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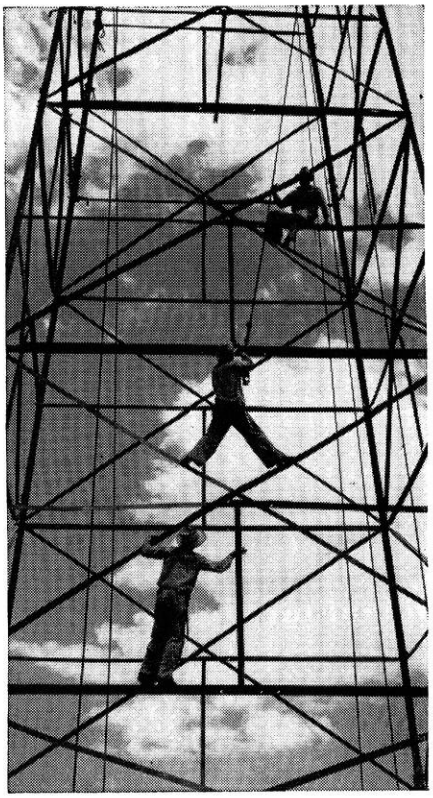
The Wisconsin engineer

May, 1953

25¢

Only STEEL can do so many jobs so well



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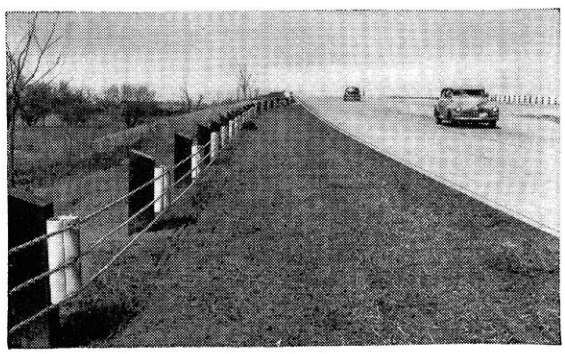

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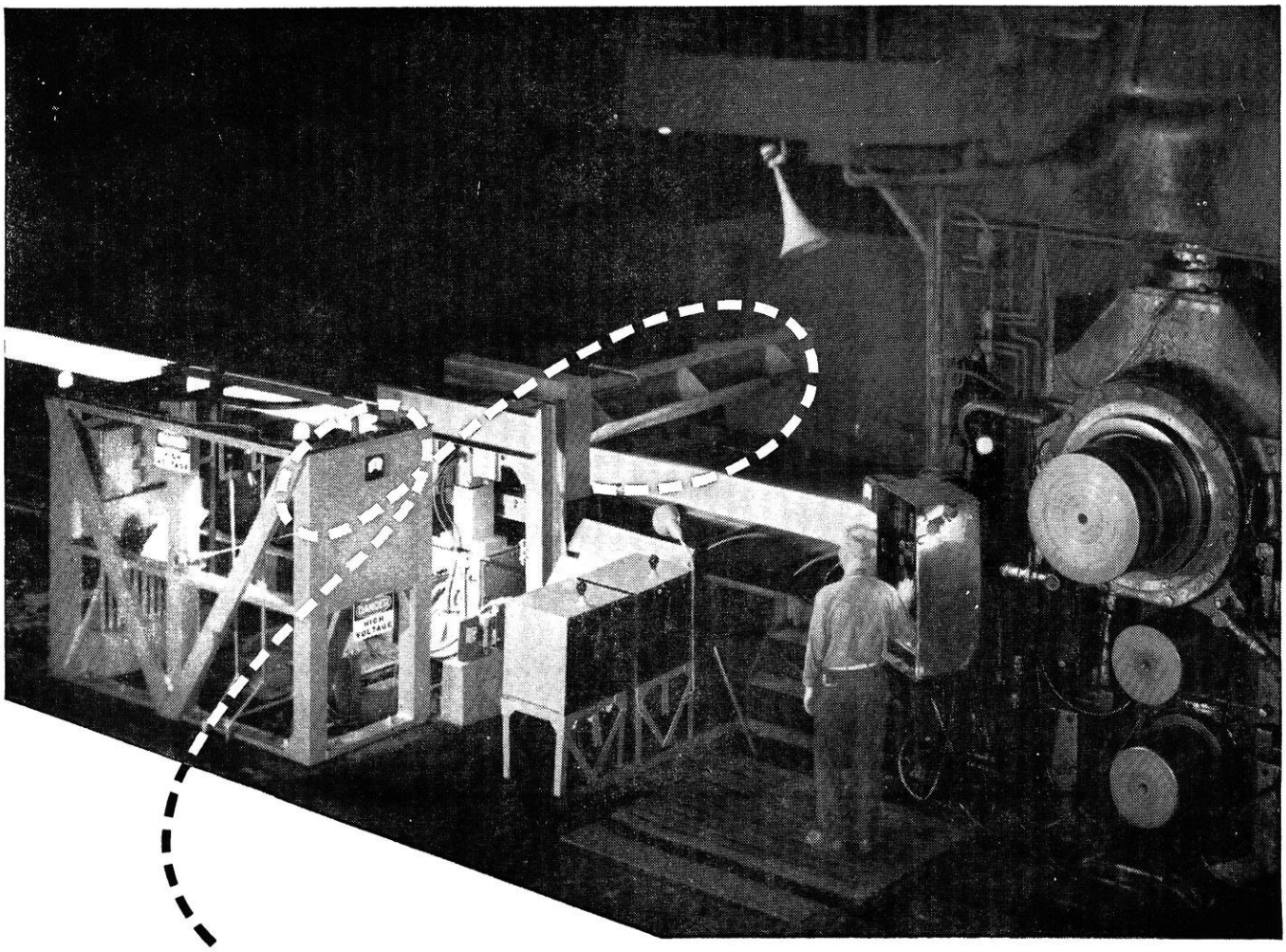

HITCH YOUR CAREER TO A PLACE WITH NEW METHODS

Under that white-hot strip of steel is an X-ray tube. Close above the steel is a specially-designed electronic measuring device.

As the steel strip speeds by at half a mile a minute, a ray beamed up through the steel is automatically measured. The results on a dial before the eyes of the "roller" give him a continuously accurate check on the thickness of the flat-rolled steel down to thousandths of an inch.

Thus, Republic employs modern science to make possible better thickness control of steel sheets and strip.

Perhaps, if you've never worked for a steel manufacturer, or sold a basic material, the import of an X-ray measurement may not raise you to high emotion. But customers know it saves them money because it avoids a lot of reject material. They have more confidence in X-ray-measured steel. They tend to favor the Republic man.

When you become part of an organization, you'll want your company backing you up with new ideas—not just standing behind you.

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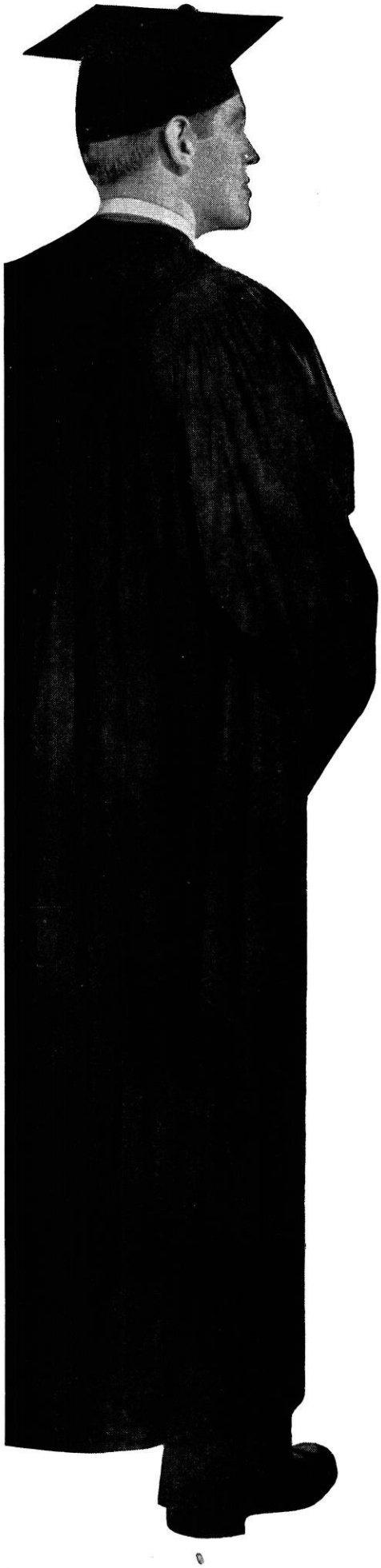

Opportunities Unlimited

for all types of engineers

CHANCES are—if he has what it takes—a young engineering graduate will find at General Motors the career opportunity he's seeking.

And there are sound reasons why.

In the first place, General Motors makes so many different kinds of products, there is need for almost every type of engineering skill. These products range from automobiles and trucks to refrigerators, fractional horsepower motors and Diesel engines. GM defense contracts include shells, bombsights, range finders, tanks and gas turbine engines.

Yet, this great variety of work is widely distributed among GM's 33 manufacturing divisions, its 111 plants in 55 towns and cities throughout the United States. So although each division has its own engineering department, each can count upon the facilities of GM's central research and engineering laboratories.

It's this combination of big-time opportunity and local intimacy that fosters so many notable engineering careers at General Motors. In fact, many of the top positions at GM right now are occupied by engineering school graduates.

Why not think about this, as your time of decision draws near? Your College Placement Office can arrange for an interview with our GM College Representative the next time he visits your campus. Or if you prefer, write direct to us.

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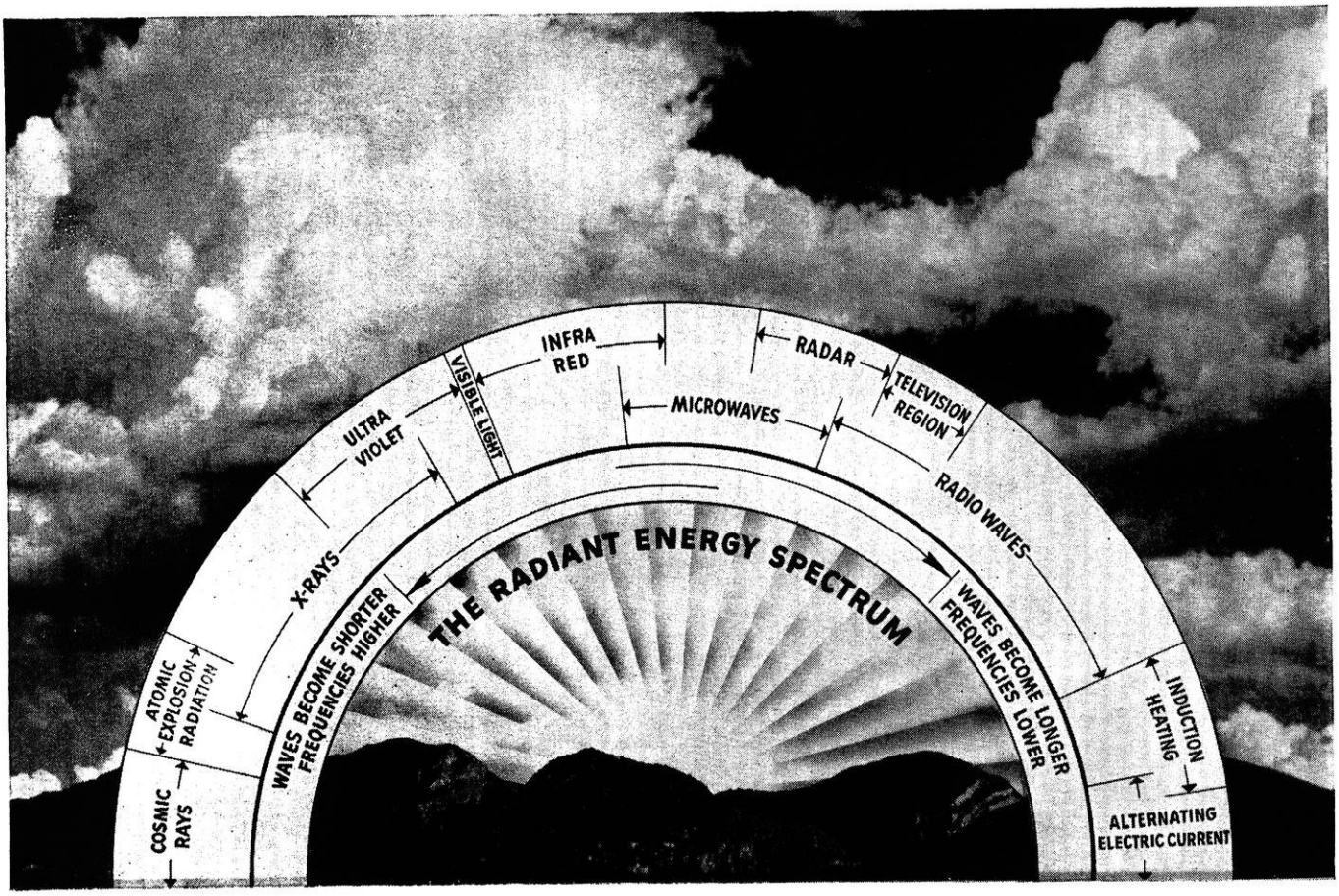
Personnel Staff, Detroit 2, Michigan



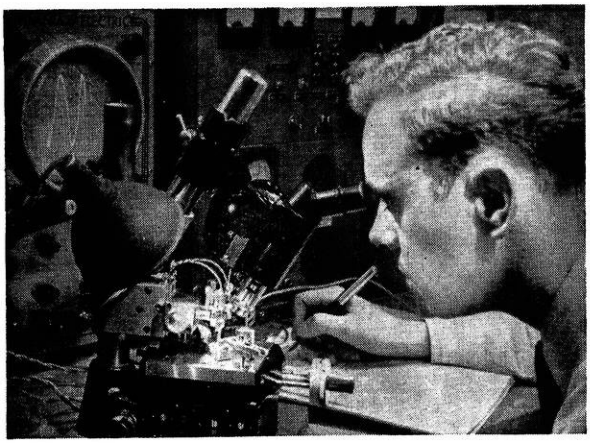
This is our HORIZON

This is the "radiant energy spectrum" — the horizon for the 1600 professional engineers engaged in research and development work at Sylvania's more than a dozen laboratories.

The research and development under way at Sylvania's laboratories reaches, in some way, into virtually every phase of this spectrum. In the broad fields of *lighting, radio, electronics, television,* Sylvania engineers are constantly finding new challenges to stimulate their imagination, new opportunities to further their careers in a steadily growing company.

Sylvania offers college graduates expanding opportunities to build a truly successful and challenging professional career.

For information on Sylvania's program for graduating engineers, see your Placement Office today — or you may write directly to Sylvania's Supervisor of Technical Employment.



A Sylvania scientist uses a micro-manipulator to adjust a transistor.

FREE copies of the Radiant Energy Spectrum, illustrated in greater detail and full color, are available by writing to Dept. "C".

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The Student Engineer's Magazine

WISCONSIN ENGINEER

Founded 1896

Volume 57 **MAY, 1953** *Number 8*

In This Issue . . .

Cover

This is the famous Boeing B-47 for which the Link trainer was built. See article, Link B-47 Simulator, page 22.

Frontispiece

Grand Coulee Dam. *Cut courtesy Westinghouse.*

Articles

Departments

Entered as second class matter September 26, 1910, at the Post Office at Madison, Wisconsin, under the Act of March 3, 1879. Acceptance for mailing at a special rate of postage provided for in Section 1103, Act of Oct. 3, 1917, authorized Oct. 21, 1918.

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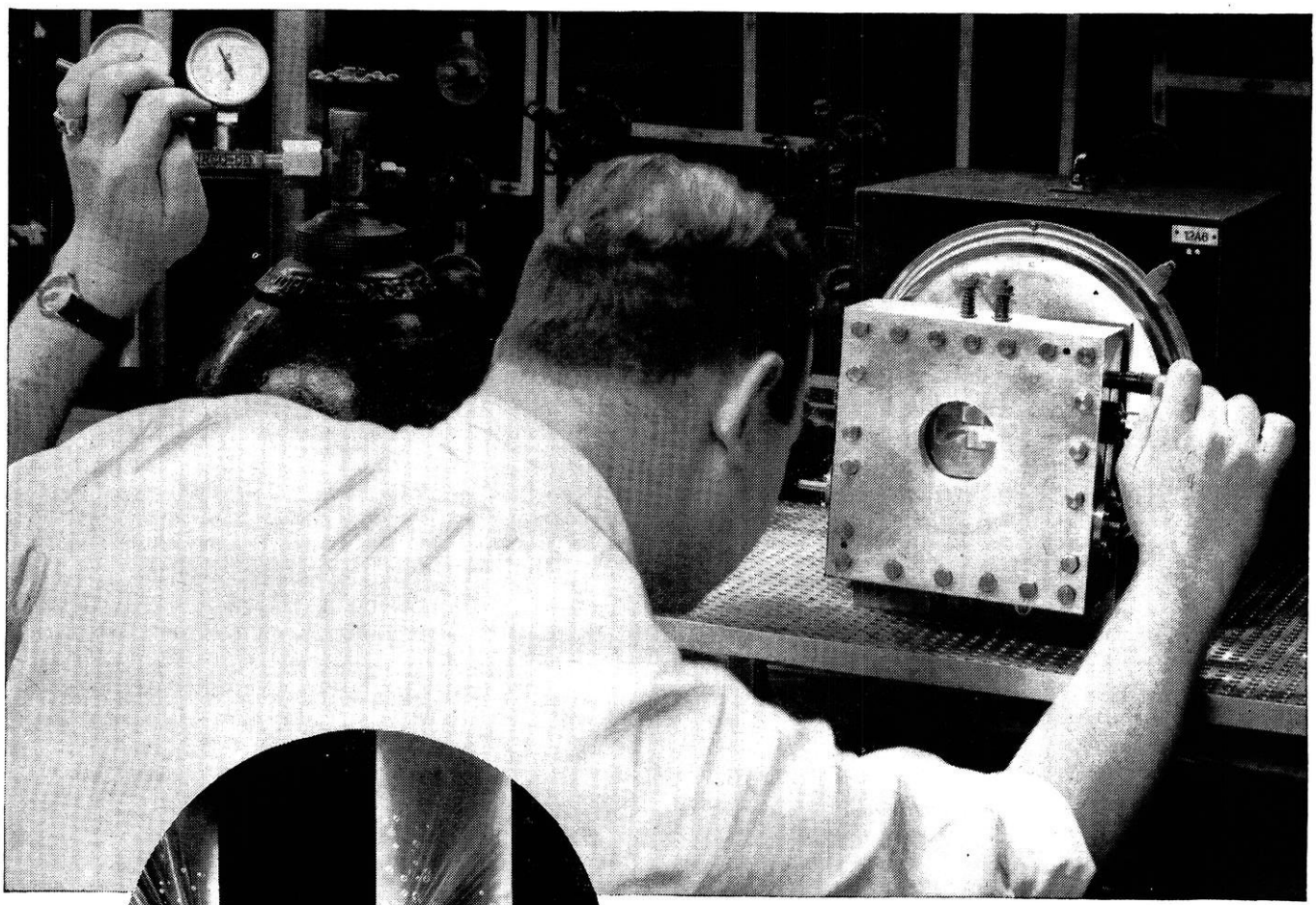
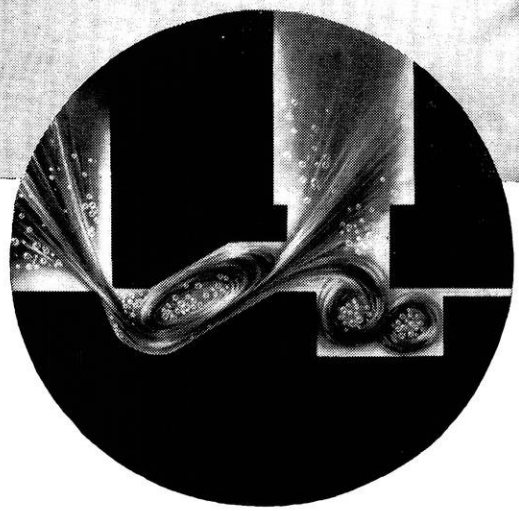


This Sperry engineer is applying the fundamentals of hydraulics to determine oil flow characteristics at high pressure. Here he introduces nitrogen to the hydraulic fluid in a complex valve to make flow patterns visible for study.



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LAST WORDS

As retiring editor, I get one last editorial, even though the work has been done by next year's editor, Jack Binning, and his well-trained staff. I have enjoyed working with the staff this year and know they will continue to increase the quality of the **Wisconsin Engineer.**

My thanks to the staff for their fine cooperation.

My thanks also to the board of directors, and especially to Professor Kommers who helped me immeasurably during the early months of the year.

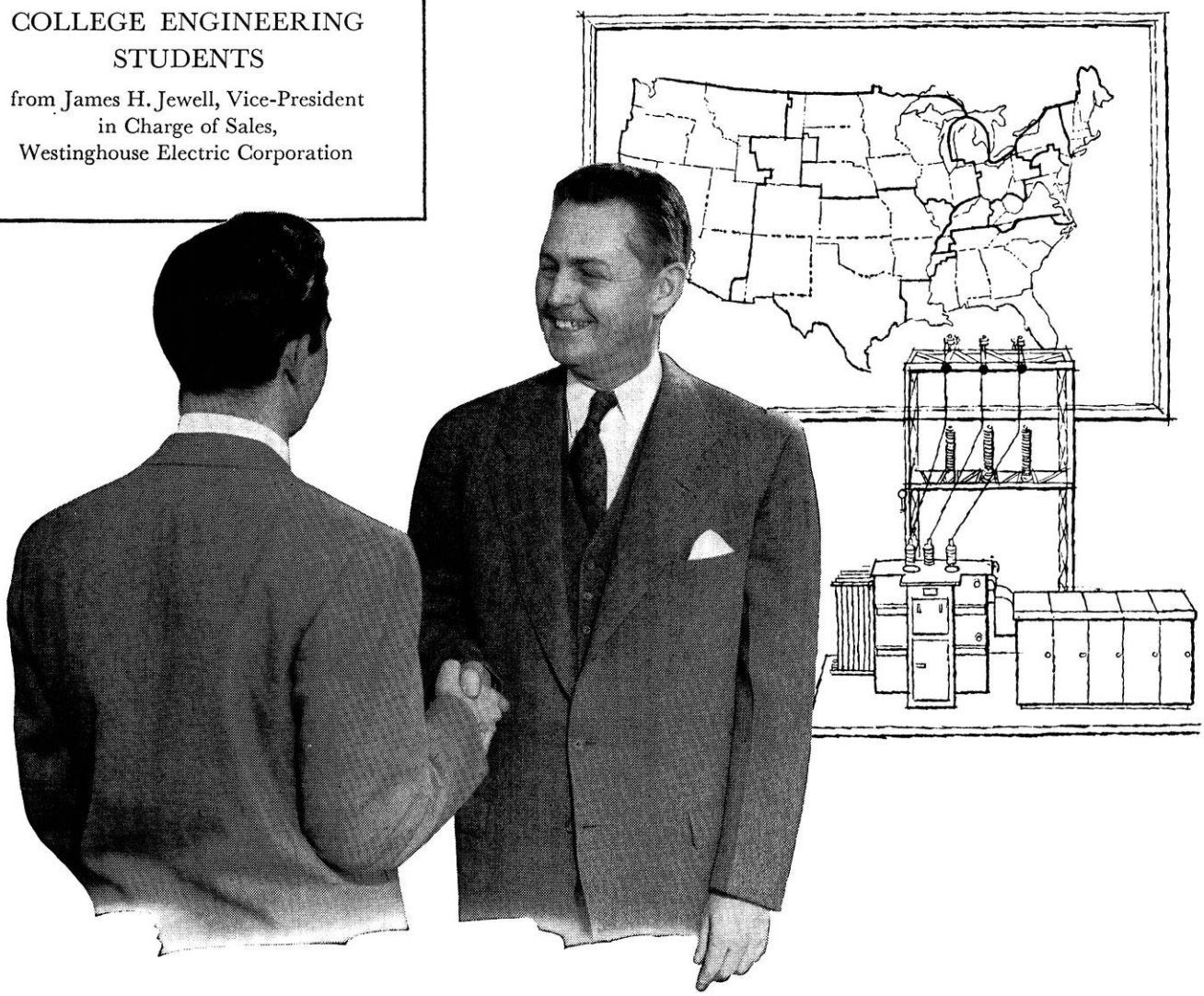
To the subscribers to our magazine and to our advertisers, may I say thank you for your support. Without you we would be non-existent.

To all my fellow seniors—best of luck and may our paths cross again, soon.

R. A. L.

A MESSAGE TO
COLLEGE ENGINEERING
STUDENTS

from James H. Jewell, Vice-President
in Charge of Sales,
Westinghouse Electric Corporation



To the young engineer with an eye on sales

Let's agree that engineering is not always to be bounded by the quiet of the research laboratory or the roar of production machinery. Some of us like to meet people, to talk with them, to sell them on our ideas. That's why many young college men, like you, are choosing careers in sales engineering.

The sales engineer is a key man at Westinghouse—an important man in our future. Our products are essential to the defense and development of our country, and applying them to the needs of industry and the military requires men who are technically trained.

Westinghouse is a diversified company. Our products cover a wide range, including equipment for generation and utilization of electrical energy, aviation gas turbines, plastics and atomic power. Westinghouse is a growing company. Our expansion program has greatly increased our productive capacity to meet the growing needs of our nation. And here at Westinghouse, you are given every opportunity for personal development. Well-planned orientation and training, and programs for continued education and management development are integral parts of the Westinghouse plan. Yes, if your eye is on a sales career, you'll find the kind of opportunity you want at Westinghouse.

