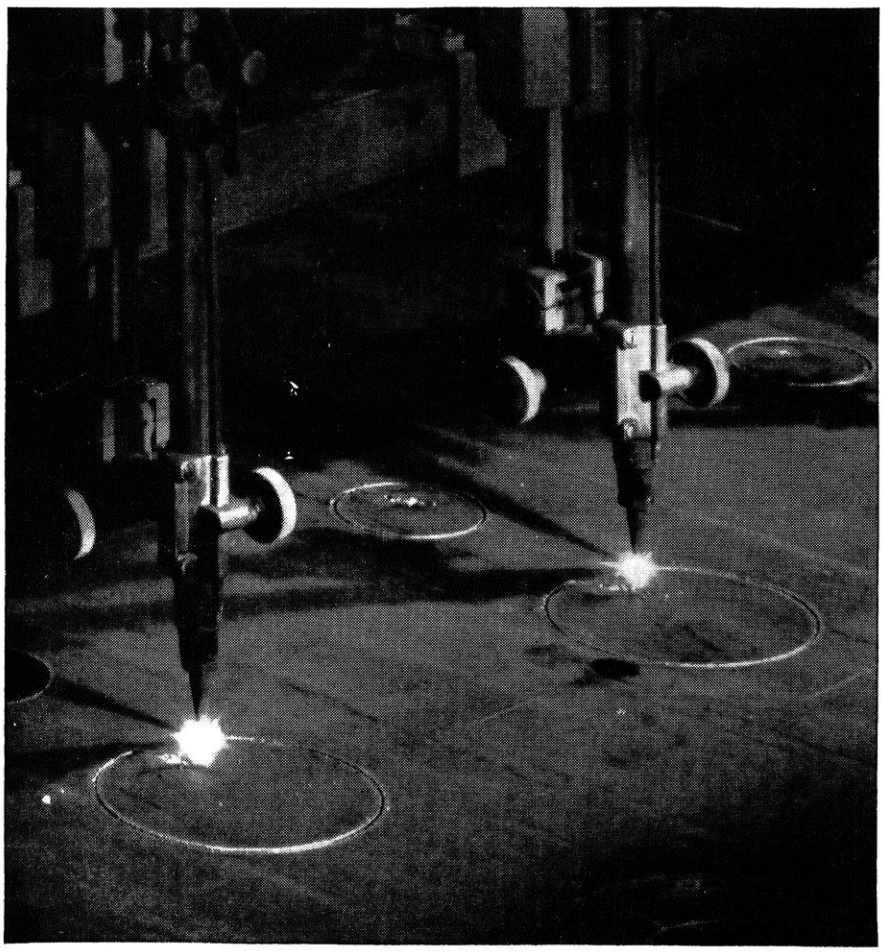
engineer

OCTOBER, 1954 25¢



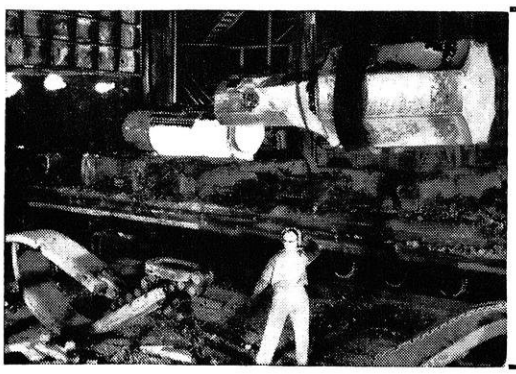
in this issue . . .

Only STEEL can do so many jobs so well



Cuts Steel Like Butter! This modern flame-cutting equipment, in use at U. S. Steel Supply Division warehouses, can follow the most complicated patterns accurately and turn out finished shapes of steel exactly as wanted. Many fabricators of steel products buy their steel from U. S. Steel Supply, and have it cut to shape before it is delivered to them.

The Spring's The Thing that gives a Trampoline its unique place in the world of exercise and entertainment. Around the edge of the resilient "bouncing" surface, more than 100 oil-tempered springs, carefully designed and precisely manufactured by U.S. Steel, quietly go about their jobs of supplying the "motive" power that enables a performer to bounce and leap as high as 26 feet.



A 42-Foot Car-Bottom Furnace heats big steel ingots like this up to forging temperature at U.S. Steel's Homestead Works. But proper heating involves a great deal of skill and experience on the part of the men who supervise the process. And U.S. Steel Forgings Division craftsmen are second to none in expertness at their various jobs. Many of them learned their skill from fathers and grandfathers who held the same jobs before them.

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If you're thinking about what you're going to do after graduation . . . if you're interested in a challenging, rewarding position with a progressive company . . . then it will pay you to look into the opportunities with United States Steel. Your placement director can give you more details, or we'll be glad to send you the informative booklet, "Paths of Opportunity." United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

SEE The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

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For further information on any product mentioned in this advertisement, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

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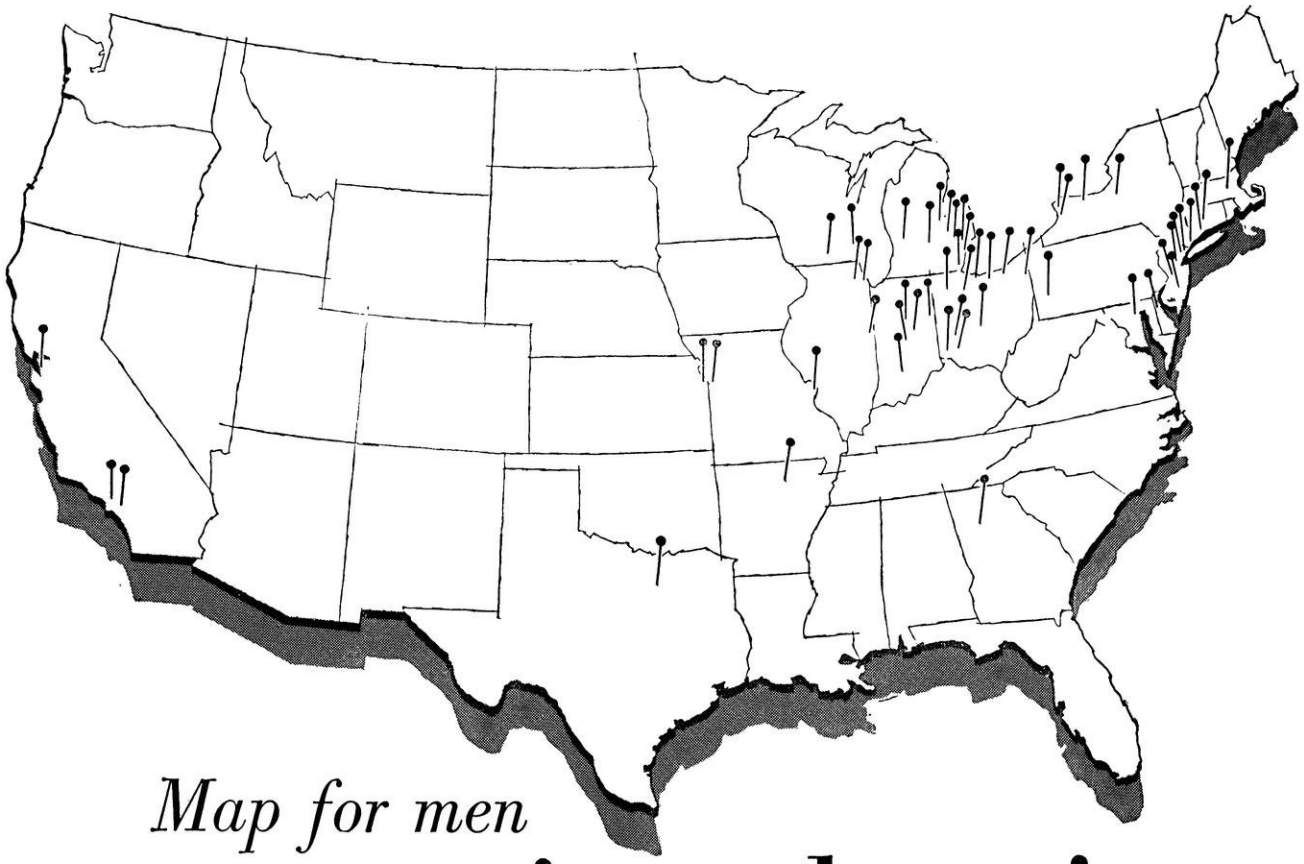

Map for men

going places!

EACH dot represents a city or town where at least one of the 116 General Motors plants is located.

These 116 plants—representing GM's 35 manufacturing divisions—provide a wide range of places in which you, as a young graduate engineer, might be working.

Each of these widely scattered plants offers the security and prestige of the GM name.

On top of that, each division has available to it the vast research facilities for which GM is famous.

In addition, we offer the scope of an organization which produces not only motorcars and their accessories, but also jet engines, refrigerators, electronic equipment, Diesel engines—just to name a few.

And most important is GM's deep-seated respect for engineering and engineers—the recognition of creative thinking that means "more and better things for more people."

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GM POSITIONS NOW AVAILABLE IN THESE FIELDS:

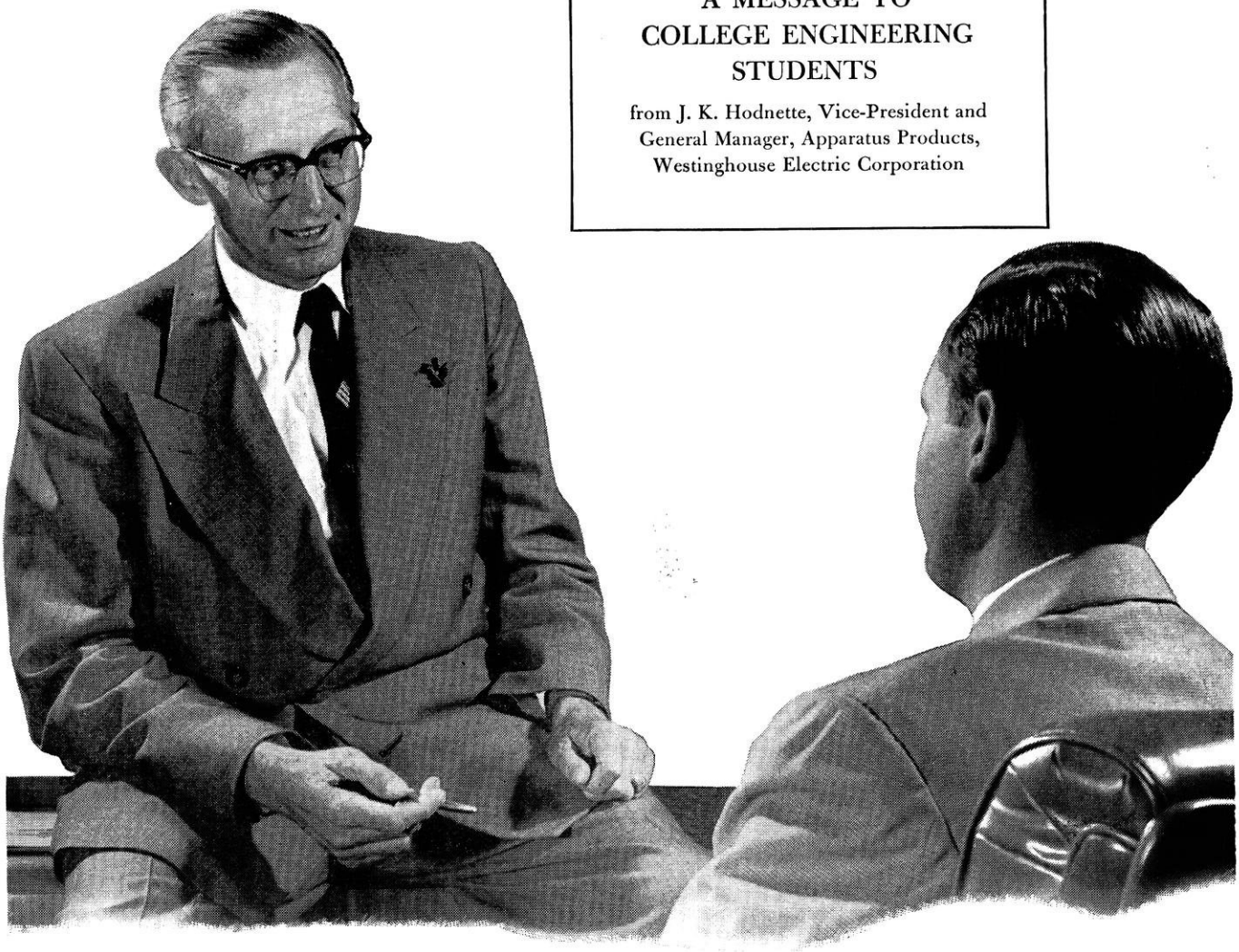
MECHANICAL ENGINEERING
ELECTRICAL ENGINEERING
METALLURGICAL ENGINEERING
INDUSTRIAL ENGINEERING
CHEMICAL ENGINEERING

GENERAL MOTORS CORPORATION

Personnel Staff, Detroit 2, Michigan

A MESSAGE TO
COLLEGE ENGINEERING
STUDENTS

from J. K. Hodnette, Vice-President and
General Manager, Apparatus Products,
Westinghouse Electric Corporation



To the young man with a vision of success

Success means different things to different men. It can mean professional recognition, or great achievement, or exciting work, or many other things. Whatever its special meaning to you—keep its image in your mind, for you are already well on the way to achieving it!

If you are *determined* to become a research scientist, you *can* be. If you have a burning ambition to become a sales engineer, you can be. If you have your sights set on a top executive spot, you'll be there someday. One might think a large company like Westinghouse would have more pressing things to think of than the ambitions of its young engineers. On the contrary, nothing is more important . . . for our professional people are our biggest asset.

Here at Westinghouse, intensive efforts are made to help our professional men realize their individual goals —through extensive training programs, study programs leading to advanced degrees, leadership programs, and guidance in professional development. You are treated as an individual at Westinghouse.

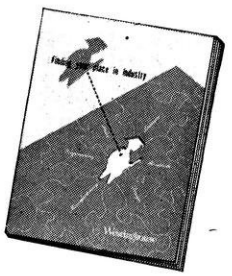
If you have the will, and are prepared, we can show you the way.

G-10271

YOU CAN BE SURE...IF IT'S
Westinghouse

For information on career opportunities with Westinghouse, consult Placement Officer of your University, or send for our 34-page book, *Finding Your Place in Industry.*

Write: Mr. C. W. Mills, Regional Educational Co-ordinator, Westinghouse Electric Corporation, Merchandise Mart Plaza, Chicago 54, Illinois.



The Student Engineer's Magazine

WISCONSIN ENGINEER

Founded 1896

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Iowa City, Iowa

Publishers' Representative:
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WISCONSIN ENGINEER

FOUNDED 1896

In This Issue . . .

ARTICLES

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DEPARTMENTS

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THE COVER

The increased productivity of our mechanized society cannot be denied. As propagators of this trend, the engineers have been loud and enthusiastic in their praise of the benefits of mechanization to all society. We see here a possible outcome of our enthusiasm. Should things turn out as the drawing depicts, engineers may be forced to revert to brainpower in place of the well-coordinated flip of the wrist involved in wielding a slide rule. Pray God not before I'm entrenched behind an impressive oak desk.

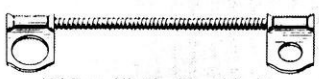
Ken Carlson, c'56, is shown leisurely reading the *Wisconsin Engineer* while the robot does his homework. Photo by Dave Dauterman; Art by Bob Kaseguma.

Precision, high-speed winding equipment for IRC elements

BASIC TECHNIQUE

Wire element is uniformly and tightly wound on an insulated core. Axial leads or other terminations are secured to element by automatic machinery. Insulated housing may be used or omitted.

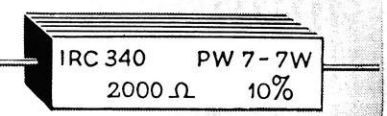
SPECIFIC EXAMPLES



IRC Type AW Wire Wound Resistors

IRC Type BW Insulated Wire Wound Resistors

IRC 4-watt Insulated Power Wire Wounds



IRC 7 and 10 watt Power Wire Wounds

IRC WINDING SKILL OFFERS REALISTIC SAVINGS TO INDUSTRY

. . . another reason why engineers specify IRC Resistors

Savings in the initial cost and assembly of component parts are an increasingly important factor to electronic engineers. That's why they depend upon IRC for their resistor requirements. IRC's mastery of winding wire elements—dating back more than 25 years—today provides a wide variety of unique units that offer realistic possibilities for savings.

IRC

Wherever the Circuit Says

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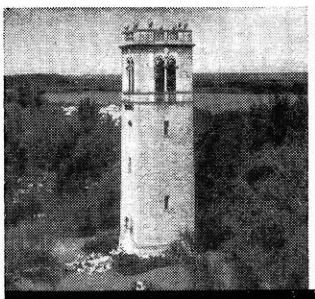
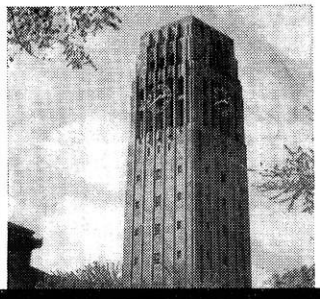
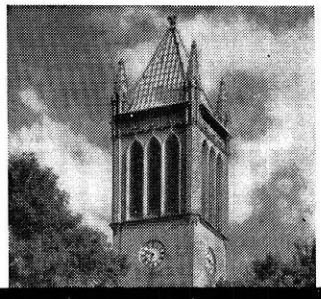
In Canada: International Resistance Co., Toronto, Licensee



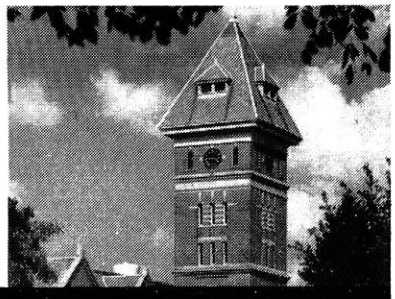
WISCONSIN



MICHIGAN



IOWA STATE



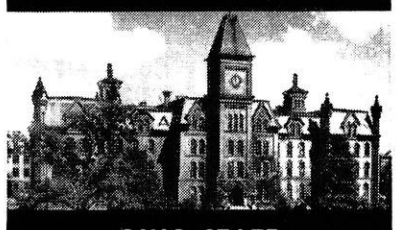
PURDUE

TEXAS A&M

ILLINOIS

PENN STATE

GEORGIA TECH



OHIO STATE

these NINE schools produce FINE engineers!

We know—because, over a period of years, many of them have come with Square D, direct from these nine schools. The vast majority are still with us—growing and prospering in the constantly expanding electrical field.

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PHYSICS GRADUATES

To those interested in advanced academic study while associated with important research and development in industry, Hughes offers two separate practical programs:

HUGHES COOPERATIVE FELLOWSHIP PROGRAM

for Master of Science Degrees

A program to assist outstanding individuals in studying for the Master of Science Degree while employed in industry and making contributions to important military work. Open to students who will receive the B.S. degree in Electrical Engineering, Physics or Mechanical Engineering during the coming year, and to members of the Armed Services honorably discharged and holding such B.S. degrees.

Candidates must meet entrance requirements for advanced study at the University of California at Los Angeles or the University of Southern California. Participants will work full time during the summer in the Hughes Laboratories and 25 hours per week while pursuing a half-time schedule of graduate study at the university.

Salary is commensurate with the individual's ability and experience. Tuition, admission fees and books for university attendance are provided. Provision is made to assist in paying travel and moving expenses from outside Southern California.

HOW TO APPLY

for the Hughes Cooperative Fellowship Program: Address all correspondence to the Committee for Graduate Study

THE HOWARD HUGHES FELLOWSHIPS

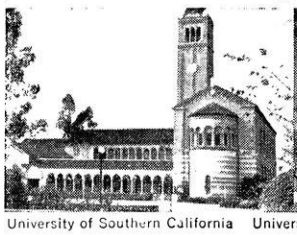
in Science and Engineering

Eligible for these Fellowships are those who have completed one year of graduate study in physics or engineering. Successful candidates must qualify for graduate standing at the California Institute of Technology for study toward the degree of Doctor of Philosophy or post-doctoral work. Fellows may pursue graduate research in the fields of physics or engineering. During summers they will work full time in the Hughes Laboratories in association with scientists and engineers in their fields.

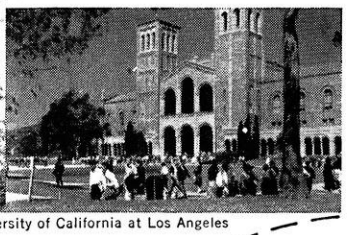
Each appointment is for twelve months and provides a cash award of not less than $2,000, a salary of not less than $2,500, and $1,500 for tuition and research expenses. A suitable adjustment is made when financial responsibilities of the Fellow might otherwise preclude participation in the program. For those coming from outside the Southern California area provision is made for moving and transportation expenses.

HOW TO APPLY

for the Howard Hughes Fellowships in Science and Engineering: Address all correspondence to the Howard Hughes Fellowship Committee



University of Southern California



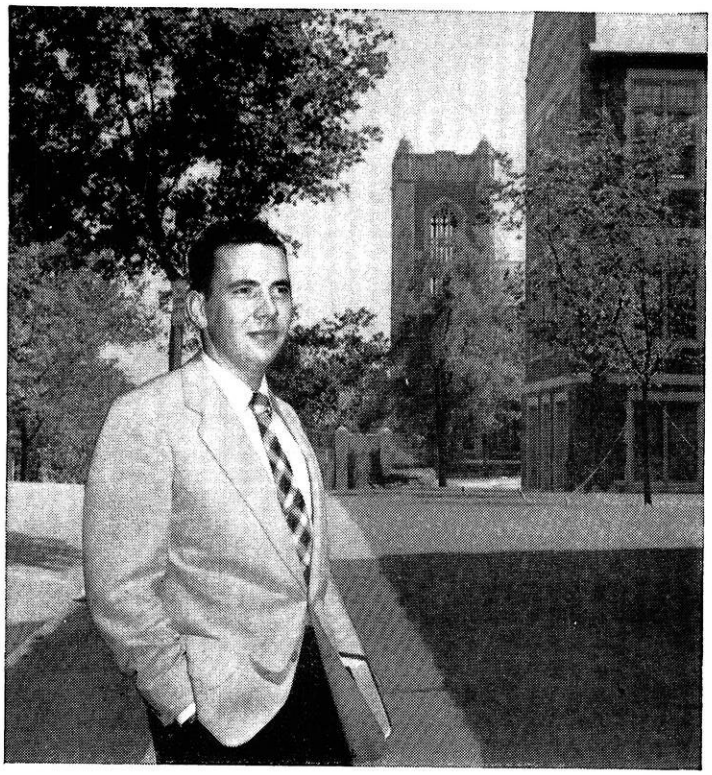
University of California at Los Angeles

California Institute of Technology

HUGHES

RESEARCH AND DEVELOPMENT LABORATORIES

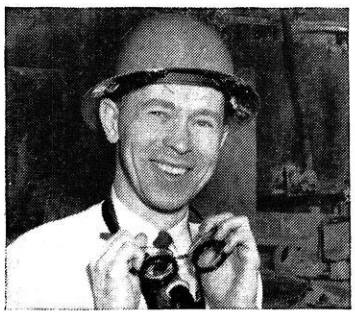
Culver City, Los Angeles County, California



Donald W. Sundstrom received his B.S. degree in Chemical Engineering from Worcester Polytechnic Institute in 1953. He's currently studying for an M.S. degree and expects to receive it next year. Like other engineering students, he's asking a lot of searching questions before deciding on a permanent employer.

Don Sundstrom asks:

What are my chances for advancement in a big firm like Du Pont?



Gerald J. Risser, B.S. Chem. Eng., Univ. of Wisconsin (1937), is now assistant manager of the Engineering Service Division in Du Pont's Engineering Department, Wilmington, Delaware.

Jerry Risser answers:

I THINK I know exactly what's behind that question, Don, because the same thing crossed my mind when I first graduated and looked around for a job. That was about seventeen years ago, when the Du Pont Company was much smaller than it is today. And there's a large factor in the answer, Don, right there! The advancement and growth of any employee depends to a considerable degree on the advancement and growth of his employer. Promotion possibilities are bound to be good in an expanding organization like Du Pont.

Right now, for example, construction is in progress or planned for three new plants. That means many new opportunities for promotion for young engineers. And, in my experience, I have found it is a fundamental principle of Du Pont to promote from within the organization—on merit.

My own field, development work, is a natural for a young graduate, because it's one of the fundamental branches of engineering at Du Pont. There are complete new plants to design, novel equipment problems to work on, new processes to pioneer—all sorts of interesting work for a man who can meet a challenge. Many of the problems will involve cost studies—some will require evaluation in a pilot plant—but, in every case, they'll provide the satisfactions which come from working with people you like and respect.

