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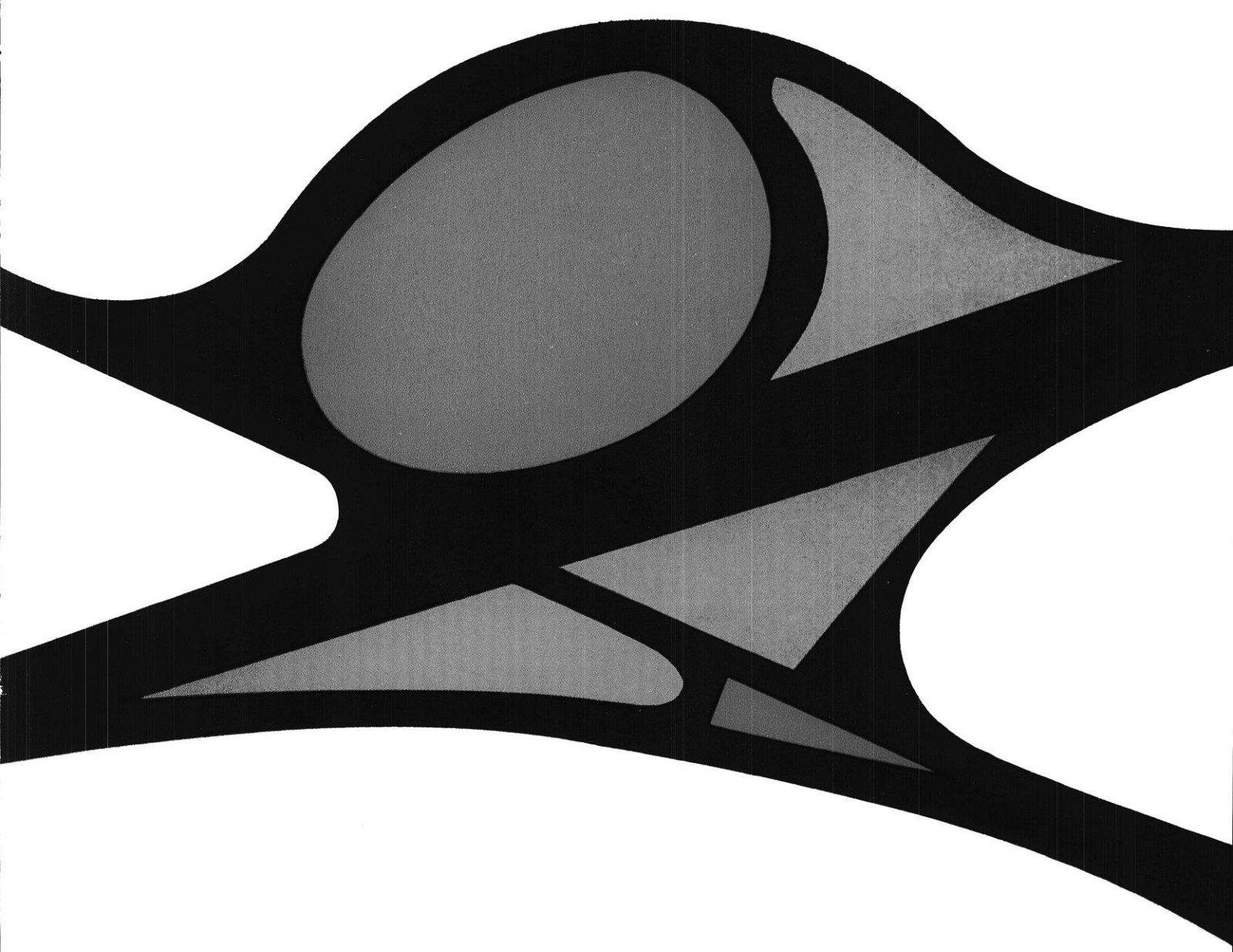
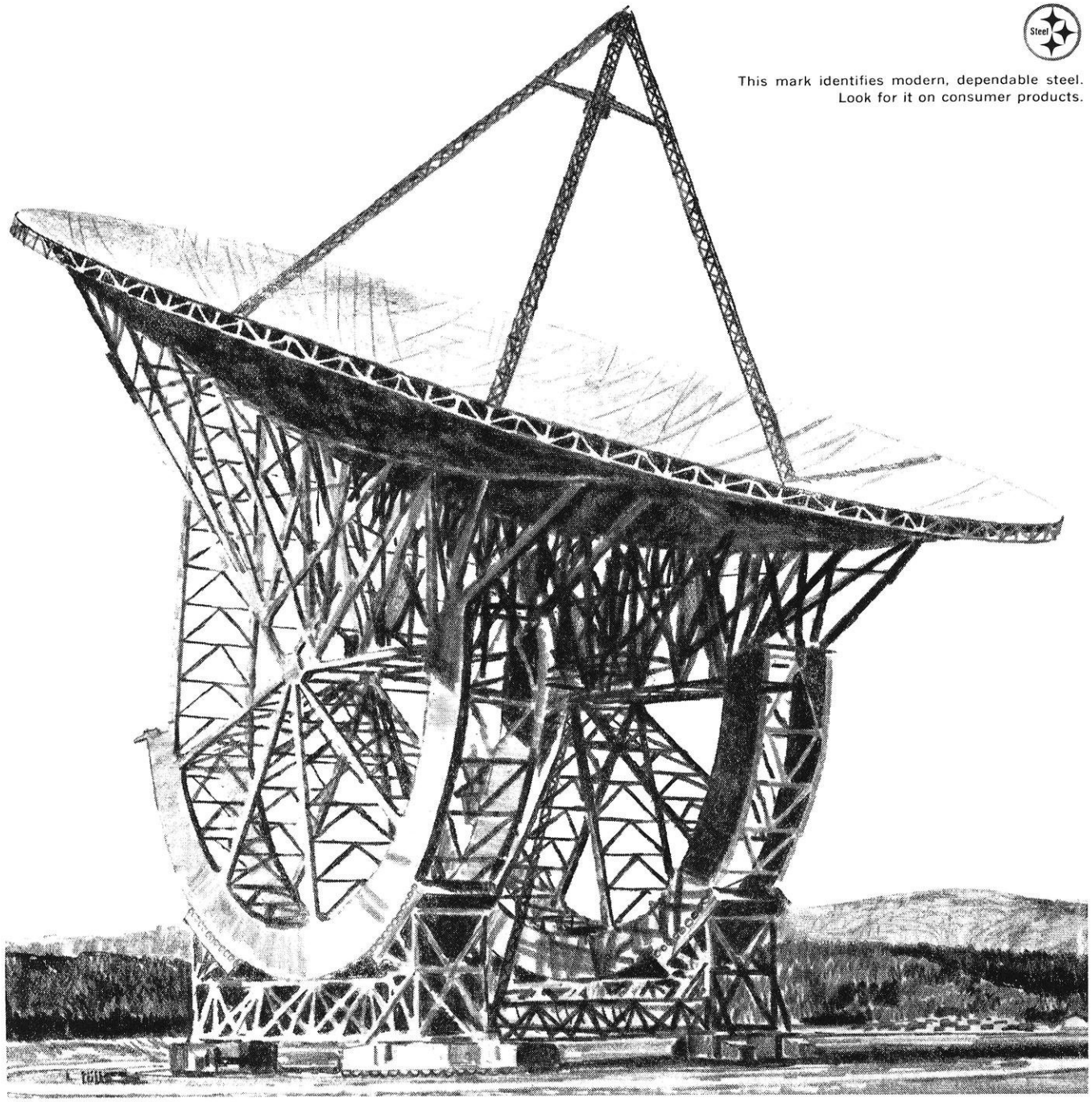
NOVEMBER, 1960 • 25 CENTS
MEMBER E. C. M. A.

THE WISCONSIN ENGINEER





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This is an artist's concept of the world's biggest radio telescope

This giant telescope will use radio waves to locate objects that are billions of light years out in space. The dish-shaped mirror will be 600 feet in diameter—about the size of Yankee Stadium. It will be the biggest movable radio telescope ever known.

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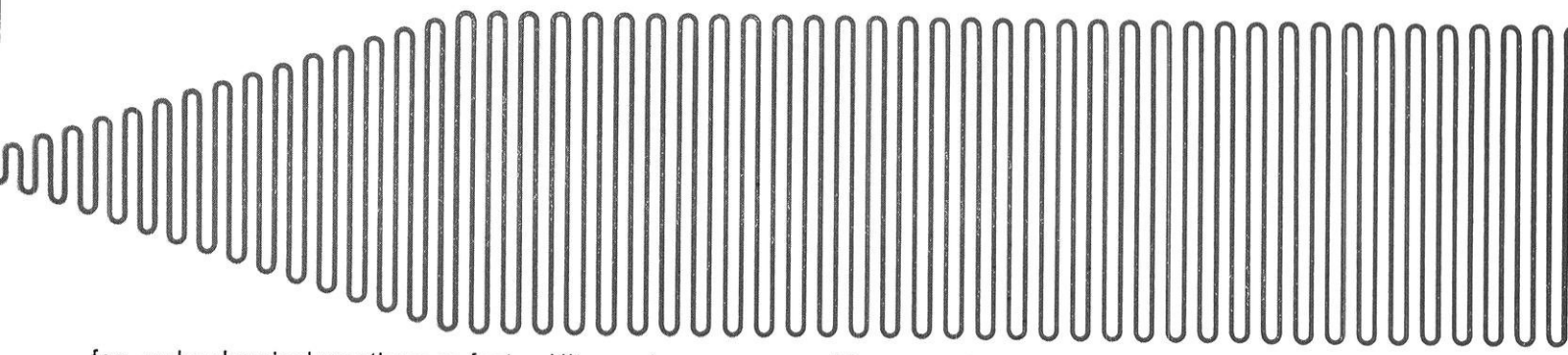
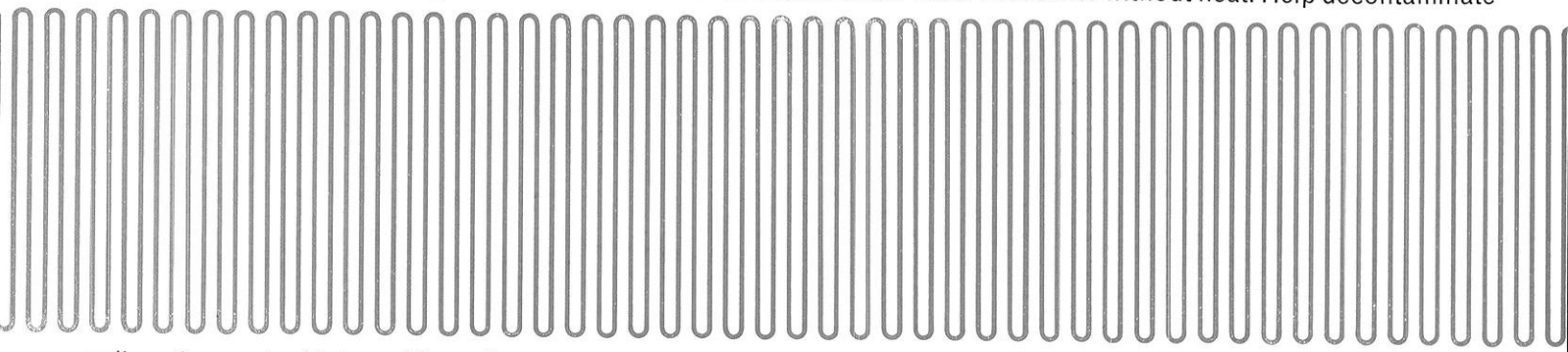
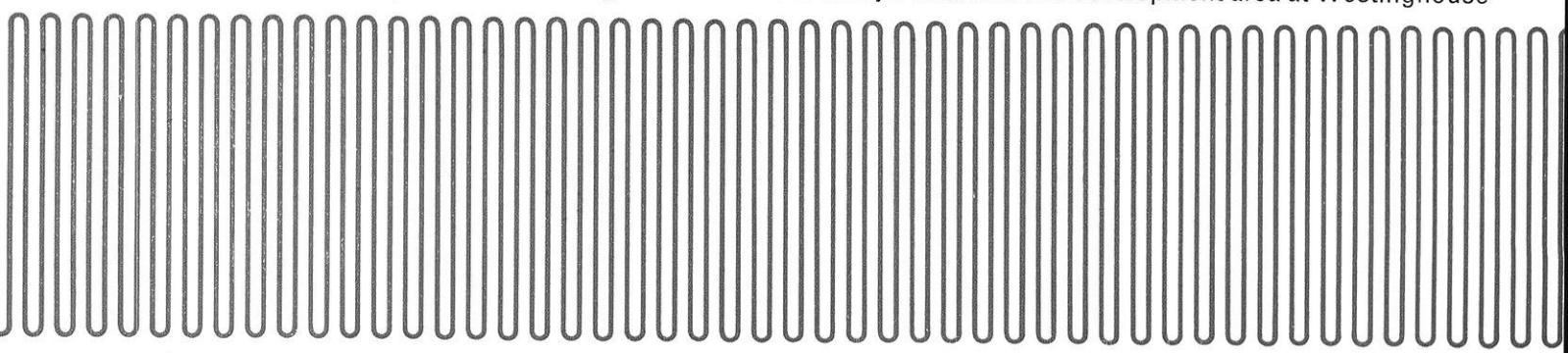


fog, make chemical reactions go faster. Ultrasonic waves can weld one metal to another without heat. Help decontaminate



radioactive parts. Make solder adhere to almost anything, even glass. Perform surgery without a knife. Change the

flavors of foods, and the crystals in a steel ingot. Ultrasonics is a major research and development area at Westinghouse



. . . and another reason why Westinghouse is the best place for talented engineers. For more information write L. H.

Noggle, Westinghouse Educational Department, Pittsburgh 21, Pa. You can be sure if it's **Westinghouse**

. . . a hand in things to come

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From the Colorado plateau—once the floor of a vast inland sea—comes the wonder metal uranium. Using sensitive instruments, Union Carbide geologists find its faint gamma rays along the beds of ancient petrified rivers.

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Finding, refining, and researching the materials used in atomic energy are all part of the work done by the people of Union Carbide to enrich your daily life. With pioneering curiosity, they are seeking new things not only in atomic energy, but also in the fields of carbons, chemicals, gases, metals, and plastics.

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UNION CARBIDE

. . . a hand in things to come

Dow means an opportunity for **individuals, ideals, ideas**

INDIVIDUALS. Chemistry seems to draw a particular kind of person. Whether he's a scientist or a salesman, an engineer or a marketing man, when he chooses the chemical industry for his career he singles himself out as an individual. This is the kind of person who makes up the Dow organization. At Dow, teamwork has its place, but it is recognized, too, that most great ideas are born in the mind of an *individual* as he thinks about the problem.

IDEALS. People may occasionally speak disparagingly of someone as "a dreamer and an idealist." But these are exactly the qualities of all the men who seek to make something great out of something commonplace. When Herbert H. Dow turned an insignificant brine well into a vast chemical empire, he established the Dow philosophy that "everything must be good for something, and we will *make* it work." The rest remained for one other factor.

IDEAS. There are few places in the world that allow more room for *ideas* than a chemical company. In the first place, *new* chemicals, most of them never before existent at all, are made at an astounding rate. If the chemical is made for a specific job, then at least *one* application is known for it. But many others are the result of pure research or are by-products. These require *ideas* to put them to work, or to convert them, or to use them for undreamed-of applications. At Dow, sound *ideas* are tantamount to *action*.

To learn more about the Dow opportunity, visit, or write to the Technical Employment Manager at one of the locations listed below.

California—Pittsburg, Seal Beach • **Colorado**—Rocky Flats • **Illinois**—The Dow Metal Products Company, Madison • **Louisiana**—Plaquemine
Massachusetts—Eastern Research Laboratory, Framingham • **Ohio**—The Dobeckmun Company; Dow Industrial Service, Cleveland
Oklahoma—Dowell Division, Tulsa • **Texas**—Freeport • **Virginia**—Williamsburg • **Canada**—Sarnia, Ontario

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN DOW

Letters To The Editor

THIS WORLD . . .

This world does not have an unlimited amount of space for an unlimited amount of people. We do not even have an unlimited amount of fresh water. There are those who seem to think the answer lies in ignoring it.

WILLIAM R. SULLIVAN
1116 S. Flower
Los Angeles 15, Calif.

An interesting observation.

All letters must be accompanied with name but will be withheld upon request.

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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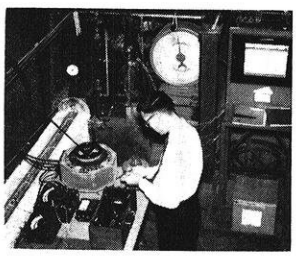
FEATURES



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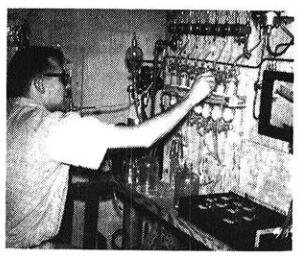

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DEPARTMENTS

NOVEMBER, 1960

THE WISCONSIN ENGINEER

The Student Engineer's Magazine *Founded 1896*

VOLUME 65, NUMBER 2

This Month's Cover, drawn by Dick Nygaard, represents one of the interchanges of the vast new Interstate Highway System. This interchange, a partial cloverleaf, is located in Washington County.

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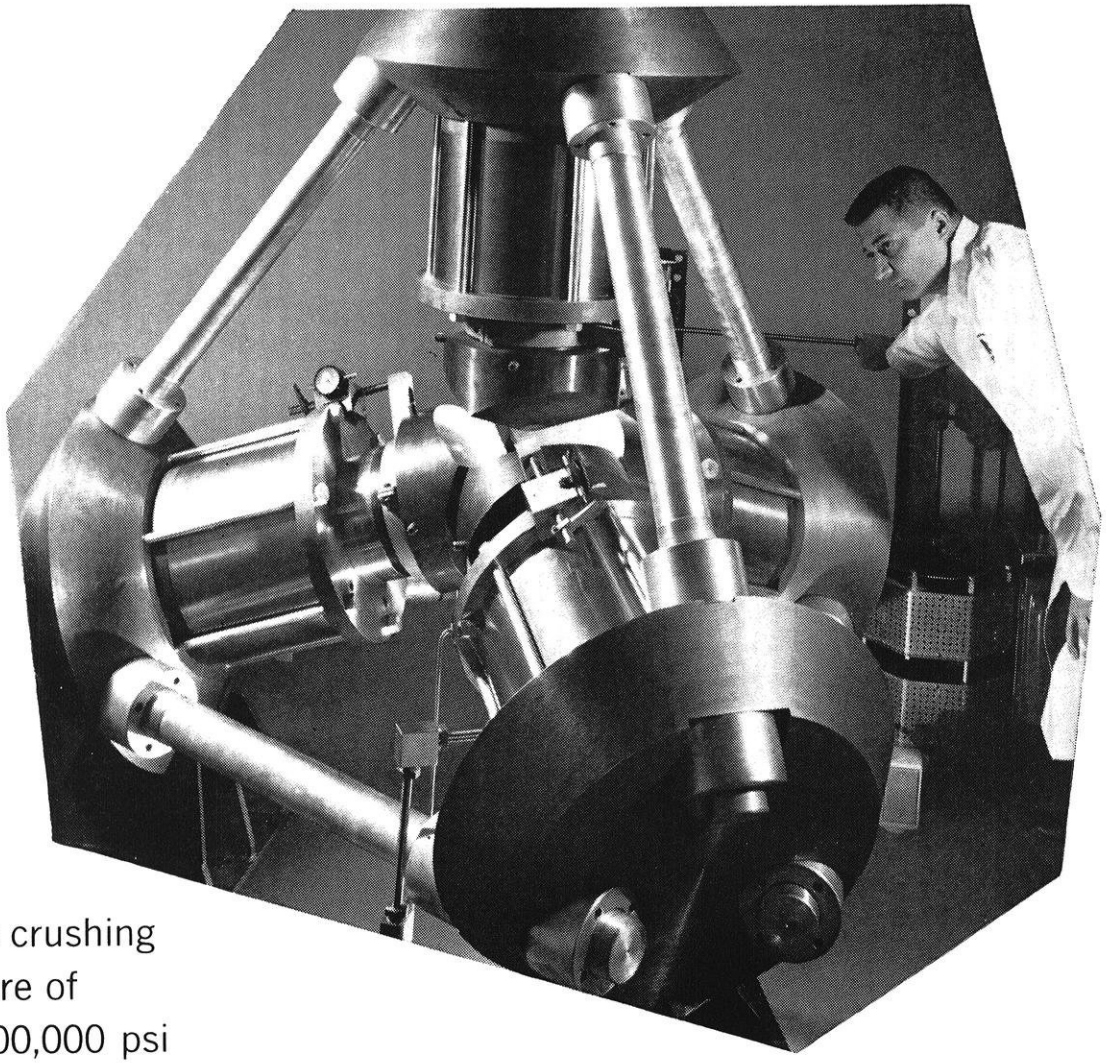

The crushing pressure of 2,000,000 psi

At the General Motors Research Laboratories the 600-ton tetrahedral anvil press duplicates pressures which exist 200 miles beneath the earth's surface. The purpose: to study the combined effect of ultra-high pressure and temperature on the physical and chemical properties of known materials with an eye toward improving their properties or even creating new materials.

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GENERAL MOTORS

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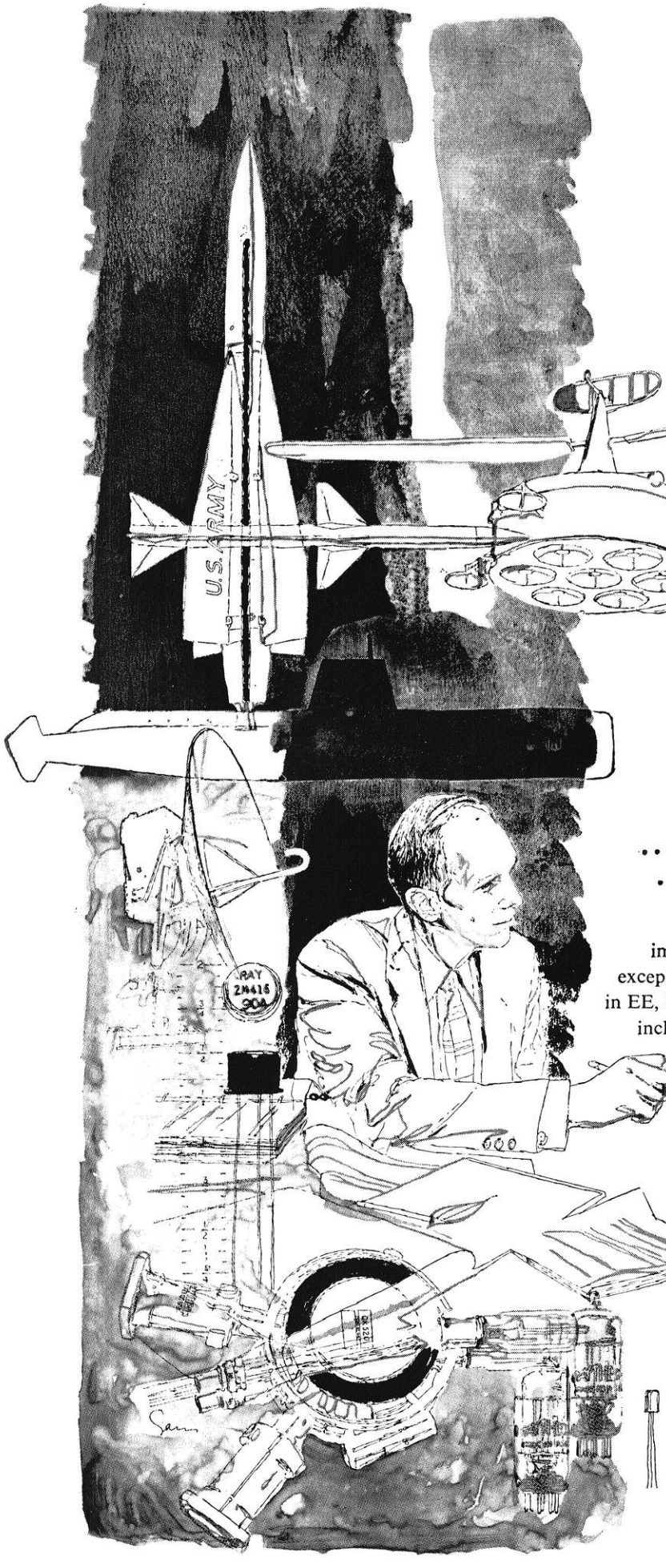

