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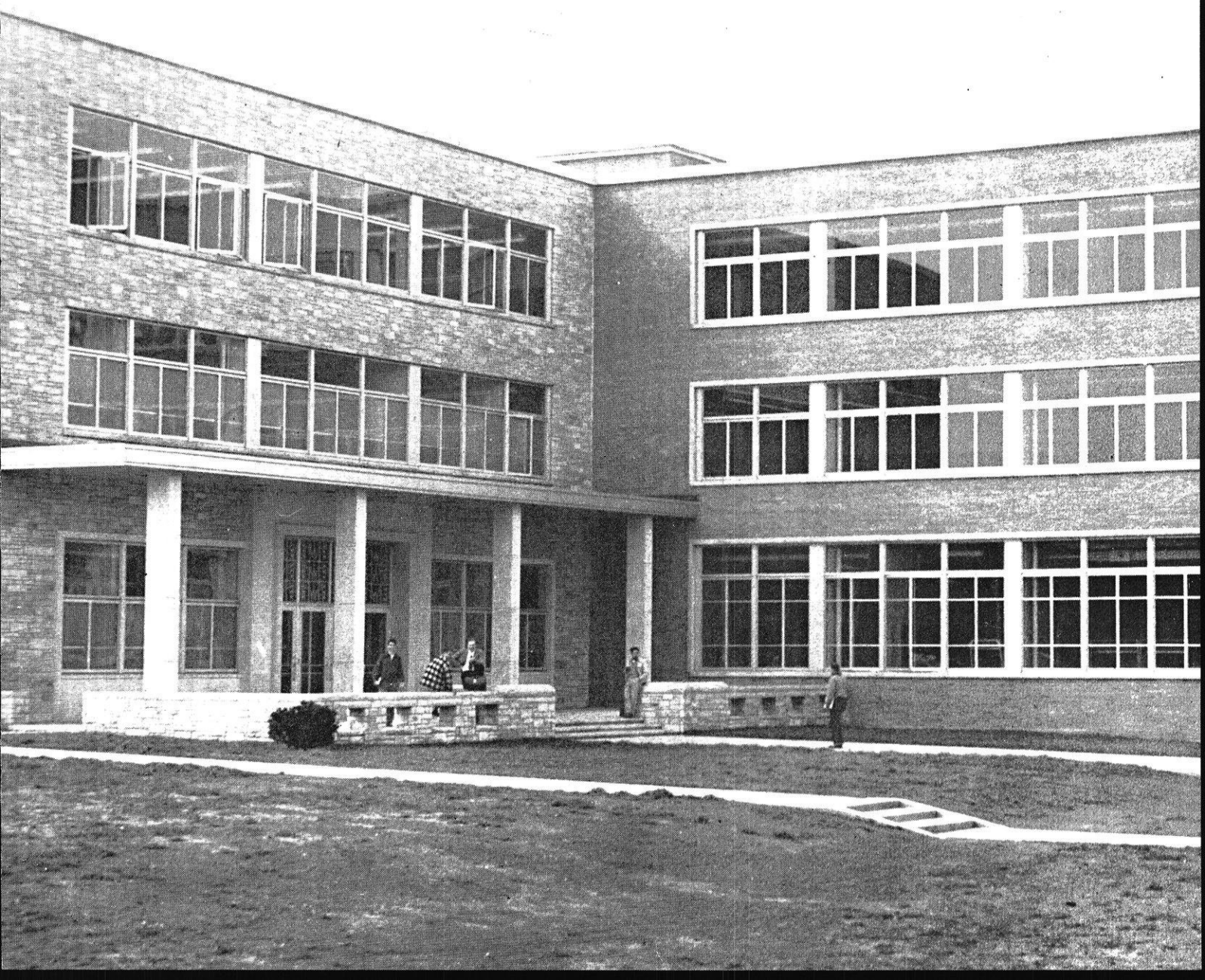

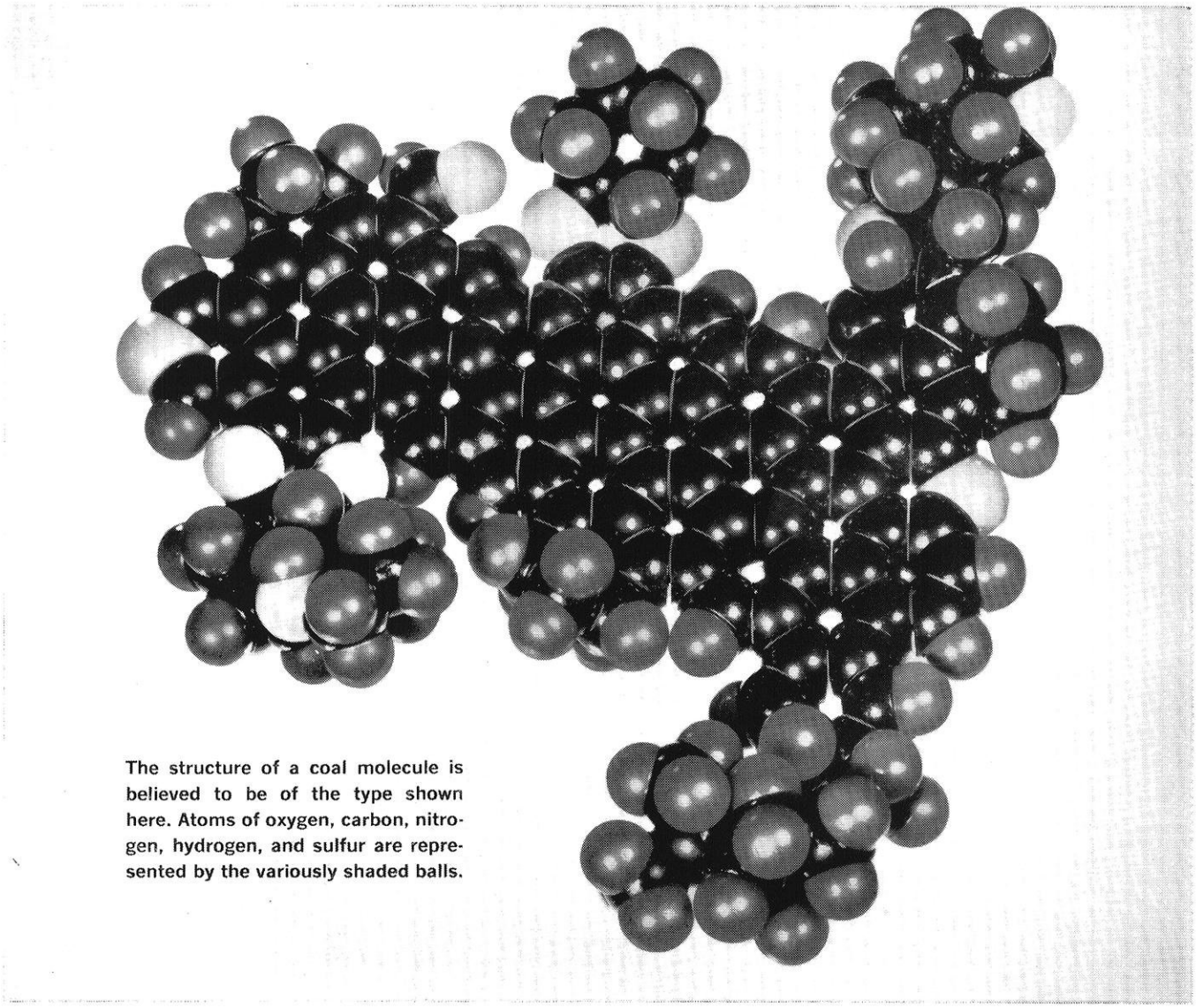

The structure of a coal molecule is believed to be of the type shown here. Atoms of oxygen, carbon, nitrogen, hydrogen, and sulfur are represented by the variously shaded balls.

Here's the alma mater of 200,000 successful grads

More than 1900 chemicals have been found in coal, and over 200,000 different products are made from them—products like plastics, synthetic rubber, synthetic fibers, and resins. There's still more to come. Only a fraction of the 1900 chemicals in coal are currently used commercially.

Today, United States Steel and other producers of coal chemicals continue to study coal, its structure, and its future potential as a source of basic chemicals.

Why, you may ask, are we so interested in chemicals when our principal business is steel? The reason is that it's just good business. In producing coke for our steel-making operations, we also produce chemicals. Thus we are always interested in anything, and *anybody*, that will help to advance the technology of these related products, improve their quality, and in general reduce the over-all cost of manufacture and provide better products and better service for our customers.

It's a big job and we need a lot of good people to do it—physicists, chemists, geologists, all kinds of engineers—people with *your* training. If you want to explore the earth's surface for ore, delve into the commercial use of coal chemicals, help rocket designers solve new problems with new steels, there might well be a place for you at United States Steel. Write for our booklet, "Paths of Opportunity"—United States Steel, Personnel Division, Room 2801, 525 William Penn Place, Pittsburgh 30, Pa.

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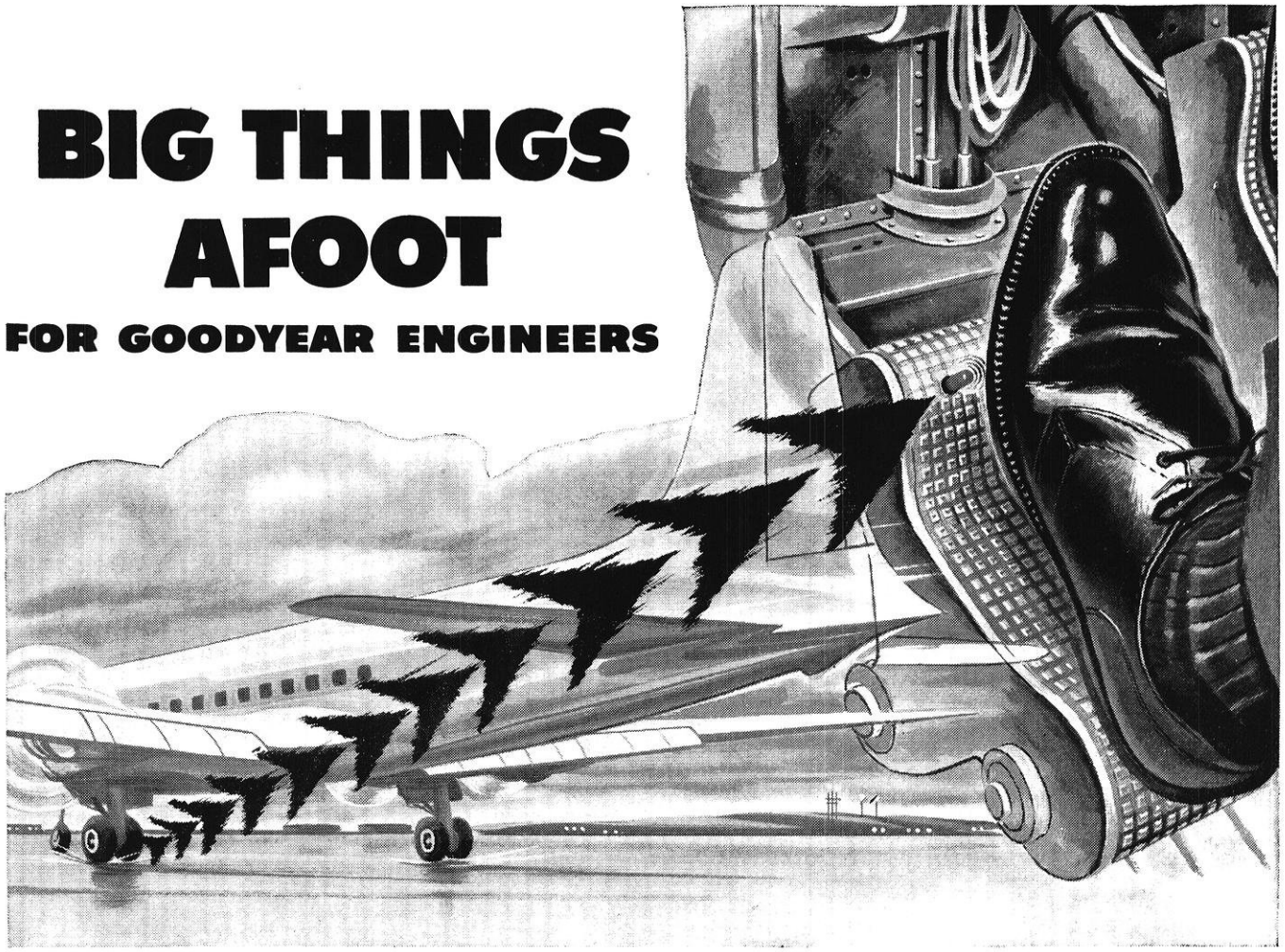
BIG THINGS AFOOT

FOR GOODYEAR ENGINEERS



The "Foot Thumper" gives a pilot complete control over skids—and typifies the opportunities available at Aviation Products

Once again, engineers of Goodyear's Aviation Products Division have come up with a vital contribution to flying safety.

Called Skid Warning System,* it gives a pilot advance notice of an impending skid, in time to prevent it from happening.

Here's how it works: The moment that rotation of any wheel begins to drop at an abnormal rate, a tiny sensing device in the axle actuates a pulsing button mounted on the brake pedal. This literally taps the pilot's foot and warns him to ease up on his brake pressure. The device keeps on thumping until the pilot releases sufficient brake pressure to allow the wheel to rotate again.

This is the first system in which the pilot maintains complete control—and full "feel"—of his aircraft at all times, while enjoying full knowledge of what is going on in this heretofore "blind area" of trouble.

Skid Warning is a good example of what engineering skill can do, given the atmosphere that prevails at Goodyear. For here we make so many different things, for so many different purposes, we need and welcome young engineers of all types—mechanical, electrical, chemical, civil, industrial.

What type of product interests you most? Tires, chemicals, plastics, aviation products, atomic energy—we can use your talent and training on all of them.

If you're seeking a job and a lifetime of useful accomplishment, you'll very likely find both in the Goodyear organization. We'd like to hear from you. Write: Technical Personnel, Dept. 806-W, The Goodyear Tire & Rubber Company, Akron 16, Ohio.

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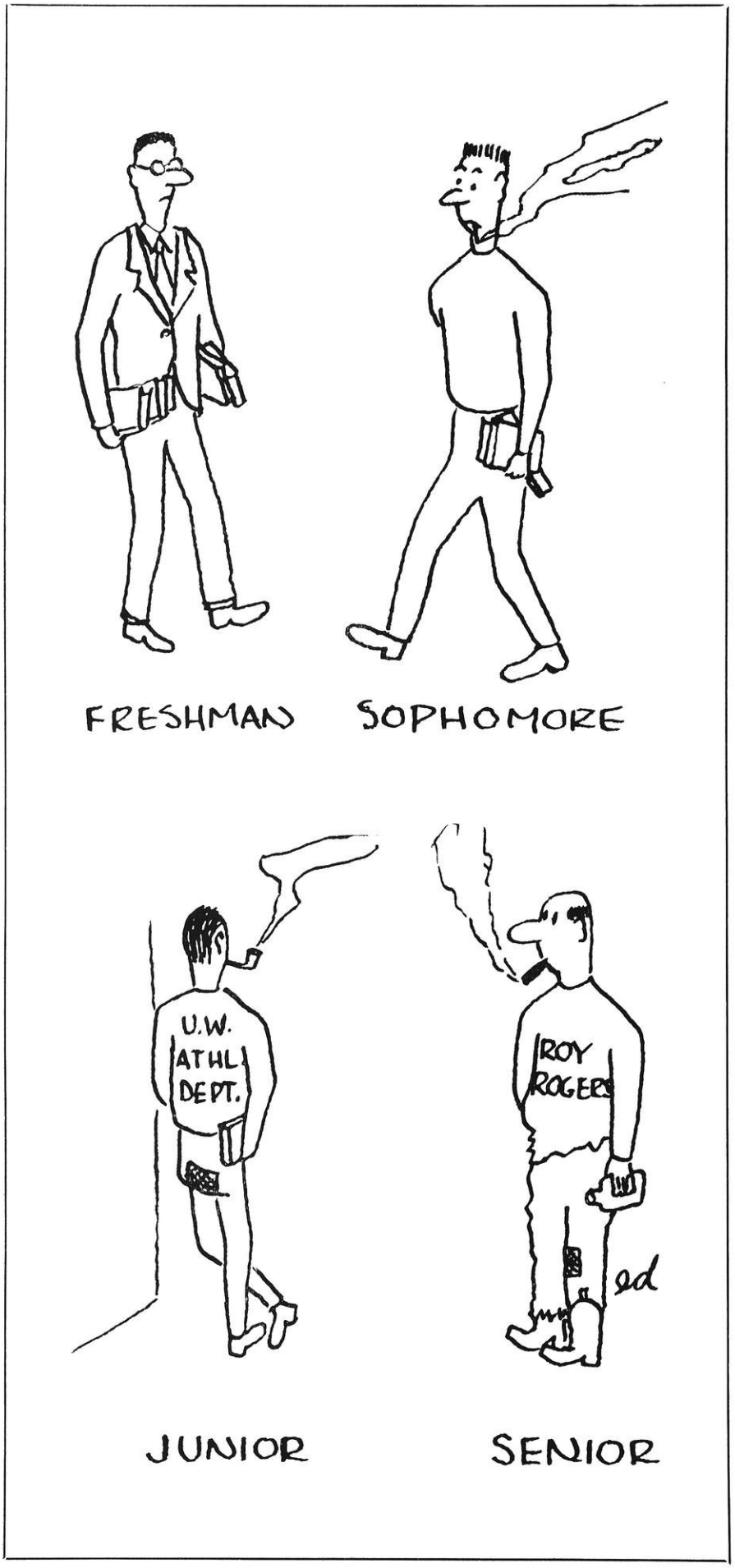

The Rise of an Engineer.

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Volume 62 MARCH, 1958 Number 6

WISCONSIN ENGINEER

The Student Engineer's Magazine

FOUNDED 1896

Features

Departments

Cover

The New Engineering Building of the University of Wisconsin campus, containing the electrical engineering and mechanics departments.

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exciting

Modern chemistry is creating exciting new horizons that challenge the inventive minds of both scientist and student. Product synthesis, by bold adaptation of natural resources to our way of life, has pushed the frontiers of chemistry far beyond its early promises.

As the chemical industry forges ahead, inventing new processes and producing new materials which assure the progress and comfort of our society, research and development soar to new heights. Imaginative exploration advances under chemists and chemical engineers. New and greater production facilities are created. Many more engineers of all kinds tackle the complex tasks of building new plants or designing new processes to expand and perfect the many operations of this ever-growing industry.

Yes, today's chemistry is a fascinating world. Filled with exciting accomplishments and possibilities, it attracts young men and women of vision who will give the industry the inspiring leadership of tomorrow.

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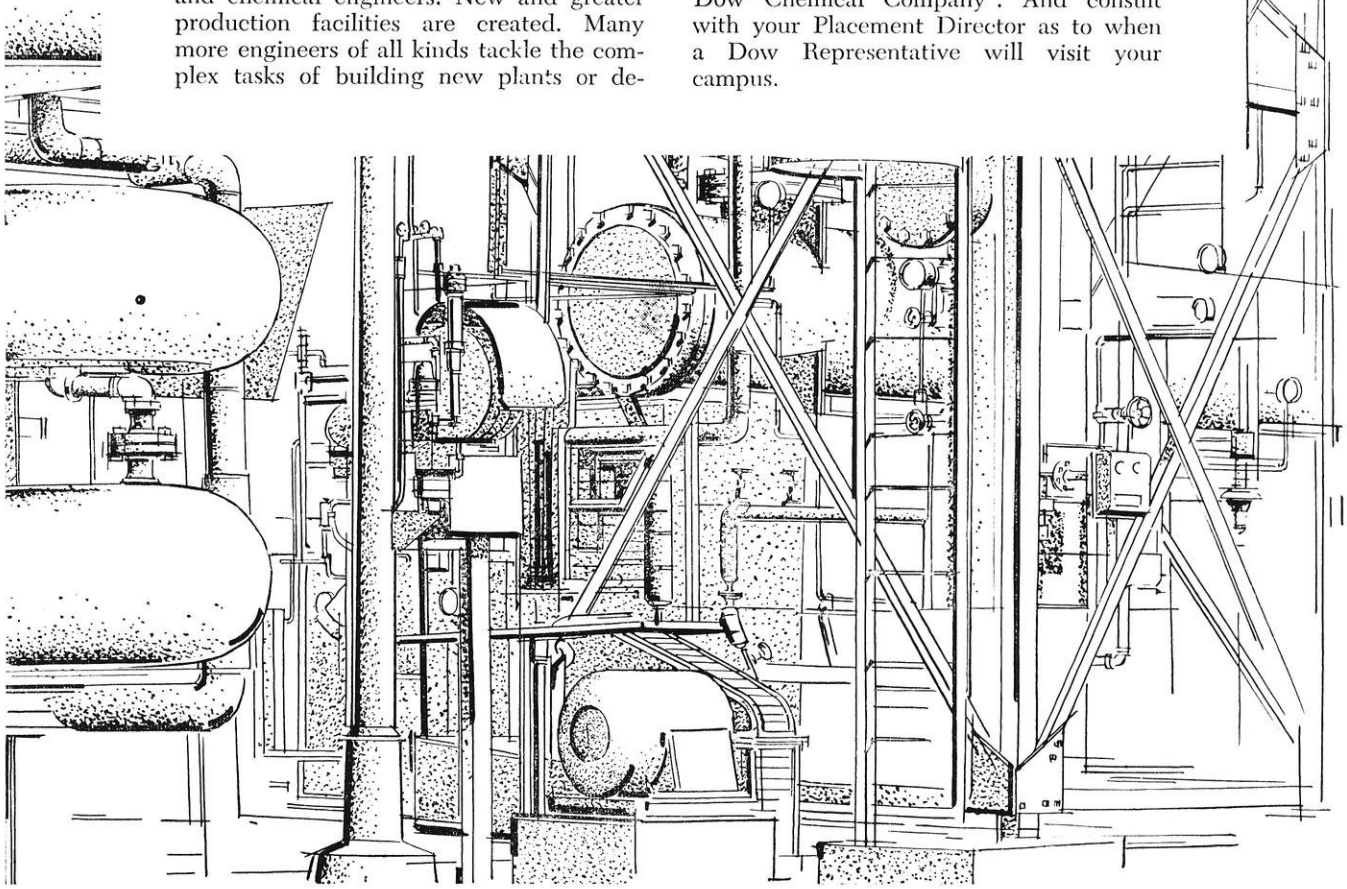

The Dow Chemical Company, Midland, Michigan

DOW

Henri Bergson...on making gods

Humanity is groaning, half-crushed under the weight of the progress it has made. Men do not sufficiently realize that their future depends on themselves. They must first decide whether they wish to continue to live. They must then ask whether they want merely to live, or to make the further effort necessary to fulfill, even on our unmanageable planet, the essential function of the universe, which is a machine for making gods.

Les deux sources de la morale et de la religion, 1932

THE RAND CORPORATION, SANTA MONICA, CALIFORNIA
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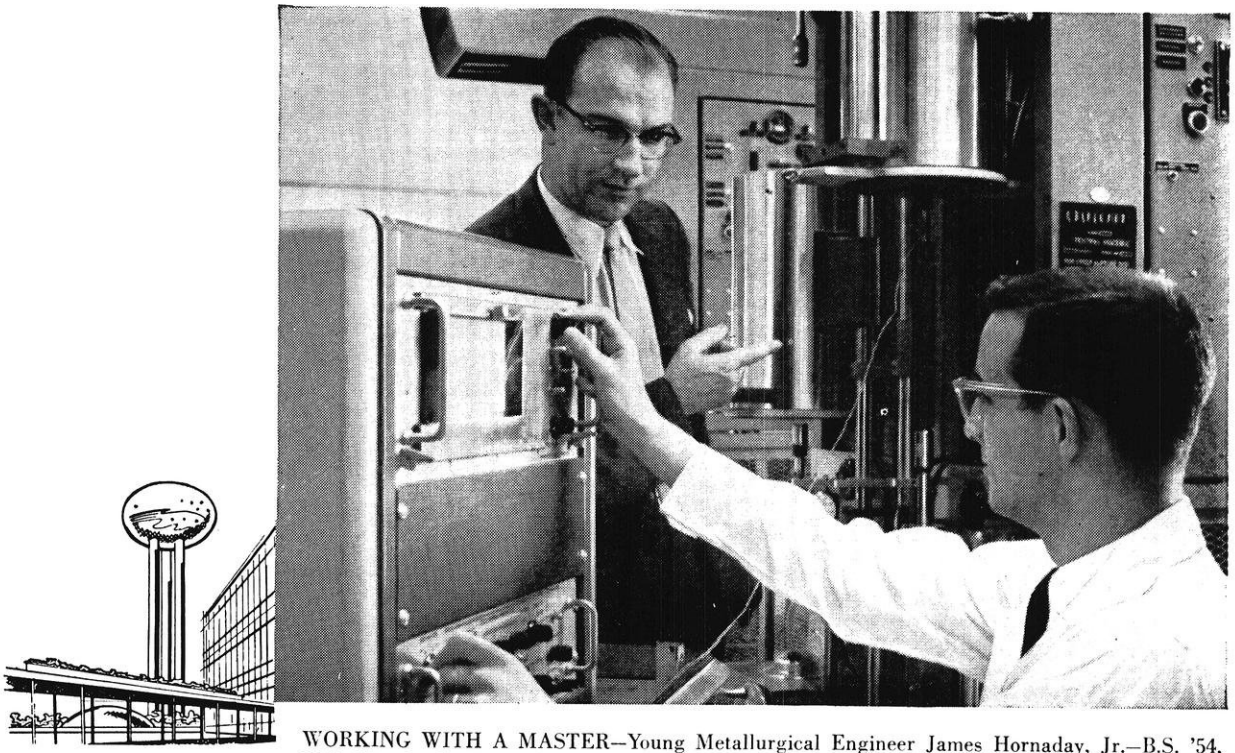

WORKING WITH A MASTER—Young Metallurgical Engineer James Hornaday, Jr.—B.S. '54, M.S. '56—develops new high-temperature coatings under guidance of Dr. Robert F. Thomson. Head of Metallurgical Engineering Department of GM's Research Staff, Dr. Thomson is recognized as one of the nation's leading metallurgists—has pioneered many advancements in his field.