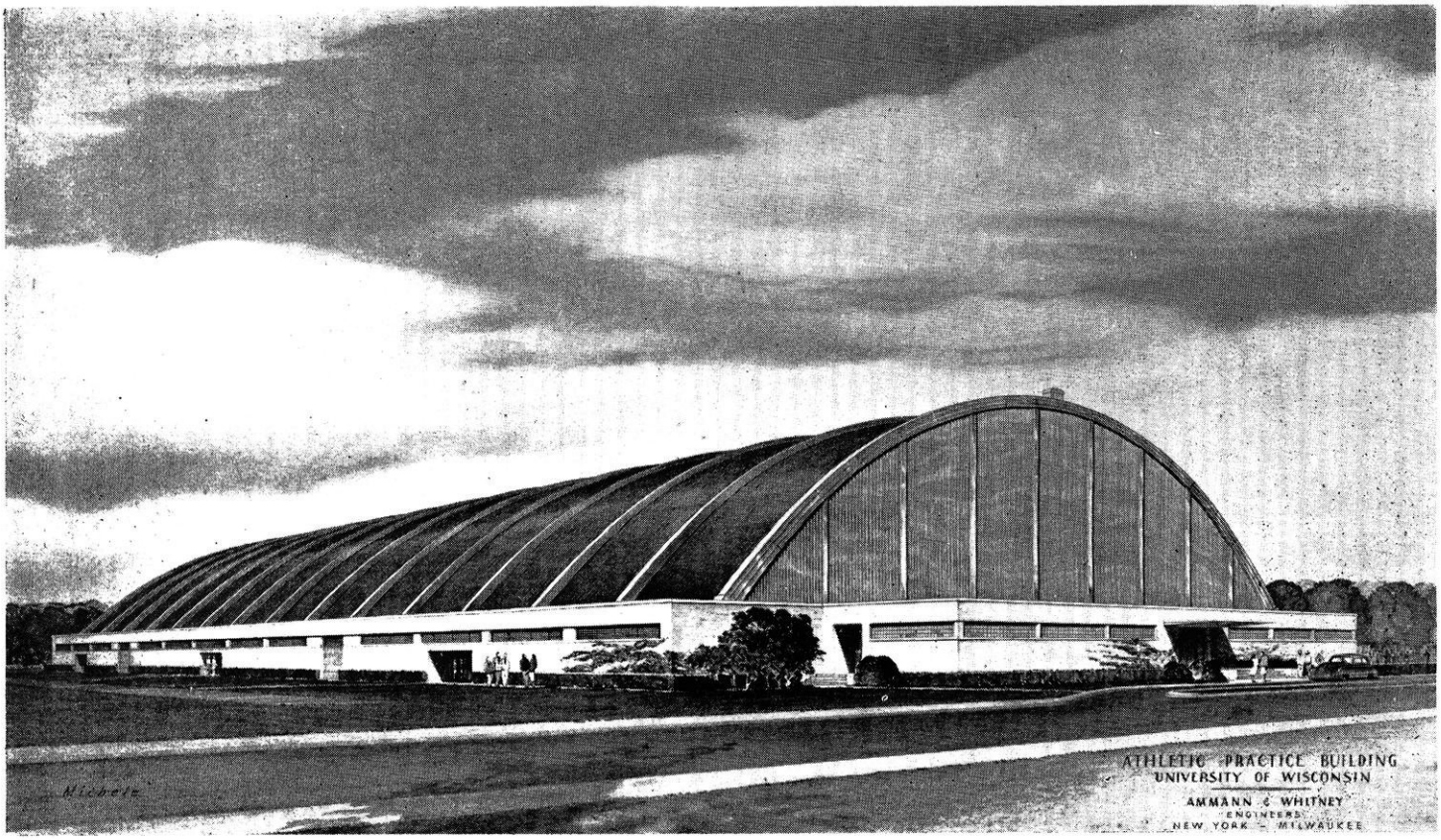
All in all, Don, your chances of advancement on merit are mighty good at Du Pont!

Want to know more about working with Du Pont? Send for a free copy of "Chemical Engineers at Du Pont," a booklet that tells you about pioneering work being done in chemical engineering—in research, process development, production and sales. There's a step-by-step outline of the leadership opportunities that confront a young Du Pont engineer—how he can advance—and how he can obtain help from experienced members of the team. Write to E. I. du Pont de Nemours & Co. (Inc.), 2521 Nemours Building, Wilmington, Delaware.

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

WATCH "CAVALCADE OF AMERICA" ON TELEVISION



THE NEW INDOOR ATHLETIC PRACTICE BUILDING

The building pictured above is the center of a heated controversy. This battle was not based on the radical concrete arch construction of the building, but rather on the proposed location.

The Board of Regents, acting on the recommendation of University vice-president, A. W. Peterson, and Regent Oscar Rennebohm, has approved contracts totaling $1,357,049 on the $1,500,000 building. The Board's action was carried out in the face of possible State Supreme Court proceedings. An appeal has been scheduled following several veterans' organizations protests to the proposed site in the Camp Randall area. The area has been set aside as a memorial to the Civil War men who trained on this spot, now almost entirely covered with University buildings. The veterans' groups are contending that the building will reduce the Memorial area to a small section, hardly representative of the size such a memorial should have.

The 190 ft. by 400 ft. structure will be financed by $900,000 from the athletic fund and a $600,000 ten year loan to be paid from athletic receipts.

The reinforced concrete structure can be built in an estimated 500 days. The required construction time for a similar structure made of steel beams is 730 days.

The final contract award is pending the approval of Governor Walter Kohler and the state engineer.

editorial

to the freshman

This time each fall—the beginning of the school term—is a good time for you engineering students to make your resolutions for the year. The conscientious student will resolve (whether consciously or not) to turn his assignments in on time and to take an interest in each of his courses.

Promptness impresses the teacher—makes it evident to him that the student is capable and deserving of a good grade. Taking an interest in a course makes it much easier to retain the information one must learn, and also makes easier the task (task for some students) of staying awake in class.

If you have trouble studying in your room because of the distractions, there are many good places to go where there is no noise. The MHA, Ag Hall, and University libraries are each open till 10:00 P. M. and in most other class buildings there are libraries which are open all day.

Any freshman who wonders if he should change classes, or his major subject, can feel free to stop in and see Professor Shiels or Miss O'Keefe at the Freshman Adviser's office in T–23. Many students each year see their advisers to get help in many types of problems.

These suggestions will prove valuable to you freshmen if you make use of them. You'll find your courses less time consuming and actually easier if you follow them.

K. A. G.

Schroeder's

ENGINE-EARS

by Ron Schroeder m'57

A.S.M.E.

The annual fall meeting of the American Society of Mechanical Engineers will be held in Milwaukee, Wisconsin September 8-10, 1954. The home of the Braves will become the home of the A.S.M.E. members during convention week. The Milwaukee Section will celebrate its 50th Anniversary at this time and is extending an invitation to all student members of the A.S.M.E. to make it a momentous event.

Convention headquarters will be located at the Hotel Schroeder with registration and technical sessions being held there.

Aside from the business meeting and individual sessions which will be held, a program of entertainment and special events has been planned to assure everyone an enjoyable time. The first social event "Gay Nineties' Monte Carlo" evening will be held at the E.S.M Building on September 7, and "Gemütlichkeit" at Blatz Brewery on September 8. Thursday's activities will be highlighted by a banquet at the Hotel Schroeder with Mr. Melvin J. Evans as guest speaker. As a registered professional engineer and a consultant to industry he will be well qualified to give us some pertinent facts on problems of people in industry.

Several industries will play host to the members of the A.S.M.E. with arrangements being completed for field trips to the Kearney & Trecker Corp., Allis Chalmers Mfg. Co., Chain Belt Co. and the new Oak Creek Power Plant. The field trips will prove to be informative and interesting since the work of these industries is so diversified as to hold the attention of all.

More complete details will be made available to all student members at a later date, so keep the fall meeting in mind and plan to attend.

★

ATTENTION CIVIL ENGINEERS

Chi Epsilon is your national honor fraternity founded on the belief that "a mark of distinction should be placed upon the undergraduate who has upheld the honor of the department by high scholastic"[1] achievement. It was founded in the spring of 1922 with 22 charter members at the University of Illinois. Since that time it has become a truly national Civil Engineering Honor Fraternity, with nearly 10,000 members and 47 chapters from California to Texas to Massachusetts and, of course, our chapter here at Wisconsin.

To be eligible for membership in Chi Epsilon a civil engineering student must have completed at least one-half of the required work for his Bachelor's degree and have at least an average grade in scholarship in the highest one-third of the class.

Chi Epsilon has the following objectives and purposes as written by F. T. Matthias, former "Transit" Editor:

> Based on the broad objective of increasing the efficacy of the civil engineering profession as an instrument of social betterment, Chi Epsilon was organized to recognize those characteristics of the individual engineer deemed fundamental to the successful pursuit of an engineering career and to aid in the development of those characteristics in the undergraduate engineer. Engineering, the application of widening scientific principles to the practical needs of society, is assuming a constantly increasing responsibility calling for a high order of proficiency from those who plan and administer engineering works. This responsibility can be adequately discharged only by a professional group possessed of good basic technical ability and of high moral character, capable of satisfactory social relationships with variety of individual types and with organizations, and with the desire and vision to realize the extent of the social changes brought about by the projects under its control. To contribute to the improvement of the engineering profession, Chi Epsilon fosters the development and exercise of fundamentally sound traits of character and technical ability among engineers which will work towards a higher standard of service offered to humanity by the profession.

"The Transit of Chi Epsilon" is the official publication of the fraternity. It is published semi-annually in spring and fall by Leland Publishers, Inc. of St. Paul. Through the magazine the fraternity performs many services to its members. One of major interest to students is its summary of civil engineering graduate scholar-

(Continued on page 46)

[1] From the Preamble of the Constitution of the Chi Epsilon Fraternity.

The Universe In Space and Time

by R. D. P. Higgins e'56

The subject of cosmology is the study of our Universe's general features, its extension in space and its duration in time; its theories utilize evidence from such things as the decay of atoms, the metabolism of stars and the flight of galaxies to describe the structure of the Universe. With the utilization of the 200-inch telescope on Mount Palomar, man today can look over two billion light years into space and see, spread more or less uniformly through that vast volume, nearly a billion galaxies.

It is of intrinsic interest to realize that man is not only looking far into distance but also far back into time. As you view the photograph of the great Andromeda Nebula, which galaxy, incidently, corresponds in quite physical similarity to the giant galaxy of which the Sun is a part, you are viewing that group of stars as it appeared about two million years ago, for it has taken this time for its light to reach us here on Earth.

Modern cosmology had its beginnings with the observation of the Doppler effect, which is the shift toward the red end of the spectrum in the light that reaches us from the distant galaxies and indicates that these galaxies are fleeing from us at a rate that is proportional to their distances from us. The discovery of the red shift has had many important consequences, and it has profoundly changed man's thinking about the cosmos. One of the chief changes was the introduction of the concept of an expanding Universe—an idea that not only finds support in the red shift, but also in classical Newtonian mechanics. The system must either contract, because of the gravitational forces between the galaxies, or expand as the result of some dispersing force overcoming the attraction, and therefore cannot be expected to remain static.

From the observed red shift it has been calculated that the galaxies are withdrawing from one another

with a kinetic energy which is about 50 times as great as the potential energy of gravitational attraction between them. It thus is inferred that the present expansion of the Universe will never stop. Also, from the observed recession velocity and the distances between the galaxies, just how long ago the expansion began from the original compressed state of the Universe has been calculated. This estimate is in the neighborhood of five billion years ago, which is in accord with the estimates of geologists and astrophysicists who calculated independently from the decay of radioactive materials in the earth and from the rate of burning of nuclear fuel by the stars.

After the great success of Einstein's general theory of relativity in predicting the deflexion of light rays by the gravitational field around the sun, Einstein proceeded to apply the theory to the Universe as a whole. The essential point of Einstein's general theory is the introduction of the notion of curved space, and the identification of the effect of gravitational forces with the change of free motion of material bodies in a curved non-Euclidean space. Remembering that there are two possible types of curvature for a curved surface: positive and negative, where positive curvature turns inward like the surface of a ball, and negative curvature, which turns outward like a western saddle. In principle it should have been possible to verify observationally whether the space in our Universe is curved either way. If, for example, by counting the galaxies within volumes of space of successively greater radii from us, the count increases more slowly or more rapidly than the cube of the distance, a positive or a negative curvature would be indicated. During the past several decades, counts of this type were carried out at the Mount Wilson and Palomar Observatories, but with rather indefinite results. The difficulty is due to the fact that we can expect to find noticeable curvature effects only at very great distances, and reliable distance estimates for galaxies so far away cannot be made because the only way distances can be judged is by the faintness of the galaxy's light. Remembering that we are also looking far back into time, it is a reasonable assumption that the intrinsic brightness of galaxies may change with time. Consequently it cannot be assured that a distant galaxy which is fainter than another is farther away. It may instead be at a different stage of evolution.

Present dynamic equations relating to the concept of an expanding Universe connect its curvature with two directly observable quantities: the mean density of matter, and the rate of expansion. With the observed value of these two quantities, the curvature of our Universe has been calculated to be negative, so that space is open and infinitely bending in the way a western saddle does, with a radius of curvature that comes out as five billion light years.

Considering the relationship between matter, represented by such particles as electrons, neutrons and protrons, and radiation, as represented by light quanta, it is recalled that radiant energy has mass, which is calculated according to Einstein's basic law by dividing the quantity of energy by the velocity of light squared. In the Universe as we know it today, matter everywhere is more massive than radiation, but that need not have always been the case. It has been theorized that in the early stages of the Universe's evolution, the mass density of radiation must have exceeded that of ordinary matter. During this period when matter had played only a secondary role in the infinite ocean of thermal radiation, the particles, so to speak, were "dissolved" in the thermal radiation much as molecules of salt are dissolved in water. As soon as matter surpassed radiation in mass density, the forces of gravity acting between the particles must have caused a growing inhomogeneity of the matter in space, with the formation of giant gaseous clouds. From these "protogalaxies" the galaxies of today must have developed, quite a bit later, by the condensation of gas into individual stars. More than fifty years ago the English astronomer James Jeans showed that the size of the clouds into which a gas of particles will be collected by gravitational forces can be calculated from the density and the temperature of the spread-out gas. On the basis of these calculations it has been inferred that the primordial gas clouds must have been 40,000 light years across, and each cloud must have had a total mass approximately 200 million times that of our sun.

By the general expansion process, the protogalaxies were pulled apart with their material later condensing into billions of stars, probably by repetition on a much smaller scale of Jean's accretion process. Later, the planets were formed, and as the result of nuclear reactions taking place in the interiors of the stars, the Universe again became brightly illuminated.

Naturally at this point, the question arises: that if our Universe started from an extremely compressed concentration of matter and radiation, how did it get this way, and what caused it to expand? Well, by considering in reverse the operation of those same relativistic formulae that the theorists have used to describe the expansion process, it is inferred that the Universe must have then condensed with just as great a speed as it is now expanding!

It thus must be concluded that until about five billion years ago, our Universe had existed for an eternity of time and was collapsing uniformly from a state of infinite rarefaction; that five billion years ago it arrived at a state of maximum compression, and that now the Universe is rebounding toward a state of infinite rarefaction.

Perhaps someday man may fully know and comprehend the role that our Universe does play in Time and in Space; that there should be no connection at all between what one might call the subnucleonic world and the larger universe seems scarcely credible. **END**

W. S. P. E.

Membership Report

Although the state as a whole didn't reach the quota, due mainly to insufficient personal contacts, we *did* break through 1,000 which puts Wisconsin in a new classification in the NSPE line up and we *did* beat Minnesota better than 2 to 1! Last fall when President Winn Hinderman got the idea to challenge us, Minnesota *was* ahead of us. Altogether the results of the year's efforts are considered very satisfactory.

NSPE increased from 30,597 to 33,010 between 7/1/53 to 6/1/54 or 7.9% according to a preliminary check. The WSPE total as of June 30 was 1,082 or the net gain was 168, which is an increase of 18.3% in approximately the same period. As of 12/31/53 WSPE was 10th in the nation. The figures for 6/30/54 should show some improvement there since our percentage increase was approximately 11% over the national average.

Of the 214, 184 are members and 30 are affiliates.

The 140% of the quota for the Western Chapter was a pleasant surprise even to the officers of that Chapter who believed that the maximum was reached a year ago. Jim Johnson has been chapter membership chairman for several years and his effective work is largely responsible for 71% of the Professional Engineers in the area now being members of WSPE. No other chapter is even close to that percentage!

The results are due to the sincere efforts and professional interest of many engineers. In some cases the final push to get a member signed up was someone other than the man listed as the sponsor. In general though we believe that the record of the sponsors is the measure of the activity of the member regarding membership. Following are the top five sponsors for the year:

Lyle Kingston, Green Bay	14 New Members
Rudy Gocht, Racine.	13 New Members
John Gammell, Milwaukee	12 New Members
Wayne Bryan, Neenah	12 New Members
James Johnson, La Crosse	9 New Members

Lyle Kingston started out strong and stayed in the lead all year. I believe that 14 is the largest number any member ever brought into WSPE in one year. He and Wayne Bryan together accounted for a large part of the FRV increase of 28% which was the best percentage in the state. The largest number increase is 81 by the Milwaukee chapter.

(Continued on page 18)

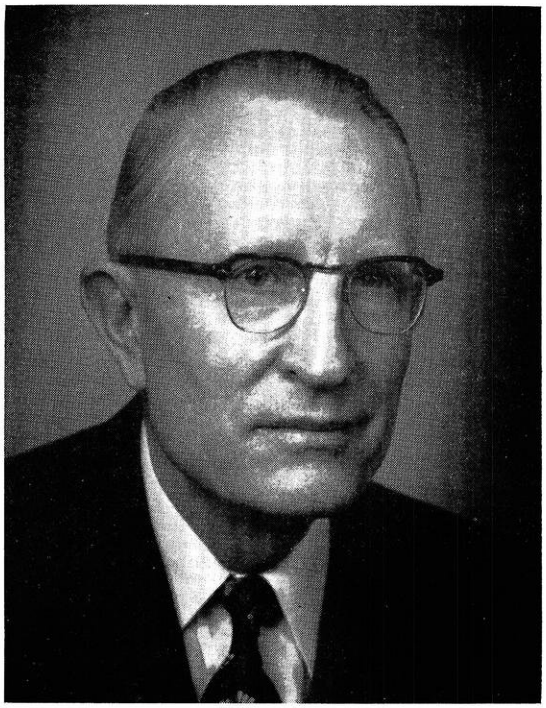
FINAL MEMBERSHIP REPORT FOR YEAR

July 1, 1953–June 30, 1954

The score for the year is as follows:

Chapter	Members & Affiliates as of 7/1/53	Quota	New Members 7/1/53 to 6/30/54	% Quota	New Chapter Totals 6/30/54	Percent Increase 7/1/53 to 6/30/54
W	55	10	14	140%	63	14 %
WV	41	15	14	93%	52	27 %
FRV	117	41	34	83%	150	28 %
SW	199	53	39	74%	229	15 %
M	342	141	81	58%	411	21 %
NW	51	17	9	53%	53	4 %
SE	64	41	15	37%	72	13 %
OS	45	32	8	25%	52	15 %
	914	350	214	61%	1082	18.3%

Meet the President



GEORGE P. STEINMETZ
State President

Mr. George P. Steinmetz, president of our state society for the coming year, has been employed by the Public Service Commission of Wisconsin and its predecessor, the Railroad Commission, from 1923 to date except for military leave of absence in World War II and shorter leaves for governmental consulting work. During World War II he served as a Major and later a Lieutenant Colonel in the Corps of Engineers and in the office of the Chief of Engineers in Washington, D.C. He was awarded the Army Commendation Ribbon for his work in reviewing and renegotiating large utilities contracts for the Army and Navy with approximately four hundred utilities in the United States.

Prior to the war, Mr. Steinmetz was a consultant for T.V.A. power contracts and the valuation of and allocation of costs for the Wilson Dam. Later he acted as consultant for the National Security Resources Board and for the West German Military Government on decartelization of German utilities and the establishment of regulatory commissions. He was recently appointed to a six year term as commissioner on the Public Service Commission of Wisconsin.

Born on April 2, 1896 near La Farge, Wisconsin, he attended La Farge High School and soon after graduation enlisted in the Army. He held the rank of Sergeant in the American Expeditionary Forces at the time of his discharge in 1919. Mr. Steinmetz studied at the University of Wisconsin, majoring in hydraulics and water power engineering and graduated with a B.S. degree in civil engineering. In 1952, the University awarded him a citation for "distinguished engineering services to the state and to the nation."

Mr. Steinmetz has been active as a member and officer of numerous professional and civic organizations, including A.S.C.E., Conference of Utility Commission Engineers, and Chi Epsilon as an honorary member. For recreation, he enjoys golf, bowling, and hunting.

In 1931 he and Helen Carlson were wed. Their two children, George Jr. and Nancy, now attend the University of Wisconsin.

W.S.P.E.

(Continued from page 16)

It is apparent that we do have a fair share of our society members who are interested enough in its growth to help out in this important activity. We feel that a great deal of work was done by still others; the results of which have not shown up yet.

And Now for Next Year . . .

1. **Prospects.** A review of the files indicates that more engineers were registered and more E-I-T's were certified by the State between July 1, 1953 and July 1, 1954 than were added to the membership rolls of WSPE during that period so that the potential is now greater than at this time a year ago. Also considering the new registrations that can be expected before July 1, 1955, we will have well over 3300 P.E.'s and over 1000 E-I-T's qualified for membership in WSPE.

2. **Quotas.** The gross gain last year was 214, practically all of it in the last six months. We should improve substantially on that score this year.

The new member in each case will be credited to the chapter in which the sponsor resides or the quota is for the *number of sponsors*. All P.E.'s registered and E-I-T's certified in Wisconsin—residing anywhere in Wisconsin as well as out of state are anybody's game.

3. **Use Last Year's Working File of All P.E.'s and E-I-T's.** Suggest that the incumbent and new chairman go over the file together and eliminate the names that are definitely impossible and mark the better prospects for early action. Wherever possible add the *place of employment* to the information already on the card. Several chapter chairmen have indicated that the *place of employment* is very helpful in their solicitation. Use the July 31, 1953 Wisconsin Registration Board Report to check and delete cards of engineers who have dropped registration. Use 1951, 1952 and 1953 reports for E-I-T's certified those years since they are listed only one year.

4. **Promotional Material and Membership Blanks** will be sent to each chapter chairman as required. We have about 1,000 copies of "One Look" to start on, also some NSPE material. The new chapter chairman should read over the material passed on to him. Have the important facts in mind. Every committee member should know the amount of dues and how they are prorated quarterly.

5. **Assignment of Membership Cards.** The chapter membership committee should thoroughly review all of the cards and assign directly to the chapter member three or four prospects ideally situated to deal with them. Each membership committee man calls on as many as possible of the remaining engineers who appear to be "available". We found out last year that some engineers and E-I-T's are waiting only to be invited to join. Let's not disappoint them. If a personal call cannot be made, using the phone is often better than a letter or the usual mailers.

6. **Fill Out Prospect Cards to Indicate Action Taken.** *Follow up* in cases where appropriate. Follow up is most important this year. The average number of contacts to sign up a new member is 4. Many have been visited only once—many not at all. Note on card date of letter and/or material sent to him, date of personal call and results. Note reason for refusal, if known. Keep non-joiner cards in active file and deeper plowing in this field by later committees in many cases will yield results not possible this year. Date card of new member and transfer to WSPE file.

7. **Forward Filled-In Application Blank.** The blank *properly signed by applicant and chapter committee chairman or worker* together with the appropriate fee should be sent directly to WSPE Secretary Eldon C. Wagner, 2318 Rowley Avenue, Madison 5, Wisconsin, who will bring it up for board action at the next meeting of the WSPE Board of Directors.

Our main objective this year—**"Beat Last Year!"** Lots of luck.

PLAN OF W.S.P.E. MEMBERSHIP CAMPAIGN

July 1, 1954–July 1, 1955

Chapter	Estimated P.E.'s & E-I-T's Not Members or Affiliates 7/1/54–7/1/55 P.E.'s	E-I-T's	Membership 7/1/54	Quota 7/1/54–7/1/55 Members & Affiliates
Fox River Valley	275		150	50
Milwaukee	1,600		411	165
Northwest	60		53	15
Southeast	260	900	72	30
Southwest	325		229	65
Western	20		63	20
Wisconsin Valley	60		52	15
Out of State	800	100	52	0
Total	3,400	1,000	1,082	360

Publicity Material for YOUR Chapter

One of the most important techniques in good public relations at the community level is achieving favorable notice in the local press. Most NSPE affiliates have succeeded in this on a once-a-year basis,—namely, during National Engineers' Week. But to be really effective, a chapter should strive to *regularly place favorable and prestige building articles in the press on a year-round basis.*

Today professional engineering leaders are voicing no little con-

cern over the quantity and quality of mathematics instruction in our public high schools. Deans of engineering schools are continually declaring that students are coming into college with only the most elementary foundation in algebra, geometry and trigonometry. Obviously this situation has the most serious import since we are now turning out only about half as many engineers each year as Russia. The situation is such that regardless of any attempts at publicity, every professional engineering society ought to have an active interest in the amount and kind of high school science and math instruction.

When you have your next meeting, even if it is only a get-together type, have the chapter president take up the subject. Have him recommend the appointment of a committee to look into ways of stimulating more interest in math in the local schools. It is enough merely to say something that indicates that your chapter will definitely consider whether or not something should be done in the near future.

As you know, the principal purpose of our public relations activities is to develop "effective public relations between professional engineers and the public." We have made and are making progress in this direction, but much remains to be done, not only to establish a satisfactory going level, but also to maintain this position after it is reached.

With the thought that the public relations program of one chapter, or some of its facets, together with the publicity springing therefrom, may be of help to another chapter, I would be very interested in receiving a copy of your planned program as soon as possible, together with any supplementary information as to specific assignments of responsibilities to the various members. I should also like to receive such evidence of public relations results including copies of all publicity articles, pictures, etc. Having this information, I will attempt, among other things, to act as a clearing house and information center to the extent that this will be helpful to all chapters.

R. C. SIEGEL
Public Relations Chairman

DID YOU ANSWER?

If not, please read this notice and respond immediately.

Dear Fellow Member:

Your opinion is needed on an important decision facing your national society!

The Board of Directors has authorized the construction of a building to serve as the Headquarters of the National Society of Professional Engineers. This building will be a three-story structure located at 2029 K Street, N. W., Washington, D. C. The estimated cost, including furnishings, is $300,000. Your professional building in the nation's capital will be a dignified headquarters reflecting the present stature and potential growth of the National Society.

The land has been acquired and the preliminary drawings for the building have been completed. Construction drawings are now in progress and we expect soon to be ready to enter into the construction contract.

Preliminary discussions indicate that private financing may be available to the Society at an interest rate of 4½% per annum. As an alternative to this plan, since many members have indicated that they feel the entire membership would like an opportunity to participate in the financing of the Society's headquarters, we are seeking to determine the extent of your interest in securities bearing an interest rate of 4% per annum. The difference in rates of interest between private financing and membership subscription is necessary because of the high cost of mailing fees, registration fees, legal fees, etc., involved in floating a loan through the Society members.