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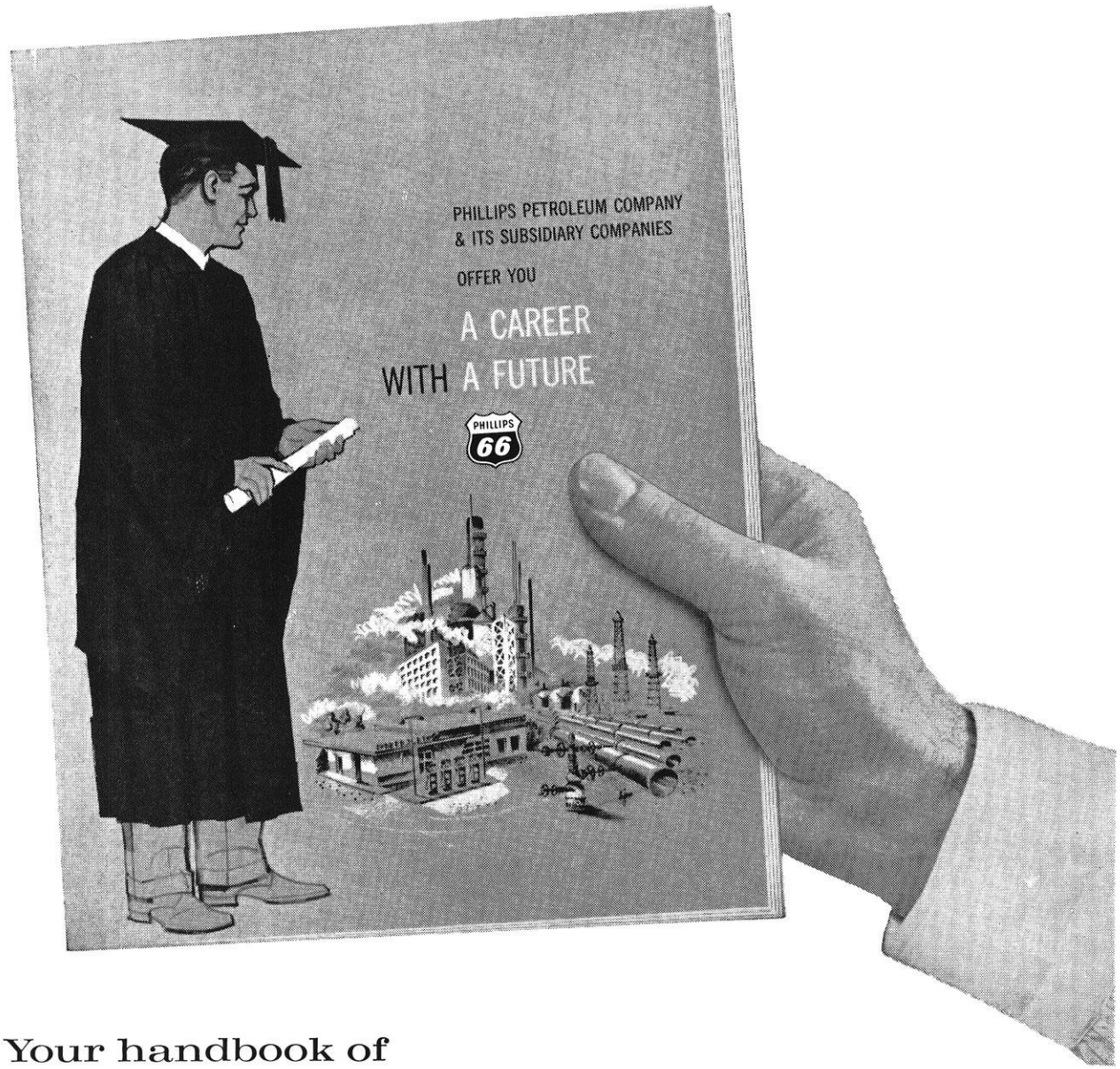

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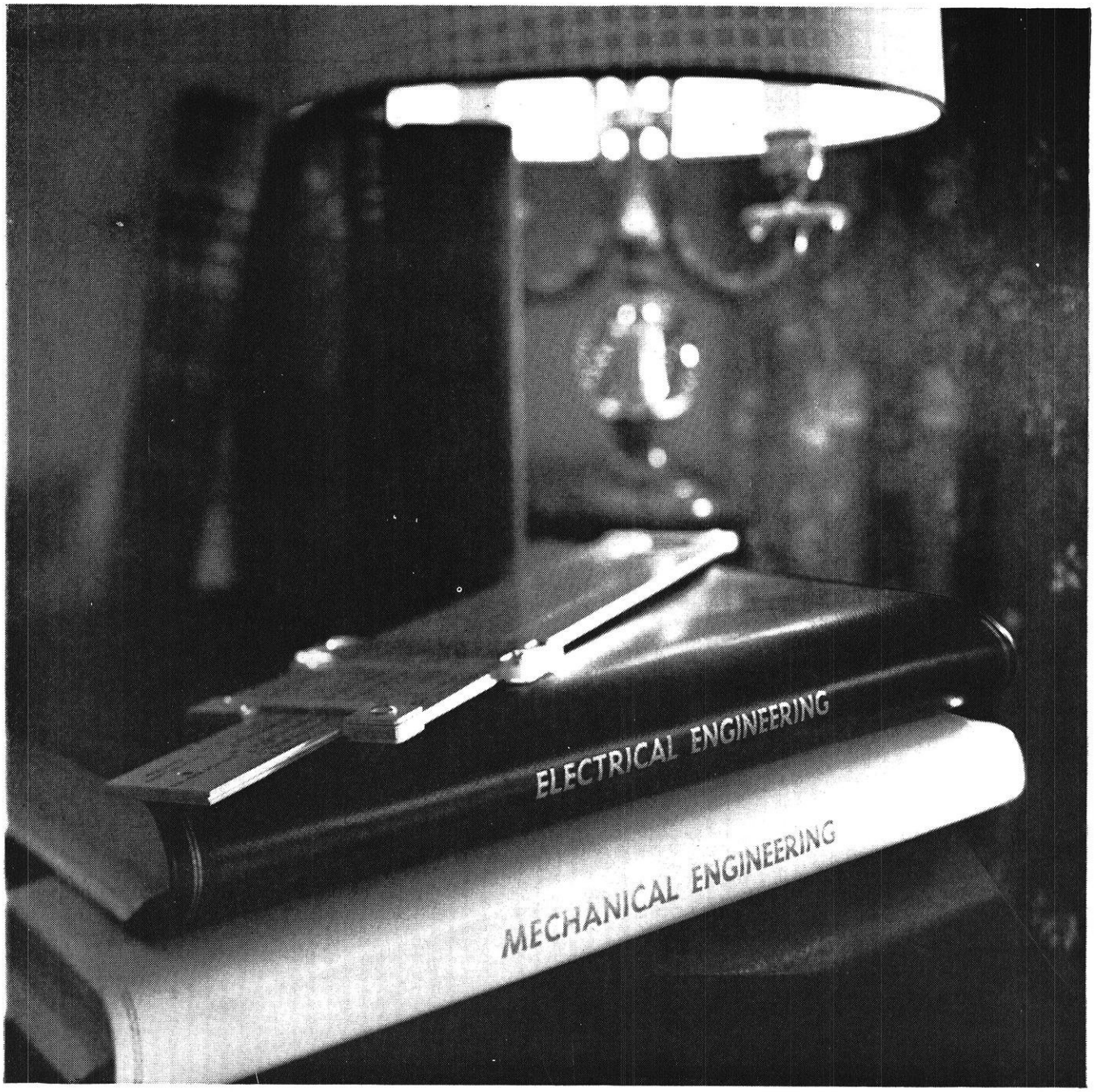


As you plan your career—be sure to consider Monsanto.

It may surprise you that Monsanto needs *electrical* and *mechanical* engineers, as well as *chemical* engineers.

Fact is, though, that Monsanto offers many opportunities to men with your professional training, including:

Mechanical Engineers . . .

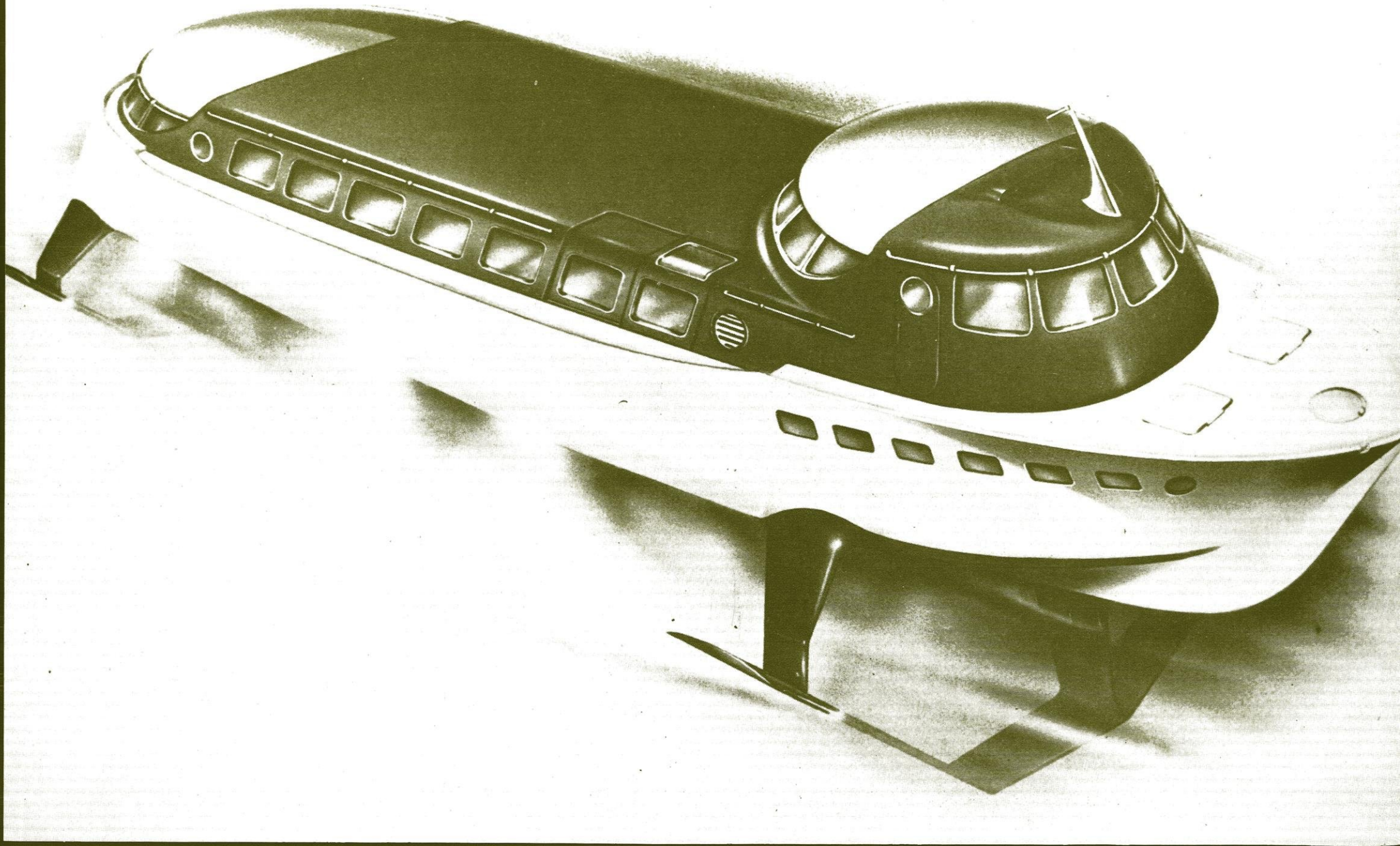
- Plant design and layout
- Equipment selection
- Materials specification
- Design of new and unique equipment
- Plant engineering
- Construction
- Specialization in the fields of fluid mechanics, stress analysis, heat transfer, etc.

Electrical Engineers . . .

- Design of electrical systems
- Power distribution and substation design
- Process control instrumentation
- Applied research
- Automated process systems engineering
- Equipment evaluation and selection

May we discuss these with you as we visit your campus this year? You can arrange for this visit with your Placement Director; or write Professional Employment Manager, EM-2, Monsanto Chemical Company, St. Louis 66, Missouri.

Monsanto



Rambling With The Editor

Should you go into graduate school? This is a question all students have to ask themselves at some time. There are many questions that must first be answered before you can make your decision. Some of these questions are: "Can you make it in graduate school?", "Can you afford it?", and "Is it worth the time and money?" One very important question is that of paying back parents or relatives the cost of your education. This may very well be the most important of all the questions.

The first of these question is one that you must answer for yourself. If your grades are good, you can probably make it in graduate school. If your grades are not too good, but you are willing to work hard, you may be able to make it. Your adviser can help you with this question, but the final decision is up to you.

There are many grants and fellowships offered that will help pay the cost of graduate work. The chance of getting a grant or fellowship is very good. The question of whether you can afford to go into graduate work is therefore answered; you have no reason to use this as an excuse for not going on.

If you like money and are interested in doing the more challenging work, you can not afford not to go into graduate school. The starting pay will be higher and the advancements will be faster if you have a graduate degree. The starting pay for a person with an M.S. is seventy to one hundred dollars per month more than the person with only a B.S. The person with a Ph.D. will start at about two hundred dollars per month more than the person with a B.S. This difference will pay back everything spent for graduate school in a few years and will pay off in much greater returns in years to come. With an M.S. or Ph.D. you have a much better choice of work, many of which are not open to people with only a B.S. Graduate school is therefore worth both your time and your money.

Paying back your parents or relatives for your education is something most of you hope to do someday. If you go into graduate school this must be put off for a few years, but when you start to work you will be making more money and can pay the money back easier. I think your parents would be willing to wait a few years if you were getting something as important as more education. If you must pay back money you have borrowed for your education, work for a few years and then come back to school.

You must start now if you do decide to go into graduate school. You will need certain credits to get into graduate school and good grades, so look into it right away.

The important thing is not when, how, or why you go into graduate school; it is that you go.—W. S. H.

Shown above is rendering of a 28-ton, high speed hydrofoil ferry boat designed by the Technical Products Division of the Waste King Corporation, Los Angeles. The boat is designed to carry 93 passengers at speeds of 40 knots over 200 miles, even in seas up to 8 feet. For additional information on the hydrofoil see the Oct., 1960 *Wisconsin Engineer*.

—Courtesy of Waste King Corporation

Patents for Mechanical Inventions

Problems and procedures acquiring patents

by R. W. Comstock, cie'62

A PATENT is an agreement between the government, representing the public, and the inventor. The government agrees that no one but the inventor will be allowed to manufacture, use, or sell his invention for a period of seventeen years without his permission. In return for this limited monopoly the inventor files his new discovery in the patent office so that everyone may profit from it when the seventeen years are over.

The present American Patent system started in 1836. It laid down the new principle that patents should be given only after inventions had been carefully examined and compared with all earlier ones. Two questions were asked: "Is the invention useful?" and "Is it new?".

Most inventors employ patent lawyers when seeking a patent. A written description, claims of the invention, and an application fee must be submitted to the patent office. If the patent examiners find that the invention fulfills their requirements a patent is granted. If anyone infringes on the inventor's patent he can force the infringer to stop using it, or sue him for the profits he made. The patent article or the package in which it is sold must be marked with its patent number. No damages can be collected for infringement of an unmarked patent, unless the patent owner has sent a formal notice to the infringer.

Patentability of Inventions

Under our American system of patent law the chief requirement for a patent is that the invention shall be new and useful and shall be the work of an original and first inventor. Thus the first thing the inventor must do to receive a patent is make sure his invention is new, useful and original. The question also arises: "What is an invention?". The patent laws require that the new machine to be patented must "disclose something amounting to invention." There are no rules however that lay down any precise tests for invention. This makes invention a matter of judgment and opinion as to whether it is present in a given situation.

APPLICATION FOR PATENT

General Requirements of an Application

The application for a patent is made by the inventor or someone who he has assigned to make the application. When the inventor is dead, insane or legally incapacitated, the legal representative of the inventor applies for the patent. The application must be made to the Commissioner of Patents in Washington, D. C. There is no particular application form. The inventor furnishes the material for the application and usually a patent lawyer is consulted to make sure everything in the application is included and in order. A complete application is comprised of:

1. A petition or request for a patent.
2. A specification, including a claim or claims.
3. An oath.
4. Drawings, when necessary.
5. The prescribed filing fee.

The petition, specification, and oath must be in the English language. All papers of the application must be legibly written or printed in permanent ink.

At the time of the application it is only necessary to file a provisional specification; however, a complete specification must be filed within one year. The provisional specification shows that the invention claimed in the complete specification was made at the date of the original application. This enables the applicant to hold for his claims the priority of the date of the original application.

The Petition

The petition is a request for the grant of a patent and must be addressed to the Commissioner of Patents. The inventor usually has a patent lawyer write the petition for him.

The Patent Specification

Introduction to the Specification. The most important parts of the

law of patents center around the patent specification. Answers to the questions of scope and validity of the claim given by the patent grant are determined by the specification. The specification contains a written description of the invention. It also shows the manner and process of making and using the invention. The specification must be expressed in full, clear, concise, and exact terms thus enabling any person skilled in the art to which it pertains, to make and use the invention.

The Structure of the Specification. The skill with which the complete specification is drafted is extremely important. The outcome of legal proceedings depends heavily on this factor. The complete specification is arranged in the following order:

1. Title of the invention, or a preamble stating the name, citizenship and residence of the applicant and the title of the invention.
2. Brief summary of the invention.
3. Brief description of the several views of the drawing, if there are drawings.
4. Detailed description.
5. Claim or claims.
6. Signature

The detailed description or body of the specification tells the public the necessary information needed to construct and operate the invention. This section of the specification may also present the theory of operation if the invention is not easily understood.

The Claims of the Specification. The claim or claims of the patent specification are the most important single part of the patent application. The claim or claims define the invention that the inventor seeks to monopolize. They are formal definitions of the scope of the invention, pointing out distinctly what the applicant regards as his invention. Each claim is independent of the other claims and states a separate monoply. The wording of the claim is very important and great care should be taken that the intention of the whole claim is expressed. The claim or claims should define a machine in terms of its structure.

An extremely important requirement of the patent claim from the applicant's point of view is that it be neither too wide nor too narrow. If the claim is too wide it will be rendered invalid. If the claim is too narrow the applicant will not be able to avoid infringement.

Oath of the Applicant

The applicant for a patent must take an oath stating that he believes himself to be the original and first inventor of the machine he wishes to patent. The applicant must also state of what country he is a citizen and whether he is the sole or joint inventor of the invention claimed in his patent. The oath may be made before any person authorized by law to administer oaths.

In every original application the applicant must distinctly state under oath that to the best of his knowledge and belief the invention has not been in public use or on sale in the Uniter States for more than one year prior to his application or patented or described in any printed publication in any country before his invention or more than one year prior to his application.

The Drawings

The Commissioner of Patents may require that the applicant for a patent furnish drawings of his invention. Section 113 of Title 35 states that when the nature of the case admits, the applicant shall furnish a drawing. Illustrations facilitating an understanding of the invention may also be furnished by the applicant or required by the patent office.

The drawings must show every feature of the invention specified in the claims. There are also certain standards the patent office sets up for the drawings pertaining to the paper, ink, symbols, legend, location of views, and other related subjects.

Filing Fee of the Application

The filing fee for each original application for a patent having 20 claims or less is $30.00. For each additional claim over 20 there is a charge of $1.00.

Models

Models were once required as part of the application for a patent but now they are not generally required; however, the patent office may require an applicant to furnish a model of convenient size to exhibit the parts of his invention.

EXAMINATION AND ISSUANCE OF A PATENT

Order of Examination

Applications that are filed in the patent office and accepted as complete applications are assigned for examination to the respective examining divisions. They are examined by assigned examiners in the order in which they were filed.

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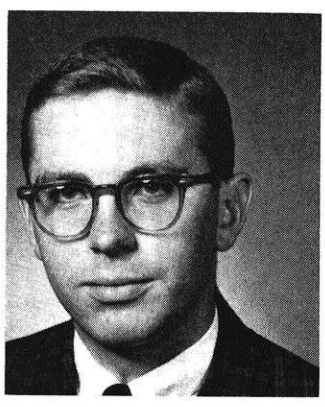


R. Warren Comstock, a junior in civil engineering, chose this topic because of an interest in law. His future plans include following up this interest by entering law school and later the field of patent law. Mr. Comstock is a Madison resident and a member of Chi Psi fraternity, the interfraternity relations committee, and the Union public relations committee.

The Examination

The examiner first checks the claims by searching the prior patents and literature to determine whether or not the claims are properly definitive of the applicant's invention without including matter that is old in the art. It is the examiner's duty to examine any questions of law that may be involved in the presentation of the claims, or of the case, and to reject claims if they appear to be unpatentable in view of any of the statutory requirements or decisions of the courts. After the examiner has finished he writes a letter to the applicant stating his position and it then becomes necessary for the applicant to file a response to the official action. The time is ordinarily six months; however, the examiner may set a shorter time for response.

The applicant is generally represented by his attorney, and while it is their duty to respond fully to the patent office actions, they have at the same time the problem of "shaping up" the patent so that it has a maximum chance of being held valid.

The examiner may finally accept or reject all or part of the applicants claims. It is then up to the applicant and his attorney to decide whether to cancel the rejected claims or to appeal.

Opposition and Belated Opposition to a Grant

The grant of a patent may be opposed by any person interested who has valid grounds for objection. Any person interested may also oppose a sealed patent if it is within twelve months of the sealing. This is known as belated opposition to a patent. Many patents are refused as a result of opposition; however, the normal effect is that the patent opposed is strengthened by an amendment of the specification to meet the attacks made by the opponent.

The person interested must have a real, definite and substantial interest: that of a manufacturer in the same field, or a trader in goods concerned, or the owner of patents for similar devices or even the inventor of such a device, or a research association whose members have such an interest.

Procedure for Protesting a Grant

The proceedings begin with a notice of opposition stating the grounds of opposition. This must be accompanied by a statement setting out the nature of the opponent's interest, the facts upon which he bases his case and the relief which he seeks. The applicant then delivers a counterstatement setting out his grounds for contesting the opposition. There is then a hearing before a senior official of the Patent Office known as a Comptroller. He delivers a written decision upon the evidence filed by the parties involved. The comptroller may also on his own motion raise additional objections during the opposition proceedings, but if this is done the applicant should be given an opportunity to deal with these objections. From the decision of the comptroller there may be an appeal to the Appeal Tribunal. A further appeal to the Court of Appeal is available in certain cases.

Interference—A Specific Form of Opposition

An interference arises in the examination of applications when two applicants claim the same invention. Interference may also arise in the Patent Office when an applicant and a patentee claim the same invention. They may be compared to a suit between two people who have as their bone of contention the problem of determining which one of them is the prior inventor and entitled to get the patent.

Section 135 of Title 35 states:

Whenever an application is made for a patent which, in the opinion of the Commissioner, would interfere with any pending application, or with any unexpired patent, he shall give notice thereof to the applicants, or applicant and patentee as the case may be. The question of priority of invention shall be determined by a board of patent interferences (consisting of three examiners of interferences) whose decision, if adverse to the claim of an applicant, shall constitute the final refusal by the Patent Office of the claims involved, and the Commissioner may issue a patent to the applicant who is adjudged the prior inventor.

The prior invention is the invention that was first reduced to practice.

Pending Patents

The average length of time between filing the patent application and the issuance of a patent is 3½ years. Some patents are issued faster than this and others take up to seven or eight years depending on the amount and nature of the rejections and appeals.

While the inventor is waiting for a patent to be issued he may manufacture his device, usually stating on the manufactured device that a patent is pending. This will discourage the manufacture of similar inventions.

Putting patent pending on a manufactured device without an application in the Patent Office is subject to penalty by law. Also the inventor can not sue for infringement until he has received his patent.

Sealing the Patent

Sealing. If the application for a patent is approved and the sealing fee paid within the proper time, a patent will be sealed on the application.

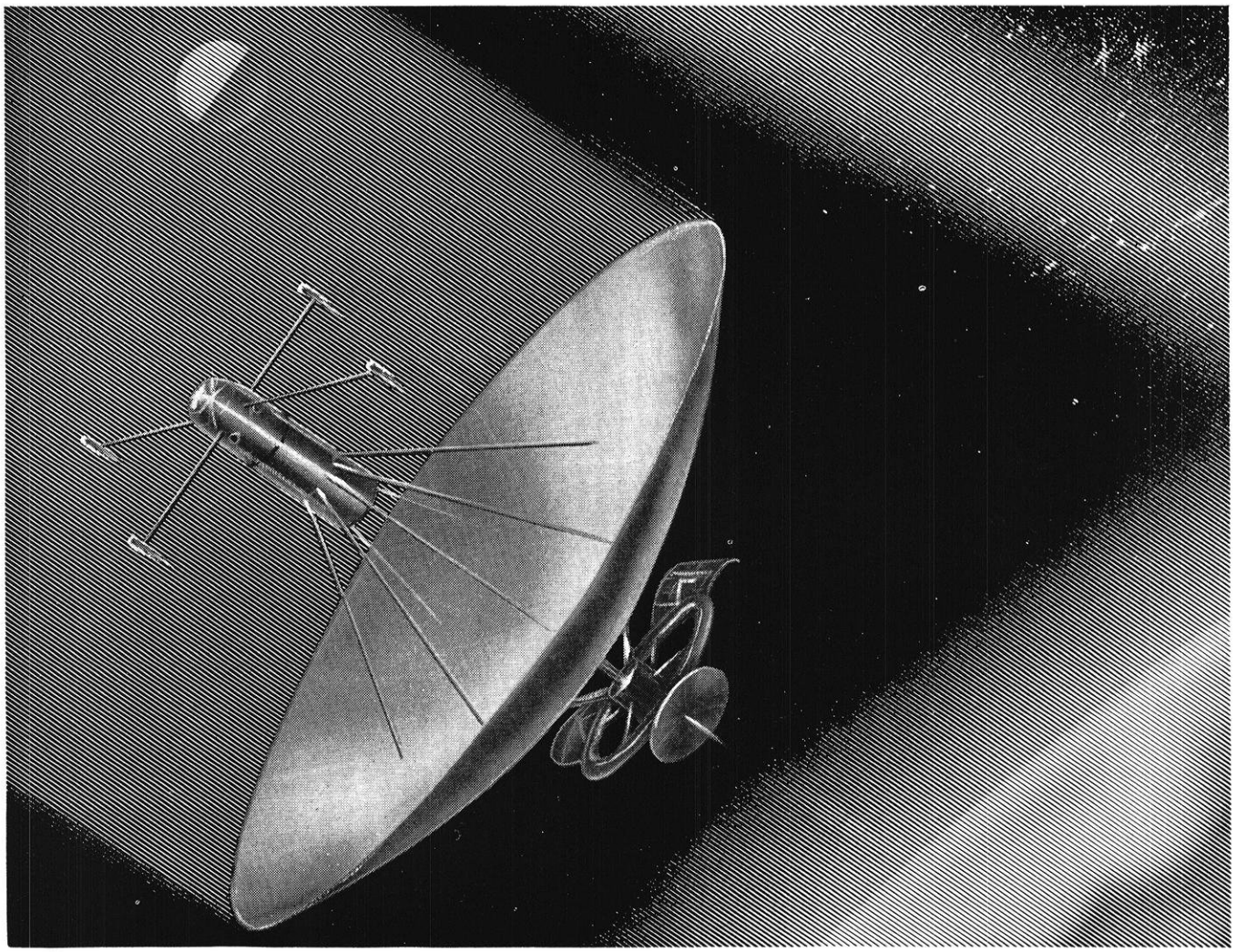
Date and Term of Patent. The patent is dated with the date of filing of the complete specification and its term is 17 years from this date.