Because *engineering* is a *profession* at GM—your professional stature grows year by year

HERE'S something of serious importance to you as a young graduate engineer:

Are you taking just a job—or are you going out to really *practice* the respected profession for which you have been so fully trained?

Here at General Motors we long ago recognized that engineering is a profession—and began treating our engineers who work on our hundreds of products as professional men.

For example our engineers are used on assignments that give them an opportunity to use their training and education as they were meant to be used. To let them practice engineering.

Or take the fact that GM encourages its engineers to gain professional recognition by presenting technical papers to engineering societies.

Take, too, the encouragement our engineers receive in working for advanced degrees, in doing original research. The fact that over 179 of our engineers and scientists received over 164 patents for such work in a recent four-month period is one indication of the opportunity for creative work here at GM.

And these are but a few examples of the fact that engineering is a profession at General Motors.

Why do we place engineering in this special category?

Because we know that from the work of our engineers at our 35 divisions and 126 plants in 71 cities and 19 states—and at our huge Technical Center near Detroit—will come the products that will keep General Motors on its progressive path.

Naturally, you get more than professional recognition. Your salary reflects your ability and progress.

And, of course, there is opportunity without limit. For 14 of the 33 GM Vice-Presidents are engineers, as are 23 of the 42 Division General Managers.

Today we are looking for young men who may fill tomorrow's GM executive positions. Should you wish to join us and practice your profession as you build your career, let us hear from you. It could be the most important letter of your life.

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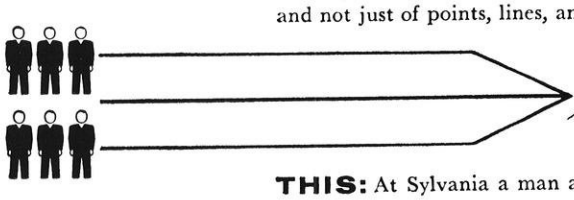
ENGINEERS and SCIENTISTS

when parallels meet

...as in advancement opportunities at Sylvania

It remained for Nicholas Lobachevsky to solve a riddle that bothered mathematicians for the better part of twenty-two centuries.* He was able to construct a rational geometry by denying Euclid's fifth postulate — by maintaining that parallels *do* meet.

Here at Sylvania Electric we have a noneuclidean geometry of our own, in which parallels also meet. It's a geometry of professional development, though, and not just of points, lines, and planes.



WHAT DO WE MEAN?

THIS: At Sylvania a man advances by one of two parallel paths.

If his interests and talents lie in the areas of engineering and scientific specialization, he advances as a *specialist.*

If his forte is in the areas of organization and administration, he advances through *management.*

These parallel paths meet in a common point: At Sylvania a man knows that he is given the fullest opportunity to develop and exercise his talents. He knows that a man goes as far and as fast as he is able in the path of his choice. Whether he chooses management or specialization, he finds *equal* rewards and compensation.

Graduates and men with advanced degrees in science and engineering will discover Research, Development, Manufacturing and Marketing careers at Sylvania — in specialization or management — in:

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Contact your college placement officer for an interview, or write us and ask for a copy of "Today & Tomorrow with Sylvania".

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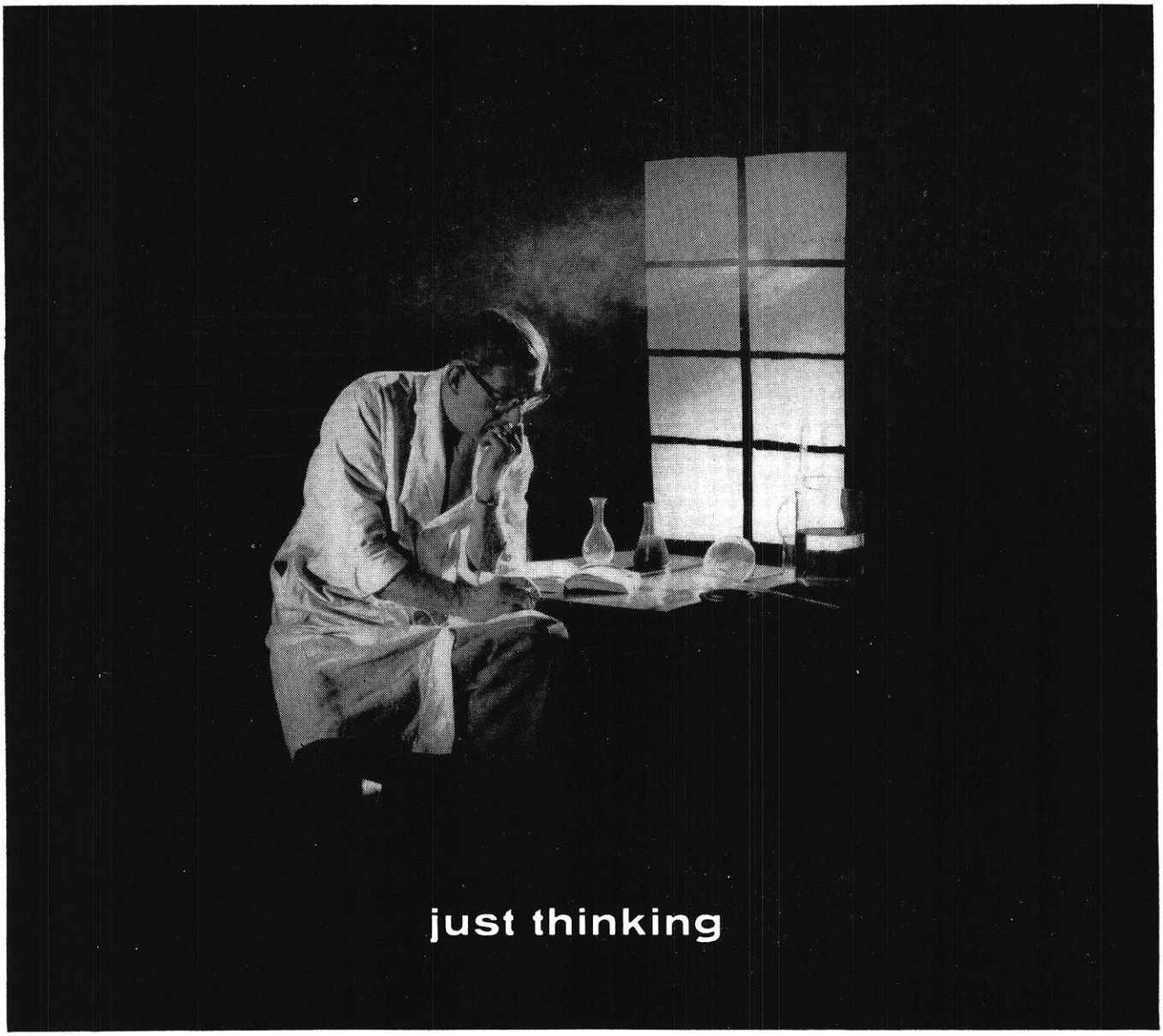

Chemical progress is autoclaves, test tubes, distillation towers . . . hydrocarbons, heterocyclic compounds . . . processes, polymerizations, products.

But mostly, chemical progress is thinking . . . men thinking. Little men, big men, medium size men . . . in lab coats, business suits, overalls . . . all of them, always, thinking.

Thinking up new products . . . new ways to make chemicals and new ways to use them. Thinking up more comfort, more convenience, better health, for everyone.

Always, the old things have to be improved, and the new things have to be proved. It takes more thinking. The thinking never stops. And so chemical progress never stops. It's that way at Koppers.

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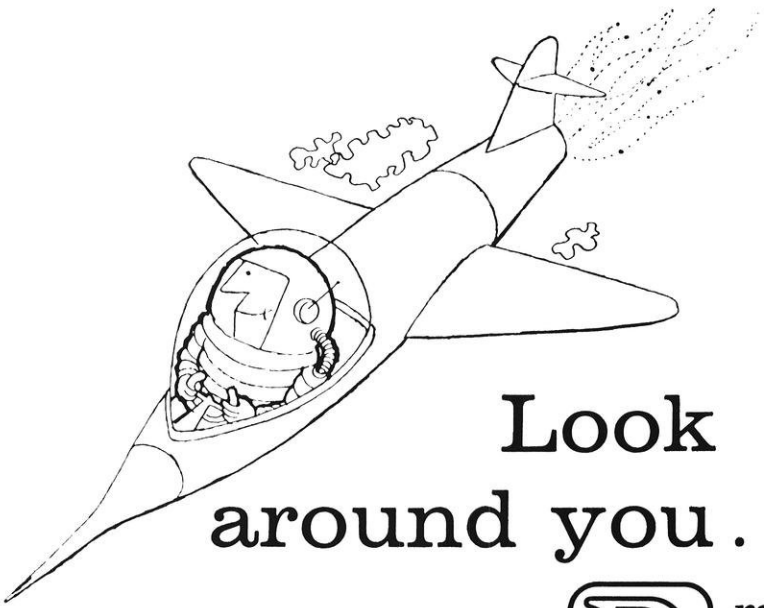

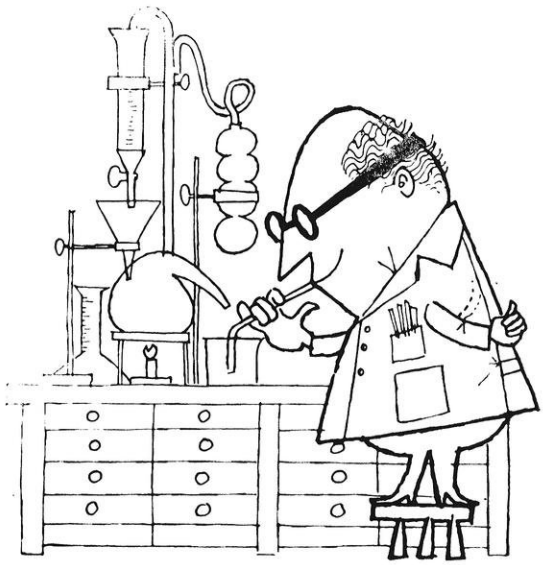

Look around you...

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Look around you . . . at paint, for example. It's much more than mere color. Paint protects. It must be thoroughly researched and carefully compounded to withstand infinite variations of atmosphere, heat, stress and other conditions. Or look at chemicals . . . their roles in the creation and development of textiles, metals, paper, agriculture, missiles, medicine. You name it; chemicals are there, making important contributions. Glass? These days, it can be made to remain rigid at blast furnace temperatures, withstand supersonic speeds, have the tensile strength of bronze. And it's much the same story for plastics and fiber glass. Everywhere you look—in architecture, industry, the home, *everywhere*—PPG products find new, exciting applications with fascinating and challenging potentialities.

Are you seeking a career that requires creative thinking, utilizes all your skills and know-how, offers a chance to learn the latest techniques? Then look into your enticing career possibilities with the Pittsburgh Plate Glass Company. Contact your Placement Officer *now*, or write to the Manager of College Relations, Pittsburgh Plate Glass Company, One Gateway Center, Pittsburgh 22, Pennsylvania.

75th ANNIVERSARY 1883—1958 PPG

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Westinghouse Sells Eight-Million-Dollar Order To Austria

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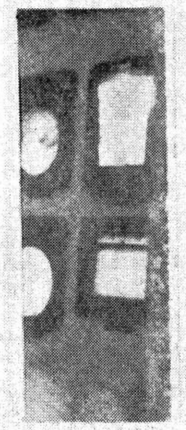


From First Commercial Plant

Atomic Power Lights City

SHIPPINGPORT SWINGS INTO OPERATION

Westinghouse Builds Tallest Heat Treating Furnace

Westinghouse Gets Contract For Hospital's Power Work

Westinghouse Builds Two Most Powerful Hoisting Units in Nation

The order totals over $1,000,000 and includes motors, motor-generator sets, and speed control equipment to drive each hoist with a payload of 36,000 pounds up the vertical shaft at a rate of better than 30 miles an hour. The hoists will operate four levels, the shallowest 1,636 and the deepest 4,720 feet below collar of the shaft.

Westinghouse Develops Ultra-Pure Silicon

WORLD'S PUREST SILICON — one of the materials used in "solid state" electronic devices has been made available to American manufacturers by Westinghouse Electric Corporation.

Westinghouse Renews Employe Stock Purchasing Plan on June 1

PITTSBURGH Pa., May 13—Westinghouse Electric Corp. will offer 400,000 shares of common stock to employes under a re-establishment of the former employe stock purchase plan beginning June 1, it was announced today by Gwilym A. Price, chairman and president. ... He said that about 22,500 employes now own company stock. "The proposed plan will be the same as the 1950 employe stock plan and is, in effect, a resumption of the previous program," he said.

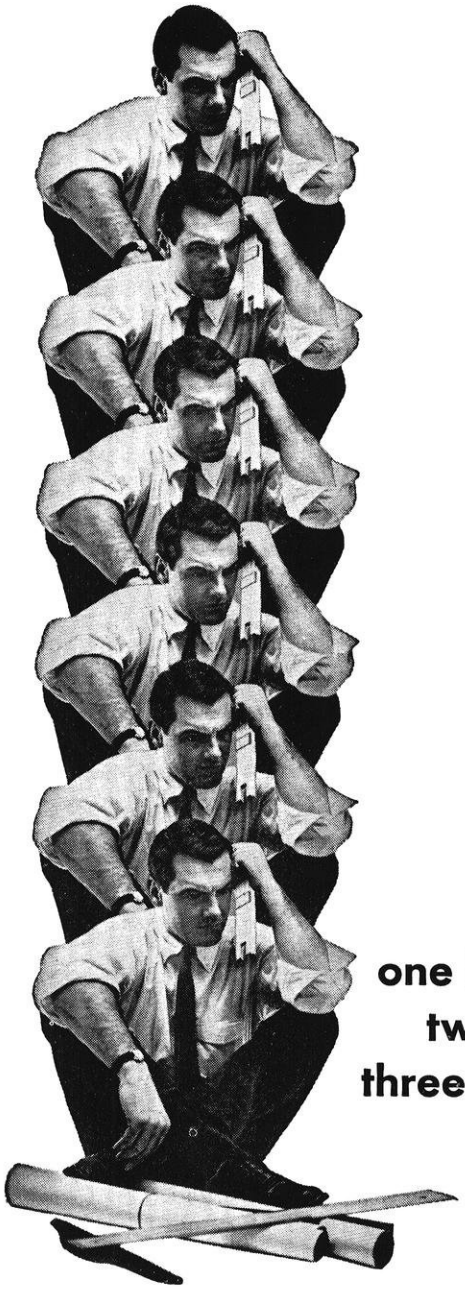
'Sherwood' Joined By Westinghouse

Thermonuclear Work

Westinghouse Inventors Set New Record

Drilling Tenders to be Built by Westinghouse

Westinghouse... first with the future



one little...
two little...
three little...

...indians! Anyway you stack the totem pole, there's very little creative work done by this row of engineers. But how do you pick a job that allows a little freedom for initiative . . . where a creative spark can help you advance? As the guy in the middle said . . . "how?"

We'd like to suggest that you investigate a company's reputation for new products . . . for being the leader in its field . . . for a willingness to begin new and untried projects. This approach should locate a company that is aggressive, eager to have its engineers progress and be rewarded. Indeed, a company to have this reputation *must* think of an engineer as more than just one of a crowd.

Your professors and placement officer are your best source for information about our reputation. We would, however, like to tell you about the varied products of LINDE . . . from synthetic crystals (developed at LINDE) to our famous HELIARC welding. You'd like to know, for example, that LINDE engineers are not required to do drafting, bench work . . . because they have specialized technicians in these fields. And, there are many other things . . . but our booklet "Look to LINDE for your future" tells this story. Ask your placement officer for a copy or write Dept XX-00. Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

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Under the Advanced Study Program, the Lockheed Graduate Study Council offers qualified students the opportunity to earn advanced degrees while employed in their chosen fields at Lockheed Missile Systems.

Eligible students must be U.S. citizens holding B.S. or M.S. degrees in engineering, mathematics, or science applicable to missile systems research and development.

Extensive laboratory facilities at Palo Alto and Sunnyvale, near Stanford University, provide an atmosphere to satisfy the most inquisitive scientific mind, yet pique the desire for further knowledge and achievement. Both locations are less than an hour's drive from San Francisco.

For further information, contact your Placement Officer, or write College Relations Office, Lockheed Missile Systems, 3251 Hanover Street, Palo Alto, California.

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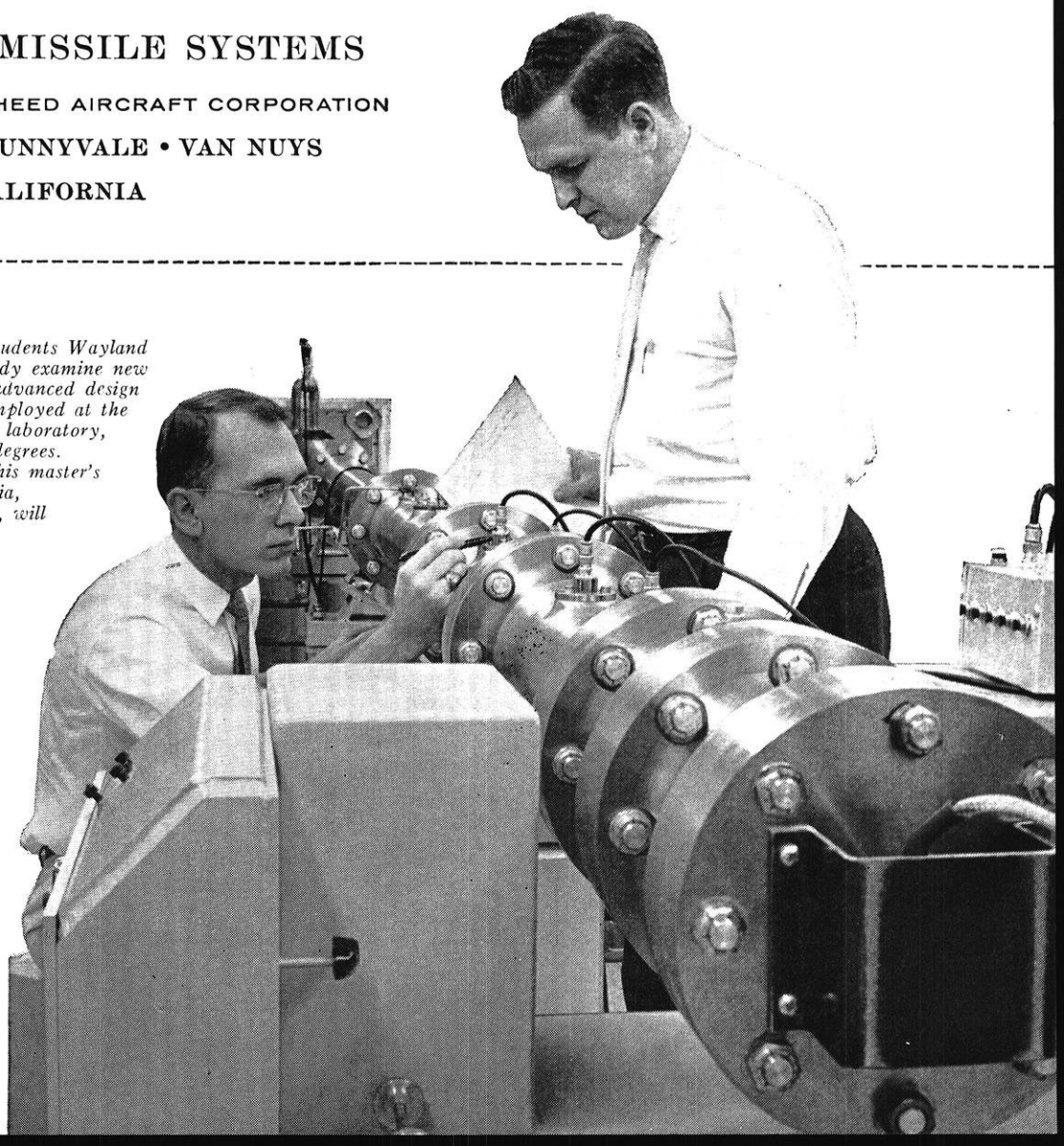
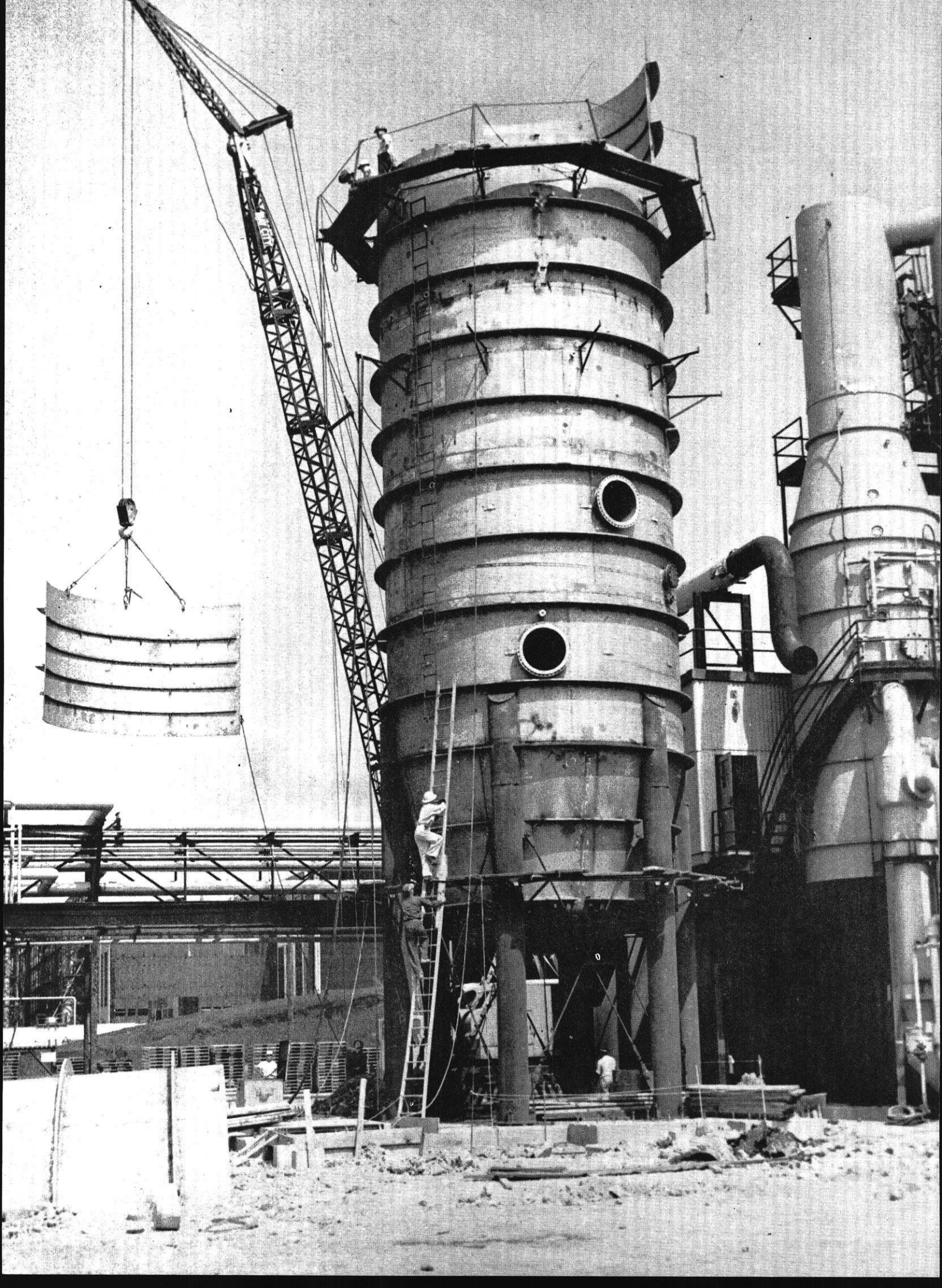


Advanced Study Program physics students Wayland Marlow III, right, and Jerry Kennedy examine new 44-foot shock tube being used for advanced design work on Polaris missile. Both are employed at the Lockheed research and development laboratory, Palo Alto, while earning advanced degrees. Kennedy, Oklahoma '56, is earning his master's degree at the University of California, Berkeley, while Marlow, Miami '55, will attend Stanford University for his doctorate.



Rambling WITH THE EDITOR

From the looks of all the hustling going on in the placement office these past few months, the problem of finding the "right" job is once again facing a graduating class of engineers. For the new graduate, this decision is certainly one of the most important that he will make. The position an engineer holds is the most important factor in his professional career, but how many engineers apply as much logical thought to the selection of such a position as they do to just one problem in thermo or mechanics? Unless he knows just what to ask a company, the graduate often finds himself working for a company several months or longer before he finds out things that should have been uncovered in that first interview.

The first important factor to consider is the use that the prospective employer will make of you as an engineer. Are you being hired as a trained technician or as a creative engineer, with challenging work assignments? There are several indications of how important engineers are to an employer. (1) What kind of training program does the company have? A tuition-refund program may be present just to attract warm bodies, but a definite in-company training program shows that importance is placed on engineers. (2) What kind of facilities will you have to work with? If you are being thrown in with several hundred other engineers all in the same huge room, the company cannot place very much of a premium on the engineers. (3) What about the number of technicians available for each engineer? According to the Engineers and Scientists of America, this ratio is very indicative of the amount of creative work that you as an engineer will be doing. For the construction industry, there should be three or more technicians per engineer, for aircraft, at least two per engineer, and for the chemical and oil industry, about one for each engineer.

The second important factor to be considered is the opportunity for advancement that a company offers. Again several questions to the employer can help you discover his present practices. (1) What per cent of the entire engineer payroll is distributed each year as merit and promotional increases? For 1957, merit increases (over and above blanket increases) should have been 4 per cent or more. Otherwise, good promotional opportunities are questionable. (2) Does the employer have a copy of the classifications and salary ranges of his engineers? If this is not available, the employer does not worry too much about promotion opportunities for engineers. (3) Find out what percentage of the company's engineers, other than those in management, are making over $10,000 a year. For 1957 this figure should have been 5 per cent or more. Otherwise, be wary.