Your response to this inquiry to determine the extent of your interest is in no way binding upon you, but will be helpful in arriving at a final decision for financing the project.

Engineers Week

October is here and so is the season for "early bird" activity to start things moving toward a well organized National Engineers' Week for February 20 to 26, 1955. These dates may seem a long way off right now. But as the months speed by, our "Week" will be upon us almost before we realize it.

This is the month to make sure your chapter has an Engineers' Week Committee Chairman and a functioning committee behind him. This is the month when plans can be made for projects which demand lots of "spadework," well in advance. This is the month to begin choosing and planning the activities that your chapter will hold at the local or community level. Chapters that pitch in now and get things rolling will most likely be chapters that will wind up February 26 with a good, well organized "Week" to look back on.

One of the things every chapter should start working on this month is a Speakers' Bureau. This is simply a selected group of member P.E.'s who can give talks on some phases of professional engineering to local civic, school, church, fraternal, and other community organizations. These talks can be one of the most effective public relations techniques for promoting National Engineers' Week at the chapter level.

By contacting these organizations now your chapter can greatly increase the probability of getting speakers scheduled for meetings which will be held during the Week of February 20 to 26. Make sure all the speakers have their topics picked out well in advance and that they have furnished copies of their talks to your publicity chairman.

(Continued on page 54)

Human Engineering

by Fritz Callies me'54

The past several years have seen a new engineering specialty come into its own—HUMAN ENGINEERING, the science of adapting the machine to fit the habits and abilities of the people who must use it, instead of forcing the operator to conform to a machine's shortsighted design.

Human engineering got its first real boost during World War II, when the armed forces found that the mechanical gadgets of modern warfare had become so complicated that most soldiers, sailors and airmen had difficulty operating them. There was no time to train armies of superexperts. The machines had to be redesigned so that men of average education could make sense out of the maze of dials, gages, knobs, and levers that sprouted like weeds on the equipment.

It was a job that the aeronautics expert, the electronics adviser, and the mechanical engineer couldn't do alone. Although skilled in their own specialties, they could not predict how nonexperts would react, especially in the excitement of battle. There were embarrassing incidents like the one involving some Navy radar equipment which no one could operate properly—until somebody discovered that a left-handed engineer had designed the controls backwards.

The armed forces finally appealed to the academic laboratories, where for years the experimental psychologists, anthropologists, and physiologists had been compiling information about people. These scientists put to use their knowledge of people's habits, instincts, and abilities to help win the war—as "human engineers."

After the war, human engineering began to show its worth in civilian life. The field of automotive design was full of possibilities. Automatic transmissions, power steering and braking, puncture-proof tires, and improved visibility were embodied in the new cars to give the driver the utmost in comfort and safety. And yet there still remain many small irritations and hazards which could easily be corrected. On many cars it is only too easy to neglect to release the emergency brake and drive off with it partially set. Bright sunlight glinting off fancy chrome on top of the dash can be distracting, to say the least. And pushing in the light switch instead of the cigarette lighter might well be disastrous on a dark road. Consider this last point, for example. Since the knobs on an automobile dashboard are operated by the fingers, which contain our most sensitive "touch" nerves, it would seem logical to use our sense of touch to find the right knob while we keep our eyes on the road. Yet the knobs in most cars today are difficult to distinguish by touch. Most of them are identical; they look more attractive that way. Human engineers at the Wright-Patterson Air Force Base have found, moreover, that the average person cannot tell two knobs apart by their position unless they are at least six inches from each other. The best solution, therefore, is to make it possible for the fingers to distinguish between the knobs by changing the shape and size of the knobs.

Human engineers already have applied this method in redesigning aircraft controls. A pilot is surrounded by hundreds of buttons, knobs, levers, switches, and cranks—each demanding his attention. During a takeoff or landing, his hands move about his cockpit as rapidly as those of Liberace playing the Twelfth Street Rag. One wrong move can result in a crash, yet most of the time he must use his eyes to guide his hands to the right control. It's no wonder, then, that 60 per cent of the air accidents investigated by the Air Force are blamed on pilot's errors. And most of those errors are simply those of doing the right thing to the wrong control—or the wrong thing to the right control.

Johns Hopkins' experts suggest redesigning numbers, as above, for better readability.

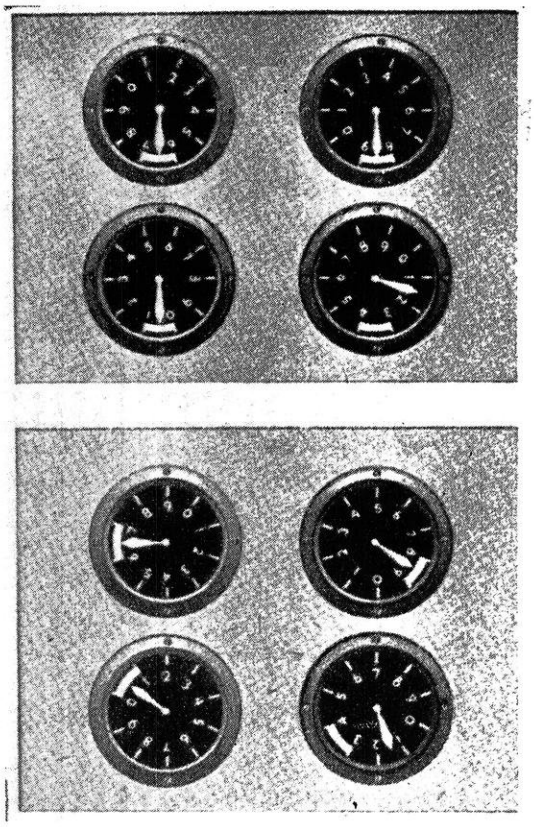
To help the pilot "see" the controls with his hands, engineers tested dozens of different control shapes and sizes. They tried to find shapes that couldn't be confused with others near them. Star shapes and crosses, for example, can't be used together, for the average person finds them too similar. And most people can't distinguish between two different-sized knobs unless one is at least a fourth larger than the other.

The engineers have adopted eleven basic shapes for the controls in military aircraft. The newest F-86 Sabre jet has a landing-gear lever topped with a wheel-like knob. The landing-flap control is shaped like a cross section of the plane's wing. Moreover, both controls are placed in convenient positions. The human engineers at Wright-Patterson's Aero Medical Laboratory are particularly proud of reports from the Air Force that the changes appear to have eliminated accidents caused by confusion between these controls.

Studies of commercial drivers by the Harvard School of Public Health have pointed out the need for some sort of standardization in the location of switches in trucks and busses, and better grouping of those critical switches and instruments most often used while in motion. Such standardization would permit a driver accustomed to one vehicle to operate another without having to adopt a completely new set of habits and reactions.

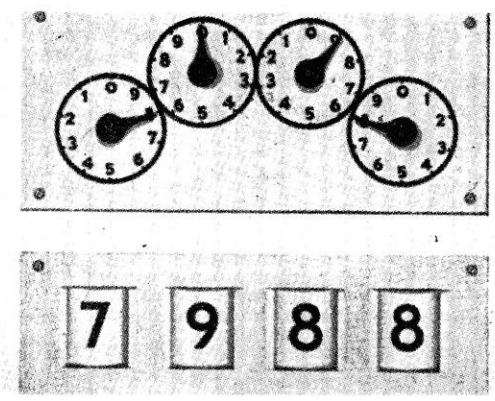
But just locating the right control is not enough, say the human engineers. No matter what happens to the control—whether it's pushed, pulled, turned, or lifted, it should follow certain rules. Psychologists have learned that people have very definite instincts about such movements. If a knob is to be turned "on", it should turn clockwise, most people agree. If a switch is being used, it ough to flip up for "on" and down for "off". Besides being in the proper direction, the motion of the control should also have the right "feel". An on-off switch should definitely feel on or off.

Violating these rules doesn't mean that the control can't be operated properly. But it does mean that the control is causing a man-machine friction. It's taking a toll in lost motion, nervous strain and extra remembering. When emergencies occur and instincts become all-important, the chances for error multiply.



—Photos Courtesy Collier's Magazine

Here all needles point the same way when the machine is functioning properly. Thus any trouble in the machine can be readily detected.



Human engineers substituted the simple-reading dial at the top of the page for the baffling old-fashioned electric meters shown here.

Another fertile field of research lies in redesigning our alphabet and numbering systems. In the tranquility of the Middle Ages, citizens had plenty of time to figure out the differences between their p's and q's. But at 50 miles per hour on a rainy night, a driver often has only a fraction of a minute to decide whether a route maker reads 88, 38, 83, or 33. If he peers at the marker a second too long, a parked truck on the road ahead may make the whole question unimportant.

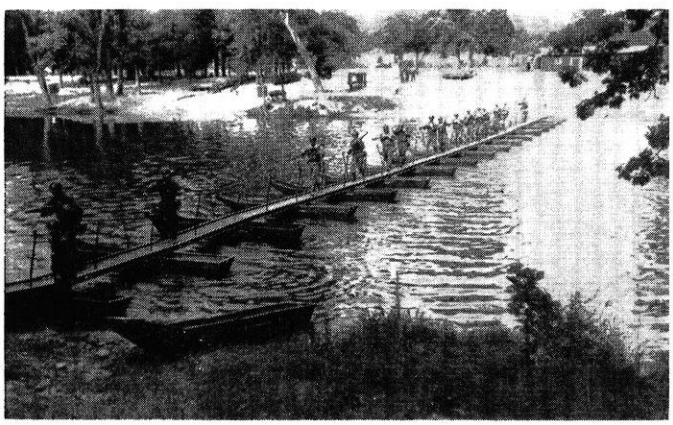
But before the human engineers could begin to take the confusion out of the alphabet, they had to find out how people read individual letters and numbers. It came as no surprise that their subjects often mistook a Q for an O, or a G for a C. But not so expected was the confusion between N and S, between M and B, and between F and P.

The next task, therefore, was to discover which part of each symbol caused the most confusion. At Johns Hopkins University, the human engineers repeated their tests, this time covering in turn the top, left, right, and bottom parts of their test cards. The scientists then could single out the features of each symbol that lead

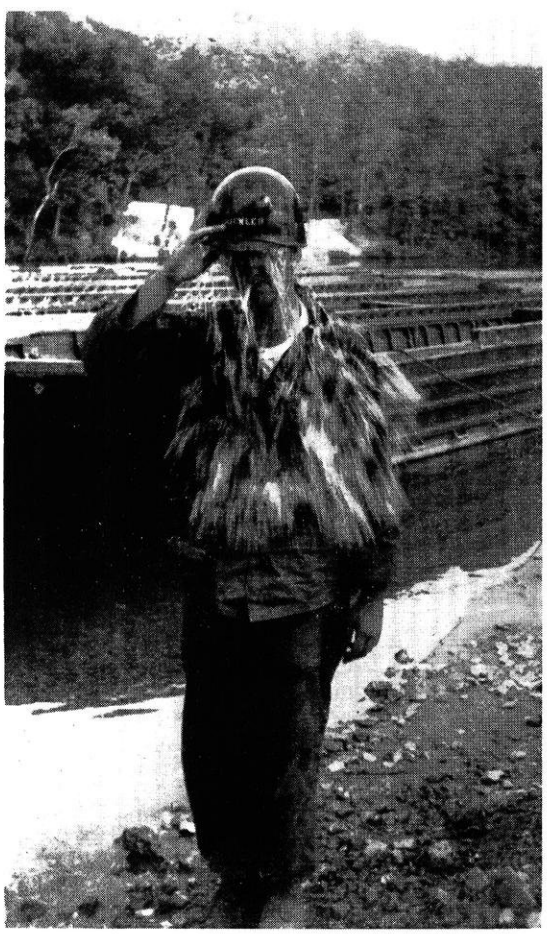
(Continued on page 32)

Engineering Corps R.O.T.C. Summer Camp—1954

by Donald Edwards m'54



After constructing this assault bridge, cadets move across to engage the "enemy."



—Photos by Dave Dauterman

Best Way To "Beat the Heat".

The Army Engineer Corp R.O.T.C. summer camp was held at Fort Leonard Wood, Missouri. Fort Wood is the largest and best equipped engineer training center in the United States. While there R.O.T.C. cadets from nearly every school in the western U. S. including Wisconsin participated in a rigorous six weeks period of training in all phases of Engineer Corp activity.

The eight hundred cadets attending were divided into six training companies. Each company had its Regular Army cadre in addition to a full compliment of cadet commissioned and non-commissioned officers. Each cadet had the opportunity to act as a squad leader on up to Company Commander, the duration of his time in office being one day. It should also be said that everyone had the honor of doing KP at least once.

A typical day would start with the first formation at 5:30 AM, police call and mess following. The company would then entruck for the training area at 6:45, training being conducted in the field until noon. Mess would be served in the field and training continued until 5:00 PM., then mess again at 6:00 and free time until 10:00 when lights out was sounded.

The range of subjects covered by the cadets was wide and varied. It is the policy of the U. S. Army that all soldiers, whether they be Engineers or Signal Corp, should be trained in infantry fundamentals. In keeping with this policy, much time was spent in learning to fire the basic infantry weapons such as the M1 rifle, the carbine, the light machine gun, and the sub-machine gun. One week was spent on the range with the M1 rifle. On the last day all cadets fired for record and received their ratings as either Marksman, Sharpshooter, or Expert. Several days were spent on infantry tactics for the small unit. What was learned here was put to test when each company had the problem of attacking a large hill at night. "Aggressors" on the hill made things warm for the onrushing cadets as they fired blank machine gun and rifle ammunition.

The larger part of the training period, however, was spent on engineer subjects such as mine fields, water supply, bridging, demolitions, field fortifications, roads, and airfields. Six types of military bridges were constructed including the famous Bailey bridge and various types of floating bridges. A mine field was laid and

(Continued on page 34)

Signal Corps R.O.T.C. Summer Camp—1954

by Fritz Callies me'54

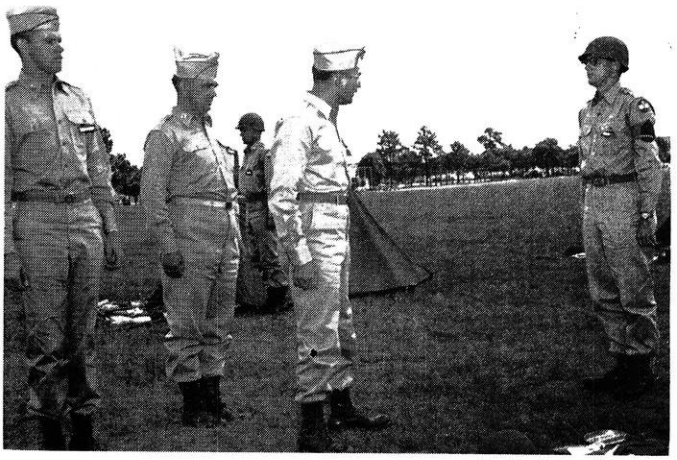
This year's Signal Corps R.O.T.C. Summer Camp was again held at Camp Gordon, Georgia. The 49 cadets from the University of Wisconsin joined with 806 Sig/C cadets from 67 other colleges and universities in filling the scorching Georgia air with radio signals, .30 caliber carbine bullets, WD-*1* field wire, and shouted commands.

The cadets were organized by institutions into a battalion of four companies, the Wisconsin men, who comprised the largest group from any one school, being assigned to Co. A. Each company had five cadet platoons, and one support platoon of 13 officers and 90 enlisted men from R.O.T.C. duty at the various institutions and from the Sig/C Replacement Training Center at Camp Gordon. These men supervised and instructed the cadets, and were responsible for the mess and supply functions. The actual positions of command within the companies, however, were rotated among the cadets. The entire Signal Corps R.O.T.C. Summer camp was under the direction of Colonel Nicholas Angel, PMS&T of Tennessee Tech.

After arrival in camp on 19 Jun 54, the cadets spent two of what seemed like the longest days of their lives being carefully examined by the post hospital, receiving their clothing and equipment, cleaning up their two-story wooden barracks, and getting initiated into the ways of army life. Although there were numerous new acquaintances to be made, boots and brass to be polished, and floors to be scrubbed, the cadets welcomed the 10 p.m. "lights-out", and even the army bunks seemed very comfortable.

The six-week camp was divided into four phases. The first three weeks, Phase I, served to familiarize the cadets with proper procedures, and operation of Sig/C equipments. The training covered five main areas of instruction: field radio, telephone and teletype, comcenter, radio relay and carrier, and field wire.

This training was put to use in Phase II, which was a "practical application" period, and included a two-day bivouac complete with C-rations, foxholes, drenching rains, and a full-pack march under aggressor bombing, strafing, ambushes, and gas attack. This was a limited-distance "shakedown" field exercise, preparatory to the week-long bivouac of Phase III.



—U. S. Army Photo

Dick De Mars is "chewed out" while "General's Aide" Bob Anderson (left) observes the technique.

During Phase III, the four cadet companies alternated as the X Corps and its 10th, 11th, and 12th Divisions, setting up complete communication systems in the field, and getting a taste of 24 hour operation, night moves, and tactical communication problems, along with aggressor action, monstrous red ants, and the hardiest, most vigorous growth of poison ivy to be found anywhere.

(Continued on page 40)

—Photo by J. Kentzler

The Field exercise in telephone communication evidently did not deal strictly with official business. Discussing the World Series, perhaps?

FACTORY TESTING OF AUTOMOBILES

by Ronald Kelm me'55

The Proving Ground

A proving ground is a plot of land equipped with roads and devices for the testing of cars. New cars are tested before being released to the public and old cars are tested to find ways of improving the new cars. The General Motors proving grounds will be discussed in this article. Other proving grounds are similar.

Roads. Every kind of road surface is found at a proving ground. There are smooth highways, wavy blacktopped rural sideroads, washboard gravel roads, boulder-studded, raw-dirt trails riddled with chuckholes and one simulating the roughest and most brutal pavements—the Belgian Block road.

A test track, five lanes wide is used for speed tests. It is so steeply banked that the cars can go around it at 85 mph without sidesway. There are other special roads, such as two level, concrete-paved test roads arranged at right angles to each other. Test engineers can use the one over which the wind happens to be blowing in the desired direction for the particular test they are conducting. On a large circular paved area known as the "skid pad", cars are driven around and around at varying speeds to determine the steering quality and performance on turns. The effect of water spray on the engine and brakes of a car is tested by driving the car through a flooded area. This gigantic bathtub is made by flooding a sunken area between two retaining walls. In a similar pond, salt water is splashed upon the car to duplicate winter driving conditions when salt is used on the roads to melt snow and ice.

In addition to these roads at the main proving ground, cars are tested on the hot, dry, dusty desert trails of Arizona. There the engine's cooling system is subjected to extreme heat. Air cleaners must prove their worth in dense clouds of dust, and air conditioning systems are tested for their ability to maintain comfortable temperatures despite tropical heat.

Hills. Various hill grades are also found at a proving ground. Hill grades as steep as 60 per cent test the reserve power of cars. Most of our Federal highways have grades less than five per cent, and no where do they exceed 14 per cent. In the Arizona mountain test, extreme punishment is brought to bear on the transmission and running gear while the engine is handicapped by the rarefied air.

—Photos Courtesy General Motors

Testing For Leaks.

★

Determining Visibility From Driver's Seat.

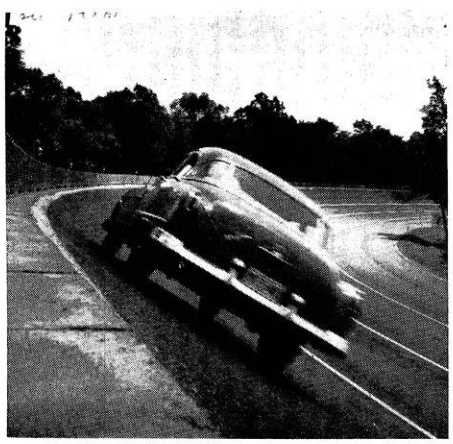
Safety Tests

Various safety tests are made as follows:

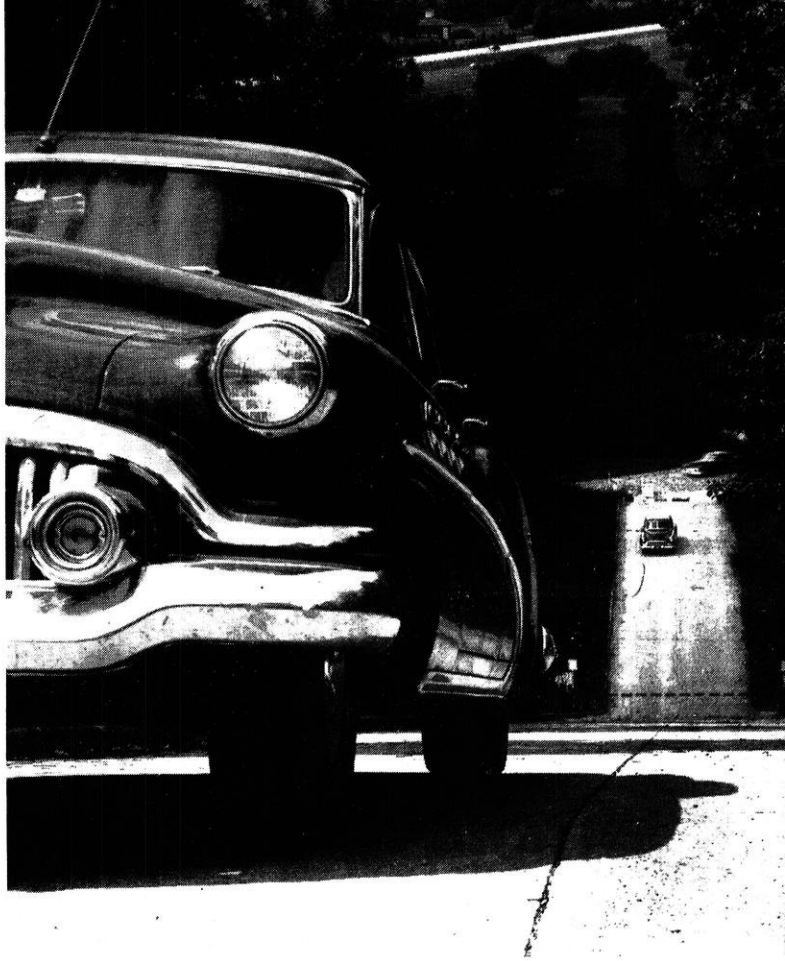
Brake Tests. The quickest way to stop a car is to press the brake pedal down just enough to cause the wheels to be on the verge of skidding. To determine the pressure exerted on the brake pedal, a special mechanical foot is used. It is a pneumatic cylinder that can be adjusted to exert any predetermined amount of force. The stopping rate is measured with a decelerometer. A moving weight in the decelerometer swings forward as the car slows down. The swing of the weight, the time, pedal pressure and pedal travel are recorded on a moving paper tape for use in rating the brakes.

Passing Power Test. It is essential that a car should have lively acceleration at country driving speeds in order to safely pass other cars on crowded highways. To measure the pickup, a fifth-wheel speedometer is used. The fifth-wheel, which looks like a bicycle wheel, is fastened to the rear of the car. A small generator driven by the fifth-wheel sends electricity to a voltmeter in amounts that are in direct proportion to the speed of the wheel. The voltmeter rests on the seat beside the driver in easy view accurately measuring the electric current and translating it to read in miles per hour.

Roll Test. Nine times out of ten a properly designed car will skid before it will overturn. To insure that a car has proper design the roll of the car is measured. This is accomplished by setting up a pole in the middle of the skid pad with a tape wrapped around it to serve as an artificial fixed horizon. Then a car, with a surveyor's transit anchored to the back floor, is driven around the pole, while an observer sights the tape with the transit. The difference between the angle reading and the transit reading when the tape is sighted while the car is stationary, indicates the car's roll.



Road Speed Test.



Hill-Climbing Test.

Blowout Test. How does a car behave when a tire blows out? To answer this question, engineers attach two dynamite caps to the sidewall of a tire on a test car, and connect them with electric wiring to a switch in the front seat of the car. As the car is driven at 70 mph, an engineer, also in the front seat, sets off the dynamite caps without warning the driver. These tests show that if the driver does not jerk the wheel or slam on the brakes, there is no sudden lunge to throw the car out of control.

Frame Test. A destructive test of a car frame is carried out in the following manner: the guinea-pig car is towed behind another car with a special hitch that can be released at will from the towing car. At a speed of 45 mph the guinea-pig car is guided so that its left wheels will travel up a wooden ramp. Just before the tow car reaches the ramp, the hitch is released and the tow car continues on out of the way. The guinea-pig car hurtles through space in a long twisting loop and usually lands on the nose of the hood. The frame is then examined for cracks or breaks.

Visibility Test. In order to drive safely, a driver must have a good view of the road. To determine a driver's visibility, the test car is driven into a room containing a large semi-circular screen on which graph lines have

(Continued on page 50)

THINK

by Thomas J. Lynch

Thomas J. Lynch

Tom Lynch, a Brooklyn native, is 21 years old and a senior electrical engineering student at the City College of New York. While in St. Augustine's High School in Brooklyn, he was editor of the school newspaper and a member of the dance band. After graduation he worked in a bank for seven months while making up his mind to take electrical engineering. He entered City College in September 1950 and has been elected to Eta Kappa Nu as well as Tau Beta Pi. In June 1954 he received a reserve commission as a second lieutenant in the Army Signal Corps after having completed four years of R.O.T.C. work. Tom's hobbies include tape recording, photography, and the electric guitar.

This essay won first prize in the nationwide Tau Beta Pi Pledge Essay Contest held for students who were initiated into Tau Beta Pi during the fall semester of 1953, and is reprinted from the April 1954 "Bent of Tau Beta Pi" for the benefit of "Wisconsin Engineer" readers.

From time to time, I have seen signs in railroad stations and office buildings proclaiming the word "Think." I imagine these signs were part of a safety or efficiency campaign undertaken by the management of the particular organization for its employees. But I often wonder how many observers of these signs took them as personal reminders, as I did whenever I saw them. And sometimes, I dare to speculate how many individuals entertained the notion that it might be a good idea if everyone could have one of these signs mentally before him during each of his waking hours.