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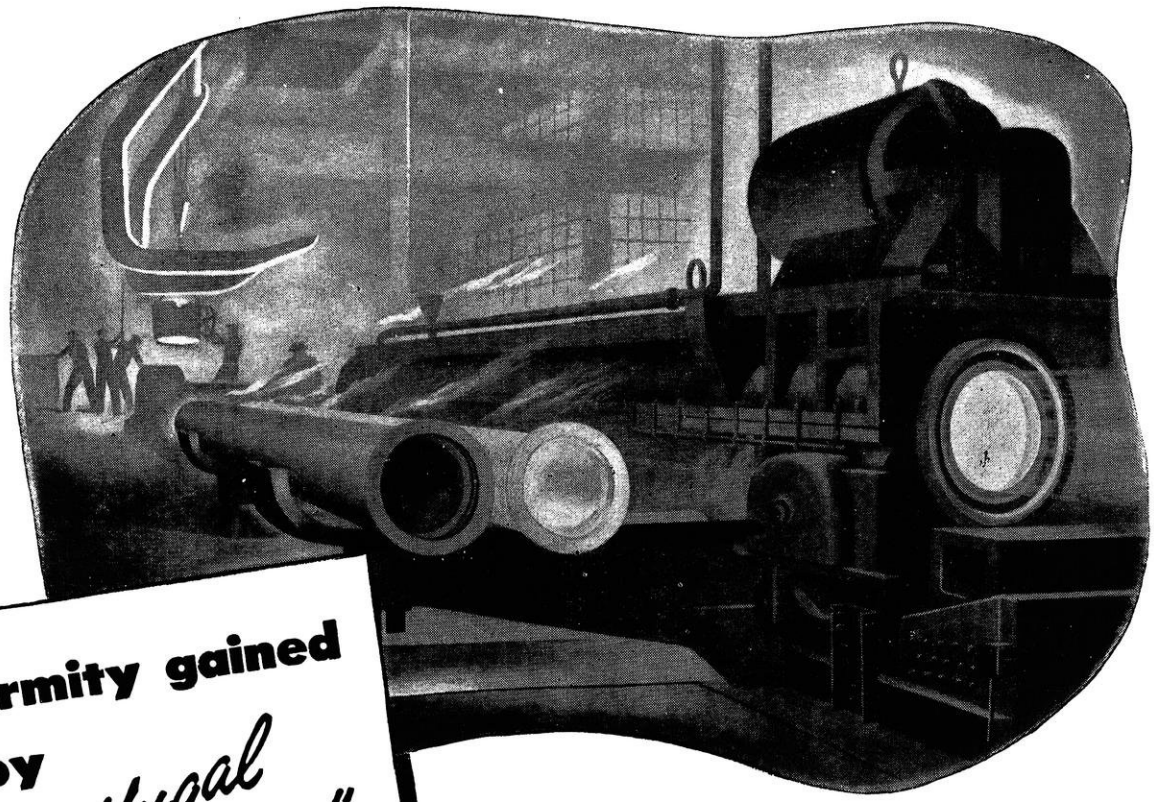


Uniformity gained by "Centrifugal Casting"

The great majority of cast iron pressure pipe produced today is cast centrifugally, in metal or sand-lined molds.

When this mechanized process was introduced 27 years ago, its potentialities for improved production controls were evident. For human fallibility was largely replaced by machine accuracy based on scientific principles.

The improved production controls made possible by the centrifugal casting process have long since been realized. Hundreds of millions of feet of centrifugally-cast-iron pressure pipe are now in service. All of this pipe is more uniform in metal structure, in wall thickness, and in concentricity, than pipe not centrifugally cast.

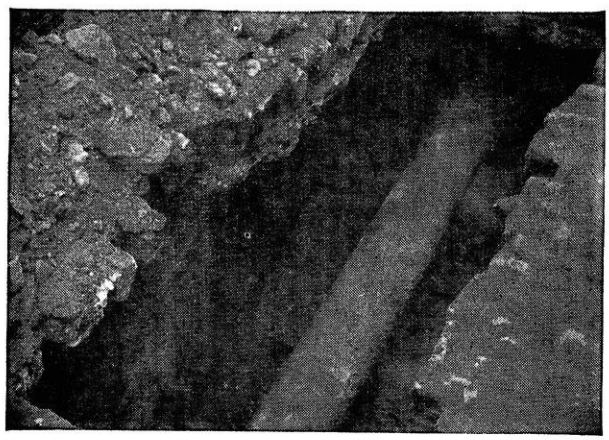
Better production control means better pipe; it results in greater uniformity of quality.

Production controls in cast iron pipe foundries start almost literally from the ground up with inspection, analysis and testing of raw materials; continue with constant control of cupola operation by metal analysis; and end with rigid tests of the finished product.

By metallurgical controls and tests of materials, our members are able to produce cast iron pipe with exact knowledge of the physical characteristics of the iron before it is poured into the mold of a centrifugal casting machine.

Cast iron pipe is the standard material for water and gas mains and is widely used in sewage works construction.

Send for booklet, "Facts About Cast Iron Pipe." Address Dept. C., Cast Iron Pipe Research Association, T. F. Wolfe, Engineer, 122 So. Michigan Avenue, Chicago, 3, Illinois.



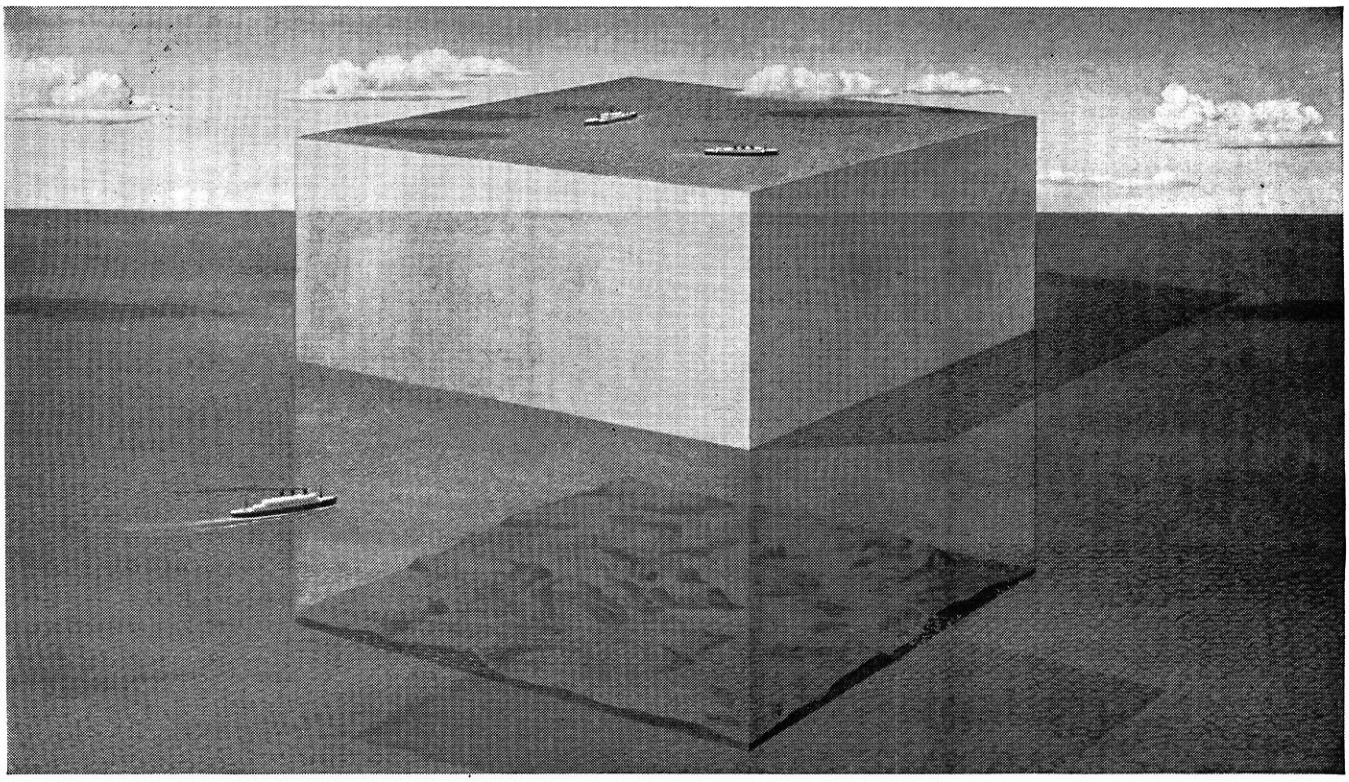
Section of 114-year-old cast iron gas main still in service in Baltimore, Md.

CAST IRON PIPE SERVES FOR CENTURIES

DOW

THE SEA IS AN INEXHAUSTIBLE SOURCE OF AN IMPORTANT METAL

Each cubic mile of sea water contains six million tons of MAGNESIUM, the lightweight metal of many uses



Today, when this nation is confronted with a crisis in our supply of many raw materials, it is of immense significance that the sea around us contains an almost unlimited supply of Magnesium. For Magnesium is light, strong, practical and versatile—the answer to many manufacturers' needs.

Dow began research on the extraction of Magnesium from brine over forty years ago. In 1941, at Dow's Freeport, Texas Plant, *the first commercial extraction from sea water was begun.* Dow pioneered in the production and development of Magnesium and its alloys and remains the leading producer and fabricator today.

Magnesium is only one of more than 600 chemicals produced by Dow. From Dow's many rapidly expanding plants throughout the nation flows an increasing abundance of chemicals and chemical products. Besides Magnesium, these include Industrial, Agricultural, and Fine Chemicals as well as Plastics.

Dow's Booklet, "Opportunities with The Dow Chemical Company," especially written for those about to enter the chemical profession, is available free. upon request. Write to THE DOW CHEMICAL COMPANY, Technical Employment, Midland, Michigan.

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DOW

• *See Page 45* •

THIS-N-THAT

Professor Crandall Is Granted Fulbright Award

Lee W. Crandall, associate professor of civil engineering at the University of Wisconsin, has been granted a Fulbright Award for study and research on timber mechanics at the Finnish Institute of Technology at Helsinki, Finland, for the 1953-54 academic year. The award is one of 240, authorized by Congress and chosen by a board appointed by the President.

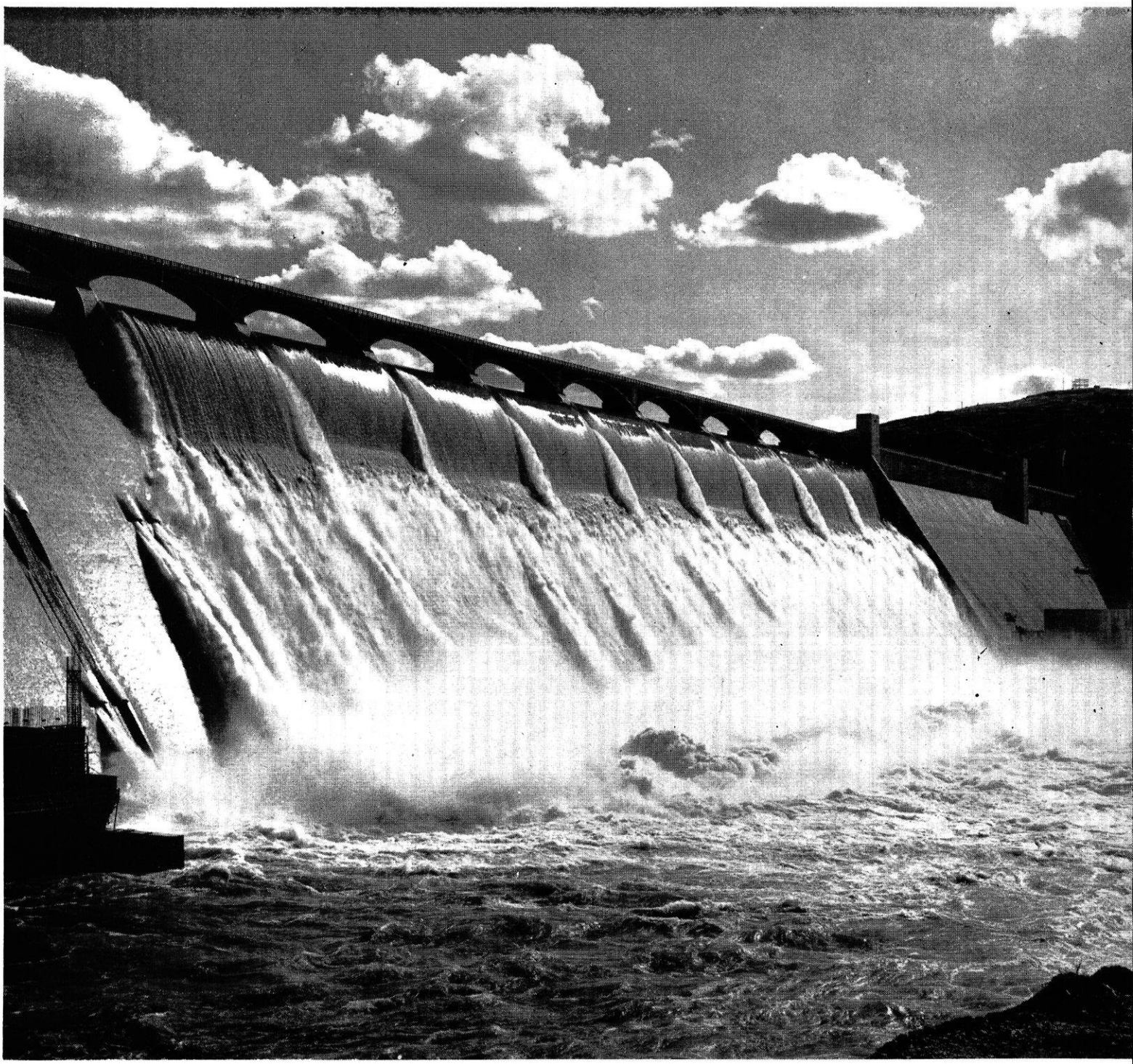
A native of Hartford, Wisconsin, he received both his bachelor's and master's degrees in civil engineering from the University of Wisconsin. He has also studied at the University of Colorado and at Stanford University, receiving his Ph.D. from Stanford in 1952.

Professor Crandall, a registered structural and civil engineer, has divided his professional career between teaching and structural design work. He is the author of the U. S. Bureau of Reclamation manual on structural design.

Professor Barker Is Honored At Engineering Meet For Contributions to Industry and Education

George J. Barker, professor of mining and metallurgy at the University of Wisconsin, was one of six nationally known engineers to be honored at the annual convention of the American Foundrymen's Society (AFS) which was held at the Morrison Hotel in Chicago, May 6.

Barker was presented with an honorary life membership in the AFS in recognition of his "outstanding contributions to the society and the casting industry in the education of young engineers for greater appreciation of the industry, the casting process, and cast products as engineering materials."



Grand Coulee Dam—A gravity-type dam that depends on its weight to hold back the waters of the Columbia River.

BULLET

by

Russell Mantzsch, me 3

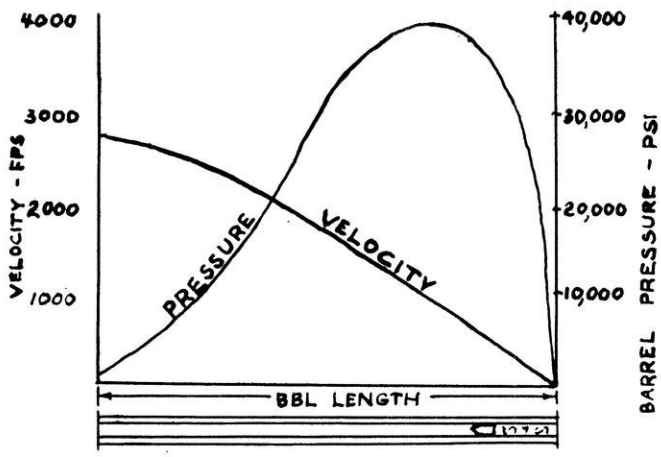
Modern rifles are capable of propelling a bullet at velocities exceeding 4000 fps. They are driven by the force developed when chemical action converts gunpowder into hot, expanding gas.

Gunpowder is a misnomer, for any resemblance between it and powder was erased almost 200 years ago. The original explosive, discovered by the monk Roger Bacon in the 11th century, was a powdered mixture of 40 per cent saltpeter, 30 percent charcoal, and an equal amount of sulphur. By 1776 the formula was modified to contain 75 percent saltpeter. Gunpowder of this type is known as black powder and is now used as a propellant only by owners of relatively antique firearms.

When black powder burns, it does so very rapidly, bordering on detonation. The charcoal and sulphur serve as fuel and the nitrate as a source of oxygen. Heat, supplied either from a flame or internal friction caused by a sharp blow, will set it off. Since tremendous quantities of oxygen are available for combustion the powder will burn within the confines of a rifle barrel. Unlike modern powders, the rate of burning of black powder is not affected by pressure so it will explode violently even if unconfined. Because of these characteristics, black powder is especially dangerous to manufacture and store.

Eventually it was found that by mixing the powder moist and drying it in the form of patties, the risk was lessened. The patties were crumbled and the kernels graded by passing over screens with from 6 to 60 openings per running inch, giving the grades FG to FFFFFG. Use of the graded kernels gives a slight degree of burning rate control but combustion is still too rapid to be efficient. Black powder is completely converted to gas before the inertia of the bullet is overcome; and as the bullet begins to travel up the barrel, the propelling force drops to an insignificant value.

The idea developed that by having a progressive-burning powder which would exert a smaller force over a longer duration, greater velocities could be obtained without building up tremendous breech pressures. When black powder burns it evolves dense smoke and soot, obscuring vision and hopelessly fouling the barrel, so there was a



Rapid initial increase in pressure within the first few inches of a gun barrel results in acceleration of bullet from rest to about 2000 feet per second velocity in traveling from breech to muzzle of a 20-odd-inch barrel.

PROPELLENTS

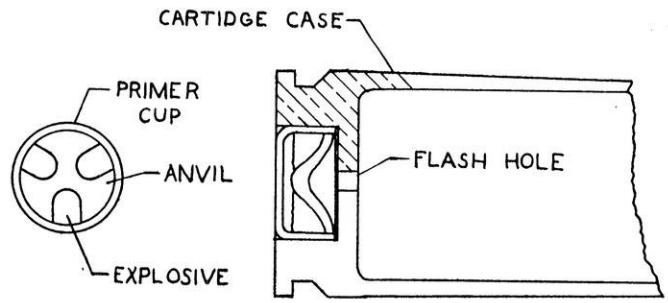
need for a smokeless powder. Hence came the modern progressive-burning, smokeless powders of today.

Smokeless powder is safer to manufacture and handle; it will not ignite by concussion nor will it explode when burned unconfined. A small heap, when ignited, will burn slowly from one side to the other as would a piece of celluloid. High temperature and pressure is necessary to make it explode.

Within the cartridge case, the change of events is this: a primer produces the flame to ignite the powder; the powder begins to burn relatively slow; and the bullet is set in motion. As pressure builds up, the rate of combustion is increased. Pressure and burning rate continue to increase until they reach a maximum when the bullet is about eight inches up the barrel. A tapering off now gradually begins, giving minimum pressure at the muzzle, but the bullet still receives push nearly all the way up. This is shown on the graph. The energy remaining at the muzzle is expended as noise.

The burning rate can be controlled by varying the chemical composition of the powder, the grain size and shape, and by adding a deterrent coating.

Chemically, smokeless powders are classified in two ways: single-base or straight nitrocellulose powder, and double-base, containing nitrocellulose and nitroglycerine. Nitrocellulose is prepared commercially by digesting vegetable fiber (cotton linters) in a mixture of nitric and sulphuric acids. This forms a nitrate of the cotton fibers. The acid pulp is thoroughly mixed, and when the digesting process is complete it receives many washings in boiling water, over a period of several days. Upon drying, the resulting substance closely resembles the original cotton linters, hence the name guncotton. Gun cotton in this state is explosively combustible. To eliminate danger, the pulp is dehydrated with alcohol rather than allowed to air dry, and compressed. Ether is then used to dissolve the nitrocellulose, and the resulting paste is fed through



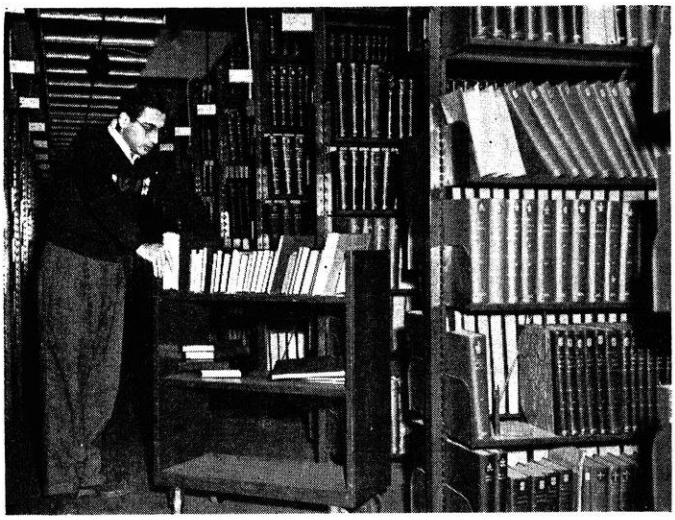
dies and formed into the desired shape and size. The grains are now ready for coating. Double-base powders are formed by dissolving the dehydrated guncotton in acetone and then blending in the nitroglycerine. Double-base powders generally ignite more easily and burn at a higher temperature than those of pure nitrocellulose.

The deterrent coating now put on the grains, controls breech pressure by slowing initial combustion. By the time the inertia of the bullet is overcome and it begins its travel up the gun barrel, the coating is gone and burning rate increases; but the volume of the combustion chamber is also increasing, so the total pressure increase is not excessive. Di- and trinitrotoloul have been used as deterrents, but most substances are secret. Finally the grains are polished with graphite in large, rotating copper drums. The graphite prevents the formation of electrostatic charges which might ignite the powder.

Some powder grains look like sections of pencil lead. 1/16 to 1/4 inch long and they may have one or more longitudinal holes through them. Other forms are thin disks or washers. The varying size and shape of different kinds of powder make them more suitable for one size of

(*please turn to page* 38)

ENGINEERING



Michael Marmura, a librarian in the Engineering Library, working in the stacks.

Occasionally someone will call the Engineering Library and after determining that we have some items of interest to him will ask "And where is the Engineering Library?" It happens frequently, that this individual turns out to be an engineering student who has just learned that the library contains something of value to him.

We hope by now that most everyone knows that the Engineering Library is located on the thir l floor of the Mechanical Engineer building in the west wing. It contains approximately 45,000 volumes dealing with all branches of engineering and some aspects of physics, mathematics and chemistry. About 350 periodicals and proceedings of engineering and scientific societies are received regularly. Practically all of the important books currently published are purchased and added to the library collection. It is reasonable to expect that in a collection of literature this size there will be something of value for everyone.

Most undergraduates are inclined to wonder; What good is all of this material? Why should I be concerned about it? To answer these questions another question might be proposed; What is a university for? Without engaging in prolonged discussion of this widely debated question, we can agree that one function of a university is to prepare its students for the work which they will undertake after graduation and to insure that they will be able to continue their education later on **without benefit of formal class work.** To achieve both of these objectives the ability to find information is basic. A library exists to store information and therefore the necessity of how to use a library and its resources is obvious.

Whenever any new problem is approached some kind of specialized information is required. It may be, for example, that an engineer will encounter in some construction a problem in plate design which he has never studied. He might be looking for a specific fact, say an ultimate strength of some material. Or perhaps he might be looking for general information about transistors and their application in industry. But whatever knowledge is needed about a problem it is usually possible to find something about it in a library.

A scientific library is used for two main purposes:

(1) To enlarge a person's knowledge and to keep informed about scientific and engineering progress.

(2) To find specific information about some subject.

Because of the complexity of the present state of scientific literature it is not easy to achieve either of these objectives.

One of the results of the tremendous strides science and engineering are making in the modern world is the vast amount of literature being published reporting these advances. Books, periodicals, transactions, proceedings, symposiums, and reports are pouring from the presses in such quantities that no one can begin to read even a portion of it. It has been estimated that nearly 36,000 scientific periodicals are now in existence and approximately 15,000 scientific and technical books are published every year. The task of the libraries is to organize and store this material so that it can be readily used; and the task of the engineering student, if he really wishes to become professionally informed, is to become familiar with this literature, to find out what it contains, and to learn how to use it.

This paper will help you to do this. It will describe our Engineering Library, discuss the use of books and periodicals, and explain the important tools such as the card catalog and the periodical indexs used for locating printed materials. Your undergraduate years is the appropriate time to learn something about engineering literature and the keys to open its resources. Learn this now and save yourself unnecessary labor later.

General Description of the Library

The purpose of any university library is (1) to provide you with the necessary written materials needed on a given subject and (2) to provide a place in which to study these materials to advantage. The Engineering Library is no exception. We strive to obtain all the newest publica-

LIBRARY

AT THE UNIVERSITY OF WISCONSIN

By W. R. Harvey, Librarian, and L. G. Zweifel, Asst. Librarian

tions for your use. While the reading room is not the most modern one in existence, it is nevertheless a large, airy, and well-lighted room suitable in every way for quiet study.

The library is open from 8-5 every day, and from 7-9 every night except Friday and weekends. Saturday it is open from 9-4.

Inside the entrance to the library on the immediate left are the encyclopedias, both English and foreign. On the same wall are the college catalogs, Sweet's File, and a number of commercial house organs. On the east wall is a section containing metallurgical abstracts and science abstracts. Further along the wall is the card catalog. A brief summary on what it is and how to use it follows later. At the end of the reading room on the left are the various indexes and abstract journals which will be discussed below. To the right of this section is the library desk where someone is always present to assist you in every possible way. If you have any question concerning the location of any material or on any procedure do not hesitate to ask for help. The current periodicals are kept in the section on the far wall of the reading room. As a general rule they are kept here for one year and are then bound for permanent retention. In the back part of the library the cataloged books and bound periodicals are kept. These stacks are open to you at all times and you are encouraged to browse through them and see what is there. The bound periodicals are on the right hand side and the books on the left. Included in this section are undergraduate theses and the pamphlet file.