Several other factors, not as important as those above, should also be considered. Under fringe benefits, you should expect as a minimum, two weeks' paid vacation after one year's employment, ten days of sick leave per year, and available group medical insurance. Profit-sharing plans and retirement plans are also important, but usually not until you have worked for the company for a period of time.

The question of security is one that is hard to evaluate for any one company. Although the most common reason for layoffs seems to be cancellation of government defense contracts, many large, stable corporations also lay off for any number of other reasons. According to the Engineers and Scientists of America, the only real security is an engineer's ability and the total national demand for each type of engineer.

Location is another factor that may comprise much of your satisfaction as a working engineer. If you have any real preferences, try to interview a lot of companies from that area. It will pay off in job satisfaction later.

In summary then, the selection of a position is the most important decision of an engineer's career. When you make your decision, try to do so by getting intelligent information on all the factors concerned.

Pictured is the building of what is believed to be the world's largest stainless steel crystallizer for making ammonium sulfate, a fertilizer. This crystallizer weighs more than 150-tons, and is 82-feet high and 20-feet in diameter. About 300-tons of ammonium sulfate will be made daily in the huge crystallizer.
—Photo courtesy Allegheny Ludlum Steel

YOUR ENGINEERING CAREER

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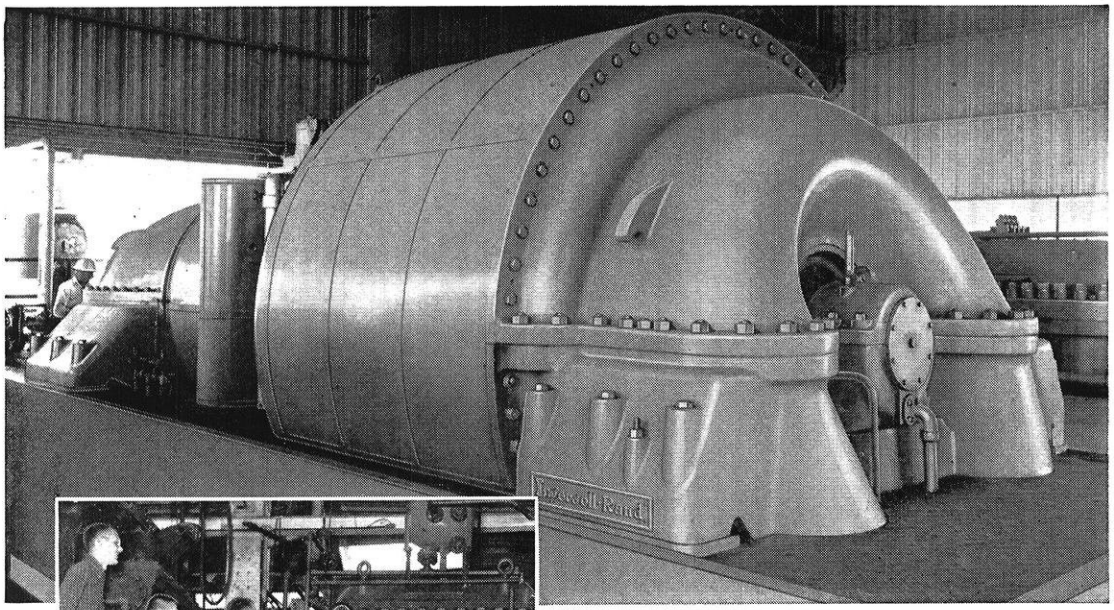

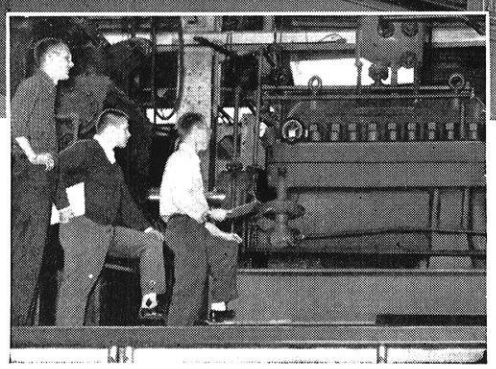

ABOVE: This huge I-R Turbo-Blower is the largest cat-cracking air blower ever built. It delivers 161, 500 cfm of 30 psi air at Tidewater Oil Company's new Delaware refinery, and is driven by an 11,250 hp I-R steam turbine.

LEFT: Engineering trainees at Ingersoll-Rand's Phillipsburg, N. J., plant check final performance tests on another blower of smaller size and higher pressure.

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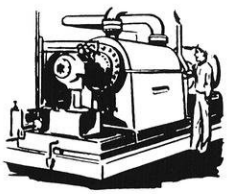
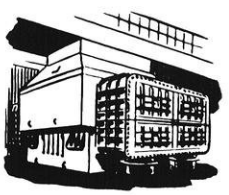


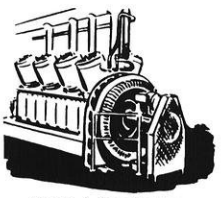
Centrifugal Pumps

Rock Drills

Air & Electric Tools



Steam Condensers



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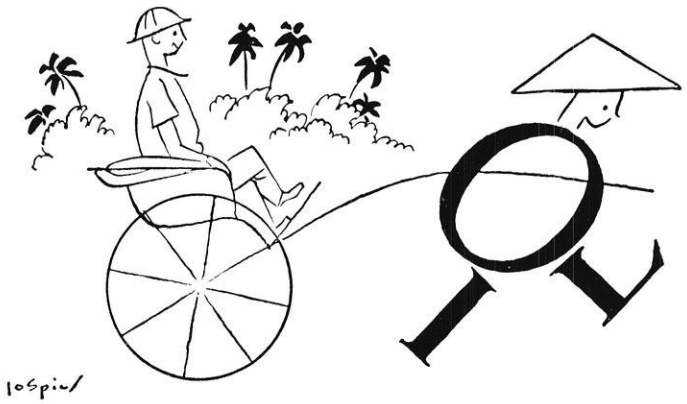

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SELF-CONTAINED UNDERWATER BREATHING APPARATUS

by Robert D. Falstad me'58

Thinking of buying a lung? This article will familiarize you with both major types of self-contained air supply.

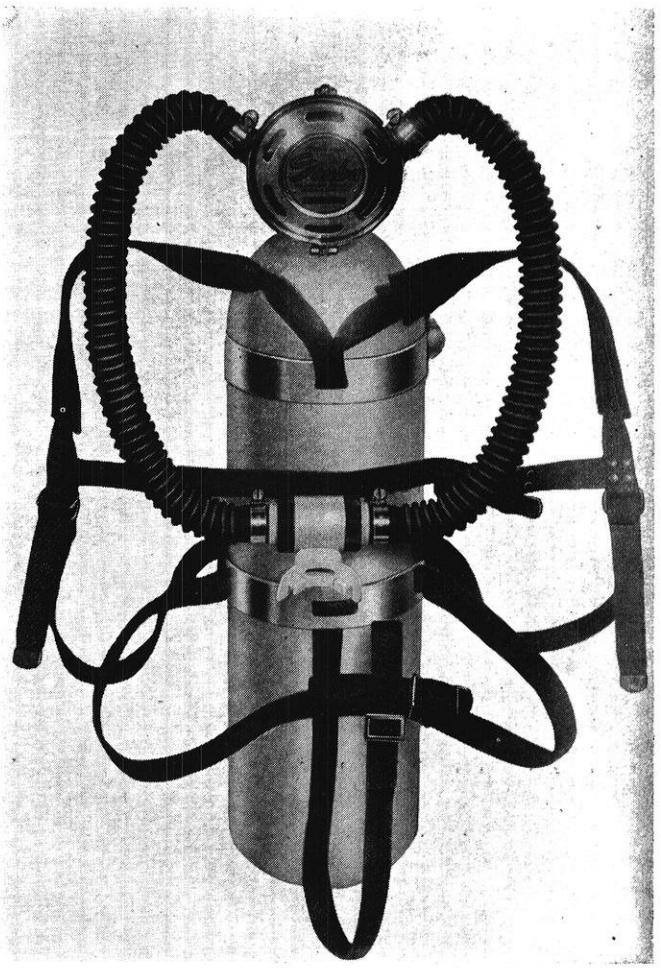
THE invention of the Aqua-Lung in 1942 by Jacques Cousteau and Emile Gagnan gave the sport of skin diving its start. Since the end of World War II over 3,000 skin diving clubs have been organized in the United States alone. The purchase of safe and reliable diving equipment is the first step in learning to enjoy the sport.

There are two main types of SCUBA (Self Contained Underwater Breathing Apparatus) available to sport divers. Both types are safe and dependable, when properly used. The open-circuit type uses compressed air carried in tanks on the diver's back, and can be safely used for dives up to 150 feet. The large amount of bubbles, characteristic of this type is caused by the exhaled air being passed out into the water. The closed-circuit or recirculating type uses compressed oxygen and a carbon dioxide absorbent, and is good for dives up to 33 feet. The same air is recirculated through the apparatus and is refreshed by the absorbent and compressed oxygen. There are no bubbles with this type of SCUBA.

The life and diving enjoyment of

—Courtesy Columbia Pictures, Inc.

—Courtesy U.S. Divers Co.



—Courtesy Healthways

Two brands of single-tank open-circuit diving apparatus.

the diver depend greatly on the construction of his equipment. All parts must be strongly made of a non-corrosive and long wearing material. There is nothing more annoying, or dangerous, to the diver than to have his equipment not function properly. In the long run it pays to buy the best equipment one can afford.

The regulating mechanism for air or oxygen is the most important part of the diving gear. If this part fails the diver will not receive air and a serious accident can occur. The diver must know how these regulators are constructed to be able to tell if they are working properly. There are two main types of regulating mechanisms.

In the open circuit mechanism: the air supply mechanism must supply large quantities of air on inhalation but must not discharge on exhalation. For this reason a "demand regulator" is used in place of a constant flow needle valve. The regulator is actuated by the difference in pressure between the water and diver's lungs on inhalation, i.e., on demand. There are two types of demand regulators:

The single stage regulator for open circuit: is the simplest type of demand regulator. The unit is cheap and often partially constructed of plastic. The high pressure air is reduced only once from tank to diver. The regulator uses the flow of air to help open the valve, on demand, and therefore is easier to breath with than the two stage. The main, although not serious, disadvantage of this unit is that it is hard to keep in adjustment. The diver can easily make this adjustment himself.

The two stage regulator for Open-Circuits is more complex and more expensive than the single stage. It is usually made out of brass, or some other non-corrosive metal, and is very solid and rugged. The air pressure is reduced twice between the bottles and the diver and can therefore be more accurately controlled. This results in less wasted air. Since the pressure in the second stage is low (60 psi), the spring adjustment in the medium pressure area can be easily kept constant, and requires little or no adjustment, once correctly set. The low pressure is not able to help turn the horseshoe valve, which results in somewhat more difficult breathing. The main disadvantages of the two stages are its higher initial cost and the more difficult breathing.

The closed circuit, or recirculatory type SCUBA, is somewhat less complicated than the open-circuit, however, more caution must be used in its operation. There are three main parts to the oxygen regulating mechanism.

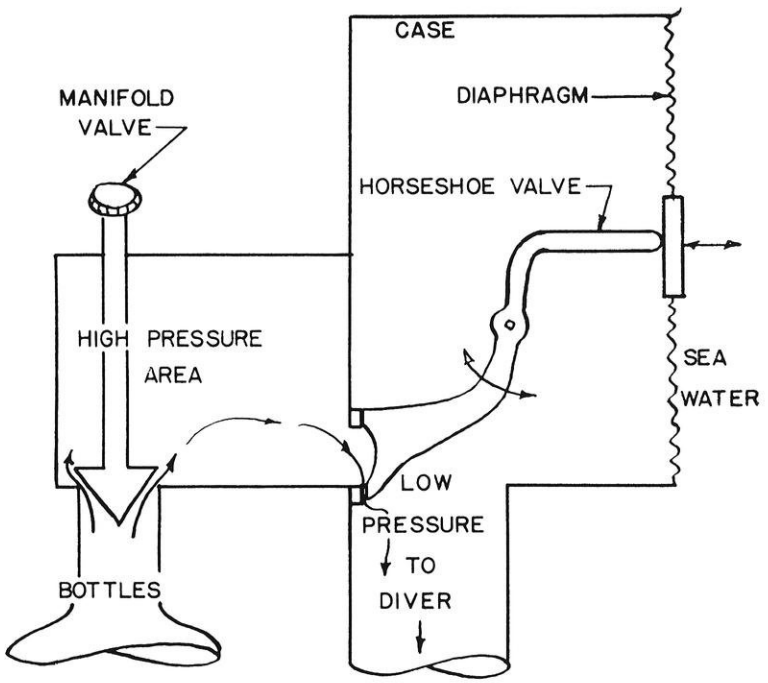
A manual type needle valve is used for regulation of the oxygen supply. This valve is located in the outlet end of the oxygen bottle. When the diver needs more oxygen he just opens the valve and lets the breathing bag expand to the desired size. Automatic type valves are available. However, the slight gain in convenience does not offset the added cost and complexity.

(continued on next page)

The cannister holds the carbon dioxide absorbent (usually soda lime). The absorbing capacity of the soda lime depends on its surface area; therefore it must be kept dry. If the soda lime becomes wet there is the added danger of toxic gases being sent through the system. It is very essential that all joints be 100 per-cent watertight. A water trap collects any traces of water which may be formed by the condensation of the water in the air. There is a non-return valve to prevent water from entering the cannister in case the breathing bag is torn.

The breathing bag is a rubberized canvas, waterproof bag of approximately 3 quart size. It is located at chest level and operates as a reservoir for the exhaled and cleaned air. The diver on inhalation draws air from the bag, which partially collapses. On exhalation the air goes through the cannister and then into the bag, reinflating it. On ascending, the expanding air must be let out through a valve, or otherwise it will rupture the bag. On descent the bag is inflated with compressed oxygen to keep it from collapsing. The tube leading to the mouthpiece has a non-return valve to prevent the direct return of exhaled air.

The containers must be of the proper size and construction to provide the proper amount of air and oxygen. The problem of recharging the bottles must also be considered when deciding what type of equipment to buy.



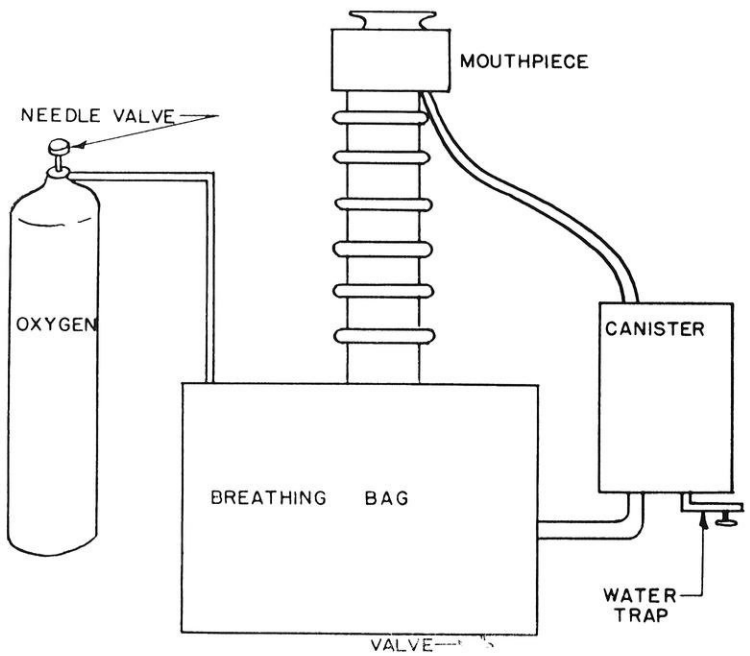
Single-stage open-circuit regulator.

Since the exhaled air goes into the water, not being reused, the air supply must be large. The deeper the diver goes the more air he uses in a dive. The tanks must therefore be capable of high pressure (2300 psi) and of large capacity (35–70 cu. ft.).

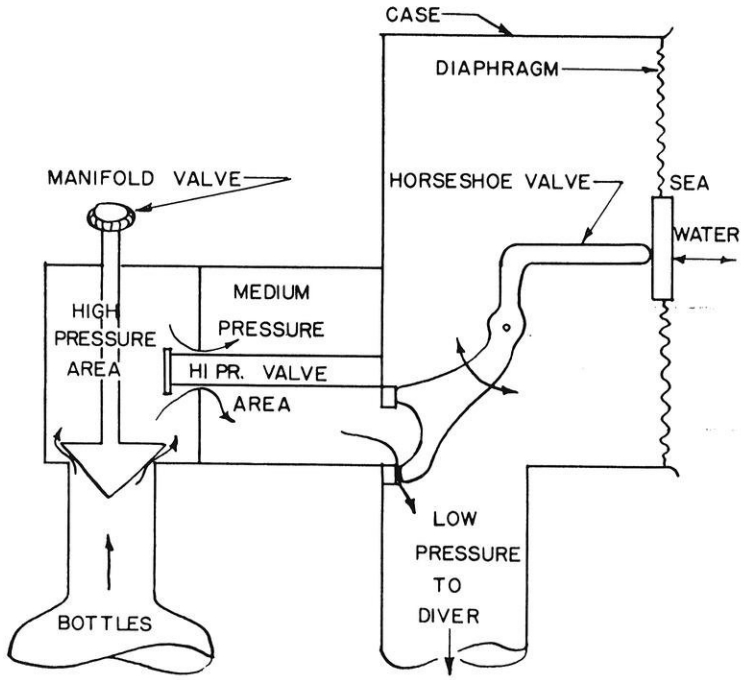
The tanks are constructed of alloy steel and are usually connected in banks of three to bring their total capacity to between 108 and 210 cu. ft. All tanks must have a reserve air valve which warns the diver when his air supply lowers to 300 psi. This warning is given by a noticeable increase in breathing difficulty. By tripping the valve the diver has enough air released to enable him to reach the surface.

Recharging the air bottles is a nuisance, particularly in a region away from diving air sources. In an active diving area many sporting goods stores can charge tanks at a cost of $1.25–1.50 per bottle. For the serious and well financed diver, there are several portable air compressors on the market. Cornelius Company builds the following two models which will satisfy most needs: a 2 cu. ft./min., 3000 psi compressor and a 0.4 cu. ft./min., 1500 psi compressor. The time of use for fully charged bottle varies considerably with depth and type of diving. As an example, a 38 cu. ft. tank lasts 40 min. at a 5 ft. depth and only 10 min. at 100 ft.

Since on a normal inhalation only 4 per cent of the oxygen in the air is used, the closed-circuit, by replenishing the oxygen and using the same air, is much more economical to operate. Each time the diver ascends he must empty his bag of oxygen to prevent rupture,



Closed-circuit flow diagram.



Two-stage open-circuit regulator.

thus wasting a whole bag of oxygen. The operator should stay at as constant a depth as possible to achieve the most economical operation.

The oxygen bottles for the closed circuit are small (3–4 cu. ft.), high pressure (2200 psi) cylinders, and are readily obtainable from welding or medical supply houses. Lower pressure bottles are available, but they may become too large for practical diving use.

Recharging the bottles is not a problem, as commercial welding oxygen is sufficiently pure and readily available. Commercial welding bottles (250 cu. ft.) may be used to supply the diving bottles when on a trip or away from a convenient supply source. One bottle may last for 4 to 5 hours and its life depends only on the number of ascents and descents. The bottles must always be kept partially full (10–12 psi) to keep dirt and water out. Most important, all bottles and fittings must be free from oil. Oxygen and oil at pressures above 800 psi are very explosive. All bottles should be stenciled "Use No Oil".

The soda lime to absorb the carbon dioxide costs about 75 cents a pound, and is easily obtained at sporting goods stores.

In *open-circuit equipment:* the soft rubber mouthpiece is connected to the regulator by two corrugated rubber tubes of approximately 1.75 in. diameter. One tube is for exhaust and one is for inhalation. The other end of each tube is fastened to the regulator. Both ends of the mouthpiece have non-return valves to control the air flow. When the bite plate fits correctly, and the mouth is closed, the system should be watertight.

The *closed-circuit* mouthpiece is similar to that of the open-circuit, the difference being in the location of the tubes.

An ordinary soft rubber face mask covers the nose but not the mouth in open-circuit equipment. This allows the diver to equalize pressures on both sides of the mask, by blowing through his nose. It is possible to have the mouthpiece built into the mask; however, this is not too popular with most open-circuit divers. With this arrangement, if the mask is lost, so is the mouthpiece.

In *closed-circuit equipment* the mask is a soft rubber hood, with glass face plate, and usually contains the mouthpiece. In the closed-circuit rig any water in the tubes is to be avoided. The whole set-up is more watertight when the mouthpiece is inside the mask.

The open-circuit harness is very simple and consists of two over-the-shoulder straps, a waist strap, and two straps between the legs. When the straps are tightened down properly the regulator cannot hit the diver in the head even when tilted back. The harness should always be buckled with the safety release.

In the *closed-circuit* the harness is attached to the breathing bag, oxygen bottle, and cannister. It is

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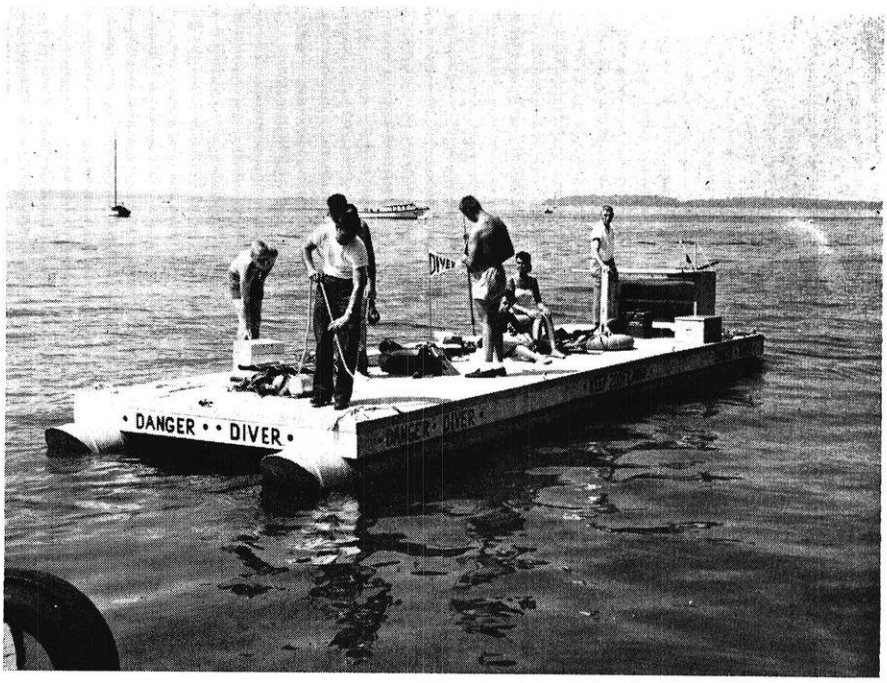


The Madison Diving Club prepares for an afternoon of diving in Lake Mendota.

SLIP-STICKS MADE EASY

by Robert P. Annen me'59

How adept are you in using a slide rule? Following are some helpful hints for the use of a general purpose slide rule; the illustrations also include a few of many special purpose designs.

CONSIDERING the wide use of the slide rule in Engineering, it follows that most students should be accomplished operators of the slide rule. This is not true, however. A survey of students at the University of Wisconsin showed that only 18 per cent use the inverted or folded scales frequently, while 60 per cent do not use them at all. These figures are significant because the sole purpose of these scales is to simplify and shorten operations. Failure to use them is certainly evidence of wasted time.

Few colleges have any form of slide rule instruction. As a result, most students use methods taught by friends, or pamphlets accompanying the slide rule. These methods are usually correct, but often lengthy. Articles such as this one are a means of presenting new methods to the student.

This article will cover only a few of the many time-savers used by slide rule experts, but will include some helpful hints throughout. It should infer the general idea of simplification, and perhaps create some further interest of the part of the reader.

It is assumed the reader is familiar with the slide rule and can perform the usual operations.

Definitions

Slide: The central sliding part of the rule.
Body: The fixed part.
Cursor: The glass runner.
Hairline: The line on the cursor.
Factor: A group of digits which represents a number.
Index: The mark associated with the primary number 1 on any scale.
Two positions are said to be "opposite" if the hairline can cover both positions at once.

The article will first discuss basic operations, then some common problem problems, and lastly apply these to some specific problems. It is advisable to refer to your own slide rule when reading this article.

Basic Operations

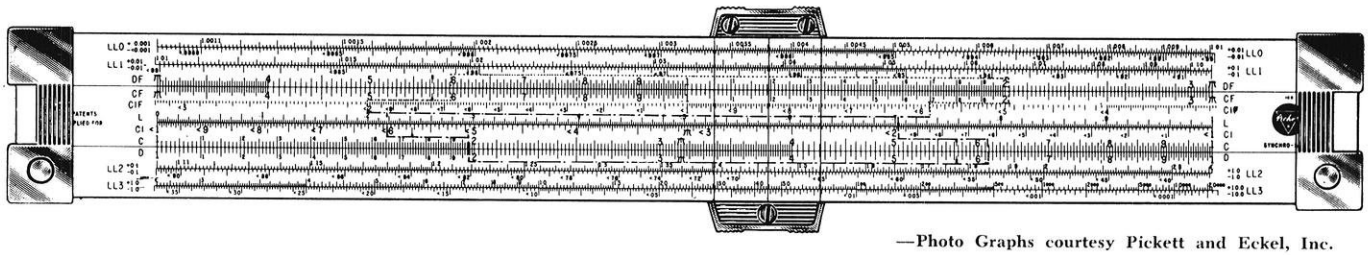
Basic operations included multiplication, division, squares, and cubes. These comprise 75 per cent of slide rule use; therefore basic operations can be the largest source of saved time. In general, the approach used is to shorten or eliminate movements whenever possible. This is done by:

1. Arranging factors before starting,
2. Using scales wisely,
3. Substituting the eye and mind for the hand whenever possible.

Center-Drift Method

This method uses the CI, CF, DF, and CIF scales as well as the C and D scales, the object being to use the least number of steps, and also to shorten the total movement of slide and cursor. This is done by dividing the numbers from one to ten into two groups called the upper and lower groups. The upper group consists of the numbers 1, 6, 7, 8, 9, 0, on the upper scales (CF, DF, and CIF), the lower group of the numbers 2, 3, 4, 5, on the lower scales (CF, DF, CIF). Since both groups fall in the center of the slide rule, it is possible to reach any number without leaving the middle of the rule. This eliminates long movements of the slide and cursor as well as the step needed to reverse the slide.