The "thinking" that I was reminded of in these signs might be defined as the *objective* gathering of *all* the factors of a situation together mentally in order to come to a sound conclusion. Now, this sounds like nothing new, and on the surface seems simple enough. But the question is, How many people think this way? There are certainly some that do—a judge, a jurist, a surgeon, an executive, a scientist, to name only a few. They are all engaged in the mental processes of gathering, sifting, weighing, and deciding. Each one of these individuals knows the importance of logical thinking; and we might say each is a "professional" thinker. But how about other people? How about the rest of us? Why can't we all use this kind of positive thinking in our everyday lives? Isn't it true that some of us go through a whole day or even a week without applying our minds to constructive thought? Our decisions are many times the result of only a slipshod attempt to analyze all the circumstances of a problem or situation. Frequently, present-day vogue or our own emotions are the only forces guiding our actions and choices. In some cases, our method of arriving at a course of action is really no more sound than the flip of a coin. Our scant thinking in little matters can become such a habit that we are sometimes lost for a way to turn or even a place to begin when a major decision faces us. Many people learn to rationalize their poor decisions so convincingly that they become unaware of the fact that their lives are falling into patterns that are shaped solely by conventions, circumstances, luck, or personal weaknesses and not by their own wills and convictions. Yet, in almost every sphere of human activity the application of objective thinking can mean the difference between mediocrity and success.

In business, the function of the executive is to oversee and make decisions. He is being paid for his ability to come to sound conclusions, and the faster he can do this, the more valuable he is to his company. If he happens to be the owner of his own business, then his ability to make quick, sound decisions is a point in his favor in the competition he must meet. Just as an executive can take advantage of constructive thinking, so too can the worker or anyone, for that matter, who has to earn a living. A person may find, on a reflective examination of his job, that it is not the kind of employment which exploits his talents to the fullest degree; and after coming to such a conclusion, he may search and find a type of work to which he more naturally will be fitted. Certainly his chances for advancement in such a field will be greater than in one to which he is not adapted or in which he has no interest. All it requires, in most cases, is taking a few minutes out of the daily routine to ask oneself: What am I trying to accomplish? And how can I best use the natural abilities I've been given to work towards my goal?

Treaties are signed, agreements are made, and sometimes an impending war is averted by the carefully worded conversations of representatives of nations. We say they use diplomacy. But what is diplomacy but merely thinking before speaking? Many books are on the popular market today which purport that they contain the secrets to social success. What they advise is largely a matter of putting oneself in the other person's place and looking at the situation from his viewpoint—and this takes thinking.

Imagine what would happen if every potential voter seriously considered his great right of suffrage and attempted to form his political opinions intelligently, and in an unbiased manner from a constructive assimilation and digestion of the current and past hap-

(Continued on page 44)

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—Illustrations Courtesy Bethlehem Steel

Taconite is quarried, rather than mined.

IRON ORE FOR THE FUTURE

by Rod Simenz, Met'55

For many years these questions have been asked and wondered about: "How long will the rich iron ore deposits in Northern Minnesota last?" "What will happen when the ore runs out?" "Will imported iron ore close up the huge mines of Northern Minnesota?" "What will the people of Northern Minnesota do if the mines close up?"

Now, it seems, to each of these questions one magic word provides the answer—"Taconite."

Finally, after 60 years of removing rich ores processed by nature to the point that they were ready for blast furnaces, man is called upon to use his ingenuity. The reason for this is that the high grade reserves of Minnesota are dwindling and the end is in sight. The time for taconite has come.

Simply described, taconite is the original and generally unchanged, iron bearing rock. Millions of years ago the great underlying structure of taconite was the bottom of a shallow inland sea. The stone, now a layer from 600 to 900 feet deep, was built up through the ages by deposits of silica, iron and other materials in the sea water.

Time and pressure changed the silt into the toughest, hardest iron bearing rock that exists. The iron is scattered through it in fine particles, some of them microscopic. Man wants to separate the valuable iron from the billions of tons of low grade ores of taconite, making this a manufacturing process rather than mining.

Taconite possibilities have been studied for a long time. Immediately following the first world war, a plant for the use of taconite was erected on the Eastern Mesabi. Methods were created, machinery installed and millions of dollars were expended. There were difficulties in eliminating the silica from the rock. These efforts failed because they were economically premature. Nevertheless, Reserve Mining Company is producing pellets in the same plant today.

The first step in the recovery of taconite is to uncover the rock. It is quarried, rather than mined. Specially designed jet piercing machines use flame and

water to drill blast holes. Then sections of rock are blown into chunks that are hauled to crushers. The jet piercer sinks a hole much faster than conventional drills.

Next the rock is crushed and ground to powder fineness, and magnetic separators extract the particles of iron. The material extracted still contains some rock dust, but it is about 60 to 65 per cent iron, as compared to the 25 to 30 per cent iron in unprocessed taconite.

The process will make very large demands for complex machinery, power and heat. Large amounts of water are needed since both the fine grinding and magnetic separation are carried out with the materials suspended in water. The end product will be high in iron content, low in impurities and desirable in structure and form. The outstanding advantage will be the excellence of the final product for furnace use.

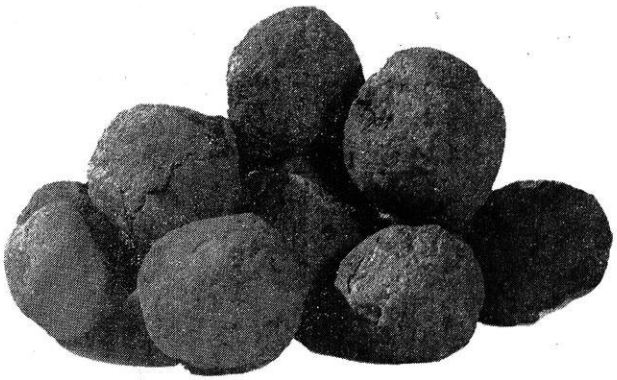
In the pelletizing process powdered magnetic material, combined with water to make thick mud, is dumped into a drum that revolves and pours out a stream of balls the size of walnuts. The balls are heated to harden them for shipping.

Experiments are being made with two other methods, nodulizing and sintering, but the pelletizing process is the one being used in the two largest taconite operations underway.

The building of plants to process taconite will rank as the greatest investment of its kind in the history of mineral benefication. Such an investment will be greater than all of the manufacturing plants in Minnesota, and it will be more than double the investment in all of the electrical plants and electrical distribution systems in the state.

A new plant now being constructed near Aurora will have a capacity of 7,500,000 gross tons of taconite pellets a year. The project will be so designed that its capacity may be expanded at a later date to 10,500,000 gross tons a year. This will be an investment of 300,000,000 dollars.

A 10,500,000 ton operation would require the mining, crushing and milling of some 30,000,000 tons of taconite per year, or 85,000 tons per day.



Processed taconite containing about 65% iron.

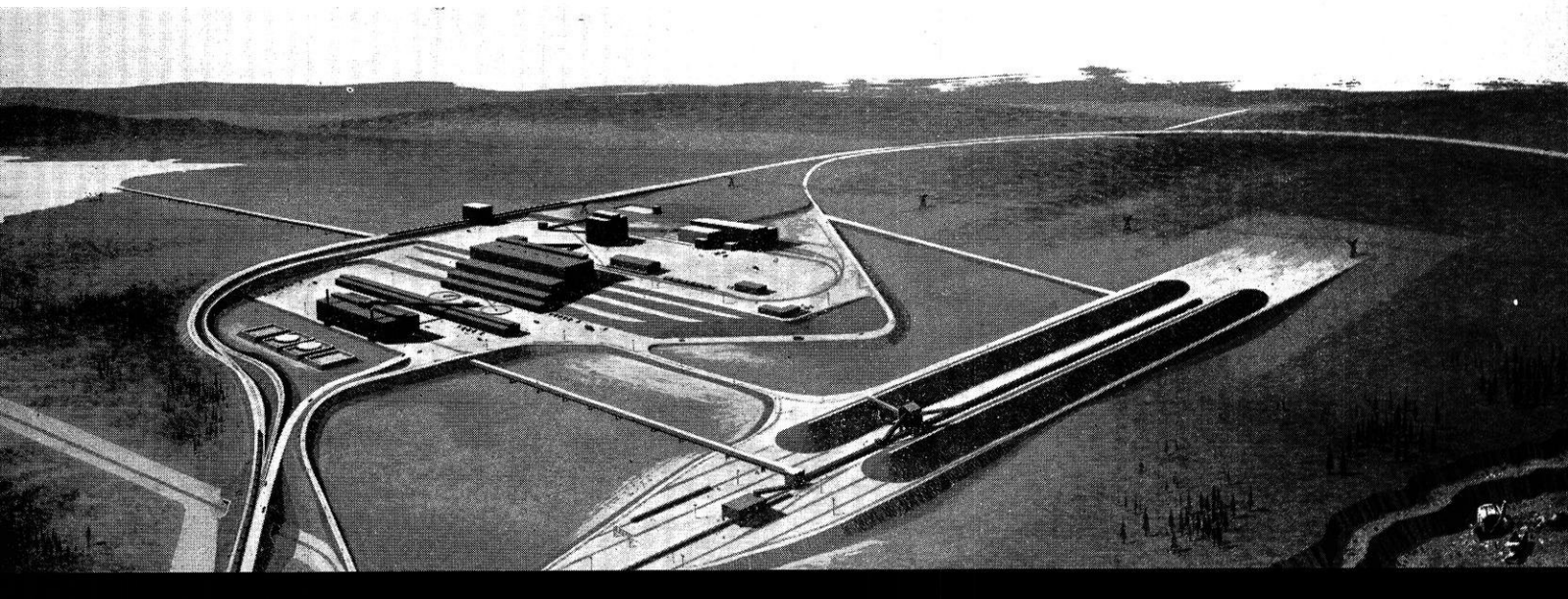
The program in this instance includes the construction of a railroad extending 73 miles from the plant to a port at Two Islands on Lake Superior, a route already surveyed. The port, to be known as Taconite Harbor, will have an ore dock specially designed to handle pellets. Facilities will be installed to receive coal and fuel oil. A large coal fired power plant will also be erected here.

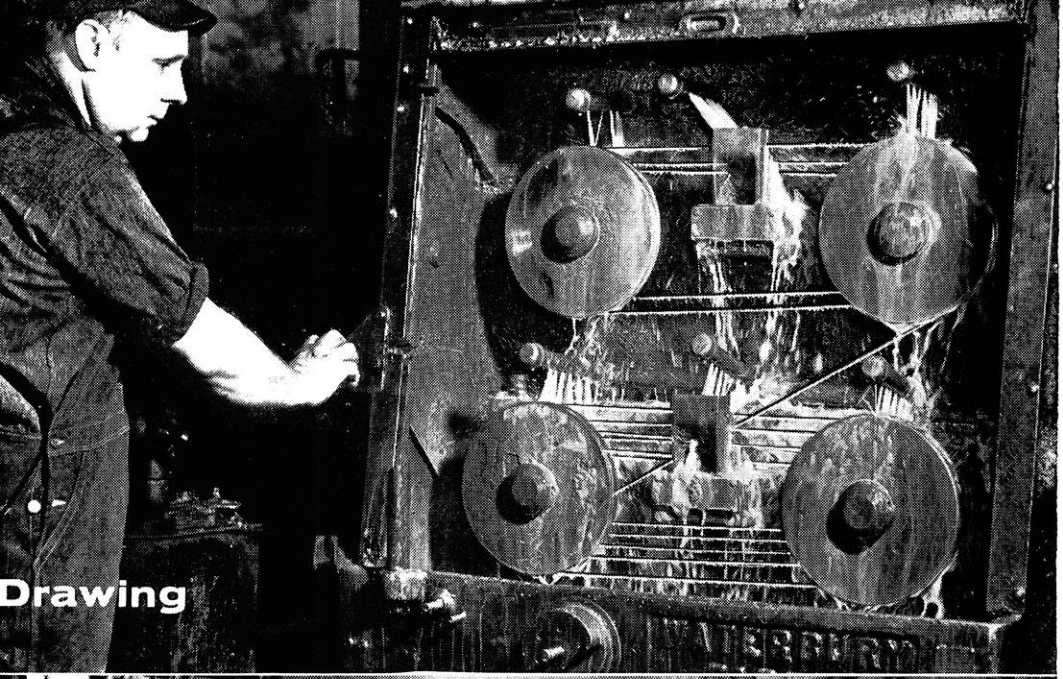
Construction activities are now in full swing. Much preliminary land clearing and site preparation work has been, and is being done, and by 1957, this large plant will be in production.

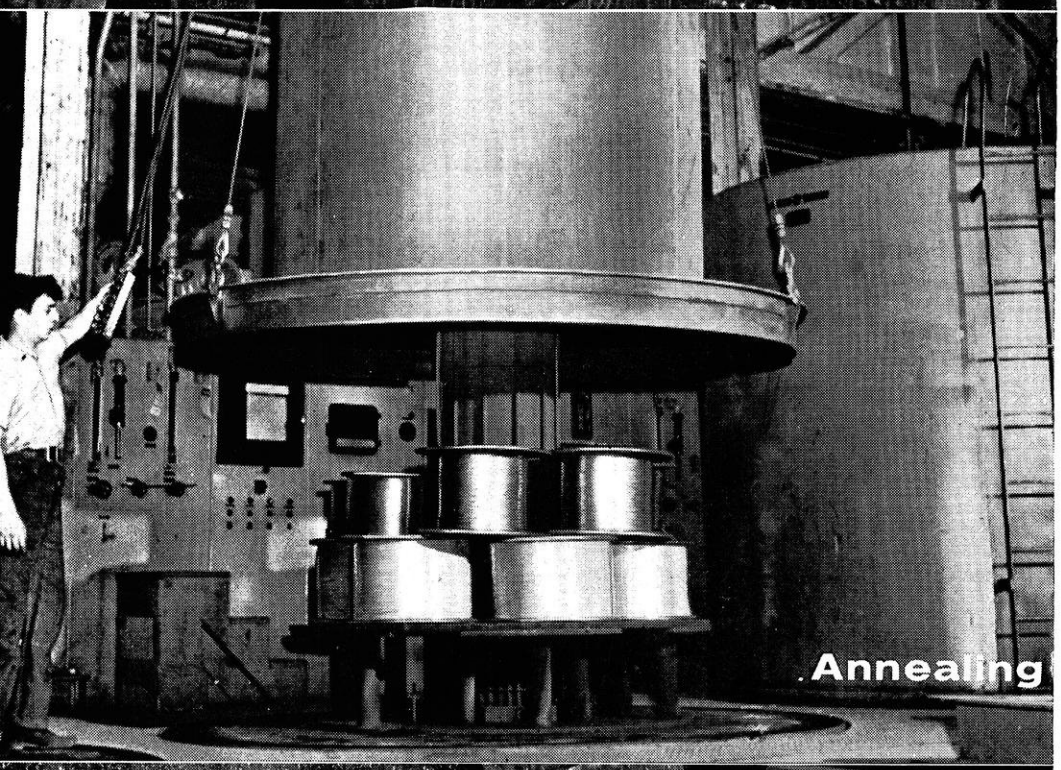
Mining operations are, traditionally, of uncertain future. This is true of high grade iron ores, where mines and ranges may become exhausted and communities lose population and hope. It is true to a lesser degree of the low grade iron ores whose reserves are almost unlimited providing that man's ingenuity will find a way to use them at competitive cost. Such an ore is taconite, whose reserves are to all practical purposes, unlimited. The great range formation has never been measured, and its tonnages are astronomical.

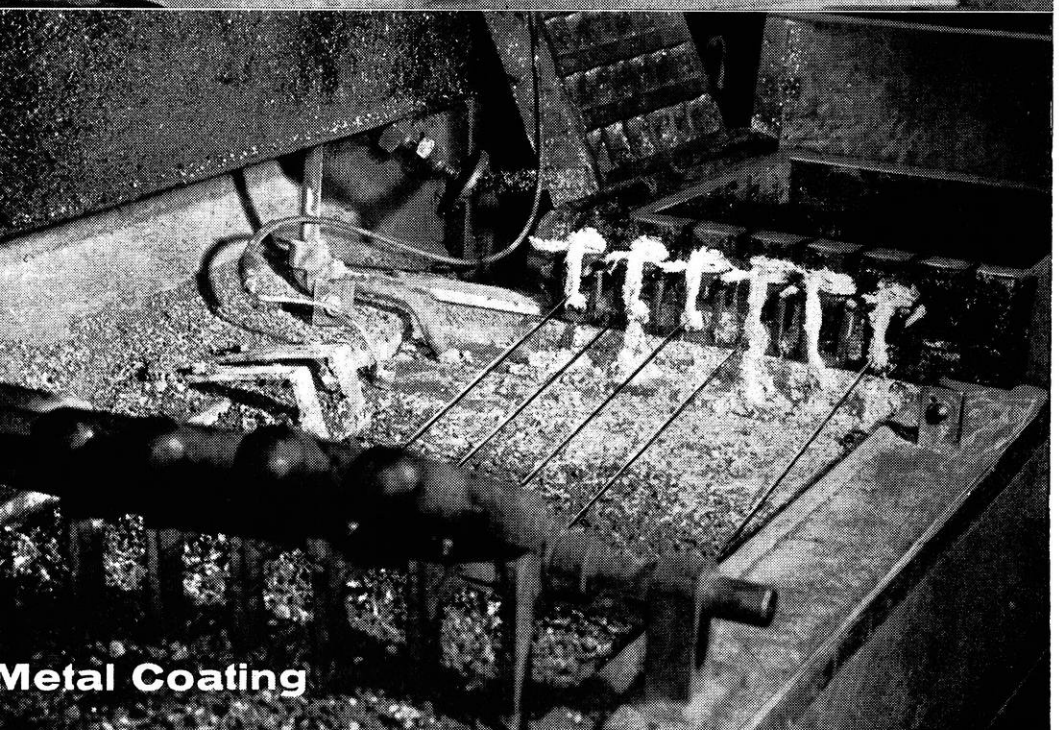
END

Artist's layout of taconite plant.









The of

Electrical conductors for wires and cables are generally made from either aluminum or copper. Except as noted below under annealing and metal coating, essentially the same method is used in preparing electrical conductors from these metals.

Preparation of Wires

The metal, after purification at the refinery, is cast into billets about four inches square and about four feet long. For use in electrical conductors, this billet is reduced in cross-sectional area to produce the flexibility required in the finished wire or cable. For example, weatherproof wire for outside power distribution, where little flexibility is required, contains conductors that are solid or made of relatively few wires. For heater cord and welding cable, where excessive flexing in service occurs, the conductors are made up of a large number of small wires. Between these two extremes there is a wide variety of cable constructions requiring numerous sizes of wires.

The reduction in area of the billet is begun on the rolling mill where the billet is reduced to rods, the commercial sizes of which vary from about one-quarter to three-quarters inch in diameter. Rods are reduced to final wire sizes by drawing through a succession of dies of gradually decreasing diameter, the reduction in area per die or draft being about 30 per cent.

Drawing

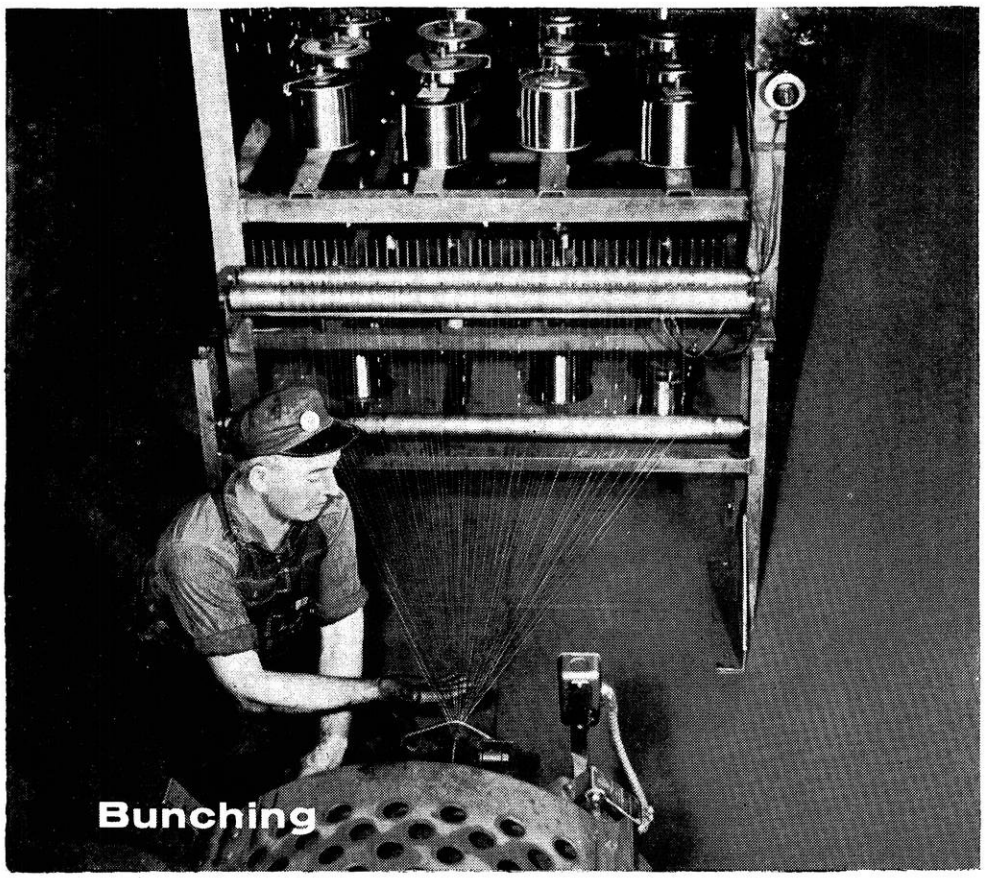
The drawing of wire increases its hardness and tensile strength and decreases its elongation and electrical conductivity. Since elongation determines the ability of a material to withstand repeated bending or flexing, it follows that the drawing of wire reduces its flexibility. Except where strength is important, as in weatherproof wires supported aerially, practically all electrical conductors should have greater flexibility and electrical conductivity than that provided by hard-drawn wire. Both flexibility and conductivity are improved by annealing hard-drawn wire.

Annealing

Annealing consists of subjecting the wire in coils or on spools to a temperature of about 650°F for about two hours. Large coils or spools may require a longer time and higher temperature. To prevent tarnishing during the annealing of copper wire, it is necessary to anneal in an inert (oxygen free) atmosphere. This precaution is not necessary in annealing aluminum wire. Annealing of hard-drawn wire increases its ultimate elongation about 2000 per cent and electrical conductivity about 3 per cent.

US RUBBER

preparation electrical conductors



Metal Coating

Unprotected copper in contact with rubber insulation combines with sulphur in the insulation to form copper sulphide. This reduces the conductivity of the copper and makes it brittle and difficult to solder. Furthermore, copper in contact with rubber, accelerates the combination of rubber with oxygen and hence promotes the deterioration of rubber insulation. To prevent this mutually harmful action, copper for use in rubber-insulated wires and cables is protected with either a thin continuous coating of inert metal, such as tin, lead, or lead-tin alloy on the individual wires or a separator consisting of a wrap of threads or tape over the uncoated conductor.

Metal coating consists of passing the individual copper wires successively through (a) dilute hydrochloric acid, (b) molten metal or alloy, (c) a wiper, (d) a cooling bath and finally to a take-up reel. The hydrochloric acid cleans the surface of the copper insuring a perfect union between the copper and the coating metal and a complete coverage of the copper by the coating metal. The wiper removes the excess coating material and produces a smooth surface on the coated wire.

Metal coating or a separator is not required on aluminum conductors for rubber insulated cables since aluminum does not combine readily with sulphur and does not accelerate the deterioration of rubber.

Stranding of Conductors

As pointed out above, the purpose of wire drawing is to so reduce the cross-sectional area of the billet or rod that a conductor of the required flexibility can be produced. In addition to adequate flexibility, the conductor must also have sufficient cross-sectional area to provide the current carrying capacity and voltage drop required for a particular application. In general, the service conditions and current carrying capacity of wires and cables are such that conductors of greater flexibility than is obtained with a single wire (solid conductors) are required. Solid conductors are used generally only on sizes 6 Awg. and smaller conductors and then only for fixed (not portable) installations. Most conductors, are, therefore, made up of more than one wire.

The formation of a conductor by bringing together the required number of wires is known as stranding, and the conductor thus formed is known as a stranded conductor. There are two fundamentally different types of stranding, namely, bunched stranding and concentric stranding. These differ in the manner in which the wires are assembled to form a conductor.

Bunched Stranding

In bunched stranding, the required number of wires are simply twisted together with no attempt being made to control their relative positions within the group. The length of the group requiring a complete turn of any one wire is known as length of lay of the strands. The length of lay varies widely with the number and size of the wires and the flexibility desired in the conductor.

Concentric Stranding

In concentric stranding the individual wires are laid up symmetrically in the form of a geometrically compact group. For example, six wires will lay snugly around one central wire, twelve wires will lay around a group of seven, etc. All of the wires are laid up around the same or a common center, hence the term "concentric stranding". The number of wires in the outer layer increases by six and the total number of wires in the assembly becomes 1, 7, 19, etc. The wires in any one layer are cabled or twisted around the central core with a definite length and direction of lay. The direction of lay of the wires is reversed in alternate layers to equalize the torsional forces resulting from twisting the wires about the central core. The length of lay depends on the size of the individual wires and the number of layers in the conductor.

Rope Stranding

A modification of concentric stranding known as rope stranding is used chiefly in the preparation of large flexible conductors for portable and welding cables. This differs from concentric stranding in that a group of wires, known as ropes, instead of individual wires, are laid up in a geometrically compact form of six around one, etc. These groups of wires may be either concentric or bunched stranded. This type of stranding makes possible building up a conductor with a greater number of wires than can be produced by concentric stranding on a machine with a given number of spools.