The Card Catalog

The index of a book is used to find whether it has material about a certain subject and if it has to find the page reference for it. In the same manner the dictionary catalog of the Engineering Library will tell you if the library has a particular book or if it has a book or group of books on a certain subject, and it will also indicate where in the library the book may be found. As the name implies, the dictionary catalog, often called a card catalog, is a collection of 3″ x 5″ cards interfiled alphabetically. Every book that the library has in its collection has a set of cards describing the book. Generally, each book has an author card, a title card, and one or more subject cards. As it is a known fact that most users of the library do not have a definite book in mind but rather only the subject, the library attempts to have a reference catalog for all possible words or phrases that a user might reasonably think of in looking up a subject. In many instances there is a "see" card which is a guide to the appropriate heading used in the catalog. Thus, if you were attempting to find some information on radio receivers, a check of the catalog under receivers would show a card "receivers, see Radio Receivers and Reception." Upon going to that heading, you would find listed all of the books in the library that deal with radio receivers and reception. In essence therefore, the listings of the books under a particular subject heading is, in reality, a bibliography of all the books available in the library on that subject. This is an important fact when preparing a bibliography of your own.

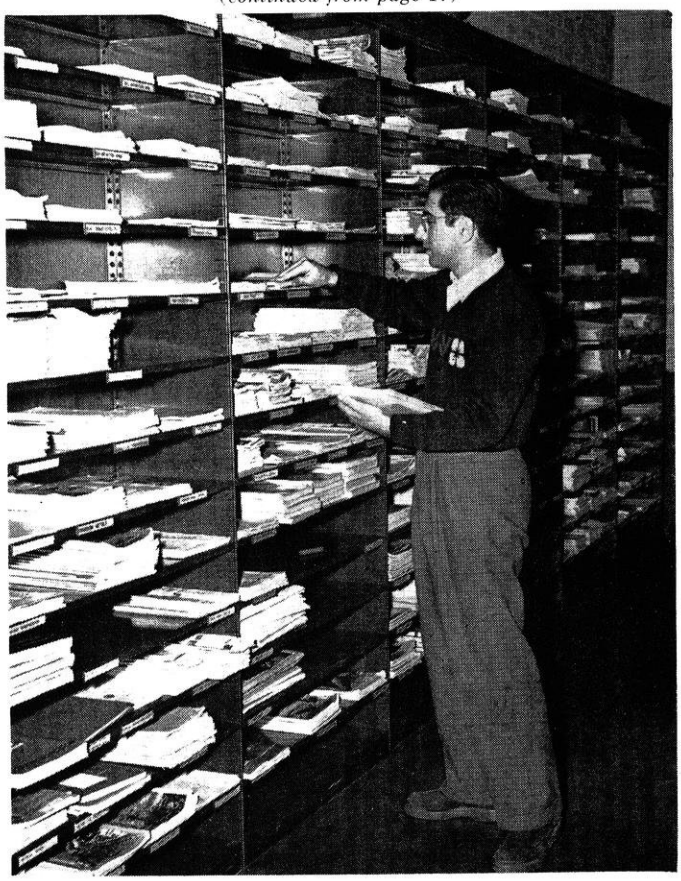
There is also contained in the catalog "see also" cards which will indicate allied subjects for that particular subject heading and provides a "rounding out" of a subject search.

After you have located a suitable book do not neglect to read all of the information given on the card. Many times you may save yourself the labor of examining the book and finding that the information contained in it is not what you wanted after all. Check the date of the book—is it recent enough for the purpose you had in mind? Check the pages listed—is it comprehensive enough? Does the book have illustrations, diagrams, charts? All of these questions and more are answered on that card.

(*please turn to page* 18)

Engineering Library - -

(*continued from page* 17)



Mr. Marmura filing magazines in the modern, well-equipped Engineering Library.

Finding the book after you have located the desired one in the catalog is a simple matter. In the upper lefthand corner of the card is a series of letters and numbers. This is the "call number" of the book and is the means of identification. No two books have the same call number. The books are arranged alphabetically by call number in the lefthand sections of the rear stacks. Browse through the stacks anytime. Once you see how the books are grouped into subjects you will be able to find what the library has in a short time.

Books

Books, as differentiated from periodicals and serials, are sources of well established facts, theories and general information. They form the background of engineering knowledge. Recourse to them is required in daily work for the solution of many problems encountered in ordinary engineering practice. As you now use your textbooks in preparing daily assignments, so will you have to use these and many other books after you have left the university. A thorough understanding of the various types of books and what you may expect to find in them is mandatory for any engineer. It will also be of value to you to become acquainted with books other than texts during your college career. They can solve many problems for you arising in your college work.

A general classification of books according to usage may be made as follows:

Dictionaries: This type of reference book is an alphabetical arrangement of words and phrases and provides an easy method of ascertaining correct meanings and pronunciations. It is one of the first places to start a bibliographical search when undertaking a study of a new problem, one which is unfamiliar to you. In few professions is the requirement of exact meaning so important as in engineering. Correctly understanding the terminology of a science is the first step in understanding the science itself. And the place to find the meaning of a term is in the dictionary.

There are two general types of dictionaries—those of language and those of subject. **Websters' New International Dictionary of the English Language** is one of the standard and most authoritative dictionaries of the English language written from a modern viewpoint. It is noted for its clearness and thoroughness and contains definitions of over 600,000 words with their historical development. Special sections are also included which list such information as abbreviations, signs and symbols, a gazeteer, and biographical information. There are other excellent unabridged and abridged dictionaries available, all of which have special features. It would benefit you to become familiar with at least several of the better ones.

Subject type dictionaries can also be classed into two categories: those dealing with branches of engineering and those dealing with science or engineering as a whole. An example of the specific type is the **Petroleum Educational Institutes Illustrated Petroleum Dictionary and Products Manual.** Another example is **Horner's Dictionary of Mechanical Engineering Terms.** While a great many of the terms found in the specialized type of dictionary can be found in general dictionaries such as **Websters,** usually the special dictionary gives a more complete definition and stresses local usage. This fact is one which is frequently overlooked. Then it is usual to find more and fuller illustrations in the specialized dictionary which clarify the written definition. Any practicing engineer would be wise to have at least one special dictionary in his collection in addition to an English dictionary. An example of the general type engineering dictionary is **Chambers Technical Dictionary,** which includes terms used in pure and applied, science, medicine, the chief manufacturing industries, engineering, construction, and the mechanic trades. An extensive coverage is provided in this work and its usefulness is increased by many tables and summaries.

Encyclopedias: This type of reference book is intended to give a greater amount of specific information and history of subjects than the dictionary. The articles are usually written by outstanding authorities and frequently contain illustrations, maps, and bibliographical references. It is remarkable how much material on a great variety of subjects is included.

Two well-known examples of the general type of encyclopedia are the **Encyclopedia Britannica** and the **Encyclopedia American.** The Americana also issues a yearbook, the **Americana Annual,** which contains summaries

of recent events. Too much emphasis cannot be given to the importance of being familiar with encyclopedias. You will find that frequently they will have all of the information you need on a particular subject and no further searching is necessary. For some unknown reason engineers tend to ignore the encyclopedia on the mistaken theory that all it contains is "arts and letters." Nothing could be further from the truth. An investigation of the list of contributors to the **Britannica** and the **Americana** reveals some of the most outstanding men in engineering and they have written some very informative articles.

An example of the subject type encyclopedia is **Van Nostrand's Scientific Encyclopedia.** This work is written primarily for the layman and has short descriptive articles with good illustrations and diagrams. The articles are also written by well-known authorities.

The International Critical Tables of Numerical Data, Physics, Chemistry, and Technology is another example of the subject type encyclopedia. It includes national and local systems of weights and measures, properties of chemicals, definitions, and other extensive data. A comprehensive index is included. One of the best special encyclopedias, now in process of publication, is the **Encyclopedia of Chemical Technology.** This great work will comprise fourteen volumes when completed and will be the most comprehensive chemical engineering encyclopedia in the English language.

Yearbooks: This is a class of material which supplements the encyclopedia and contains such information as the events of the year and general statistics. **The World Almanac** is perhaps the most widely known. This valuable and handy reference work contains statistics of governments, industries, schools, and much other descriptive data. It also has a chronology of important events.

Handbooks: Here is one of the most important collection of books for the practicing engineer. They are compilations, written in technical language, of fundamental and tabulated data and information. Every engineer will need at least several books of this kind in his personal library and should be familiar with the type of information they contain. They will be your handiest reference tool. Some examples of such books are: **Handbook of Chemistry and Physics, Kent's Mechanical Engineers' Handbook, Brady's Materials Handbook, Henny's Radio Engineering Handbook, Standard Handbook for Electrical Engineers,** and **Mark's Mechanical Engineering Handbook.**

Directories: This type of reference book lists the names and locations of persons, places, and organizations. For biographical sketches and addresses of persons, such works as **Who's Who in America, Who's Who, Who's Who in Engineering,** and **American Men of Science** are valuable. For the location and description of places, the **Encyclopedia Britannica Atlas, Lippincott's New Gazeteer,** and the **Rand McNally Atlas** are useful. For organizations, their products and locations, **Thomas Register of American Manufacturers, McRae's Blue Book** and **Kelly's Directory of Merchants, Manufacturers, and Shippers of the World** are excellent sources. There are also a number of periodic publications listing commercial organizations, government research bureaus, societies and institutions.

The Periodical Literature and How to Use It

Approximately 36,000 scientific periodicals are published every year in all languages throughout the world and of this number about 15,000 are devoted to engineering and industrial science. Appearing in these 15,000 journals are roughly 750,000 articles on technical subjects. It is obvious that no person can hope to examine even a small portion of this output or to become reasonably familiar with its general outline. Most of these periodicals publish yearly indexes but it would also be an impossible task to consult them in any comprehensive manner. Obviously what is needed is some key to this literature so that it can be used in an effective manner. It is unfortunate that some men of vision realized years ago that the results of research being published in technical periodicals would be of little value unless it were adequately indexed and, consequently, did something about it. Both J. B. Johnson and F. E. Turneaure, former deans of the College of Engineering at the University of Wisconsin, were among these early pioneers who started the indexing services in this country. Dean Johnson was the first editor of the Engineering Index, which will be discussed later, and Dean Turneaure served as an associate editor on its staff.

Two kinds of publications have been devised to organize systematically periodical literature: index serials and abstract journals. These publications are constructed in much the same way and differ largely on whether abstracts have been included. For the most part, index serials and abstract journals are formed by listing under subject headings in alphabetical order important articles that have appeared in the periodical literature. Complete bibliographical information is given about the article so that it can be easily located. The author, title, and original periodical reference is given and in the abstract journals a short abstract of the article is included so that the researcher can determine if the article will be of interest to him.

The Engineering Library receives among others the following indexes and abstract journals with which all undergraduates should make themselves acquainted: **The Engineering Index,** the **Industrial Arts Index, Chemical Abstracts, Physics Abstracts, Electrical Engineering Abstracts,** and **Metallurgical Abstracts.** To explain the use of these, the first three will be described.

The Engineering Index: This index, published every year in book form, contains short annotated descriptions of important technical literature appearing in (1) about 2,000 periodicals both foreign and domestic, (2) transactions of engineering societies, (3) important government publications, (4) publications from engineering experiment stations, and (5) new books. The entries are

(please turn to page 44)

Houdriforming

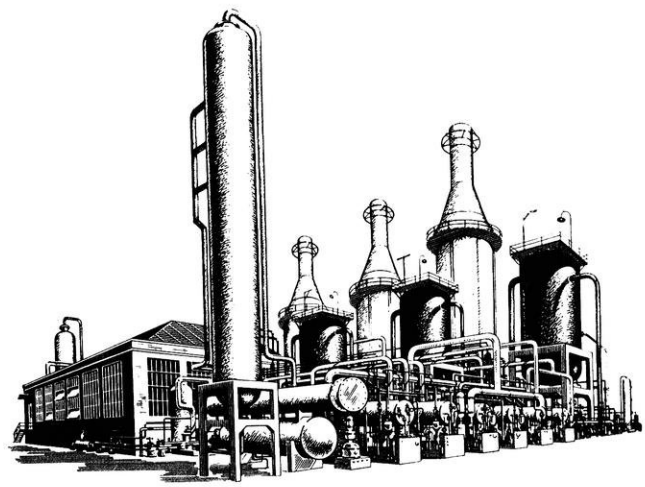
Story courtesy:
John Falkner Arndt & Co., Inc.

Two gallons of today's gasoline do the same work that three gallons did in 1925 at no increase in list price. Historically, such improvements in motor fuel quality and economy have paced the steadily increasing requirements of advanced engine designs—a gradual increase in octane number has been accompanied by a corresponding increase in engine compression ratio. However, this trend has reached a point where the refiner is now confronted with the problem of producing record octane gasoline in record volume. This situation comes at a time when the ability of the present methods of refining treatments is fast approaching a limit.

The critical status of high octane gasoline production is indicated in the most recent survey of octane requirement published by the Coordinating Research Council which represents petroleum refiners and the automobile industry. This report shows that the average premium gasoline produced in 1950 satisfied the octane requirements of only 75 per cent of high-requirement cars, while the average regular grade satisfied only 55 per cent of all cars. C. G. Kirkbride, president of Houdry Process Corporation of Philadelphia, Pennsylvania, has announced the development of Houdriforming, a "reforming" process utilizing a unique catalyst which up-grades the low octane components of motor fuel and thereby will greatly assist refiners in meeting the increased demands for high octane gasoline.

Constant improvement in motor fuel quality is a problem which has challenged refiners since the days when horseless buggies chugged along dirt roads on one cylinder. For although each new high-compression engine can run on yesteryear's gasolines, it does so to the accompaniment of sharp metallic clinking "knocks." Quantitatively, the anti-knock performance of a gasoline is expressed in terms of octane numbers. Since 1925 the octane number of regular-grade gasoline has risen generally from less than 60 to the middle 80's, and, in some cases higher, and from about 70 to well above 90 for premium grade fuels.

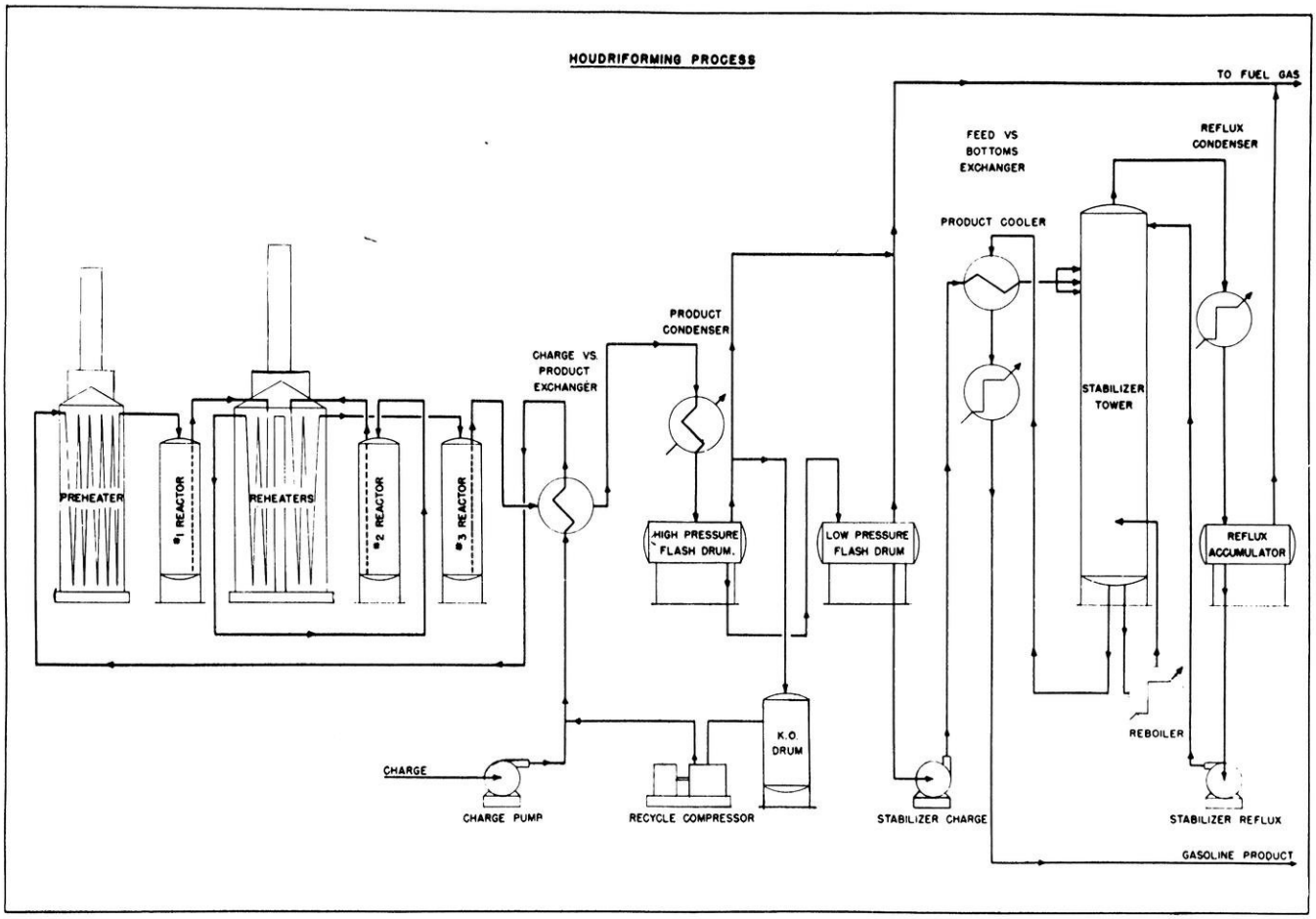
An early notable anti-knock treatment was discovered shortly after World War I. Two General Motors chemists, Midgely and Boyd, working under the direction of Charles F. Kettering, found after a tedious search that the addition of less than a thimbleful of tetraethyl lead per gallon of gasoline is effective in reducing engine knock. Refiners still improve octane values with this expensive liquid. However, the present octane problem cannot be solved merely by increasing the concentration of tetraethyl lead in gasoline. One reason is that after a sharp initial boost in octane number, the effectiveness of continued tetraethyl lead addition levels off gradually. In addition, there are definite mechanical and performance limitations to the amount of lead which an engine can tolerate.



A HOUDRIFORMER REFORMING UNIT
The three units in the foreground are reactors, behind which are three heaters.

The next significant milestone in octane improvement was Eugene Houdry's discovery of catalytic cracking in 1927. Houdry's process improved both the yield and quality of gasoline by breaking down the higher boiling components of petroleum into more volatile ones of exceptionally high octane number. By blending catalytic gasoline with straight-run gasoline (obtained from the fractional distillation of crude oil), refiners achieved new highs in octane values.

Refiners have installed more and more catalytic equipment to keep abreast of rising octane levels, which are expected to continue climbing. As with tetraethyl lead, there are practical limits to the extent which catalytic cracking can raise the average octane number of the total refinery output of gasoline. Chief limitation is the low octane value (usually less than 50) of virgin naphthas



which constitute from 60 to 70 per cent of straight-run gasoline. This naphtha fraction is "dead weight" insofar as present methods of octane improvement are concerned.

Removal of the restrictions which virgin naphthas impose on the yields of high octane gasoline obtainable from crude oil has long been the dream of refiners. Thermal methods have been used in the past, but such methods yield only relatively low octane number products and therefore cannot meet the current demands for high octane blending stocks. Crux of the problem has been to develop a highly selective catalyst capable of governing the conversion of knock-producing compounds into high octane mixtures for incorpation in motor fuels. Since its founding over twenty years ago, Houdry Process Corporation, the pioneer and leader in the application of catalytic processes to refinery operations, has actively engaged in research to develop "the" catalyst. Culmination of this effort is "Houdry Type 3 Catalyst," a highly selective and rugged catalyst produced from commercially available materials at Houdry's newest catalyst plant in Paulsboro, New Jersey.

Development of "Houdry Type 3 Catalyst" made possible the Houdriforming process. In this "continuous catalytic reforming process, "virgin naphthas" are passed over the pelleted catalyst arranged in beds with reactor vessels. In the ensuing reactions this dual-function catalyst strips and re-arranges the molecular structure of knock-producers, reforming them into high octane compounds. Experimental runs indicate that this process can convert naphthas into gasoline of over 100 octane number with excellent yields. In fact, it is estimated that if all the virgin naphthas were up-graded to high octane levels by Houdriforming instead of by the older thermal reforming method, a saving of 4.5 per cent in crude oil would be effected.

Houdriforming also is of interest to producers of natural gasoline, that volatile mixture obtained by condensing the gasoline vapors present in natural gas. To date, this product has been disposed of insofar as possible by blending it with motor gasoline, where it has proven useful in improving winter starting. However, there are limitations to the volumes which can be so utilized depending on octane levels, volatility requirements, and seasonal fluctuations. By reforming natural gasoline to higher octane levels, producers will ease their marketing problem.

In addition to up-grading low octane gasoline, Houdriforming operations can be adapted alternatively to produce petrochemicals, that fast growing community of chemicals derived from petroleum. Selected naphtha fractions are "reformed" in Houdriformers to produce large volumes of aromatic chemicals such as benzene, toluene, and xylenes.

These aromatics, once strictly coal tar babies, are greatly in demand for the making of explosives, textiles, plastics, rubber, insecticides, paints, drugs, soapless detergents, and many other products of daily usage. Appreciable volumes of aromatics are blended with aviation gasoline to provide

(*continued on page* 32)

LINK B-47 SIMULATOR

Story courtesy:

Link Aviation, Inc.

The nation's first jet bomber simulator, designed and constructed for the USAF by Link Aviation, Inc., Binghamton, N.Y., is currently in the hands of Air Force inspection teams undergoing rigid inspection tests preliminary to acceptance and utilization in the USAF's complex bomber training program.

This new electronic simulator is a ground training version of the B-47B Stratojet bomber. Upon completion of acceptance tests, the new simulator will be used in conjunction with the training of crewmen for the Air Force's fastest and highest flying jet bomber. The new Link jet simulator costs only a fraction of the jet aircraft, but it provides the 1001 training steps required to train proficient crewmen for the six-jet Boeing B-47.

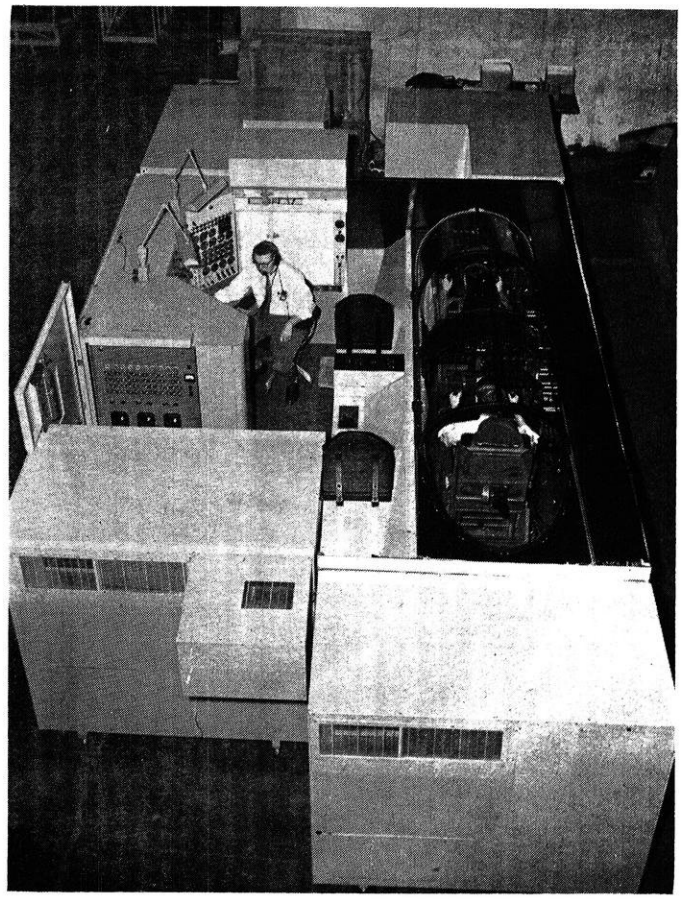
Thanks to a single motor-generator power supply and miniature electronic units designed by Link engineers, duplication of the B-47 aircraft is accomplished in a compact training package weighing but 16,000 pounds. The entire training unit is contained in an enclosed area of approximately 280 square feet. Aircraft duplication includes normal and emergency engine, flight, and communications operation, as well as Assisted Take-Off (ATO) and procedures for refueling in the air.

Flight realism in the B-47B simulator is emphasized through the incorporation of typical high-speed jet flight features. As the aircraft approaches the touchdown point in land, there is a noticeable tendency for it to continue to float. As a result, the pilot is required to nose the plane down to make contact with the runway. This flight characteristic is one of the Link jet simulator's latest innovations. Not only does it require the pilot to conform to the landing technique of the aircraft, but it permits each flight to be terminated on a most realistic note.

Stalls are electronically duplicated in the Link bomber counterpart. A buzzer warns the pilot of an impending stall but movement of the controls and built-in buffeting provide identical conditions of the actual in-flight stall.

Of special significance from the crew training standpoint is the trainer's accurate simulation of fuel consumption and changing CG. The same factors—power setting, altitude, etc.—which govern the rate of fuel consumption in the aircraft govern the fuel consumption in the simulator. Under given conditions the two are identical. As for the center of gravity, any change in the simulated load distribution—fuel consumption, jettisoned bombs or tanks, etc.—causes a corresponding change in the simulated CG, which in turn requires retrimming of the plane. Both systems are manually controlled by the instructor who is provided with separate overriding controls.

Upon entering the spacious training area of the B-47B jet simulator, one is impressed with the complexity and verisimilarity of the modern jet flight simulator. Fore and aft along the right wall is the simulator itself—a replica of the tandem cockpits of the B-47 Stratojet bomber. On the left is the electronically equipped in-



Minus its top cover, the new Air Force B-47B Flight Simulator provides a tandem cockpit for pilot and co-pilot, right, and full complement of instruments and duplicate controls for instructor, left. At center, are two observation seats used by flight instructors.

The entire trainer is normally covered by a light tight canvas which forms a thermal barrier and also provides optimum instrument flight conditions.

Cut courtesy Link Aviation.

structor's quarters with its control-studded console flanked by recorders. Under the streamlined canopies of the simulator are the pilot and co-pilot's stations—each with its own set of controls, instrument panel and complement of equipment.

It is here that the versatile crew of the B-47 will be going through their paces. From the time they climb into the cockpits to make their pre-flight checks before firing up the six jet engines until the end of the flight, the crewmen will be duplicating in the trainer what they will actually be doing later in the plane.