The difficulty of this method is choosing the proper scales. This can be done by observing the following rules.



—Photo Graphs courtesy Pickett and Eckel, Inc.

The center drift method explained in the article uses two groups of factors, here outlined with dots and dashes.

Rule 1. Set the first factor on the D scale (or DF scale, depending if the number is in the upper or lower group.)

Rule 2. For division, start with a regular scale. (C or CF)

Rule 3. For multiplication, start with an inverted scale. (CI or CIF)

Rule 4. For repeating the same operation alternate between regular and inverted scales.

Rule 5. For alternating operations, repeat the same scales.

Example. $\frac{37.3 \times 12.2}{4.63 \times 8.13} = 12.1$

Step 1. Set hairline at 37.3 on D scale. (Rule 1)

Step 2. Move 4.63 on C scale to hairline. (Rule 2)

Step 3. Move hairline to 12.2 on CF scale. (Rule 5)

Step 4. Move 8.13 on CF scale to hairline. (Rule 5)

Step 5. Read 12.1 on DF scale under index of CF scale.

This example began with division, so a regular scale was used to begin. It then alternated between multiplication and division, so the regular scales only were used. When using a regular scale, there is a choice between the C scale and CF scale.

Example. $15 \times 16 \times 18 = 4320$

Step 1. Set hairline at 15 on DF scale. (Rule 1)

Step 2. Move 16 on CIF to hairline. (Rule 2)

Step 3. Set hairline at 18 on C scale. (Rule 4)

Step 4. Read 4320 on D scale under hairline.

Since this was a repeating operation, the scales were alternated between regular and inverted.

Note how the operations jump from the upper scales to the lower scales. There is no choice between the regular and inverted scales, since they are determined by the operation. There is a choice between the straight and folded scales however, and this is made to keep the slide and cursor moving towards the center. Thus the name "Center-drift."

When using the center-drift method, the position of the decimal point in the answer must be found by inspection. In some cases this is time-consuming. If the operation is confined to the C and D scales, there is a simple, accurate method of determining the position of the decimal point.

During the operation, note must be made only when the index of the C scale is to the right of the corresponding D scale index as shown in figure 2. When in that position, if the operation is:

Division: Add one decimal place.

Multiplication: Subtract one decimal place.

Keep a total in mind as you work, and when the operation is complete, you have the net number of decimal places moved during the operation. These are subtracted or added to the number of decimal places found in the factors of the problem. The number of decimal places in the problem is found by subtracting the number of decimal places (digits to the left of the decimal point) in the denominator from the number in the numerator.

Example $\frac{81.6 \times .0114}{285 \times .0025} = 1.308$

During the operation we find that the slide protruded to the right

Two times during division	2 places.
One time during multiplication .	−1 places.
	1 net place
In the numerator:	
81.6	2 places.
.0114	−1 place.
	1 place
In the denominator:	
285.0	3 places
.0025	−2 places
	1 net place
Numerator	1 place
Denominator	−1 place
Operation	1 place
	1 total

The numbers in the answer are first written with the decimal point preceding the first digit as in

.1308

Then the total number of decimal places are pointed off, positive to the right, negative to the left, as shown.

1.308

By arranging the order of factors, it is possible to keep the slide to the left as much as possible, where the count is not affected.

Common Problems

A good deal of time is spent solving common equations. Two frequent problems are finding the area of a circle and solving the Pythagorean theorem.

In every branch of engineering there are problems involving the Pythagorean principle. There is a method for solving these problems

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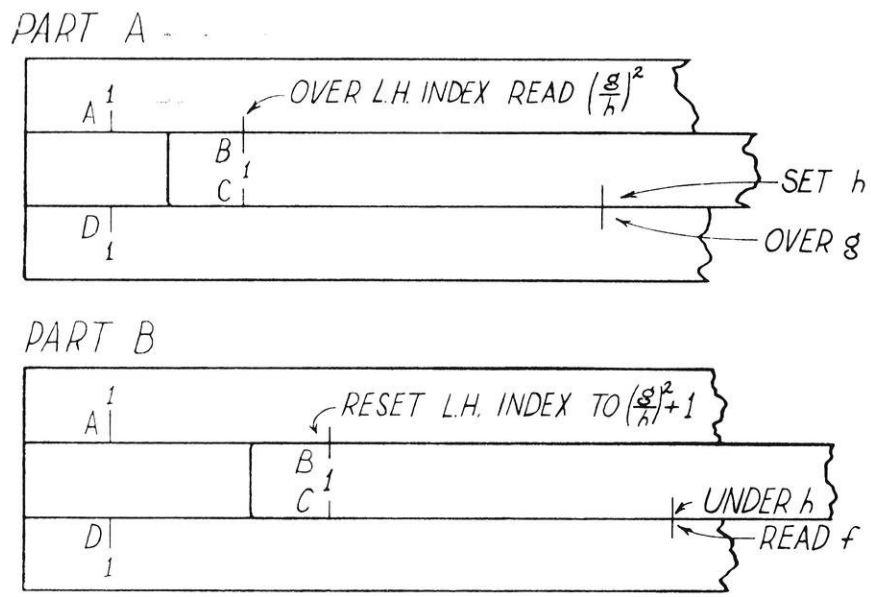


Scale settings when solving the pythagorean principle. See text.

which eliminates the finding of squares and square roots. However, it is possible only on a slide rule having A and B scales. The A scale has the square of each value opposite it on the D scale. The B scale is identical to the A except it is on the slide.

Procedure. For a right triangle of base (g), altitude (h), and hypotenuse (f),

$$f = (g^2 \div h^2)^{\frac{1}{2}} = h\left(\left(\frac{g}{h}\right)^2 \div 1\right)^{\frac{1}{2}}$$

by algebraic transformation. In all cases the larger numerical value can be assigned as (g), so that (g/h) is greater than unity. Referring to figure 1A, (h) is set on the C scale over (g) or the D scale. The value $(g/h)^2$ can be read on the A scale over the left-hand index of the B scale. The factor 1 (under the radical in the equation) is then added to the value just read, and the B scale index moved to the new value as shown in figure 1B. Finally the desired value of (f) is found under (h) on the C scale.

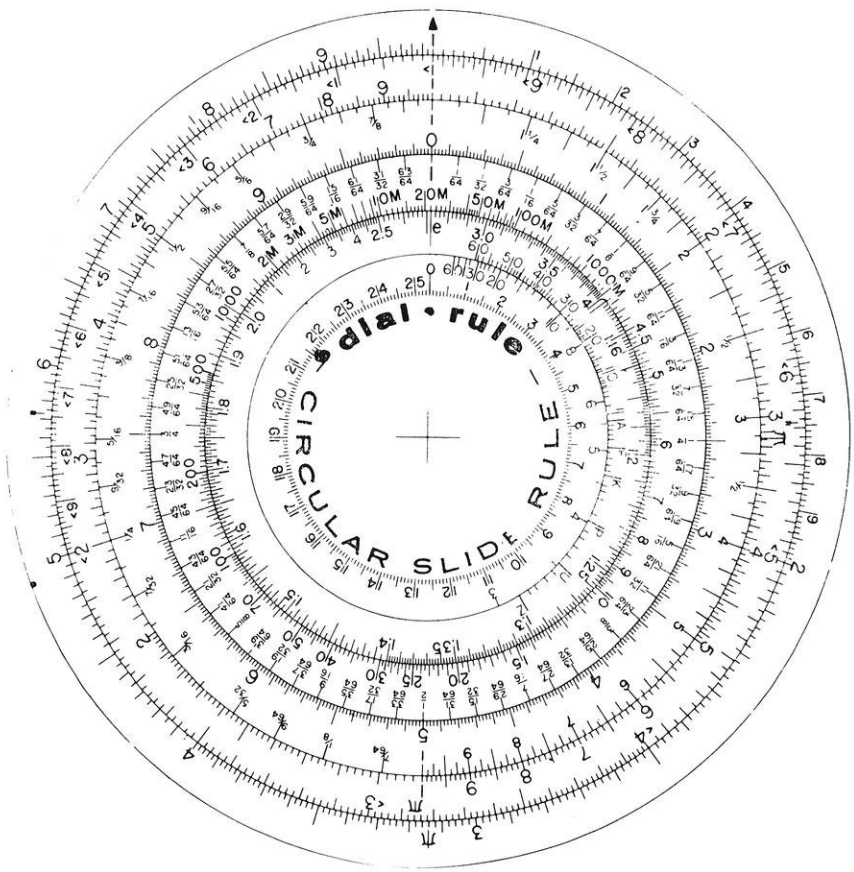
Example. 9.2 and 16.5 are the legs of a right triangle. Find the hypotenuse.

Step 1. Set 16.5 on the C scale over 9.2 on the D scale.
Step 2. Read 3.22 on the A scale.
Step 3. Move the index to 4.22 on the A scale.
Step 4. Read the answer 18.9 on the D scale under 9.2 on the C scale.

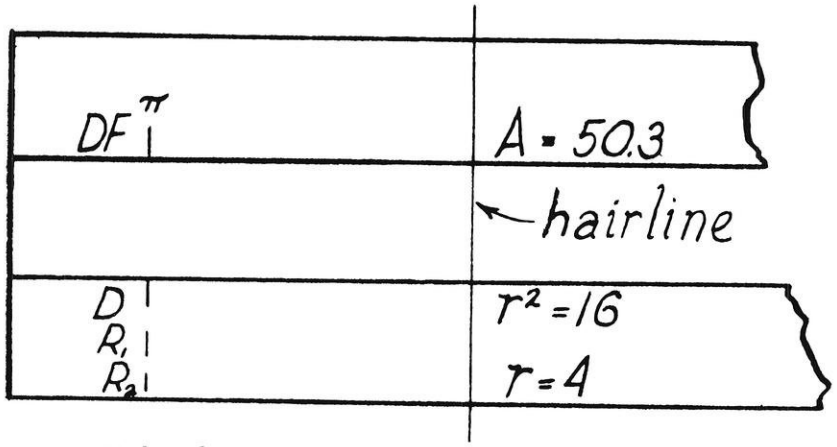
On a slide rule having root scales, it is possible to find an area with no movement of the slide, and only one setting of the hairline. The answer appears on the DF scale which makes it possible to solve for an area without interrupting an operation. Procedure:

$$\text{Area} = 3.14\,r^2 \text{ or } \frac{3.14\,d^2}{4}$$

Step 1. Set the hairline on (r) in the root scale.
Step 2. Read the area on the DF scale, or if given in terms of diameter;
Step 3. Move 4 on the CF scale to hairline.
Step 4. Read answers on DF scale opposite index of CF scale.



This is a plan view of a circular slide rule popular with shop men; the scales (reading from outer edge in) are C, CI, A, A^F, L, F^A, LL_2, LL_3, DS, DT, and M. Rotating cursors are used instead of a "slide".



Finding the area of a circle with one setting of the cursor.

Example. Find the area of a circle having a diameter of 4 inches.

Step 1. Set hairline on 4 in root scale.

Step 2. Move 4 on CF scale to hairline.

Step 3. Read 12.5 on DF scale opposite index on CF scale.

Applied Problems

Every branch of Engineering has numerous problems which appear frequently in calculations. It is a good idea to develop a particular method for working problems. When developing a method use all the tricks available.

Efficiency Equation

The equation for ideal thermal efficiency

$$e = 1 - 1/r^{k-1}$$

(e) is the ideal thermal efficiency (unknown)

(r) is the compression ratio = 7 (given)

(k) is the heat constant = 1.3 (given)

can be tedious to solve. But by establishing a method, it is quickly solved as follows:

Step 1. Set the C scale index on 7 in the LL3 scale.

Step 2. Read 1.9 on the LL2 scale opposite .33 on the C scale.

Step 3. Without moving the slide, set hairline on 1.9 on C scale.

Step 4. The reciprocal of 1.9 is .526 found under the hairline on the CI scale.

Step 5. Instead of subtracting .526 from 1, read the CI scale backward to get 47.4 per cent.

The last step reading the scale backwards, replaces subtraction on paper. Reciprocals can be found on the inverted with using the slide.

Polar Moment of Inertia

The polar moment of inertia is

$$I = \frac{bh(b^2 \div h^2)}{12} = \frac{b^3h}{12}\left(1 \div \left(\frac{h}{b}\right)^2\right.$$

$$\left.\right) = \frac{1.5^3 \times 2.22}{12}\left(1 \div \left(\frac{2.22}{1.50}\right)^2\right)$$

The factors have been arranged into a more convenient form.

Step 1. Set 1.50 on C scale opposite 2.22 on D scale.

Note the wise choice of the starting point. By reducing the factors in parenthesis to one, the rest of the operation can be done continuously.

Step 2. Read 1.48 on D opposite index of C scale.

Step 3. Move hairline to 1.48 on C and 2.19 on D. This is $(2.22/1.50)^2$

The square scales were not used in this case, because they would affect continuity.

Step 4. Add 1 to 2.19 mentally obtaining 3.19 and set hairline over 3.19 on D scale.

Step 5. Move 12 on C scale to hairline, and move hairline to 2.22 on C and read .59 on D.

Step 6. Find 1.50^3 by reading 3.375 on K scale opposite 1.50 on D scale.

Step 7. Move hairline to 3.375 on C and read answer 1.99 on D scale.

The slide is not moved during step 6, and remains in position for step 7. Never move the slide or cursor unnecessarily.

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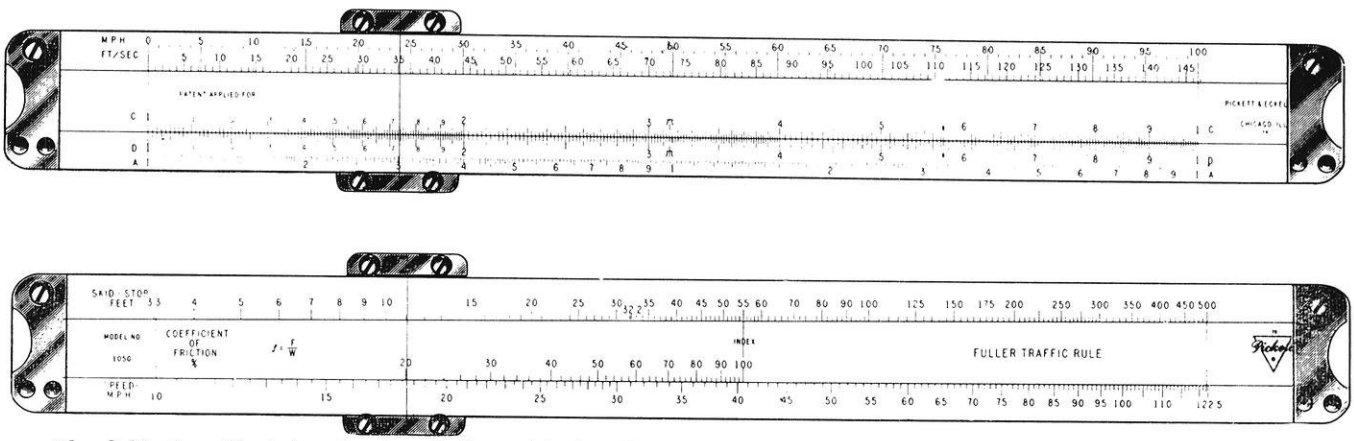
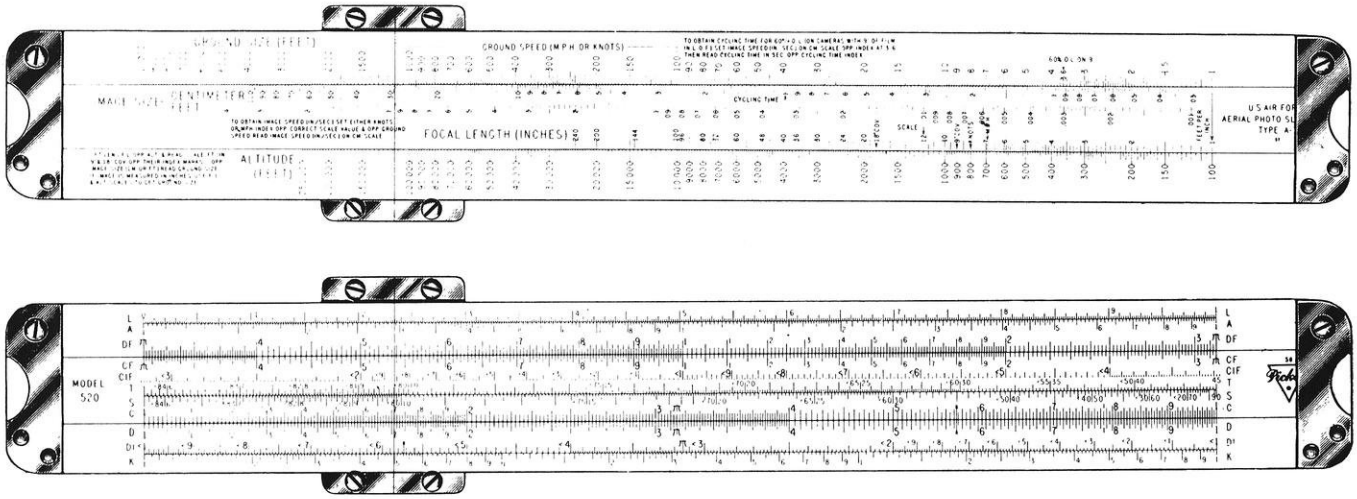


The field of accident investigation dealing with the *Physical Laws* relating to speed, stopping distances, coefficient of friction of road surfaces, interpretation of skid marks and other related data has become highly important to the American automobile driver.

This (special purpose) slide rule, by which mathematical formulae can be applied to the physical data at the scene of an accident to give true and unbiased answers to the questions involved was designed by Lt. L. J. Fuller of the Los Angeles Police Department. Lt. Fuller has been a member of the Los Angeles Police Traffic Bureau for 20 years and is a graduate of the Northwestern University Traffic Institute.



The Aerial Photo Slide Rule was designed by Amrom H. Katz of Wright-Patterson Air Force Base as a duplex double purpose rule with a series of scales on the front face for solving problems in vertical aerial photography and a series of scales on the back face for solving general problems common on a standard slide rule.

Summary

Following is a list of helpful hints, some of which are used in this article.

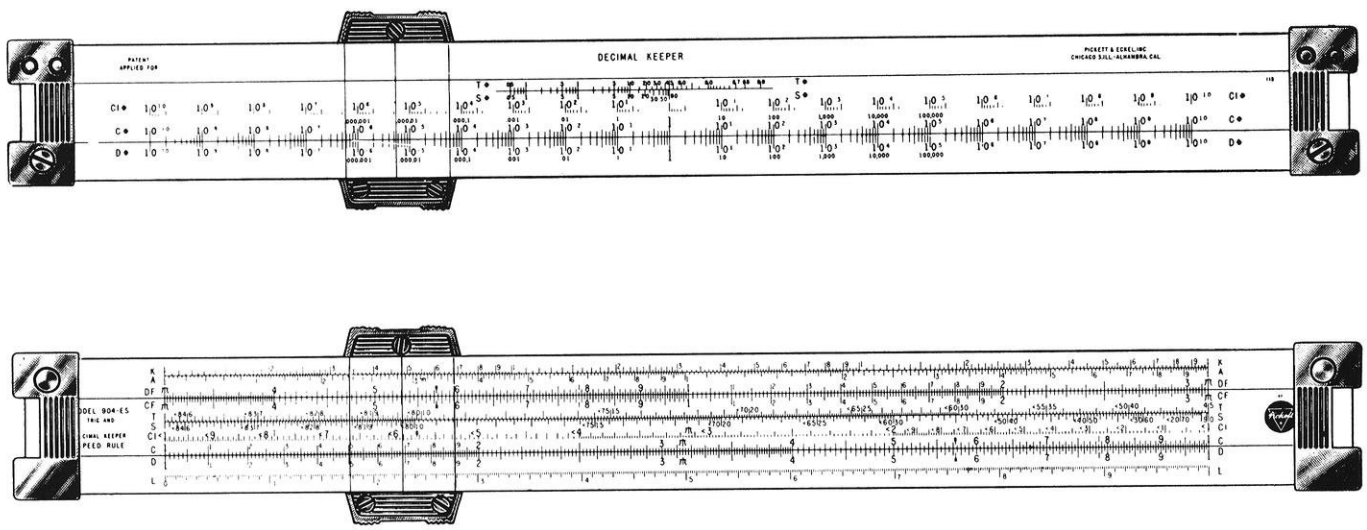
1. Rearrange factors into a convenient form.
2. Use factors in a sequence which simplifies operations, but avoid confusing them.
3. Make use of all scales which simplify.
4. Perform simple calculations in your mind.
5. Practice reading the scales backward.
6. Use constants to prevent repetition of work.
7. Practice reading numbers opposite an index without using the hairline.
8. Leave slide and hairline in position after a portion of a problem is finished. Chances are the next part uses the results of the previous part.
9. Keep the rule clean, and in good adjustment.

Keeping these in mind when attacking problems should save time regardless of the method used, and when used in conjunction with special methods, should reduce the time for solving the problem to one-third or one-fourth its value when using the usual methods. This was stated by R. G. Blaine, who has written five books on the slide rule and innumerable articles. On a problem-type exam, like those given in most Engineering courses, about 50 per cent of the allotted time is spent "cranking out" equations. However an efficient operator can save two-thirds of that time or 20 minutes in the case of an hour exam.

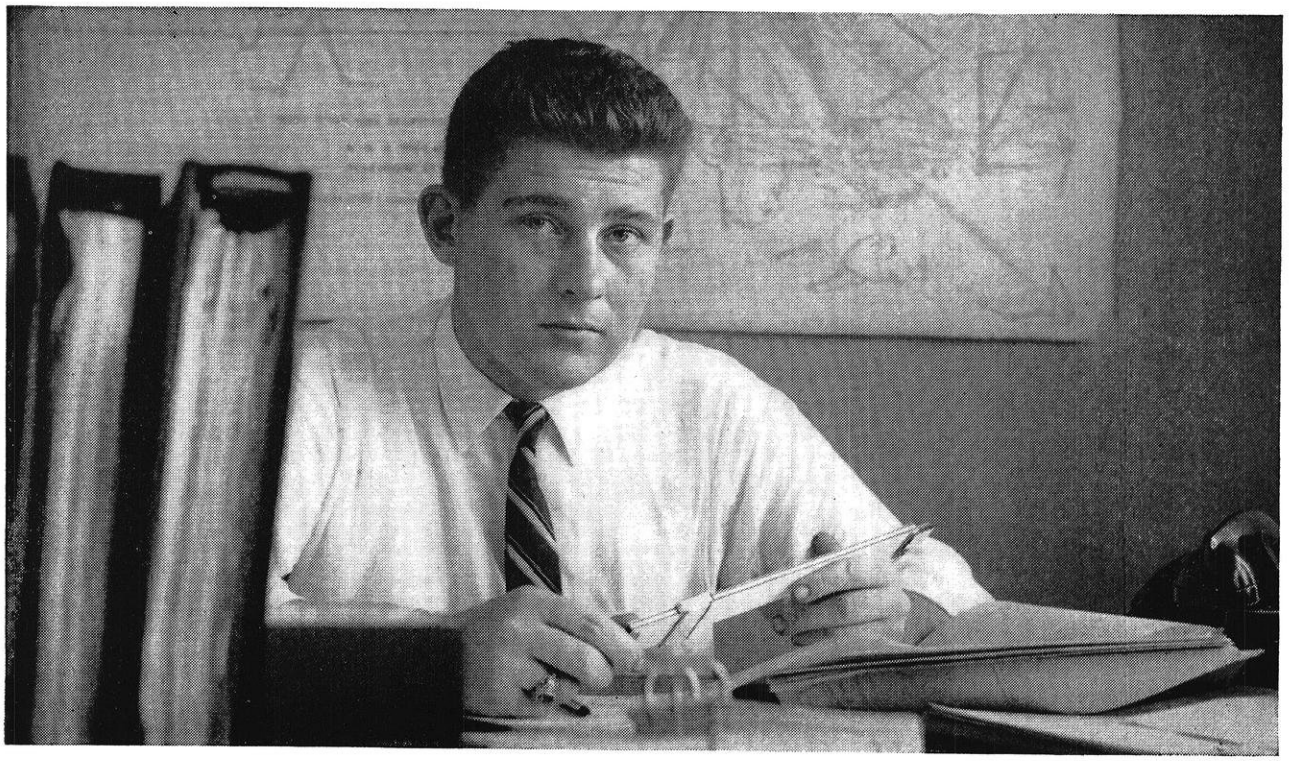
Good technique also provides better accuracy and less chance of error. There are less steps involved, so errors are less frequent.

These techniques require some time and practice to learn, but are well worth the effort.

THE END



This trig and decimal-keeper slide rule is designed particularly as a "teaching tool" for high school and grade school students to help them to think in powers of ten. This model is a "preview" rule that has been in use in ten high schools for about six months.



John Lawlor, B.S. in E.E., Brown, '52, answers some questions about

An engineering career with the Bell Telephone Companies

John Lawlor is a Transmission Engineer with New England Telephone and Telegraph Company in Boston. His answers reflect his experiences during five years in the telephone business.

Q ***How did you begin as an engineer in the Bell Telephone Companies?***

A My first fifteen months were spent in "on-the-job" training—changing assignments every three months or so. These assignments gave me a broad, over-all background in telephone engineering. And they were accompanied by plenty of responsibility. They progressed in importance with my ability to handle them.

Q ***What is the attitude of older engineers and supervisors toward young men?***

A I've found a strong team spirit in the telephone company. You're encouraged to contribute your ideas, and they're received with an open mind. Young men and new ideas are regarded as vital to the continuing growth of the company.

Q ***How about opportunities for advancement?***

A I'd say they depend on the man. Opportunities to demonstrate your ability come with each new job you're given. The size and importance of your assignments grow with your ability to handle them. All promotions are made from within, and the growth of the business is creating new openings all the time. One more thing. Most telephone engineering locations are convenient to colleges. You can aid your advancement by keeping on with your studies.