PROBLEMS AFTER RECEIVING A PATENT

Validity of Patents

Validity of patents deals with the various grounds upon which the patent grant may be revoked by the courts. These same grounds may also be used as defenses in an action for infringement of a patent. Most of these grounds are further available as grounds for opposing the grant of a patent in proceedings at the patent office, or in similar proceedings within twelve months after the grant of a

(Continued on page 52)



Advanced power conversion systems for space vehicles utilizing energy of the sun or heat from a nuclear reactor are now being developed by Garrett's AiResearch divisions. Under evaluation are dynamic and static systems which convert heat into a continuous electrical power supply for space flight missions of extended duration. Component and material developments for these systems are being advanced in the fields of liquid metals, heat transfer, nonmechanical and turboelectric energy conversion, turbomachinery, alternators and controls.

Besides solar and nuclear power systems for space applications, other product areas at Garrett include small gas turbine engines, environmental systems for advanced flight vehicles, cryogenic fluid systems and controls, pneumatic valves and controls and missile accessory power units.

This diversification of project areas enables the engineer at Garrett to specialize or diversify according to his interest, not only making work more interesting but increasing the opportunities for responsibility and advancement.

An orientation program lasting several months is available for the newly graduated engineer, working on assignments with highly experienced engineers in laboratory, preliminary design and development projects. In this way his most profitable areas of interest can be found.

For further information about a career with The Garrett Corporation, write to Mr. G. D. Bradley in Los Angeles.

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SCIENCE HIGHLIGHTS

by Dave Cress me'63

PHOTOGRAPHY PROVIDES KEY IN TRANSLATING MACHINE

Photography, the recording medium that stores the greatest amount of information in the smallest space, is the key to success of the Air Force's new translating machine that changes Russian to English at the rate of 40 words per minute.

Previous translating machines have usually been modified computers. Their Russian–English "vocabularies" were stored on magnetic tape or punched cards. This limited both the size of the vocabualry that could be stored and the speed with which it could be searched electronically for words and phrases.

Through photography, an entire 55,000 word vocabulary is stored in a 3/8-inch channel printed on a ten-inch glass disk. The channel is scanned vertically and horizontally by electronics until the machine matches a Russian word—fed in with punched tape—to its English equivalent, which is then printed automatically on a typewriter.

Modifications of the machine will enable it to translate more than 2,400 Russian words per minute with greater precision and better grammar than it does now at the slower rate.

At present the English translation emerges in a rough but meaningful form for refinement by human translators.

When more of the capacity of the photographic disk is used, it will store about 500,000 Russian words and idioms on a single surface. Words are printed in a line code of bars and spaces.

The glass disks are sent preformed to Kodak in Rochester, N.Y. There they are coated with high-resolution emulsion, then inspected microscopically for any flaws in the surface.

Even with a 500,000 word vocabulary the disk barely scratches the surface of photography's information storage capacity.

A Kodak research scientist recently disclosed that a high-resolution film, exposed with present optics, is capable of storing 600 million bits of information per square inch. This means that the entire contents of the Encyclopedia Britannica could be stored on a single 4-inch square piece of film.

SNAP I-A

The Martin Company has started testing of a compact, lightweight generator which can convert heat from a by-product of nuclear reactors into electricity to power advanced satellites and space probes for at least a year. The conversion system in the 125-watt unit uses no moving parts.

The generator is called SNAP I–A (System for *N*uclear *A*uxillary *P*ower). It is similar in principle to SNAP-3, a grapefruit-sized device which was first demonstrated publicly by President Eisenhower early last year.

SNAP 1–A is roughly egg-shaped, 34 inches long and 24 inches in diameter. Most of its dull metal surface is dotted with screw-headed caps marking the location of 277 thermocouples. The complete generator weighs 175 pounds.

The new system promises more power than any energy unit launched into space so far either by the U.S. or the Soviet Union. Some systems have combined solar cells with chemical batteries to build up to such wattage levels periodically, but these cannot operate continuously at high power.

Martin engineers point out that SNAP 1–A, unlike solar cells, would not be affected by the impact of micrometeorites in space. Operating independently of the sun, the nuclear unit would have the addi-

tional advantage of being able to produce power while in the shadow of the earth. The absence of moving parts in the conversion system greatly reduces the chances of any malfunction.

The fuel capsule for SNAP 1–A, which will not be inserted until electrical and environmental tests of the rest of the system are complete, will be located at the very center of the generator, supported by light metal tubing. The capsule will contain tightly-sealed pellets of a radioactive material called Cerium–144, which decays spontaneously, producing heat in the metal around it.

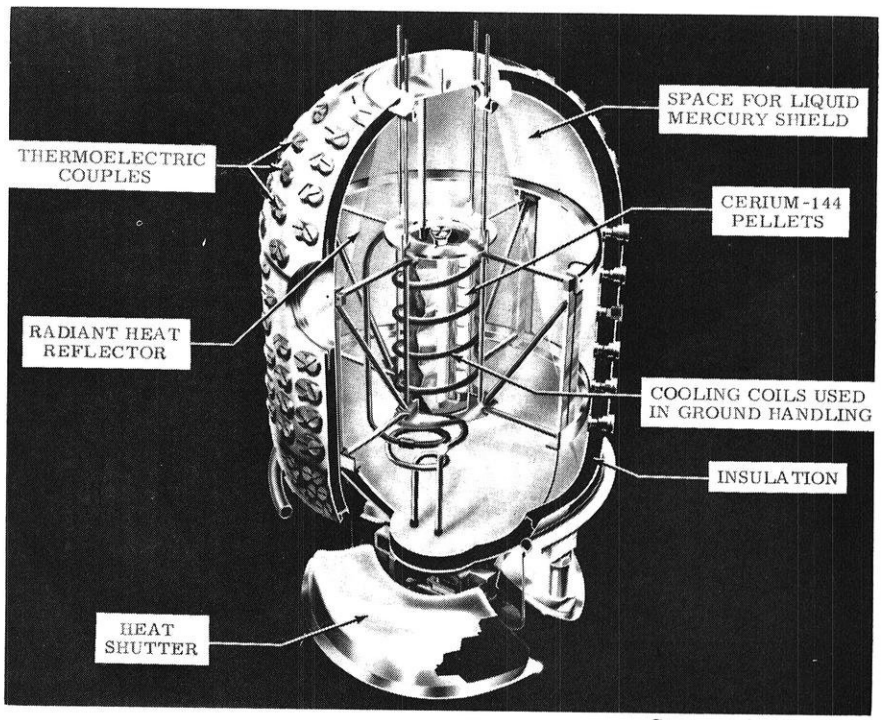
As the inner ends of the thermoelectric elements are heated, the outside ends always remain somewhat cooler, so that the difference in temperature produces a small electric current in each pair. These thermocouples are connected in series to add up to 125 watts at 28 volts. Tests being conducted now use as electrical heater to simulate the fuel.

Cerium-144 is a normal by-product of the fission process in all nuclear reactors. The material which ultimately will power SNAP 1–A is being separated from other fission products at the Oak Ridge National Laboratory of the AEC and will be supplied to Martin in sealed form early next year for use in the ground test unit.

As the radioisotope decays, the amount of heat it produces will gradually decrease. For this reason, SNAP 1–A has been built with a temperature-sensitive shutter, which will let some of the heat leak out at the beginning of operation but will gradually clamp shut. Thus the electrical output will remain constant at 125 watts for a full year and then will taper off.

A solar cell system with the same constant output might be comparable to SNAP 1–A in weight, but would be much bulkier unless a complex mechanical device were used to keep the cells pointed toward the sun. Unoriented cells would have to cover an area of more than 100 square feet.

Extensive and conclusive tests have been carried out under contract to the AEC to assure that the radioisotope fuel of SNAP 1–A would not be released if a satellite-carrying rocket exploded on the launch pad or failed to reach orbital velocity. Once in orbit, the fuel capsule is designed to burn up completely upon reentry into the atmosphere.



—Courtesy of Martin Co.

Cutaway drawing of SNAP I-A shows inner components of the 125-watt system for auxiliary power now undergoing preliminary tests.

During ground-handling operation before launch, the hollow interior of SNAP 1–A can be filled with liquid mercury, which acts as a shield for its radiation. This could be drained, moments before lift-off, to reduce the weight of the payload.

ELECTRO LANE

Electro Lane, an experimental device that visibly or audibly warns a motorist when he's too close to the pavement edge or centerline, will be put to practical use at General Motors Proving Grounds.

Somewhat comparable to the "beam" by which aircraft pilots keep course from one airport to another, Electro Lane was developed by Electronics and Instrumentation Department of GM Research Laboratories. Last Jan. 13, GM Research demonstrated it to the Highway Research Board.

This will be its first realistic test on vehicles using GM Proving Grounds' four-mile Ride and Handling Loop which resembles a conventional two-lane highway. In the center of each lane is a wire in the pavement radiating low frequency (2 kilocycle) power.

When a car veers to the left or right, ferrite core coils on either side of the front bumper pick up electrical signals from the road. Signal strength varies with the pickup coil's distance from the road wire. From an individual coil the 2 kc signal is amplified and fed to one of two warning lights.

Intensity of the light is proportional to deviation toward that side. In addition, the signal from either side or pickup coil is applied to a network that feeds a speaker only after a pre-set level is reached. Thus, a driver will be alerted by light or sound, or both, if he is too far toward the right pavement edge or toward the left roadway centerline.

The director of GM Proving Grounds wants to determine the success of the device in warning his drivers of fatigue or drowsiness. This is a problem even with some experienced, expert test drivers, just as it is with many motorists on public highways.

The Proving Grounds Installation will give engineers valuable experience with the device similar to a public road system.

If Electro Lane proves successful on the four-mile Ride and Handling Loop, which consists of assorted road surfaces, it will be considered for other roads of the Proving Grounds' 65-mile system.

(Continued on page 54)

Thomas O'Connell (B.S. in M.E., Notre Dame, '54; M.B.A., New York University, '60). Recently, as part of his job in marketing at IBM, he found himself assisting the customer technicians with the design problems of one of the world's busiest bridges.

WHAT'S AN IBM MAN GOT TO DO WITH REDESIGNING A BRIDGE?

Tom O'Connell is an engineer working in marketing areas as an IBM Data Processing Representative. His job is to introduce management to the advantages of electronic data processing. Once they have acquired an IBM system, he acts as a consultant on new uses for the system.

A Spectacular Engineering Achievement. How is he helping to redesign a bridge? One of his clients is the agency which constructs and operates transportation facilities in the New York-New Jersey area. Recently, they began to add a lower deck to the George Washington Bridge. It has been a spectacular engineering achievement. Sections were brought up the Hudson River on barges and hoisted hundreds of feet into position. All this while heavy traffic continued in both directions.

This double-decking of one of the world's busiest bridges took complex planning. An IBM system materially aided in the verification of bridge design calculations and in suspension bridge truss analysis under various loading conditions. Tom O'Connell supplied many of the computer programs that were used in conjunction with other programs developed by the customer. Tom now knows a lot more about the problems of bridge design.

A Job That Makes News. One of the exciting aspects of Data Processing Marketing at IBM is this wide diversity of systems application. Using the knowledge a man has gained in college, and backed by the comprehensive training he receives at IBM, he moves into many kinds of application areas. The areas are always interesting, sometimes newsworthy. In fact, almost every day newspapers carry stories about new applications of computer systems in important areas of business, industry, science and government.

If you would like to find out in more detail about the many kinds of marketing opportunities at IBM, our representative will be visiting your campus soon. He'll be glad to sit down with you and discuss the reasons why marketing is a career with a virtually unlimited future. Your placement office can make an appointment. Or you may write, outlining briefly your background, to:

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Girl of the Month

ANN GIBSON

Here's a Madison girl for the November girl of the month. In the near future you may be seeing ANN on television for she plans to combine public communication with her home economics interests. With such ambitious plans she is usually in a hurry so it's no wonder that you will see her riding about the campus on her red bicycle.

562 PROGRAMS, PROJECTS & STUDIES AT HUGHES

THE DIVERSITY OF ELECTRONICS ACTIVITY AT HUGHES PROVIDES AN IDEAL ENVIRONMENT FOR THE GRADUATING ENGINEER OR PHYSICIST. THESE ACTIVITIES INCLUDE:

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- Fire Control Radar Systems
- Pulsed Doppler Radar and Anti-Submarine Warfare
- Naval Tactical Display Systems
- 3-Dimensional Radar
- Air-to-Air Missiles
- Space Propulsion Systems
- Tunnel Diodes
- Infrared Devices
- Satellite Active Repeater Development
- Wide Band Scanning Antenna Feed Systems
- Microwave Antennas and Radomes
- Guidance and Navigation Computers
- Satellite Communication Systems
- Satellite Reconnaissance Drone
- World-Wide Communications Networks
- Command Control and Information Processing
- Micro-Electronics
- Linear Accelerators
- Gamma Rays
- Nuclear Fission
- Remote Handling Devices
- Photoconductive Materials
- Electroluminescence
- Solid State Display Devices
- Terminal Communications
- Line-of-Sight UHF and VHF Relay Systems
- Air Traffic Regulation and Landing System
- Pincushion Radar
- Logi-Scale General Purpose Computer
- Radar Closed Loop Tester
- Missile-Range Ship Instrumentation
- Precision Trajectory Measurement System
- Space Vehicle Subsystems
- Telemetering Systems
- Radiation Sources, Detection, Handling Equipment and Effects Analysis
- Inertial Missile Guidance Systems
- Machine Tool Controls
- Microwave Tubes
- Transistors and Diodes
- Rectifiers
- Thermal and Magnetic Relays
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- Plasma Physics Research

ELECTRICAL ENGINEERS AND PHYSICISTS

B.S., M.S. or Ph.D. (Mid-Year and June Graduates)

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December 9, 1960

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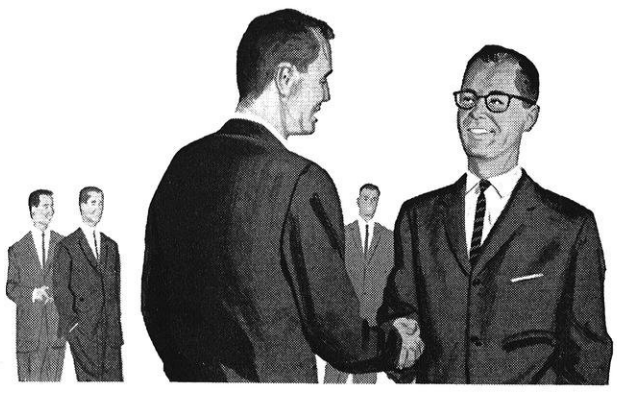
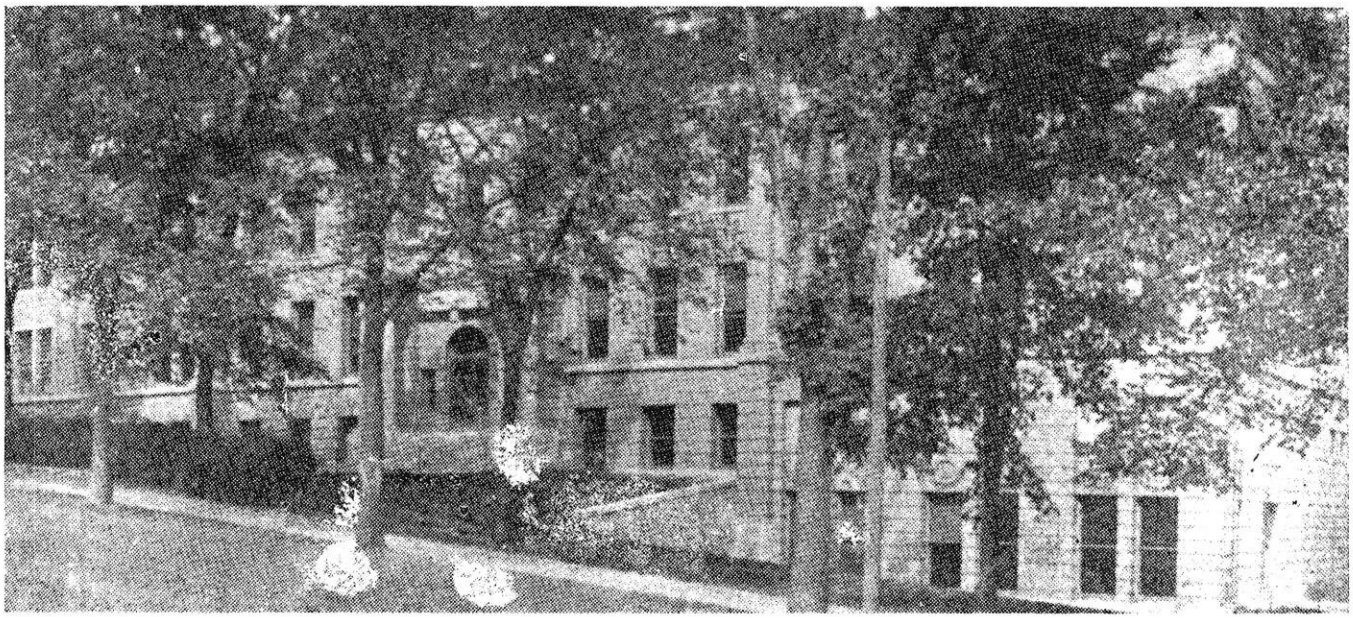


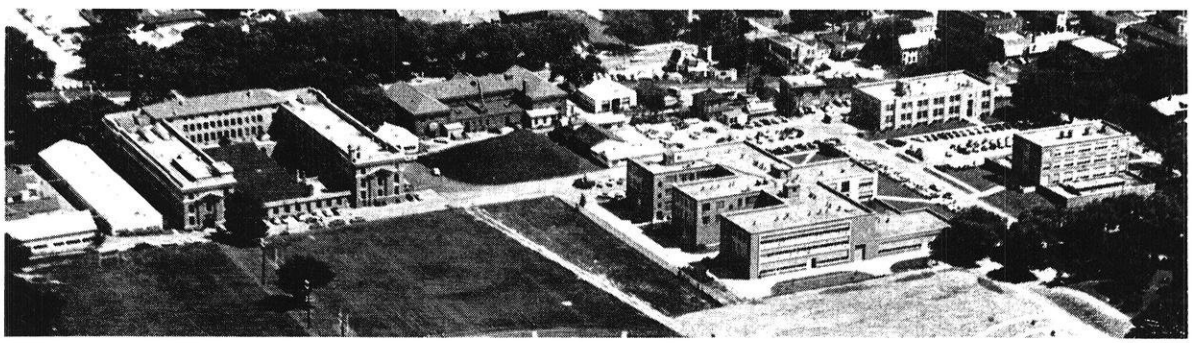
CREATING A NEW WORLD WITH ELECTRONICS

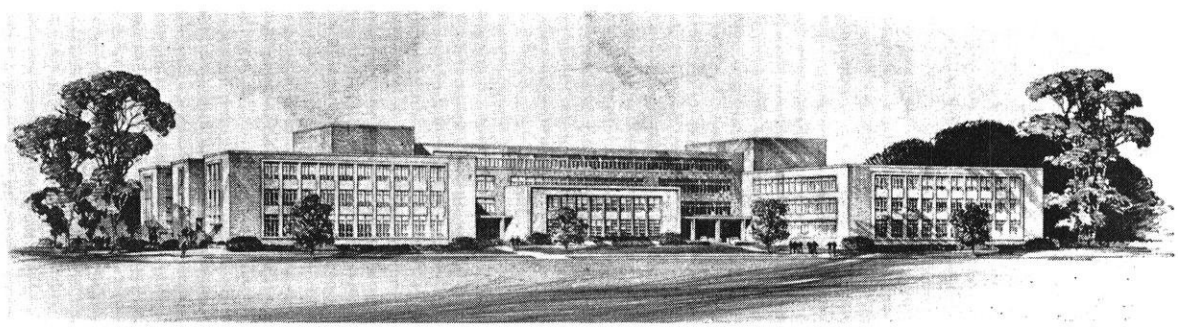
HUGHES

HUGHES AIRCRAFT COMPANY

Culver City, El Segundo, Fullerton, Malibu, Newport Beach, Oceanside, Los Angeles, Calif.; Tucson, Arizona





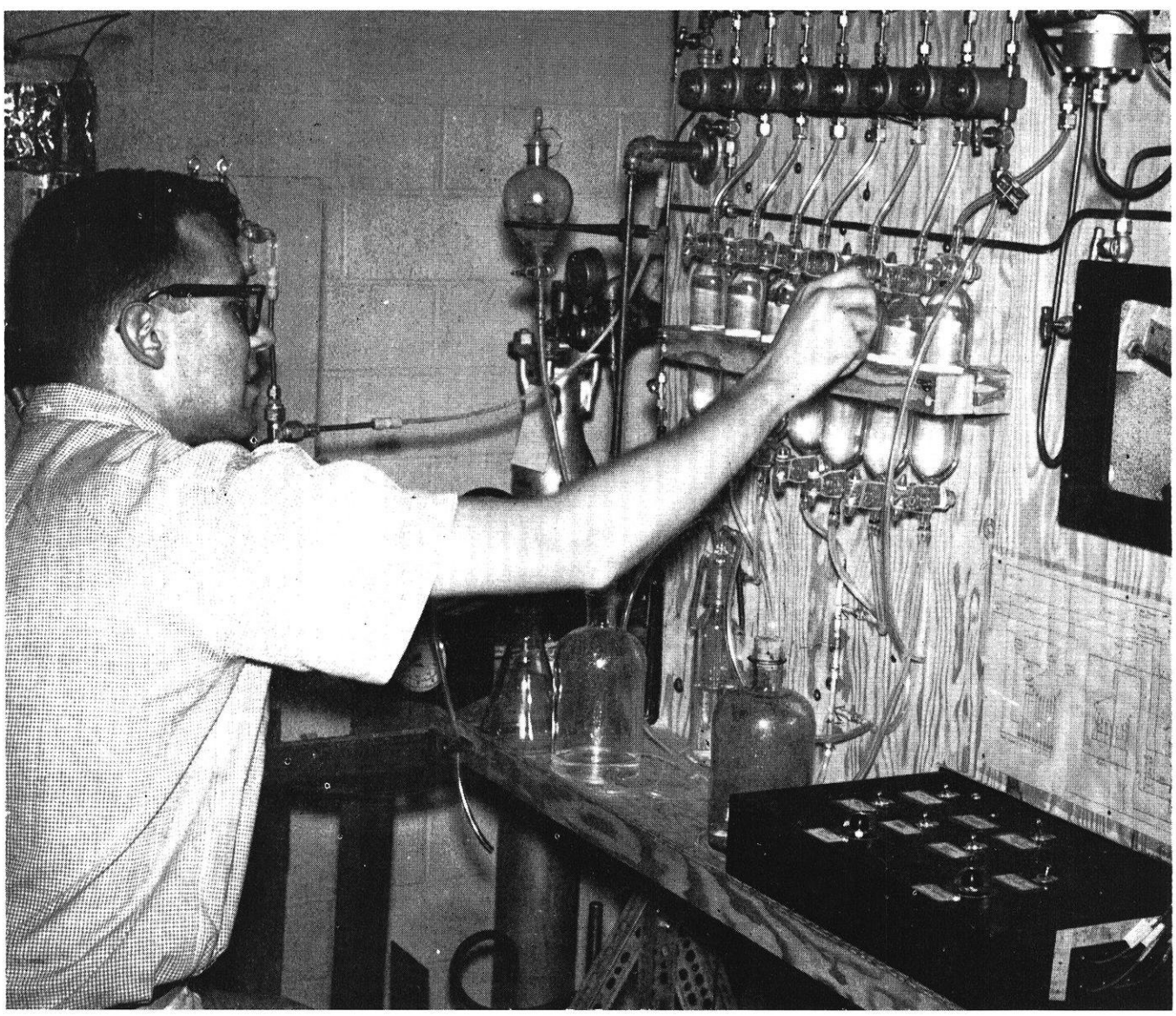


Graduate Opportunities

at the

University of Wisconsin

Compiled by William Huebner Che'61



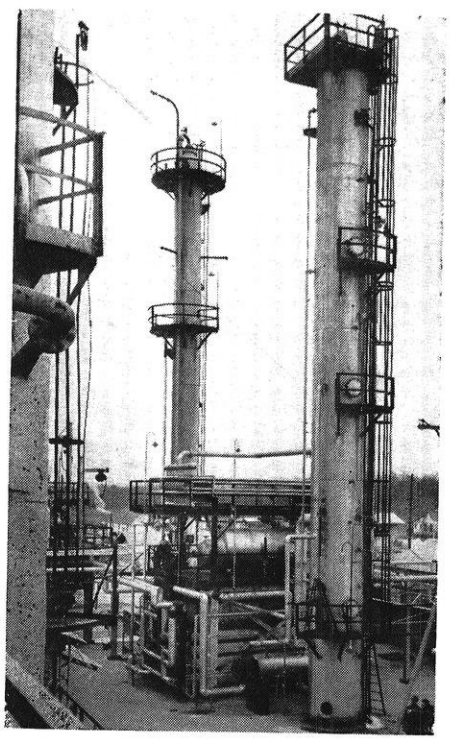
Chemical Engineering

by R. Byron Bird
Chairman of Graduate Committee

THE graduate program in chemical engineering has as its objective the training of the future *leaders* in research and teaching. The department is proud to count among its students some of the top-ranking graduates from many departments of chemical engineering both in the U.S. and abroad. And the department is also proud of the many Ph.D.'s who, after leaving Madison, have assumed responsible positions in industry, government, and teaching.