The engine starting sequence in the simulator is the same as in the aircraft. So are the take-off and landing and the flight maneuvers in between. Simulated altitudes, air speeds, control pressures, and even high speed flight sounds and noises are presented to the crewmen with amazing exactitude. These, added to the inch for inch duplication of the cockpit and the identical placement of aircraft controls and equipment, mirror the physical and flight characteristics of the B-47B jet aircraft.

Major functional features of the Air Force's first jet bomber simulator include:

1. Six-jet engine system duplicating on-the-ground and in-the-air starting sequences and all phases of in-flight engine operation.

2. Complete set of engine instruments: rpm, tail pipe temperature, fuel and oil pressure.

3. Actual aircraft throttle quadrant with six throttles and standard locking and friction controls.

4. Actual aircraft wheel and rudder (dual) controls with pedal brakes.

5. Flaps, landing gear, and trim controls.

6. Drag chute simulation.

7. In-flight refueling simulation.

8. ATO (Assisted Take-Off simulation).

9. Pilot's instrument panel with standard B-47 arrangement of flight instruments for all-weather flight among which are the latest high-speed and high-altitude indicators: vernier drum type air-speed indicator with barber pole maximum safety needle; new five inch directional and attitude gyros; ID-249 and 250 for VOR and ILS; Machmeter; accelerometer; altimeter, cabin altimeter and stand-by compass. In addition, the trainer is equipped with the usual standard indicators; rate of climb, flaps, gear, turn and bank, etc.

10. Co-pilot's instrument panel with duplicate instruments plus a set of electrical and hydraulic indicators which include: 6 load meters, ac and dc voltmeters, and 4 hydraulic indicators.

11. Duplicate co-pilot controls; throttle, flight, flap, gear, trim and drag chute controls plus emergency landing gear extension and retraction controls.

12. 14 circuit breakers—**simulated for the first time in a jet simulator.** Circuit breakers are provided on the aircraft for individual circuit protection. They form a fail-

(please turn to page 48)

HIGH SCIENCE

Edited by

Gene Worscheck, m'55

FEWER LINES SAVE TIME

Both of these drawings tell the same story but General Electric Company draftsmen are being encouraged to use the smaller, simpler one at the left. The larger drawing required 57 square feet of drafting paper, and eight days of a man's time to draw it. The smaller drawing took two days and required less than four square feet of paper. To conserve manpower and material GE is teaching the streamlined drafting to its 5000 draftsmen.

LIGHTS

NICKEL ALLOY STEEL

In testing high voltage circuit breakers at the General Electric Company's switch gear development laboratory, two giant generators are intentionally short-circuited. Each is normally rated 125,000 kva, but provides short circuit currents up to 182,000 amperes, the instantaneous peak of the offset wave corresponding to over 1½ million kva (rms) symmetrical short-circuit duty. Naturally, such operation builds up tremendous mechanical stresses inside the machine which tends to twist loose the 200-ton stator assembly.

No damage is done to the equipment, however, because these machines are mounted on steel plate springs which cushion the shock and damp out the resistant vibrations. The springs must absorb these high torsion shock loads as often as 40 times an hour, hence a tough, durable and dependable steel is required.

GE engineers, working with United States Steel Corporation metallurgists, determined that a rolled alloy steel, "U.S.S. Carilloy" 4340, provides the needed high mechanical properties. This nickel-chromium-molybdenum steel, well known for its satisfactory performance in a wide variety of critical applications throughout industry, is readily heat treated and develops an optimum combination of strength and resistance to impact and fatigue, to meet the needs of this specialized spring job.

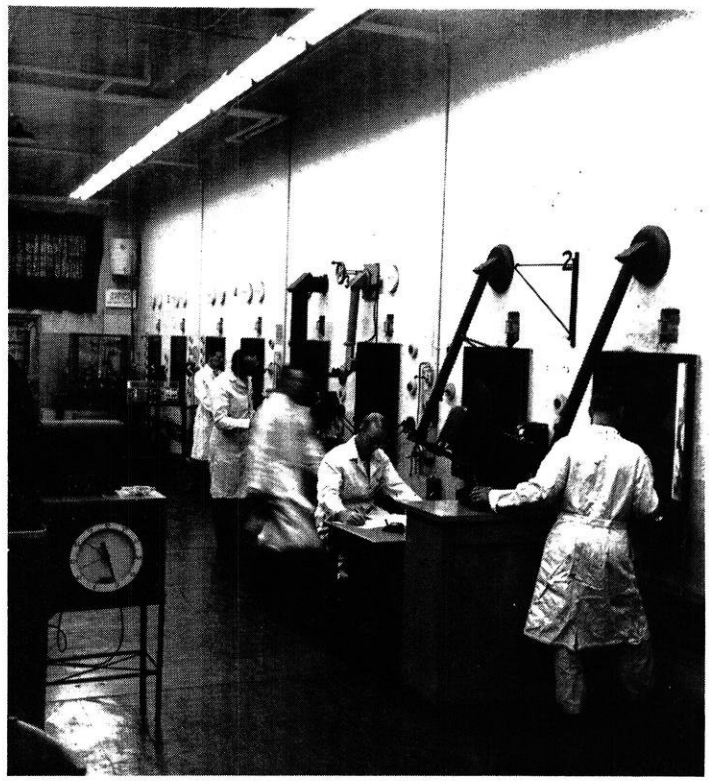
Under the most severe short-circuit, where 8 million lb.-ft. of torque is developed, frame rotation is only about ½" each way at the point of spring attachment; and the axial center line stays within 30 mils of its normal position. These movements are sufficient to cushion the shock, and the 4340 alloy steel stands up under the punishment.

(*please turn to page* 34)

"HOT LAB"— ATOMIC AGE TOOL

Nuclear scientists, who work daily with radioactive materials too "hot" to handle, have been able to solve many of their problems by using one of the most unique "tools" of the Atomic Age—the "Hot Laboratory."

One such group of scientists is at work in the Bettis Plant, Pittsburgh, Pa., of the Atomic Energy Commission. This plant is operated by the



Testing and observing radioactive material.

ALUMNI NOTES

by
Eugene Buchholz, m'55

MAURICE M. HANSON

APPRENTICESHIP FIELD CHIEF RECEIVES LABOR DEPARTMENT'S TOP AWARD

A Distinguished Service Award, the U. S. Department of Labor's highest honor award, was presented Maurice M. Hanson, Chief of Field Operations for the Bureau of Apprenticeship, by Secretary of Labor Martin P. Durkin at ceremonies held recently in Washington, D. C.

The award was presented, Secretary Durkin said, in recognition of Mr. Hanson's outstanding contribution to the advancement of apprentice training programs within the construction industry.

One of the original group of field men hired by the Bureau of Apprenticeship when that agency was started in 1936, Hanson worked for two years as apprenticeship field representative in Michigan, Indiana, Illinois, Wisconsin, Iowa, Minnesota, Nebraska, South Dakota, North Dakota, Kansas, and Missouri.

He became Regional Supervisor of the Apprentice-Training Service for that territory in 1938, a post which he held until he was appointed an Asisstant Director of the Apprentice-Training Service in 1942. He became Chief of Field Operations for the Bureau in 1950.

Mr. Hanson has been responsible for the Bureau's national promotional efforts in the construction industry. His major assignment has been to obtain the cooperation of national employers' associations and international unions in furthering the national apprenticeship system recommended by the Federal Committee on Apprenticeship.

A native of Wisconsin, he holds a degree in civil engineering and a master's degree in vocational education from the University of Wisconsin. Prior to joining the Bureau staff, he worked as a civil engineer and as an instructor of apprentices and journeymen in the plumbing trade.

Longenecker, E. A., m'22, formerly president of the Le Roi Co., has been elected president of Yard-Man, Inc., Jackson, Michigan, manufacturers of hand and power lawn mowers. Longenecker most recently has been works manager of Jacobsen Manufacturing Co. of Racine, also a manufacturer of lawn mowers. He joined Jacobsen in 1950 as a consultant after resigning as Le Roi president.

Heywood, Walter A., ch'47, is now engaged in research for the General Electric Co. at their Knolls Atomic Power Laboratory in Schenectady, New York.

Maldari, Joe A., c'38, is a structural engineer for the Carbide and Carbon Chemicals Corporation of South Charleston, West Virginia.

Murray, Vernon M., e'27, MS'34, is supervising district manager of the Bonneville Power Administration.

Laubenstein, Donald F., e'48, has recently taken a post with the station design section, Electric Design, Commonwealth and Southern Corporation of Jackson, Michigan.

Prescott, Robert E., m'34, has been appointed to the technical staff, Bell Telephone Laboratories, Inc., Murray Hill, New Jersey.

Stolze, George A., ch'42, is doing metallurgical work in the precision casting department of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Nethercut, Edgar S., c'89, died on August 12, 1952, at Evanston, Illinois, at the age of 82. In 1917 he became secretary of the Western Society of Engineers, a position that he held until 1935, when he retired.

Schroeder, Frank C., c'07, died in Dallas, Texas, on Feb. 2. From 1916 until his retirement in 1949, he was with the Wisconsin Electric Power Company in Milwaukee as building engineer.

Weaver, Warren, c'17, director for natural science, Rockefeller Foundation, was elected president of the American Association for the Advancement of Science at the St. Louis meeting.

Willson, Clarence A., c'21, research engineer of the American Iron & Steel Institute, is the new vice chairman of the Construction Standards Board of the American Standards Association.

Loverud, Earl K., c'23, is general sales manager of the Bready Tractor & Implement Co. of Solon, O.

Salter, George S., c'24, recently named chief filtration engineer in the newly organized Department of Public Works, Chicago, has been elected president of the Chicago Engineers Club.

Thompson, John G., c'28, was appointed city engineer of Madison on April 9, after an entertaining series of maneuvers involving the city council, which wanted Thompson; Thompson who wanted the position but did not want to take a civil service examination; and the city's civil service commission, which wanted compliance with its regulations.

UNIVERSITY OF WISCONSIN
MADISON 6

COLLEGE OF ENGINEERING
OFFICE OF THE DEAN

April 16, 1953

Mr. Robert A. Leisses, Editor
THE WISCONSIN ENGINEER
Mechanical Engineering Building

Dear Mr. Leisses:

The Executive Committee of the College of Engineering wishes me to convey through your publication an appreciation of the fine cooperative spirit which was exhibited by the students of the College in the conduct of the Engineering Exposition of 1953. We have received many complimentary reports and are justly proud of their fine contribution to the program of the College.

Especially do we commend the work of the following: Kenneth Schneck, Chairman; Richard Crago, in charge of commercial exhibits; Jack Miller, in charge of student exhibits; John Hickman, in charge of publicity and alerting high school students; the work of Allen Schmidley, David Hanke and Reinhart Postweiler of the Polygon Board; and the aid of the editors of THE WISCONSIN ENGINEER in promoting the Exposition. We are also particularly gratified by the participation of student exhibitors who demonstrated much initiative in the development and conduct of their part of the program.

May I express my personal satisfaction for the efficient manner in which exhibits were set up and speedily removed at the conclusion of the event.

Very truly yours,

MOW:mh

M. O. Withey

Dean

W.S.P.E.

Edited by

Stephen Carter, m'55

WISCONSIN SOCIETY OF PROFESSIONAL ENGINEERS

SECRETARY'S OFFICE
201 Kensington Drive
Madison 4, Wis.
W. G. Youngquist, Secretary

With the
BOARD OF DIRECTORS

- Legislative Report
- 1954 NSPE Meeting
- Functional Group Recommendations
- Summer Meeting
- Public Service Commission
- Registration Board
- Ladies Auxiliary

Board meetings were held on March 7th in Milwaukee and on April 10th in Madison in connection with Engineers Day at the University of Wisconsin. Of special interest:

Ed Kallevang, chairman of the legislative committee, reported that he had appeared on behalf of the Society in opposition to Bill 65S in the state senate. This bill proposes to set up an overall organization for the administration of all state licensing. He presented objections as outlined by a special WSPE committee and stated that the bill would probably not pass.

Chairman Kallevang also reported that WSPE had been represented at both the senate and assembly hearings on the bill for the licensing of land surveyors and had officially registered in favor of the bill.

Harry Gute, chairman of the steering committee for the 1954 NSPE meeting in Milwaukee was appointed as permanent chairman of the 1954 meeting. Approval was also given to the appointment of Robert W. Smeaton as publicity chairman and Orrin Andrus of program and entertainment committee for the meeting.

Herb Moore, chairman of the private practice functional group presented several actions of that committee for consideration by the board. The items discussed and the actions taken are outlined below:

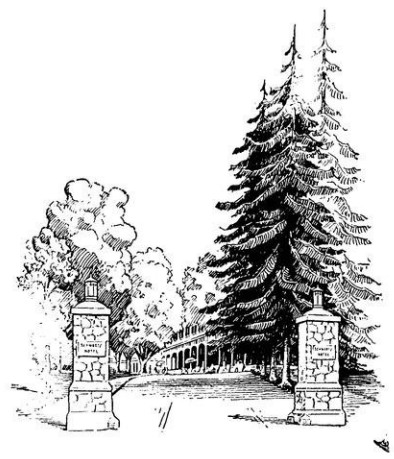
(1) Suggestion that dues be raised to $20.00 per year and a permanent secretary be employed. This proposal was placed on file.

(2) Suggestion regarding examinations necessary for registration of engineers for state services. It was stated that Bill 81A in the state senate would require the certification of a registered sanitary engineer who is seeking state service. This matter was referred to the legislative committee for action.

(3) Proposal to change state registration act to bring it into conformance with the model law by having the registration board appointed by the governor. Pierce Ellis stated that he planned to consult with Vice President Steinmetz so that they could agree on a man to head the legislative committee for the next two years. The legislative chairman would be instructed to study needed changes in the registration act and be prepared to introduce the proposed changes in the next legislature.

(4) The matter of the responsibility for the enforcement of the registration act was brought up for consideration. George Sievers read portions of his letter to Mayor Ziedler of Milwaukee concerning an interpretation of the act by the city building inspector and also read the reply by the mayor. The mayor stated that no action would be taken except on advice by the city attorney. A letter on the same subject written to the mayor by member Walter Sherman was also brought to the attention of the board. Herb Moore stated that he felt the matter had been handled in a proper manner and complimented George Sievers on the quick action taken.

(5) A suggestion that registration requirements of engineers in training could be set up more logically by an industrial board rather than a collegiate board was con-



sidered. This matter was discussed at some length by the board. No formal action was taken but it was agreed that it would be desirable to set up a committee to offer help and work closely with the registration board on this matter.

(6) Discussion was held regarding the advisability of changing the time of the functional group meetings held in conjunction with the annual or summer meetings so that recommendations for action could be brought before the board.

A motion was made by Director Sievers and seconded by Past President Agthe that functional group meetings would hereafter be scheduled on the first day of all Society meetings. **Passed.**

The dates of September 18 and 19 were approved for the summer meeting which will be held at the Schwartz Hotel on Elkhart Lake.

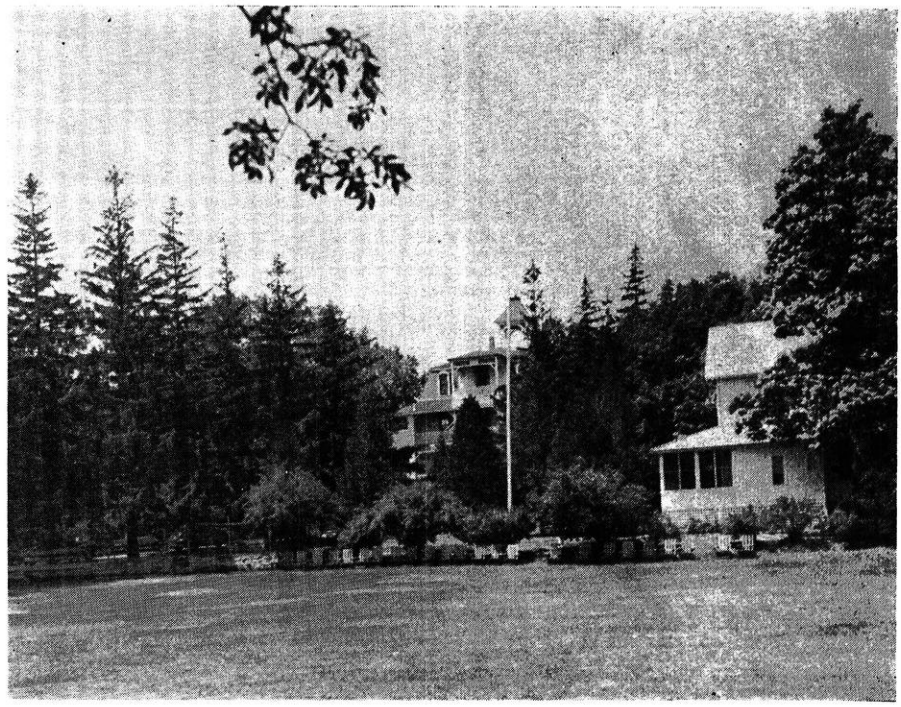
It was agreed by the Board that a recommendation be made to the governor requesting that serious consideration be given to the appointment of a registered professional engineer to the vacancy on the Public Service Commission.

George Sievers reported that the registration board had indicated that they were to meet in April and at that time would set a date for the meeting between the board and the special committee set up by WSPE to consider the proper enforcement of the registration act.

A communication was received from the national committee seeking to set up ladies auxiliaries in the various states. It was reported that a number of states now have such units. Chapters are urged to communicate with the state secretary in regard to this matter.

ANNUAL FALL MEETING DATE SET FOR SEPT. 18-19

Have you ever considered what has been accomplished by the American Medical Association, American Bar Association, and American Dental Association in building the prestige and economic status of their members in the public mind? Is it not obvious that our prestige and economic status can likewise be improved by consistent support of WSPE, the organization which represents the professional engineer?



A scene of the Schwartz Hotel in Elkhart Lake where the September meeting will be held.

If you agree that we have few duties of greater importance than guiding the future of our profession through support of WSPE, then you will certainly attend the fall meeting of WSPE. Never before has there been a better opportunity to combine a most important business obligation with that needed recreation prescribed by your family. That is made possible by the plan of your officers and directors to hold the fall meeting of WSPE on Friday and Saturday, September 18 and 19, at a famous Wisconsin resort, the Schwartz Hotel on Elkhart Lake near Sheboygan. This resort has been chosen repeatedly by many well-known companies and associations for their annual meetings. It is famous for its facilities, excellent cuisine, and know-how on handling large groups of people. The recreational facilities available include golf, tennis, fishing, baseball, riding, hiking, swimming, shuffleboard, sun-bathing, and, of course, there will be time for chit-chat, too.

This is an appeal to you to assist in the worthy activity of supporting WSPE by attending this fall meeting with your wife and/or other guests. An unusually interesting program is being arranged for the ladies. Please note on your calendar at once the dates of September 18 and 19. We suggest that you come early on Friday so that you may spend a pleasant day enjoying the various recreational facilities with your engineering friends prior to the reception, buffet supper, and get-together on Friday evening. Saturday is going to be an unusual day of business and pleasure for you and your guests. You can make this a full week end by staying through Sunday for further recreation, if you so desire.

Suffice it to say that your program committee has planned a number of surprises which you cannot afford to miss.

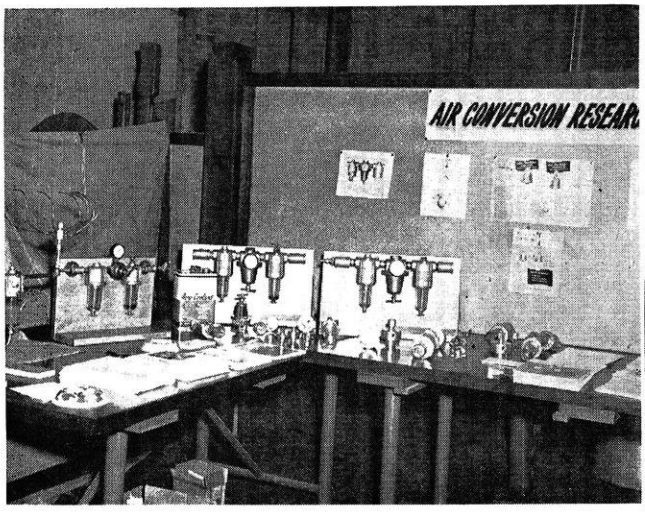
We are pleased to welcome the following into the Society:

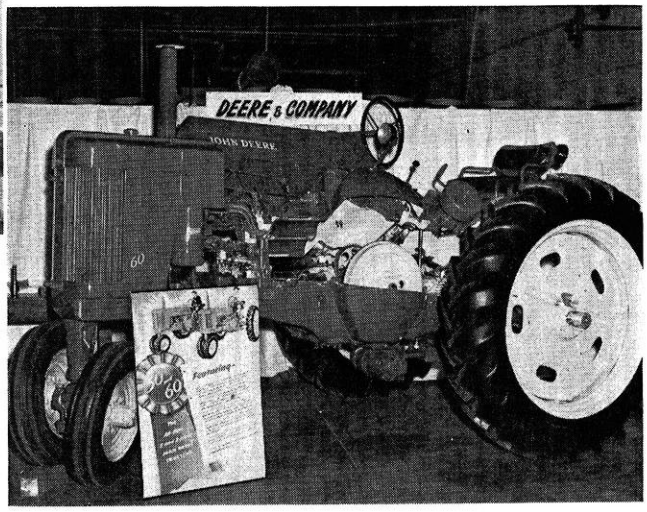
MEMBERS

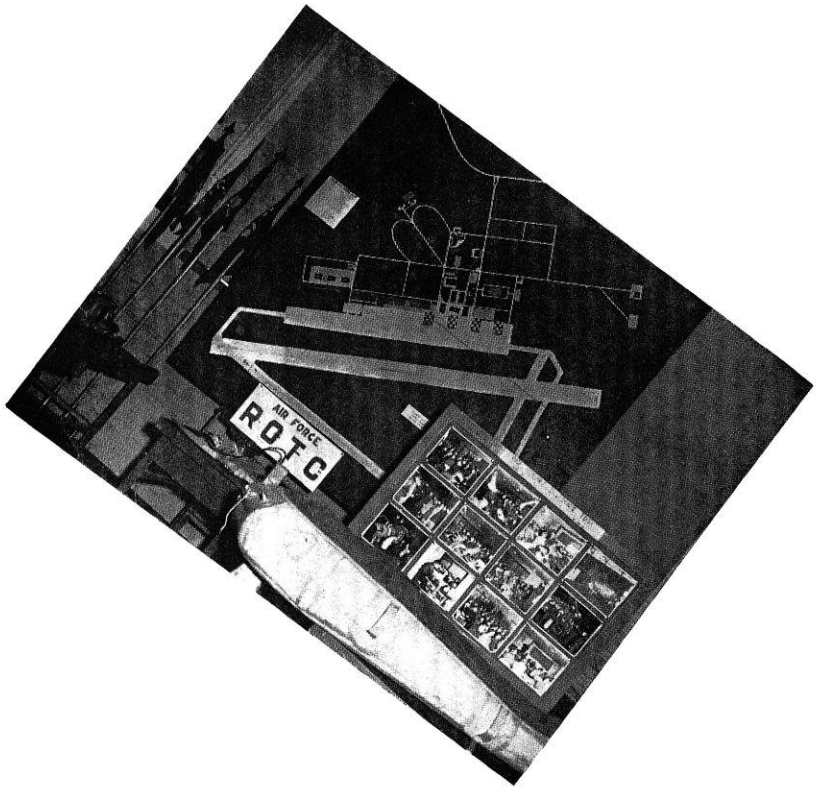
Robert J. Giesen, Vice President and Engineer, Kasper Construction Company, Manitowoc, Wis.

(continued on page 40)

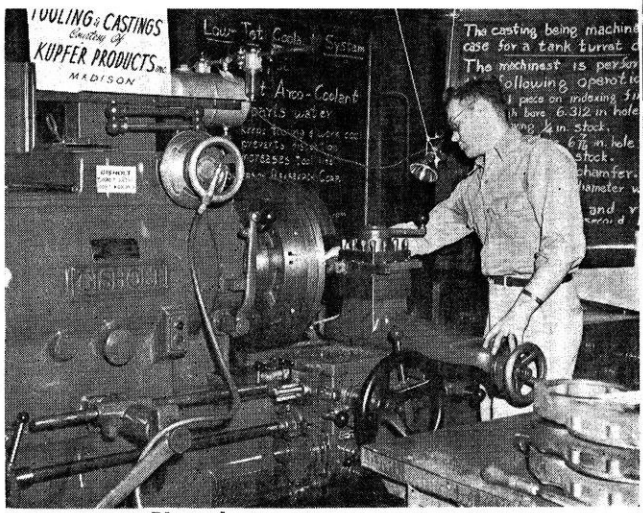
Engineering



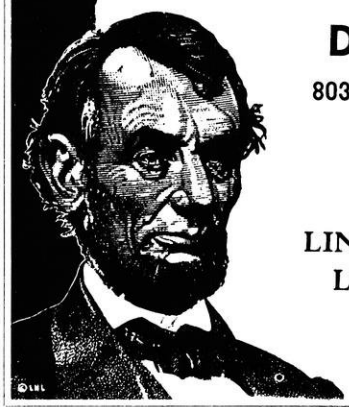




Exposition



Photos by
Dave Dauterman



Houdriforming - -

(*continued from page* 21)

with maximum power during take-off. In addition, most of the new synthetic fibers require aromatics for their manufacture.

An important by-product of all Houdriforming operations is high purity hydrogen. This gas is widely used in petroleum refining as well as in such familiar applications as the production of ammonia for fertilizer and the conversion of vegetable oils into cooking fat.

Houdry engineers have made economic studies of Houdriforming used in conjunction with typical refinery facilities processing 10,000 barrels of crude oil per day. These studies indicate that additional profits resulting from Houdriforming operations will retire the invest ment cost in from one to two years.