Q ***How does the telephone company stack up where pay is concerned?***

A Starting salaries are competitive with those offered by most large companies. Raises are based on merit, with several increases during your first two years with the company. What's more, your performance is reviewed regularly to make sure that your pay keeps up with your progress. All things considered, I think a Bell Telephone career is second to none in rewards and opportunities.

• • • •

Find out about career opportunities for *you* in the Bell Telephone Companies. Talk with the Bell interviewer when he visits your campus. And read the Bell Telephone booklet on file in your Placement Office, or write for "Challenge and Opportunity" to: College Employment Supervisor, American Telephone and Telegraph Company, 195 Broadway, New York 7, N. Y.

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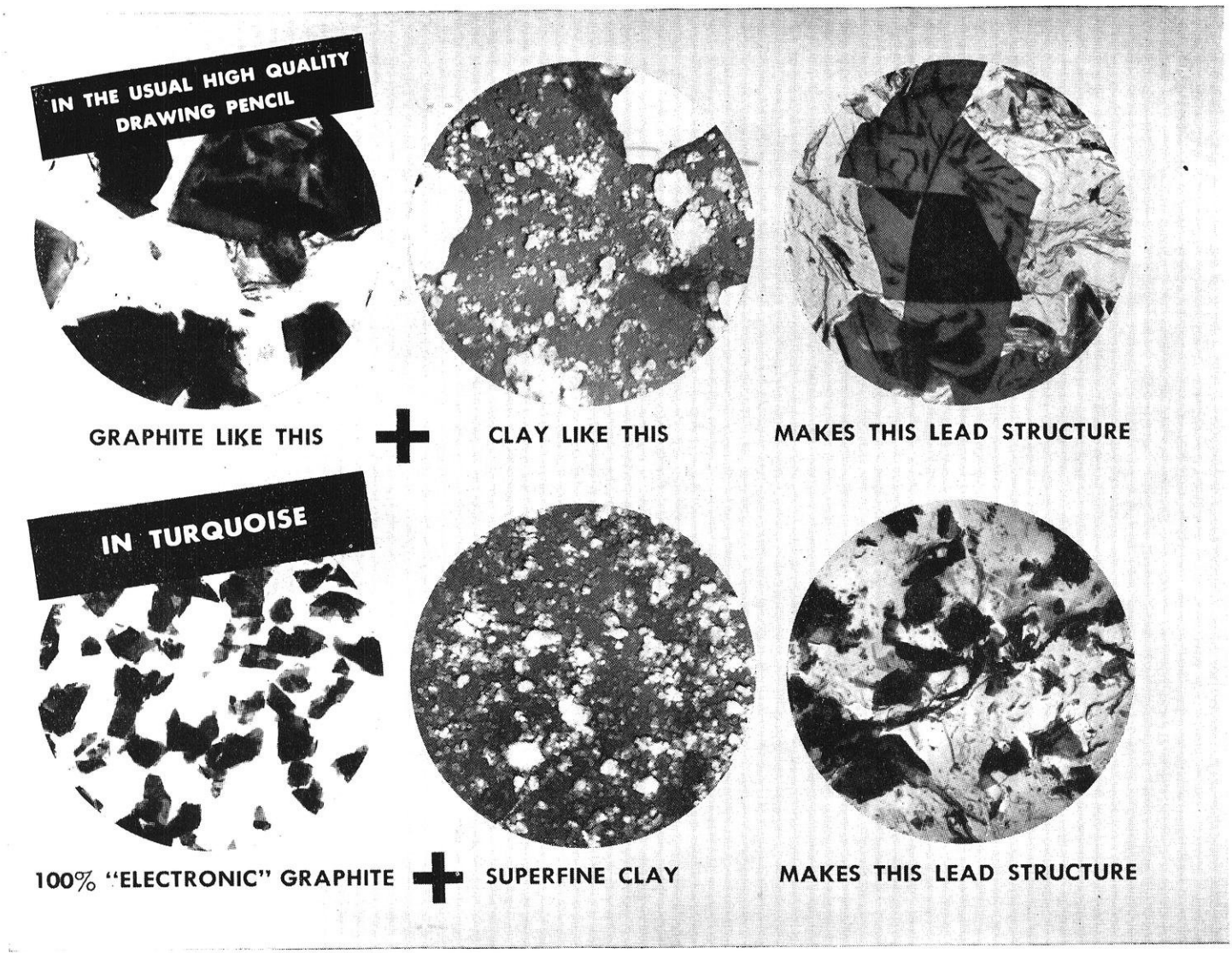

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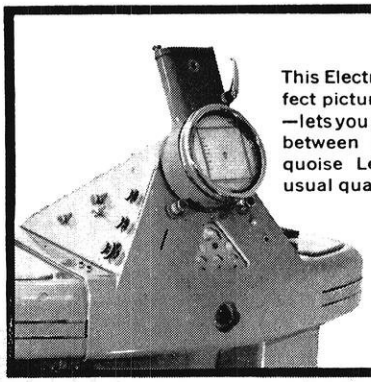
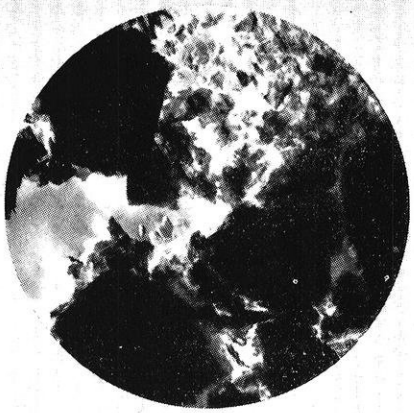


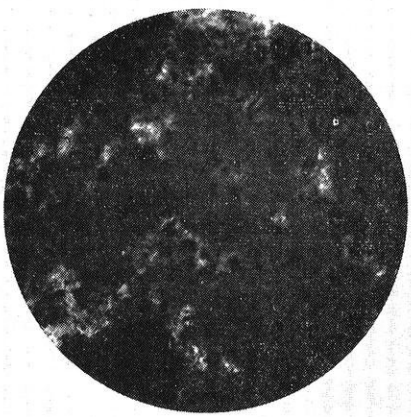
This Electron Microscope takes perfect pictures 7,500 times actual size—lets you see the startling difference between Eagle's "Electronic" Turquoise Lead and the lead in the usual quality drafting pencil.

Photographs courtesy of Ladd Research Industries, Inc.



...AND MARKS LIKE THIS

Relatively large, irregular particles of graphite make a rough-edged line. Drawings will be inferior.



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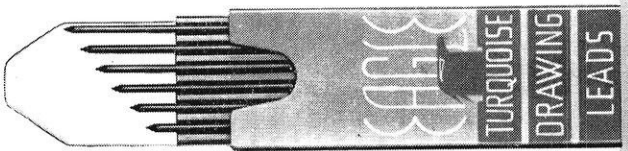

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SCIENCE HIGHLIGHTS

by Ed Allen m'60

REACTOR VESSEL—ATOMIC-POWERED SURFACE SHIP

The reactor vessel for the prototype nuclear propulsion plant for the nation's first atomic-powered surface ship program has been shipped to the construction site at the Naval Reactors Facility at Arco, Ida.

The 100-ton pressure vessel was designed and built under subcontract to the Bettis atomic power division of Westinghouse Electric Corporation which is prime contractor to the Atomic Energy Commission for the design and development of the nuclear propulsion plant for the prototype. The reactor plant will be a pressurized water type of advanced design and will be suitable for powering one shaft of a large surface vessel.

The vessel flange, which is 18 inches thick and has an outside diameter of 137 inches, was machined from a 70-ton forging, the largest ever forged from an electric furnace ingot. The vessel shell is formed from 7-inch thick alloy steel plate and is 105 inches in diameter.

Measuring over 19 feet long, the reactor vessel body is made from manganese-molybdenum alloy steel with the interior clad with a type of stainless steel. Final machining of the reactor vessel was performed in an air-conditioned room using optical measuring devices to maintain very close tolerances.

The vessel was welded with Foster Wheeler's automatic submerged-arc welding technique and all pressure welds were examined by x-ray. The stainless steel cladding on the vessel flange was deposited by a special automatic weld cladding process.

A 50-ton head will close the vessel, house the control rods and provide access to the reactor core.

NEW ICE-REINFORCED TANKER

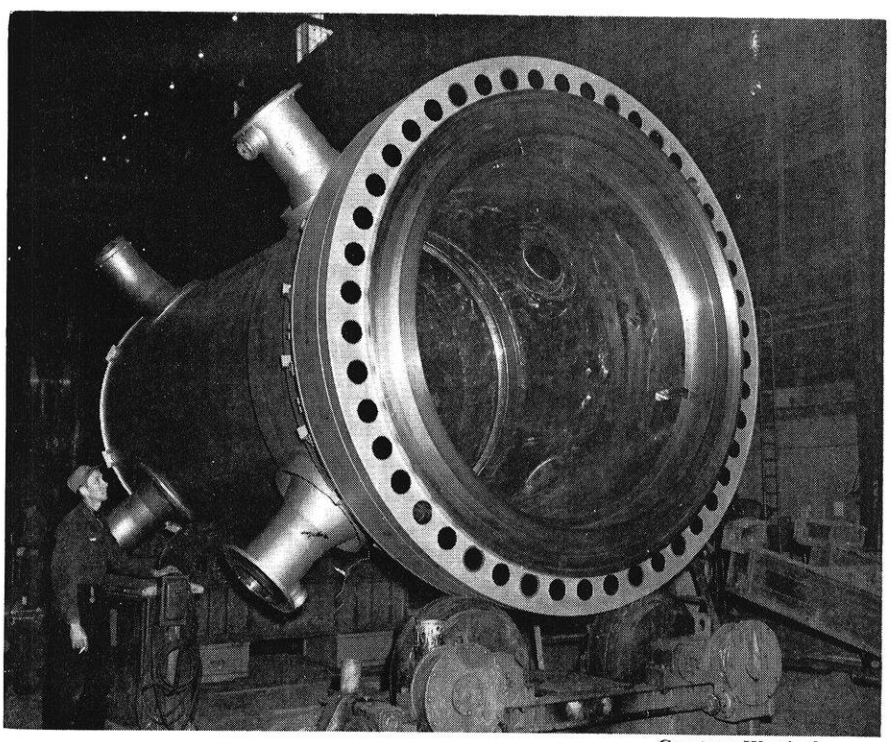
The Navy's Military Sea Transportation Service has laid up for the winter its prototype ice-strengthened tanker USNS ALATNA—four months out of the shipyard but already a veteran of arduous Arctic service.

The ALATNA, first of two ice-reinforced tankers built for the Navy during 1957, probably was given one of the shortest sea trials on record before going an "active duty."

Eight days after delivery to MSTS, and with only 24 hours of trials under her reinforced hull, she sailed north as part of the 1957 MSTS Arctic Resupply Operation. This year's 96-vessel task force was charged with the duty of supplying DEW Line stations and other military bases in the Far North.

MSTS records on this year's expedition refer to the "worst ice conditions in the last half-century." The Navy calls the 1957 iceberg season "bad" and has recorded reports of berg sightings as far south as Bermuda. MSTS attributes this to a longer, colder winter in the Far North, with few if any melting periods.

The initial operational assignment given the 5,720-ton ALATNA took her, as part of the re-supply



—Courtesy Westinghouse

This giant 100-ton pressure vessel for the prototype nuclear propulsion plant of the nation's first atomic-powered surface ship is shown prior to shipment to the Naval Reactors Facility at Arco, Ida.

fleet, to such locations as Foxe Basin, Frobisher Bay and other strategic locations in the vicinity of Hudson Strait.

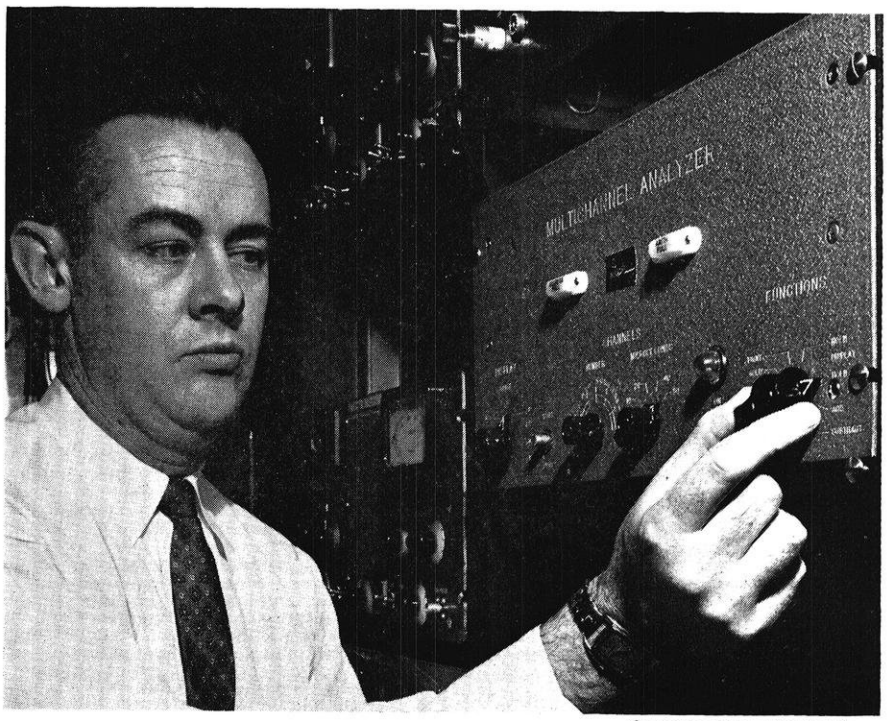
In this duty the ALATNA set out to prove a concept of the Navy's Bureau of Ships that has been built into four other vessels destined to fill the same role on future supply missions to outposts of the West's defense perimeter. These include a sister vessel, the USNS CHATAHOOCHEE—already accepted by MSTS and in service—and three ice-strengthened cargo vessels either completed or under construction.

The ice-reinforced hull of the ALATNA is the first application of that type of ship construction to a vessel other than an icebreaker by a Western Allied nation. As such, her performance in recent months was closely watched by naval authorities of several nations.

Vice Adm. John M. Will, commander of MSTS and the galaxy of ships that make the service the nation's third largest ocean carrier, is a known enthusiast of the ALATNA and its ability to get through when the going is toughesct. Admiral Will saw the ALATNA in action during a Far North inspection trip and came back with special praise for the ship. He says:

"The performance of USNS ALATNA during MSTS Arctic Operations more than justified my expectations for this sturdy ship. Faced with a timetable rapidly being cut short by early winter, ALATNA delivered urgently needed fuel through ice-choked waters impenetrable to conventional tankers.

The USNS Alatna, a ice-reinforced tanker built for the Navy undergoes tests in the Arctic Sea.



—Courtesy General Electric

A new neutron counter computing device accomplishes in an hour what it previously would have taken a man a month to do.

NEW NEUTRON COUNTER

Two GE engineers at the Knolls Atomic Power Laboratory here have developed a new electronic computing device for measuring, counting and classifying time of flight of neutrons from a nuclear reactor which accomplishes in an hour what it previously would have taken a man a month to do.

Elmer J. Wade and Donald S. Davidson of KAPL developed the first all-transistorized time of flight analyzer for use in determining the neutron energy distribution of various types of reactors. It contains 256 channels, compared to a device previously in use at KAPL which furnished only 11 channels for recording information on different energy range neutrons.

Employed in reactor development work at KAPL, the analyzer, through its work-saving features, has freed highly trained scientists from routine calculating work. They can now spend time saved in evaluating information the new analyzer provides for them.

Savings in time and labor by the new analyzer are matched by the space it conserves at the laboratory. The device is only 8 inches high, 19 inches long and 13 inches deep, compared to earlier analyzer equipment which took up at least 10 times that amount of space at the laboratory.

Most of the space-saving came in the use of 293 transistors in

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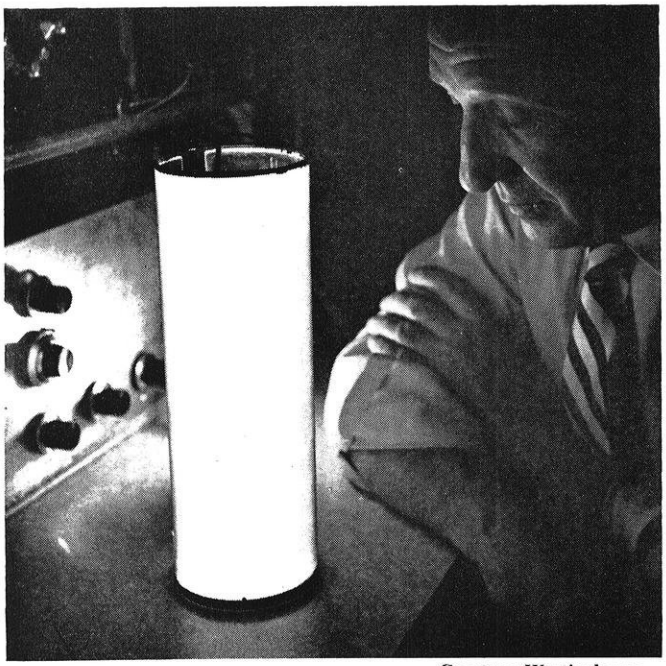
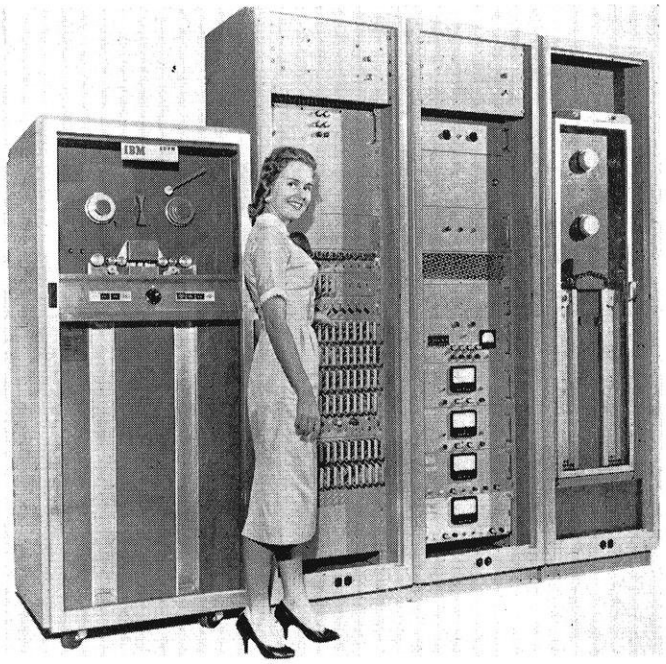


—Courtesy Westinghouse

This bright cylinder demonstrates how an opaque fabric woven from stainless steel wire can become a light source.



—Courtesy Electronic Engineering

A new computer language translater permits inchange of data between different computers and data processing equipment.

place of as many vacuum tubes, along with more compact circuitry through use of printed circuits, Wade and Davidson point out.

In addition, the new analyzer uses only eight watts of power, compared to two kilowatts needed to operate the earlier vacuum tube equipped analyzer.

The KAPL engineers said the analyzer works this way:

Development of new reactors at KAPL involves mock-up of various fuel arrangements and accurate measurement of resulting neutron energy spectrum.

This is accomplished in a large part by measuring the time of flight of neutrons over a given distance and recording the number of these neutrons which fall into 256 different velocity ranges. Through various calculations, scientists can convert the velocity of these neutrons into corresponding energy ranges.

To accumulate this vital information, a neutron beam coming out of the thermal test reactor is chopped by a rotating shutter so that velocity can be measured. At the end of a flight path of established length, the neutrons are detected by a counter and the information relayed to the analyzer.

Information on each neutron counted is directed into one of 256 channels, each representing a velocity range. Up to 65,536 neutron counts is stored in each of these channels.

After the experiment this information is transmitted over cables to electronic calculating equipment which punches information from each channel of the analyzer onto a separate card.

This information is then fed into a digital computer for analysis of the data from the cards and the result is then automatically plotted on a graph which shows the reactor energy characteristics.

The entire operation from neutron count to production of a graph which reveals the energy spectra of the reactor requires only about an hour, compared to what would have been a month's work for a single scientist recording data manually.

ELECTROLUMINESCENT LIGHTING

To the casual glance, a bright cylinder might resemble nothing more remarkable than a glass wind-screen around a high-output candle. To researchers in electroluminescent lighting at the Westinghouse lamp division the cylinder is a bit more complex and interesting: it demonstrates how an opaque fabric woven from stainless steel wire can become a flexible light source when coated with phosphorus and a transparent conductive material. Before it was curled into a cylinder, the steel fabric was twelve inches square and lay flat upon the lab bench. Other flexible light sources have been made with a nylon base. Light output visible here resulted from the application of 250 volts at 4000 cycles.

COMPUTER LANGUAGE TRANSLATOR

Rapid interchange of data is now possible between different types of electronic computers and data processing equipment by means of the Electronic Engineering Company's new Computer Language Translator.

Magnetic tapes recorded in the format of one computer can be translated and recorded on another magnetic tape directly usable by a different computer. Translation operations which have required several hours using punched card methods can now be accomplished in seconds.

The Computer Language Translator can also convert punched cards or punched paper tape to magnetic tape. Data recorded on magnetic tape can be converted to punched cards, paper tape or line printer.

The equipment has been designed on the building block principle to provide the flexibility necessary to adapt the system to the wide variety of requirements en-

(continued on page 58)

"I'm in the business and I know..."

"Not too long ago I was in the same situation you fellows are in now. Senior year and the big decisions. What am I going to do with my education? What am I going to do for a living?

"Well, I talked to a number of people and did as much letter writing and looking around as I could. The way I figured it, I wanted opportunity . . . a fair chance to put my capabilities to work and to be recognized for what I could do. Of course, I wanted to be well paid, too. It all seemed to add up to the aircraft industry . . . and to me it still does.

"In the space of just a few years I've worked on quite a few projects, important projects that some day may mean a great deal to this country. They sure meant a lot to me. And I wasn't standing still either. My salary and my responsibilities have increased with each promotion. That means lots of challenges, new and tough problems that we have to solve, but that's the way I like it. So, if you want some advice from this "old grad," choose the aircraft industry. It's the wisest choice, I'm in the business and I know."

Probably no other industry in America has grown so fast *and advanced so far* in a short time as has the aircraft industry. And yet there is no limit to how far man's inventiveness and imagination can push the boundaries. Radical new concepts that would have been unthought of just a few years ago are the drawing-board problems of today.

Truly aviation is still in the pioneering stage, and one of the leaders is Northrop Aircraft, which has been making successful contributions to our nation's defense for over 13 years. Projects such as the Snark SM-62, world's first intercontinental guided missile, have identified Northrop as a successful pioneer. And new aircraft such as the supersonic, twin-jet T-38 advanced trainer are maintaining this reputation.

Let us tell you more about what Northrop can offer you. Write now, regardless of your class, to Manager of Engineering Industrial Relations, Northrop Division, Northrop Aircraft, Inc., 1034 East Broadway, Hawthorne, California.

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CAN YOU FIGURE IT OUT?