The graduate student in chemical engineering takes a handful of advanced chemical engineering courses, which emphasize the key research interests in this field, such as: thermodynamics, fluid dynamics, diffusional operations, kinetics and catalysis. In addition he seeks to add to his storehouse of basic information by taking four or five courses in a minor—usually mathematics, physics, or chemistry; the applied fields must always draw heavily on the basic sciences for new techniques, ideas, and inspiration. Graduate students must also pass examinations to prove their proficiency in reading scientific works in two foreign languages (currently, the two most important foreign languages in chemical engineering are German and Russian). In this connection it would be well to encourage those planning to go to graduate school at any university to take two to four semesters of German or Russian while undergraduates.

Most of the graduate students' time is occupied in research, individual study, and informed exchange of ideas by means of conferences, seminars, or friendly arguments. The research in the chemical engineering department is motivated to a large extent by a desire to contribute to the solution of some of the key unsolved problems of the modern chemical industry. It is hoped that the results of these research efforts will ultimately provide the basis for better design methods, better materials, better production techniques, and "better living through chemistry."



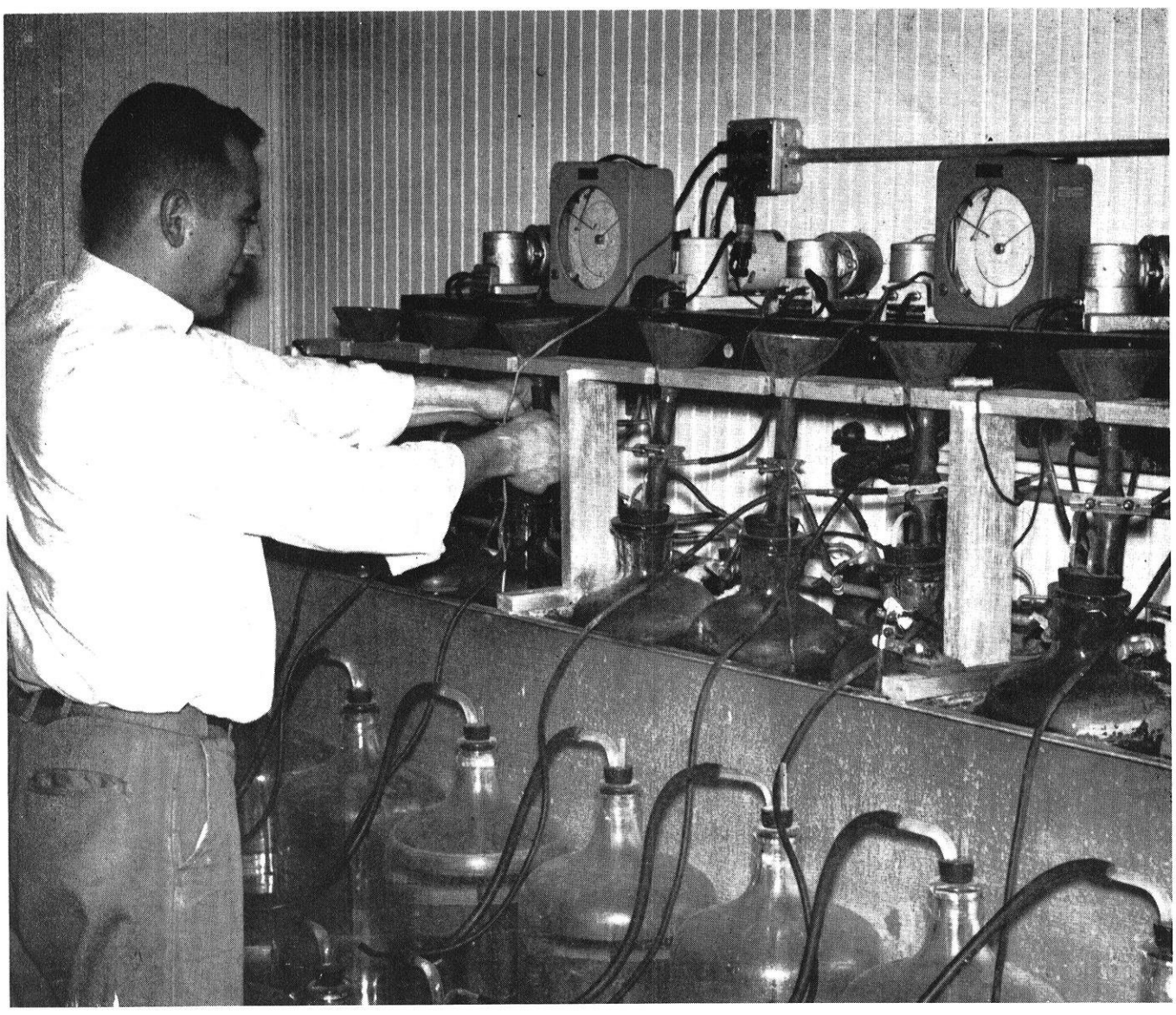
Chemical Engineering Equipment

Some of the areas of interest to the chemical engineering research professors are: fabrication of films, fibers, and reinforced plastics; applications of transport phenomena in ionic systems; measurements of transport properties of dense gases; rheology of high polymers and their solutions, semi-permeable membranes and behavior of adhesives; the nature of solid catalysts and their role in enchancing chemical reactions; dependence of chemical reaction rates on structure of organic molecules; automation, process dynamics, and simulation techniques; use of applied mathematics, numerical analysis, and statistics to solve chemical engineering problems; electrochemical processes and corrosion phenomena.

Numerous fellowships are available for qualified students. The competition is keen, and clearly those students whose previous academic records are outstanding have the best opportunity for financial assistance for doing teaching or research. THE END

Top—The chemical engineer at work in the petroleum industry.

Bottom—John M. Ausman at work on his regeneration of a single catalysis.



Civil Engineering

by Arno T. Lenz

Chairman, Civil Engineering Department

GRADUATE study in Civil Engineering is spread over a variety of fields, many of which are more closely related to studies outside engineering than with each other. Generally, these fields may be classified as City Planning, Highways, Hydraulics and Fluid Mechanics, Hydrology, Sanitary Engineering, Structures, Surveying and Photogrammetry.

A student who desires to enroll for advanced work leading to the M.S. or Ph.D. degrees should determine his major interest and select those courses which will give him the broad or detailed training he desires. It is usually highly desirable that the student beginning graduate work have a specific goal toward which he is working so that both his courses and research can be coordinated toward that objective. He should discuss his plans with the faculty member with whom his interests are most closely identified so this man will be able to serve as his major professor. Those students presently employed away from Madison or enrolled at another school, can do this by correspondence directed to the faculty member if known or to the department chairman who will route the correspondence to the proper person when the student indicates his professional interests.

Advanced work in City Planning frequently is coordinated with Regional Planning, Political Science, and related fields in the College of Letters and Science. Advanced courses in City Planning and Design are supplemented by those in Airports, Municipal Engineering Practice, Traffic Control, Highway Engineering Materials and Administration, Photogrammetry, and River Basin Planning, and many outside the college. These courses, together with research on problems found in the Madison and Milwaukee areas and others throughout the state and nation, form the nucleus of this graduate program.

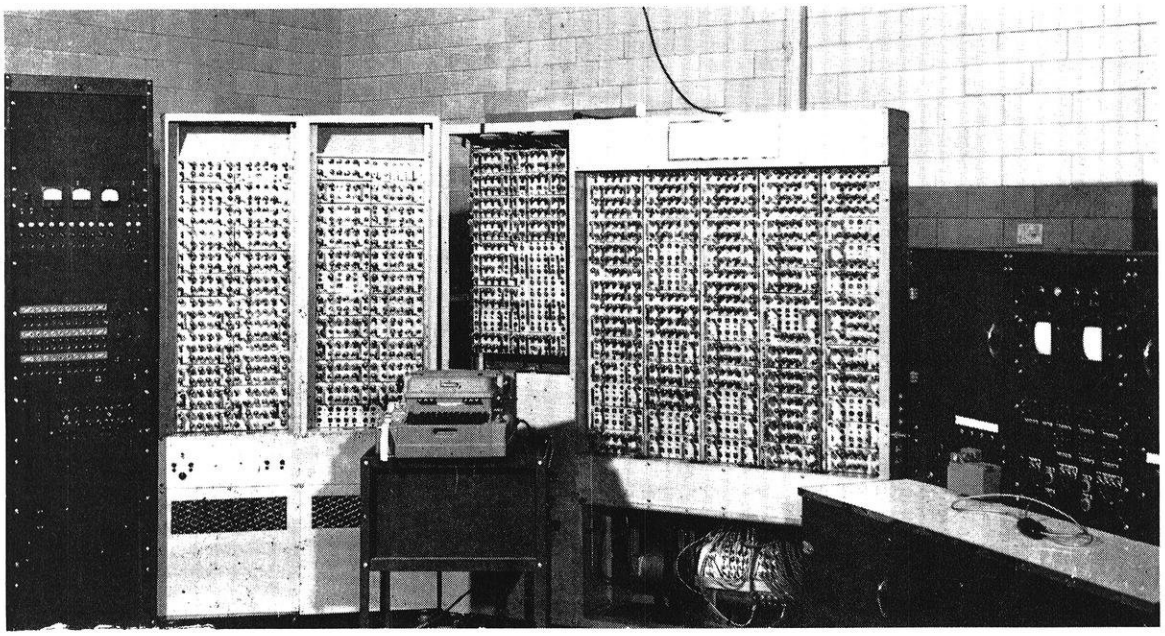
Hydraulics and Fluid Mechanics is a very broad field. The Hydraulic and Sanitary Laboratory on the shore of Lake Mendota provides facilities for experimental and theoretical research. A low pressure water system supplied by lake water can provide up to ten cubic feet per second flow to an assortment of flumes and channels of various sizes and shapes for both research and laboratory classes. A high pressure water system with a head of 200 feet supplies water for other experiments and an oil circulation system with pressures up to 2000 pounds per square inch, rather unique in university laboratories, is useful for special experimentation. Pumps, piping and meters used for transporting and measuring water and oil are supplemented by a small wind tunnel so all fluids can be studied experimentally. Courses in Advanced Hydraulics and Fluid Mechanics, Hydraulic Machinery, River and Irrigation, Water Power, and Hydraulic Design are supplemented with work in Hydrology in this department and Advanced Mathematics, Mechanics and related work in other departments throughout the University.

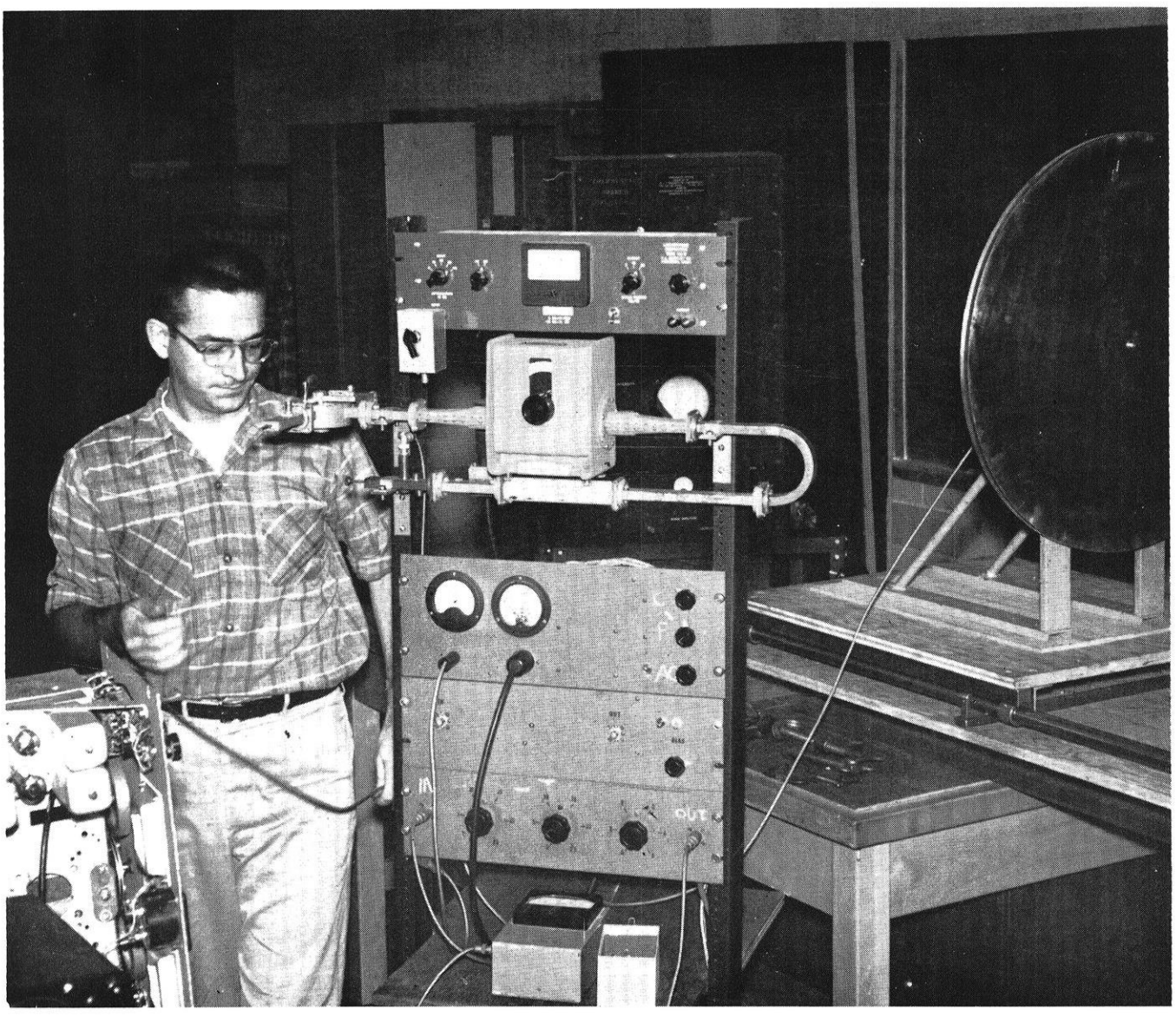
Hydrology, justified as a separate field of study because it is so closely related to other natural sciences in the physics of the earth series, is closely related to Meteorology and Geology and graduate students are encouraged to broaden their backgrounds in those fields. Hydrological Investigations and River Basin Planning are of primary importance along with the applications of Hydrology in Water Power, Irrigation and River Hydraulics, Hydraulic Design, Hydraulic Machinery, Water Supply, and Sewerage. Some field work is done on the collection of rainfall and runoff records in cooperation with the Agricultural Research Service of the U. S. Department of Agriculture. Records from the U. S. Weather Bureau, Geological Survey, and other governmental agencies are readily available for these studies.

(Continued on page 56)

Top—A freeway story on the Los Angles X-way. It is named the "Stack".

Bottom—Joe Mauna working on his "High rate sludge digestion" project.





Electrical Engineering

by Prof. V. C. Rideout

Chairman of Graduate Committee

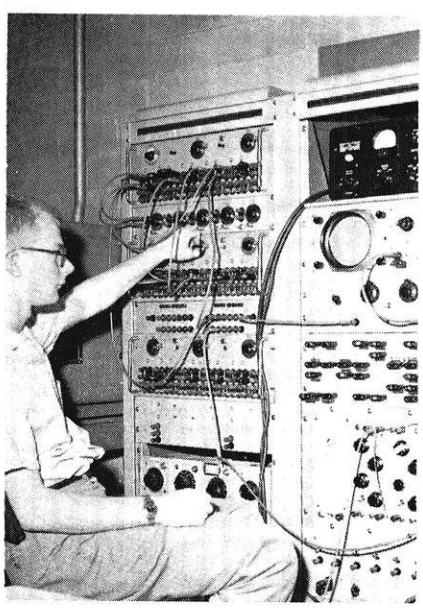
THE graduate program in Electrical Engineering is a large one with about 40 Master of Science and 8 Doctor of Philosophy students graduating each year. Because of this size a large number of courses can be supported at the 100 and 200 levels, providing many choices of area of specialization for the student.

Among the more important possible areas of specialization which are a part of Electrical Engineering are

Network Theory
Control System Studies
Electromagnetic Fields and Microwave Circuits
Communication Systems and Information Theory
Rotating Machines
Electronics
Power Distribution Systems
Computers and Computing

These areas, in turn, include subareas. Thus in electroncis an area of specialization might be in transisitors, thermistors, zener diodes or discharge in gases. In each of the above areas of specialization there are about half-a-dozen courses at the 100 and 200 levels—some of which, however, appear in more than one classification.

One of the important decisions a new graduate student must make is his choice of a major professor to direct his thesis research, and advise him on courses selection. This selection may have some financial overtones, for most professors interested in research will have one or more WARF (Wisconsin Alumni Research Foundation) research assistantship's assigned to him which he wants to fill.



Electrical Engineering student at work.

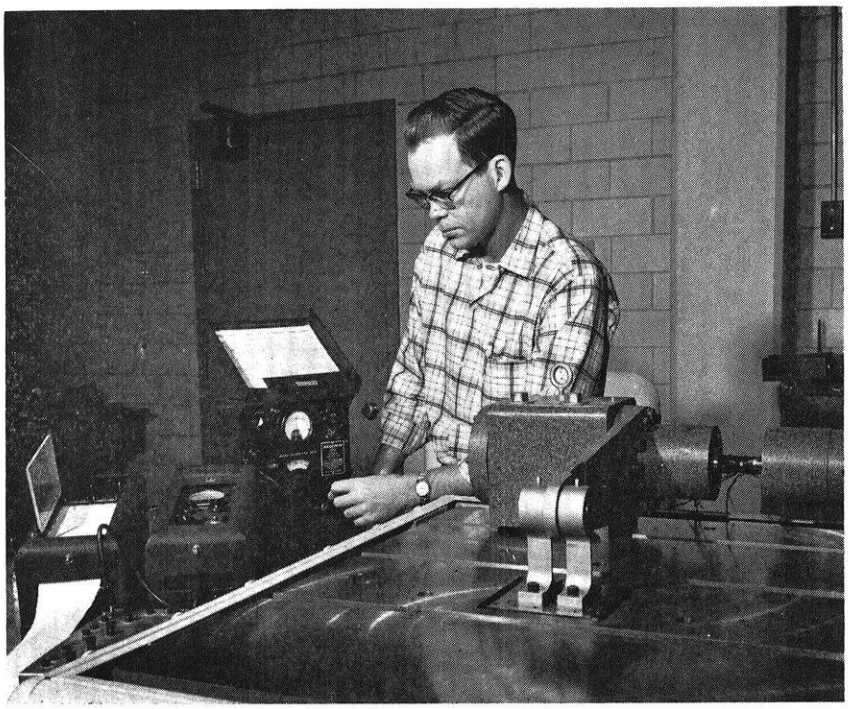
In addition to assigned research assistantships, there are unassigned assistantships, as well as university scholarships and fellowships for for which the interested student should apply (get forms in the Departmental office and make application by Feb. 15). These forms also apply to some fellowships such as the Bacon Fellowship.

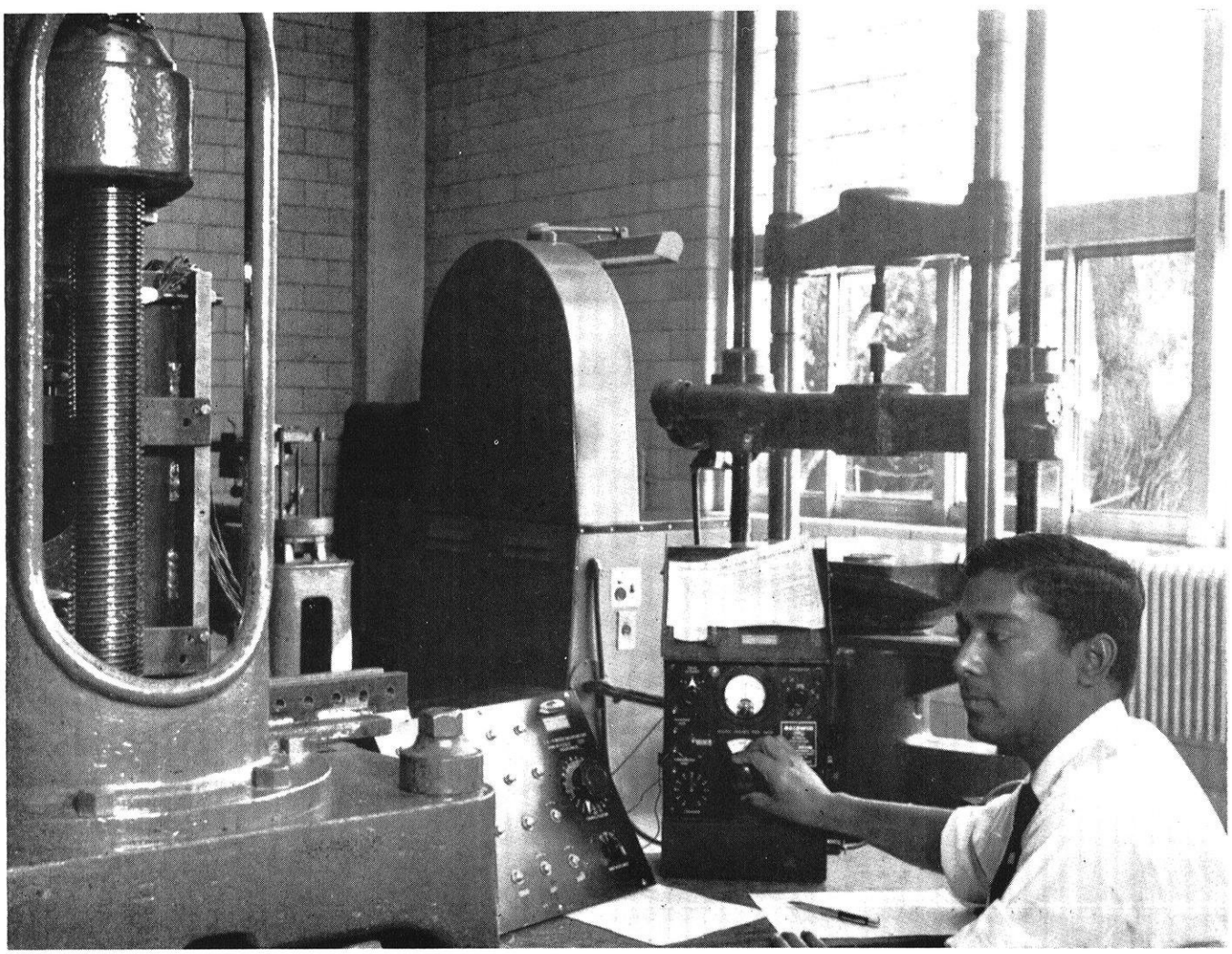
There are other fellowships for which the interested student should apply. Most important are the National Science Foundation Fellowships. Watch billboards for announcements on these. Applications must usually be made in February for fellowships starting in the following September.

In conclusion a word should be said in support of the idea of taking graduate work at all, for the strain of four years and 146 credits may leave even the most capable student a bit weary of the educational process. Perhaps the strongest arguments in favor of advanced degree work came from the B.S. graduates who return for such work after a few years in industry, often at considerable sacrifice. Their motive is usually the desire to get more opportunity to do the interesting, non-routine research jobs, or to prepare to go into teaching. Be sure to talk to such people, and other graduate students as well, before you make your decision on graduate work.

Top—One of the computers available to graduate students at the University of Wisconsin.

Bottom—James Beyer at work finding the loses in transmission of microwaves. He is doing this project for the army.





Engineering Mechanics

by Prof. George W. J. Washa

Chairman, Mechanics Department

THE Department of Engineering Mechanics has offered graduate work leading to the M.S. and Ph.D. degrees over a long period of time, even though it has only recently, September, 1959, started an undergraduate curriculum leading to the B.S. degree in Engineering Mechanics. Graduate students in Engineering Mechanics have come from other Engineering disciplines and from Applied Mathematics and Mechanics.

In order to earn an M.S. degree a student is expected to take 24 credits beyond the B.S. degree and to attain a working knowledge of the following subjects: advanced statics and dynamics, materials of construction, advanced strength of materials, applied mathematics, and experimental stress analysis. A thesis is usually required.

Two options for the Ph.D. are available in the Department. In the Analytical option the student is expected to attain a working knowledge of the following branches of Mechanics: advanced statics and dynamics of rigid bodies, particle dynamics, advanced strength of materials, materials of construction, vibrations, fluid mechanics, stress analysis, theory of elasticity, theory of plasticity, elastic stability, and experimental techniques. In addition he is expected to become familiar with advanced mathematical methods such as Laplace, Fourier and Hankel transforms, complex variables, differential equations, and advanced calculus.

In the Materials option the student is expected to attain a working knowledge of the branches of Mechanics required for the Analytical option and to take some work in advanced mathematics. In addition he is required to develop proficiency in the general experimental techniques and in one or more of the following fields that apply in his case: wood products, soils, metals, plastics, concrete and masonry materials. The required proficiency may be attained by completing a carefully selected group of additional courses in Engineering Mechanics and in related fields such as Physical Chemistry, Physics in the Solid State, and Metallurgy, and completing a thesis in the field of specialization. The thesis in either the Analytical or Materials option requires one academic year of work or the equivalent.