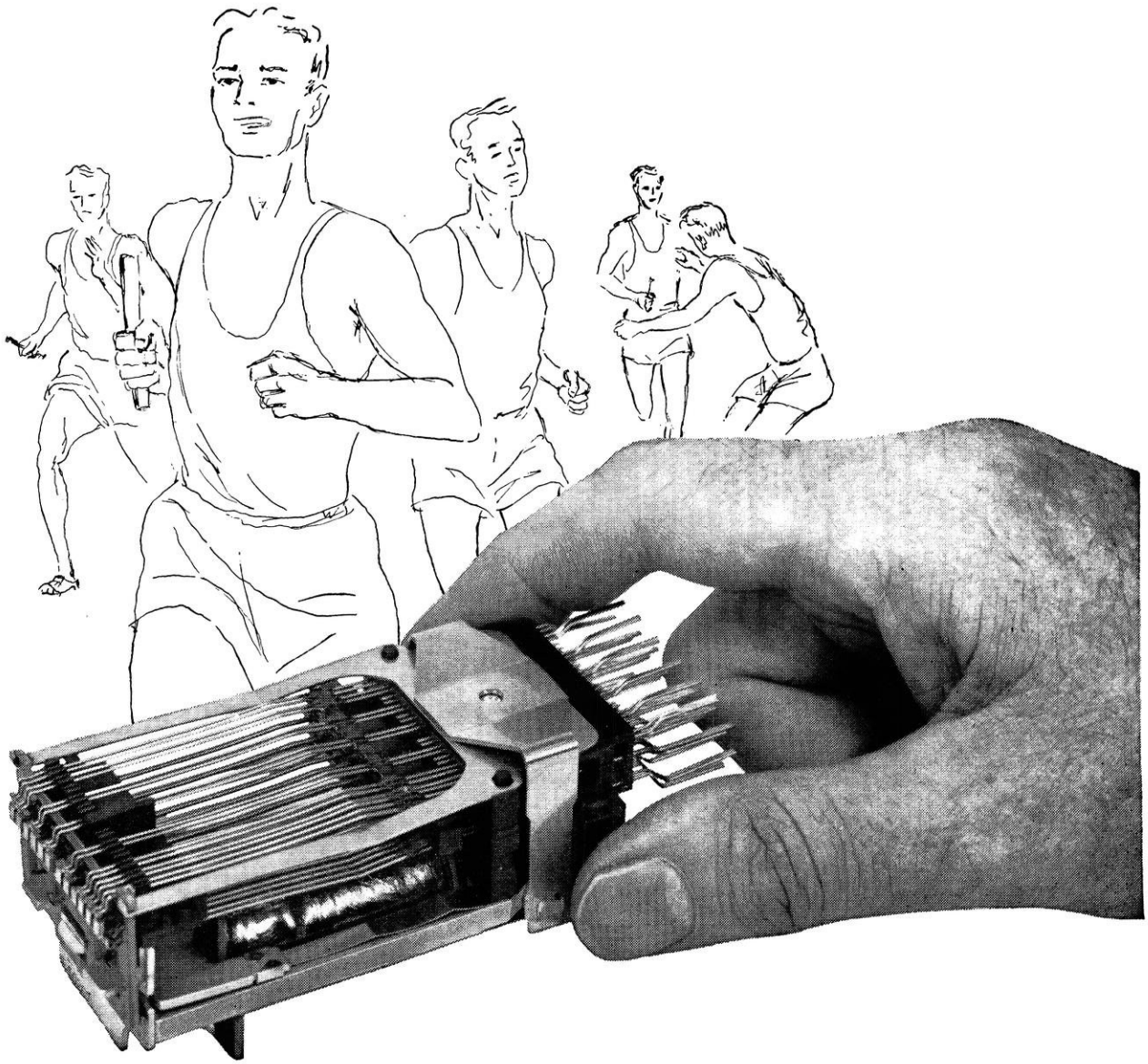
Already proved in several years of pilot plant operation, Houdriforming soon is to be placed in commercial operation. The first such plant will be the 11,000 barrel-per-day Houdriformer being constructed at Sun Oil Company's refinery at Marcus Hook, Pennsylvania. Operating in conjunction with Sun's new Arosorb process for the purification of aromatics, the new installation will produce annually more than 13,000,000 gallons of benzene; 30,000,000 gallons of toluene; and 15,000,000 gallons of aviation blending stock. Additional Houdriforming facilities aggregating approximately 25,000 barrels per day are also under construction in this country and abroad.

PROCESS DESCRIPTION

The naphtha charge from the fresh charge pump is joined by a hydrogen-rich recycle gas stream and the combined streams flow through series heat exchange with the reactor effluent stream and fired preheater coil into the No. 1 reactor. The reactants undergo a temperature drop in passing through the reactor because of the endothermic heat of reaction. The temperature level is adjusted by passing the partly reacted material through a reheat coil before continuing the reaction in the No. 2 reactor. A second reheater and passage through the No. 3 reactor completes the hydrocarbon conversion.

The reactor effluent is cooled by heat exchange with the reactor charge stream and cooling water and flashed in the high pressure flash drum. A portion of the flashed vapors are delivered to the recycle gas compressor for compression and return to the reactors; the remaining vapors are transferred to the fuel gas header. The high pressure flash liquid is pressured into the low pressure flash drum where most of the hydrogen remaining in the stream flashes into vapor and is also delivered to the fuel gas header.

The low pressure flash liquid is then pumped into a conventional stabilizer tower. Stabilized gasoline is produced as bottoms product with the vapor product taken overhead for delivery to the fuel gas system. The purpose of the low pressure flash drum is to lower the hydrogen content of the stabilizer tower charge stream and thus reduce the operating pressure of the tower.



A NEW RELAY RECORD

RELAYS—which are high-speed switches—are the nerve centers of the dial telephone system. In a split second, they set up a connection and then are off to direct the next call. In a large city, more than 1000 relays are used every time a number is dialed.

Now a new wire spring relay—devised by the Bell Laboratories—is at work. With only 11 instead of 70 parts, it is twice as fast, uses less power, and costs less to make and maintain than its predecessor. Result: calls go through faster and switching is done with less equipment.

Men and women of the Bell System—in operating, manufacturing and laboratory work—continually seek new ways to improve telephone service. Qualified engineering graduates can find well-paid and interesting careers in the telephone business. Your placement officer can give you details about opportunities for employment in the Bell System.

BELL TELEPHONE SYSTEM

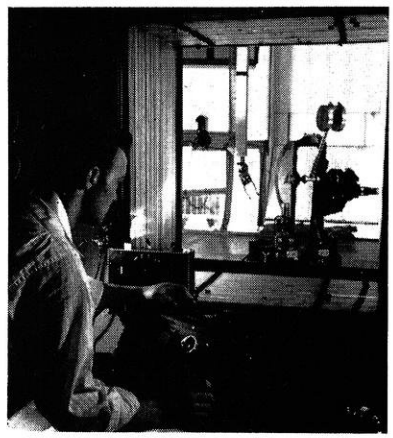
Science Highlights - -

(continued from page 25)

Westinghouse Atomic Power Division, which is engaged in two of the nation's atomic projects — construction of the atomic power plant for submarine U.S.S. Nautilus, and development of another nuclear reactor for a large vessel, such as an aircraft carrier.

A major problem in the construction of nuclear reactors is that of handling radioactive materials during tests and laboratory analyses. For safety purposes, this testing is done almost completely by remote control in a building known as the "hot lab."

There are five "hot spots," or cells, in the "hot lab" and these are separated from the main working area by a thick concrete and lead wall. In the cells themselves—each separated from the other by a thick steel wall—are testing devices designed especially for the lab's operations.



Exposing materials to radiation.

The inside of each cell is viewed through a 36 - inch - thick window comprised of layers of plate glass separated by oil. Mechanical claw-like "hands"—controlled from outside the cell—move radioactive objects into position for testing. A periscope-telescope arrangement enables scientists to examine specimens through a remotely controlled microscope.

SUPERCHARGED GENERATOR DESIGN

This latest and most important step in the history of size reduction of steam turbine generators is a further development following the first use of supercharged cooling in the rotor of a 60,000 - kw Allis-Chalmers generator installed in mid-1951.

In this newest development in supercharging, cooled hydrogen is forced at high velocity through the conductors of both stator and rotor. Heat removing ability is so effective in this design that generator length and diameter are both cut to remarkable ratios. Exciter size has also been reduced through the use of an entirely new excitation system.

The first completely supercharged machine is being built for development and test purposes. It will have a nominal rating of 40,000 kw and a 60,000-kw rating at increased hydrogen pressure.

Developed by RCA Victor, the new "45 Extended Play" record gives music lovers more music for less money plus a perfect medium for playing shorter classical works and multiple popular selections.

Twice as much music on the same size record

Another RCA achievement in electronics:

A challenging question was asked RCA engineers and scientists in 1951. How can we increase the playing time of a 7-inch "45" record, *without using a larger disc?*

Sixteen months of research gave the answer, "45 EP"—Extended Play. Public response confirmed this as *the most important achievement in the new recording speeds.* More than 2 million RCA Victor "45 EP" records were bought in the first four months of their existence!

Research leadership—your guide to better value: the ability of RCA Victor to solve the problem of more music on a "45 Extended Play" record accents the importance of research *to you.* Whether you plan to buy television, radio or any other electronic instrument, research leadership adds more value to all products and services trademarked RCA or RCA Victor.

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, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer 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 Division, RCA Victor, Camden, New Jersey.
Also many opportunities for Mechanical and Chemical Engineers and Physicists.

Secret of "45 Extended Play" is RCA Victor's discovery of a new way to cut a master disc—with an electrically heated stylus. Grooves are closer. Sound quality is cleaner, clearer, more alive.

RCA® *RADIO CORPORATION OF AMERICA*

World leader in radio—first in television

William R. Parlett, Cornell '48, Sets Sights on Executive Sales Job

BILL PARLETT has learned that helpful engineering suggestions promote good customer relations.

"Within the next ten years", says William R. Parlett, young Worthington Sales Engineer, "many of the officers of the corporation, district office sales managers and top salesmen will be retired.

"Appreciating the fact that someone must fill these jobs, our management is striving to develop capable leadership among the younger men of the corporation.

"As a prospective Worthington Sales Engineer, I received several months of classroom instruction by works managers, top sales personnel and application engineers at all of the Worthington plants. The background I obtained was a sound basis for further development and learning gained in one of the product sales divisions and then in a district sales office. After obtaining sufficient product knowledge and sales training, I was ready to sell directly to industry. As more important sales assignments are available, I feel I will progress in proportion to my own development and sales performance.

"As a Worthington salesman I contact a class of trade with which it is a pleasure to do business. The company's reputation is a key to a welcome reception by my customers.

"I have found that with Worthington you have job satisfaction, adequate compensation, and unlimited opportunity."

When you're thinking of a good job, think *high*—think *Worthington.* 3.6

FOR ADDITIONAL INFORMATION, see your College Placement Bureau or write to the Personnel and Training Department, Worthington Corporation, Harrison, N. J.

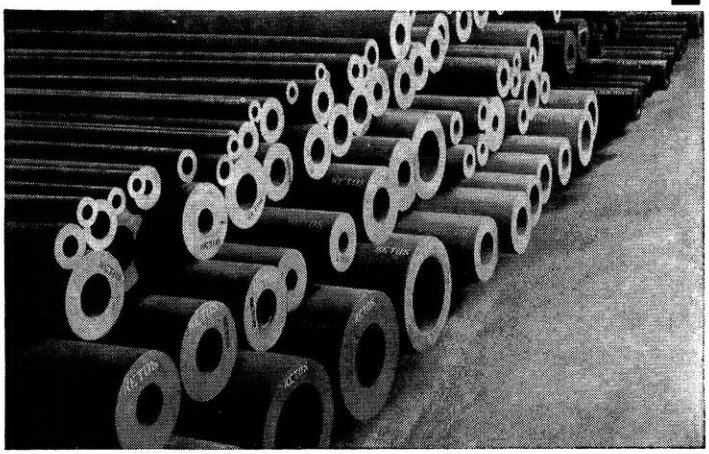
WORTHINGTON

The Sign of Value Around the World

What's Happening at CRUCIBLE

about hollow tool steel

Crucible is now making its high quality tool steel available in hollow form. Bars of Crucible Hollow Tool Steel can now be obtained with machine finished inside and outside diameters and faces — in three famous grades: KETOS, AIRDI 150 and SANDERSON. Already its use has effected substantial savings for makers of tool steel parts with cutout centers.



typical applications

The ring shaped tools that can be fabricated from hollow tool steel are virtually limitless — beading rolls, bearings and bushings, blanking and briquetting dies, cam dies and followers, chuck jaws, circular knives and shears, cutters, die holders and inserts, engraver and edging rolls, extrusion dies, feed and flue rollers, forming rolls, nozzles, saws, sleeves, slitters, stamping dies, wheels . . . and many others.

how it cuts costs

Crucible Hollow Tool Steel permits a toolmaker to bypass drilling, boring, cutting off and rough facing operations. Naturally, this results in less production time per unit, greater machine capacity, and a reduction in scrap losses. In some cases material costs alone are cut 20% by the use of Crucible Hollow Tool Steel instead of regular bar stock.

availability

All grades and sizes of Crucible Hollow Tool Steel are carried in stock in Crucible warehouses conveniently located throughout the country.

CRUCIBLE HOLLOW TOOL STEEL

Sizes (inches)	GRADES		
	Sanderson	Ketos	Airdi 150
2 O.D. x 1 I.D.	x	x	
2½ O.D. x 1½ I.D.		x	
3 O.D. x 1½ I.D.		x	
3¼ O.D. x 1¼ I.D.	x	x	x
3¼ O.D. x 1½ I.D.		x	
3½ O.D. x 1½ I.D.	x		
3½ O.D. x 2 I.D.	x	x	x
4 O.D. x 1½ I.D.			x
4 O.D. x 2 I.D.		x	x
4¼ O.D. x 1¾ I.D.			x
4½ O.D. x 2 I.D.	x		x
5 O.D. x 2 I.D.	x	x	x
5 O.D. x 2½ I.D.		x	x
5 O.D. x 3 I.D.	x	x	
5½ O.D. x 1¾ I.D.			x
5½ O.D. x 2 I.D.		x	
5½ O.D. x 2½ I.D.	x		x
6 O.D. x 1¾ I.D.			x
6 O.D. x 2 I.D.		x	
6 O.D. x 3 I.D.	x	x	x
6½ O.D. x 3¼ I.D.			x
6½ O.D. x 3½ I.D.		x	
6½ O.D. x 4 I.D.			x
7 O.D. x 2¼ I.D.			x
7 O.D. x 3 I.D.	x	x	
7 O.D. x 3½ I.D.			x
7 O.D. x 4 I.D.	x	x	
7½ O.D. x 3 I.D.	x	x	
7½ O.D. x 3½ I.D.	x	x	
7½ O.D. x 4 I.D.			x
8 O.D. x 3½ I.D.	x	x	
8 O.D. x 5 I.D.	x	x	x
8¼ O.D. x 3½ I.D.			x
8½ O.D. x 5¼ I.D.	x	x	x
9 O.D. x 4 I.D.	x	x	
9 O.D. x 5 I.D.		x	x
9 O.D. x 6 I.D.	x		
10 O.D. x 4 I.D.		x	
10 O.D. x 5 I.D.	x	x	
10 O.D. x 6 I.D.	x	x	x
11 O.D. x 4 I.D.	x	x	
11 O.D. x 6 O.D.	x	x	
11 O.D. x 7 I.D.		x	x
12 O.D. x 5 I.D.	x	x	x
12 O.D. x 6 I.D.	x	x	
12 O.D. x 7 I.D.	x	x	
12 O.D. x 8 I.D.		x	
13 O.D. x 6 I.D.		x	x
13 O.D. x 7 I.D.	x	x	
13 O.D. x 8 I.D.			x
13 O.D. x 9 I.D.		x	
14 O.D. x 7 I.D.	x	x	x
14 O.D. x 10 I.D.		x	
15 O.D. x 9 I.D.		x	x
15 O.D. x 10 I.D.		x	
16 O.D. x 10 I.D.	x	x	x
16 O.D. x 12 I.D.	x	x	

technical service

If you make tools with machined-out centers and wish additional information on Crucible Hollow Tool Steel, or technical assistance in solving an application problem, call in a Crucible representative. Our experienced staff of tool steel specialists is always available.

CRUCIBLE first name in special purpose steels

53 years of Fine steelmaking

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

Midland Works, Midland, Pa. • Spaulding Works, Harrison, N. J. • Park Works, Pittsburgh, Pa. • Spring Works, Pittsburgh, Pa.
National Drawn Works, East Liverpool, Ohio • Sanderson-Halcomb Works, Syracuse, N. Y. • Trent Tube Company, East Troy, Wisconsin

Bullet Propellents - -

(continued from page 15)

charge, bullet, or gun, than others. Holes are put in the grain to maintain a constant combustion surface. As the outer surface grows smaller, the hole surface grows larger. Disk shaped powder, which has maximum area per unit, finds wide use in pistols which, because of their short barrels, must have a faster burning powder. Shot guns, in the forward part of the barrel is relatively weak as compared to a rifle, must have a fast powder to exert the maximum pressure near the breech where there is sufficient strength.

Even though much has been done to control pressure surges, great care must be taken when working near maximum loadings. If the maximum is exceeded—even slightly, the powder loses all of its former characteristics; pressures will skyrocket, and the normal progressive-burning becomes detonation. Strangely, the most dangerous powders are those used for low pressure loads. Though not manufactured any more, Du Pont #80, a nitrocellulose powder, is an excellent example. It is designed for pressures up to 20,000 psi. Its critical point is about 30,000 psi. If the powder charge at the critical point is increased by one grain avoirdupois, the pressure will jump 10 to 50,000 psi; the variation depending on the other characteristics of the cartridge. Actually for optimum accuracy, whether near the critical point or not, load variations should be no more than one tenth of a grain.

Smokeless powder is reasonably safe to handle if in good condition, but improper storage may bring trouble. Single-base powders are slightly hygroscopic and in extreme dampness they may obsorb enough moisture to impair ignition. Excess temperature tends to decompose the powder, causing higher pressures when burned. Double-base powders become dangerous when faulty manufacture or storage causes them to sweat out droplets of pure nitroglycerine. While this is quite rare, undue agitation of such powder could cause an explosion.

Since World War II a new innovation in gunpowder has been developed. It is ball powder, so called because the grains are spherical. A primitive form was produced in 1933, but real strides were not taken until the war. Most commercial cartridges are now loaded with it, but it will be some time before it becomes available to the public in bulk quantities. Its chief advantages lie in its simplicity and safety of manufacture, compactness, and its ability to make use of relatively impure nitrocellulose. The spherical form is theoretically wrong; for as it burns, the surface decreases instead of remaining constant. This is compensated for by increasing the depth of the deterrent coating. Ballistically, it is the same as standard powder.

While the balls pack well in a cartridge case, there is only point contact between them, leaving ample space for the igniting flame to surround each grain. Two other advantages of ball powder are its ease of flow through automatic loading machines and the low calorific value of its outer layer. This means that the initial temperature will be lower, thereby reducing barrel throat erosion. The hottest point will be about six inches up the barrel. Here there is a larger area to dissipate the heat, so barrel life is greatly prolonged. Combustion temperatures are roughly 3000 degrees Centigrade. It appears that some day this type of powder will be used exclusively.

The primer, while only the igniter, is included here because of its direct effect on combustion.

Cartridges have two classifications as to their type of priming: rim-fire and center-fire. As the only difference between these primers is in the method of inclusion in the cartridge case, this discussion will be limited to the operation of the more important center-fire primer.

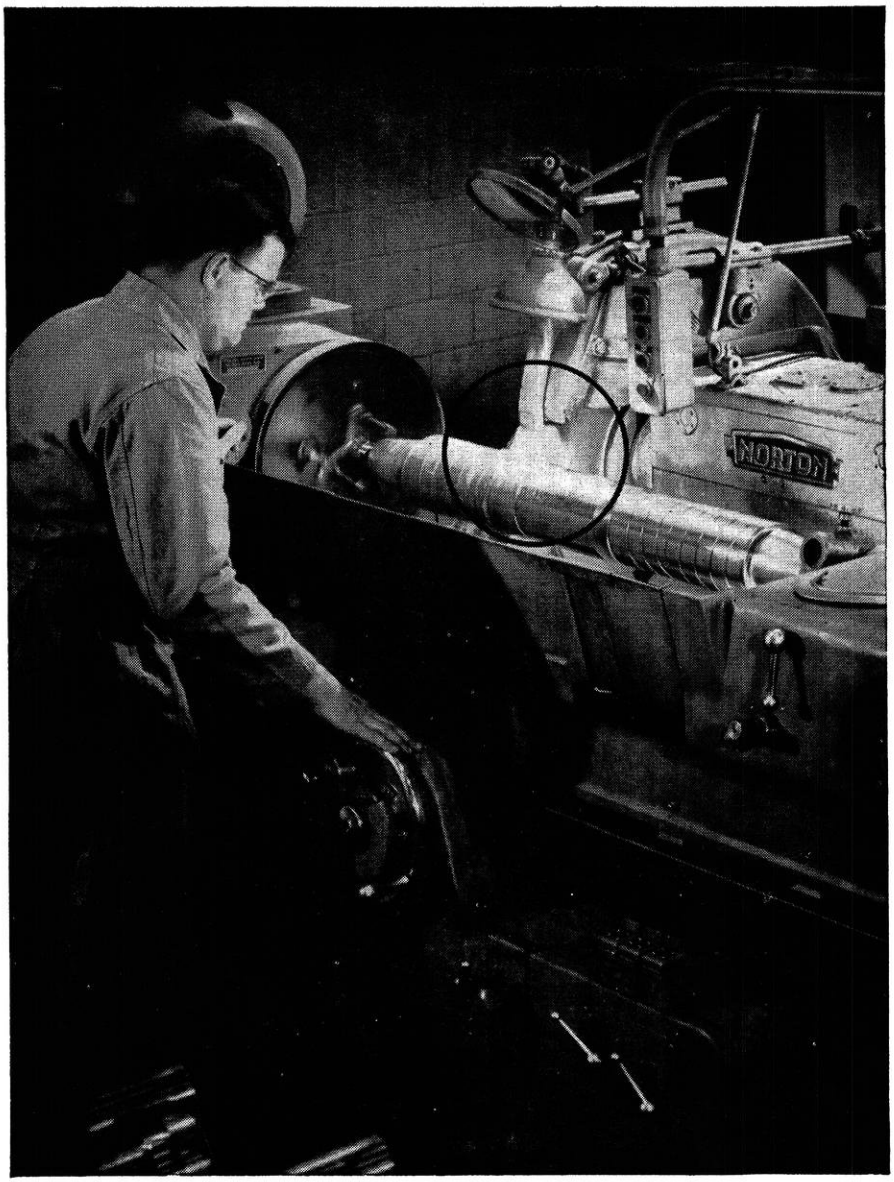
Center-fire, sporting arms primers are manufactured in two sizes, having diameters of .175 and .210 inches. They consist of three basic parts: the cup, the anvil, and the explosive; the cup and anvil being made of brass. These form a unit which is inserted into a primer pocket in the base of a cartridge and can be ejected and replaced with a new one after firing. The cup holds the explosive pellet and the anvil, in such a way that when struck by the firing pin, the dented cup will pinch the pellet against the anvil. The resulting explosion throws a 3 to 4000° C flame through the flash hole in the primer pocket into the powder chamber, thereby starting combustion.

By virtue of the physical requirements of a primer, it is necessary to have a shock sensitive, solid explosive which will burn in an instant.

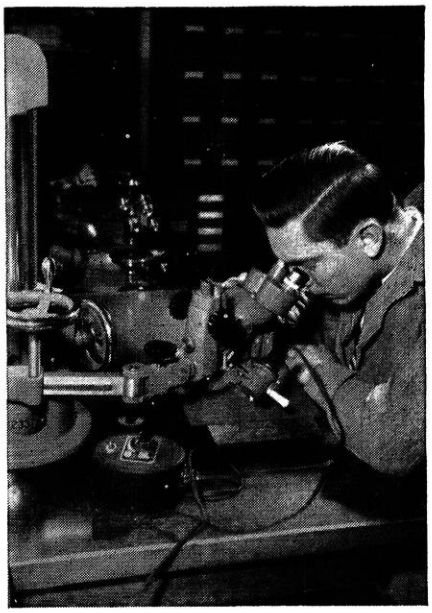
A priming mixture, like gunpowder, must have a source of oxygen and a fuel, antimony sulphide being a common fuel. Early primers contained fulminate of mercury as their oxygen source. This was satisfactory as an explosive, but the free mercury produced when it burned amalgamated with the brass cartridge case, making it too brittle to reuse. Substituting Pottasium chlorate for the fulminate, while eliminating brass deteriation, brought about the problem of corrosion. Upon firing, the chlorate gives up its oxygen, becoming the salt, potassium chloride. This is impregnated in the steel of the gun barrel by the outrushing gas. As this salt is hygroscopic ,rusting is rapidly promoted. Nevertheless the chlorate mixture makes a fine primer, and with proper gun cleaning, can be used without damage resulting. This is the Frankford Arsenal #70, used by the army through World War II.

Now adopted by the army and used for many years commercially, is the non-mercuric, non-corrosive primer, containing neither fulminate or chlorate. Instead, barium compounds are being used. Such commercial primers are peroxide, TNT, tetryl, and various new, organic nitro compounds are being used considerably more violent in their action, creating higher pressure at ignition and hence increasing the burning rate of the powder. When used with maximum pressure loads, the powder charge must be several grains less than if chlorate primers are used.

Thus it is the knowledge of combustion, keynoted with the ability to control, that has made possible the safe harnessing of the violent forces of explosive fuels.



The New Norton G Bond. The grinding wheel this man is using — in a Norton grinding machine — is made with the new Norton G Bond, one of the most important grinding wheel achievements in 45 years. The G Bond is a special vitrified bond, developed by Norton research engineers, that gives greatly improved grinding performance in many precision and semi-precision jobs — typical of the "Touch of Gold" that Norton brings to *all* grinding.



Helping To Produce The G Bond, Roderic C. Lancy, M. S., Ch. E., a recent graduate of Worcester Polytechnic Institute, examines bond particles under a stereoscopic microscope in the Norton research laboratories.

How modern grinding gets the

"TOUCH OF GOLD"

Ever consider how grinding with exactly the right wheel literally gives shop men the "Touch of Gold?"

That's because every time a top-performing grinding wheel touches the work, value is being added. At the same time the manufacturer is cutting costs and increasing profit-margins . . . while the ultimate purchaser of the product itself is getting more for his money.