Problem: Determine the digits represented by dots in the multiplication example at the right.

```
  .1...
x   417
-------
  .....
 ....
.....
-------
 9...057
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*Solution at bottom of page

Robert A. Pike tells what it's like to be . . . and why he likes being . . . a Research Physicist with IBM.

FIGURING OUT A CAREER?

Selecting a career can be puzzling, too. Here's how Bob Pike found the solution to *his* career problem—at IBM:

"I became interested in computers and transistors at college," Bob Pike recalls. "Upon graduation, I naturally turned to the computer field. IBM, as a leader in the field, looked like a good place for me." After a training period, he joined the Semi-Conductor Device Development Group in Research. Promoted to Associate Physicist soon afterward, his present assignment is leading a group of technicians in fabricating high-frequency, high-power PNP drift transistors. "These will be used as core drivers in a high-speed memory array," he says. His future? At the rate IBM and the electronic computer field are expanding, Bob Pike foresees excellent opportunity for advancement in the area of his choice.

* * * *

There are many excellent opportunities for well-qualified engineers, physicists and mathematicians in IBM Research, Development and Manufacturing Engineering. Why not ask your College Placement Director when IBM will next interview on your campus? Or, for information about how your degree will fit you for an IBM career,

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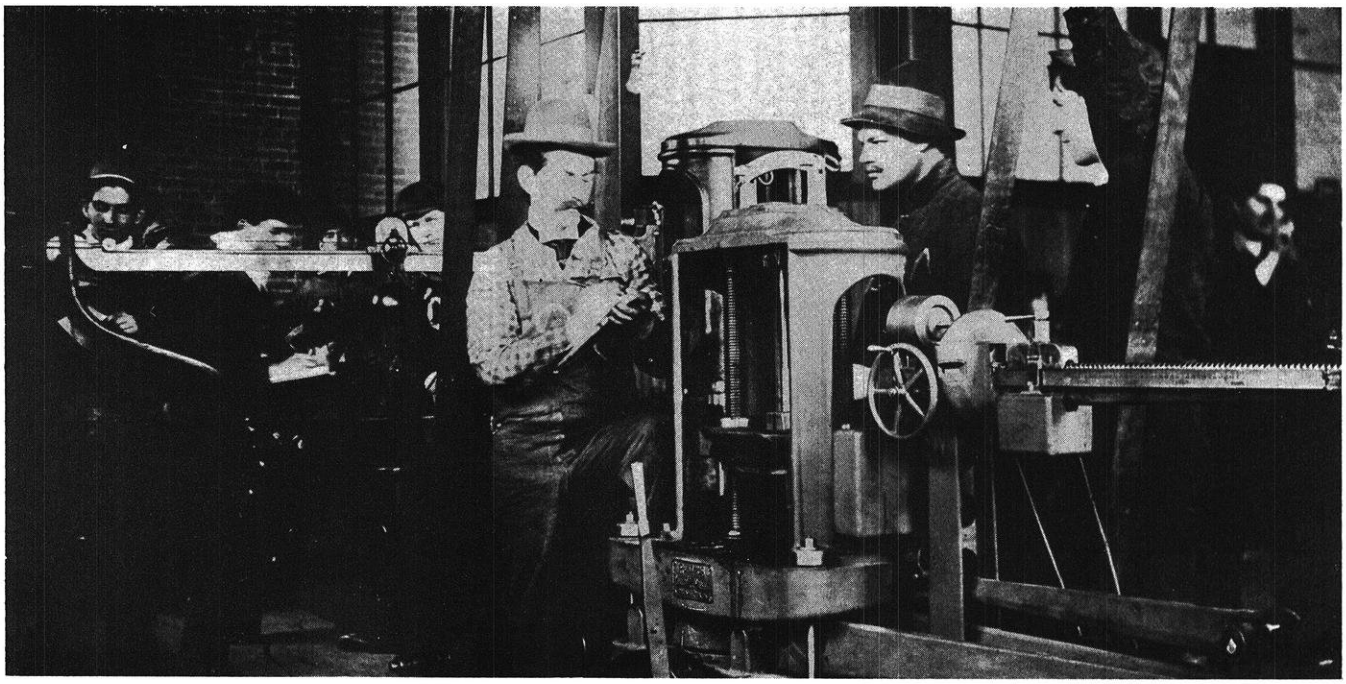
***SOLUTION**

Let the multiplicand be $D1CBA$. Since the units digit in the answer is 7, the only value possible for A is 1. This also fixes one of the dots in the hundreds column as a 1; to get a 5 in the answer, the other dot must be a 4. Hence B can only be a 2. Similar reasoning will determine C as 9 and D as 2. Answer = 21921.



THE OLD—

AND THE NEW.

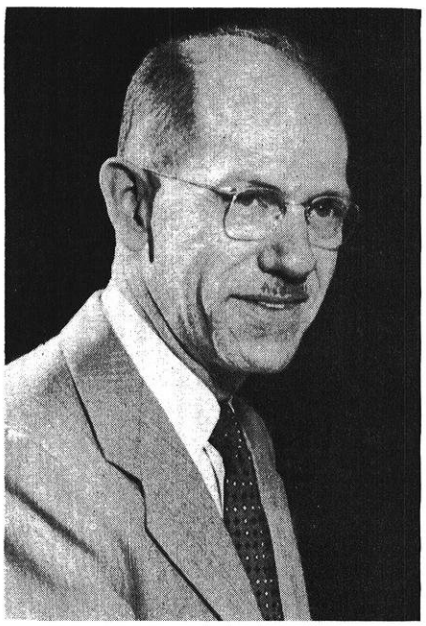
High School Section

Compiled by Russell Jacobson e'58

We of the Wisconsin Engineer staff want to take part in relaying all the information we can concerning engineering, to the high school student contemplating engineering as a career. To accomplish this we have asked a group of the top educators at this university to comment on engineering and its advantages and to give a concise resume of the opportunities available in the five different fields of engineering. The section is concluded with a series of typical questions asked by high school students thinking of enrolling in engineering school.

Opportunities In Engineering

by Kurt F. Wendt
Dean, College of Engineering



Kurt F. Wendt.

A FEW, short years ago the introduction of jet propulsion heralded a new age in transportation. Today our efforts are concentrated on rockets, missiles, and satellites. We are already exploring outer space, planning trips to distant planets, and discussing "space law" in the confidence that man will soon be called upon to govern vast new portions of our universe. On every hand we hear about the need for more and better training in the basic sciences and in engineering. Hundreds of letters from high school students and their parents ask: "What is engineering? What does the engineer do? Should I be an engineer?"

Engineering is the art and science directed toward the adaptation of materials found in nature into useful forms, and the harnessing and conversion of natural forces into useful power by efficient and economical means.

The profession is commonly divided into six major fields: chemical, civil, electrical, mechanical, mining and metallurgical engineering, each with many sub-divisions. Recently the special field of nuclear engineering, which draws upon all the other fields, has come into prominence, especially at the graduate level.

Manufacturing and processing of substances from raw materials through carefully controlled chemical and physical changes comprise the field of chemical engineering. Civil engineering, the oldest branch, at one time included all engineering of a non-military character; the main divisions are structural, sanitary, hydraulic, and transportation engineering. Electrical engineering has two main divisions: power engineering, which is concerned with the generation, transportation, and application of electrical energy; and the broad field of communications and electronics which includes telegraph, telephone, radio, radar, television and control. The mechanical engineer deals chiefly with the design and construction of machines for the generation or transformation of power, the design and production of machine tools, and industrial planning and management. The mining engineer searches for and extracts all classes of minerals from the earth; the field naturally divides itself into mining geology, mining engineering, and mineral dressing. The metallurgical engineer extracts metals from their ores and subsequently refines and combines metals to produce alloys possessing special properties.

In the following pages you will find detailed statements about each of these fields of engineering. Many combinations of engineering and agriculture, commerce, city planning, light building industry, or law are also possible and provide unusual opportunities for qualified students. Anyone interested should write for a pamphlet giving further information about "combined programs in engineering."

We are frequently asked why we do not offer a program in aeronautical engineering. The aeronautics field draws on all of the basic fields for its specialists. Mechanical engineering furnishes the men for power design, civil for structural design, electrical for the electronic gear and controls, and so on. Students in any curriculum may elect courses in aerodynamics and other aeronautical specialties in their last two years.

A new graduate program leading to the Master's degree in Nuclear Engineering has just been inaugurated. Students in any branch of engineering can qualify for entrance by planning their undergraduate programs with care and by including a series of advanced courses in mathematics, physics, heat transfer, and nuclear engineering as electives.

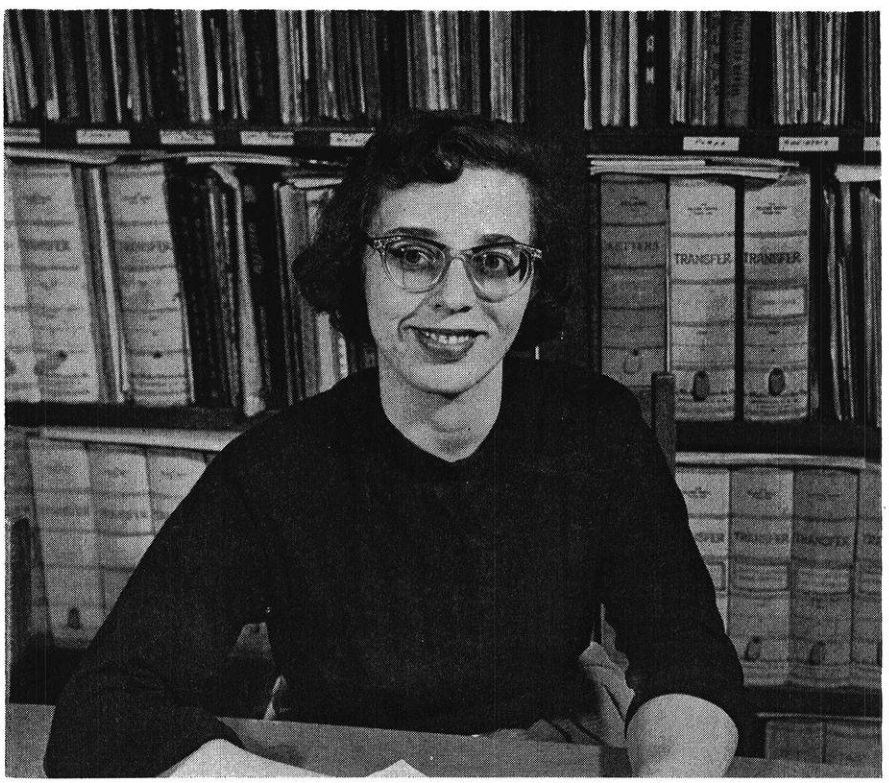
Emphasis on basic sciences and mathematics is increasing. More physics and mathematics are being required in every engineering curriculum. A year ago we announced that for admission to the first course in mathematics in engineering it would be necessary for the student to present the equivalent of four years of high school mathematics including advanced algebra, solid or analytic geometry, and trigonometry. Students not qualified must take preparatory courses and must also expect to spend extra time in catching up. New developments in engineering are so complex that advanced graduate training is becoming increasingly important. The day is not far distant when one-quarter to one-half of our undergraduates will find it profitable to continue their studies at least to the Master's level.

Regardless of field, many areas of work and a large variety of

(continued on page 68)

What Should I Do?

by Lois B. Greenfield
Director, Engineering Education Research



Lois B. Greenfield.

YOUR high school career involves a great deal of decision-making. What would I like to do? At what would I be most happy? What courses should I take? How can I best prepare for the future? These questions are pertinent, and each of you must take the responsibility for determining the final answers for himself.

High school should be a time for exploration of interests and aptitudes, as well as for the development of habits and skills. Any student interested in carefully planning his future will delve into as many avenues as are open to him, become familiar with as many jobs as he can. He will self-critically examine the areas in which he performs best, the kinds of activities which interest him most. He will constantly be looking for new fields or developments which might prove stimulating to him. He will look, listen, and read. He will consult his teachers and parents and friends for their opinions, so as to gain a more objective evaluation of himself.

The wise student will use his time in high school to develop efficient study habits, to learn to plan his time effectively, and to work with concentration. Many talented students have difficulty when they come to college because they cannot do these things, because they do not know how to study or utilize their talent.

Grades become increasingly important as you progress from high school to college, and may be decisive in gaining admission to college. Strive for the best grades you are capable of making. It's not enough to "just get by".

You may not know as yet what college you wish to enter, nor what courses you wish to take. You must, therefore, plan your high school career so that you will be able to enter any college you choose, or take any course. The basic requirements for entrance into *any* college include 3–4 credits in English, 2–4 credits in a foreign language, 1–2 credits in social studies or history, one credit each in physics and chemistry, and four credits in mathematics, distributed as follows: algebra, 2; plane geometry, 1; solid or analytical geometry, ½; and trigonometry, ½. As you approach graduation, write for the catalogue of colleges you are considering, and make sure you meet the requirements for admission. You may be able to enter college with deficiencies in a particular area, but this involves loss of *your* time. Better to enter free and clear.

Simple course credit is not enough. Many colleges now give placement tests to entering freshmen. If you have studied hard, and learned as much as possible, you may be able to eliminate certain requirements in college, and thus have more time to devote to other interests.

Now is the time to consider the importance of effective study habits, good grades, and proper course preparation. Remember, "A word to the wise . . ." It's your decision.

Career Opportunities in Engineering

by James A. Marks
College of Engineering, Placement Director

James A. Marks.

IN SPITE of the recent decrease in business activity and subsequent increase in unemployment the demand for engineers is still good. There is little question that the shortage of engineers as it existed for the past few years has diminished, but the long range opportunities in engineering are still excellent. Certainly the engineering graduate still has an advantage over most other college graduates when he looks for his first job after graduation.

The number of companies that are visiting the campus to interview graduating engineers is still high and the number of openings that are available make it possible for the new engineering graduate to find the kind of work he wants. Companies that are looking for engineers, however, are being much more selective. Scholastic achievement, extra curricular activities, personality, character, and all of the other factors that employers look for are being more critically examined.

At the same time, the increased competition for better students has meant that starting salaries are not only staying as high as they have been in the past but in many cases are increasing. It is not unusual for the graduate engineer to receive a salary of $6,000 during his first year after graduation. There is every reason to expect that starting salaries will continue to rise at least as much, if not more, than general income levels rise. Certainly engineers can expect handsome financial rewards in the years to come.

Of course salary should not be the prime reason why anyone should choose a career in engineering—or in any field, for that matter. Instead the individual should consider the kind of work he (or she) will be doing and whether or not he will be happy doing it. While this might imply that only those who have a deep interest in things mechanical, for example, would consider engineering it should be pointed out that for many jobs normally considered to be non-engineering in actual practice virtually demand an engineering background.

Sales, production supervision, management, and many other jobs have become exceedingly technical in nature and an engineering education is a real asset in almost any field. Under these circumstances the high school student who has the ability will find an engineering education to be better basic training than perhaps any other field. Even though he's not sure what type of work he would eventually be interested in, an engineering background will always be valuable.

A vital part of engineering that is too often overlooked is engineering education. The demand for engineers will obviosuly provide more and more opportunities in the teaching of engineering. The individual who would enjoy a career in education and who has the ability to pursue engineering will find an extremely bright future in engineering education.

The placement office of the College of Engineering has expanded along with the increased enrollment of engineering students and the need for engineering graduates. Of course, the primary purpose of the placement office is to provide facilities and information for seniors when they begin looking for a job and give counsel and advice to those who want help.

This spring almost 1000 representatives from companies throughout Wisconsin and all over the country will visit the campus to interview seniors. These companies provide literature and other information about the opportunities available. The seniors examine this material, interview companies that are interesting to them and in most cases visit the companies before accepting an offer.

Although many seniors must enter military service after graduation, most companies will hire them, even for just a few weeks, and then grant military leave. Or if the graduate prefers he can use the placement office after returning from service. At any time all College of Engineering alumni can use the placement office if they wish to relocate.

A new approach is also developing in terms of summer employment for engineering students while still in college. Even after the freshman year it is possible to find summer work in some phase of engineering. The placement office has thus become important to students all through their college career, as well as during the senior year. Besides just providing a chance to earn money the student can gain worthwhile experience in summer work and see how his

(continued on page 68)

Are You Ready for College?

by K. G. Shiels
Assistant Dean and Freshman Advisor

K. G. Shiels.

A LARGE number of the students who enter the colleges and universities of this country each year find themselves in scholastic difficulty at the end of their first term and the situation in our College of Engineering is no exception. Our experience in counseling with freshmen engineers clearly shows that inadequate preparation, poor study habits and lack of aptitude for the course selected are some of the factors which lead to unsatisfactory performance.

In a recent article, a College Dean suggested the following method of self-analysis involving eight questions to be answered by the prospective college student:

1. "Can I write five consecutive paragraphs on a given topic and express myself coherently, correctly and intelligently?"
2. "Can I read an article in the "Atlantic Monthly" rapidly (400–500 words per minute) and comprehendingly, and retain the main arguments lucidly in mind for three days?"
3. "Do I know how to prepare successfully for examinations, so that I don't become confused, panicked and ineffectual when I face the necessity of taking a test or examination?"
4. "Can I listen to an address or lecture and note briefly the main points so that, when I've gone home, I can reconstruct the essential theme of what the lecturer said?"
5. "Can I go to the library and find quickly the reference and source books I need for preparing a paper and take the necessary notes effectively for writing an assignment of the topic?"
6. "Can I make up a budget for the daily use of my time to meet all my necessary assignments, have a proper amount of time left for eating, sleeping and wholesome recreation, and stick to that budget in spite of all the lures of the flesh and the devil?"
7. "When I have homework to do, can I settle down to it properly and concentrate on my work at once without daydreaming and frittering away my time?"
8. "Have I learned how to systematize? Can I put order and system into my thinking—my notetaking—my outline before writing a theme—my schedule of study—my schedule of daily reviews?"

If you can answer "Yes" to all of these queries, you have acquired study habits adequate for success in college. If you are deficient in some of these abilities, now is the time to do something constructive about them unless you are willing to enter college with one or two strikes against you.

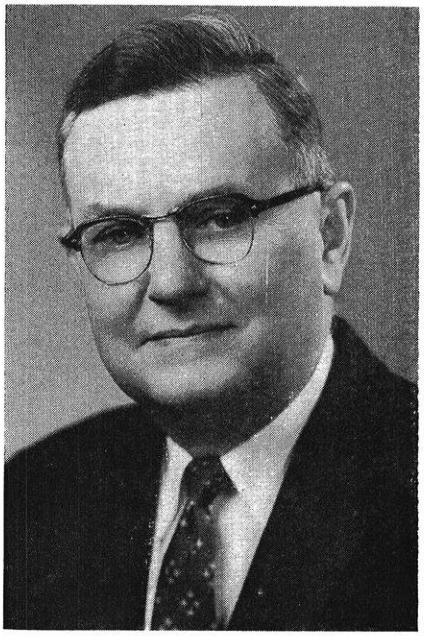
Many students enroll in college with an interest and a desire to study in a definite field but with little information regarding their aptitude for mastering the fundamental subject matter. The services of the Student Counseling Center will be available this coming summer to students who expect to enter the University of Wisconsin at Madison next Fall. If you are in doubt regarding your chances for success in the field of your choice, you may take this opportunity to obtain expert information regarding your aptitudes and interests. All students who have submitted their school records and have been granted permits to enter the University will be sent complete information regarding this service by the Office of Admissions.

Good high school preparation, satisfactory study habits and adequate aptitude coupled with determined application and the will to do your best will bring you well on your way to success in your College studies.


CHEMICAL
ENGINEERING

Chemical Engineering

by Professor R. A. Ragatz
Chairman, Chemical Engineering Department



R. A. Ragatz.

Professor Ragatz is a true native of Wisconsin, born in Prairie du Sac, receiving his BS, MS, and Ph.D. at the university, the latter in 1931. He has done some specialty work in Plastics and is now in the process of writing a book.

THE chemical engineer translates the laboratory discoveries of the research chemist into large-scale manufacturing operations. The research chemist almost always works with small-scale equipment in a laboratory. His equipment is usually made of glass; his product yields are small, usually a few grams at most. The chemical engineer, on the other hand, designs and operates the large-scale apparatus needed to produce the desired material in commercial amounts.

The chemical engineer finds employment with companies engaged in the manufacture of gasoline, fuel oil, lubricating oil, greases, asphalt, rocket fuels, synthetic rubber, rubber products, synthetic textile fibers, synthetic detergents, soaps, insecticides, weed killers, sulfa drugs, and anti-biotics. The chemical engineer produces a host of "petrochemicals" such as toluene, formaldehyde, ethyl alcohol, ethylene glycol, and benzene. The pulp and paper industry and the plastics industry employ many chemical engineers. In all of the foregoing manufacturing activities, research chemists and chemical engineers form a coordinated team.

The manufacturing processes in which the chemical engineer engages are usually quite complex and require a series of well-defined processing steps, some of which are chemical in nature and some of which are essentially physical in character. Typical chemical processes are polymerization, sulfonation, chlorination, nitration, hydrogenation, oxidation, reduction, hydrolysis, and alkylation. Typical physical operations are pumping of fluids, transport of solids, heating or cooling of materials, crushing and grinding, mixing, filtration, drying, absorption of gases by liquids, solvent extraction, crystallization, distillation, and evaporation. Chemical engineers select the various chemical and physical operations needed to make the desired product; they work out the best conditions for each step; they design the equipment needed for each step; they build and operate the complete plant.

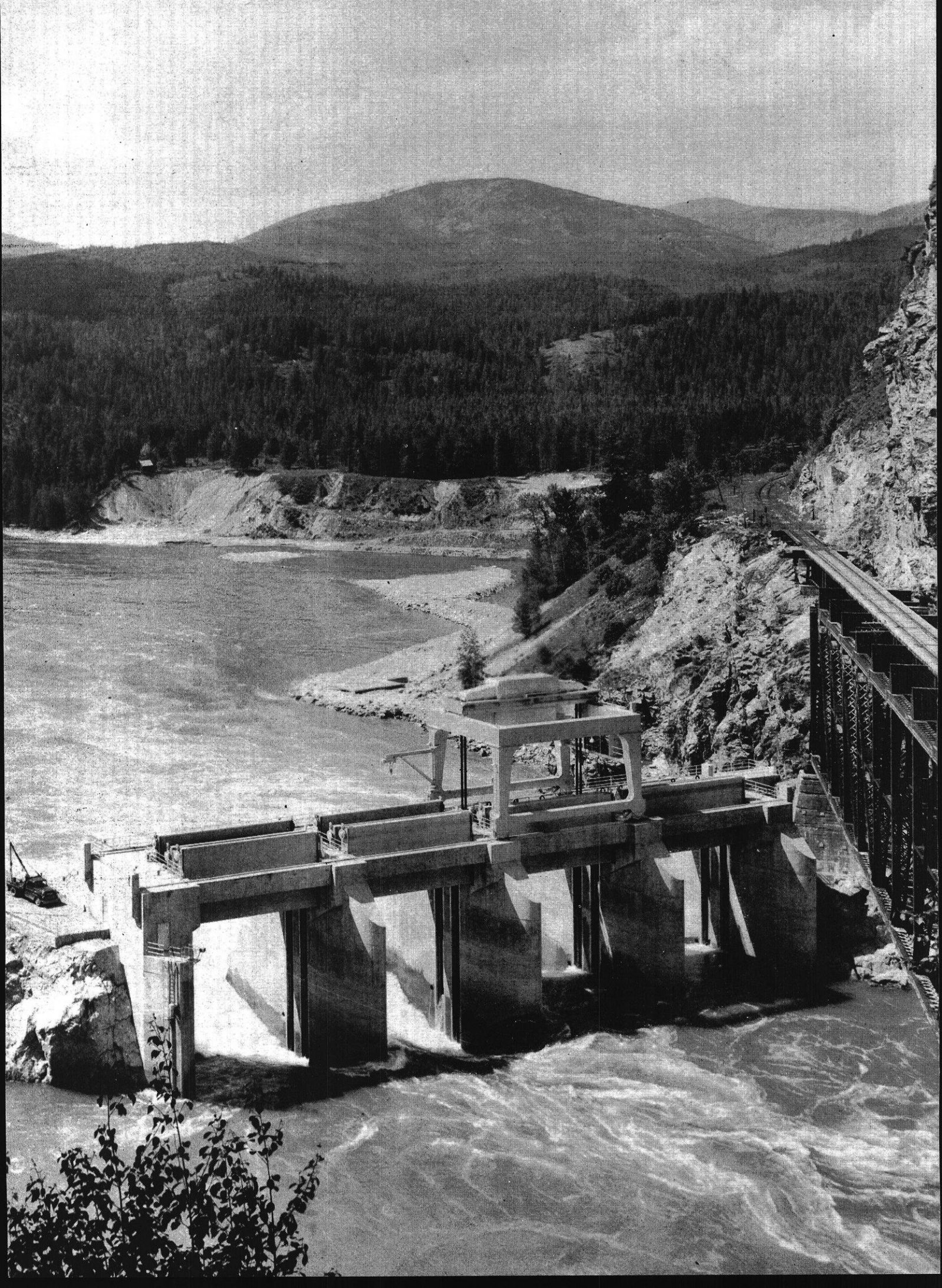
In a large company employing many chemical engineers, the type of work carried out by a particular individual may be restricted to one of the following general lines of activity: development, production, maintenance, process control, inspection and testing, design, construction, technical sales and customer service, administration. If a chemical engineer works for a smaller company, his duties probably will encompass several of the foregoing types of work.

The Department of Chemical Engineering has excellent instructional facilities. The Chemical Engineering Building, which was occupied in the fall of 1952, has well-equipped undergraduate laboratories for instruction in unit operations, chemical manufacture, process measurements and control, applied electrochemistry, plastics, and technical analysis. Facilities for graduate MS and PhD thesis projects are also provided.

The curriculum in chemical engineering has, for many years, been accredited by the American Institute of Chemical Engineers and also by the Engineers' Council for Professional Development. The curriculum is constantly under scrutiny, and periodic changes are made as called for by new scientific discoveries and changed industrial conditions. After an extensive study extending over a period of a year and a half, a revised curriculum was adopted and placed in operation in the fall of 1957.

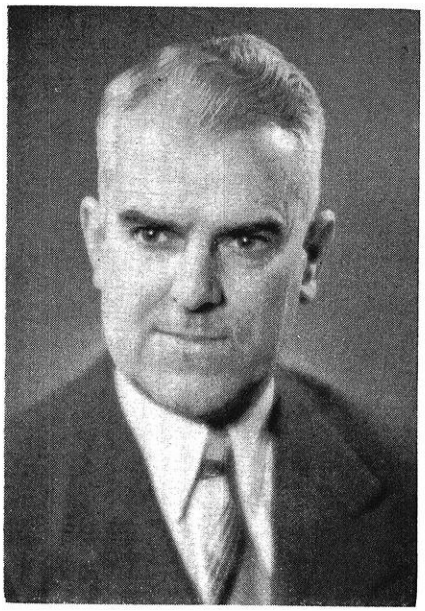
The tremendous growth of the chemical industry since World War II has created many employment opportunities for graduates from the chemical engineering course. Prospective students should bear in mind, however, that Wisconsin has relatively few chemical industries, with the result that most of our graduates secure employment outside of the state. A notable exception is Wisconsin's large pulp and paper industry, in which many of our graduates have secured employment.

The new Chemical Engineering Building on the University of Wisconsin campus.



Civil Engineering

by Prof. James G. Woodburn
Chairman, Civil Engineering Department



James C. Woodburn.

Prof. James G. Woodburn has been Chairman of the Department of Civil Engineering since 1949. He was born in Bloomington, Indiana, and received his BA and MA from Indiana University, his BS from Purdue, and his PhD from the University of Michigan. He taught at the State College of Washington for several years before coming to Wisconsin. He has specialized in Hydraulic Engineering and the legal phases of engineering, and is co-author of the Hydraulics text used in several university courses.

CIVIL engineers have always been connected with the development of transportation systems. The great advance in the nineteenth century was in the building of our railroads, which still employ many engineers in operation and maintenance. The mid-twentieth century sees continued expansion of highways, airlines, and pipelines. The growth of highway traffic that has resulted from increasing population and establishment of new industries has led to the rapid building of expressways and tollroads. The development of airports and allied facilities, not only in this country but all over the world, has been phenomenal. Pipelines are a highly favored mode of transportation for petroleum products and natural gas. The civil engineer occupies a prominent place in the planning, surveying, designing, constructing and operating of all these transportation facilities.