Excellent laboratory facilities are available for physical and mechanical tests of materials. The cement and concrete laboratories are equipped to take care of a large variety of research problems. Special laboratories are available for various tests of metal properties such as fatigue, creep, static and impact properties. Experimental stress determinations may be made by photoelastic methods and by various types of strain gages. In the soils laboratory problems of consolidation, shear strength, permeability, bearing capacity and classification may be solved. The vibrations laboratory is equipped for work on problems in dynamics and mechanical vibrations.

Some idea of the wide range of thesis topics covered in Engineering Mechanics is provided by the following list of representative titles:

- Dynamic Balancing Machines
- Mechanical Vibration Isolation
- Soil Stabilization Methods for Evaluating Soil Bearing Capacity
- Stresses and Deflections of a Thin Cylindrical Shell Radially Loaded Along an Element
- Deformation of Metals Under Combined Tension and Torsion
- Force Analysis of a Reinforced Pipe Junction
- Minimum Restrictions on Energy Method in Elasticity
- Banding Analysis of Directionally Reinforced Pipe
- Durability of Concrete Subject to Freezing and Thawing

(Continued on page 57)

Top—Richard R. Ruegemer performing a torsion fatigue experiment on a notched shaft.

Bottom—Baikunth P. Ambasht determining the buckling properties of an aluminum plate with a central hole.

What would YOU do as an engineer at

Development testing of liquid hydrogen-fueled rockets is carried out in specially built test stands like this at Pratt & Whitney Aircraft's Florida Research and Development Center. Every phase of an experimental engine test may be controlled by engineers from a remote blockhouse (inset), with closed-circuit television providing a means for visual observation.

Pratt & Whitney Aircraft?

Regardless of your specialty, you would work in a favorable engineering atmosphere.

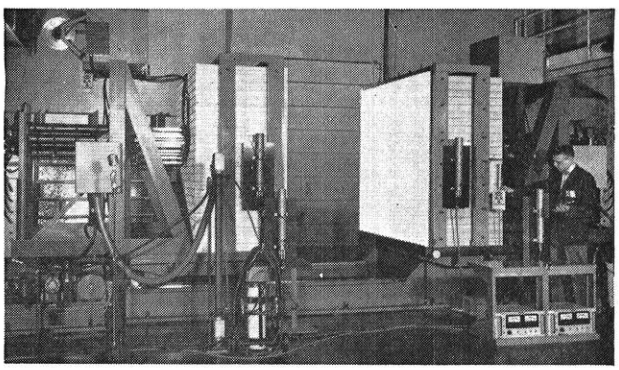
Back in 1925, when Pratt & Whitney Aircraft was designing and developing the first of its family of history-making powerplants, an attitude was born—a recognition that *engineering excellence* was the key to success.

That attitude, that recognition of the prime importance of technical superiority is still predominant at P&WA today.

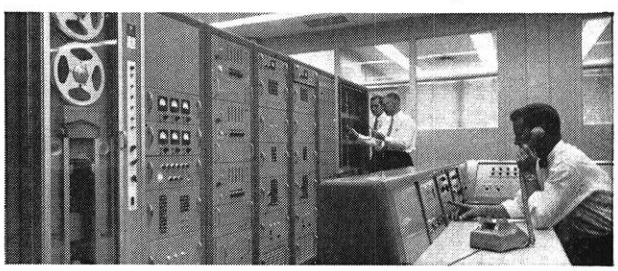
The field, of course, is broader now, the challenge greater. No longer are the company's requirements confined to graduates with degrees in mechanical and aeronautical engineering. Pratt & Whitney Aircraft today is concerned with the development of all forms of flight propulsion systems for the aerospace medium—air breathing, rocket, nuclear and other advanced types. Some are entirely new in concept. To carry out analytical, design, experimental or materials engineering assignments, men with degrees in mechanical, aeronautical, electrical, chemical and nuclear engineering are needed, along with those holding degrees in physics, chemistry and metallurgy.

Specifically, what would *you* do?—*your own engineering talent* provides the best answer. And Pratt & Whitney Aircraft provides the atmosphere in which that talent can flourish.

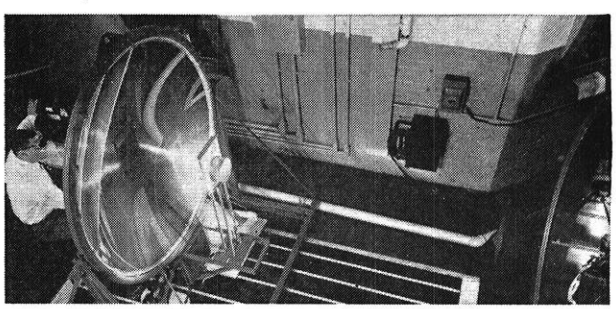
For further information regarding an engineering career at Pratt & Whitney Aircraft, consult your college placement officer or write to Mr. R. P. Azinger, Engineering Department, Pratt & Whitney Aircraft, East Hartford 8, Connecticut.



At P&WA's Connecticut Aircraft Nuclear Engine Laboratory (CANEL) many technical talents are focused on the development of nuclear propulsion systems for future air and space vehicles. With this live mock-up of a reactor, nuclear scientists and engineers can determine critical mass, material reactivity coefficients, control effectiveness and other reactor parameters.



Representative of electronic aids functioning for P&WA engineers is this on-site data recording center which can provide automatically recorded and computed data simultaneously with the testing of an engine. This equipment is capable of recording 1,200 different values per second.



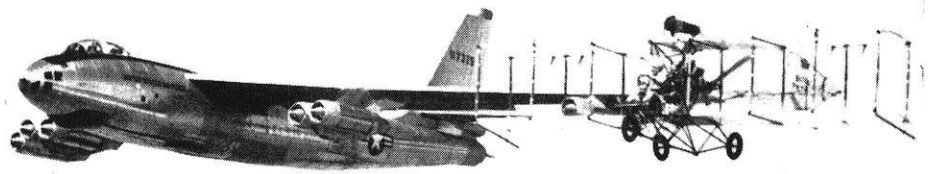
Studies of solar energy collection and liquid and vapor power cycles typify P&WA's research in advanced space auxiliary power systems. Analytical and Experimental Engineers work together in such programs to establish and test basic concepts.

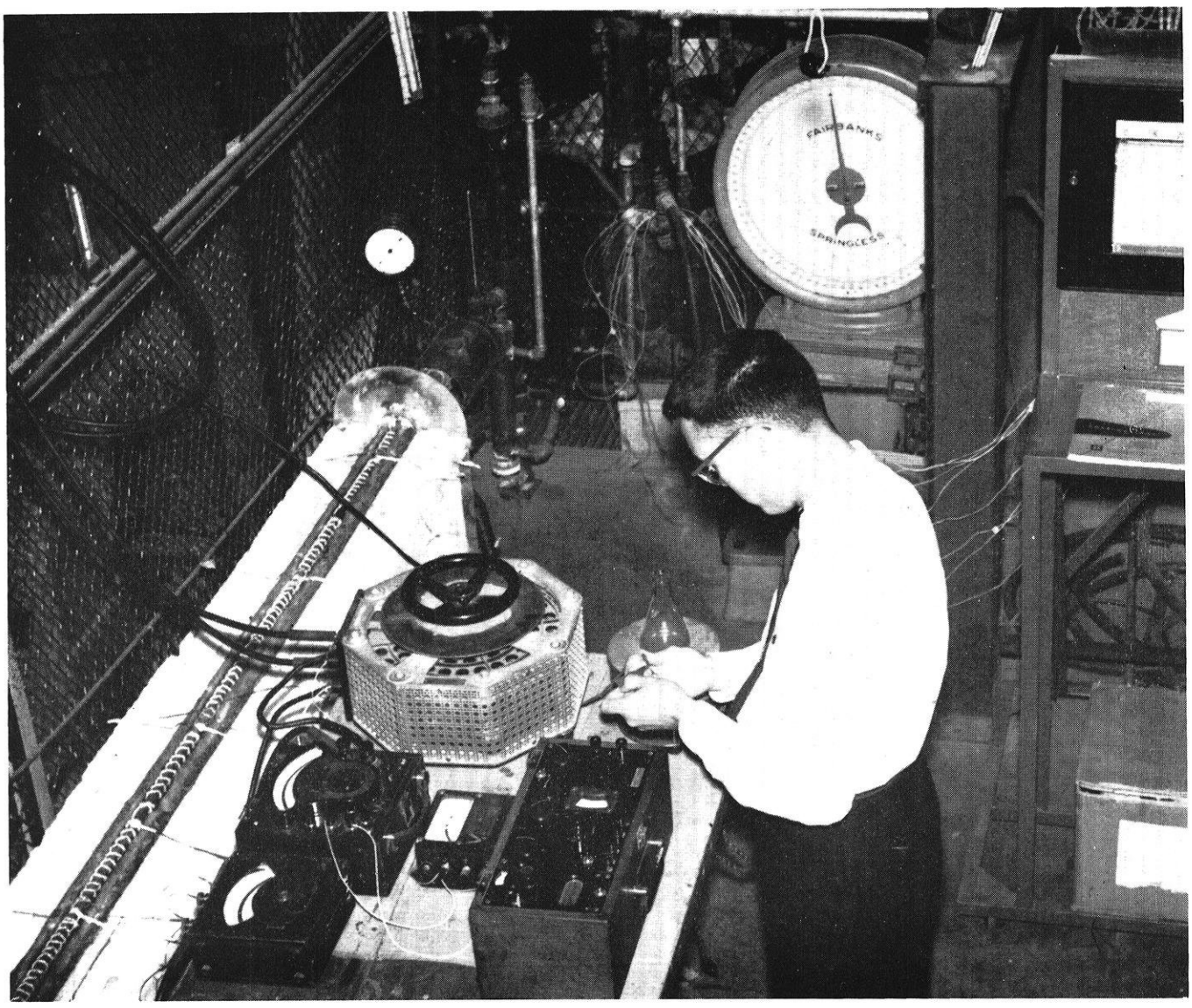
PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation

CONNECTICUT OPERATIONS — East Hartford

FLORIDA RESEARCH AND DEVELOPMENT CENTER — Palm Beach County, Florida




FAIRBANKS
SPRINGLESS

Mechanical Engineering

by Ralph J. Harker

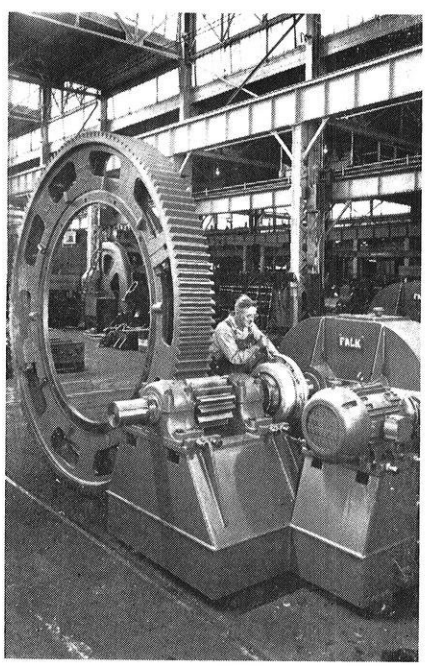
Chairman, Mechanical Engineering

A SUCCESSFUL graduate program requires a competent faculty and adequate research facilities. Other factors which are desirable include financial support for graduate students, a well-rounded series of graduate courses, an attractive campus, and satisfactory housing.

The Department of Mechanical Engineering at the University of Wisconsin has a well-developed program leading to both the Master of Science and the Doctor of Philosophy degree. Current graduate enrollment on the Madison campus consists of 79 students, of which 33 are candidates for the Ph.D. degree. An additional 79 graduate students are enrolled in the evening off-campus program at Milwaukee.

The graduate faculty in the Department comprises seventeen men who are serving as major professors; that is, they advise on programs and act as thesis supervisors for the graduate students. This faculty group represents an unusual combination of academic training and engineering experience, and includes specialists in many of the recognized areas of Mechanical Engineering.

Thesis research is performed in a number of well-equipped laboratories. Research facilities are available in the fields of heat transfer, combustion, vaporization, heating and ventilating, gas turbines, vehicle dynamics, magnetohydrodynamics, experimental stress analysis, vibration, oil hydraulics, automatic controls, friction and lubrication, motion and time study, welding and metal-cutting. Analog computer facilities are available, as well as access to the digital computer facilities of the Numerical Analysis Laboratory.



—Photo Courtesy of Falk Corp.

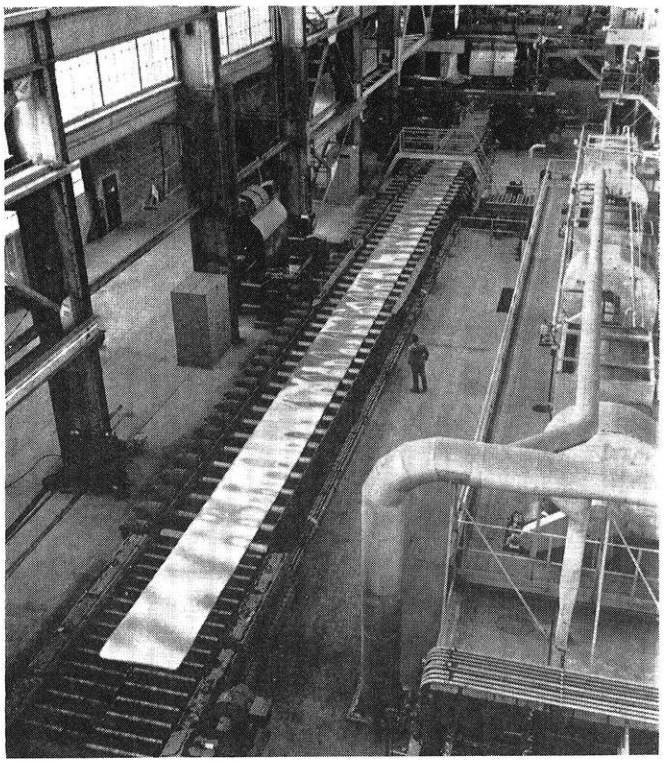
Mechanical Engineering Products

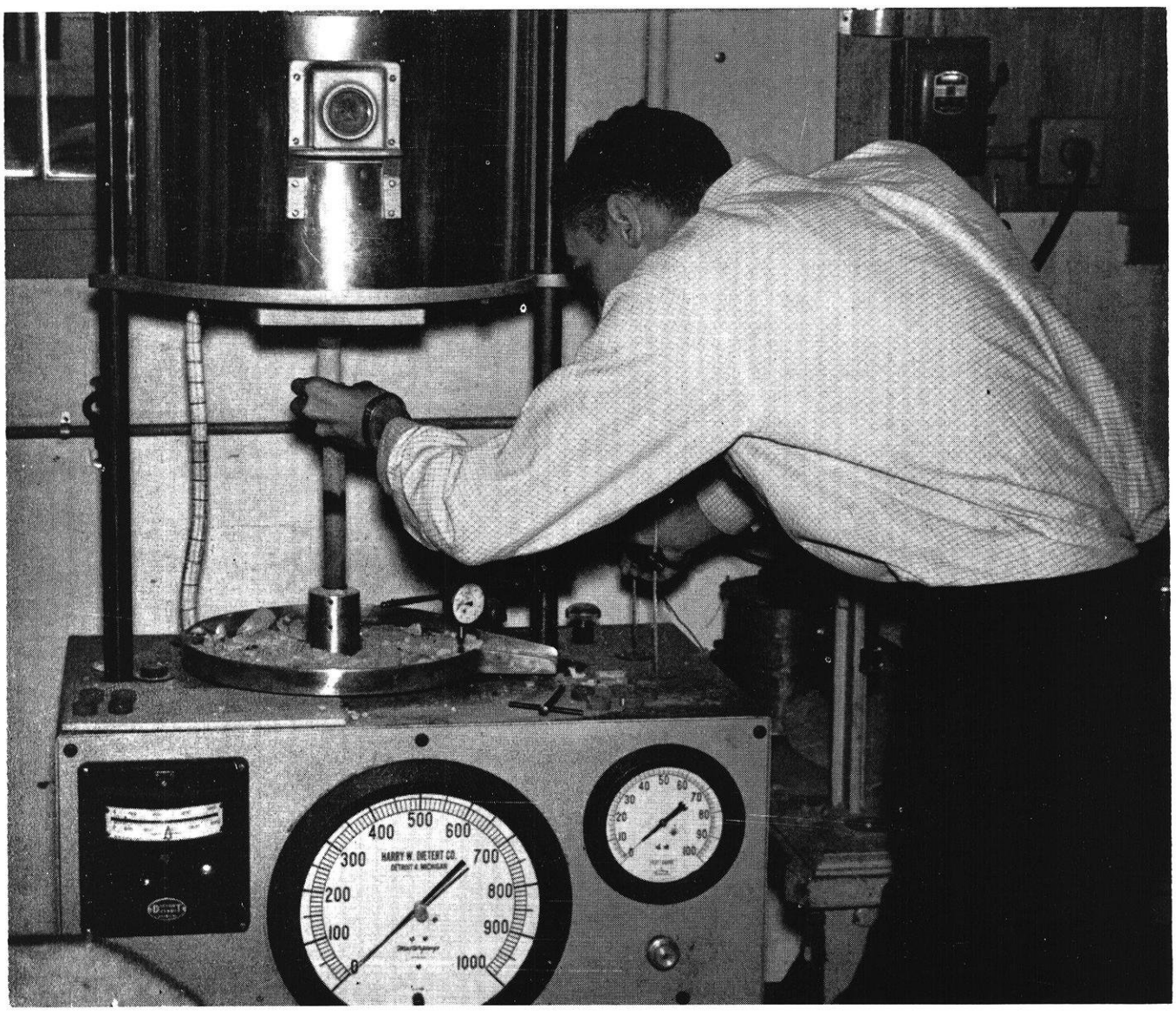
In addition to the competitive graduate fellowships and research assistantships which are available to all students in the College of Engineering, the Department awards a number of WARF Research Assistantships and industrial fellowships. All of the awards indicated allow the recipient full trial fellowships. Industrial fellowships, currently are awarded for study in the department by the Caterpillar Tractor Company, Cummins Engine Foundation, Evinrude, General Motors and the Trane Company. Stipends vary from $1500 to about $3000 per year.

Opportunities for qualified Mechanical Engineers with advanced academic training are multiplying with increasing emphasis on research and theoretical considerations in industry. Students with demonstrated scholastic aptitude are encouraged to undertake graduate study in order that they may be adequately prepared for careers in engineering research, design, or teaching. THE END

Top—Dramatic progress in the past 41 years of aviation is depicted here as a jet-powered Boeing B-47 zips past a 1912 pusher-type plane. Mechanical engineers have been responsible for much of this progress.

Bottom—Paul W. Ing working on his project, a single component—two phase heat transfer.




HARRY W. DIETERT CO.
DETROIT 4, MICHIGAN
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Mining and Metallurgical Engineering

by Professor P. C. Rosenthal

Chairman, Department of Mining and Metallurgy

GRADUATE work in the School of Mining and Metallurgical Engineering is normally carried out in three areas. These three areas are:

Mining Engineering

Areas for independent studies and research are open pit and underground mining development, methods, operational techniques and related studies in the field of rock mechanics, minerals beneficiation, mining geology and economics.

A broad selection of related courses is available to support such study. The many courses in advanced engineering and basic science subjects give the graduate student remarkable choices which enable him to search deeply into any advanced scientific and engineering phase of mining. Within the department are offered excellent courses in mineral dressing, materials handling, mineral industry economics and the science of ground control.

Available elective subjects in advanced geology, economics, Business Administration and Labor and Management Relations offer the finest possible contribution to the completion of advanced education in mining and mineral industry engineering.

Top—The product of the Metallurgical Engineer comes forth.

Bottom—John C. Bierlein running a ditatometer temperature test on sand specimen.

Mineral Concentration and Extractive Metallurgy

Based on the concept that the eventual utilization of low grade ore deposits within the continental United States is essential to our national economy and security, the graduate program in the fields of mineral concentration and extractive metallurgy is being directed towards this end.

Principal graduate studies in this field include the newer techniques of metal recovery, particularly those applicable to the less common and more exotic metals. Research includes flotation, electrostatic-dynamic and electromagnetic concentration, chemical processing and direct gaseous reduction.

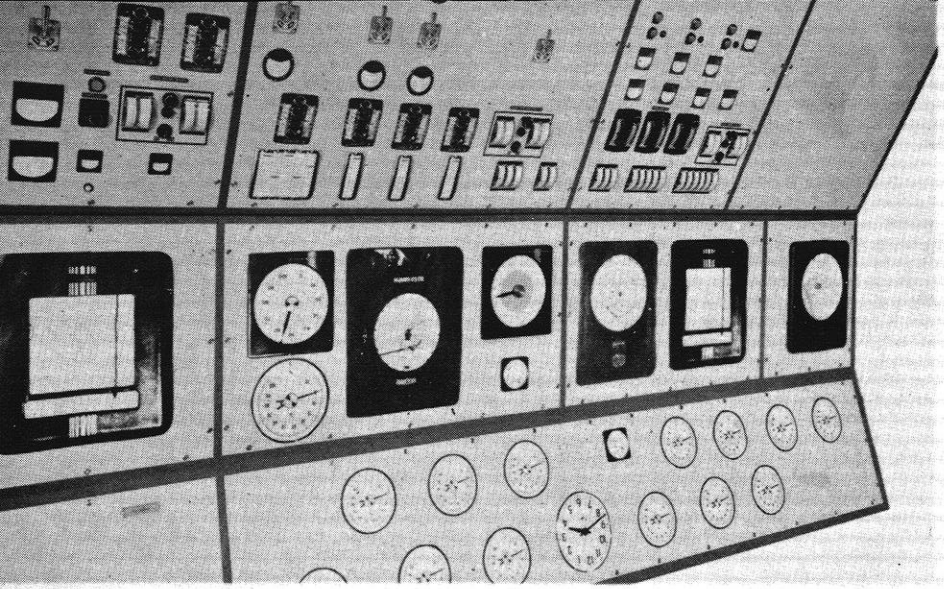
Although low grade chromite and other ores are being investigated, the large reserves of low grade iron ore in the Wisconsin Gogebic range have become the principal target for this research, with the hope of eventually developing an economic process for their utilization.

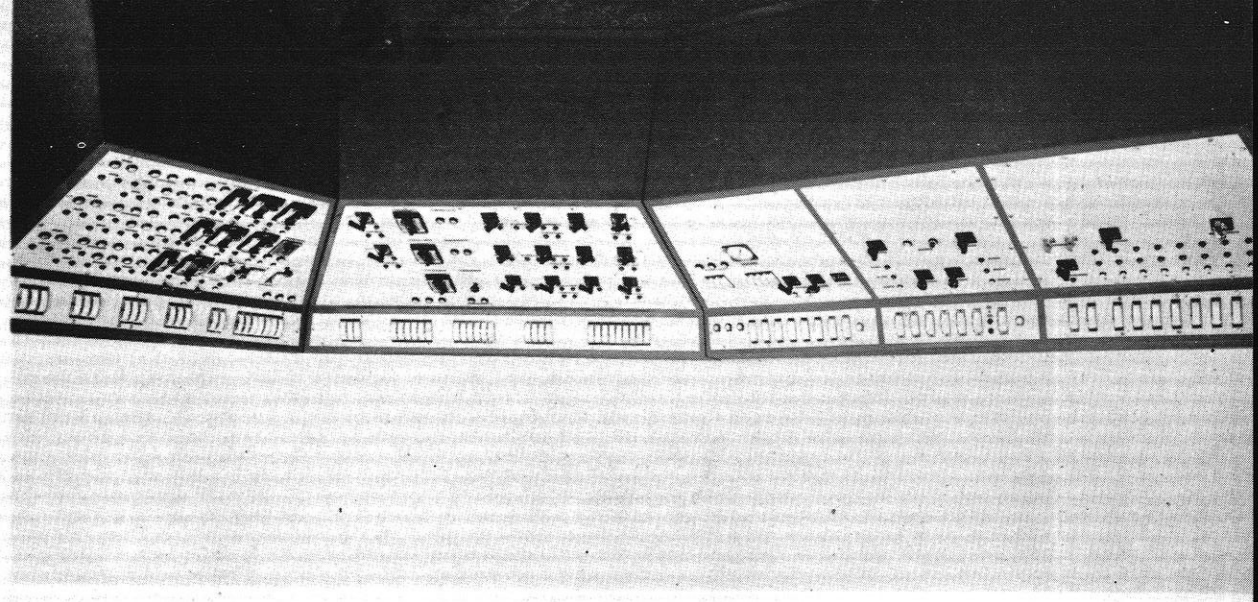
Physical Metallurgy

Physical metallurgy is concerned with the basic structure and properties of metals and alloys and their engineering use. Since the engineering use of metals depends on their production in usable forms, a portion of the graduate program is concentrated in the metal casting and metal-forming fields. While there are many specialized fields of research available to the graduate student, one given special attention in the Mining and Metallurgical Engineering Department is focused on the behavior of steels exposed to hydrogen at high temperatures and pressures such as found in the petroleum industry. The basic behavior of metallic materials in fatigue is being studied from several different angles under an NSF grant. Fundamental studies are being carried out on several aspects of heat treatment and phase transformations. Studies in physical metallurgy provide a good foundation for careers in materials engineering.

Graduate assistantships of various kinds are available in the Department of Mining and Metallurgical Engineering. Some of these come from funds granted by the University Research Committee and others from industry sponsored projects. The graduate degrees of Master of Science and Doctor of Philosophy can be earned by qualified students in either Mining or Metallurgy.