Other Strandings

Other types of conductor strandings, such as "sector-shape", "compact-strand" and "segmental" are used for special purposes to reduce conductor diameters and conductor losses.

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPARTMENT • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Human Engineering

(Continued from page 21)

to confusion, and conversely, accurately spot the characteristics which distinguish each letter and number.

With this information before them, Johns Hopkins engineers have begun developing a new set of numbers. They are exaggerating or altering the parts of various digits that now look alike. If they have their way, engineers in 1984 may be seeing numbers on their slide rules like those on page 20.

The phenomenon of hearing has also been given its share of attention by the human engineers. Take the problem facing men who work in noisy surroundings, but who depend for safety on warning sounds or shouted instructions. Human engineers, when confronted with this situation, suggested that earplugs should be worn. Laboratory tests have shown that blocking the ears reduces the total noise, and yet allows the ear to pick out the smaller sounds hitherto lost in the blare. This discovery is now being used during the warm up of planes on Navy aircraft carriers. Earplugs deaden the screech of the motors, but the sailors can still hear spoken instructions. The human engineers have also suggested redesigning communication equipment to cut down the normally louder vowel sounds in order to give more emphasis to the consonants, and thus increase intelligibility under adverse conditions.

From these discoveries, with their far-reaching implications, all the way down to the most trivial gadget, the human engineer is working to eliminate frustrations and irritations which we find in our daily life. He finds his field wherever men conflict with the machines they invent. As an engineer, himself, he knows that no modern machine is the result of one man's effort. Even to create an electric iron, there has to be an electrical engineer to specify switches and heating coils, a metallurgist to find a tarnishproof metal for the base, a mechanical engineer to build the machine to make the base, and a chemist to experiment with various plastics for the handle. After these men have completed their jobs, an industrial designer has to put the parts together in a design with maximum eye appeal.

Each man is an expert in his field. But no single expert has the training or experience to predict accurately where all man-machine frictions might occur. The finished iron may operate perfectly in the testing laboratory. It may outshine all competitive models in the store windows. But, says the human engineer, the new iron's true worth can be measured only when it is in the hands of somebody with ironing to do. Only then do the man-machine irritations become apparent. At that point, another kind of expert is needed—someone whose specialty is people. This, then, is the field of the human engineer. **END**

QUARTZ CRYSTALS

How a 1¼ hour "gem-cutting" operation became an 8-minute mechanized job

PROBLEM: Preparing quartz crystals for use as electronic frequency controls calls for the highest degree of precision. So much so, in fact, that prior to World War II skilled gem-cutters were employed to do the job.

But during the war, there were not enough gem-cutters to keep up with the demand for crystals in radar, military communications and other applications.

Western Electric tackled the job of building into machines the skill and precision that had previously called for the most highly skilled operators.

SOLUTION: Here is how quartz crystals are made now—by semi-skilled labor in a fraction of the time formerly required:

A quartz stone is sliced into wafers on a reciprocating diamond-edged saw, after determination of optical and electrical axes by means of an oil bath and an X-ray machine. Hairline accuracy is assured by an orienting fixture.

The wafers are cut into rectangles on machines equipped with diamond saws. The human element is practically eliminated by means of adjustable stops and other semi-automatic features.

The quartz rectangles are lapped automatically to a thickness tolerance of plus or minus .0001". A timer prevents overlapping. Finally, edges are ground to specific length and width dimensions on machines with fully automatic microfeed systems.

Most of these machines were either completely or largely designed and developed by Western Electric engineers.

RESULTS: With skill built into the machines —with costly hand operations eliminated— this Western Electric mechanization program raised production of quartz crystals from a few thousand a year to nearly a million a month during the war years. This is just one of the many unusual jobs undertaken and solved by Western Electric engineers.

Quartz stones are cut into wafers on this diamond-edged saw, with orientation to optical axis controlled by fixture. This is just one of several types of machines designed and developed by Western Electric engineers to mechanize quartz cutting.

Western Electric

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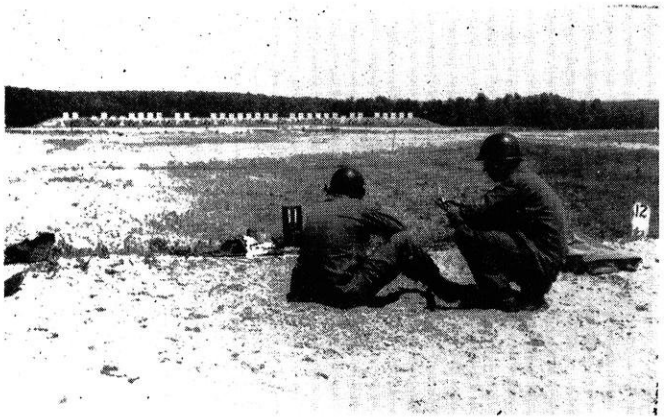
Manufacturing plants in Chicago, Ill.; Kearny, N. J.; Baltimore, Md.; Indianapolis, Ind.; Allentown and Laureldale, Pa.; Burlington, Greensboro and Winston-Salem, N. C.; Buffalo, N. Y.; Haverhill and Lawrence, Mass.; Lincoln, Neb.; St. Paul and Duluth, Minn. Distributing Centers in 29 cities and Installation headquarters in 15 cities. Company headquarters, 195 Broadway, New York City.

Engineering Corps R.O.T.C.

(Continued from page 22)



Firing the M1 at target 200 yds. distant.

Cadets stand by as another section of steel treadway is lowered into place on a pontoon bridge.

then detected by probing. The worth of the probing method of mine detection was proven when several mines were recovered that had not been planted by the cadets. Demonstrations and actual driving experience on engineer heavy equipment proved very interesting. It was really possible to get the feel of what a big D8 "Cat" was capable of when sitting up there in the driver's seat. A day on road building with pick and shovel made everyone appreciate all the more the worth of our heavy equipment. The cadets learned that the large amount of mechanical equipment in the Engineer Corp presents a big maintenance problem. Many hours were spent in teaching maintenance procedures and Army "red tape" connected therewith.

Any Article on Fort Leonard Wood would be incomplete without some mention of the climate. To put it mildly, it was HOT. The barracks thermometer read up to 95 degrees, but the mercury was out of sight nearly every time anyone had the courage to look. The week that it hit 115 degrees every day was about the worst of it, however. At any rate, most of our Wisconsin cadets were relieved to end their vacation in the Ozarks and get back once more to the cool shores of Lake Michigan.

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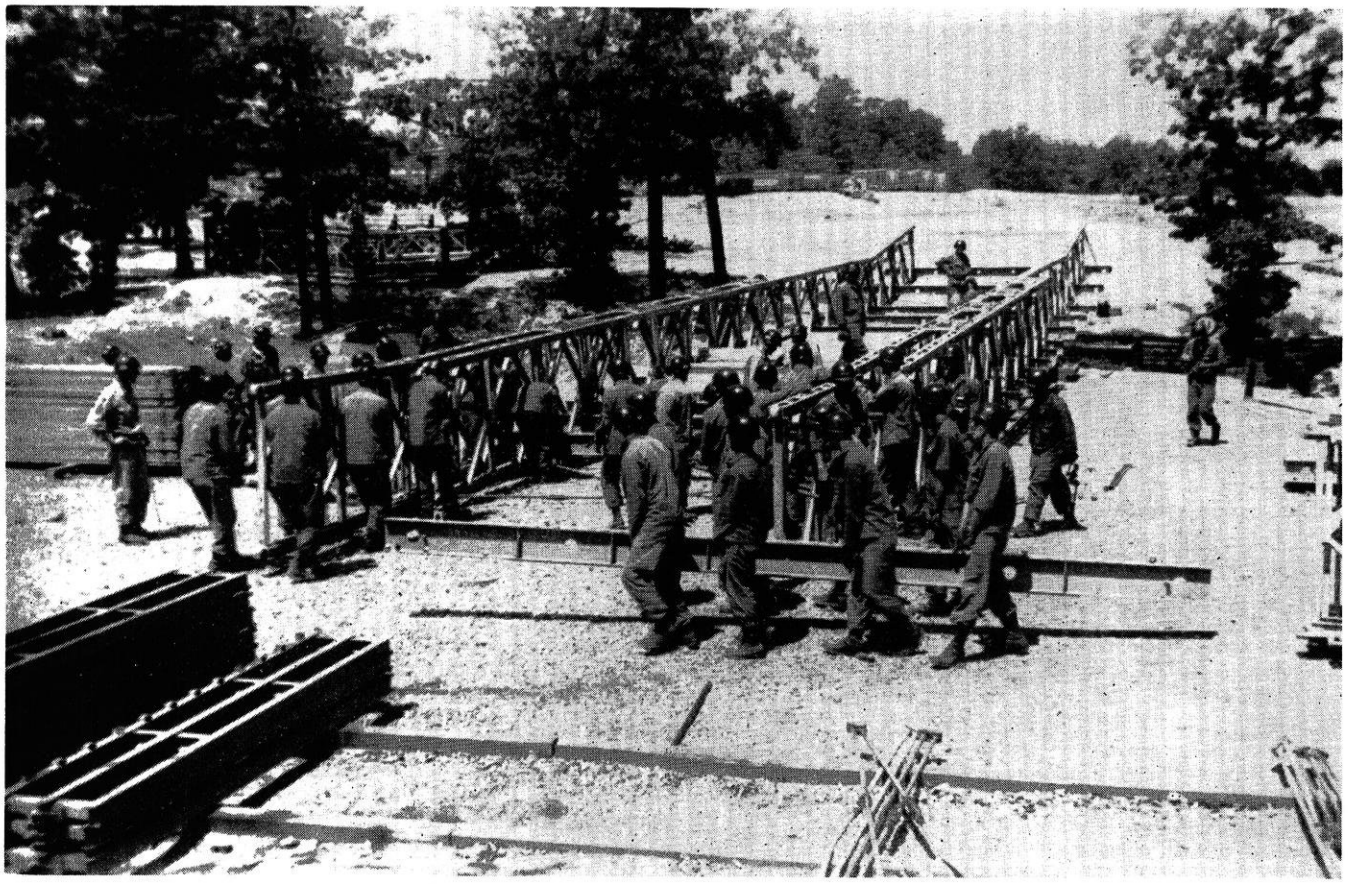
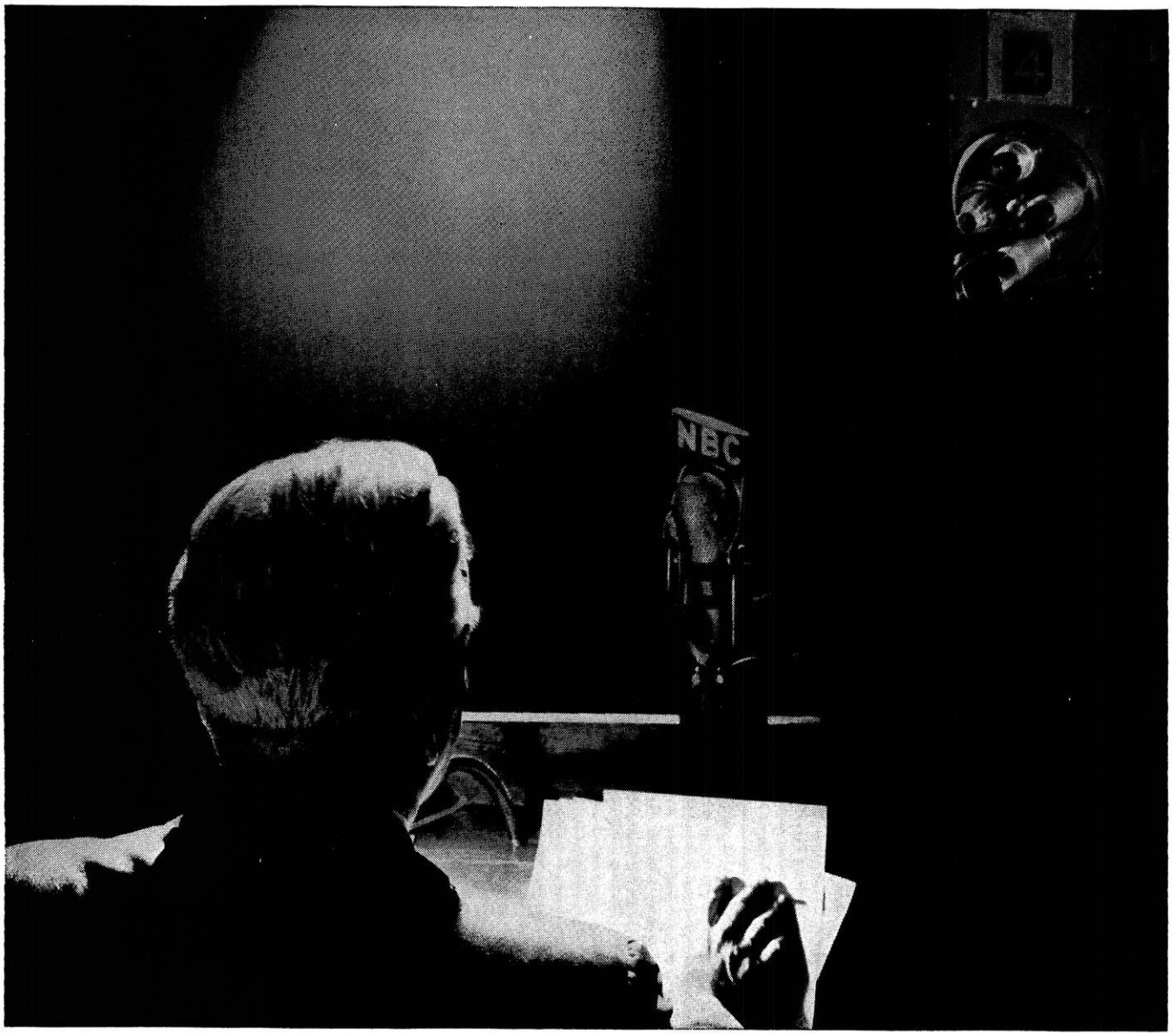


Construction of a Bailey Bridge. Cadets in foreground carry a transom into position.



Audio, Video and Freedom

Millions of eyes are watching . . . millions of ears listening. They are seeing the significance in each expression, hearing the overtones in every word.

The American people are sitting in judgment.

When they speak their decision, it will be spoken with a sureness that can come only from seeing for themselves.

Thus, the newest miracle of mass communication matures to a mighty force for freedom and understanding. And RCA, long dedicated to keep America pre-eminent in world communications, promises Americans constant progress toward ultimate perfection in all phases of radio and television.

Radio Corporation of America

Electronics for Living

Continue Your Education With Pay—At RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable training and experience at a good salary with opportunities for advancement. Among many projects with unusual promise:

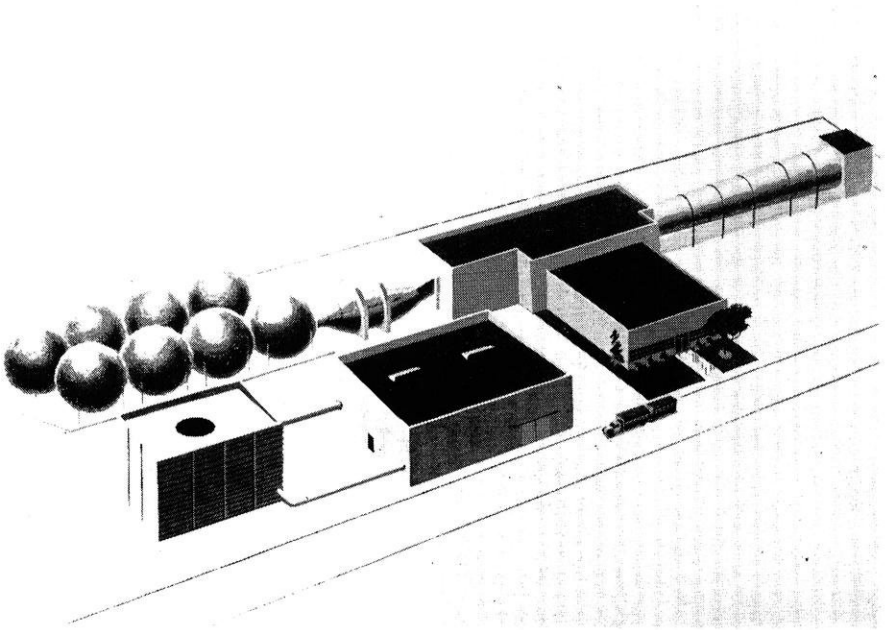
- Development and design of radio receivers (including broadcast, short-wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to College Relations Div., RCA Victor, Camden, N. J. Also many opportunities for Mechanical and Chemical Engineers and Physicists.

SCIENCE HIGHLIGHTS

Edited by Carl Burnard CiE'57

SUPERSONIC WIND TUNNEL



A construction contract for the major portion of a $4,500,000 wind tunnel capable of testing airplane and missile designs at speeds ranging from 400 miles an hour to more than three times the speed of sound has been awarded by North American Aviation, Inc.

Negotiations are underway to locate the developmental facility near North American's F-86 Sabre Jet and F-100 Super Sabre assembly lines at Los Angeles International Airport.

The tri-sonic test facility, so called because advanced airplane designs will be tested at speeds slower, equal and faster than that of sound, will be one of the largest constructed by a private company.

Technically, the test facility will be the nation's largest intermittent, blow-down tunnel. Wind speeds will be produced by compressed air rushing from a series of large volume storage spheres at selected intervals. Each test will be less than a minute in duration.

Three internal structures will provide a unique control over the test speeds. An adjustable nozzle, a transonic chamber and a variable diffuser will be placed in a series in the throat of the tunnel instead of separated as in other tunnels to regulate air speeds at sub-sonic, transonic and super-sonic levels. Adjustments to each structure in the series to change wind velocity will be made in a fraction of the time necessary for adjustments in other tunnels.

Relatively large, the tunnel's test chamber will handle an airplane or missile model with a wing span of about four feet. The chamber will be 17 feet long and seven feet square.

Other tunnels with similar speed ranges operate with a continuous flow of air, but construction costs are several times greater than that for the intermittent type.

The tri-sonic wind tunnel will be an addition to the company's extensive research facilities. In use for several years have been a large sub-sonic test facility for exploratory work at low speeds and a super-sonic tunnel with a small test chamber. Both played key roles in the development of the F-86 Sabre Jet series and the super-sonic F-100 Super Sabre.

North American estimates an additional cost of $500,000 for acquisition of the building property and for construction of buildings to house testing equipment.

The facility is expected to be completed in March, 1956.

★

FLUORESCENT LAMP LIFE

Scientists now almost instantly can predict approximately how long a particular fluorescent lamp will burn—something which formerly could be found out only by burning it until it blinked out after an average period of 7500 hours.

Other things being equal, the life of a fluorescent lamp is proportional to the amount of a chemical, called "emission coating," held by the lamp's cathode. By weighing this emission material, which serves as the source of electrons to carry

the current through the lamp, the life of a lamp can be estimated.

The development engineer said his organization had developed a novel electronic method which permits rapid testing of fluorescent lamps for the quantity of chemical on their cathodes, but without breaking open or even lighting the tubes.

In this method, Thayer explained, the lamp under test is compared in an electronic circuit with a lamp having an uncoated cathode. When the current is applied, the coated cathode is slower to increase in temperature. This difference in resistance to heating is roughly proportional to the weight of the emission coating, and can be read on a meter.

The getting of the desired quantity of chemical on the cathode, and retaining it there through all lamp processing and handling steps, requires close controls, according to the G-E engineer. He said many checks are made to insure high quality. The new electronic tester is said to be an especially useful control tool in detecting short-life lamps.

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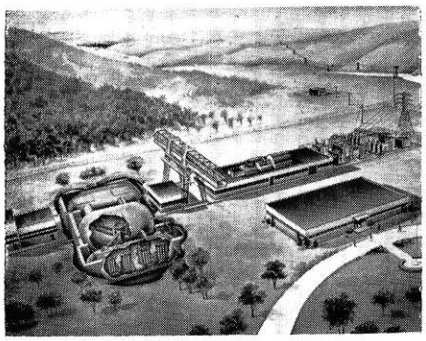
CENTRAL STATION ATOMIC POWER PLANT

This preliminary artist's sketch shows the nation's first central station atomic power plant which is to be built at Shippingport, Pa.,



near Pittsburgh. Westinghouse Electric Corporation is developing and building the reactor portion of the plant under contract to the AEC. The Duquesne Light Company will design and construct the turbine generator portion and will operate the entire plant.

The plant components depicted are, from the left: a building for fuel handling, the atomic reactor and heat exchangers, the maintenance building and overhead traveling crane, the turbo-generator building, the switchyard containing transformers and circuit breakers, and transmission lines. In the right foreground is a building containing shop and administrative facilities.

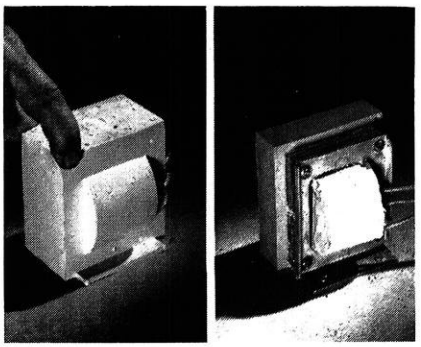
As can be seen from the cutaway view, the atomic reactor which provides the heat, and the heat exchangers which generate the steam, will be located underground in concrete and steel structures. These underground structures will provide protection to operating personnel and the surrounding area in addition to the many protective devices in the reactor itself. The large central underground structure houses the reactor itself which is located within the vertical, cylindrical container which represents the pressure vessel. Water under pressure is pumped through this vessel. It is heated and is pumped to the four heat exchangers, two of which are visible in the cutaway foreground. The other two are in the horizontal, cylindrical structure to the rear. Heat from this pressurized superheated water converts other water in heat exchangers to steam. The steam then is piped to the turbo-generator. This pioneer nuclear power plant will produce a minimum of 60,000 kilowatts of electricity.

★

HIGH RESISTANT COATING

A resilient dielectric coating or encapsulating material for extreme temperature electric and electronic components has been developed by Dow Corning Corporation. Identified as Silastic S-2007, the new silicone rubber cures in 2 to 4 hours at 200° C to form a rubber-like jacket which is uniform, heat-stable, moistureproof and highly resistant to oxidation, ozone and weathering.

Tests indicate that transformers properly coated with this new ma-



terial will easily pass both the moisture resistant and low temperature flexibility requirements of MIL-T-27 grade 1. Fully cured coatings also have about twice the thermal conductivity of conventional resinous or rubber dielectrics, assuring cooler operation at high temperatures.

Supplied as a solvent free, low consistency paste, Silastic S-2007 may be applied by dipping, vacuum impregnating, or may be molded in fitted encapsulating molds. Coated parts may be placed directly into a hot air oven for vulcanization. Neither pressure nor a graduated cure is necessary.

★

TRANSISTORS

Tubeless radio and television receivers came a step closer to the American living room recently when the GE Electric Research Laboratory announced development of a new and revolutionary means of producing germanium for transistors.

Transistors, which require tiny bars of the element germanium, are the new devices capable of performing many of the electronic chores now done by more complicated vacuum tubes like those in radio and television sets.

Dr. Robert N. Hall, a young physicist in the laboratory, has developed a means for producing as many as 100 wafer-thin layers of specially treated germanium in a six-inch ingot. Other methods produce only one or two of these vital layers. Dr. Hall emphasizes, however, that the new method is still in the laboratory stage.

(Continued on page 52)

ALUMNI NOTES

by Dick Paske EE'56

Cummings, Albert E., c'15, director of research for the Raymond Concrete Pile Co., is one of five new appointees to the advisory committee of the research division of New York University's College of Engineering.

•

Neef, John H., c'04, who died a year ago in Oregon, left a bequest of $1,400 to the university to establish the Grace Bradley Neef Trust Fund in memory of his wife.

•

Schneible, Douglas E., c'38, highway research engineer, hydraulics research branch, U. S. Bureau of Public Roads, is the author of a paper on "Some Field Examples of Scour at Bridge Piers and Abutments" which appeared in the August, 1954 number of BETTER ROADS.

•

Prochaska, Victor H., c'27, died on July 23 after a brief illness. He was bridge design engineer with the State Highway Commission of Wisconsin.

•

Ingersoll, Alfred C., c'42, assistant professor of civil engineering at the California Institute of Technology, has been appointed under the Point Four program as a specialist in fluid mechanics at the Bengal Engineering College in India.

•

Wagner, Aubrey J., c'33, has been appointed general manager of TVA. He has been assistant general manager since 1951 and has been with TVA since 1934.

ROBERT GLASS

Glass, Robert G., '54, is currently employed at the Columbus Division of North American Aviation, Inc. He has been assigned to the Engineering Department in the Master Lines Group where he is assisting in computing and establishing master lines for construction of basic elements of aircraft, and detailed dimensions of external contours. The Columbus Division is designing and manufacturing high-speed military aircraft for the Air Force and Navy.

•

Michalos, James P., c'38, has been appointed professor of structural engineering and chairman of the Department of Civil Engineering of New York University, New York City.

Ackermann, William C., c'35, resigned from TVA last May to accept a position as head of the newly formed Section of Watershed Hydrology of the Agricultural Research Service in Washington, D. C.

•

Trier, Robert J., c'25, for the past eight years assistant chief, has been named chief of the branch of roads, Bureau of Indian Affairs, Department of the Interior.

•

Plautz, Edgar G., c'25, has been appointed as district engineer of the Milwaukee Metropolitan district of the State Highway Commission of Wisconsin.