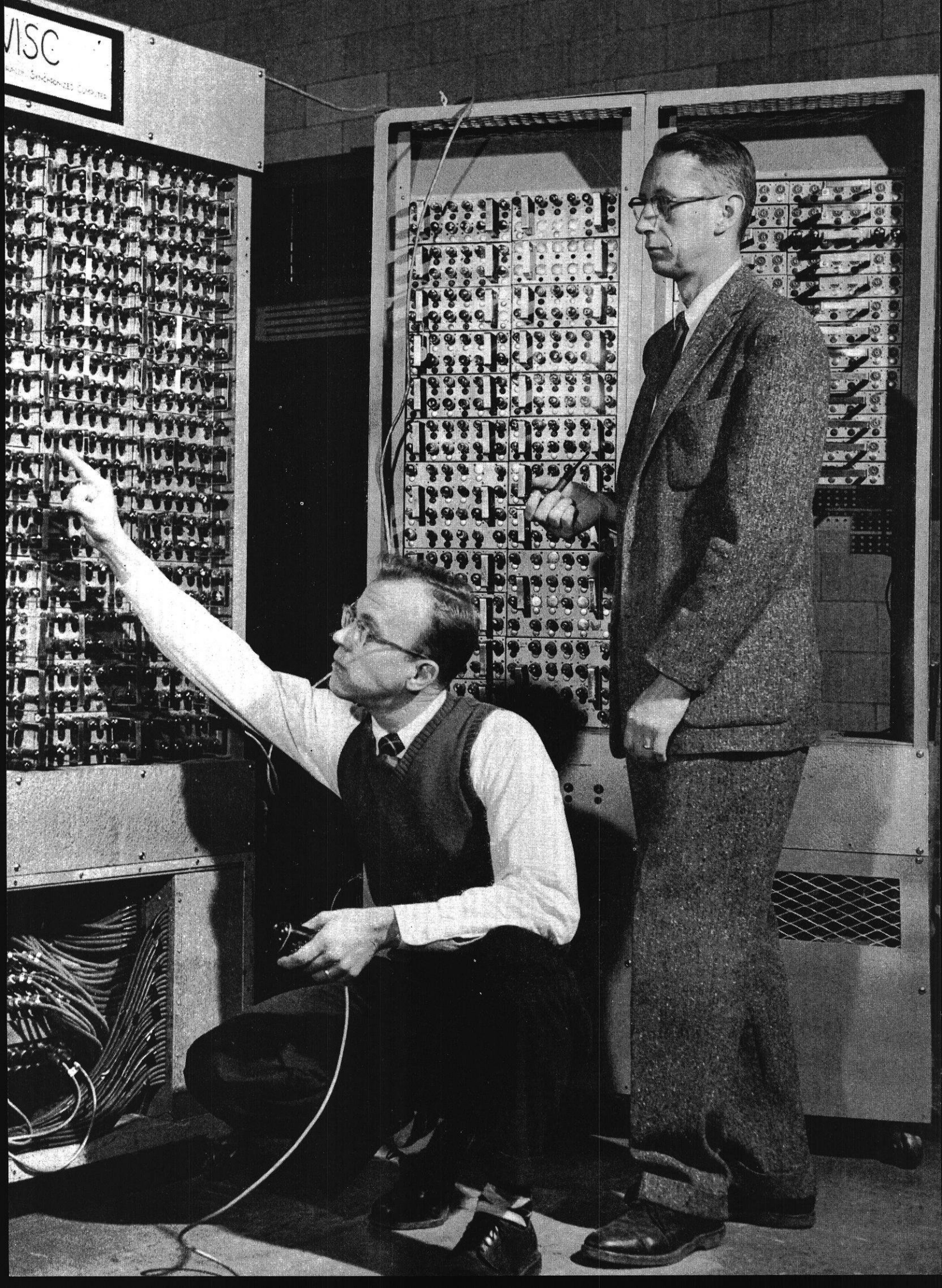
Another field that continues to be attractive to civil engineers is that of structures. There is increasing demand for more housing, shopping centers, office space, public buildings, factories, and other structures of all kinds, both large and small. Civil engineers are associated with architects in the design and construction of large steel and concrete buildings, with contractors in the design and building of homes and apartments, and with public agencies in city planning, redevelopment of slum areas, and laying out of parks and playgrounds. Most spectacular in the field of structural engineering is the construction of great bridges. Many have been built, others are under construction, while still longer and larger ones are being planned for the future.

With growth in population comes also increased demand for civil engineers to provide safe and adequate public water supplies and to build sewerage systems and treatment plants which will return waste waters to the streams in a form least harmful to fish and other wild life and most satisfactory from the standpoint of use of the lakes and streams by the public. Civil engineers design and build flood control works to prevent or reduce damage from floods, improve river channels for the benefit of navigation, and provide port facilities for both inland and foreign shipping. Water power plants are designed by civil engineers and built under their guidance. Many engineers are engaged in land reclamation, either by the draining of swamp lands or by bringing irrigation water to dry lands from rivers or reservoirs through miles of canals and aqueducts.

Many civil engineers also find work as surveyors. Surveying is one of the first jobs to be done when an engineering project is undertaken. Surveys must be made to aid in determining the most economical and feasible routes for highways, irrigation canals, and pipelines. Such surveys have been greatly speeded by aerial mapping. There must be surveys of sites for bridges, buildings, dams, and airports. The proper laying out of housing and other municipal developments depends largely on detailed surveys of the proposed sites. Surveyors also locate property lines and determine areas, and thus help to settle disputes between land owners. Much of our country's area still remains to be mapped in detail and many surveyors are engaged in that work.

As with any profession, the future of civil engineering depends on maintaining a continuing supply of young persons who are eager and qualified to enter that profession. The usual road to becoming a civil engineer leads through years of training in a college of engineering. The colleges cannot operate without teachers, and there are many opportunities these days in the engineering teaching profession for young people who have done well in their college work, who have gone ahead to take graduate work, and who also have acquired some practical experience.

The main spillway of the Box Canyon hydro project near Lone, Washington.


VISC

Electrical Engineering

by Professor H. A. Peterson
Chairman, Electrical Engineering Department

H. A. Peterson.

Prof. Harold A. Peterson has been Chairman of the Department of Electrical Engineering since 1947. He is from Essex Iowa, and received his BS and MS (with high distinction) from the University of Iowa. He is a Fellow in AIEE, a Senior Member of IRE, and a member of several other engineering societies. He also holds eight patents in the field of electrical engineering.

ELECTRICAL Engineering is a young profession. Only seventy-five years ago on September 30, 1882, the first waterwheel driven electric generator was put in operation at Appleton, Wisconsin. Since that time growth and development of the profession have been phenomenal. Today, the American Institute of Electrical Engineers (AIEE) has over 50,000 members, not including student members. In addition, there are approximately 48,000 members of the Institute of Radio Engineers (IRE).

A few generations ago, electricity was available in the homes of only a few. Today, it is available in almost every home. Electrical engineers have been largely responsible for bringing this about. Today heavy tasks around the farm home, and other tasks in all homes, can be done quickly, efficiently, and without drudgery. The benefits of radio and television have been brought to many homes. These are some of the more obvious consequences of electrical engineering.

Electrical Engineering has expanded tremendously in scope in recent years. Automatic control theory, information theory, the transistor, new analytical techniques, analog computers, digital computers, extra high voltage power transmission, and many other developments, have been basically important in this expansion. The control of guided missiles; and the very special instrumentation problems associated with the recording of data, and transmitting such data back to earth from the satellites are largely the responsibility of the electrical engineer. The problems are fascinating and challenging, requiring much imagination and resourcefulness in obtaining solutions. Advanced training in science and mathematics is required for creative work in these areas.

At the University of Wisconsin our facilities in the Engineering Building are among the best in the country. Our course of study in electrical engineering is constantly under surveillance so that improvements can be made from time to time to keep in step with the needs and demands of industry.

There is a joint student branch of the AIEE-IRE on the campus with a faculty member in charge as branch counselor. This student branch elects its own officers, holds regular meetings, and sponsors activities of interest to student engineers. It affords a means for orienting students with regard to professional activities within the AIEE and IRE following graduation.

The University of Wisconsin offers excellent opportunities for study in electrical engineering. Young men and women with good high school records and a real interest in science and mathematics would do well to consider enrolling in this course of study which leads to a most interesting professional life of basic importance to our economy and security.

Two engineering faculty members operating the recently completed WISC computer located in the EE building.

Mechanical Engineering

by Benjamin Elliott
Chairman, Mechanical Engineering Department

Benjamin Elliott.

Professor Ben G. Elliott has been Chairman of the Department of Mechanical Engineering since 1948. He was born in North Platte, Nebraska and received his B.S. and M.S. from the Rose Polytechnic Institute, and the M.E. degree from the University of Wisconsin. A Fellow of A.S.M.E., he served as vice-president of the society from 1953 to 1957. He was a Director of the National Society of Professional Engineers from 1951 through 1954, and is active in numerous engineering and civic organizations.

IN THE home, the Mechanical Engineer has been responsible for our "domestic revolution" which has brought into the home the products of research and development—heating, cooling, refrigeration, kitchen and laundry equipment, and power tools of all types. He has electrified and mechanized the home as well as the farm.

A prospective Mechanical Engineer should have a pronounced interest and proficiency in mathematics and the physical sciences, should have imagination and inherent curiosity, and an interest in exploring new ideas and a desire to "build" and create.

A career in Mechanical Engineering usually begins by enrollment in an accredited college of engineering. The subject matter studied includes basic courses in mathematics, chemistry, physics, mechanics and materials, drawing and design, thermodynamics and heat power, electrical engineering, shop and industrial processes, economics and accounting procedures, language, speech, technical writing and human relations.

In addition to preparing young men and women for interesting and profitable technical careers, an engineering training is extremely valuable in other fields of activity. Many engineering graduates go into business, commerce, agriculture, law and public service. The number of engineers in responsible executive and administrative positions in industry, business and government is increasing.

The future for properly trained engineering graduates is excellent. Opportunities are numerous, starting salaries are relatively high and advancement depends upon ability and capacity, and the willingness to work hard.

Mechanical Engineering is one of the oldest branches of the engineering profession dating back to the early 1880's when the American Society of Mechanical Engineers was founded. It is concerned primarily with the design, production and operation of machines, tools, prime movers and manufactured products for all types of industry.

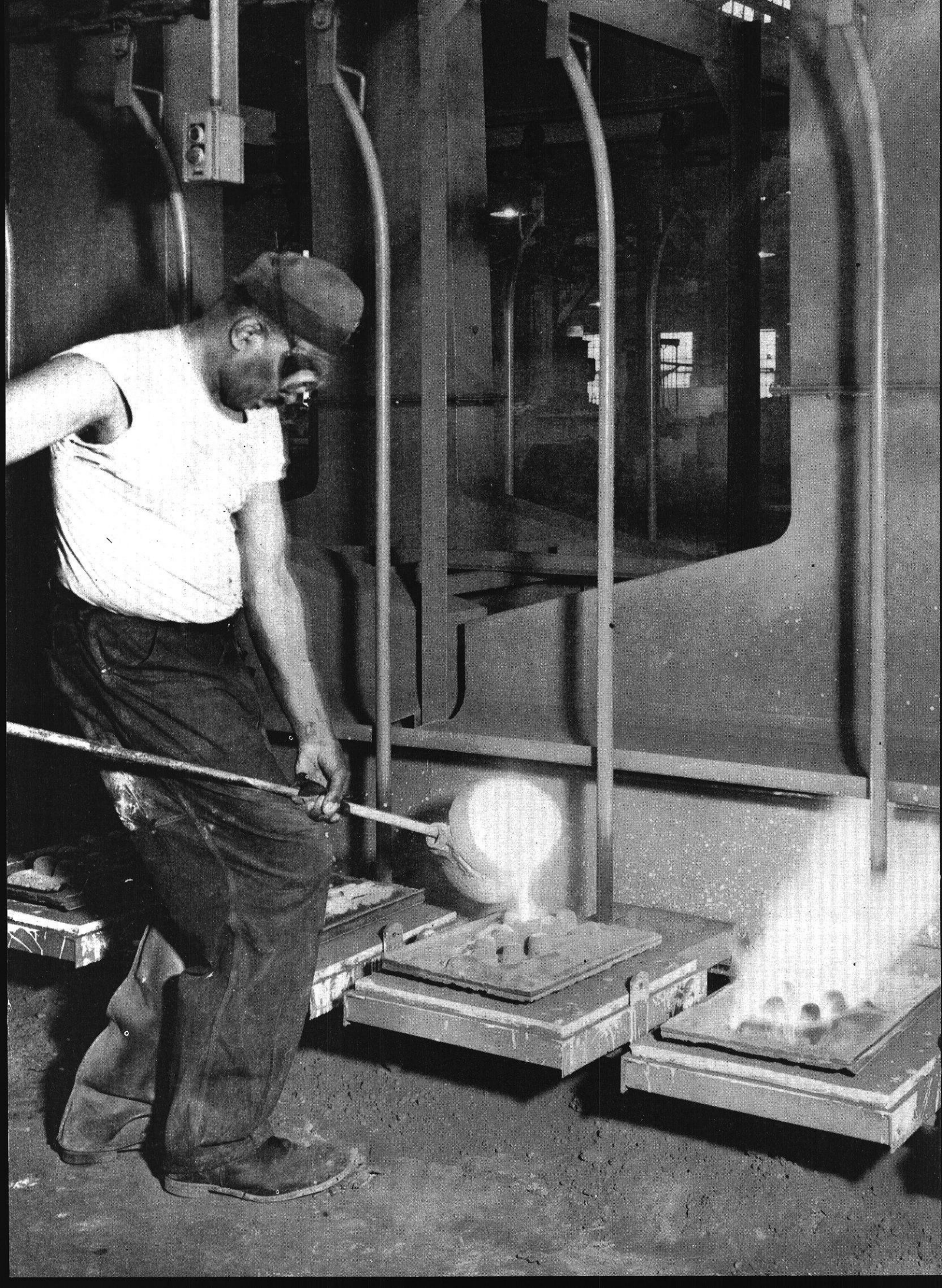
The Mechanical Engineer designs, develops and produces our vast array of "machine tools" which are the very foundation of our industrial age. He is also responsible for the generation of the vast quantities of energy which constitute the life blood of our present day economic and industrial society. One of his current problems involves the practical application and utilization of nuclear and solar energy. He also plays a major part in designing, producing and operating the elements of our vast systems of transportation and communications—automobiles, trucks and buses, locomotives, trains, aircraft and ships.

In the defense of our country and freedom, the Mechanical Engineer plays a key position. He designs and develops our jet aircraft, rockets, guided missiles and our space ships.

The Mechanical Engineer is a highly important factor in our great process industries—petroleum, coal, gas, iron, steel, paper, lumber and forest products. He is an integral part of the great printing industry and the production of our books, newspapers and periodicals.

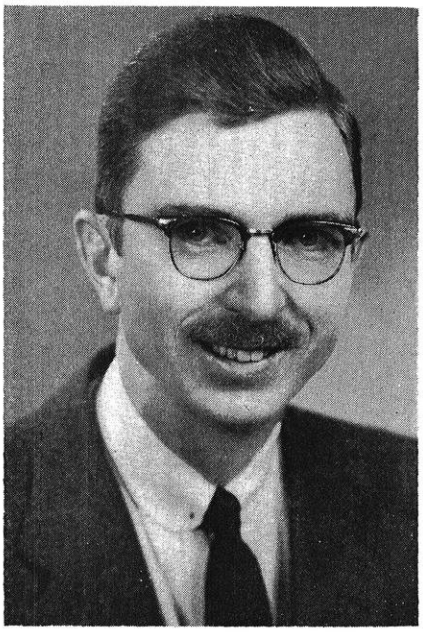
In the field of consumer goods, the packaging, handling and moving of the endless list of everyday articles is a particular activity of the Mechanical Engineer.

The Mechanical Engineering Building of the University of Wisconsin campus.



Mining and Metallurgical Engineering

by Professor P. C. Rosenthal
Chairman, Department of Mining and Metallurgy



P. C. Rosenthal.

This is Professor Rosenthal's third year as department head. He received his BS and MS in Metallurgical Engineering from the University of Wisconsin. He has been very active in the AFS and ASM, being chairman of several committees. He was co-author of "Principles of Metal Casting" and has just completed another book.

IF YOU were to examine a list of the elements and their properties you would find that the majority of them would be classified as metals. Further investigation into the use of these metals would reveal that almost everyone of them has some commercial application in the pure or alloyed form. A more intensive study, such as would be gained in a mining or metallurgical engineering program of courses, would establish that even many of the non-metals such as oxygen, carbon, phosphorus, etc., play an important part in metal processing and alloying. Thus the mining or metallurgical engineer deals with a wide variety of elements and combinations therof, and must understand the chemical and physical problems associated with their preparation and use.

Utilization of metals begins with the discovery and development of mineral wealth. This is the work of the mining engineer. The curriculum for mining engineering includes, in addition to courses in mine evaluation, development, and ore removal, related courses in geology, mineral concentration and chemical processing. There are also courses in related fields such as hydraulics, surveying, electrical engineering, and heat and power.

One option of the curriculum in this field concentrates on the geological aspects of mining. The graduate from this program is referred to as a geological engineer and would be primarily concerned with finding and exploring new ore bodies or oil fields. He would estimate the economic value of the ore and determine how it might best be extracted from the earth.

The mining engineer designs, constructs, and operates mining properties. He, in effect, begins where the geological engineer leaves off because his principal tasks are associated directly with the mining operation. He plans the method of removing the ore, designs the transportation system and handles related problems of ventilation, power supply, etc.

In the petroleum field, the counterpart to the mining engineer is the petroleum engineer. His job is to plan and operate the oil-drilling and pumping equipment and arrange for the storage of the crude petroleum. He should also be familiar with methods used to locate new petroleum fields.

Once the ore is removed from the earth, it must be processed further before the metal can be extracted. This is called mineral beneficiation, mineral dressing or mineral concentration. This field represents the link between mining on the one hand and metallurgy on the other. The mineral dressing engineer designs and operates plants for the separation of the valuable minerals from the waste products. This field is becoming increasingly more important as the richer ore deposits become exhausted and lower grade ores must be utilized. In Wisconsin, for instance, the use of the available low grade ores awaits development of economical methods for concentrating these ores to higher iron contents. The mineral dressing engineer uses many methods and devices for concentrating ores such as gravity separation, "heavy media" separations, and flotation. His program of study is much the same as that of the mining engineer but usually contains less mining and more metallurgical engineering subjects.

After the mineral dressing engineer has completed his work of concentrating the ore, the metallurgical engineer steps in to reduce the ore to the metallic state. In this work he may utilize heat, electricity, chemicals or a combination of these factors. Since this treatment usually involves chemical reactions, this metallurgical engineering field is called chemical or extractive metallurgy. An example of an extractive metallurgical operation is the reduction of iron ore in the blast furnace to produce pig

(continued on page 68)

Malleable iron is poured into shell molds on an overhead trolley conveyor.

What's Your Question?

HIGH school students have many questions concerning requirements and activities of college life. Following are questions and the respective answers pertaining to student life at the University of Wisconsin.

What educational program does the University of Wisconsin offer?

Students have the opportunity to study in almost all major areas of endeavor, including the humanities, arts, sciences, and social studies. In addition, preprofessional and professional opportunities are available in engineering, commerce, teaching, medicine, law, pharmacy, and many allied fields. All told, the University offers over 1,200 courses from which to choose.

What are the admission requirements?

The general method of admission is by presenting a certificate of graduation from an accredited high school with the recommendation of the principal. Sixteen units are the fundamental requirement, which for engineering must include four years of math, including advanced algebra, solid or analytic geometry, and trigonometry.

Does the University have an official grading system?

The University of Wisconsin marks on an alphabetical basis with the grade points per credit as follows:

"A" (Excellent) 4 grade points per credit
"B" (Good) .. 3 grade points per credit
"C" (Fair) ... 2 grade points per credit
"D" (Poor) ... 1 grade point per credit
"F" (Failure) . 0 grade point per credit

What are the semester fees?

In all colleges and schools except Law and Medicine the fees are $100 per semester for a resident of the state and $275 for a nonresident.

What housing arrangements are available?

Housing accommodations for single students include:

University Residence Halls, Cooperative houses, sororities, fraternities, the University YMCA, International House for graduate men, and rooms in private homes throughout the residential sections of the city. The University Housing Bureau is the clearing center for all student housing information and is located at 434 Sterling Court.

Does the student have any supervision in the planning of his courses and program?

Yes, the University operates on an advisory system whereby each new student is assigned a faculty adviser. The adviser is expected to help the student in the choice of his course and in the selection of a well-balanced program.

Is there additional counseling service available to students?

A trained staff is available to counsel students regarding personal, vocational, or academic problems. The Student Counseling Center is located at 740 Langdon Street.

What provisions do the University provide toward the maintenance of the health of the student body?

The services of the Department of Preventive Medicine and Student Health are available to students who are regularly enrolled in the University of Wisconsin. The Student Clinic and Infirmary are located in the West wing of Wisconsin General Hospital.

Are scholarships available for undergraduate students?

There are many scholarships available to deserving students. Scholarship information and application forms may be obtained from the Office of Admissions, 166 Bascom Hall. Mr. Field—114 Bascom.

Is there an ROTC program?

Freshmen and sophomores are required to take basic Army, Navy, or Air Force ROTC. Eligible Junior students may apply for advanced training.

Are student loans available?

Loans for educational purposes in amounts up to $250.00 are made for periods of less than a year to students in good standing, who have established a satisfactory academic record of at least one semester at the University of Wisconsin.

What are the possibilities of obtaining part-time work?

The Student Employment Bureau is often able to locate some kind of part-time work for those who desire it. Its address is 435 N. Park Street.

Does the University operate any Extension Divisions?

The University of Wisconsin operates Extension centers in Sheboygan, Milwaukee, Racine, Wausau, Green Bay, Kenosha, Manitowoc, Menasha, and Marinette.

How are the library facilities?

There are more than a dozen libraries, the chief among them being the Memorial Library and the Library of the State Historical Society.

Are there sororities and fraternities on campus?

There are sixteen sororities and thirty-four social fraternities on campus, with all but one maintaining resident houses for their members. In addition, there are many professional fraternities.

RCA ELECTRONICS KEEPS A RADAR "WEATHER EYE" ON YOUR COMFORT ON THE GREAT AIRLINES

Flying into a starless night, the pilot's vision may reach a mere 50 yards. Yet he sees a storm brewing 150 miles ahead.

Within minutes he plots a slight change in course and flies a smooth, safe corridor *through* the weather. His passengers complete their trip in comfort and on schedule.

Credit RCA Electronics for the "Weather Eye" radar that makes all this possible. And United Air Lines' all-radar fleet for being the first (among 24 leading airlines) to use this important development.

RCA pioneering also produced radar that guides ships at sea and tracks man-made satellites through space. RCA pioneered color television, produced the world's largest electronic computer, peanut-sized transistors and much, much more.

Progress like this helps explain why RCA *means* electronics — and why electronics means a happier, healthier, more secure future for you.

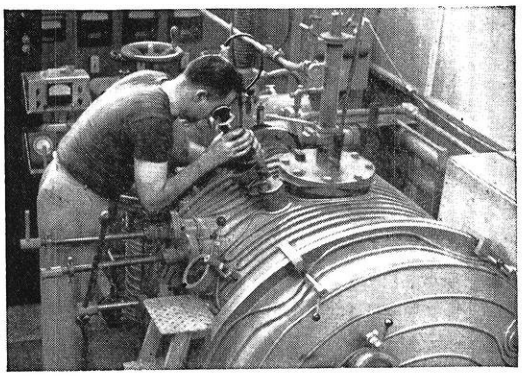
RADIO CORPORATION OF AMERICA

WHERE TO, MR. ENGINEER?

RCA offers careers in TV and allied fields—in research, development, design and manufacturing—for engineers with Bachelor or advanced degrees in E.E., M.E. or Physics. Join the RCA family.

For full information write to: Mr. Robert Haklisch, Manager, College Relations, Radio Corporation of America, Camden 2, New Jersey.

What's doing...



Vacuum melting has opened up new horizons for development of alloys. Here, a Pratt & Whitney Aircraft metallurgist is shown as he supervises preparation of an experimental high-strength nickel-base alloy, melted and cast under high vacuum.

Induction melted heat of high-temperature alloy being poured in P & W A's experimental foundry. Molten metal is strained into large water tank, forming metal shot which is remelted and cast into test specimens and experimental parts. Development and evaluation of improved high-temperature alloys for advanced jet engines is one of the challenges facing metallurgists at P & W A.

at Pratt & Whitney Aircraft in the field of Materials Engineering

The development of more advanced, far more powerful aircraft engines depends to a high degree on the development of new and improved materials and methods of processing them. Such materials and methods, of course, are particularly important in the nuclear field.

At Pratt & Whitney Aircraft, the physical, metallurgical, chemical and mechanical properties of each new material are studied in minute detail, compared with properties of known materials, then carefully analyzed and evaluated according to their potential usefulness in aircraft engine application.

The nuclear physics of reactor materials as well as penetration and effects of radiation on matter are important aspects of the nuclear reactor program now under way at P & W A. Stress analysis by strain gage and X-ray diffraction is another notable phase of investigation.

In the metallurgical field, materials work involves studies of corrosion resistance, high-temperature mechanical and physical properties of metals and alloys, and fabrication techniques.

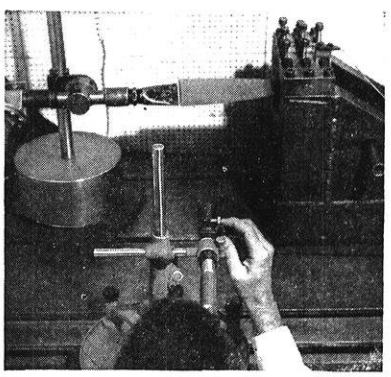
Mechanical-testing work delves into design and supervision of test equipment to evaluate fatigue, wear, and elevated-temperature strength of materials. It also involves determination of the influence of part design on these properties.

In the field of chemistry, investigations are made of fuels, high-temperature lubricants, elastomeric compounds, electro-chemical and organic coatings. Inorganic substances, too, must be prepared and their properties determined.

While materials engineering assignments, themselves, involve different types of engineering talent, the field is only one of a broadly diversified engineering program at Pratt & Whitney Aircraft. That program — with other far-reaching activities in the fields of mechanical design, aerodynamics, combustion and instrumentation — spells out a gratifying future for many of today's engineering students.