Norton grinding wheels have top performance "engineered in." And as the world's largest producers in the abrasive field, Norton is always able to furnish the right abrasive or abrasive product for every job — thus supplying countless workers throughout industry with the true value-adding, cost-cutting "Touch of Gold."

Your Future with Norton

As industry expands, the demand for Norton products naturally increases, in a constantly growing list of grinding, polishing and other abrasive applications. A career with Norton — making better products to make other products better — offers steadily increasing opportunities for personal progress. But wherever your career in industry may take you, you will find the Norton "Touch of Gold" an invaluable aid to better production.

NORTON

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Abrasives • Grinding Wheels • Pulpstones • Oilstones
Abrasive Paper and Cloth • Grinding and Lapping Machines • Non-Slip Flooring • Refractories • Boron Carbide Products

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W.S.P.E. - -

(continued from page 29)

De Witt E. Yates, Chief Engineer and factory manager, W. S. Darley Co. (Chicago) Chippewa Falls, Wis.

Luther M. Kratz, Engineer, Luarkens, Inc., Eau Claire, Wis.

Richard G. Birkholz, Chief Engineer, Dorr Sales and Engineering Co., Milwaukee, Wis.

Arthur R. Dux, Engineer, State Highway Commission of Wisconsin, La Crosse, Wis.

Juan B. De La Torre, Engineer in Charge-Hydraulic Group, Power Section, Export Division, Allis Chalmers Manufacturing Co., Milwaukee, Wis.

Donald O. Covault, Engineer, Wisconsin State Highway Commission, Madison, Wis.

Edward A. Dickinson, Sales Engineer and Manager, E. A. Dickinson and Associates, Milwaukee, Wis.

Edward C. Youngman, Chief Mechanical Engineer, Mead and Hunt, Inc., Madison, Wis.

John H. Gerber, District Office Engineer, Allis Chalmers Manufacturing Co., Milwaukee, Wis.

Charles Conrad de Young, Assistant Plant Engineer, Thilmany Pulp and Paper Company, Kaukauna, Wis.

Edgar L. McFerren, Chief Engineer, Engineering Department, Giddings and Lewis Machine Tool Company, Fond du Lac, Wis.

David L. Strand, Engineer, Wisconsin State Highway Commission, La Crosse, Wis.

Robert R. Claypool, Assistant Plant Layout Engineer, Plant Engineering Dept., Cutler-Hammer, Inc., Milwaukee, Wis.

Ferdinand A. Ritter, Engineer Assistant, Dairyland Power Cooperative, La Crosse, Wis.

Francis W. Biehl, Engineering Draftsman, Giffels and Vallet, Inc., Detroit, Michigan.

●

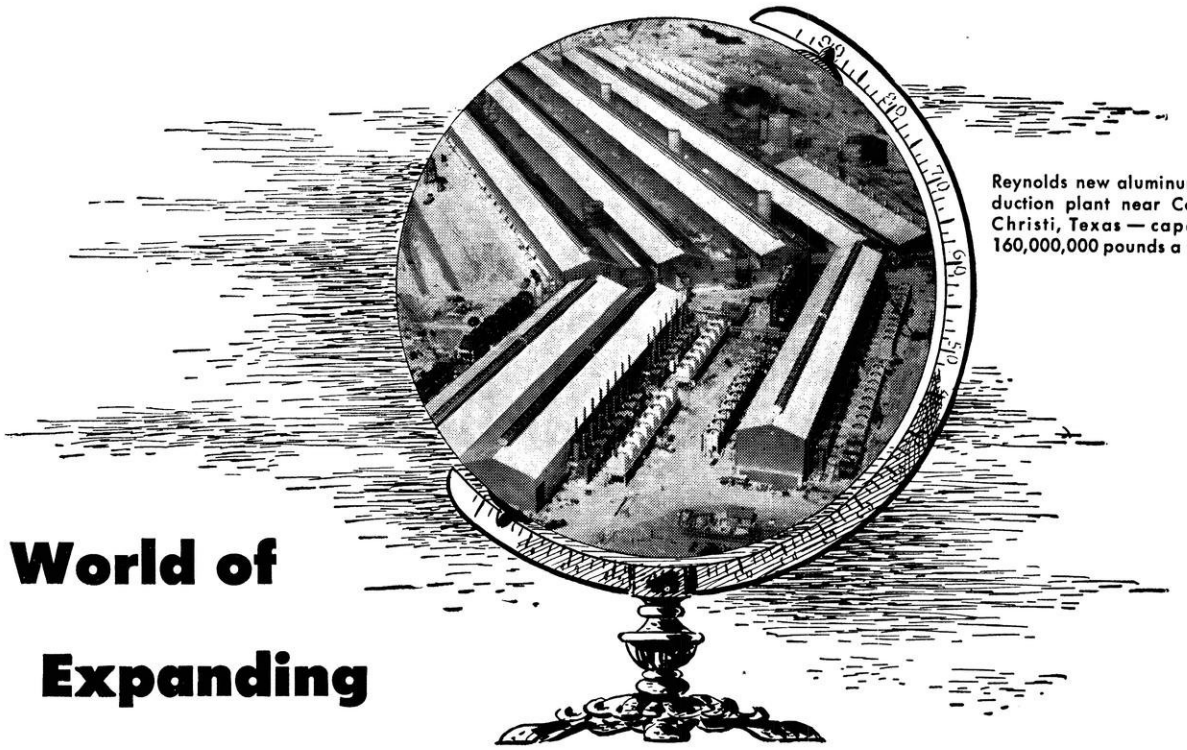
WESTERN CHAPTER

The regular monthly meeting of the Western Chapter of the Wisconsin Society of Professional Engineers was held Thursday evening, March 19, 1953 at the Linker Hotel, C. A. Wahlstrom presiding.

A recently elected member, J. R. Koenig of the Engineering Department of Dairyland Power Cooperative attended his first meeting of the group. The following engineers attended as guests: Robert Olson, Production Engineer, Trane Company; William Harris of the CB&Q Railroad; Max Peters, Northern States Power Company; Joe Meyer, Standard Oil Company; Harold Erickson, Resident Engineer at the La Crosse Sewage Disposal Plant and Robert Koch.

A written report prepared by Arthur Christenson was read covering the activities of the local chapter and the recent Engineers' Week activities. The report brought out the shortage of engineers and suggested again that the best method of interesting more students in engineering is to contact them early in their high school careers so that they may take suitable courses in preparation for a college course of study in engineering.

(continued on page 50)



Reynolds new aluminum reduction plant near Corpus Christi, Texas — capacity 160,000,000 pounds a year.

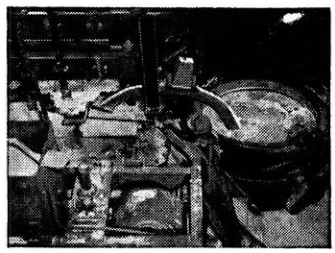
A World of Expanding Opportunity!

In a land noted for rapid expansion of free industrial enterprise, few companies have matched the swift and continuing growth of the Reynolds Metals Company. Now operating 27 plants in 13 states, and still expanding, Reynolds offers the ambitious engineering graduate a world of opportunity.

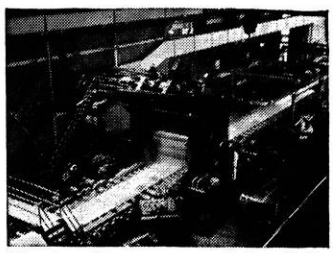
Reynolds operations include bauxite mining in domestic and foreign locations... chemical and electrolytic processing to produce aluminum pig ...sheet rolling... drawing and extrusion of mill and structural shapes ...foil rolling and printing... powder and paste production... finished parts and products fabrication. In these and in the allied sales and marketing operations promising careers exist for graduates in virtually any phase of engineering.

On-the-job training is the Reynolds policy—after preliminary orientation which may include basic experience in production plants for sales personnel, and sales office work for technical trainees. Liberal insurance, hospitalization and retirement programs are maintained.

For important background information on "your future in Aluminum," *mail the coupon.* If you are definitely interested now, write direct to General Employment Manager, Reynolds Metals Company, 3rd and Grace Streets, Richmond 19, Va.

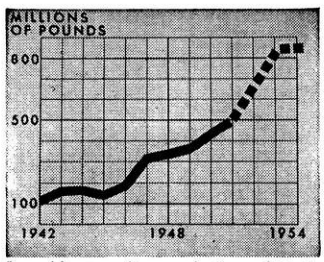


Tapping one of huge battery of electrolytic cells



Sheet rolling—reverse hot mill in operation

REYNOLDS ALUMINUM



Reynolds expanding production — historic chapter in 33 years of continuing growth.

Reynolds Metals Company, Employment Dept.
Richmond 19, Virginia

Please send me, **FREE,** your 96-page booklet, "The ABC's of Aluminum"; also the 44-page book, "Reynolds Aluminum . . . and the Company that makes it."

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Address _____

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or

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with an interest in

RADAR

or

ELECTRONICS

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Here is what one of these positions offers you:

THE COMPANY

Hughes Research and Development Laboratories, located in Southern California, are presently engaged in the development and production of advanced radar systems, electronic computers and guided missiles.

THE NEW OPENINGS

The positions are for men who will serve as technical advisors to government agencies and companies purchasing Hughes equipment—also as technical consultants with engineers of other companies working on associated equipment. Your specific job would be essentially to help insure successful operation of Hughes equipment in the field.

THE TRAINING

On joining our organization, you will work in the Laboratories for several months to become thoroughly familiar with the equipment which you will later help users to understand and properly employ. If you have already had radar or electronics experience, you will find this knowledge helpful in your new work with us.

WHERE YOU WORK

After your period of training—at full pay—you may (1) remain with the Laboratories in Southern California in an instructive or administrative capacity, (2) become the Hughes representative at a company where our equipment is being installed, or (3) be the Hughes representative at a military base in this country—or overseas (single men only). Compensation is made for traveling and moving household effects, and married men keep their families with them at all times.

YOUR FUTURE

In one of these positions you will gain all-around experience that will increase your value to our organization as it further expands in the field of electronics. The next few years are certain to see large-scale commercial employment of electronic systems. Your training in and familiarity with the most advanced electronic techniques now will qualify you for even more important future positions.

How to apply:

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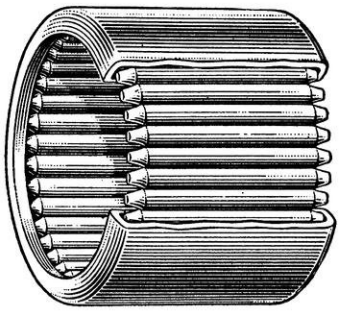
See your Placement Office for appointment with members of our Engineering Staff who will visit your campus. Or address your resumé to the Laboratories.

The Torrington Needle Bearing

. . . shaft hardness determines effective load capacity



The economy of the Torrington Needle Bearing is due in part to the fact that the shaft usually serves as the inner race. Thus, since the shaft is an integral part of the bearing, its load capacity limits the capacity of the bearing assembly. In order to obtain the full rated load capacity of the Needle Bearing, it is necessary that the shaft be at least surface-hardened to the equivalent of Rockwell C-58.

Loads and Speeds Related to Shaft Hardness

Because of material or design limitations, it is sometimes desired to run Needle Bearings on shafts softer than the recommended Rockwell C-58. This can be done safely providing the bearing loads and speeds are not too severe. However, the capacity of the bearing assembly is only as great as the load capacity of the shaft, regardless of the rated load capacity of the bearing as indicated in the catalog. The shaft capacity decreases very rapidly as the surface hardness is reduced below the recommended Rockwell C-58 minimum hardness.

Figure 1 shows this very clearly. It can be seen that reducing the shaft hardness to Rockwell C-52 gives a resulting load factor of .5. In this case, the catalog rating must be multiplied by .5 in order to obtain the true capacity of the bearing assembly.

Unheat-treated, cold rolled shafting will only carry 2%-3% of the bearing's rated load capacity.

The speed of the application is also important in determining proper hardness to assure satisfactory shaft life. The chart in Figure 2 illustrates this effect.

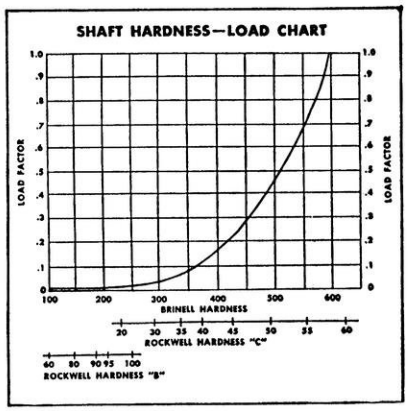


Figure 1. If the surface hardness of the shaft, its tensile strength, or the per cent of carbon is known, the load factor can be read either right or left from the intersection of the curve. The load factor, multiplied by the rated capacity of the bearing, will give the shaft capacity and the capacity of the application.

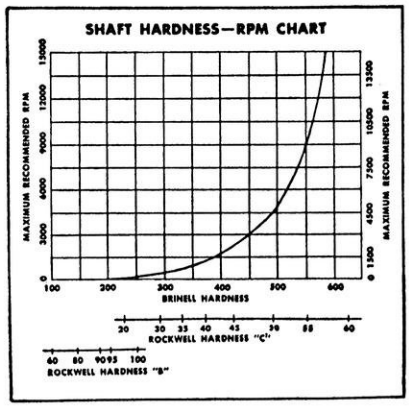


Figure 2. As the speed increases, it is desirable to increase the shaft hardness. For a given rpm, read across to the curve and down to the proper hardness. Conversely, if hardness is known, read up to the curve and across to the maximum rpm for that shaft.

Hardened Inner Races Available

When it is either impossible or impractical to harden the shaft, it is necessary to use an inner race which will provide the required surface for Needle Bearing operation. Inner races are available for all sizes of Needle Bearings. When used, inner races should be securely fastened to the shaft by clamping against a shoulder, by snap ring, or by press fit.

When designing Needle Bearings into a piece of equipment where shaft hardness is a question, the economics of using inner races as compared to a properly heat treated shaft should be carefully analyzed. When all factors such as inner race cost, securing devices, and actual assembly time are considered, it is usually found more economical to heat treat the shaft.

Engineering Library - -

(continued from page 19)

arranged in alphabetical order by subject matter and are cross indexed. A complete author index is given at the end of the volume. Dean Johnson in describing this index back in 1892 was fully aware of its value. He writes:

> "The value of a carefully prepared index such as is here offered can scarcely be overestimated. Even though the publications to which the references are made are not in one's private library, they generally are accessible and can be found in public or society libraries. On the other hand even though these volumes all stand on one's own shelves, if he does not know what they contain, or where to find an article which he dimly remembers to have seen, the task of making the search is so great as to forbid the effort, and the volumes remain unconsulted. It is the writer's firm belief that an index, such as this, without a library is of more value to the student than the library if he has no index to its contents."

Here is a typical entry taken from **The Engineering Index.** Note that the article referred to appeared in the magazine **Western Construction** for September 1951 on pages 59-61. The volume and issue number specified as v 26 n 9 are also given to provide a precise record of where the original article can be found. Observe that the brief summary contains sufficient information to appraise the original article.

> New Method for Prestressing Circular Concrete Structures. Western Construction v 26 n 9 Sept. 1951 p 56-61. Eight circular silos 36 ft in diam and 72.5 ft high at Oro Grande, Calif, cement plant, built to increase cement storage capacity by 120,000 barrels, are of prestressed concrete; silo walls are from 9 to 7 in. thick; illustrated description of prestressing; wire was a high carbon steel having ultimate tensile strength of about 222,000 psi and "proof stress" of 180,000 psi.

The Industrial Arts Index: This index lists articles by title and subject from about 300 magazines covering the fields of business, commerce, industry, and engineering. There is some overlapping between this index and the **Engineering Index,** but in general the **Industrial Arts Index** does not cover highly technical articles. Here is a typical entry taken from the **Industrial Arts Index.** Note the absence of any annotation describing the article. The abbreviation "bibliog" and "il" indicate that a bibliography is included and that the article is illustrated.

> Chemical engineering materials of construction; sixth annual review. bibliog il Ind & Eng Chem 44:2285-380 0 '52.

Chemical Abstracts: This publication of the American Chemical Society is undoubtedly the finest example of literature coverage in the world today. Approximately 700 abstractors working under the direction of experienced editors undertake to provide a complete coverage of the literature of chemistry and chemical engineering. Over 5,000 scientific journals are systematically covered and any article found therein which contains original information of chemical interest is abstracted. These abstracts are arranged under 33 main sections and published in periodical form twice a month. An author index is included with each issue and at the end of the year complete author, subject, formula, and patent indexes for all issues are published. Another useful index tool published for **Chemical Abstracts** is the 10-year cumulative index which enables a researcher to examine ten years of chemical literature in one master index.

Here is a typical entry taken from a recent issue of **Chemical Abstracts.** Note again the complete article reference given by the title, volume number, page numbers, and year. The abstract itself provides a short description of the experimental work done and the results obtained.

> Heat transfer to air flowing through packed tubes. P. C. Chu and J. Anderson Storrow (Doll. Technol., Manchester, Engl.). Chem. Eng. Sci. 1,230-7 (1952). —The effect of packing diam., packing thermal cond., and ratio of packing length to tube diam. was studied in the transfer of heat from the wall of a steam-heated 1 in.-bore copper tube to air for R3 up to 3500. Thermal cond. of the packing has no influence at Re below 1600 but does have influence from 1600 to 3500. The length of the packed tube is an important variable, but the packing diam. has little effect on the heat transfer.

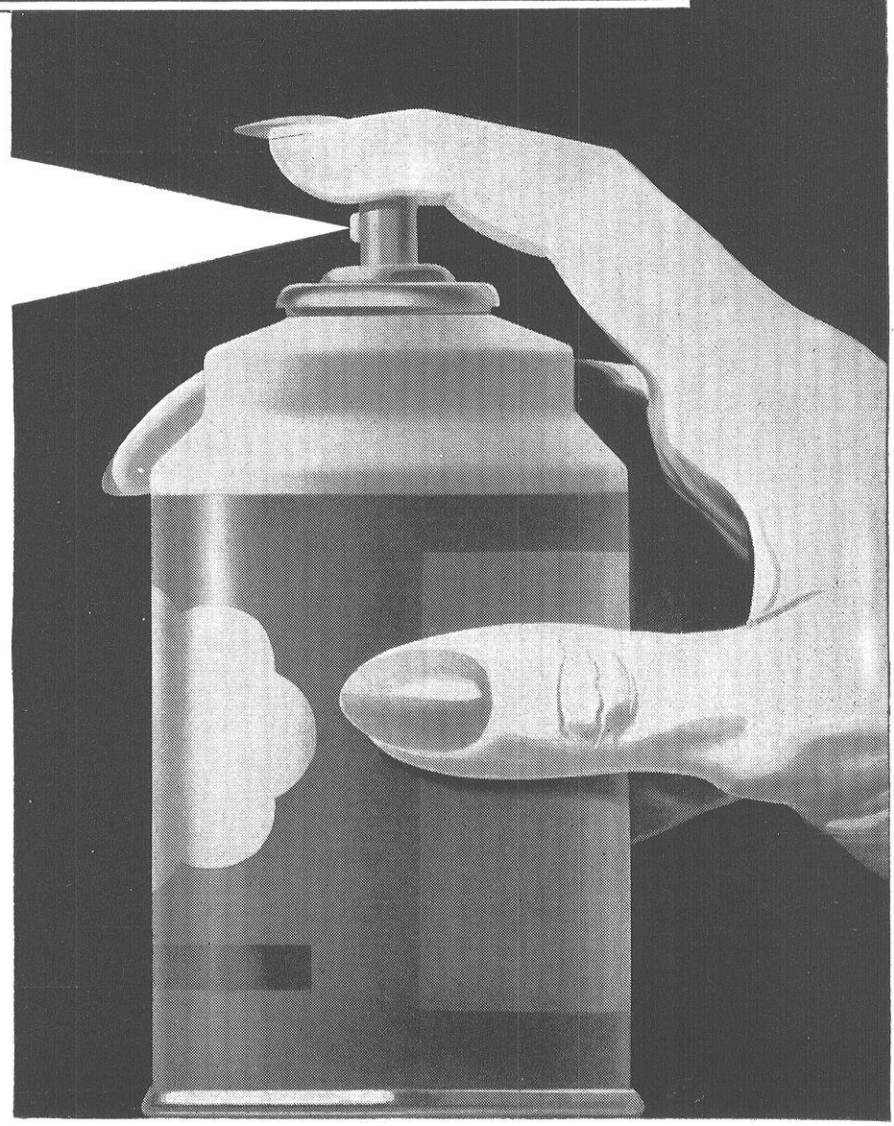
It is worth repeating that you should not as an engineering student leave the university without gaining some understanding of these indexes and their use. Another excellent practice which you can usefully adopt as a way to further your professional development is the habit of scanning the important periodicals covering your major field of interest. It would be impossible to make a search for specific information doing this, but the habit is excellent for keeping in touch with the progress of science and technology and for being well informed on new developments in engineering.

Conclusion

The preceding sections are by no means inclusive in the sense that all books and periodicals which you will find useful are included, but they do indicate the main types of engineering literature with which you should be familiar. Every branch of engineering has its own problems and consequently its own "tools" for their solution. As you become familiar with the literature resources mentioned in this paper, the problem of research resolves itself into one of selectivity. You will find that some of the materials are excellent for your work while others are not.

But having learned something about the important kinds of scientific literature and how they are used you will have provided yourself with a powerful technique to use in solving problems. It will aid you in your current academic work, and, in the future, it will enable you to handle more easily the professional problems which you will encounter.

Push-Button Lacquer



CHEMICAL PROBLEM...

. . . a means of "touching up" furniture, automobiles, and household equipment that would be convenient, easy to do, and not messy.

SOLUTION . . .

. . . aerosol lacquers, made with nitrocellulose and resins produced by Hercules. These quick-drying sprays, readily applied at the touch of a finger, restore original color to any lacquered or baked enamel surface.

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This is but one example of the far-reaching chemical developments in which you could participate at Hercules—in research, production, sales, or staff operations. It suggests the ways Hercules' products serve an ever-broadening range of industries and end-uses.

Hercules' business is solving problems by chemistry for industry . . .

. . . soaps, detergents, rubber, insecticides, adhesives, plastics, paint, varnish, lacquer, textiles, paper, to name a few, use Hercules® synthetic resins, cellulose products, chemical cotton, terpene chemicals, rosin and rosin derivatives, chlorinated products and other chemical processing materials. Hercules® explosives serve mining, quarrying, construction, seismograph projects everywhere.

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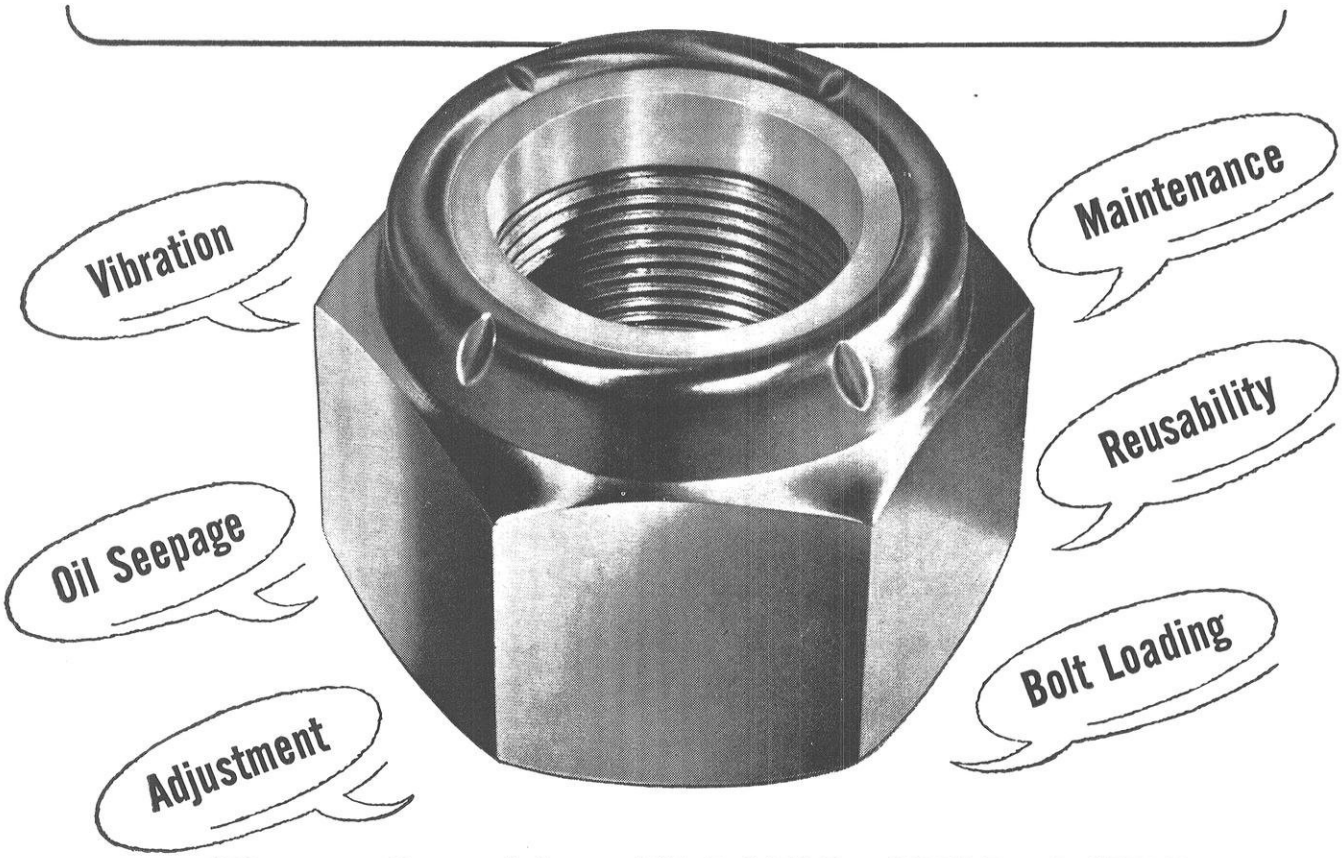
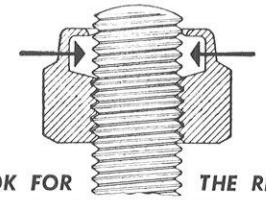
Whenever fastening problems arise...