•

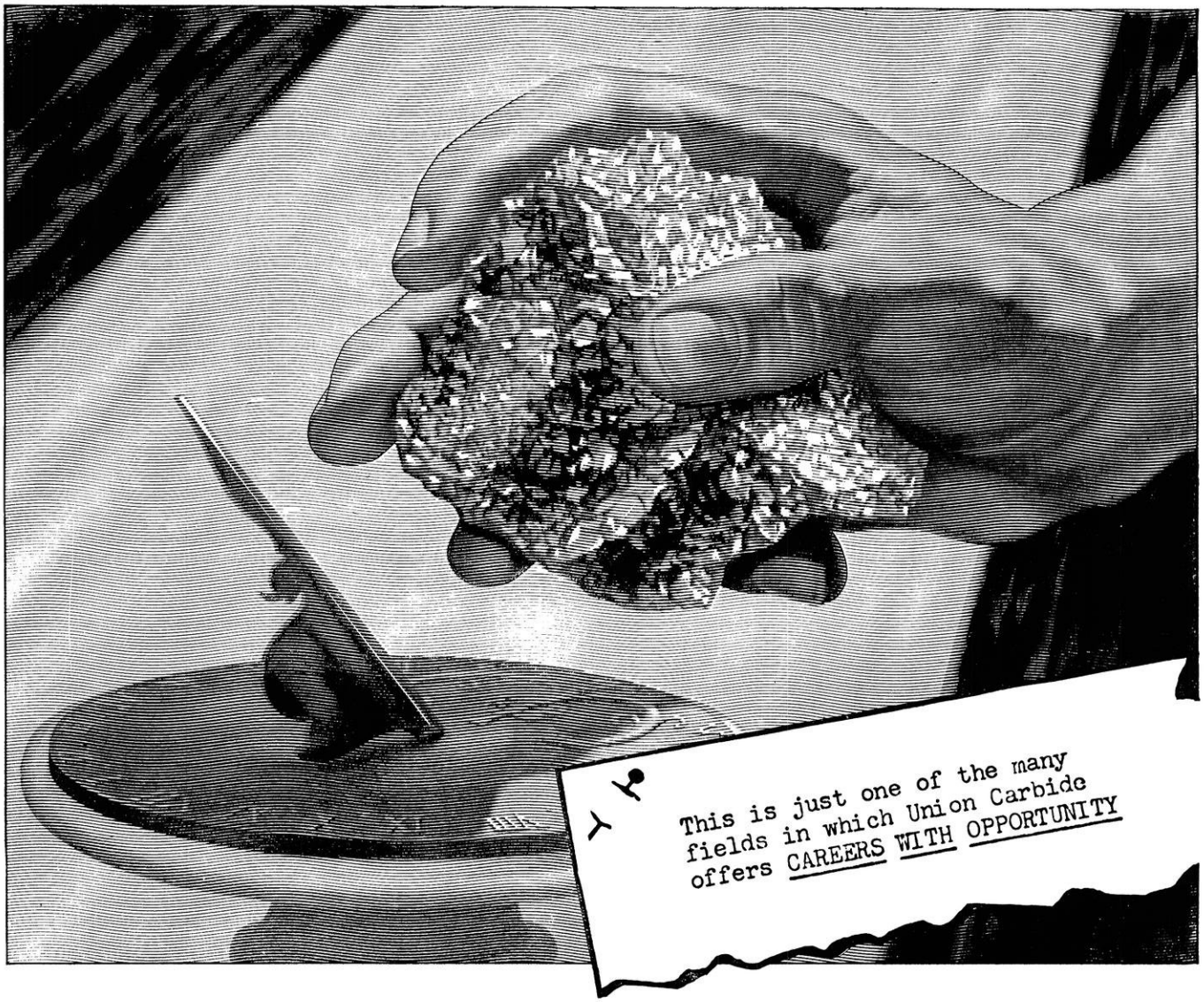
Moritz, Earnest A. c'04, has recently been named to membership in the Colorado River Commission. He served for many years as engineer with the Reclamation Bureau and was Regional Director at Boulder City, Nevada, at the time of his retirement from that service.

•

Gamble, Raleigh W., c'16, has been named district engineer of the Asphalt Institute for the states of Illinois and Wisconsin, with headquarters in Chicago. He recently retired as superintendent of the Bureau of Street Construction and Repair in Milwaukee.

•

Hosig, Irwin B., c'05, has retired from service with the Bureau of Reclamation after 49 years on the engineering staff. **END**



The metal that makes time stand still

Thanks to chromium, steel now serves you with strength and beauty that lasts a lifetime

IN TIME, one of man's most useful materials—steel—is often the victim of such destructive forces as rust, corrosion, heat, or wear.

THESE NATURAL ENEMIES of steel now are mastered by the metal called chromium. When the right amount of chromium is added to molten steel, the result is strong, lustrous stainless steel that defies the ravages of time.

IN HOMES, TODAY, stainless steel is a shining symbol of modern living. It brings us care-free sinks, gleaming tableware and kitchen utensils—all with beauty that lasts a lifetime.

IN INDUSTRY—Food is prepared in super-sanitary stainless steel equipment. Streamlined trains and buses are made of this wonder metal. Vital parts of jet planes that must withstand both blazing heat and sub-zero cold are made of tough, enduring stainless steel.

SERVING STEEL...AND YOU—The people of Union Carbide produce alloys of chromium for America's steelmakers. This is another of the many ways in which UCC transforms the elements of nature for the benefit of everyone.

STUDENTS AND STUDENT ADVISERS: *Learn more about career opportunities with Union Carbide in* ALLOYS, CARBONS, CHEMICALS, GASES, *and* PLASTICS. *Write for booklet G-2.*

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—Photo by Matthew Brady, circa 1864

Barracks, although not new, were kept well scrubbed and polished by the proud cadets.

Signal Corps Summer Camp

(Continued from page 23)

The last week of camp was devoted to various demonstrations of infantry weapons, an air-drop by a Signal detachment, new experimental Sig/C equipments, and television application. Also included were visits of inspection, pistol instruction, and deprocessing prior to departure from camp on 30 Jul 54. At the conclusion of camp 145 cadets were commissioned as 2nd Lieutenants.

In between this rigorous schedule was sandwiched several dances at the air-conditioned Service Clubs, with real, live girls lured in from nearby Augusta; the inter-Company sports program; and Col. McDermott's traditional beer party for the Wisconsin cadets.

This summer's nation-wide heat wave did not miss Camp Gordon—newspapers told of farmers in the area losing their chickens due to heat prostration, but the Signal Corps kept right on marching through the burning sands. And there was that unforgettable Wednesday that saw the 855 wildly cheering cadets reveling and splashing in one of the rare tropical monsoons, chomping on hailstones and shivering delightedly as the deluge drenched their scorched fatigues.

Again the University of Wisconsin's record at camp was outstanding: 11 cadets were designated Distinguished Military Students, Cadet James P. McNaul being rated as 7th among the 855 cadets on the basis of leadership, technical knowledge, and marksmanship.

The 1954 Military Police R.O.T.C. Summer Camp was also held at Camp Gordon during the same period.

END

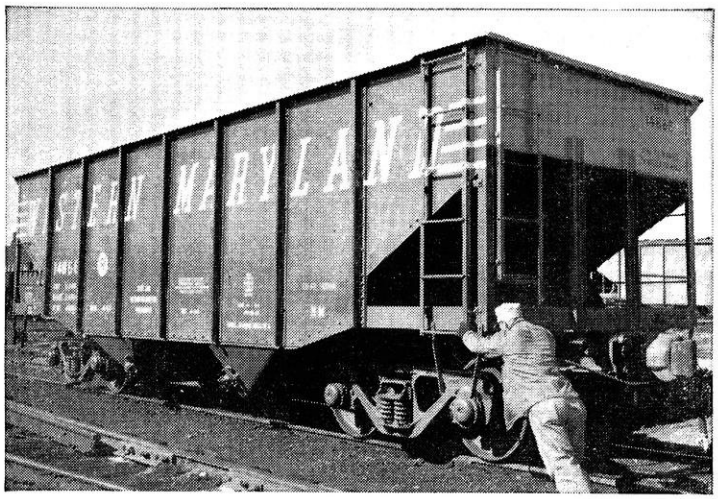
★

A general and a colonel were walking down the street. They met many privates, and each time the colonel returned their salute, he would mutter, "The same to you." The general's curiosity soon got the better of him, and he asked, "Why do you always say that?" The colonel answered, "I was a private once and I know what they are thinking."

* * *

During maneuvers, an army commander ordered a notice to be placed on a bridge and stating, "This bridge has been destroyed by air attack," but to his chagrin, he noticed through his field glasses that a foot regiment was crossing the bridge against his orders. He sent his adjutant to the officer in charge to find out why the orders were being defied. An hour later the adjutant was back. "It is all right, Sir," he reported, "the troops are wearing signs saying, "We are swimming."

Another page for **YOUR BEARING NOTEBOOK**

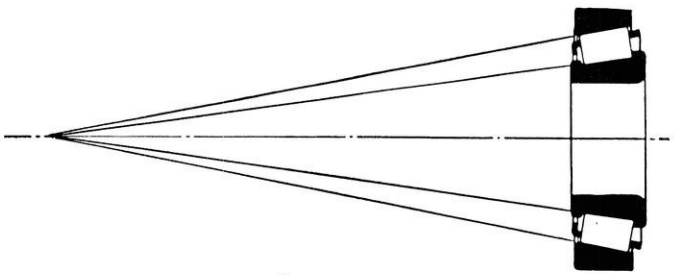


How to design a freight car one man can push

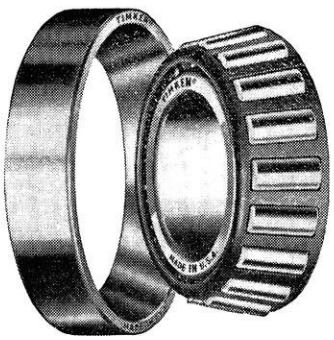
You can make a big 55-ton freight car roll so easily one man can push it. How? By mounting its axles on Timken® tapered roller bearings. Timken bearings *roll* the load, eliminate the metal-to-metal sliding friction that makes old-style friction bearings start hard. They reduce starting resistance 88%. And, with Timken bearings, there's no danger of hot boxes —the major cause of freight train delays.

TIMKEN® bearings are designed to roll the load

As you see here, all lines drawn coincident with the working surfaces of a Timken bearing meet at a common point on the bearing axis. This means Timken bearings are designed to give true rolling motion. And, since they're tapered they can take radial and thrust loads in any combination.

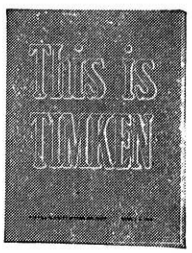


TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



Want to learn more about bearings or job opportunities?

Some of the engineering problems you'll face after graduation will involve bearing applications. For help in learning more about bearings, write for the 270-page General Information Manual on Timken bearings. And for information about the excellent job opportunities at the Timken Company, write for a copy of "This Is Timken". The Timken Roller Bearing Company, Canton 6, Ohio.



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL ⬯ AND THRUST ⟷ LOADS OR ANY COMBINATION

"Allis-Chalmers Graduate Training Course Gave me a head start"

says GERALD SMART

Marquette University, BS—1948
and now Supervisor of Plant Engineering,
Allis-Chalmers, Norwood, Ohio, Works

"MOST MEN graduating from college don't have a clear idea of what they want to do. These individuals are helped by Allis-Chalmers Graduate Training Course to find the right job whether it be in design, sales, engineering, research or manufacturing.

"My case is a little different, however. I started the course with all my interest centered on tool design and 'in-plant' service. The reason is that I started getting vocational guidance from some very helpful Allis-Chalmers men back in 1940."

Served Apprenticeship

"At their suggestion I had gone to school part time while working full time. This not only gave me the chance to serve an apprenticeship as a tool and die maker, and earn money, but I learned what I wanted to do after graduation.

"Then came the war and service in the Navy. After the war I finished school. By the time I started on the course in 1948, I knew what I liked and seemed best fitted to do. As a result, my entire time as a GTC student was spent in the shops.

"The 18 months spent in the foundry, erection floor and machine shop have all proved valuable background for my present job.

"As supervisor of plant engineering at the Norwood Works, I am concerned with such problems as: Plant layout, material handling equipment and methods, new construction, new production methods to be used in building motors, centrifugal pumps, and *Texrope* drives. It's an extremely interesting job.

"From my experience, I'd say, whether you're a freshman or a senior it will pay you to talk to an Allis-Chalmers representative now. You can't start planning your future too soon. And you can't plan starting at a better place, because Allis-Chalmers builds so many different products that you'll find any type of engineering activity you could possibly want right here."

Facts You Should Know About the ALLIS-CHALMERS Graduate Training Course

1. It's well established, having been started in 1904. A large percentage of the management group are graduates of the course.

2. The course offers a maximum of 24 months' training. Length and type of training is individually planned.

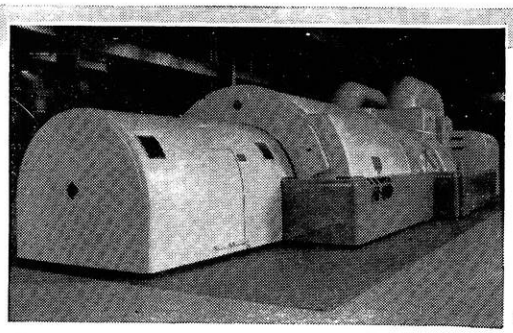
3. The graduate engineer may choose the kind of work he wants to do: design, engineering, research, production, sales, erection, service, etc.

4. He may choose the kind of power, processing, specialized equipment or industrial apparatus with which he will work, such as: steam or hydraulic, turbo-generators, circuit breakers, unit substations, transformers, motors, control pumps, kilns, coolers, rod and ball mills, crushers, vibrating screens, rectifiers, induction and dielectric heaters, grain mills, sifters, etc.

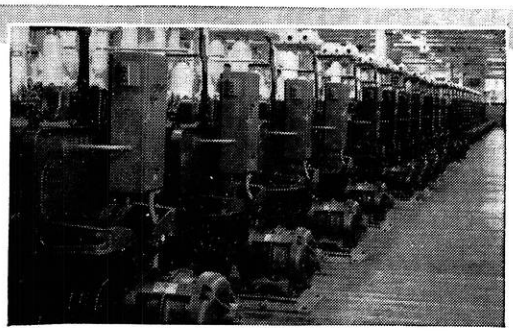
5. He will have individual attention and guidance of experienced, helpful superiors in working out his training program.

6. The program has as its objective the right job for the right man. As he gets experience in different training locations he can alter his course of training to match changing interests.

For information watch for the Allis-Chalmers representative visiting your campus, or call an Allis-Chalmers district office, or write Graduate Training Section, Allis-Chalmers, Milwaukee 1, Wisc.



Steam turbines, condensers, transformers, switchgear, regulators are built for electric power industry.



Motors, control, *Texrope* V-belt drives—all by Allis-Chalmers are used throughout industry.

ALLIS-CHALMERS

Texrope is an Allis-Chalmers trademark.

C-5678

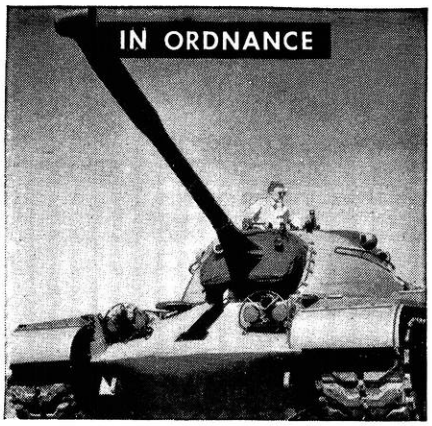
Think

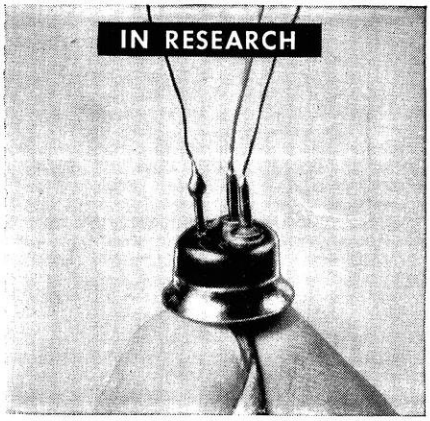
(Continued from page 26)

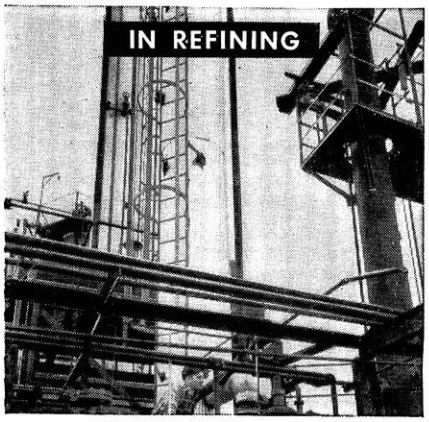
penings in his local community, state, and federal governments. Certainly our ideal of a representative democracy would be more closely approached, if every citizen took time out once in a while to make up *his* mind about *his* government.

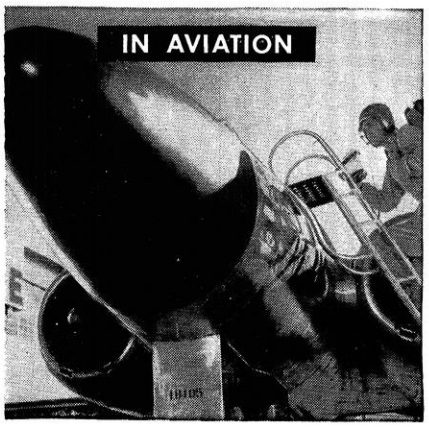
Besides assisting a man in his business, social, and political capacities, sound thinking can help him discover and learn more about one of the most fascinating subjects he could study—namely, himself. Although it is very probable that he will never be able to "know himself," still the fruits of his inner search and examination may prove to be well worth the effort. By acquiring the habit of observing his own reactions to various situations and then making a valiant attempt to "see himself as others see him," he can reap many useful lessons. First, his self-examination will gradually dissolve the hard shell of self-esteem and vanity that surrounds him. When he realizes that basically he is not so different from his fellow men, and that for every undesirable or annoying trait that he can find in his neighbor, one or more can be found in him, he will find it increasingly easier to get along with others, to understand them, and in turn to be understood by them. Second, the certain degree of humility that he will acquire from this introspection will help lift the veil of prejudice, conceit, and doubt that covers his mind, making his mental vision clearer and his perspective outlook sharper. Third, his character will be strengthened by this truer picture of himself for he will begin to lose many of the qualms and fears that once beset him and left him prone to his own weaknesses. His strengthened will power will allow him to assume a more complete control over his thoughts and actions, and thus allow him to pursue his goals with unity of purpose and undiminishing vigor. Finally, the knowledge that a man acquires of himself through self-reflection can often aid him immeasurably in discovering the real meaning of life itself. He may study nature, its laws and its organization, but here in his own makeup he has the noblest product of creation—the employer of nature, man. And by reflecting on the marvelous capabilities of human activity—art, literature, government, technology—he may begin to ask himself: From where? How? By whom? And for what purpose is all this?

Constructive thinking is not easy, and the ability of proficiently applying it to the problems of living is something that would seem to come only after many years of tireless effort. But the ability of human beings to think and reason is such a valuable gift that it should not be wasted. When I consider the far reaching effects that sound thinking can bring about in the life of almost every human being and the human race in general, I wonder why there are not more signs reminding all mankind to "Think." **END**









HONEYWELL OFFERS CHALLENGES UNLIMITED

THE challenges and problems for the engineer in the automatic control field are unique in their variety and in the insight provided into all of the industries of today's modern world.

The development and manufacture of tiny transistors for electronic control . . . the design and construction of giant control valves for oil refineries . . . the challenge of finding fish with underwater sonar . . . of providing automatic flight for supersonic jets . . . temperature controls for today's modern home . . . for atomic piles . . .

These are a few of the fields in which Honeywell's several divisions are engaged, providing automatic controls for industry and the home.

These controls are made possible by the creative imagination of highly trained engineers working with the very latest research and test facilities.

With nine separate divisions located throughout the United States and with factories in Canada, England and Europe, Honeywell offers unlimited opportunities in a variety of challenging fields. Based on diversification and balance between normal industry and defense activities, Honeywell will continue to grow and expand because automatic control is so important to the world's progress. And automatic control is Honeywell's business.

That is why we are always looking for men with ideas and imagination and the ambition to grow with us. In addition to full time engineering and research employment we offer a Cooperative Work Study program, a Summer Student Work Study program and Graduate Fellowships. If you are interested in a career in a vital, varied and diversified industry, send the coupon for more information.

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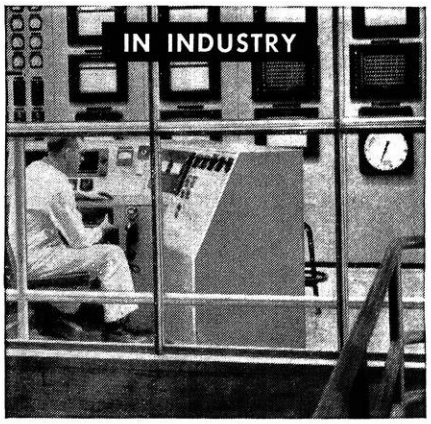

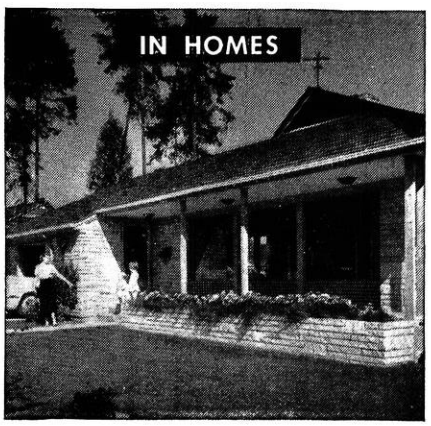

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Engine-Ears

(Continued from page 13)

ships, fellowships, and assistantships available to students at engineering colleges throughout the country.

We hope that many of the civil engineering readers will apply themselves to their studies and be among the future members of Chi Epsilon.

★

TRIANGLE

Triangle, a fraternity of architects and engineers, was founded in 1907 to help men planning to enter the engineering and architectural fields to get a greater reward from their years at school.

Since its installation in 1913, the Wisconsin Chapter has been trying to do just that. Along these lines numerous extracurricular activities are included in this semester's program.

On the athletic side we have volleyball, basketball, bowling, and tennis teams ready for their contests in interfraternity play. With regard to the social side of our school life, we have just had a successful party after the Marquette game. It was a jubilant bunch of fellows who celebrated the Badgers' rousing victory. Looking at the more serious aspect of college life, the fraternity now has seven men on the staff of the Wisconsin Engineer, and many more are members of the various engineering societies.

"Oscar," the iron man of Triangle, now has some competition as the guardian of 438 N. Frances. Since we allowed our treasured "Blarney Stone" to be stolen again, we thought a double guard would be in order.

Toward this end we acquired a new mascot, a "curbstone setter" whom we named "Tringle." All members of Triangle sincerely hope that since this "ferocious beast" has taken up residence at our house, further raids of this sort (by members of the Marquette Chapter) will be discouraged.

HEAT CONDUCTION TEXT WRITTEN BY UW PROFESSOR

Madison, Wis.—A volume which will be of special help to the individual interested in the theory of heat conduction, but without great mathematical preparation for the subject, became available to the public May 28.

"Heat Conduction," published by the University of Wisconsin Press, is aimed especially at readers in this category.

"To this end," the preface notes, "fewer types of problems are handled than in the larger treatises, and less stress has been placed on purely mathematical derivations . . ."

The book, written jointly by UW Emeritus Prof. of Physics Leonard R. Ingersoll; Otto J. Zobel, Bell Telephone Laboratories, Inc., N. Y.; and Alfred C. Ingersoll, California Institute of Technology, has a second purpose —that of being of practical use to engineers, geologists, and geographers.

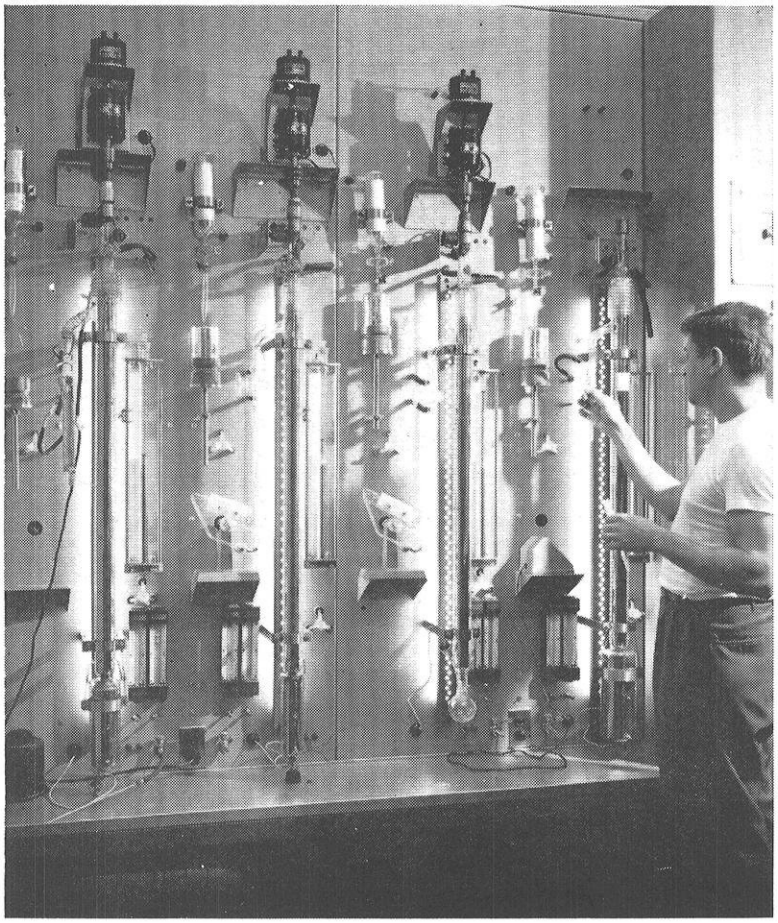
Say the authors:

"The geologist and geographer are interested in a new tool which will help them in explaining many thermal phenomena and in establishing certain time scales. The engineer . . . has developed many useful tables and curves for the solution of more general cases and is interested in finding still other methods of attack."