THE END





Nuclear Engineering

by Prof. Max W. Carbon

Chairman of Nuclear Engineering Committee

NUCLEAR engineering is a young and rapidly growing field based on principles of nuclear physics and of conventional engineering disciplines. Primary among these principles is the interaction of radiation with matter—such phenomena as the scattering of neutrons and gamma rays by atoms and nuclei, the fissioning of heavy nuclei, the formation of radioactive isotopes, and the displacement of atoms in crystals during radiation bombardment. Other considerations of vital importance to the field include the metallurgy of new materials such as uranium, zirconium, and beryllium; conventional and newer techniques of transferring heat such as the use of liquid metals; electronic instrumentation and automatic control techniques; chemical separation processes; and thermal-stress theories.

Present applications of nuclear engineering include the design and use of rectors for central-station power plants and for the propulsion of naval vessels, and the use of radiation for tracer and measurement applications in industrial production and research. In addition, extensive research and development efforts are being devoted to the design of reactors for the propulsion of aircraft and space vehicles; to the generation of auxiliary power for space flight missions; to the use of radiation to influence chemical reactions and to develop new materials; to the study of means to control thermonuclear reactions; and to the study of direct conversion of thermal-to-electrical energy in nuclear reactors. The field may be expected to expand in many of these directions, and nuclear engineering will remain at the frontier of technological research and development for many years to come.

Nuclear engineering is thus a field of graduate study which offers exceptional opportunities for engineering or science students with strong backgrounds in modern physics and mathematics. The growing demands of industry, government, and education will afford fine opportunities for a professional career to the graduate nuclear engineer—opportunities ranging from research and development through design, process control, manufacturing, and administration.

Further Information

For further information on admission to graduate school, fees, and housing consult the Bulletin of the University of Wisconsin Graduate School.

Information about financial support on the details of the Nuclear Engineering Program may be obtained by writing to Prof. Max W. Carbon, Chairman of the Nuclear Engineering Committee, 324 Mechanical Engineering Building, University of Wisconsin.

The electronic analog simulator and operator training consoles for the Enrico Fermi atomic power plant near Monroe, Mich.

Top—The simulator is an electronic working model of the fast-breeder reactor.

Left—Nuclear and liquid metal portion of the training station.

Right—Steam and electrical portion of the training station.

—Courtesy of Holley Carburetor Co.

Fellowships and Scholarships Available at the University of Wisconsin

The problem of money for graduate school is a very big one. You have already paid for four or five years of school and now the problem of paying for a few more years comes up.

Each department has some of its own scholarships, fellowships, and grants to help the student through his work. There are also some grants that are common to *all departments. Some of these are not used to their utmost by students and are worth looking into.*

Below is given some information about the grants that are common to all departments.

TEACHING ASSISTANTSHIPS

The current scale is $1950 for the academic year. The apprentice is required to carry a half-time teaching load, but he is allowed to carry 9 credits of academic work.

RESEARCH ASSISTANTSHIPS, "ASSIGNED"

The current scale is $1790 for the academic year or $2148 for the calendar year. The appointee must do research work on a project for which funds have been appropriated and full academic credit is given for this research work. The student can take a full load (12 credits) of graduate work, including research.

ALUMNI RESEARCH FOUNDATION RESEARCH FELLOWSHIPS

The current scale is $1830 and fees for an academic year or $2200 and fees for a calendar year. This award is made to outstanding students who are given a free choice of research projects.

COLLEGE OF ENGINEERING RESEARCH FELLOWSHIPS

The current scale is $1790 for the academic year or $2148 for the calendar year. The appointee works on a thesis residence project.

UNIVERSITY FELLOWSHIPS ASSIGNED

The current scale is $1700 for the academic year.

NONRESIDENT TUITION SCHOLARSHIP

This pays the difference between resident and nonresident tuition.

NATIONAL SCIENCE FOUNDATION SCHOLARSHIP PROGRAM

Two separate and distinct programs are operated, as indicated below. A student may apply for only one type of appointment; applications for both will not be accepted.

1. NSF *Cooperative* Graduate Fellowships.
   (a) Obtain application papers from our Graduate School Office, 150 Bascom Hall.
   (b) The executed forms are sent *to the school you wish to attend.* If you wish to go to Wisconsin, turn in the forms to your departmental office.
   (c) Stipend is $2200 on annual basis, plus all fees.
   (d) Applicants must be U.S. citizens.
   (e) Closing date is November 4, 1960, with awards announced March 15, 1961.
2. NSF Graduate Fellowships.
   (a) Application forms are obtainable from Fellowship Office, National Academy of Sciences–National Research Council, 2101 Constitution Avenue, N. W., Washington 25, D. C. Later this semester, forms can also be obtained from our Graduate School Office.
   (b) The executed papers are to be transmitted to the address given under 2 (a).
   (c) The student has a free choice of schools.
   (d) Stipend *this* year is $1800 on an annual basis, plus all fees.
   (e) Applicants must be U. S. citizens.
   (f) Closing date probably will be January 1, 1961, with awards being announced March 15, 1961.

FULBRIGHT FELLOWSHIPS FOR STUDY ABROAD

1. Information on Fulbright Fellowships and application forms for 1961–62 appointments are available in the Graduate School Office, 150 Bascom Hall.

2. Applications for 1961–62 appointments are due in the Graduate School Office by October 15, 1960.

Note: The posted printed announcements from the headquarters office in Washington, D. C., indicate a closing date of October 1, but this has been extended locally to October 15.

For information about fellowships, scholarships, and grants for each department, write to the department at any of the following addresses.

CHEMICAL ENGINEERING DEPARTMENT
1002 Engineering Building
Professor R. A. Ragatz, Chairman

CIVIL ENGINEERING DEPARTMENT
207 Mechanical Engineering Building
Professor A. T. Lenz, Chairman

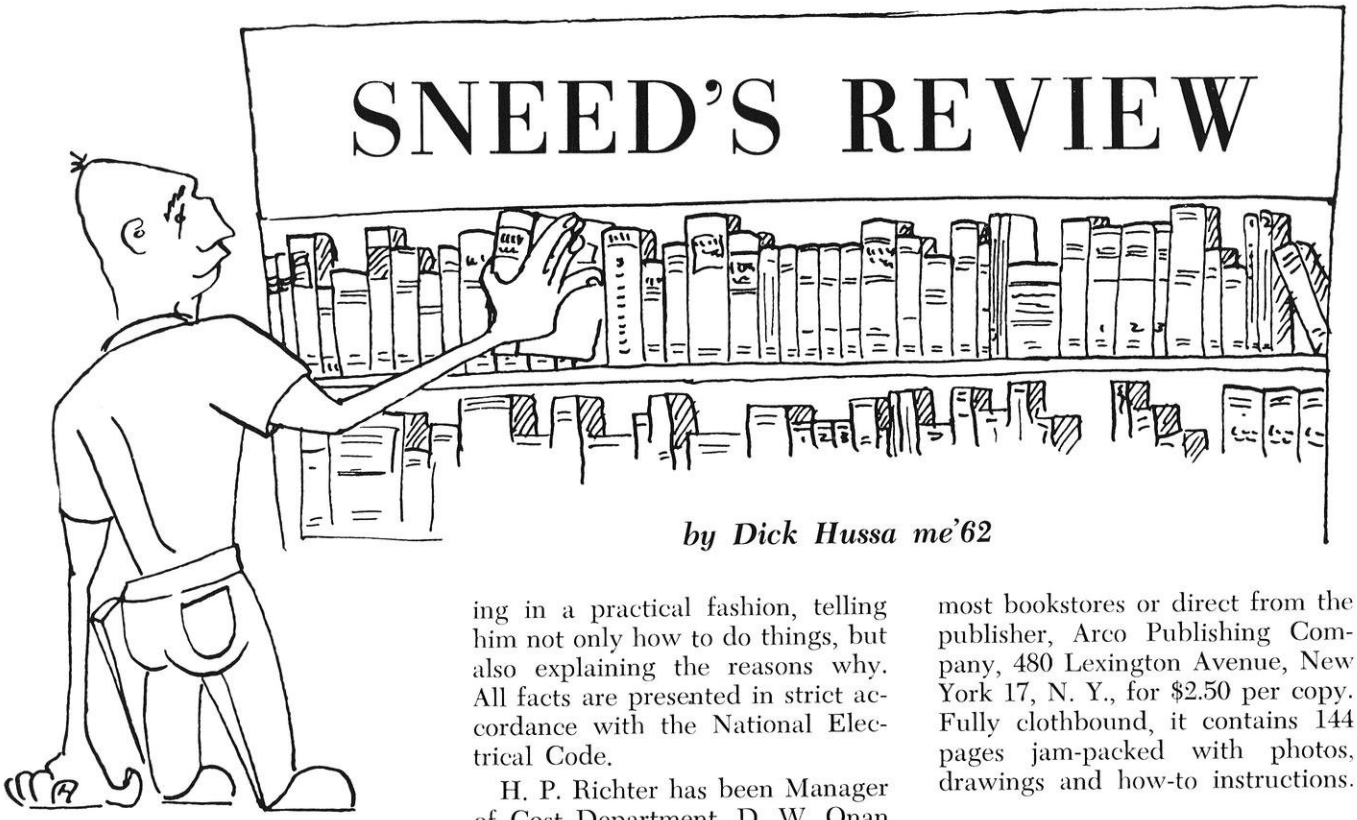
ELECTRICAL ENGINEERING DEPARTMENT
2004 Engineering Building
Professor H. A. Peterson, Chairman

MECHANICS DEPARTMENT
2953 Engineering Building
Professor G. W. Washa, Chairman

MECHANICAL ENGINEERING DEPARTMENT
210 Mechanical Engineering Building
Professor R. J. Harker, Chairman

MINING AND METALLURGICAL DEPARTMENT
202 Mining and Metallurgy Building
Professor P. C. Rosenthal, Chairman

SNEED'S REVIEW



by Dick Hussa me'62

PRACTICAL ELECTRICAL WIRING

H. P. Richter, 592 pages, $7.95

Practical methods for handling wiring and installation jobs are presented in this newly published manual. It shows how to plan and carry out all types of lighting and power wiring jobs on the farm, in homes, factories, stores, schools, and other structures.

In addition to presenting fundamentals, terminology, basic principles, theeory behind practices, and practical wiring instructions, the book includes hundreds of on-the-job tips and short-cut suggestions.

Thoroughly rewritten, the Sixth Edition has been revised to be in line with the 1959 Edition of the National Electrical Code. The latest procedures are reflected in a special section of farm wiring problems, and in another on principles of good lighting. Included is the analysis of wiring sectional ranges and ovens, covered in the 1959 Code for the first time. In addition, the book provides fresh coverage on wiring refrigerating type hermetic motors, recent types of lighting, and on the characteristics and procedures of installing the "MI" cable.

The book is planned to enable the reader to learn electrical wiring in a practical fashion, telling him not only how to do things, but also explaining the reasons why. All facts are presented in strict accordance with the National Electrical Code.

H. P. Richter has been Manager of Cost Department, D. W. Onan & Sons, and is a member of the International Association of Electrical Inspectors.

HANDYMAN'S CONCRETE AND MASONRY HANDBOOK

R. J. DeCristoforo, 144 pages, $2.50

Apparently, one of the easiest home improvement jobs is masonry and concrete work. Many home handymen have learned to their regret that this a falsehood, and have long wished for an authoritative guide. This need is now fully satisfied with the publication of "Handyman's Concrete and Masonry Handbook" by R. J. DeCristoforo.

Complete in every way, each vital step in home concrete and masonry work is clearly outlined. Not only the basic fundamentals for mixing good concrete, expert tips in bricklaying, how to build walks and driveways are included, but also there are complete plans for the construction of a concrete block garage and a family swimming pool. Over 300 illustrations and drawings show even the most inexperienced how to build terraces, retaining walls, sewage disposal units, dry wells, and many other permanent conveniences.

"Handyman's Concrete and Masonry Handbook" is available at most bookstores or direct from the publisher, Arco Publishing Company, 480 Lexington Avenue, New York 17, N. Y., for $2.50 per copy. Fully clothbound, it contains 144 pages jam-packed with photos, drawings and how-to instructions.

STEREO HI–FI HANDBOOK

Joseph Marshall, 144 pages, $2.50

Even in a field as new as stereo, a knowledge of the basic principles is needed. Though there is little in print aimed at the hi-fi buff, this situation is being remedied with the new "Stereo Hi–Fi Handbook". Author Joeseph Marshall presents the basis principles simply, with stress on the how-to aspect, the available equipment and down-to-earth advice on purchasing and assembling components.

This excellent new book can be divided into two parts. The first few chapters tell what stereophonic high-fidelity is all about and how, in general terms, it is achieved. The remainder of the handbook describes the components needed to obtain good stereo, how to choose, buy, and put them together prudently so you will get the most for your money. The ten full chapters, illustrated with more than 300 photographs and charts, deal with such subjects as: Understanding stereo, what you can hear with stereo, loudspeakers, amplifiers, pick-ups and turntables, tuners, tape records, how to assemble and adjust, right down to a listing of the best available tapes and discs. In all, this is one of the most complete books ever written on the subject.

"Stereo Hi–Fi Handbook" is available from bookstores or direct from the publisher, Arco Publishing Company, 480 Lexington Avenue, New York 17, New York. In addition to the full, how-to illustrations, it contains 144 pages of text, and is clothbound to make a permanent addition to any highfidelity technical library.

Mr. Marshall has been identified with high-fidelity from its inception. He is the designer of the Golden War series of amplifiers and has served as a consultant to some of the major hi–fi manufacturers.

In "Stereo Hi–Fi Handbook" he has utilized his vast knoweldge and years of experience to produce one of the most comprehensive books ever written for the stereo fan.

ELECTRICAL NOISE

W. R. Bennett, 288 pages, $10.00

How noise originates in electrical circuits, the terms in which it is described, how it is measured, and how circuits may be designed to minimize undesirable effects from noise are presented in this newly published book. It describes in qualitative and quantitative terms the physical nature of various important noise sources, including thermal agitation or resistance noise, shot noise in vacuum tubes and semiconductor junctions, noise from spontatneous emission of electromagnetic radiation, and noise in gas discharges. Fundamentals needed for analyzing basic sources of noise are covered, and methods of measurement and design are stressed. A discussion of the relation of signal and noise in communication systems of various types is included.

Coverage of recent advances includes a treatment of noise in transistors, masers, and parametric amplifiers. Among the subjects of special interest are the properties of thermal noise and its relation to blackbody radiation, and an introduction to elementary mechanics which is woven into the discussion of the maser and of noise in semiconductors Fundamental facts about such devices as junction diodes, transistors, gas discharge tubes, klystrons, traveling wave amplifiers, and nonlinear reactive amplifiers are given as an adjunct to their noise properties. In addition to the standard theory of noise figure and its significance, a treatment is given of the more comprehensive Haus–Adler theory of noise measure. The book also presents a comprehensive review of noise in the various methods of signal transmission such as amplitude modulation, frequency modulation, and the different kinds of pulse modulation.

W. R. Bennett has served on the Technical Staff of Bell Telephone Laboratories since 1925, and presently holds the title of Data Communications Consultant. His long career in transmission research has included pioneer contributions to methods of analyzing and controlling noise. He has had many papers published in technical journals on important problems in signal transmission.

Further information on Bennett's *Electrical Noise* is available from McGraw–Hill's Industrial and Business Book Information Service., 327 West 41st Street, New York 36, N. Y.

(Continued on page 52)

CRYSTAL GAZING...

BEYOND TODAY'S HORIZONS

A helicopter equipped with a specially adapted radio system — this is the modern method Wisconsin Electric Power Company uses for emergencies and for routine patrol of its many miles of transmission lines. It is typical of the Company's use of modern tools to solve present and future problems.

Company engineers are currently developing the shape and form of transmission lines which will be part of the horizon in 1980 and beyond. Utilizing analog and digital computers, they are looking at the Company's present 138,000 volt rural transmission system. Should it be replaced with extra high voltage lines, higher than some of the Company's present 230,000 volt lines? Should a super power grid be mounted over the 138,000 volt system which would then become a sub-transmission system? These are among the challenging plans that must be made today to suit an ever changing tomorrow. Imaginative, even revolutionary answers must be forthcoming from engineers like yourself.

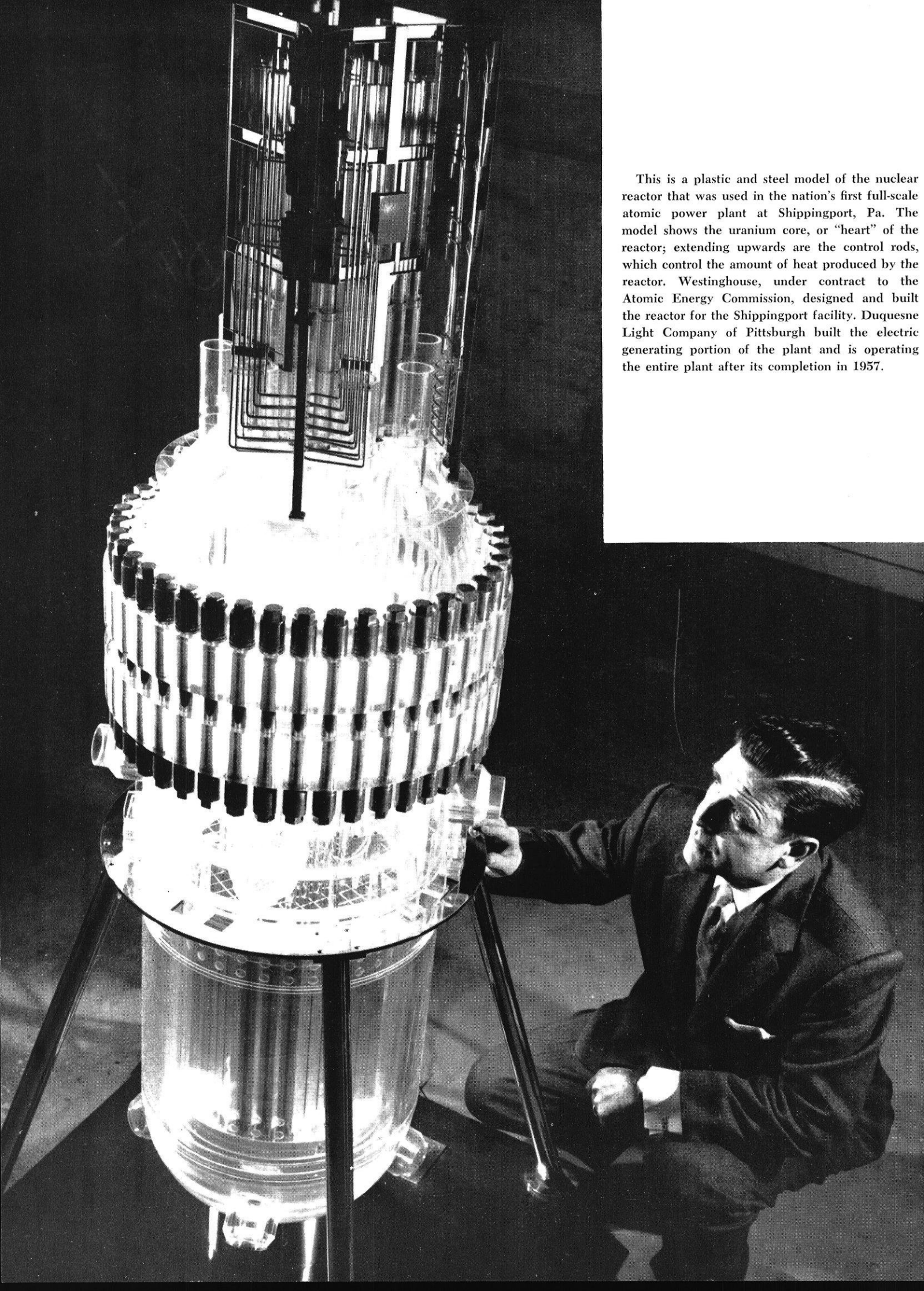
Plan now to ask our representatives about future opportunities in your field of engineering — excellent possibilities to pioneer in the future horizons of electric power.

WISCONSIN ELECTRIC POWER COMPANY SYSTEM

Wisconsin Electric Power Co.
MILWAUKEE, WIS.

Wisconsin Michigan Power Co.
APPLETON, WIS.

Wisconsin Natural Gas Co.
RACINE, WIS.



This is a plastic and steel model of the nuclear reactor that was used in the nation's first full-scale atomic power plant at Shippingport, Pa. The model shows the uranium core, or "heart" of the reactor; extending upwards are the control rods, which control the amount of heat produced by the reactor. Westinghouse, under contract to the Atomic Energy Commission, designed and built the reactor for the Shippingport facility. Duquesne Light Company of Pittsburgh built the electric generating portion of the plant and is operating the entire plant after its completion in 1957.

Jobs at Du Pont offer...

Challenge

...important, stimulating work in your chosen field, for a company that's a leader in research—the development of new products, new ways of producing them, and new areas for their use. Du Pont's methods of training, extensive modern equipment and working atmosphere will help you work at the top of your ability, help you keep growing.

Opportunity

...for continuing advancement consistent with your qualifications, working with men who have made their mark, learning from men who have achieved. Here you are given every encouragement to score your own success. Here you are an individual; your own good ideas are wanted, you are credited with them, and you will be rewarded for them.

CHEMISTS **ENGINEERS**

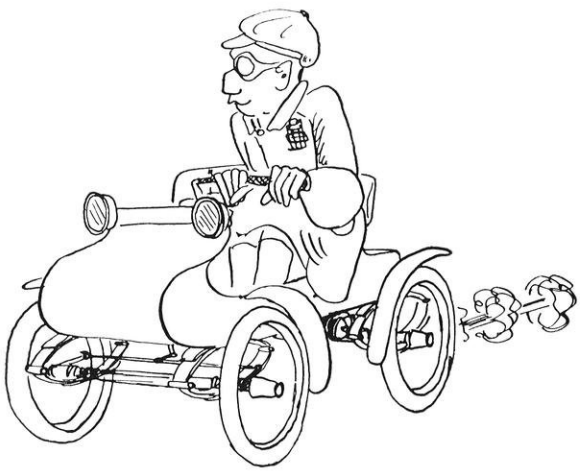
PHYSICISTS

MATHEMATICIANS

due soon to receive a Bachelor's, Master's or Doctor's degree... talk with your placement officer... or with our personnel representative when he is on campus. Or write us. E. I. du Pont de Nemours & Co. (Inc.), Room 2430-11 Nemours Building, Wilmington 98, Delaware.

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

Better Things for Better Living... *through Chemistry*



THE ENGINEER OF YESTERYEAR

by Reidar O. Nilsen, cie'61

ECHO DEPTH SOUNDER

November, 1928

A DEVICE attracting general interest is the Behin echo-depth-sounder. This device is designed to enable soundings to be made at sea by noting the time interval taken by a sound to travel from the surface to the bottom and then to return as an echo. The true basis of the invention is an instrument capable of measuring time down to the thousandth part of a second. This instrument is at any point on the ship and is connected to a firing head and two microphones. When the firing head control on the instrument is operated, a cartridge is ejected from the ship's side. This cartridge is fitted with a delay action fuse and explodes when it has decended through a few feet of water. The noise of the explosion is caught by one of the microphones which operates a relay that starts the action of the time interval recorder. The echo from the bottom is shortly afterwards received by the second microphone, which acts to stop the recorder. From the known velocity of sound in water, the scale of the recorder may be graduated to read directly the sounding in feet or fathoms. The two microphones are placed inside on opposite sides of the ship's hull to prevent the echo-receiving microphones from operating under the sound of the explosion which sets the starting microphone to work. In some instances where this shielding effect is not available, the echo-receiving phone is fitted with an arrangement which momentarily throws it out of action as the cartridge is fired.

CORNSTALK PAPER

April, 1929

The last weeks of 1929 record an event which is of great importance to printing, engineering, and agricultural circles—the successful manufacture of paper from cornstalks.

In the manufacturing process, the shredded cornstalk is placed in digesters or cooking tanks, together with cooking liquors. After the shredded cornstalk has passed through the cooking process the resultant pulp is a soft, brownish material. This is then bleached to give it the right color.

Pulp made from cornstalks, straw and similar fibrous plants has characteristics different from those of pulp made from wood. The cornstalk pulp has a shorter fiber and is much more easily hydrated than wood or rag pulps. This particular characteristic lends itself well to some grades of paper, such as glassine or other transparent or semi-transparent papers. Paper made with a certain proportion of cornstalk tends to be stiff and brittle. Cornstalk pulp as a material for the manufacture of paper has some valuable properties, but also certain limitations. It is probable that a certain small percentage will be used in the manufacture of printing papers. It is doubtful if this will ever exceed 20 per cent if the same quality of paper is desired that is used at the present time.

RADIO ALTIMETER

March, 1930

A method of judging depth by means of radio impulses has been found to reduce the hazard of "blind flying" considerably. The apparatus consists of an oscillatory circuit the constant of which vary as the height of the plane changes. This variation is due to change in capacity of the circuit as it moves with respect to the earth. A meter in the circuit is calibrated in feet, suitable corrections being made for varying conditions.

The instrument is especially valuable for flying in fogs such as are encountered in trans-oceanic flights. Under such conditions the pilot is more interested in keeping away from the ground than in knowing his exact height. Distinctive signals are given out as the plane approaches the earth. The ordinary barometer is not sufficiently accurate to record minute variations; the radio altimeter is quite accurate at short distances from the earth, however.

(Continued on page 50)

This is the 1960 Bethlehem Loop Class

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In early July, 1960, 202 college graduates reported to our general offices in Bethlehem, Pa., for an intensive period of indoctrination. For five weeks they attended talks by top management, viewed Bethlehem films, visited steelmaking operations almost daily. Upon completion of this first phase of training every man had a sound, basic knowledge of our large and diversified organization.