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LOOK FOR THE RED LOCKING COLLAR

It is threadless and resilient. Every bolt impresses (but does not cut) its full thread contact in the Red Elastic Collar to fully grip the bolt threads. In addition, this threading action properly seats the metal threads—and eliminates axial play between bolt and nut threads. All Elastic Stop Nuts—regardless of type or size—lock in position anywhere on a bolt or stud, maintain accurate adjustments and seal against liquid seepage. Vibration, impact or stress reversal does not disturb prestressed or positioned settings.

Whenever fastening presents a problem—ESNA is ready with a quick answer. More than 3000 types and sizes of self-locking vibration-proof fasteners—plus the "know-how" of ESNA engineers—are available here at ESNA.

ESNA has long been known as "design headquarters" for self-locking fasteners. Accepted by Army, Navy and Air Force, virtually every aircraft built in the past decade has been Elastic Stop Nut-equipped. On the railroads, in the oil fields, on automobiles and construction equipment, Elastic Stop Nuts manufactured to exacting quality control standards, are doing specialized jobs every day.

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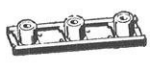

GANG CHANNEL


NYLON CAP

DESIGN HEADQUARTERS FOR SELF-LOCKING FASTENERS

Link Simulator - -

(continued from page 23)

safe system which safeguards the plane from fire hazards arising from possible circuit overloading or electrical faults within the circuits. The systems protected by the breakers include: power plant; fuel, electrical, hydraulic, and flight control systems; autopilot; instruments; ATO control; etc. In the trainer simulation, the breakers are controlled by the instructor.

13. Complete high and low frequency radio simulation with combat interphone.

14. Complete aircraft hydraulic and electrical simulation and numerous warning, test, and signal lights and switches.

Much of the effectiveness of the crew's training in the B-47B flight simulator is derived from the fully equipped instructor's console which is located directly opposite the trainer unit. Here the instructor, the mastermind behind each training flight, sets up and controls each practice hop, introducing problems and conditions as the occasion demands.

Directly in front of the instructor as he sits at the console are a myriad of switches, push buttons, lights and instruments which provide unlimited flexibility of instructioneering. To his left is a huge flight recorder which continuously records the ground position of the aircraft during simulated flights. On his right are two additional recorders which provide him with range, azimuth and altitude information for ILS and controlled approaches and let-downs. All three are Cartesian coordinate-type recorders designed for specific application on the B-47B simulator.

The large flight position recorder graphically plots the aircraft's course on full scale aeronautic charts representing a geographic area 700 miles square. Resetting the recorder and repositioning the chart during the flight permits uninterrupted training flights of unlimited distance and duration.

In approach problems, the simulated aircraft's position is graphically presented on the two other recorders, both of which are integrated with the simulator's ILS. The upper recorder on the right flank of the console picks up the aircraft when it is within 15 miles of the station. From this point on, it accurately plots and records the distance of the plane from the point of touch-down, indicating at the same time any deviation, within the maximum limits of the chart, from the glide path.

On the lower approach recorder a circular chart is used with the station located in the center. This recorder picks up the simulated aircraft 13 miles from the station. From then on it takes but a glance at the recorder to determine the exact azimuth and range of the aircraft with respect to the station. Landing system markers, outer, middle, and boundary, can be inserted manually by the instructor.

Besides furnishing the instructor with information for ILS problems, the two approach recorders provide the necessary information for GCA talk-downs. Both approach systems can be accomplished concurrently.

At the instructor's fingertips are controls for setting up VOR, VHF, and low frequency radio stations which provide omnirange, voice and loop facilities. There are dials for introducing and changing field elevation, magnetic variation, barometric pressure, and wind (with variable speeds from any direction). There are still others for changing the weight and center of gravity in the simulated B-47 itself.

Included too, are duplicate flight and engine instruments and tell-tale lights to keep the instructor constantly aware of what is going on in the simulator's cockpits.

However, the controls that provide the instructor with his most effective and powerful training tools are the rows of switches and buttons on the console's emergency condition panel. With the flick of a switch or the push of a button, the instructor can change the course of a normal, smooth running flight into a veritable nightmare for the crew. Overheating engines, engine failure, icing, hydraulic system failure, fire, instrument failure, and fuel system failure are but a few of the **65 different potentially hazardous conditions** which can be most realistically duplicated in the simulator.

While any one or any combination of these conditioned situations is capable of adding grey hairs to the Air Force's "omni-dexterous airmen," the real purpose behind their design is to provide the crewmen with safe and realistic media for learning to cope with the unexpected. After repetitive encounters with these simulated emergencies, many of which could not be safely duplicated in the air, the pilot and crew became alert to the unusual and react to it as if it were routine.

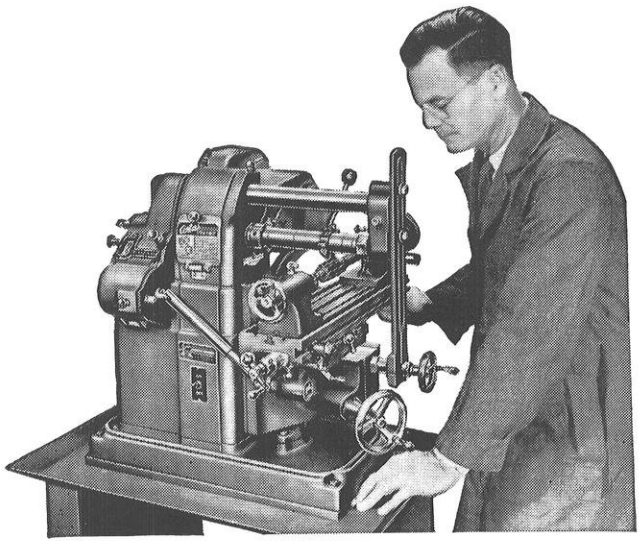
A blackout curtain partitions the instructor's station from the simulator. The curtain may be left open for routine practice work or may be drawn for simulated night and weather flights. And for the convenience of the instructors, an exterior seat is located next to each cockpit for observation purposes during training flights.

Two L-shaped paneled cabinets extending in front of the enclosed training area house many of the hundreds of electronic components which comprise the simulator's complex flight, engine and radio systems. Additional components are concealed beneath the side panels of the inclosure itself. In most instances the chassis on which the components are mounted are draw-type which can be easily pulled out for maintenance, adjustment or inspection checks.

Separate exterior cabinets are also provided for the control loading system and the cockpit air conditioner at the rear of the training area. Both operator's conditioner and the main power plant of the simulator, however, are installed in a compact cabinet within the enclosure.

Transportation and installation problems of the huge B-47B jet simulator were anticipated in the structural design of the unit. For ease of handling in shipping and for quick installation on delivery, the simulator is sectionalized into seven major sections. Each is castered for optimum mobility.

Another page for **YOUR BEARING NOTEBOOK**

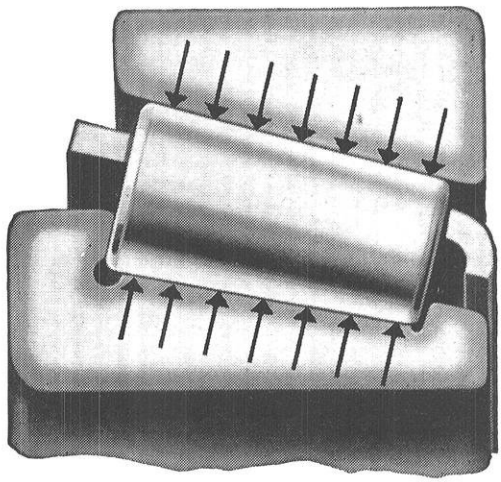


How to give an 8-speed miller greater spindle accuracy

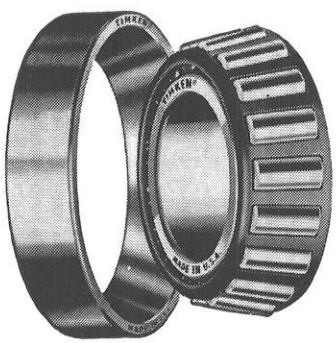
This milling machine has 8 speeds, from 62 to 2870 RPM. To hold the spindle in accurate alignment at these various speeds, design engineers mount it on Timken® precision bearings. Long-lasting milling precision is assured. Spindle accuracy can be controlled because Timken bearings are adjustable. And they provide more than enough capacity for any tool load.

Line contact of TIMKEN® bearings keeps spindles rigid

Because Timken bearings carry the load along the line of contact between rollers and races, they give a wider, more rigid support to the shaft. And the tapered construction of Timken bearings enables them to take radial and thrust loads in any combination. End-play and deflection in the shaft are practically eliminated.

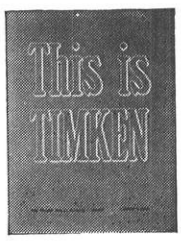


TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



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 ✳

W.S.P.E. - -

(*continued from page* 40)

R. C. Clark discussed the proposed changes in legislation now under consideration at Madison which would affect the professional engineers of the state.

Donald Grunditz, secretary of the chapter, introduced Mr. William Dackis an engineer of the Heat Transfer Sales Department of the Trane Company who spoke on "Heat Transfer Surface." Mr. Dackis holds a Bachelor of Science degree from Duke University. He pointed out that one of the basic reasons the Trane Company is one of the largest in the industry is due to the process of aluminum brazing. They can build larger units than any other manufacturer using this process in joining aluminum surfaces. The various types of heat transfer surface were discussed and illustrated by means of slides.

The monthly meeting of the Western Chapter of the Wisconsin Society of Professional Engineers was held Tuesday evening, April 14, at the Linker Hotel, C. A. Wahlstrom presiding. Arrangements are being made to have the May meeting as ladies' night.

The main speaker at the dinner meeting was Meteorologist A. D. Saniel of the United States Weather Bureau who gave the engineers an interesting account of the history and activities of the Weather Bureau. It was set up with an initial appropriation of $20,000 in 1870. The LaCrosse Station was set up in October 1871. The bureau last year spent $26,000,000. The first observers were under the direction of the army. In 1890 the Weather Bureau was transferred to the Agriculture Department and in 1942 to the Commerce Department of the United States Government. Since one of the present important services now is pilot warning for aircraft many of the weather stations are located at airports.

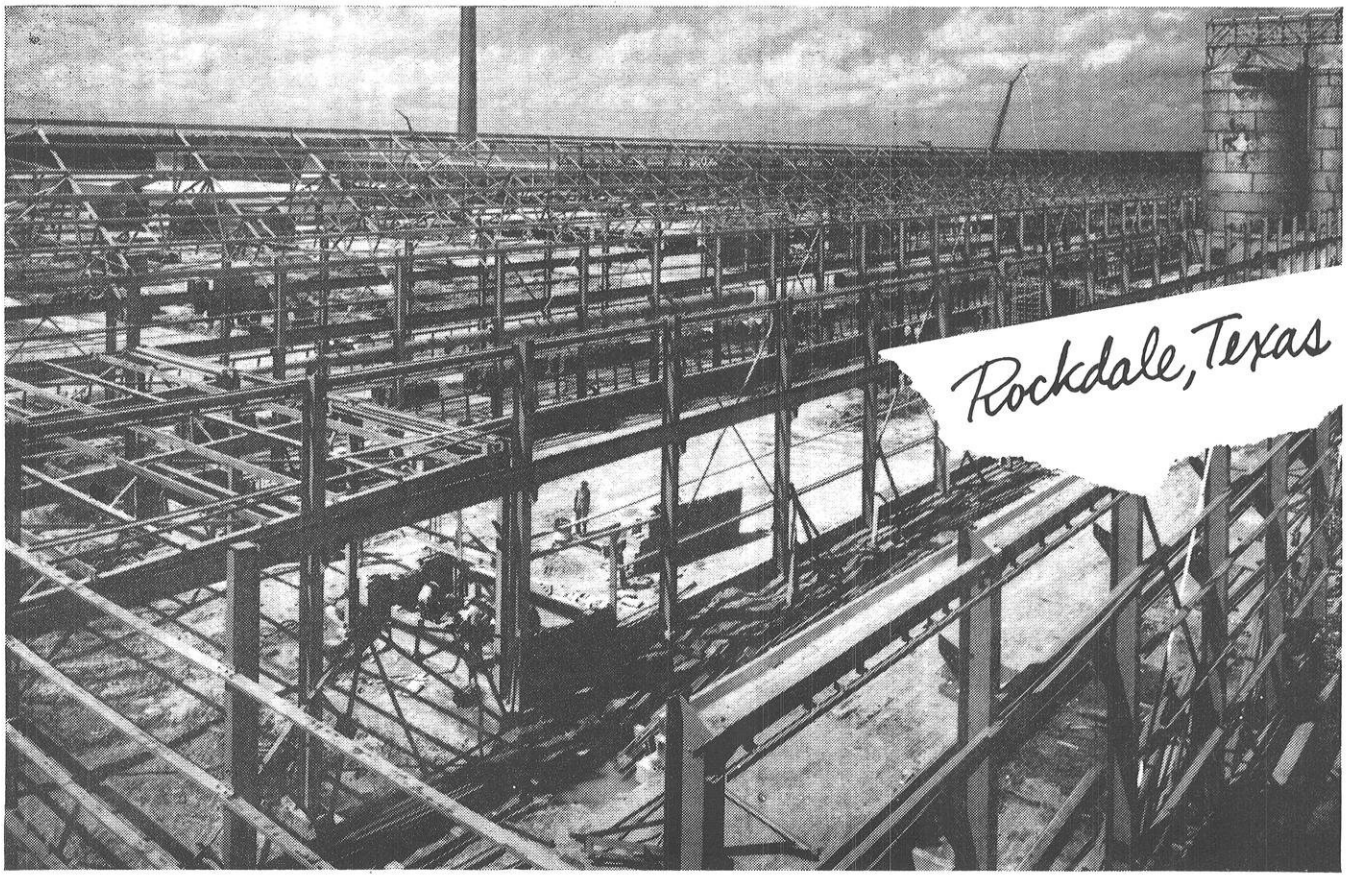
Saniel pointed out that approximately 5,000 people in the United States serve without salary as weather observers and make a report each month showing daily temperature, rainfall and other data. Data on the higher altitudes for weather conditions is made possible by an automatic recorder known as a raysonde which consists of small aneroid barometer built into a two tube radio transmitter operating at 144 megacycles which is carried aloft by a balloon sending out signals translated by the receiver on the ground into pressure, temperature and moisture data as the balloon ascends.

The service of the weather bureau in this area is also important in giving flood warnings. These timely warnings have saved large sums of money and many lives especially in the last few years. Since more accurate data is available on rainfall and water flow it is possible to forecast stages of the river very accurately compared to forecasting weather. Saniel exhibited various maps, charts and equipment used by the weather bureau and described the publications put out by the department which is of special interest to utility and construction engineers.

WIS. VALLEY CHAPTER

A business meeting was held at the Hotel Wausau March 23. Following the business meeting, members, ladies and guests enjoyed a steak dinner at the hotel. After dinner entertainment was provided by a sleight-of-hand artist.

Mr. Nelson, Steam Power Superintendent of Wisconsin Public Service Corporation, gave a very interesting talk on the Weston Steam Power Plant which is now being built south of Rothschild by Wisconsin Public Service. In his talk he explained why this plant is being built; how its location was decided upon, as well as explaining some of the design features of this plant.

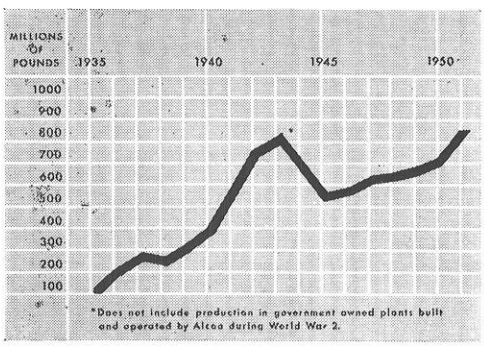


Is part of your future being built here?

Here you see the beginning of another addition to Alcoa's expanding facilities. This plant, at Rockdale, Texas, will be the first in the world to use power generated from lignite fuel and will produce 170 million pounds of aluminum a year. This and other new plants bring Alcoa's production capacity to a billion pounds of aluminum a year, four times as much as we produced in 1939. And still the demand for aluminum products continues to grow. Consider the opportunities for you if you choose to grow with us.

What can this mean as a career for you?

This is a production chart—shows the millions of pounds of aluminum produced by Alcoa each year between 1935 and 1951. Good men did good work to create this record. You can work with these same men, learn from them and qualify yourself for continually developing opportunities. And that production curve is still rising, we're still expanding, and opportunities for young men joining us now are almost limitless.

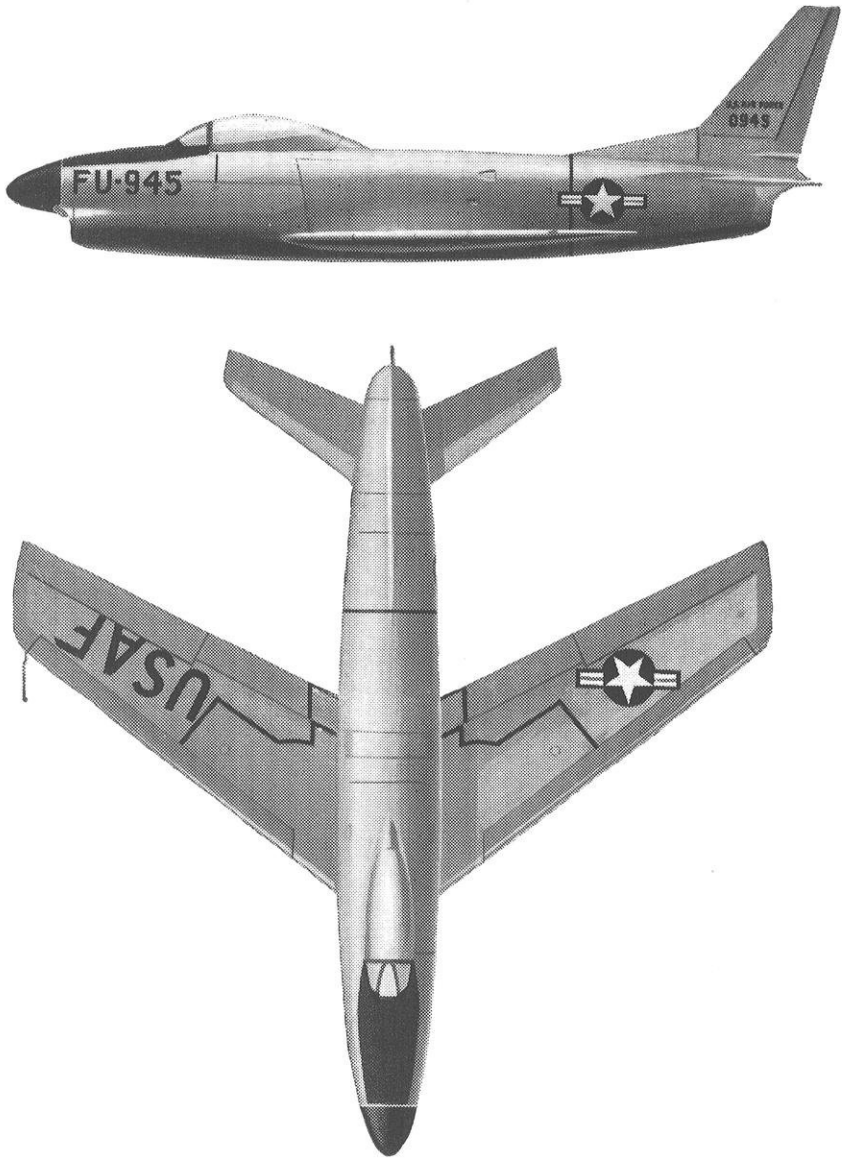


Ever-expanding Alcoa needs engineers, metallurgists, and technically minded "laymen" for production, research and sales positions. If you graduate soon, if you want to be with a dynamic company that's "going places," get in touch with us. Benefits are many; stability is a matter of proud record; *opportunities are unlimited.*

For more facts, consult your Placement Director.

Alcoa Aluminum

ALUMINUM COMPANY OF AMERICA



YOUR IDEAS

Will Keep Planes Like This On The American Team

What makes great planes like North American Aviation's F-86D and sister *Sabre* jets? The answer is new ideas . . . young ideas. And just as the ideas of young engineers of a decade past helped perfect the plane you see above, so will the ideas of today's engineering students—your ideas—perfect tomorrow's F-???. That's why North American Aviation always has challenging career opportunities for bright, young graduate engineers.

Today, North American is developing projects of a new era—aircraft, guided missles, rocket engines, rockets, electronics, atomic energy. If you'd enjoy the challenge of pioneering in these advanced fields, consider looking to the future with North American when you complete your engineering training. In the meantime, feel free to write for information concerning a career in the aircraft industry.

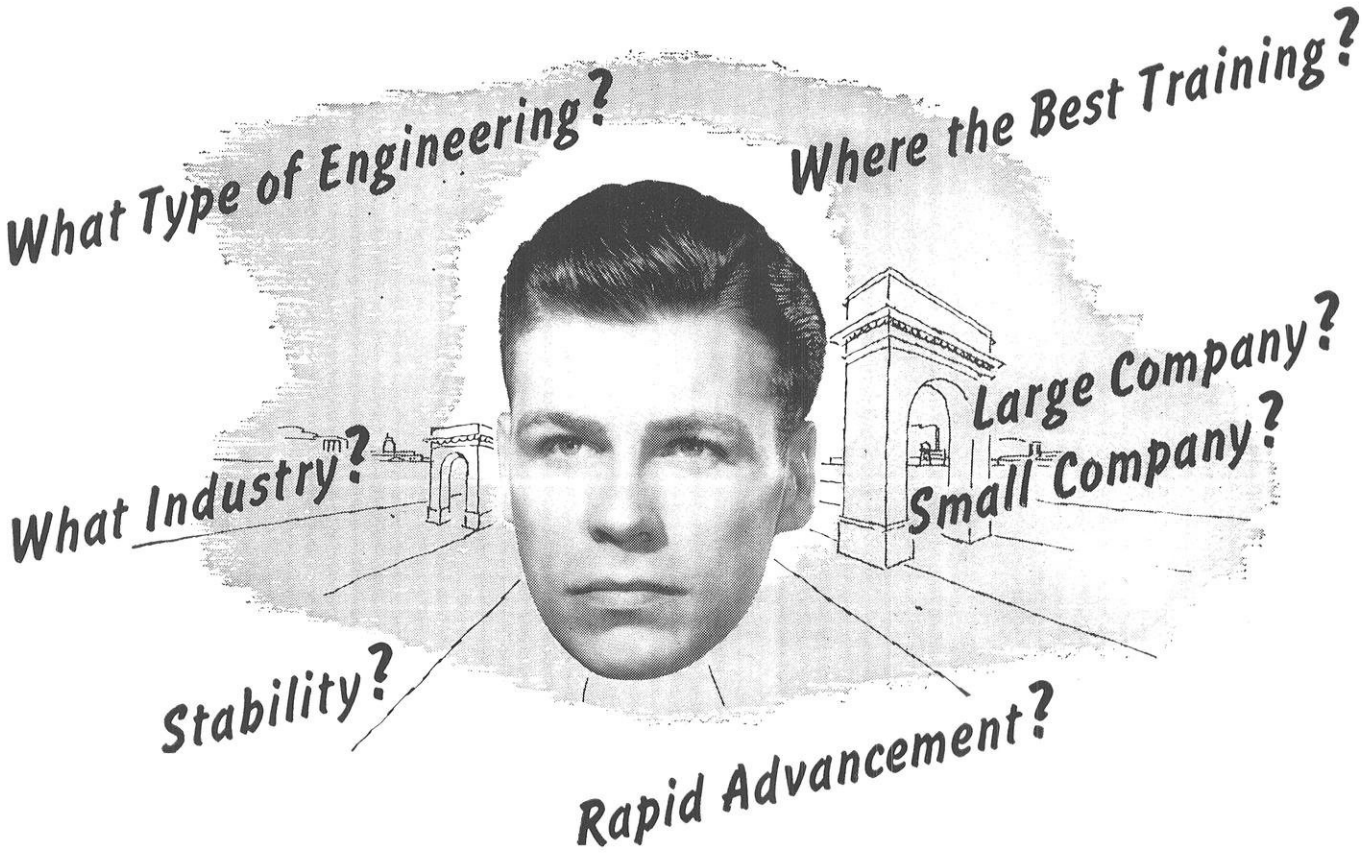
Your student placement office will be glad to supply you with more detailed information. Or if you prefer, write direct, including your name, address, placement preference and personal data. Please address your reply to:

D. R. Zook, Employment Director, 5701 W. Imperial Highway, Los Angeles

NORTH AMERICAN AVIATION, INC.

Los Angeles, California • Columbus, Ohio

NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD



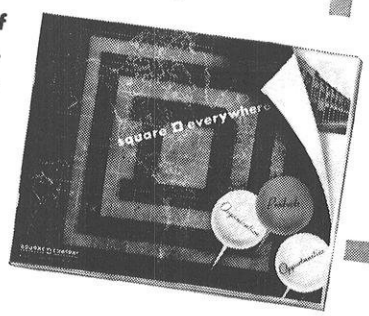
As you look toward your future employment, you'll have many questions to consider. We believe we can give you some interesting facts which may help you find the answers.

We'd like to tell you about the electrical industry and where it's going. More specifically, we'd like to tell you about Square D and what we have to offer.

GEORGIA TECH, ILLINOIS, IOWA STATE, MICHIGAN, OHIO STATE, PENN STATE, PURDUE, TEXAS A & M, WISCONSIN—for years, Square D has been looking to these great schools for its engineering talent. Electrical, mechanical, industrial and general engineers—all make up the Square D team. It's a strong team—one we think you'd like to be a part of.

Mail the Coupon...

...for your copy of a 16-page "Get-Acquainted" brochure which tells a lot about Square D, its products, services, markets and opportunities.