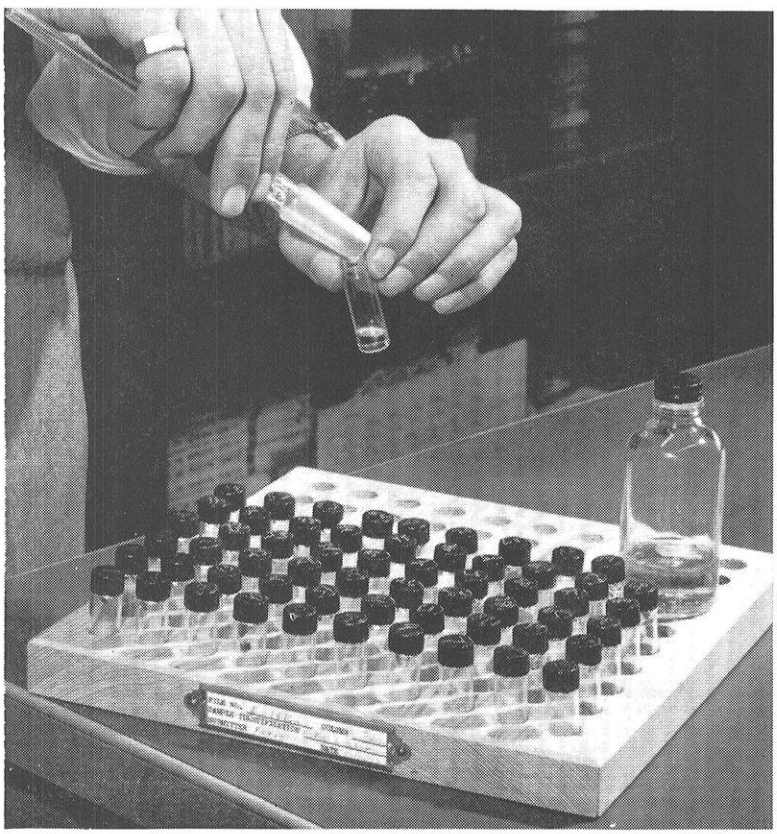
A feature of particular importance to those whose interests are largely on the practical side is the discussion of auxiliary graphical and other approximation methods by which many practical heat conduction problems may be solved with only the simplest mathematics.

Successor to an Ingersoll-Zobel text of some years ago, "Heat Conduction" is available over the nation's book counters at $5 per copy.

END



A laboratory assistant (above) takes a fraction from one of the new miniature stills at Standard Oil's Whiting laboratories. The small charge in the large bottle (below) can be separated into 60 fractions in these exact stills.



NEW MINIATURE STILLS

Valuable Laboratory Aids

Some stills in oil refineries are gigantic devices which process 30,000 barrels of petroleum a day. Others are so small—and so exact—that they may take more than a week to distill five ounces of liquid.

Scientists at Standard Oil's Whiting laboratories now are working with eight new miniature stills so precise they are considered the finest of their type in the world. These stills, installed last year, are used to study liquids produced during research on such things as aviation gasoline, synthetic lubricants and detergents, plastics and plasticizers, and petrochemicals.

Laboratory men often work with only an ounce of liquid which may be made up of hundreds of different chemical compounds. Technicians usually wind up with individual "fractions" of about 1/50 of an ounce to be examined with mass and infra-red spectrometers, chromatography and other aids.

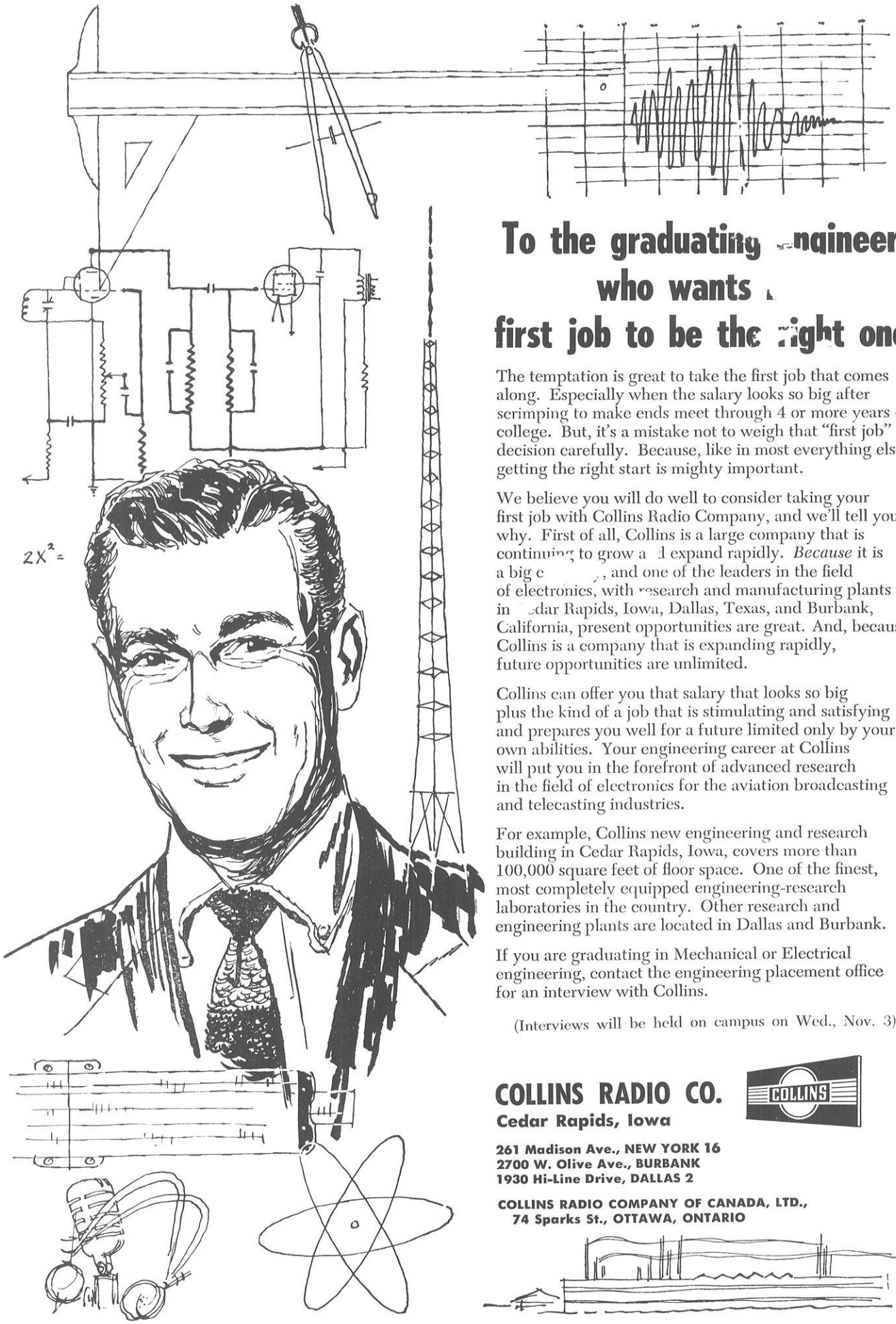
Another new research still at Standard Oil's Whiting laboratories has a packed column one inch in diameter and 16 feet high. It is probably the most efficient packed column ever built.

Such precise up-to-the-minute laboratory equipment helps Standard Oil scientists in their never-ending search for new and better products. And it offers young technical men the assurance that Standard Oil is a sound, progressive place to build a scientific career.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois

STANDARD



To the graduating engineer who wants his first job to be the right one

The temptation is great to take the first job that comes along. Especially when the salary looks so big after scrimping to make ends meet through 4 or more years of college. But, it's a mistake not to weigh that "first job" decision carefully. Because, like in most everything else, getting the right start is mighty important.

We believe you will do well to consider taking your first job with Collins Radio Company, and we'll tell you why. First of all, Collins is a large company that is continuing to grow and expand rapidly. *Because* it is a big company, and one of the leaders in the field of electronics, with research and manufacturing plants in Cedar Rapids, Iowa, Dallas, Texas, and Burbank, California, present opportunities are great. And, because Collins is a company that is expanding rapidly, future opportunities are unlimited.

Collins can offer you that salary that looks so big plus the kind of a job that is stimulating and satisfying and prepares you well for a future limited only by your own abilities. Your engineering career at Collins will put you in the forefront of advanced research in the field of electronics for the aviation broadcasting and telecasting industries.

For example, Collins new engineering and research building in Cedar Rapids, Iowa, covers more than 100,000 square feet of floor space. One of the finest, most completely equipped engineering-research laboratories in the country. Other research and engineering plants are located in Dallas and Burbank.

If you are graduating in Mechanical or Electrical engineering, contact the engineering placement office for an interview with Collins.

(Interviews will be held on campus on Wed., Nov. 3)

COLLINS RADIO CO.
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261 Madison Ave., NEW YORK 16
2700 W. Olive Ave., BURBANK
1930 Hi-Line Drive, DALLAS 2

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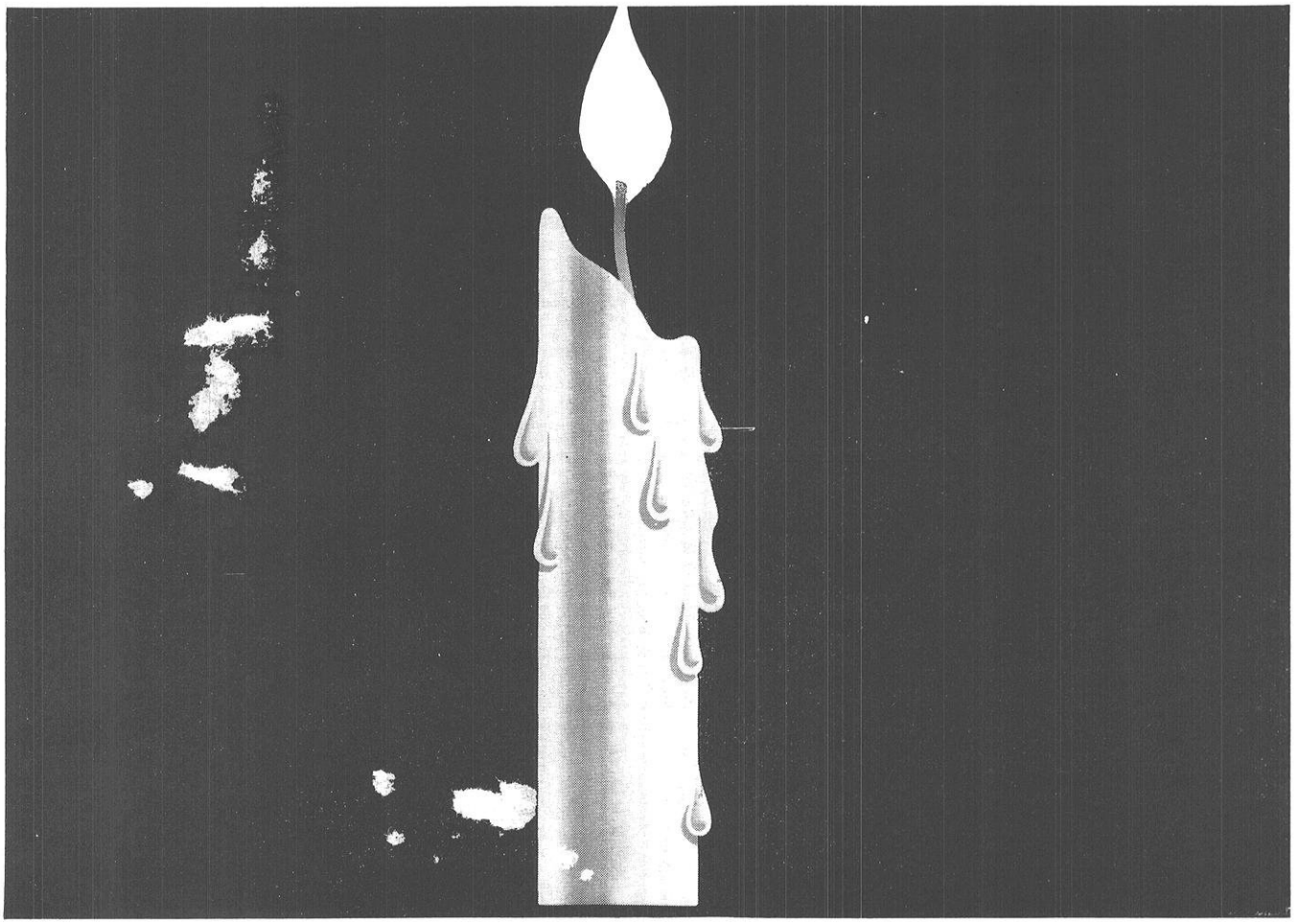

WAX WORKS . . .

Until a few decades ago, the principal users of wax were the candlestick makers. Today's diversified demands for wax put it in the class of modern industrial miracles.

Go into a super-market . . . see how wax works in the packaging and protection of milk and dairy products, cereals, bake goods, frozen foods. Think of its use in drug and cosmetic products . . . cups, crayons and carbon paper . . . polishes, preservatives and paper matches . . . And the number of industrial applications defies accurate calculation.

TOO BIG FOR BEES . . .

The ancients knew the physical properties of wax . . . and bees supplied the raw material. What then spurred this century's growth in production to more than a half-million tons a year?

The answer lies partly in the petroleum industry's desire to find more profitable applications for one of its products . . . partly in the desire of other industries to improve their processes and products.

AMERICA WORKS LIKE THAT . . .

Here, industry is paradoxical. It is independent, yet dependent . . . cooperative, yet competitive. It strives to make more money, yet is always seeking ways to keep costs and prices down.

And, to further these aims, management relies on the constant flow of information available through America's all-seeing, all-hearing and reporting Inter-Communications System.

THE AMERICAN INTER-COM SYSTEM . . .

Complete communication is the function, the unique contribution of the American business press . . . a great group of specially edited magazines devoted to the specialized work areas of men who want to manage better, research better, sell better, buy better.

COMMUNICATION IS OUR BUSINESS . . .

Many of the textbooks in which you are now studying the fundamentals of your specialty bear the McGraw-Hill imprint. For McGraw-Hill is the world's largest publisher of scientific and technical works.

After you leave school, you will want to keep abreast of developments in your chosen profession. Then one of McGraw-Hill's many business magazines will provide current information that will help you in your job.

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HEADQUARTERS FOR TECHNICAL AND BUSINESS INFORMATION

McGRAW-HILL FOR BUSINESS

Automobile Tests

(Continued from page 25)

been drawn. Lights in the room are turned out except for two headlight bulbs mounted inside the car in the position normally occupied by the dirver's eyes. Light rays spread out in all directions showing on the grid-work screen what is visible to the eyes of the driver.

Comfort Tests

Tests which indicate the degree of comfort to the driver and occupants of a car follow.

Center of Gravity Test. The location of the center of a car affects its riding qualities and ease of steering. The center of gravity is found by using physical laws discovered by Galileo. The car is placed on a large swing and the swing is set in motion. A photo-electric cell hooked up to an electronic-stop watch, called a "Chronograph", automatically times the rhythm of swing. The same procedure is repeated on a smaller swing. Data from these tests indicate the location of the center of gravity above the floor of the swing which is assumed to be the floor of the road.

Wheel Turning Test. The steering ease of a car is tested by driving the car along a tortuous curving path painted on the skid pad. A special steering wheel is used, mounted on the regular one. A dial on the special steering wheel registers in ft.-lbs. the amount of effort that is exerted in guiding the car.

Sound and Vibration Tests. Sensitive microphones, magnetic-tape recorders, oscillographs and vibration indicators are used to track down annoying vibration or noise to their source. For example, in one test, a car is towed with its rear wheels off the ground, so that microphones can pick up road noises from the front wheels only and transmit them to recording apparatus in a following car.

Dimension Test. There are many body dimensions of a car which are important from the standpoint of passenger comfort. The horizontal dimensions are measured with a telescope mounted on a horizontal rail. A point is sighted on a car placed parallel to the rail, and the telescope is then moved to a second position. A dial on the telescope shows precisely how far the telescope was moved. For height measurements a hydro-gage is used which works on the principle that liquids seek their own level. One end of a rubber hose containing liquid can be moved to any height position on the car. The other end of the hose is connected to a glass tube mounted on a wall. The level of the liquid in the tube and a scale alongside the tube indicate the height.

Power Tests

To evaluate the power of a car the following tests are conducted.

Hill Climbing Tests. The power of a car may be expressed in various ways; one is to give it in terms of its hill climbing ability. In these tests the car starts at the bottom of the hill with a speed of 10 mph. The accelerator is then pushed to the floor and held there until the top of the hill is reached. The speed of the car indicates its power. To understand how well an engine stands up under the laboring load of full throttle operation on long continuous hills, a mechanical mountain is used. This is a vehicle equipped with a special electric brake which can be adjusted to impose any amount of drag on a towing car.

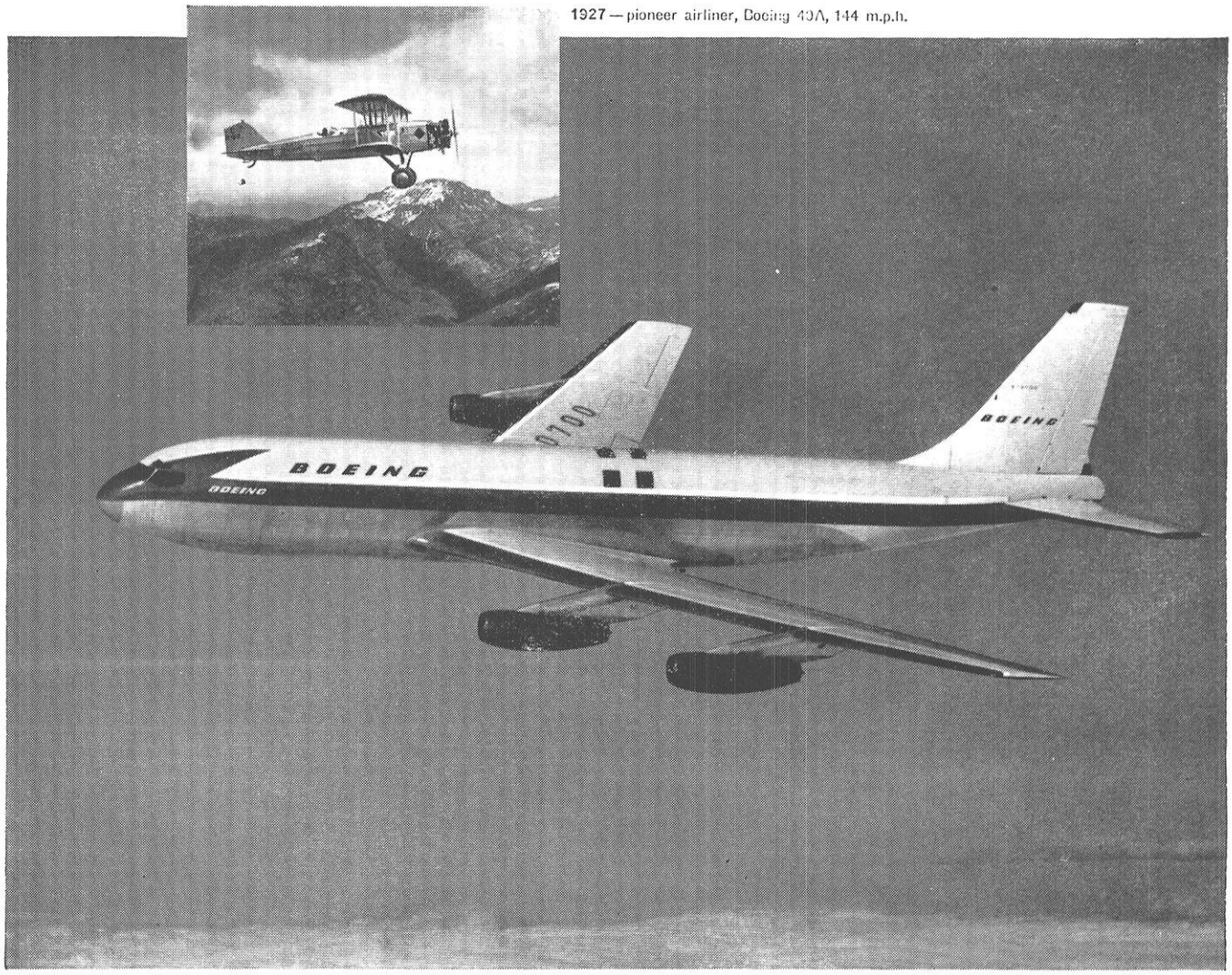
Compression Test. The power of a car can be expressed in terms of its compression ratio, which is a ratio of the volume of the fuel charge before and after compression. To determine the volume of a cylinder coated with carbon, a special device is used. A fitting is screwed into the spark plug hole and an air hose furnished with a whistle is connected to it. When the engine is operated on the other cylinders, air is forced through the whistle and its tone is converted into a visual pattern on an oscilloscope. The pattern indicates the volume of the cylinder.

Fuel Test. An engine must have good high-octane fuel to develop its full power. The octane rating of the fuel also has an important bearing in determining the exact instant at which the spark plug should fire. To determine what the spark timing should be for a given fuel, a car is used in which the ignition system can be controlled from inside. When the driver pushes the accelerator down to the floor-board for maximum pick-up, a test engineer adjusts the spark timing until the engine is the quietest. That setting is then best for the fuel used.

Endurance Test

Periodically, a group of cars is taken on an almost continuous 25,000 mile durability run. They are all driven the same number of miles over each of the roads at the proving ground. Only at meal time, or for an infrequent stop for gas, does the car come to a halt for a brief respite. Special fuel pumps print on a card the exact quantity of fuel delivered so that an accurate record is kept of fuel consumption. At the end of the test, each car is taken into a garage and dissembled. The hundreds of parts are tagged and laid out on long tables. Then, company engineers come to see how their products stood up under actual operating conditions. With a complete case history on each car, engineers are given a preview of the mechanical condition of a car after about two years of service by the average owner. This advance knowledge assists the design engineers in perfecting cars before they are delivered to customers. **END**

The source of this material is, "The Big Road Test," a General Motors publication.



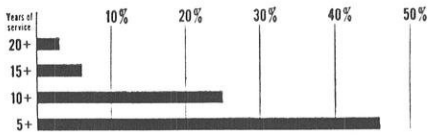
Two trail-blazing transports . . . both Boeings

America's pioneer transcontinental airline passenger plane, the 40A of 1927, was a Boeing. Today, America's first jet transport is another Boeing, the 707. This quarter-century of commercial design leadership is paralleled by military design leadership ranging from the old B-9 bomber to the fighter-fast Boeing B-47 and B-52 jet bombers of today.

For 38 years Boeing engineers have blazed exciting new trails in design, research and production. They're blazing them today in jet aircraft, guided missiles, and research in supersonic flight and the application of nuclear power to aircraft.

If such new-horizon engineering appeals to you, Boeing offers a rewarding career, whether you are in civil, mechanical, electrical or aeronautical engineering, or a related field. Boeing is expanding steadily, and employs more engineers today than even at the peak of World War II. Boeing also promotes from within, and holds regular merit reviews to give you individual recognition.

At Boeing you'll find an unusual range of opportunity, from applied research to production design, from work with new materials and techniques to contacts with a cross-section of industry through the company's vast subcontracting program. Boeing employs draftsmen and engineering aides to handle much routine work, thus freeing engineers for more stimulating assignments.



Boeing engineers enjoy stable careers —46% having been with Boeing for 5 years or more; 25% for 10, and 6% for 15. Many engineers have been here 25 years, and 7 have been with Boeing for 30.

Boeing helps engineers continue their graduate studies, and reimburses them for tuition expenses.

For further Boeing career information, consult your Placement Office, or write:

JOHN C. SANDERS, Staff Engineer—Personnel
Boeing Airplane Company, Seattle 14, Wash.

BOEING

SEATTLE, WASHINGTON WICHITA, KANSAS

Science Highlights

(Continued from page 37)

Each of these layers contains germanium mixed with a trace of gallium. They are separated by thicker regions of germanium containing minute amounts of antimony.

One section of the "gallium-doped" layer in each transistor does the work of the grid in a vacuum tube, Dr. Hall explained. The "antimony-doped" layers take the place of the cathode and plate in a tube.

Using the new method, several thousand transistors can be produced from each ingot. The method will improve transistor performance and is expected to cut production costs. As a result, the new technique may permit the use of transistors for the first time in television sets.

Among disadvantages in the use of these tiny devices are their high cost and poor performance at high frequencies and at high temperatures.

Transistors are expected to make possible the construction of equipment ranging from tinier hearing aids to small-size "electric brain" machines that now take up an entire room. Transistors as small as grains of rise also are expected to replace many vacuum tubes in telephone, telegraph and other communications equipment.

Other salient facts pointed out by Dr. Hall:

Transistors are expected to have a life expectancy at least 10 times that of tubes.

Transistors can operate on about one-millionth of a watt, but tubes require much higher power, about one watt, simply to heat the filament to the proper temperature.

Tubes are complicated devices of glass and wire, while transistors require only a chip of germanium about 40-thousandths of an inch square, insulating material and 3 wires. Transistors can withstand shocks many times greater than those that shatter vacuum tubes.

SINGLE CHAMBER HEAT TREATING FURNACE

A car-type heat treating furnace in which a modest one-story bungalow could fit easily has been built by the Westinghouse Electric Corporation.

The furnace will be used for the stress relieving of large weldments. With a fully usable charge space 30-feet long, 18-feet wide and 16-feet high, single or multiple parts weighing up to 100 tons may be treated at one time.

The furnace was designed for a maximum operating temperature of 1600 degrees F. but stress relieving will be performed at approximately 1175 degrees F.

The front door of the furnace, as well as the floor, rides on 20 car wheels on four parallel railroad type tracks.