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Whatever your engineering curriculum, chances are there's a splendid opportunity for you with Bethlehem Steel—the nation's second-largest steel producer, manufacturer of many finished products, the world's largest privately owned shipbuilding organization, and fabricator and erector of steelwork for buildings, bridges, and other steel structures.

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BETHLEHEM STEEL

(Continued from page 48)

ELECTRIC EYE USED TO DETECT ESCAPING PRISONERS

May, 1930

When a model of a prisoner creeping up a model prison wall came within the range of vision of an "electric eye" a revolver trained on the prisoner was fired and a bell on the prison wall sounded a general alarm. In addition this device might have turned on a system of flood lights and set off a battery of machine guns or even a barrage of tear gas. The protective field available seems unlimited; it is only necessary to select the severity of the method to be used.

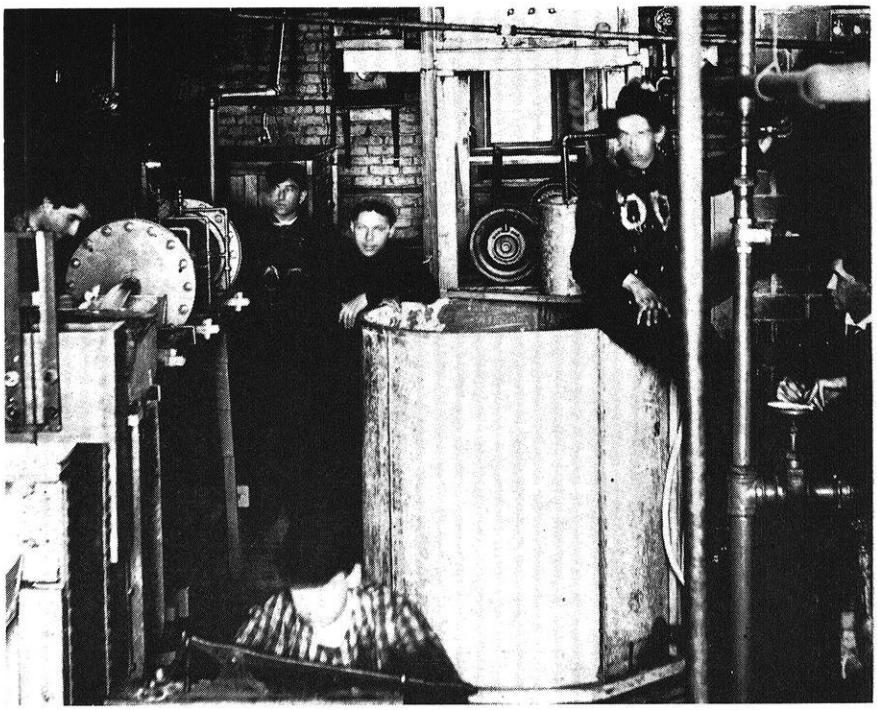
This was the first demonstration of how science may thus stop the ever frequent prison breaks. This use of the "electric eye" is only one of its many possible applications. The mechanism involved for the prison demonstrations was relatively simple. At one end parallel to the prison wall and near the top, a small and scarcely noticeable beam of light shined steadily into the "electric eye" which was mounted at the other end. When desireable, an invisible beam of ultra-violet light may be employed. Any interruption to this beam, though ever so slight, causes the desired sequence of events to occur with lightening like rapidity. The interruption of light causes the flow of current through the "electric eye" to cease. The impulse thus created, amplified through a grid glow tube, operates the relays. These in turn pull the trigger of the revolver and set of the electric bell or whatever other devices which have been installed.

POWER FROM THE GULF STREAM

November, 1930

The newspaper recently announced that Professor George Claude, French scientists, had succeeded in launching and sinking a large tube that will constitute a part of an installation designed to utilize the heat energy of the Gulf Stream. The tube was installed at Matanzas, Cuba. This was Professor George's third attempt to install the tube, two other tubes having been destroyed at the loss of $1,000,000.

The system proposed by Claude proposes to generate power from the sea by "boiling" the warm surface water in a vaccum produced by means of the cold water from the deep levels. The steam so generated is to be used in a very low pressure turbo generator operating a dc motor at 5,000 r.p.m. Such a turbine has been built and subjected to tests, which gave satisfactory results. An experimental plant on the banks of the river Meuse in Belgium indicated that the proposal is based upon sound energy considerations.



Hydraulics Laboratory.

PAVING BRICKS TO BE LAYED ON IRON BASE IN ILLINOIS

December, 1930

Three different designs of brick paving with a sheet iron base will receive their first test in 150 feet of pavements on the Grand Avenue connection with the Rochester road near Springfield, Illinois, a contract for which has just been awarded. The iron base will be layed on a very carefully rolled and leveled subgrade. Following this, there will be a layer of 2½" or 3" brick with asphaltic filler. Three 50-foot sections will be layed with the iron base, one using blue annealed flat sheets and the two-others galvanized corrugated sheets, in one case with the corrugations parallel to the road and in the other transversely. The iron base is to be ¼" thick, while the corrugated iron will be 10 gage. Expansion and contraction in the flat iron section will be provided for by overlapping sheets along the center line. One transverse edge will be turned down to grip the roadway, while the other edge, lying transversely to the road, will be supported upon the adjoining plate section to provide free movement. The end of the plates at the edge of the pavement will be turned up to form retaining walls for the paving material.

DISAGREEABLE ODOR NEW SAFETY MEASURE

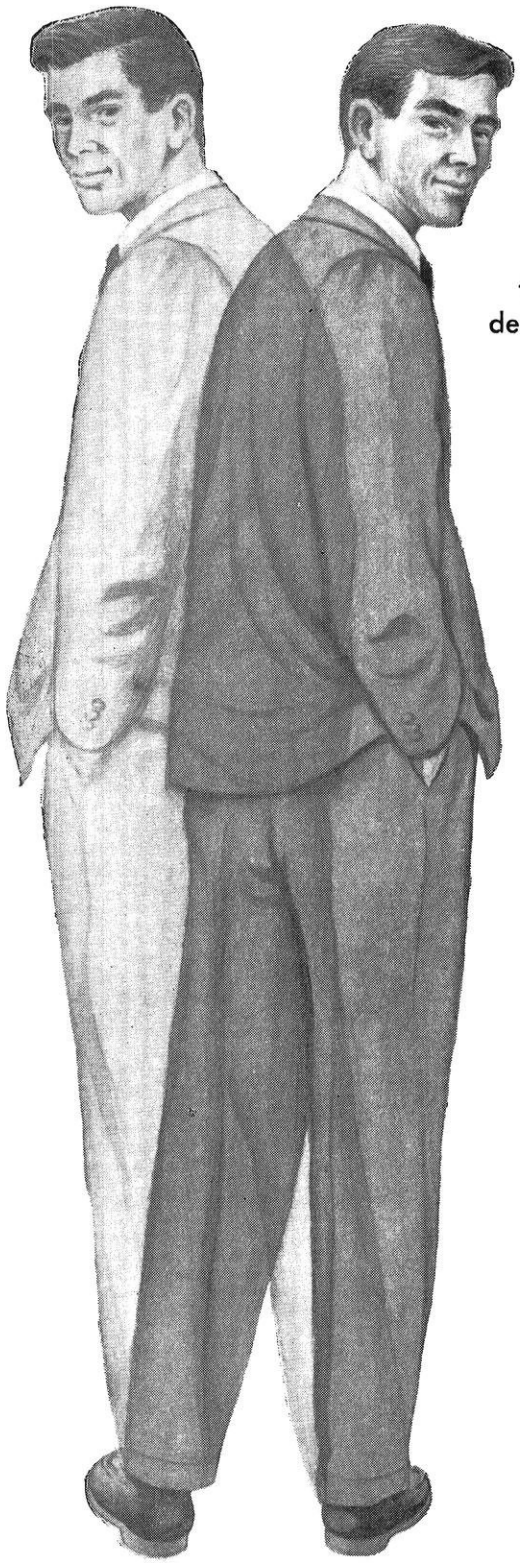
January, 1931

A disagreeable odor, shot through the ventilation lines at a rate of thousands of feet per minute, will be used to warn miners of fire in metal mines.

The odors are injected in liquid form into the compressed air line supplying air to the mines. Little liquid is required, the odors being detectable at concentration of only a few parts per million parts of air. At higher concentrations the odor becomes strong enough to make the warning positive. None of the odors used can exert any harmful influence even if inhaled for a long period. Some of the odor-producing substances used are known technically as butyl mercaptan, ethyl mercaptan, butyric acid (odor

(Continued on page 56)

MEN ...who are Engineers, **look twice** at the many advantages CONVAIR-POMONA offers



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Patents

(Continued from page 14)

patent. The major areas concerned with validity of patents are:

1. Novelty.
2. Utility.
3. Obviousness.
4. Prior Claiming.
5. Sufficiency of Description.

Novelty. The patent laws require that an invention be new. This means that the subject matter that the applicant seeks to patent or has patented shall not have been known or used prior to the date of his own invention. If an invention has been known or used prior to your same invention, your patent will not be issued or it will be revoked depending on whether you are applying for a patent or have already received a patent.

Utility. It is an objection to the validity of a patent in court proceedings if the invention so far as claimed, in any claim of the specification, is not useful. Utility is defined by patent law in the following manner: If an invention does what it is intended by the patentee to do, and the end obtained is itself useful, the invention is a useful invention. Utility in this sense is essential to the validity of a patent.

Obviousness. If an invention is obvious and does not involve any inventive step with regard to what was known or used before, the patent is invalid. Obviousness is also a ground of opposition to the grant of a patent.

The question of obviousness is one of great difficulty and is similar to that of lack of novelty. The question in novelty is whether anything within the claim was old and the question of obviousness is whether anything within the claim would have been obvious. Judicial decisions as to obviousness are very difficult to forecast.

Prior Claiming. There are grounds for objection to the validity of a patent if an invention was claimed in a granted patent of earlier priority date.

Prior claiming of an invention is also a valid ground for objection to the grant of a patent. This is known in patent law as interference.

Sufficiency of Description. It is both a ground of opposition to the grant of a patent, and a ground of objection of the validity of a patent when granted if "the complete specification does not sufficiently and fairly describe the invention and the method by which it is to be performed." In court this objection is used only where it is contended that the specification does not contain the necessary information to enable the invention to be put into use. To be sufficient, the complete specification must contain instructions to enable all those to whom the specification is addressed, to produce something within each claim by following the directions of the specification, without any new inventions or additions of their own.

Infringement

Infringement is often defined as the lawful invasion of the right of monopoly granted to the patentee. It occurs when a party, without permission from the owner of the patent, makes, uses, or sells the device that falls within the limits of the patent monopoly. There need be no intent to infringe and the infringer might not know of the existence of the patent. Infringement can only arise where the device which is made, used, or sold, is covered by the claim or claims of the patent in question.

The function of the claims of a patent is to define the scope of the patent. Hence, in order for a patent to be infringed, one or more of the claims must be infringed. Each claim is in effect a separate patent and one claim may be infringed, another not infringed.

Where a device is being manufactured under a patent, it should be properly marked in accordance with the patent laws. If a patented article is properly marked the infringer is liable for the profits or damages, but if the product is not marked the infringer must be given actual notice of infringement before he becomes liable for damages or profits.

REFERENCES

1. Chester H. Biesterfeld, *Patent Law for Chemists, Engineers and Students*, New York, John Wiley and Sons, Inc., 1946.
2. T. A. Blanco While, *Patents for Inventions*, New York, Stevens and Sons, 1950.
3. Arthur M. Smith, *Patent Law—Cases, Comments and Materials*, Ann Arbor, Michigan, Overbeck Company, 1955.
4. B. P. Fishburne, *The Patent Application—Preparation and Prosecution*, Washington, D. C., John Byrne and Company, 1943.
5. *Official Gazette*, United States Patent Office, Vol. 748, No. 2, November 10, 1959.
6. C. J. Hamson, *Patent Rights for Scientific Discoveries*, Indianapolis, The Bobbs-Merrill Company, 1940.

Sneed's

(Continued from page 43)

FEEDBACK CONTROL SYSTEMS

By Otto J. M. Smith
694 pages. $13.50

Dynamics of different systems have much in common. The components of these systems are part of the open-loop characteristics. The job that has to be done, and the way that the system does it, are specifications on the closed-loop characteristics. Analysis is the prediction of closed-loop characteristics from information concerning the given components only.

This book presents the rigorous relationship between the open-loop transient, sinusoidal, or statistical response and the closed-loop transient, noise, and disturbances in an analytical form. From any one of the six responses above, the other five may be computed. The closed-loop transient response is available from open-loop measurable data like vector margin and vector attenuation.

Synthesis is the determination of the required components from the statement of the system job. Linear statistical design is based on a minimum spectral error power. The only approximation is the expression for the original spectral data for signal, noise, and disturbances in an analytical form.

All restrictions on the system are introduced in the same form as the spectral data. The final system is the optimum linear predictor to compensate for the unalterable components. Transportation lags and dead times are incorporated into feedback systems by a block-diagram statement of what is possible, followed by block-diagram substitutions to form a linear analytical predictor. **THE END**

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Science Highlights

(Continued from page 17)

WESTINGHOUSE SCIENTISTS DEVELOP NEW SYSTEM FOR INFRARED SEEING

A new infrared system sensitive enough to see moving objects near room temperature solely by means of the invisible heat rays they emit has been developed by scientists of the Westinghouse research laboratories in Pittsburgh, Pennsylvania. Known as the phothermionic image converter, the all-electronic device changes the infrared radiation emitted by an object into a visible picture on a television screen. The speed with which it responds to infrared is roughly equal to that of the human eye to visible light.

Disclosure of the infrared imaging device was made at the winter meeting of the American Institute of Electrical Engineers, by Dr. Max Garbuny, head of the team of Westinghouse research scientists that developed the system. The development, first in a series of such devices, was sponsored mainly by the Wright Air Development Center of the U. S. Air Force.

Dr. Garbuny described the Westinghouse phothermionic image converter as operating on infrared radiation of relatively long wavelengths. Such radiation is emitted by comparatively cool objects such as the human body. Hotter objects, for example those that actually glow red hot, emit more energetic radiations of shorter wavelength in the "near" infrared, and are easier to detect.

Infrared is becoming increasingly important, particularly in its military applications. Infrared systems are used for missile guidance, fire control, reconnaissance and warning systems. Their outstanding advantage is that they are undetectable by the enemy. No telltale signals are broadcast. All objects above the temperature of absolute zero constantly emit infrared radiation, and infrared systems simply pick up these naturally occurring signals through space.

These systems operate upon the broad principle of sensing the heat energy radiated by a body and converting it, by means of some form of heat-sensitive detector, into equivalent electrical signals that can be amplified and made visible to the human eye. The traditional method has been to use a sensitive crystal, or infrared cell, to detect the radiation, and a mechanical scanning system to make the image visible.

The newer approach is an all-electronic imaging system, because such a device has the potential advantages of faster response, higher sensitivity and better picture detail. The phothermionic converter is an important step in bringing this type of system to reality.

It is sensitive enough to detect moving objects near room temperature when they exhibit temperature differences of approximately 20 degrees Fahrenheit. This is just about the spread between the temperature of the human body and that of the average living room. In addition, the system is fast enough to follow the movement of such objects with the same speed as a normally visible object is followed by the unaided human eye.

The key component in the newly announced system is a unique infrared-sensitive detector, or retina. The retina is a three-layer sandwich only a few millionths of an inch thick. The center layer of the sandwich is an ultra-thin support film of aluminum oxide about one millionth of an inch thick. This film is made by chemically dissolving away all of the aluminum metal in a piece of suitably treated household aluminum foil, leaving only the thin layer of aluminum "rust" which coats the foil's surface.

The front surface of the oxide support film is coated with an even thinner layer of nickel, deposited in such thickness that it strongly absorbs infrared radiation. The back surface of the film is coated with a thin layer of a photoemitting material called cesium bismuth—a chemical compound capable of releasing electrons when light shines upon it. Of key importance is the fact that the photoemitter's ability to release electrons under the stimulus of light varies with its temperature, changing two or three percent for every degree its temperature changes.

To increase the over-all sensitivity and performance of the detector, it is cooled to a temperature of about 180 degrees below zero Fahrenheit.

In use, the infrared radiation from an object is focused on the heat-absorbing layer of the retina, forming a temperature pattern of the scene. This temperature pattern transfers through the thin support layer to the photoemitting surface, where it can be perceived simply by scanning a spot of light across the surface. As the light spot scans the photoemitting surface, many or few electrons flow from the surface in exact conformity to the heat pattern on it. These electrical signals are then amplified and fed to a standard television picture tube, where a visible picture appears. Thus, a point by point description of the temperature scene is created on the television screen.

* * *

PROFITABLE SPILLAGE

An assayer in Nevada developed and operated what was probably the shortest-lived mine in Nevada history last February. The assayer, since 1948, tested iron ore brought to his office by a mining company. Each truck spilled a little ore in the parking area. After testing his own property, the assayer mined 700 tons of ore and sold it back to the mining company.

* * *

SAWDUST-BASED HIGHWAY

Canadian engineers are using a thick layer of sawduct to build a portion of a highway between Vancouver and New Westminister, B.C. In this area, the Burnham Throughway crosses deposits of peat and very soft clay up to 80 feet in depth. The sawdust is placed over the peat, which is too soft to support construction vehicles and sand is placed on top of sawdust.

* * *

INVERTING INTERFEROMETER FOR STELLER STUDIES

The National Bureau of Standards has developed an interferometer which shows promise as a

(Continued on page 57)

Engineer of Yesteryear

(Continued from page 50)

of rancid butter) and amyl acetate (banana oil). In addition to the use of a disagreeable odor as a warning signal, the regulations state that in mines equipped with electric lights the engineers shall also flash all electric lights nine times in three series of three flashes each. Since trouble may develop in the electrical system, however, the odor signal is considered to be the more reliable warning.

IMPORT OF ICE FROM THE TROPICS

February, 1931

This ice is a product of carbon monoxide gas found in wells of the Tampico, Mexico, oil fields, flowing to the surface at a pressure of 1,000 pounds per square inch. A New York concern has erected a factory which solidifies the gas into "sub-zero" ice. It has a capacity of 40,000 pounds a day. Vessels with insulated chambers of cork board a foot thick will bring the ice to the U. S. THE END

Civil Engineering

(Continued from page 27)

The Sanitary Engineering laboratories are among the finest in universities in the United States. Sanitary Chemistry and Bacteriological Laboratories are available to graduate students. Because the Sanitary and Hydraulics laboratories are in the same building, it is possible to study such problems as flow in sedimentation basins, where both facilities and staff of the two divisions are used jointly. Courses include such subjects as advanced work in Water and Sewage Analysis and Treatment, Industrial Waste Treatment, and Public Health Engineering. Outside the department students are expected to obtain a thorough foundation in Chemistry and Bacteriology.

A graduate student in Structures can specialize still further with major study in concrete, steel, or wood structures. The division enjoys close cooperation with the U. S. Forest Products Laboratory here in Madison, especially the departments of Physics and Engineering,

Products Development, and Packaging. The Bridge Department of the University Highway Commission has also been most helpful to this division. Class work includes advanced courses in Reinforced and Prestressed Concrete, Plastic Design of Steel Structures, Timber Structures, Indeterminate Structures, Arches, Highway Bridges and Culverts, and Foundations. Outside the department the student is encouraged to take work in advanced Mathematics, and Mechanics and Materials.

Surveying and Photogrammetry are also available to graduate students. A year ago a stereo plotter was obtained by which elevations can be obtained from pairs of aerial photographs. This, together with surveying instruments of all kinds and a beautiful campus and camp at Taylor Lake near Lake Superior, provide excellent laboratory facilities. The Wisconsin Highway Commission has also been very helpful in providing aerial photographs, and plans. Course work is largely in Advanced Surveying and Photogrammetry. Geophysics, Soils, Astronomy, and Highway Engineering are all of interest to graduate students in this division.

Seminar conferences and advanced independent study supplement the formal class work and research in the department.

Engineering Mechanics

(Continued from page 31)

Research work in the Department has been supported by grants from the University and other state agencies, various subdivisions of the federal government and many industrial organizations. Fellowships, scholarships, research and teaching assistantships are available in the department.

Many recipients of advanced degrees in Engineering Mechanics are employed on the instructional staffs of leading universities, some are employed by various governmental agencies such as the National Aeronautics and Space Administration and the Atomic Energy Commission, and others have positions in a wide variety of industries.

THE END

Science Highlights

(Continued from page 54)

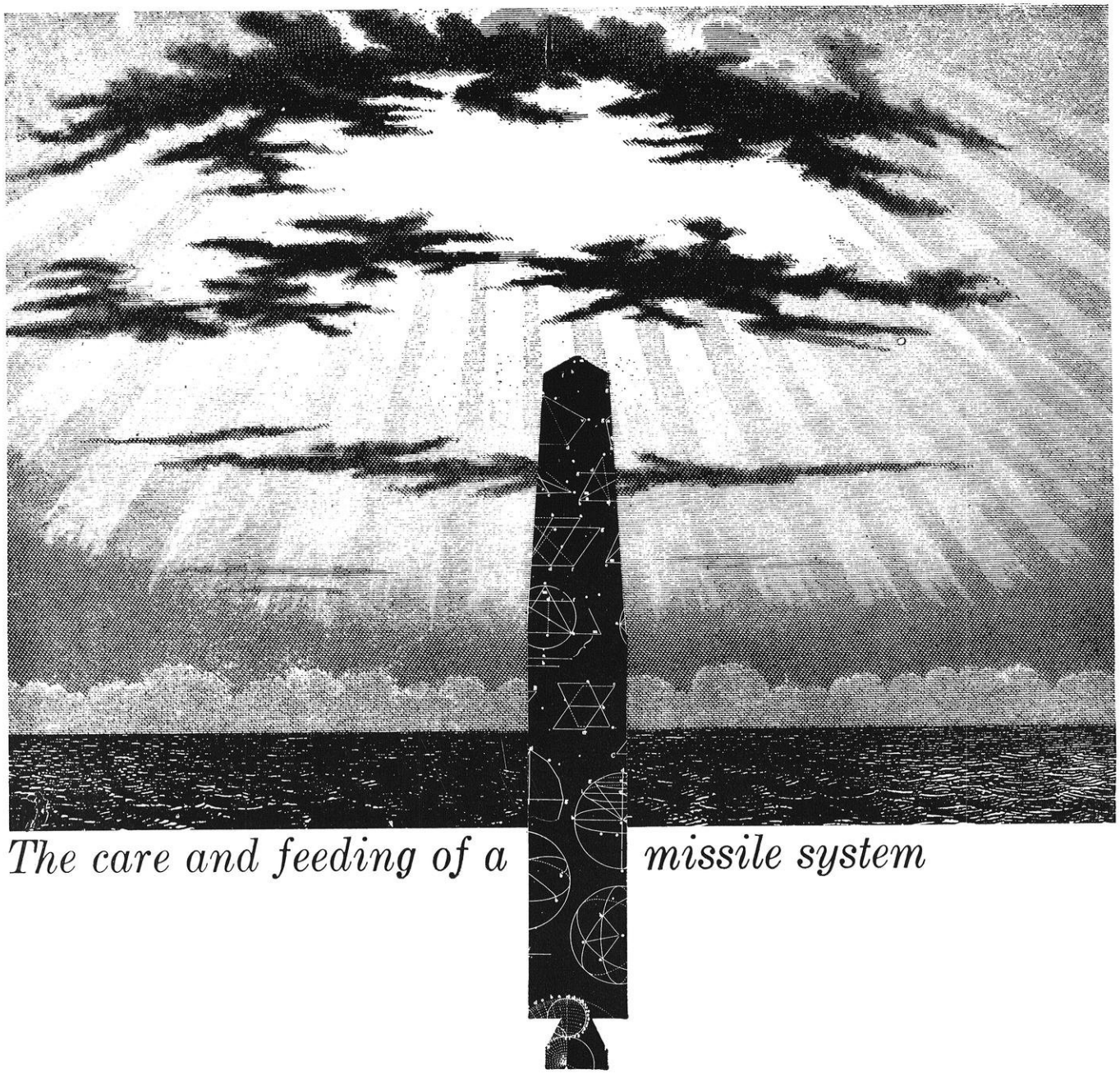
simple, accurate, convenient-to-use instrument for astronomical research. This interferometer, consists of a double-image prism and a telescope objective. With this combination, the separation, the diameters, and the time of meridional transit of stars can be accurately measured. In addition, the instrument provides a means of checking on aberrations in astronomical objectives, both reflectors and refractors.

The use of interferometry in astronomy has been greatly limited by the low luminosity of the light sources involved (the star or stars under observation) and the complexity of interferometric devices developed for stellar observations. For example, measurements with one such instrument, the Michelson stellar interferometer, are based on variations in the contrast of interference fringes appearing in the focal plane of the lens. As atmospheric conditions affect contrast markedly, this device is unsuitable for any but ideal viewing conditions. Another interferometer, the Mach–Zehnder instrument, is more practical, but its complexity is a deterrent to general use. The instrument developed by the Bureau, on the other hand, is both easy to operate and much less dependent upon atmospheric conditions.

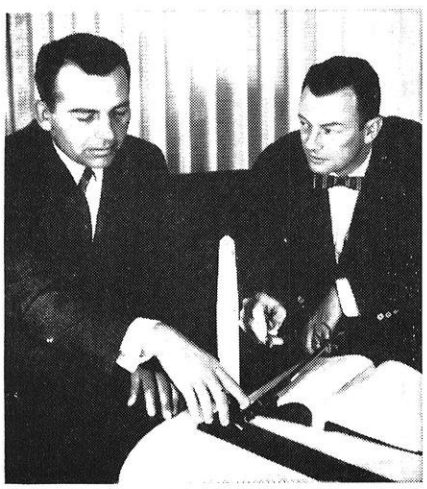
The Bureau's instrument is a *wavefront-inverting* interferometer. This optical property is introduced by the nature of the prism used—a modified Koesters prism consisting of two identical prisms cemented together with a partially reflecting film on the inner face. The fringes produced by this device can be viewed from either side of the prism. From either side, a segment of the objective appears to be folded over on to the remaining part. If the objective is bisected by the dividing plane of the prism, fringes occupy exactly half the lens area. If it is bisected off center, only the overlapping area contains fringes and the remaining portion is interference-free. THE END

Wife: "Let's go out and have some Real Fun Tonight."