Square D Company, Dept. SA
6060 Rivard Street, Detroit 11, Michigan

I'd like a copy of
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School_____ Class_____

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City_____ Zone_____ State_____

SQUARE D COMPANY

THE DU PONT DIGEST

DU PONT SCIENCE AND ENGINEERING GRADUATES MEET THE PUBLIC IN

Technical Sales

More and more, industry is on the lookout for technically trained men and science majors who have an interest in and aptitude for selling. A number of departments at Du Pont prefer men with such training for sales positions. A technical understanding of the properties of a substance helps a man do a better selling job—and offers the customer better service.

Because of the diverse applications of Du Pont's many products, there is a need for sales representatives with widely varying technical backgrounds. There are problems involving chemistry and many types of engineering in such fields as plastics, ceramics, textiles and many others.

Technical men may work in direct sales, sales service, or sales development groups, depending on departmental organization. In some cases technical men handle all phases of selling. In others they deal mainly with customer problems. Some departments also maintain a sales development section that works on technical problems connected with the introduction of a new product or a new application for an established one.

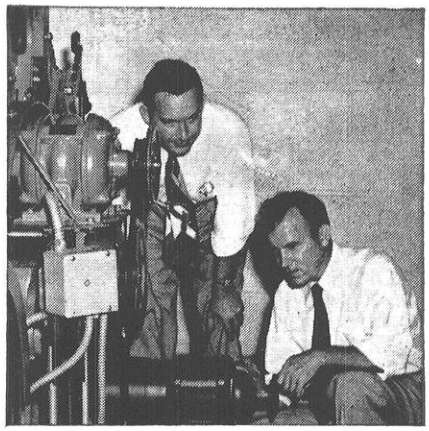
Edgar G. Boyce, *Ashland State (right), helps a customer improve his method of applying silicate adhesive in the manufacture of corrugated boxboard.*

Ivan R. Smith, *B.S. in Ch.E., Kansas State University '40 (right), advises the operator of a galvanizing machine on the efficient use of a Du Pont flux.*

Here are examples of the kind of problems attacked by technical men in Du Pont sales groups:

1. Find a more economical way to apply sodium silicate used in making corrugated paperboard. Du Pont men, as in many other instances, were able to make substantial savings for the customer.

2. Introduce fabrics of "Orlon" acrylic fiber for use in dust filtration. This involved evaluation and modification of filter fabrics in cooperation with makers of dust-control equipment, and with plant personnel having serious dust-recovery problems.



James A. Newman, *B. S. in Ch. E., North Carolina State '40, discusses study of optimum settings and conditions for carding nylon staple with Prof. J. F. Bogdan of North Carolina State's Research Division.*

3. Reduce the time needed for processing motion-picture film used by race tracks. Technical service men carried the problem to a research group which developed an emulsion that could be processed in about one-third the former time.

Technical men interested in sales work at Du Pont usually acquire needed background in a laboratory or manufacturing plant. Depending on their interest and abilities, they may then move into technical sales service, sales development, or direct sales.

In any of these fields, the man with the right combination of sales ability and technical knowledge will find not only interesting work but exceptional opportunities for growth in the Company.

College graduates with many types of technical training find opportunities at Du Pont. Write for your copy of "The Du Pont Company and the College Graduate." Address: 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

Entertaining, Informative—
See "Cavalcade of America" on Television

STATIC

BY I. R. DROPS

Freshman German Student: "What is castor oil known as in Holland?"

Senior: "Old Dutch Cleanser."

* * *

A doctor was called to a house on a confinement case. The doctor went upstairs to his patient while the anxious husband remained below.

After some time the doctor came downstairs and inquired of the husband, "Do you have a little screwdriver—just a little tiny one about this size?"

Shortly, he again came downstairs to say, "I need a much larger screwdriver—one about this size!"

The next trip down he asked for a small wrench. A moment or two later he returned to obtain a larger wrench. Next he wanted a mallet and a chisel. All the time the anxious husband was becoming more and more anxious.

The straw that broke the camel's back was when the doctor once more raced down the stairs and asked for the ice tongs.

"Ice tongs, Hell—what in the world are you doing with all those tools? Tell me—is it a boy or a girl?"

"How do I know," said the Doc, "I can't get my damn medicine case open."

* * *

Small Boy (looking at an elephant): "Gee, Ma, ain't that a hell of a big animal?"

Proud Mama "How many times must I tell you not to say ain't?"

* * *

Major Cox: "Cadet, where's the balance of your rifle?"

White: "This is all they gave me, sir."

* * *

Fun . Fun . Fun Worry, Worry, Worry

Judge: "Are you sure this man was drunk?"

Cop: "Well, he was carrying a manhole cover and said he was taking it home to play on his victrola."

* * *

The lunatic who, after a very exemplary record of sanity was discharged from the asylum, was returned home, and on the following morning decided to shave as every man does. He nailed the mirror to the wall, stood before it, lathered his face, proceeded to shave; at this moment the nail slipped and the mirror fell to the floor. He stood gazing at the blank wall before him, then remarked bitterly: "Just my luck, second day out, and I've cut my blooming head off."

* * *

Boris, who comes from Czechoslovakia, has been in this country only a few months. He does not speak English very well, and in conversation one day was asked, "Boris, what is it that you are most anxious to see in America?"

"Well," replied Boris, "I weesh most to meet dat famous Mrs. Beech who have so many sons in the last war."

* * *

Have you heard the new radio program about the girl who wanted two bathrooms? It's called "The Wife's Other John."

* * *

"I want a shave," said the disgruntled Sergeant as he climbed into the barber's chair. "No haircut, no shampoo, no rum, witch hazel, hair tonic, hot towels, or face massage. I don't want the manicurist to hold my hand, nor the bootblack to handle my feet. I don't want to be brushed off, and I'll put on my coat myself. I just want a plain shave, with no trimmings. Understand that?"

"Yes, sir," said the barber quietly. "Lather, sir?"

Things are different—up there!

You would be amazed at the tricks nature plays in the stratosphere

As aviation progress has carried man farther into the upper air, he has found that nature has many tricks up her sleeve in the stratosphere. Many things that worked well on the ground wouldn't do as well, or failed completely, in the space beyond the clouds. Things are truly different up there.

CARBON BRUSHES ARE AN EXAMPLE—These brushes are the contact points that carry electricity between moving and stationary parts of motors and generators. They're in electric razors, sewing machines, huge diesel locomotives—and in modern aircraft.

THEY COULDN'T STAND ALTITUDE—Today's high-flying planes require literally hundreds of small electric motors and many carbon brushes. Here was one of nature's quirks, for brushes which worked well on the ground and at lower altitudes couldn't take the thin, dry air of the stratosphere. They'd spark and quickly disintegrate. And if the brushes failed, the motors also would fail.

UCC FOUND THE ANSWER—The people of Union Carbide attacked this problem. Through research they developed special carbon brushes that worked uniformly well at all altitudes, making stratosphere flying a practical reality.

OTHER AIDS TO FLYING—Better carbon brushes that keep motors and generators running, alloy metals that stand the terrific heat of jet engines, plastic insulation for high-altitude wiring, and oxygen that provides the breath of life in the upper air—these are but a few of the many UCC products that are helping aviation reach new heights.

STUDENTS and STUDENT ADVISERS: *Learn more about the many fields in which Union Carbide offers career opportunities. Write for the free illustrated booklet "Products and Processes" which describes the various activities of UCC in the fields of* ALLOYS, CARBONS, CHEMICALS, GASES, *and* PLASTICS. *Ask for booklet C-2.*

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AND CARBON CORPORATION
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UCC's Trade-marked Products of Alloys, Carbons, Chemicals, Gases, and Plastics include

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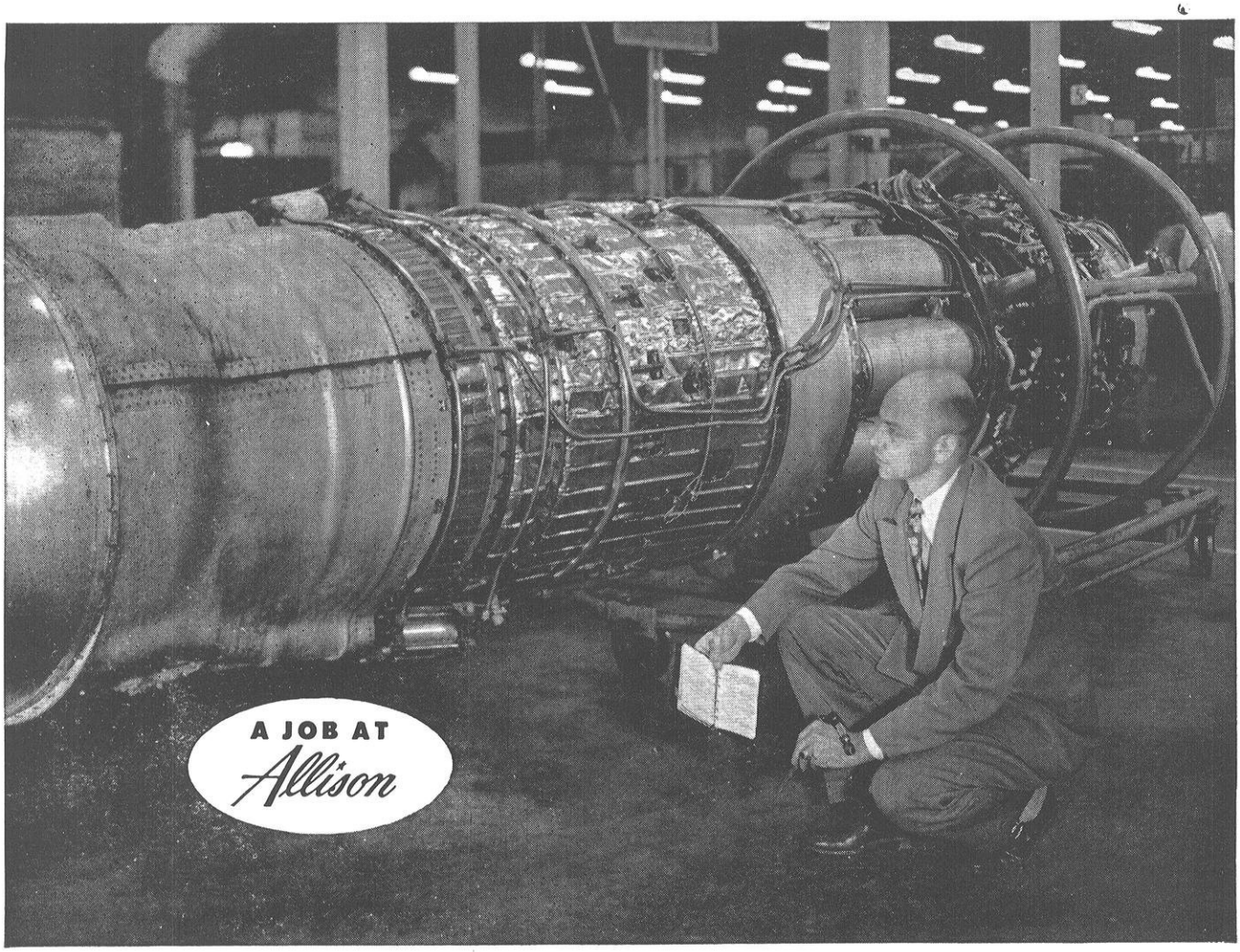
DYNEL Textile Fibers • BAKELITE, KRENE, and VINYLITE Plastics • LINDE Oxygen • SYNTHETIC ORGANIC CHEMICALS



● Earle R. Wall, Jr. was graduated from Virginia Polytechnic Institute in 1941 with a B. S. degree in Mechanical Engineering and after a five year tour of duty with the Army came to Allison to do pioneering work on turbo-jet engines.

Earle today has an important job as an engineer in the turbo-jet design group and he is working on afterburners for some of America's newest jet engines. Allison Division was the first aircraft engine manufacturer to produce turbo-jet afterburners. The afterburner is a thrust augmentation unit for jet engines to give the engine more thrust in take-off, climb and combat emergencies. An additional cone is added after the turbine where more fuel is injected into the exhaust gases of the engine and ignited to give a larger amount of thrust.

Earle's job includes the thermodynamic and mechanical design of afterburners which must diffuse exhaust gases from the turbine at temperatures over 1650 degrees Fahrenheit, with a minimum loss of energy, and consume additional fuel for thrust augmentation. After the correct design has been calculated and drawn, prototypes of the afterburner are tested by the Test Control group and Earle then analyzes results. One of the many problems is the endurance life of the exhaust unit. He must make a choice of present metals or search for new metals to withstand the high temperatures and forces of the gases which pass through.

Earle and many other Allison engineers have interesting, important jobs in the science of jet engines. They are making a direct contribution to national defense and adding to their own knowledge of a subject which offers lifetime careers for engineers.

Allison is looking for young men with degrees in **MECHANICAL ENGINEERING, ELECTRICAL ENGINEERING, AERONAUTICAL ENGINEERING** ***and*** **INDUSTRIAL ENGINEERING.** ***There are also a number of openings for majors in Metallurgy, Electronics, Mathematics and Physics.*** Write now for further information: R. G. Greenwood, Engineering College Contact, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.

Allison

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Design, development and production—high power TURBINE ENGINES for modern aircraft . . . heavy duty TRANSMISSIONS for Ordnance and Commercial vehicles . . . DIESEL LOCOMOTIVE PARTS . . . PRECISION BEARINGS for aircraft, Diesel locomotives and special application.

THIS NEW AUTOMOTIVE LABORATORY at Standard Oil's Whiting Research Laboratory is now in operation testing and developing new and improved gasolines and lubricants.

They help design the future

• In the laboratories of today, the world of tomorrow is taking shape—test by test, experiment by experiment.

What man will be capable of in years to come, how he will work and play, how he will travel, all depend to a large extent on the fuels and lubricants that will power the machines of the future.

More than a quarter of a century ago Standard Oil opened its first automotive laboratory, and from time to time has enlarged the facilities.

Now Standard Oil has added still another unit. The new building located at Whiting, Indiana, is devoted entirely to the testing and development of automotive fuels and lubricants.

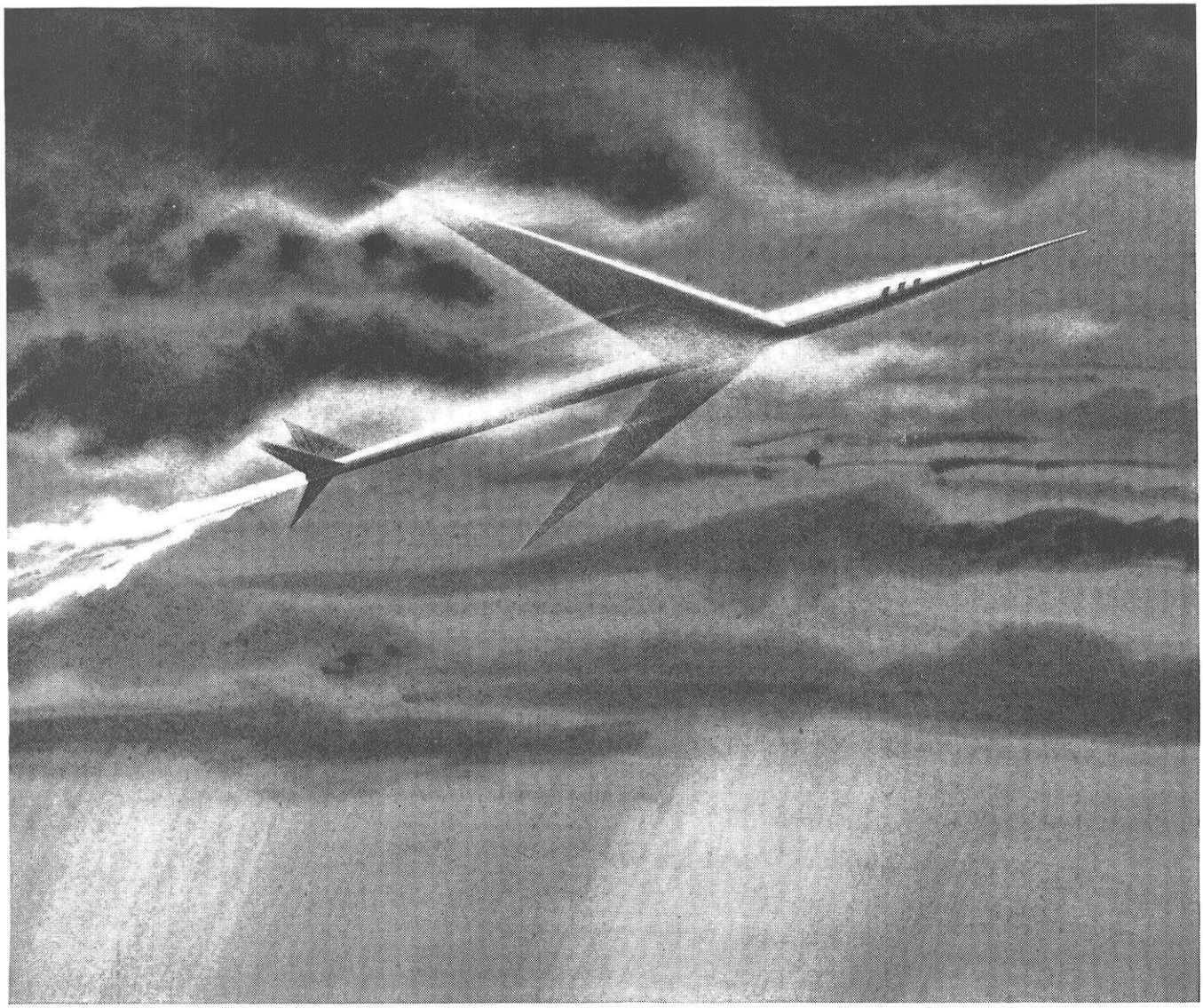
Full-scale testing is conducted in a room containing every needed facility for the measurement and control of operating conditions. The test engines include the principal types used today or anticipated for the future. Each of 16 engines, with its dynamometer, is mounted on a separate concrete foundation, isolated from other parts of the building to eliminate vibration.

In the expansion of our laboratories, young technical men find evidence that the challenge of the future, with its stimulation and rewards, is being met at Standard Oil.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois

STANDARD



Do you want to get ahead in engineering?

Then—after you graduate—join a company that's expanding in fields where big engineering futures lie.

At Boeing you'll find plenty of room to get ahead in such projects-with-a-future as a major guided missile program . . . research in supersonic flight and nuclear-powered aircraft . . . America's first-announced jet transport . . . and the revolutionary B-47 and B-52 jet bombers.

You'll find Boeing a stable 36-year-old company, that has grown practically continuously. For example, Boeing now employs 6000 engineers in contrast to 3500 at the peak of World War II. And although Boeing is a large concern, it is so organized that each engineer is an individual who stands out—and progresses—in proportion to his ability.

Boeing is constantly alert to new techniques and materials — and approaches them without limitations. Extensive subcontracting and major procurement programs — directed and controlled by engineers—give you a varied experience and broad contacts with a cross section of American industry. No industry, in fact, matches aviation in offering such a wide range of experience, or breadth of application — from pure research to production design, all going on at once.

Boeing engineering activity is concentrated at Seattle in the Pacific Northwest, and Wichita in the Midwest. These communities offer fishing, hunting, golf, boating and other recreational facilities. Both are fresh, modern cities with fine residential and shopping districts, and schools of higher learning where you can study for advanced degrees.

There are openings in ALL branches of engineering (mechanical, civil, electrical, aeronautical, and related fields), for **DESIGN, DEVELOPMENT, PRODUCTION, RESEARCH and TOOLING.** Also for servomechanism and electronics designers and analysts, and physicists and mathematicians with advanced degrees.

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

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

BOEING

PHOTOGRAPHY AT WORK No. 2 in a series:

Knitting mill solves help shortage, attracts and keeps full staff

Hand Knit Hosiery Company of Sheboygan, Wisc., knitters of Wigwam Socks, found many potential employees resisted jobs simply because they didn't know the sort of opportunities offered.

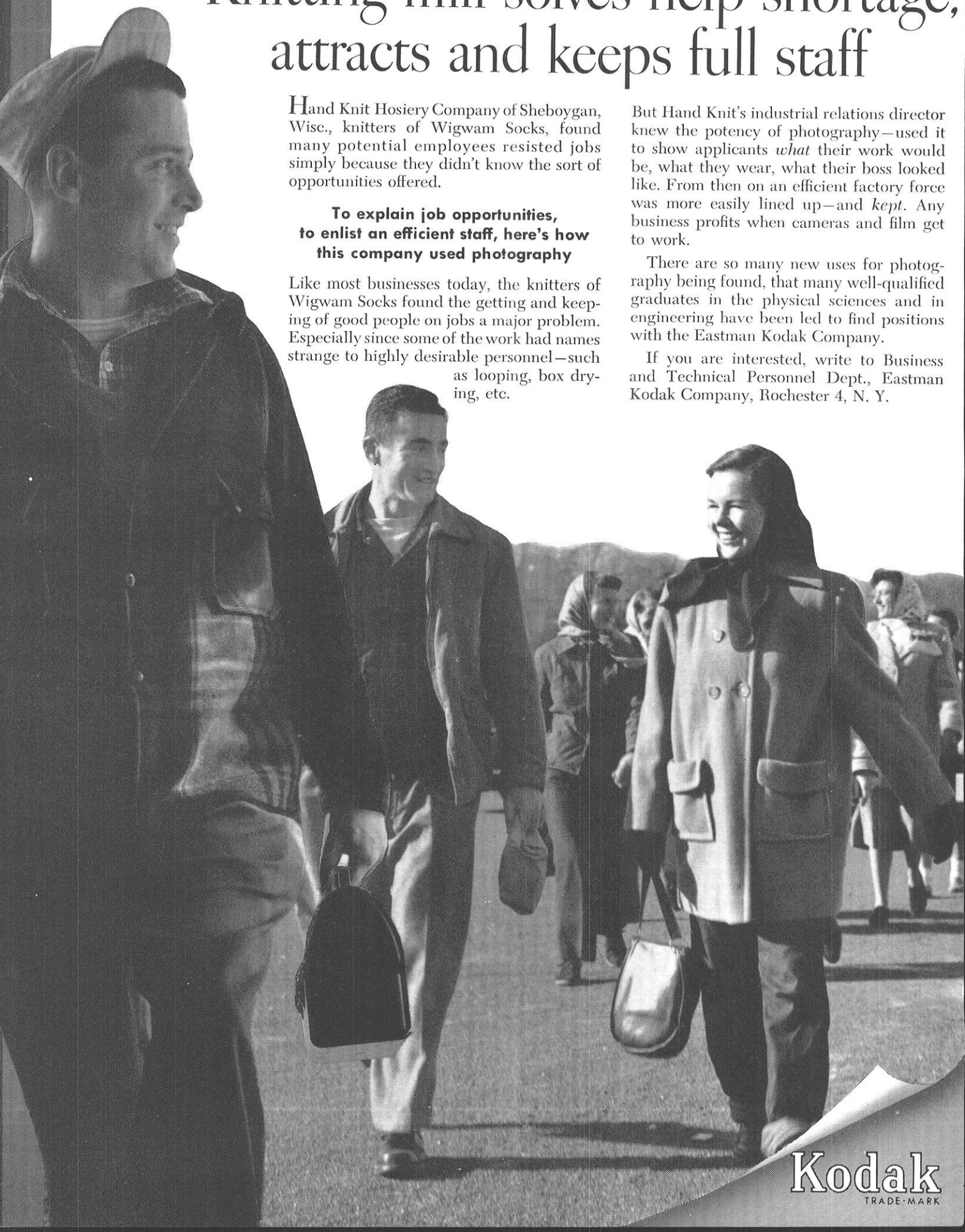
To explain job opportunities, to enlist an efficient staff, here's how this company used photography

Like most businesses today, the knitters of Wigwam Socks found the getting and keeping of good people on jobs a major problem. Especially since some of the work had names strange to highly desirable personnel—such as looping, box drying, etc.

But Hand Knit's industrial relations director knew the potency of photography—used it to show applicants *what* their work would be, what they wear, what their boss looked like. From then on an efficient factory force was more easily lined up—and *kept*. Any business profits when cameras and film get to work.

There are so many new uses for photography being found, that many well-qualified graduates in the physical sciences and in engineering have been led to find positions with the Eastman Kodak Company.

If you are interested, write to Business and Technical Personnel Dept., Eastman Kodak Company, Rochester 4, N. Y.



Kodak
TRADE-MARK

6 WAYS TO BEGIN A SUCCESSFUL CAREER

TEST ENGINEERING PROGRAM—offers engineering graduates opportunities for careers not only in engineering but in all phases of the Company's business. Includes rotating assignments plus opportunities for classroom study.

BUSINESS TRAINING PROGRAM—open to business administration, liberal arts, and other graduates . . . for careers in accounting, finance, administration, and other fields. Includes on-the-job training plus classroom study.

CHEMICAL AND METALLURGICAL PROGRAM—provides rotational assignments in chemistry, chemical engineering, and metallurgy. Also offers graduate-level courses stressing solution of practical engineering problems through application of basic principles of physical chemistry and unit operations.

MANUFACTURING TRAINING PROGRAM—for developing leaders in the field of manufacturing. Open to graduates with a technical education or a general education with technical emphasis.

ADVERTISING TRAINING COURSE—offers graduates career opportunities in all phases of advertising, sales promotion, and public relations work. Includes on-the-job training and a complete classwork program.

PHYSICS PROGRAM—offers physicists rotating assignments in applied research in many fields of physics plus ample opportunity for organized classroom study. Program graduates have gone into such fields as research, development, manufacturing, design, marketing.

FEW companies can offer as broad a range of career opportunities as General Electric. Whether a young man is interested in science or engineering, physics or chemistry, electronics or atomic energy, plastics or air conditioning, accounting or sales, employee relations or advertising, drafting or jet engines . . . he can plan for himself a G-E career.

The training programs summarized here are only a few of the "open doorways" that lead to successful careers in a company where big and important jobs are being done, and where young people of vision and courage are needed to help do them.

If you are interested in building a G-E career after graduation, talk with your placement officer and the G-E representative when he visits your campus. Meanwhile, for further information write to College Editor, Dept., 2-123, General Electric Co., Schenectady 5, New York.

You can put your confidence in—

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