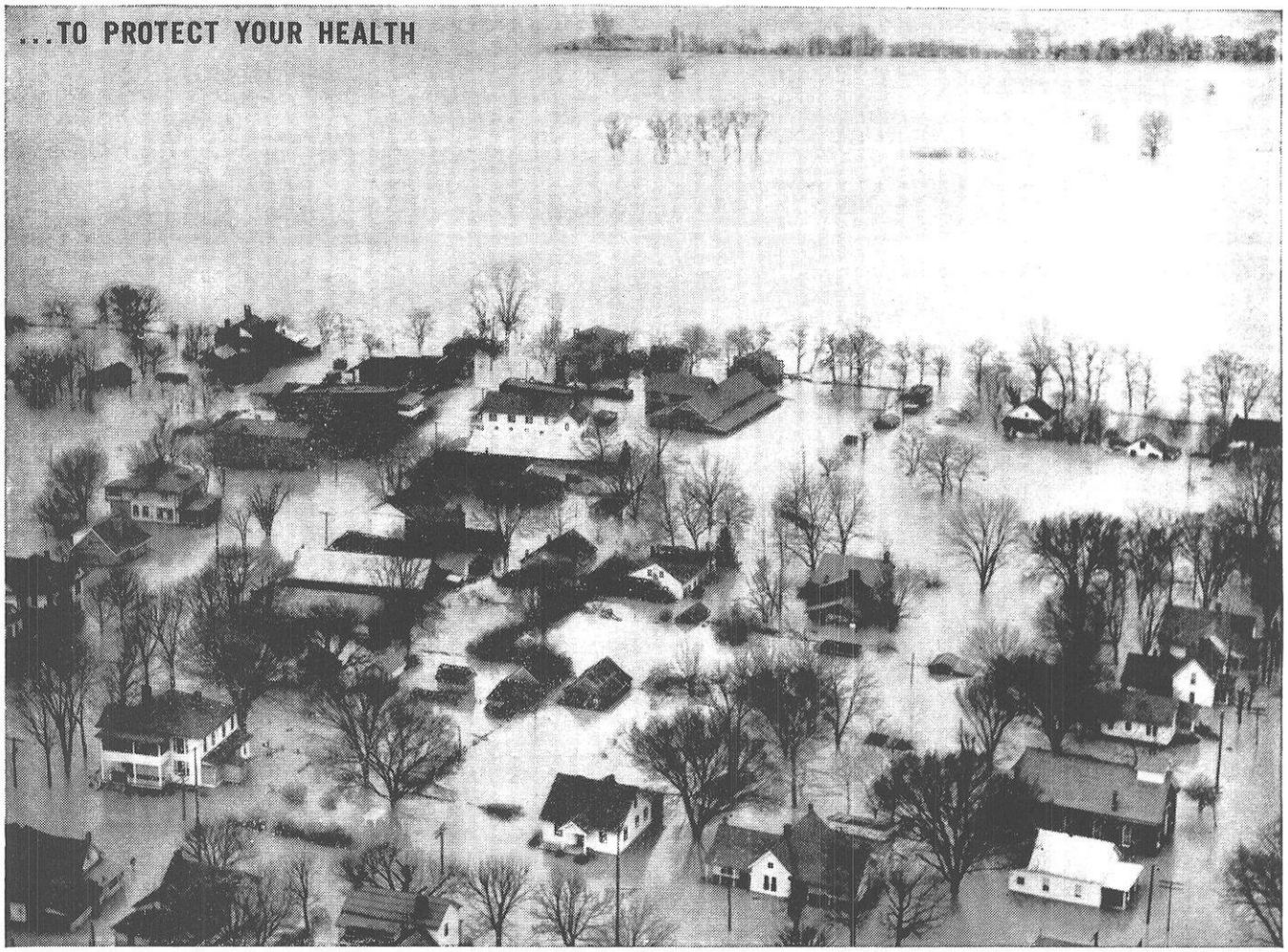
Near the top and behind the furnace chamber itself, a refractory-lined combustion chamber is mounted into which four burners with a rating of 7 million Btu's per hour will fire.

The air passing through the combustion chamber is heated by the burning of gas, and enters the furnace from the rear through ducts suspended from the ceiling. This duct work distributes the heated air through various side openings as it travels toward the front, assuring uniform heating throughout the charge space.

To complete the cycle, air is drawn out of the furnace through two recirculating blowers having a total circulating rate of 120,000 cubic feet per minute. Duct work then directs the air flow upward to the combustion chamber and thence into the furnace chamber again. Each recirculating fan is powered by a 50 hp. motor.

This method of firing and the use of internal duct work prevent hot spots within the charge space and eliminate the need for overhead space above the furnace roof.

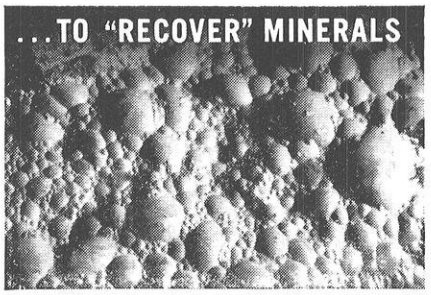
A program control is provided to automatically regulate the cycle of heat-up, soak and cool-back to handling temperatures. A damper control is provided so that outside air can be admitted close to the blowers to hasten cooling near the end of the cooling cycle. **END**



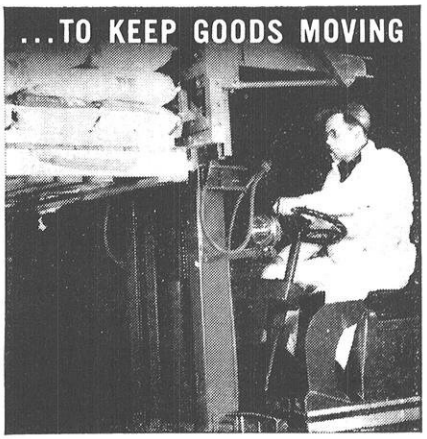
WHEN FLOODS COME, the threat to health from polluted waters is minimized by using pine oil disinfectants in clean-up operations. Pine oil disinfectants have long been recognized for their high germicidal action and good cleansing qualities. Economical to use, and possessing a pleasant fragrance, disinfectants, cleaning compounds, and soaps made with Hercules® Pine Oil are widely used in industry and the home.

HOW HERCULES HELPS...

Most businesses are helped today by Hercules' business ...the production of synthetic resins, cellulose products, chemical cotton, terpene chemicals, rosin and rosin derivatives, chlorinated products, and many other chemical processing materials—as well as explosives. Through close cooperative research with its customers, Hercules has helped improve the processing or performance of many industrial and consumer products.



THE FLOTATION PROCESS is used extensively in industry to separate fine particles of valuable minerals, ranging from coal to gold, from less useful materials by floating to the surface and removing in a froth formed by air bubbles. Hercules flotation agents, Yarmor® Pine Oil, Rosin Amine D Acetate, and others, serve as frothers or collectors in this job.



DESIGNED TO PROTECT industrial equipment, from the time it leaves the factory, lacquer is outstanding. When necessary, re-finishing can be done quickly and economically because of lacquer's fast-drying, fast-taping properties. As a major supplier of nitrocellulose to lacquer manufacturers, Hercules has available a wealth of technical information on lacquer and its many uses.

G54-9

HERCULES

HERCULES POWDER COMPANY
INCORPORATED
Wilmington 99, Delaware
Sales Offices in Principal Cities

W.S.P.E.

(Continued from page 19)

SPEAKERS' BUREAU

1. Function—Have a list of good *interesting* speakers who may be available to address civic organizations and other public meetings.

2. How to find speakers in your chapter: In addition to chapter officers and members known to you as lively and interesting speakers, scan your chapter membership list with special consideration of the following groups:

Public Officials
Members of College Faculties
Consulting Engineers
Industrial Engineers and Executives

3. Make your speakers' bureau known.

Notify all local civic and professional organizations that you have available qualified speakers during Engineers' Week. Such notification should be made in September, when organizations formulate their programs. It should be followed up in December or early January.

Do not forget to include the following organizations in your mailing list:

Chamber of Commerce
Civic Organization: Rotary, Lions, Kiwanis, etc.
Fraternal Organization: Elks, Moose, Masonic Lodges, Knights of Columbus, etc.
Service Organization: American Legion, Veterans of Foreign Wars, Red Cross, etc.
Men's Clubs: Local Churches and Temples, University Clubs, Alumni Clubs.
Women's Organizations: Woman's Club, League of Women Voters, Garden Clubs, etc.
School Organization: P.T.A. of each School, Student Organizations.
Professional Organizations: Engineering, Medical, Law, Accountants, Press.

State Highway Commission Officers

The State Highway Commission of Wisconsin today named its future District Engineers for five of its ten districts to replace men who will retire this year.

At Lancaster, where Thomas W. Reilly (SW chapter) has been District Engineer since 1921, Elroy H. Hinkely (SW chapter) presently Assistant District Engineer, has been named for the post.

Thomas M. Reynolds (W chapter) at La Crosse who has been a District Engineer longer than any other man in the state, will give up the position he has held since January 1, 1920 to Vere L. Fiedler (SW chapter) Assistant Engineer of Maintenance, of Madison.

William F. Baumgartner (NW chapter) at Eau Claire, District Engineer since 1925, will be replaced by Edwin R. Holm (NW chapter), his Assistant District Engineer since 1941.

Garth I. Germond at Superior, District Engineer since 1929, will be succeeded by Richard C. Clark (W chapter) of La Crosse, who has served there as Assistant District Engineer since Sept. 1926.

Steven A. Koszarek at Rhinelander, District Engineer since 1931, will turn over the post to his assistant, Henry Winat.

Chairman Harold L. Plummer, in announcing the Commission's designations, reported that the assignments were on the basis of written and oral promotional examinations conducted by the Bureau of Personnel and open to Commission engineers of grade IV or above who hold Wisconsin registration as Professional Engineers.

District Engineer carries with it the civil service rank of Engineer VI, with salary range (including cost-of-living bonus) of $8200 to $9900 per year.

There are nine district offices in the state, plus a Milwaukee Metropolitan District. No change is involved in the District Engineer positions at Madison, Green Bay, and Wisconsin Rapids.

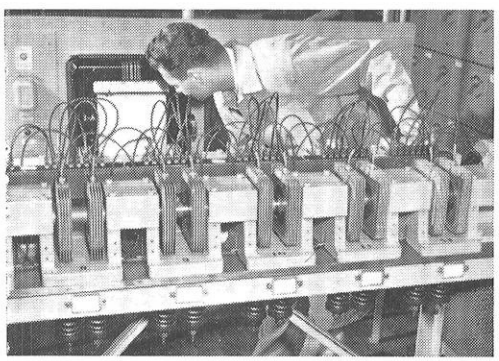
The new assignments are the second of this nature this year. On July first, Wesley J. Burmeister (SW chapter) was named District Engineer out of Milwaukee and Edgar G. Plautz (M chapter) as Milwaukee Metropolitan District Engineer. END

ARCHIMEDES DISCOVERS THE RULE OF TUB!

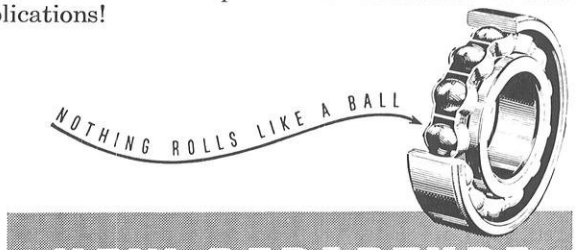
Apparently no one told Archimedes he had filled his tub too full. The results were damp but—Eureka!—led to a great discovery . . . the Law of Specific Gravity.

Research today is a little different. At New Departure, for example, we have 28,000 square feet of floor space devoted to product engineering laboratories. Here, we determine fatigue and friction characteristics of materials . . . test bearings under actual operating conditions . . . develop new designs . . . study bearing lubrication . . . conduct hundreds of research experiments for specific customer installations.

Such facilities are one of the many reasons why engineers and designers *call on New Departure* for assistance in **ball** bearing applications!



Research at New Departure has been responsible for development of such devices as the Rockwell hardness tester and many forms of precision grinding and gauging equipment . . . such advances as the preloaded angular contact double row ball bearing and the self-sealed, lubricated-for-life ball bearing.



NEW DEPARTURE
BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT

STATIC

by I. R. Drops

HOW TO STAY IN COLLEGE

1. Bring the professor newspaper clippings dealings with his subject. Demonstrates fiery interest and gives him timely items to mention to the class. If you can't find clippings dealing with his subject, bring in any clipping. He thinks everything deals with his subject.

2. Look alert. Take notes eagerly. If you look at your watch, don't stare at it unbelievingly and shake it.

3. Nod frequently, and murmer, "How true." To you, this seems exaggerated. To him, it's quite objective.

4. Sit in front, near him. (Applies only if you intend to stay awake). If you're going to all the trouble of making him aware of you, you might as well give a good impression, especially if you are in a large class.

5. Laugh at his jokes. You can tell. If he looks like he is smiling, and he looks up from his notes, he has told a joke.

6. Ask for outside reading. You don't have to read it, just ask.

7. If you must sleep, arrange to be called at the end of the hour. It creates an unfavorable impression if the rest of the class has left and you sit there alone, dozing.

8. Be sure the book you read during the lecture looks like the book from the class. If you do math in chemistry class match the books for size and color.

9. Ask any questions you can think of which he might be able to answer. Conversely, avoid announcing that you have found the answer to a question he couldn't answer, and in your younger brother's second grade reader, at that.

10. Call attention to his writing. Produces and promotes an extremely pleasant feeling connected with you. If you know he's written a book, or an article, ask in class if he wrote it.

If you want to study, in addition to the other things mentioned above, it is up to you, and somewhat controversial at that.

* * *

Drunk in phone booth: "Number, hell! I want my peanuts."

* * *

I think that I shall never see
A girl refuse a meal that's free;
A girl with hungry eyes not fixed
Upon the drink that's being mixed;
A girl who doesn't like to wear
A lot of junk to match her hair;
But girls are loved by guys like me
'Cause I don't like to kiss a tree.

* * *

An enemy, I know, to all
Is wicked, wicked alcohol.
The Good Book, though, commanded me
To learn to love my enemy.

* * *

Then there was the Chemical Engineer who died from drinking shellac. The boys all agreed that he had a fine finish.

* * *

A local preacher has recently announced that there are 726 sins.

He is being besieged with requests for the list, mostly from ILS students who think they are missing something.

* * *

Student: "Could you help me with this problem?"

Professor: "I could, but I don't think it would be quite right."

Student: "Well, take a shot at it anyway."

M E: "What did you do with my shirt?"

Wife: "I sent it to the laundry. Why?"

M E: "Ye gods, woman! A whole semester of thermo was on the cuffs."

* * *

Marriage is an educational institution in which a man loses his bachelor's degree without acquiring a master's.

* * *

"When my girl isn't thirsty or hungry . . . she's asleep."

* * *

The Engineer is a great "magazine"(?)
The College gets all of the "fame." (?)
The printer gets most of the money,
The staff gets all of the blame.

* * *

She: "My dad is an engineer. He takes things apart to see why they won't go."

He: "So what?"

She: "You'd better go."

* * *

D. U.: Hey, don't spit on the floor.

Pledge: 'Smatter, does it leak?

* * *

One instructor's philosophy: "Why be difficult when with a little effort, you can be impossible?"

* * *

A quartet is where all four think the other three can't sing.

* * *

Senior: "Gee, but I'm thirsty."

Freshman: "Wait a minute, I'll get you some water."

Senior: "I said I'm thirsty not dirty."

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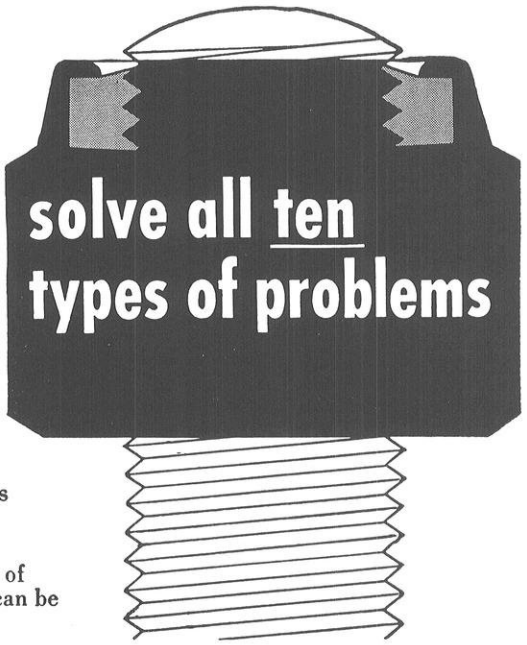
elastic stop nuts solve all ten types of problems

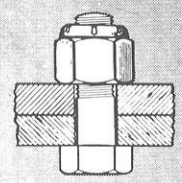


Here are ten typical fastening problems. One device, the ELASTIC STOP nut, solves them all—without additional parts or operations. Deliberately undersized in relation to bolt diameter, the red elastic collar grips the bolt with a perfect fit, exerting a continuing self-locking pressure against the threads, and holding the nut securely in place at any point on the bolt. It also provides a tight seal against the bolt threads, which prevents seepage and wear-producing axial play. And because the bolt threads are protected against moisture from without, the nuts are not "frozen" to the bolt by corrosion.

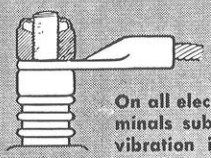
ELASTIC STOP nuts stay tight, right where you put them, in spite of vibration and stress reversals. Yet they are not jammed in place, and can be removed with a wrench and reused many times.

For further information on ESNA self-locking fasteners, mail the coupon below.

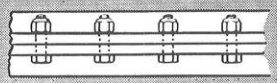
TIGHTENED AGAINST THE WORK



Wherever a vibration or impact proof bolted connection is desired.

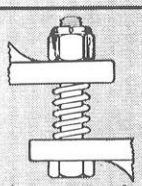


On all electrical terminals subjected to vibration in transit or operation.

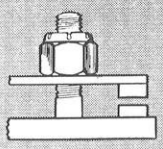


For uniform and precise prestressing of multiple bolt assemblies . . . adjusted by predetermined wrench torques.

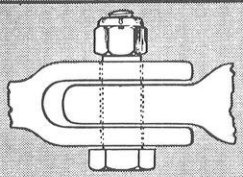
LOCATED ANYWHERE ON THE BOLT



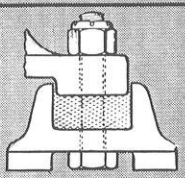
Spring-mounted connections or dynamic balancing, where nut must stay put yet be easily adjusted.



On make-and-break adjustment studs where accurate contact gaps are required.

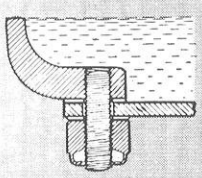


For bolted connections requiring predetermined play.

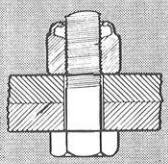


For rubber-insulated and cushion mountings where the nut must not work up or down.

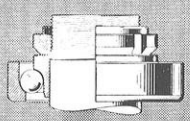
FOR MANY SPECIAL APPLICATIONS



To seal bolt threads where elimination of leakage past stud threads is necessary.



To seal bolt threads where it is necessary to protect them from corroding elements.



To obtain delicate adjustments for applications such as bearing locknuts where precise adjustment is essential.

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2330 Vauxhall Road, Union, New Jersey

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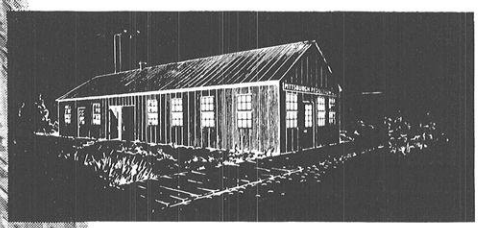
THE ALUMINUM INDUSTRY WAS BORN ON SMALLMAN STREET

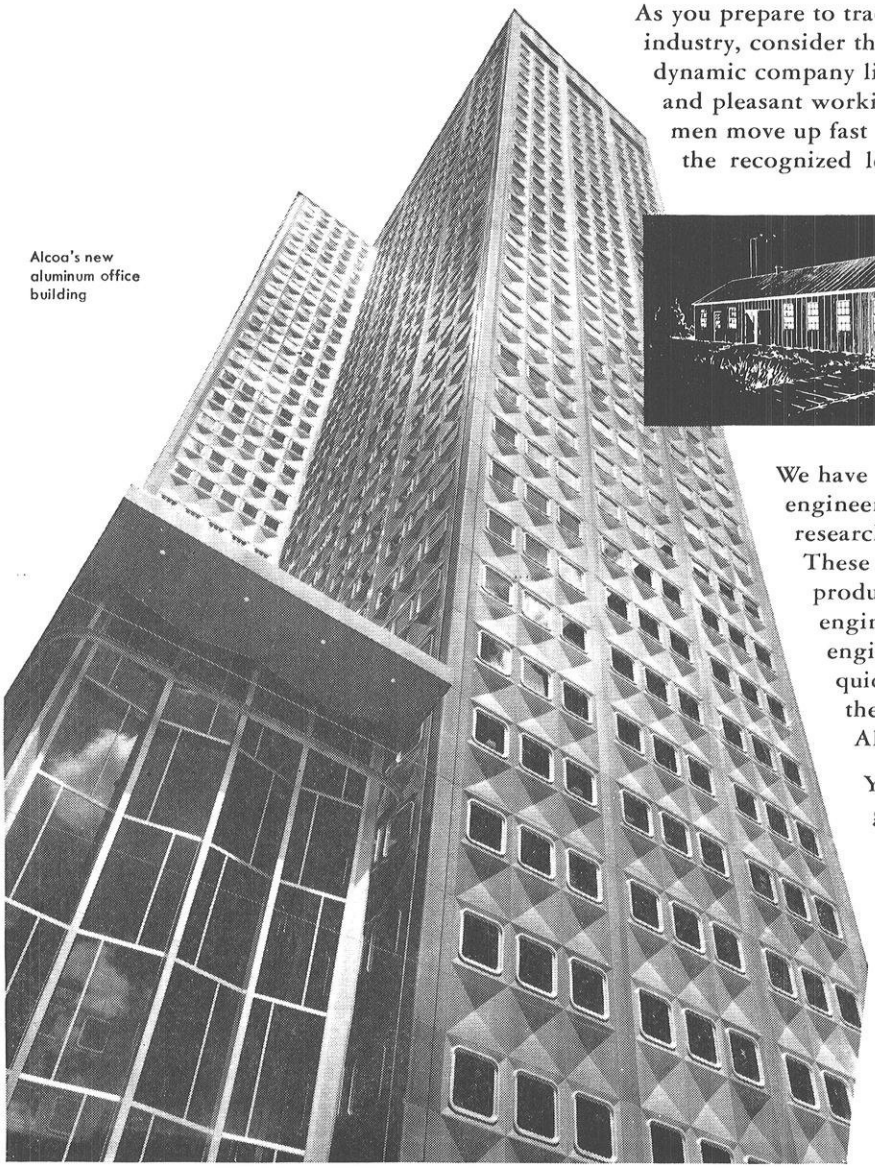
▼ In 1888, the aluminum industry consisted of one company—located in an unimpressive little building on the east side of Pittsburgh. It was called The Pittsburgh Reduction Company. The men of this company had real engineering abilities and viewed the work to be done with an imagineering eye. But they were much more than that. They were pioneers . . . leaders . . . men of vision.

A lot has happened since 1888. The country . . . the company . . . and the industry have grown up. Ten new territories have become states, for one thing. The total industry now employs more than 1,000,000 people—and the little outfit on Smallman Street? Well, it's a lot bigger, too—and the name has been changed to Alcoa. ALUMINUM COMPANY OF AMERICA . . . but it's still the leader—still the place for engineering "firsts".

As you prepare to trade textbooks for a position in industry, consider the advantages of joining a dynamic company like Alcoa—for real job stability and pleasant working conditions—where good men move up fast through their association with the recognized leaders in the aluminum industry.



Alcoa's new aluminum office building



We have fine positions for college graduate engineers—in our plants, sales offices and research laboratories from coast to coast. These are positions of responsibility in production supervision, plant and design engineering, industrial research or sales engineering. Right now it may be quicker than you think from a seat in the classroom to your career with Alcoa. Why not find out?

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Austin Bush, Rensselaer, '50, Helps Develop New Pump

AUSTIN BUSH, inspecting stuffing box assembly on boiler feed pump.

Reports interesting project engineering assignments at Worthington

"Despite its size as the leading manufacturer in its field," says Austin Bush, "I have found Worthington pays considerable attention to the interests of the individual. The company's excellent training program consists of several months of working with the various types of equipment manufactured, augmented by technical lectures, and talks on the organization of the corporation.

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"Opportunities for advancement are good, and pleasant associates make Worthington a fine place to work."

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PHOTOGRAPHY AT WORK—No. 10 in a Kodak Series

Photography took a look

and a harvester got a stronger set of teeth

John Deere engineers, building a new beet harvester, wanted spring-tooth disposal wheels with long life. High-speed movies showed the way.

The disposal wheels on the new John Deere beet harvester moved faster than the eye could see.

So the engineers studied them in action, slowed down by the high-speed motion picture camera. A small difference in design resulted in extra-long life for the spring teeth.

Slowing down fast action is but one way photography helps product design and manufacture. With x-rays it searches out hidden faults in castings, welds, and assemblies. And by photographing cathode ray traces, it discloses the causes of improper operation. These are but a few of the ways photography saves time, reduces error, cuts costs and improves production.

Graduates in the physical sciences and in engineering find photography an increasingly valuable tool in their new occupations. Its expanding use has also created many challenging opportunities at Kodak, especially in the development of large-scale chemical processes and the design of complex precision mechanical-electronic equipment. If you are interested in these opportunities, write to Business & Technical Personnel Dept., Eastman Kodak Company, Rochester 4, N. Y.

Eastman Kodak Company
Rochester 4, N. Y.

With the high-speed motion picture camera, John Deere engineers took pictures of their spring-tooth wheels in action at 3000 a second. Projected at the standard 16 frames a second, the motion was studied, slowed down to almost 1/200 of its actual speed.

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LOOKING AHEAD WITH GENERAL ELECTRIC

In the next 10 years there will be more opportunity in the electrical industry than in all the 75 years since Edison invented his lamp

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Thomas Edison invented his electric light at age 32.

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