Husband: "OK. If you get home first leave the light on in the hall."



The care and feeding of a missile system



It takes more than pressing a button to send a giant rocket on its way. Actually, almost as many man-hours go into the design and construction of the support equipment as into the missile itself. A leading factor in the reliability of Douglas missile systems is the company's practice of including all the necessary ground handling units, plus detailed procedures for system utilization and crew training. This complete job allows Douglas missiles like THOR, Nike HERCULES, Nike AJAX and others to move quickly from test to operational status and perform with outstanding dependability. Douglas is seeking qualified engineers and scientists for the design of missiles, space systems and their supporting equipment. Write to C. C. LaVene, Box P-600, Douglas Aircraft Company, Santa Monica, California.

Alfred J. Carah, Chief Design Engineer, discusses the ground installation requirements for a series of THOR-boosted space probes with Donald W. Douglas, Jr., President of DOUGLAS

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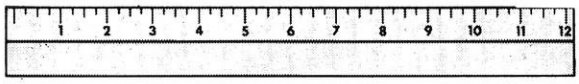

ONLY 12 INCHES WIDE...

Tom Speer, Senior Engineering Research Supervisor at Standard Oil, inspects one of the 12 sections in a new miniature road tester. Under simulated weather conditions, four wheels whirl around to reveal wear patterns and other vital information. (INSET) Ruler shows wear pattern after strip has taken pounding from tires during rain, freeze, thaw and heat.

...THIS 'ROAD' CARRIES

WORLD'S HEAVIEST TRAFFIC!

Say good-bye to washboard pavements and chuck holes—their doom may be sealed!

Key weapon in the war on costly road damage is a new miniature highway developed in the Standard Oil research laboratories in Whiting, Indiana. It is only 12 inches wide and 44 feet in circumference, but it carries heavier loads than any highway in the world. This Tom Thumb turnpike will eventually lead to methods of building longer-lasting, smoother, safer highways...at far less cost to taxpayers.

Four wheels whirling around hour after hour can give it any degree of traffic intensity desired. Pressure that corresponds to the weight of the heaviest trucks can be applied to the wheels. To simulate actual traffic, the wheels are placed on braking and acceleration 90 per cent of the time. Automated electronic equipment can quickly change "road conditions" from desert dry to cloudburst drenched. "Road conditions", too, can be changed from freezing to thawing.

Within weeks, the new test-tube roadway can determine what happens to roads during years of use in all kinds of weather. It can pretest paving formulas and techniques, and may show how to eliminate washboard pavement and chuck holes. Savings in highway research alone may run into millions of dollars. Even larger savings in auto and road repairs and possibly in gasoline taxes are in sight.

This test-tube roadway is just one of the many exciting developments at Standard. Every day, scientific research, pure and applied, points the way to new or improved products. This work holds great challenge and satisfaction for young men who are interested in scientific and technical careers.

STANDARD OIL COMPANY

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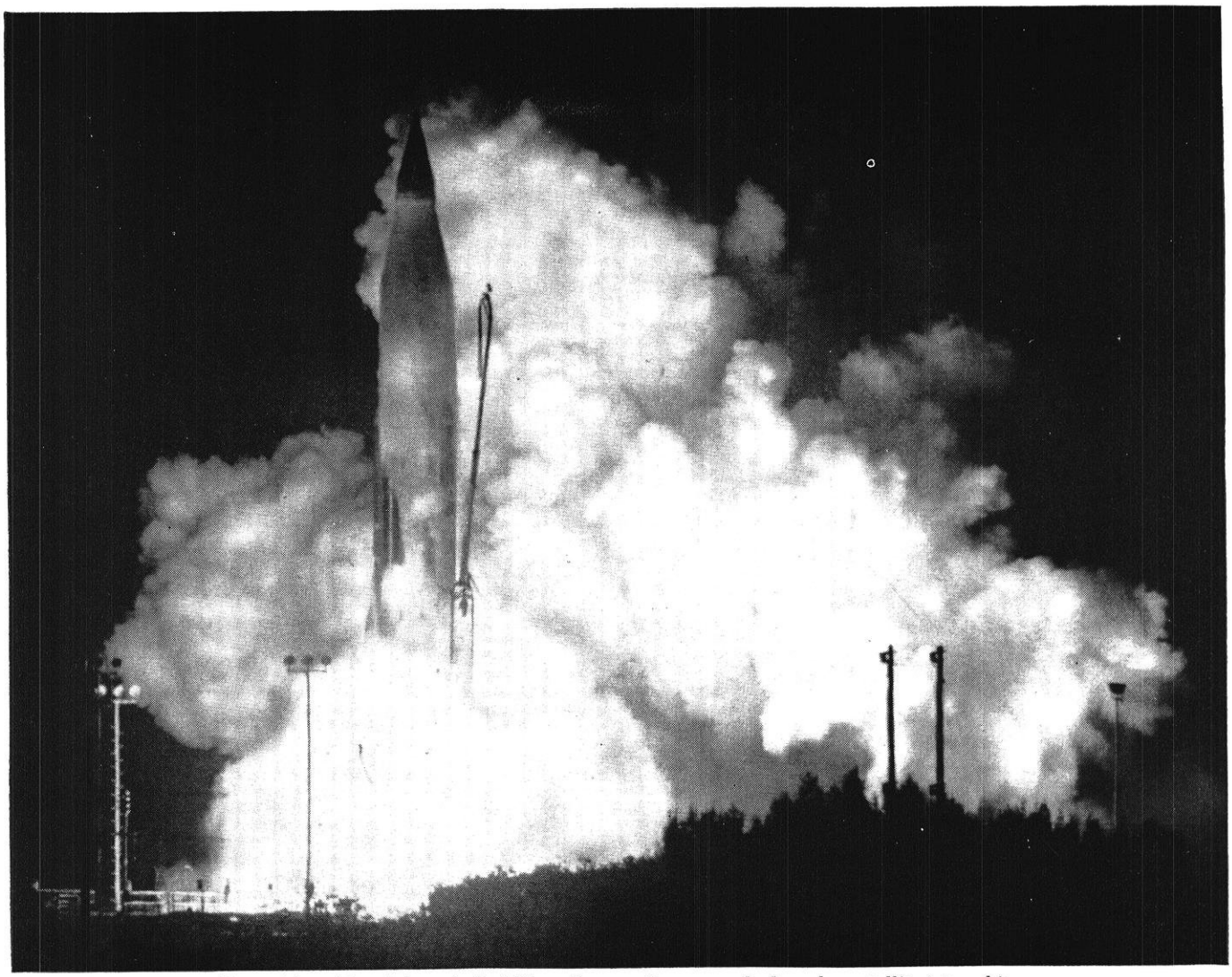
THE SIGN OF PROGRESS...
THROUGH RESEARCH



Record-breaking Atlas missile billows flame and vapor as she launches satellite into orbit.

130 tons of missile with a skin thinner than a window pane!

The Nickel Stainless Steel skin of the Atlas missile is actually about one-third as thick as the glass in your window.

And yet look what this skin does:

- It is the sole structural framework for Atlas—130 tons of dead weight at the moment of firing.
- It serves as the wall of the propellant tanks in Atlas' weight-saving design.
- It withstands the deep chill of liquid oxygen (—297°F) . . . the high heat of supersonic speed (400°F-600°F).

. . . and it is less than 1/25 of an inch thick!

No wonder they call stainless the space-age metal. No wonder engineers turn more and more to Nickel Stainless Steel as temperatures rise . . . as speeds soar . . . as demands get more and more severe.

But space is only *one* of the new worlds science is penetrating, and not even the newest. Witness man's 35,805-foot dive into the depths of the Marianas Trench in the Pacific. Or his exploration of deep cold. Of super pressures. Of ultrasonics.

Before the manipulation of such new environments can even be considered, scientists and engineers need to know exactly what happens to metals under extreme conditions.

Inco Research a source of such data

Quite often, Inco Research has already developed the information needed and has it neatly filed and cross indexed. Ready for use. In several instances, when a new alloy was needed, barrier breakers have found it already developed and tested by Inco Research.

Remember Inco Research when, in the future, you encounter severe new conditions and need useful data.

The International Nickel Company, Inc.
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INCO TRADE MARK

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The International Nickel Company, Inc., is the U.S. affiliate of the International Nickel Company of Canada, Limited. (Inco-Canada)—producer of Inco Nickel, Copper, Cobalt, Iron Ore, Tellurium, Selenium, Sulfur and Platinum, Palladium and Other Precious Metals.

STRIPPED GEARS

by William S. Huebner

She (gushingly): "Will you love me when I'm old?"

He: "Love you? I shall idolize you. I shall worship the ground you walk on. I shall-er-ah, you're not going to look like your mother, are you?"

* * *

The professor grimly eyed the class as he prepared to return a batch of examination papers. "You will remain seated while they are passed out," he commanded. "If you were to stand, it is conceivable that you might accidentally form a circle. That would make me liable for arrest."

"Why?" the E.E.'s wanted to know.

"I could be arrested for maintaining a dope ring."

* * *

A young C.E. was proudly showing the Governor his first project, a three million dollar dam. The Governor stared in amazement and exclaimed, "Migawd, the water—it's supposed to be on the other side."

* * *

Pledge (at dinner table): Must I eat this egg?

Brother: Yes!

Silence.

Pledge: The beak, too?

The editor of this column points with pride to the clean, white spaces between these jokes.

* * *

A woman approached a famous psychiatrist and said, "I do wish you'd see my husband. He blows smoke rings through his nose and it frightens me."

"I can see nothing wrong with that," said the doctor. "I don't know that it's so terribly unusual for someone to blow smoke rings through his nose."

"But," complained the woman, "my husband doesn't smoke."

* * *

They laughted at Watt, too, until he invented the Watt Schmacallit.

* * *

He went to an agricultural college and his classmates voted him "The boy most likely to sack seed."

* * *

M.E. "Thought you were going to visit that blonde in her apartment tonight."

Aggie "I did."

M.E. "How come then you're home so early?"

Aggie "Well we sat awhile and chatted. Then suddenly she turned out the lights. I can take a hint."

"Mommy, mommy, Sheldon is sticking his head out of the window!"

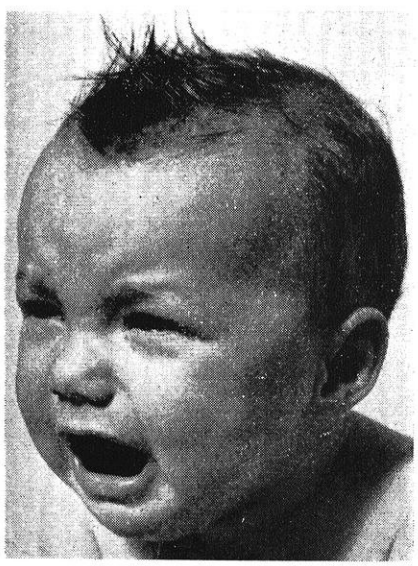
"So, what's wrong with that, dear?"

"But, Mommy, it's on the end of a stick!"

* * *

Men are peculiar, as women have long suspected. For instance, a man who hadn't kissed his wife for five years just shot a man who did.

Sneedly, Jr.



"Alright you guys. This R.O.T.C. unit is gonna shape up."

It's a Small World

It's a tough world for the American businessman. Every time he comes up with something new the Russians invent it a week later and the Japanese make it cheaper.

* * *

Awed by his secretary's new diamond ring, the boss asked for the particulars.

"Oh," she said, "When Grandma died, she left $1,000 for a stone in her memory. This is it."

* * *

Fred: "I'm looking for a girl who doesn't drink or smoke or have any bad habits."

Ned: "What for?"

* * *

"Hey! Did you see that young lady smile at me?"

"That's nothing. The first time I saw you I laughed right out loud."

* * *

Three decrepit, gray-haired gentlemen were seated together in the park discussing their personal philosophies for achieving a ripe old age.

"I'm eighty-six," said the first, "and I wouldn't be here today if I hadn't scorned tobacco and alcohol in every form, avoided late hours and the sinful enticements of the opposite sex."

"I owe my ninety-three years to a strict diet of black-strap molasses, wheat germ bread, and mother's milk," said the second old man.

"When I was eighteen," the third man said, "my father told me that if I wanted to enjoy life as much as he had, I should smoke black cigars, drink nothing but hard liquor, and carouse with a different woman every night. And that's exactly what I've done."

"Incredible," said the first old man.

"Amazing," said the second, for their friend was obviously the grayest, most elderly appearing of the three, "Just how old are you?"

"Twenty-two."

* * *

Che: "What if I tried to put my arm around you?"

Tri-Delt: "I'd put up a fight."

Che: "What if I tried to kiss you?"

Tri-Delt: "I'd put up a fight."

Che: "What if I tried to . . .

Tri-Delt: "Listen, how long do you think a girl can keep on fighting?"

No!! You can't help me with my engineering report.

Coed: "If wishes came true, what would you wish for?"

Engineer: "Gosh, I'm afraid to tell you."

Coed: "Go ahead, you sap. What do you think I brought up this wishing business for?"

* * *

Then there is the story of what one strawberry said to another:

"If we hadn't been in the same bed we wouldn't be in the same jam."

* * *

A young engineer was showing a visiting Russian the skyline of New York City. The engineer pointed out one of the skyscrapers and mentioned that it took only ten months to build it. The Russian grinned and said it could be built in five months in Russia. The engineer pointed out another building and bragged that it was built in only six months. The Russian laughed and said it could be built in three months in Russia.

The Russian noticed the Empire State Building and asked how long it took to build it.

"You've got me," said the engineer. "It wasn't there yesterday!"

The thrifty Scotsman asked the bank for a loan of a dollar and was told he must pay four per cent interest at the end of the year.

"That's four cents?" asked the Scotsman.

"Do you have any security?" asked the banker.

"I do. Fifty thousand dollars in U. S. Bonds."

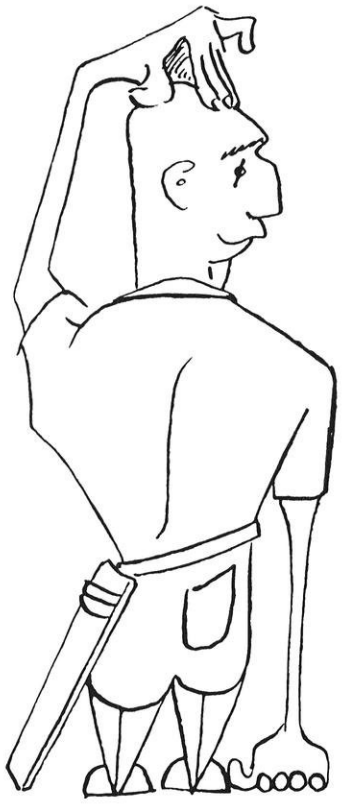
The bank accepted the bonds and gave him the dollar. At the end of a year, the Scotsman came back with a dollar and four cents to clear up his debt and asked for his fifty thousand in bonds back.

As he returned the bonds, the banker asked, "I don't want to be personal, but if you have all these bonds, why did you have to borrow a dollar?"

"Well," replied the Scotsman, "do you know any other way I can get a safety deposit vault for four cents a year?"

* * *

Heard any good jokes lately? Send them to "Stripped Gears" c/o Wisconsin Engineer, 333 M.E. Bldg. One dollar will be awarded for each joke used.



So You Think You're SMART!

by Sneedly, Law'66

THE other night when I was in one of the local pubs I overheard a conversation between a hill student and a pretty co-ed. Hill student: "If I kiss you, will you call for help?" Co-ed: "Will you need help?"

In the next booth there was an engineer and another pretty co-ed. The conversation went like this: Engineer: "Everytime I kiss you it makes me a better man." Co-ed: "Why try to get to heaven in one night?" Conclusion: The engineer is an engineer but his capabilities do not end there.

Send your answers with your own name and address to:

SNEEDLY
c/o The Wisconsin Engineer
333 Mchanical Engineering Building
Madison 6, Wisconsin

All answers must be sent in the mail and only letters with the correct answers having the earliest postmark will be considered the winner(s).

Answers to October puzzles.

1. 45353
2. 5 feet
3. Let three digits be x, y, z in that order

   $3z - 2x + 12y = 66$
   or $12y = 66 - (3z - 2x)$
   $3z - 2x$ cannot be negative, so y is less than 6
   None of digits can be 5, so y is less than 5
   $3z - 2x$ is not greater than 25 (3x9 — 2x1)
   12y cannot be less than 41
   y is greater than 3
   y equals 4
   $3z - 2x = 18$

(1)	(2)
x = 0	x = 3
z = 6	z = 8

   no zeros in solution therefore (2) is answer.

Here are this month's problems that require a little logic and mathematics. Do not fear. The only math required is a little advanced arithmetic.

1. A commuting professor normally is met by his chauffeur at a specific time and driven home. One certain afternoon the professor catches a train that arrives one hour earlier than his usual train. Eschewing the local taxi, he walks home. On the way, he is met by his own car making the usual trip at the usual constant speed. The chauffeur drives him home from there, and it is observed that they arrive precisely ten minutes earlier than on a normal day. How long was the commuter a pedestrian?

2. Hans, Reinzi, Egbert, and Pedro are going fare hunting tomorrow on a boulevard that runs directly north and south, with no traffic lights. They estimate that equal numbers of pedestrians walk in each direction, at an average of four miles per hour.

Hans says: "You're all crazy to use up gas cruising around all the time. I'm going to park beside the curb until a fare comes along."

Reinzi says: "I'm going to cruise up and down at four miles an hour, and I'll have twice the chance of picking up a fare."

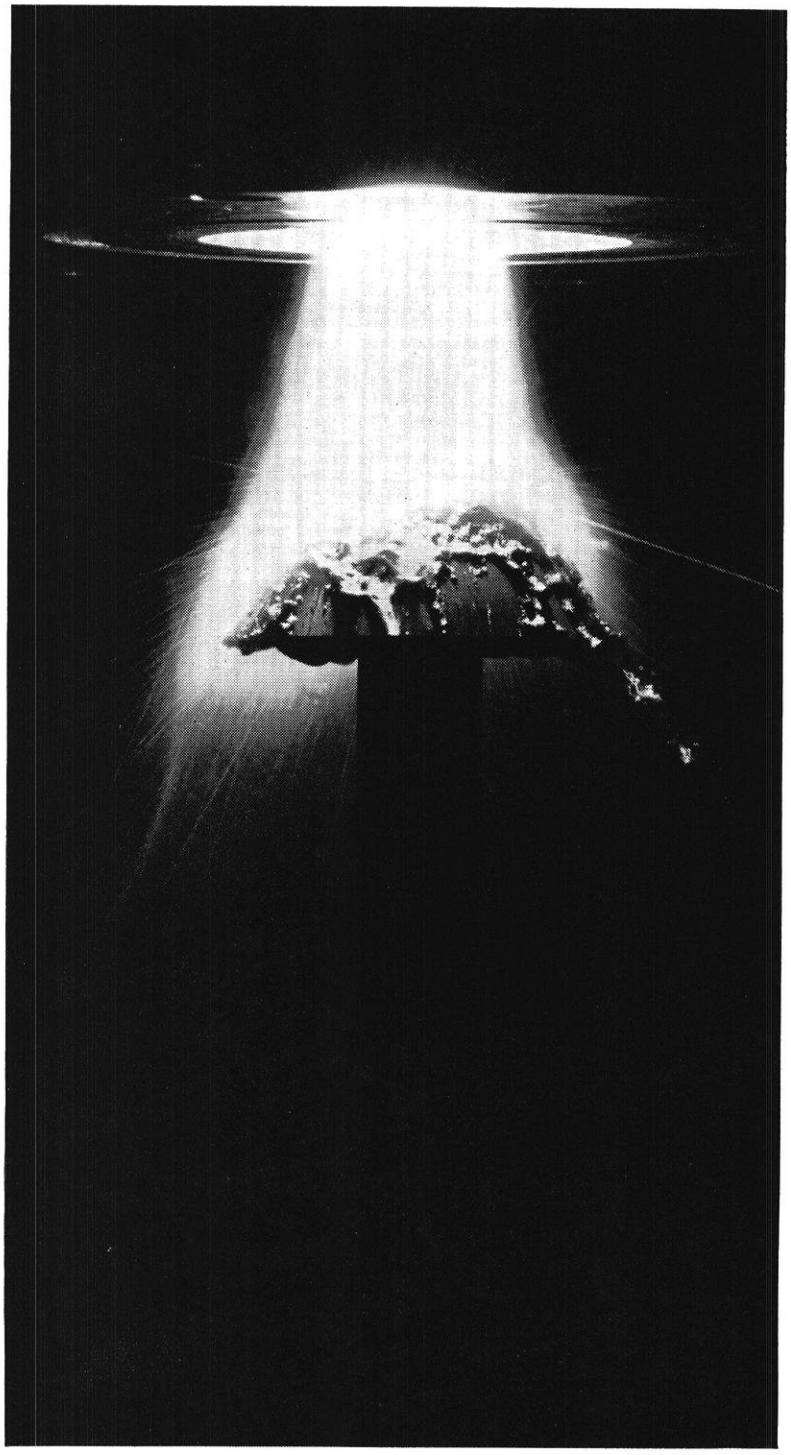
Egbert says: "Eight miles an hour for me, up and down the boulevard; and I'll have twice the chance of picking up a fare."

Pedro says: "I'm going to average twelve miles an hour and I'll have twice as much chance as Egbert of getting a fare."

Figure out the true facts, deciding who was right and who was wrong.

3. What is the area of a regular five pointed star inscribed in a circle of five inch radius?

If your sights are set on  research and development–



Jet heat blast of more than 15,000 degrees Fahrenheit flares over surface of an experimental nose cone shape in a physics laboratory of Avco Research and Advanced Development Division, Wilmington, Mass.

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RESEARCH and development engineers find photography one of their most versatile tools. Camera and film can record the readings of instruments—can capture for study the fleeting transient on the oscilloscope face. The content and structure of metals can be studied by photospectrography or x-ray diffraction. And stresses in parts are visualized by photographing plastic models with transmitted polarized light.

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One of a series*

Interview with General Electric's Charles F. Savage Consultant—Engineering Professional Relations

How Professional Societies Help Develop Young Engineers

Q. Mr. Savage, should young engineers join professional engineering societies?

A. By all means. Once engineers have graduated from college they are immediately "on the outside looking in," so to speak, of a new social circle to which they must earn their right to belong. Joining a professional or technical society represents a good entree.

Q. How do these societies help young engineers?

A. The members of these societies —mature, knowledgeable men— have an obligation to instruct those who follow after them. Engineers and scientists—as professional people—are custodians of a specialized body or fund of knowledge to which they have three definite responsibilities. The first is to *generate* new knowledge and add to this total fund. The second is to *utilize* this fund of knowledge in service to society. The third is to *teach* this knowledge to others, including young engineers.

Q. Specifically, what benefits accrue from belonging to these groups?

A. There are many. For the young engineer, affiliation serves the practical purpose of exposing his work to appraisal by other scientists and engineers. Most important, however, technical societies enable young engineers to learn of work crucial to their own. These organizations are a prime source of ideas — meeting colleagues and talking with them, reading reports, attending meetings and lectures. And, for the young engineer, recognition of his accomplishments by associates and organizations generally heads the list of his aspirations. He derives satisfaction from knowing that he has been identified in his field.

Q. What contribution is the young engineer expected to make as an active member of technical and professional societies?

A. First of all, he should become active in helping promote the objectives of a society by preparing and presenting timely, well-conceived technical papers. He should also become active in organizational administration. This is self-development at work, for such efforts can enhance the personal stature and reputation of the individual. And, I might add that professional development is a continuous process, starting prior to entering college and progressing beyond retirement. Professional aspirations may change but learning covers a person's entire life span. And, of course, there are dues to be paid. The amount is graduated in terms of professional stature gained and should always be considered as a personal investment in his future.

Q. How do you go about joining professional groups?

A. While still in school, join student chapters of societies right on campus. Once an engineer is out working in industry, he should contact local chapters of technical and professional societies, or find out about them from fellow engineers.

Q. Does General Electric encourage participation in technical and professional societies?

A. It certainly does. General Electric progress is built upon creative ideas and innovations. The Company goes to great lengths to establish a climate and incentive to yield these results. One way to get ideas is to encourage employees to join professional societies. Why? Because General Electric shares in recognition accorded any of its individual employees, as well as the common pool of knowledge that these engineers build up. It can't help but profit by encouraging such association, which sparks and stimulates contributions.

Right now, sizeable numbers of General Electric employees, at all levels in the Company, belong to engineering societies, hold responsible offices, serve on working committees and handle important assignments. Many are recognized for their outstanding contributions by honor and medal awards.

These general observations emphasize that General Electric does encourage participation. In indication of the importance of this view, the Company usually defrays a portion of the expense accrued by the men involved in supporting the activities of these various organizations. Remember, our goal is to see every man advance to the full limit of his capabilities. Encouraging him to join Professional Societies is one way to help him do so.

Mr. Savage has copies of the booklet "Your First 5 Years" published by the Engineers' Council for Professional Development which you may have for the asking. Simply write to Mr. C. F. Savage, Section 959-12, General Electric Co., Schenectady 5, N. Y.

***LOOK FOR** other interviews discussing: Salary • Why Companies have Training Programs • How to Get the Job You Want.*

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