Engineer measures residual stress in a compressor blade non-destructively, using X-ray diffraction. Stress analysis plays important part in developing advanced aircraft engine designs.

The important effects of gases on the properties of metals have been increasingly recognized. Pratt & Whitney chemists are shown setting up apparatus to determine gas content of materials such as titanium alloys.



P & W A engineer uses air jet to vibrate compressor blade at its natural frequency, measuring amplitude with a cathetometer. Similar fatigue tests use electromagnetic excitation.

Pratt & Whitney Aircraft operates a completely self-contained engineering facility in East Hartford, Connecticut, and is now building a similar facility in Palm Beach County, Florida. For further information about engineering careers at Pratt & Whitney Aircraft, write to Mr. F. W. Powers, Engineering Department.

World's foremost designer and builder of aircraft engines

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation

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ENGINE EARS

by Wayne Rogers, me'59

ENGINEERING INSTITUTES

The University Extension Division has announced its list of Engineering Institutes for the second semester which includes 22 subjects from Engineering Photography to Welding.

After April 11 the Institutes will be conducted in the comfortable surroundings of the new Wisconsin Center Building on the corner of Lake and Langdon streets. They are presently held in T–16, Linden Dr. and Babcock Dr.

The following is a list of the Institutes offered for the coming semester:

Welding Applications . . February 12–14
Industrial Lubrication . . February 26–28
Bituminous Roads . . . . . March 3–5
Plastic Design of Steel Structures . . . . . March 12–14
Plastics Molding . . . . . March 19–21
Engineering Refresher (Basic Engineering) . . . . . March 24–25
Industrial Engineering Seminar On Maintenance Productivity . . . . . March 25–26
Industrial Research Organization . . . . . March 27–28
Effective Engineering Specifications . . . . . April 9–11
Engineering Refresher (Civil Engineering) . . . . . April 14–15
Air Utilization in Treatment of Industrial Wastes . . . . . April 15–16
Effective Drafting Operations . . . . . April 24–25
Engineering Photography . . April 29–30
Industrial Control Applications May 1–2
Engineering Refresher (Mechanical Engineering) . . . . . May 5–6
Industrial Product Design . . . . May 8–9
Seminar for Chief Industrial Engineers . . . . . May 13–14
Power Plant Practice . . . . . May 20–23
Engineering Organization . . . May 22–23
Engineering Refresher (Electrical Engineering) . . . . . May 26–27
Industrial Packaging . . . . . May 27–28
Consulting Engineers—Professional and Management Problems . June 5–6

Contact Engineering Institutes, University Extension Division, The University of Wisconsin, Madison 6, Wisconsin for enrollment blanks or additional information.

ASME PROJECT

A leading Russian technical journal will soon be translated into English on a regular basis by The American Society of Mechanical Engineers, it was announced today. The effort marks the first time that the engineering society has undertaken such a project.

Under a $35,000 grant from the National Science Foundation ASME will publish the bi-monthly "Journal of Applied Mathematics and Mechanics."

The announcement noted that the Society had undertaken the task of translation "in an attempt to correct the present situation in which the Russians are familiar with the content of most, if not all, of our technical publications, while only a few of theirs are translated for use by the English-speaking world."

Arrangements have been made with Russian scientists, said an ASME spokesman, to secure proof sheets of the Russian journal in advance of final printing, to permit speedier translation.

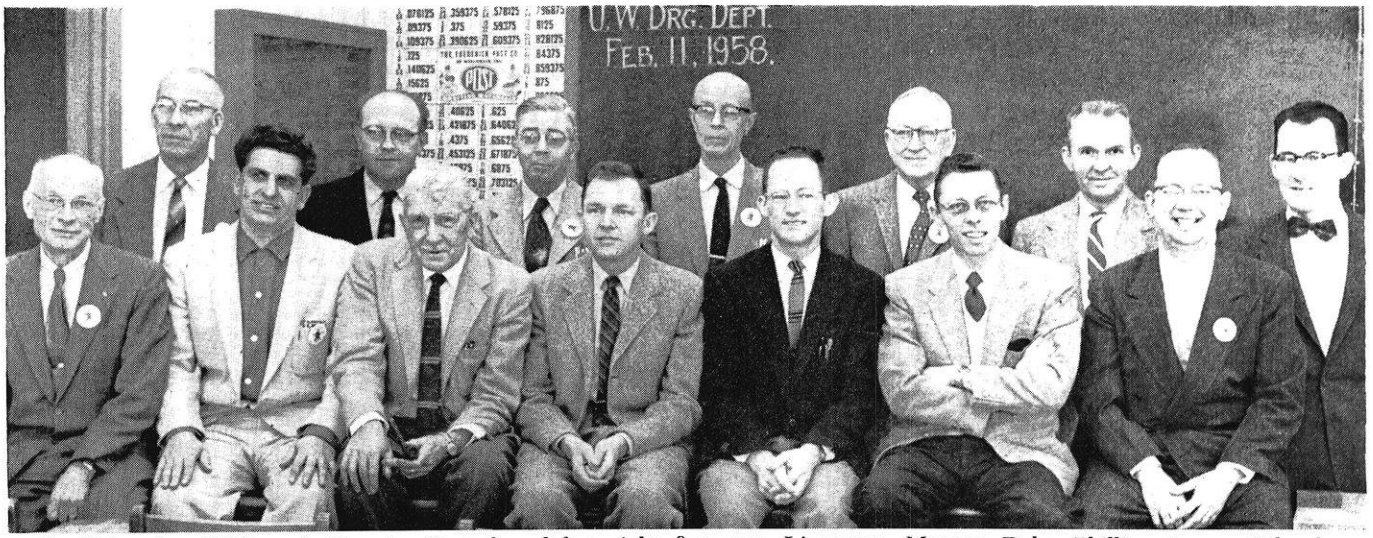
In the Russian language the magazine is known as "Prikladnaya Matematika i Mekhanika", usually abbreviated as "PMM".

The magazine contains the latest theoretical and practical advances made by Russian scientists in mathematics, fluid dynamics and solid state physics. Copies will be sold, on a subscription basis, to any interested persons or groups at an annual rate of $35 for the six issues. ASME members are entitled to a 20% discount. Subscriptions may be ordered from the Order Department, The American Society of Mechanical Engineers, 29 West 39th Street, New York 18, New York.

In a statement accompanying the announcement, James N. Landis, ASME President said, "Translation of the Russian publication "Journal of Applied Mathematics and Mechanics," one of the leading publications of its kind anywhere in the world, is expected to make important technical contributions to the English-speaking world. It will provide many English-speaking engineers and scientists with access to the latest U.S.S.R. developments in a truly fundamental field. It is a service in which The American Society of Mechanical Engineers is happy to take part, and to lead the way.

"In addition to making information available, however, the very initiation of such a project is a valuable contribution in itself. It serves to underline the universal nature of science and engineering, and to emphasize that in these fields there are no natural boundaries between nations. It is my hope that this project, together with the benefits that are sure to follow, will help to break down some of the artificial barriers that now exist, and that from such relatively modest beginnings as these, better international understanding will grow and flourish."

Publication begins with the first 1958 issue, of which 2500 copies will be printed. The exact date of appearance is uncertain, according to the announcement, because the



The University of Wisconsin Drawing Dept. from left to right; first row: Livermore, Manner, Doke, Phillips, Jensen, Schwehr, Schwebke; second row: Shiels, Barry, Worsencroft, Griffith, Morris, McCollough, Leidel.

first issue of the year has not yet appeared in Moscow.

Professor George Herrmann of Columbia University will serve as editor of the translated magazine.

Efforts to have the journal translated were initiated by the Applied Mechanics Division of ASME. The Society's Board on Technology approved the suggestion and arranged to secure the grant from the foundation.

AIEE–IRE

The members of the AIEE and IRE wish to take this opportunity to commend Al Bahr and his committee for the fine job done on the exhibit in the M.E. lobby. The exhibit is to be replaced by another on March 15, so if you have not already seen it, there is not much time left.

Bill Serstad reports that although the basketball team did not break any scoring records they had a great deal of fun and that's the main thing after all. Thanks for handling the team, Bill.

The Electrical Engineering department got off to a very good start in the St. Pat contest this year with a total of 30 button design entries, one of which took second place. The society's St. Pat candidate is Don Clarson.

The "Putting Hubby Through" committee headed by Dave Chapman reports steady progress. For the benefit of those who have not heard of this project, it is planned to present the wives of engineering graduates with a diploma for their help in "putting hubby through" college. The diploma is to be as near a duplicate of the BSEE degree as possible.

The newly elected men who will represent the EE's on Polygon board are Tom Damm for the IRE and Al Goshaw for the AIEE. The alternates are Dave Chapman and George McCormick.

The joint meeting of the AIEE-IRE student branch and the local chapter which was held on Jan. 15 in the Memorial Union was attended by quite a few students despite the fact that a large number of exams were given the same week. There were many who missed the beer and pizza because of this, however.

Officers

President—Russ Jacobson
Vice-President—Wayne Stiede
Secretary-Treasurer—Bill Haas

Committees

Publicity—Paul LeMere
Membership—Carl Kaack
Putting Hubby Through—Dave Chapman
Basketball—Bill Serstad
Exhibit—Al Bahr
Paper Competition—Phil Hein
Refreshments—Jim Czeck
Program—Wayne Stiede

CIVIL SERVICE EXAMS

The United States Civil Service Commission announces that there is still need in the Federal service for Engineering Aids, Physical Science Aids, Engineering Technicians, and Physical Science Technicians. The salaries range from $3,175 to $5,440 a year.

To qualify, applicants must have had appropriate experience or a combination of education and experience. For positions paying $3,670 and below, appropriate education alone may be qualifying.

Further information and application forms may be obtained at many post offices throughout the United States, or from the U. S. Civil Service Commission, Washington 25, D. C. Applications will be accepted by the Civil Service Commission in Washington until further notice.

NUCLEAR INSTITUTES

Nine Institutes on Nuclear Energy for engineering educators will be held throughout the nation this summer under the sponsorship of the Atomic Energy Commission and the American Society for Engineering Education.

The purpose of the institutes is to provide special training in the fields of nuclear energy and the nature of nuclear reactor problems so the teachers can incorporate this material in their teaching programs.

The 1958 institutes will include four basic courses for teachers with no special background in nuclear energy, four advanced-level courses and one new basic course for teachers in technical institutes.

This program reflects a substantial increase in offerings since the courses were first offered in the summer of 1956. The first year, only two institutes were held, with an attendance of 90. In 1957, four were given, with 80 participants. The nine 1958 institutes will provide instructional capacity for more

(continued on next page)

than 225 teachers who will be preparing themselves to participate in nuclear education programs for engineering students.

The AEC is investing approximately $400,000 in the operation. Applicants will be selected by subcommittees of the ASEE Nuclear Committee on the basis of the candidate's experience and the instructional use to be made of the training.

Participants will receive a minimum of two month's pay in addition to their regular salary for the academic year. For an applicant to be considered, the educational institution will be required to contribute to him a minimum of one month's salary. The AEC grant will match this contribution to a maximum of $750 plus round-trip railroad fare.

Applications for appointment may be obtained from the deans of engineering or from ASEE headquarters. They should be sent to Prof. W. Leighton Collins, Secretary of the ASEE, University of Illinois, Urbana, Ilinois.

Each of the basic institutes will be combined programs of a university and a national laboratory, with a quota of from 25 to 30 participants at each location. The dates for all are June 23–August 15 and the locations are: North Carolina State College, Raleigh, with Oak Ridge National Laboratory; Cornell University, Ithaca, with Brookhaven National Laboratory; Purdue University, Lafayette, Ind., with Argonne National Laboratory; and University of California at Berkeley with Radiation Laboratory at Livermore.

The advanced institutes with quotas of from 20 to 25 participants will be as follows: Reactor Theory, University of Michigan, June 23 to August 15; Reactor Instrumentation and Control, Argonne National Laboratory, June 23 to August 15; Chemical Processing, Hanford Laboratories, June 22 to August 15; and Nuclear Metallurgy, Ames Laboratory, June 30 to August 22.

The course for teachers in technical institutes, with a quota of 25 participants, will be held at Pennsylvania State University from June 30 to August 8 and at Argonne National Laboratory from August 11 to August 22.

HUGHES FELLOWSHIPS

Hughes Aircraft Company, Culver City, Calif., will grant master of science fellowships to 150 college graduates to help them pursue advanced studies in science and engineering, Robert J. Shank, vice-president, engineering, announced today.

Fellows will be selected from applicants with outstanding scholastic records from universities throughout the nation.

Inaugurated in 1952 to help alleviate the shortage of top scientific talent, the Hughes program so far has enabled 265 students to obtain master's degrees while an additional 217 are currently enrolled in the plan.

Successful candidates receive full tuition, books and university fees plus salaries for part-time work as members of the Hughes research and development staff. While studying a half-time regular university curriculum they also are assigned to advanced research in military and industrial electronics, according to Shank.

Fellows selected will work towards masters degrees in electrical or mechanical engineering or physics at University of Southern California, University of California at Los Angeles, California Institute of Technology or University of Arizona.

"Hughes Aircraft, through a comprehensive education program, has attempted for years to develop young scientific and engineering talent," Shank said. "The company is actively working with high school teachers and students, aids undergraduate university students, and provides fellowships for higher academic study leading to doctor's degrees."

In addition several hundred Hughes employees attend university classes with financial assistance from the company.

Shank added that acceptance of Hughes fellowships involves no obligation for future employment. Fields of study in science and engineering are left entirely to the choice of the individual fellows.

Applications sent to the company by April will be considered for awards for 1958.

ALUMNI NEWS

MATHIS ON AIChE COMMITTEE

J. F. Mathis has been appointed to the National career guidance committee of American Institute of Chemical Engineers. This committee provides information, counsel and leadership to local section committees that are responsible for assistance in high school career guidance programs. Committeemen are charged with liaison duties between their local section and the national committee; Mathis represents South Texas Section. Each committeeman is also given a specific project by the national committee.

In Research and Development Division at Humble Oil & Refining Company's Baytown refinery, Mathis heads the section responsible the process development research on fuels. He holds the B.S. degree in chemical engineering from Texas A & M and the M. S. and Ph.D. degrees from University of Wisconsin. (The latter in 1951 and 1952.)

Dr. and Mrs. Mathis have two children; they live at 1003 North Circle Drive in Baytown.

DRAEGER PROMOTED

M. L. Sims, Resident Manager, announces the appointment of A. G. Draeger as Production Manager of the Nitro Plant of FMC Organic Chemicals Division (OHIO–APEX).

Mr. Draeger was Engineering Section Director of the Westvaco Chlor–Alkali Division of FMC at South Charleston, W. Va. He spent eleven years in research and development at that Division.

Prior to his association with Westvaco Chlor–Alkali in 1946, he was with Victor Chemical Works at Chicago Heights, Ill. and Nashville, Tennessee for six years.

Mr. Draeger is a graduate of the University of Wisconsin. He is a member of the American Institute of Chemical Engineers.

He will continue to reside in St. Albans, W. Va. with his wife and two children.

THE END

To **engineering undergraduates** in a whirl about the future...

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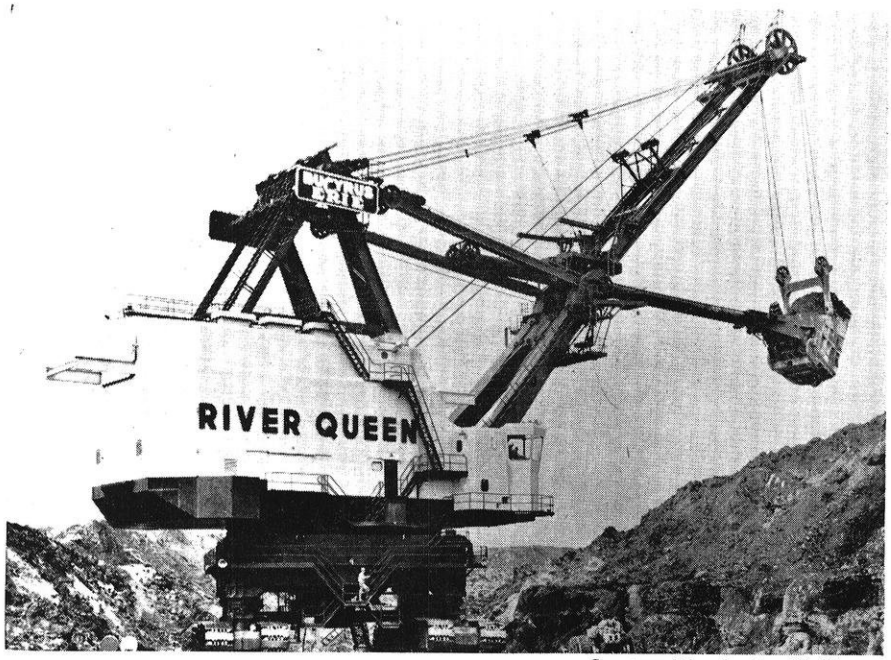

—Courtesy Lincoln Arc Welding

This 2400-ton stripping shovel scoops up 55 tons every 55 seconds.

Science Highlights

(continued from page 32)

countered in the electronic data processing field. The needs of a particular system are met by providing the proper combination of available modules.

The modular design approach allows a single Translator system to perform any one of several input-output requirements. In such cases, the desired mode of operation is selected by means of a computer-type plugboard.

2400-TON STRIPPING SHOVEL

Every 55 seconds this 2400-ton stripping shovel scoops up 55 tons of overburden at Greenville, Kentucky. With a 145 ft. boom and 86 ft. dipper stick to give a wide swing range and maximum spoil pile height, the loads transmitted to the base are hefty and complex. They are handled with a considerable margin of safety by a new type of welded steel design perfected by the Bucyrus-Erie Company, South Milwaukee, Wisconsin. The sides are welded box girders, 8 ft. 4 in. deep and 5 ft. wide, field welded on the flanges to diagonals and corner girders. The base is 40 ft. square, with a 38 ft. diameter roller circle.

The new welded design of the 226 ton base produced an overall cost saving of 24% and a reduction in the shovel's operating costs of 20%.

Design and fabrication of the base weldmen were the subjects of a first grand prize-winning paper submitted in the recent Machine Design competition sponsored by The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. Author was Tom Learmont, Product Engineer with Bucyrus-Erie.

RAYMOND CONCRETE PILE COMPANY ESTABLISHES ANNUAL AWARD

Establishment of the Alfred A. Raymond Award "to encourage originality in research and development in the field of foundation engineering" has been announced by Raymond Concrete Pile Company.

The annual award—carrying an honorarium of $1,000—is named for Alfred A. Raymond who invented the first cast-in-place concrete pile and in 1897 founded Raymond Concrete Pile Company, today one of the world's foremost international foundation and construction firms.

Participants in the competition will be asked to prepare papers "on any of the phases of the design and construction of foundations for structures." Manuscripts will be accepted free from practicing and professional engineers, faculty members of accredited engineering schools and graduate students. The deadline for papers is Sept. 1, 1958.

Judges who will select the winning entry are Ralph B. Peck, professor of foundation engineering, University of Illinois; Dr. R. E. Fadum, Head, Department of Civil Engineering, North Carolina State College of Agriculture and Engineering; and E. A. Dockstader, consulting engineer, Boston.

Engineers interested in submitting papers should register and receive complete instructions by writing to: Alfred A. Raymond Award, Room 1214, 140 Cedar Street, New York 6, N. Y.

SENSITIVITY OF PHOTO PROCESS EXPLAINED

The "history" of a photographic film during the hundredth of a second or so of a normal photographic exposure was unfolded by Dr. William West of Kodak Research Laboratories before a meeting of the Armed Forces Communications & Electronics Association in Washington, D. C.

An expert on photographic sensitization, Dr. West spoke to the scientific group on the chemistry and physics of latent image formation.

"The important property of the latent image is that it can catalyze the production of silver when the film is placed in a developer," he said.

All that is required to make the light-sensitive silver bromide grain in a photographic film developable is that a single "latent image center" containing only a few atoms of silver be produced by the exposure to light, Dr. West said.

"About 100 million times as much silver is formed by development as is formed directly by the light, and it is this enormous multiplication of the effect of the light by the development process that renders the photographic emulsion so extremely sensitive," he said.

Dr. West explained that electrical measurements of photographic materials in the dark and on exposure to light showed that the primary effect of the light was to form negatively charged electrons and an equal number of positive charges. Trace amounts of sensitizing materials, acting as tiny "traps", allow the electron to com-

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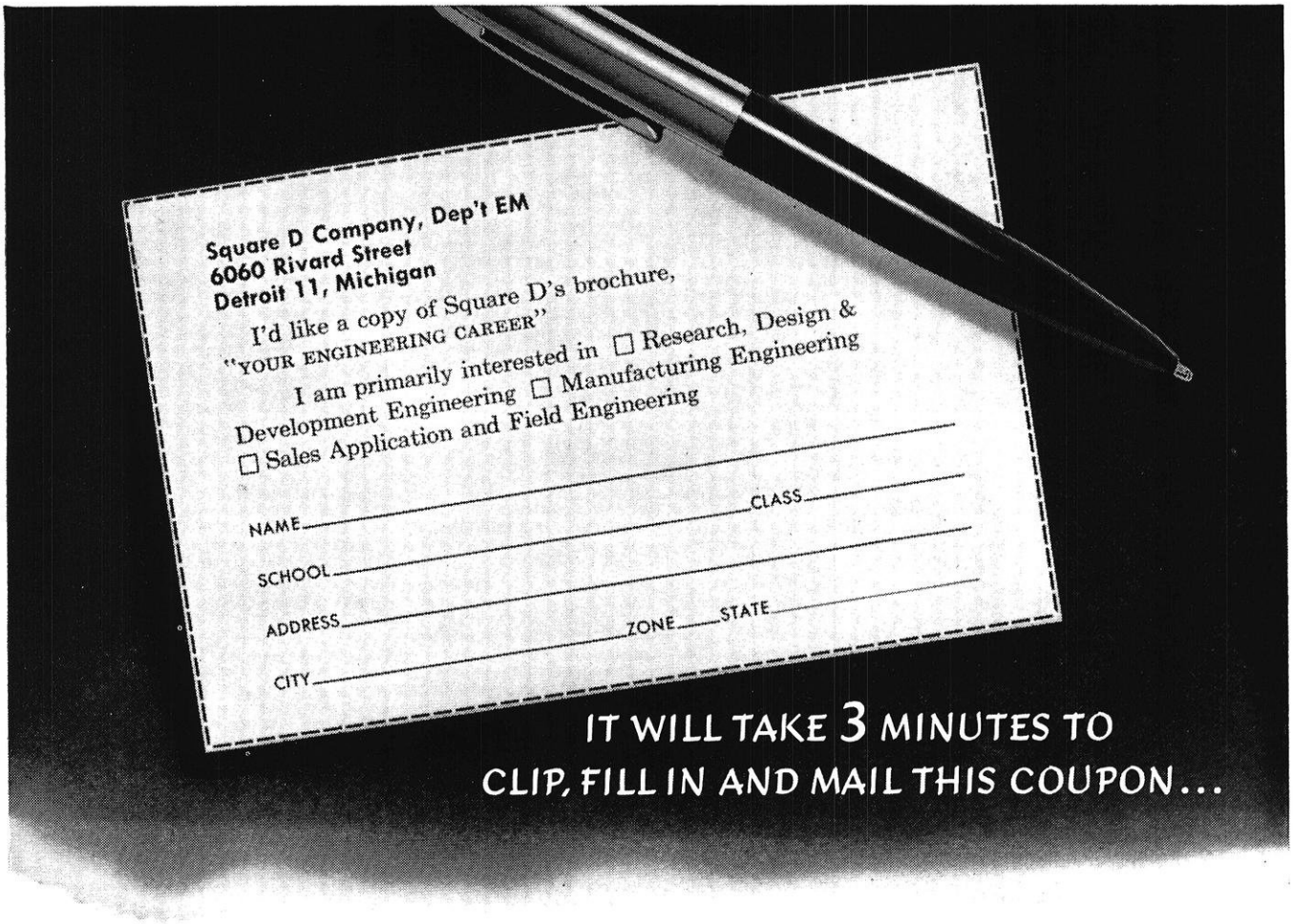
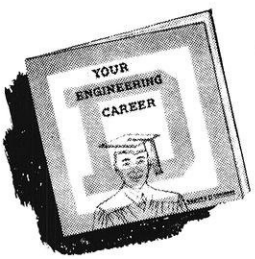


...It could be the most important 3 minutes you've ever spent!



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Wisconsin Society of Professional Engineers

WISCONSIN VALLEY CHAPTER ENGINEERS WEEK

CARL W. GIESLER

The main activities of the Wisconsin Valley Chapter WSPE during Engineers Week are centered in the school program of our group.

We received good response to the *Future in Engineering For Me* contest. Our judging committee felt that the number and quality of entries warranted setting up some additional prizes in our chapter. Therefore we have selected 1st, 2nd, 3rd, and three honorable mention winners. We wished we would have been able to give about a dozen more prizes because we received so many good entries. The 3rd place winner will be given $5.00 (five) in cash and honorable mention winners will receive $2.00 in cash.

The 1st and 2nd place winners with their parents and science teachers will be our guest at our Engineers Week Banquet on Feb. 22. This banquet will be held at the Wausau Hotel and will be the climax of the week's activities.

An *Engineer of the Year* award for a Wisconsin Valley Engineer will be presented to one of our members at this same meeting. It was decided to time this activity for Engineers Week so it could better be worked in with that week's publicity.

At least half a dozen of our members are active in school programs where they will act as special speakers for Engineers Week or part of the Career Day Programs of the schools. Part of their programs will include *The American Engineer* film and passing out of the booklet by NSPE—*Engineering a Career of Opportunity.*

At Rhinelander the Society will have a display in the window of the Wisconsin Public Service Corp. This will cover the theme of general engineering much like the window we ran in Wausau last year.

We plan the usual amount of TV, radio, and newspaper coverage of events and acknowledgment of Engineers Week. There will be special bulletin boards set up in many of the area schools.

It is hoped we can get time to introduce our contest winners in the essay contest and our Valley Engineer of the year on WSAU-TV Saturday afternoon, Feb. 22. We would like to have the winner read his essay on TV at that time.

ENGINEERS' CREED

As a professional engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare.

I PLEDGE

To give the utmost of performance, to participate in none but honest enterprise, to live and work according to the laws of and the highest standards of professional conduct. To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations. In humility and with need for Divine Guidance, I make this pledge.

SECRETARY'S OFFICE

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Madison 5, Wisconsin
HENRY A. KALLSEN, *Secretary-Treasurer*

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HERBERT NELSON, *Ch.*, Fox River Valley Ch.
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E. C. KESTING, *Ch.*, Lake Superior Ch.
A. W. DEBLAISE, *Ch.*, Southeast Ch.

W.S.P.E. OFFICERS—1957–58

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CLIFFORD J. NELSON, *First Vice President*
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NATIONAL REPRESENTATIVE

A. OWEN AYRES
WILLARD S. COTTINGHAM

NORTHWEST CHAPTER

"Engineers' Week" was observed at a dinner meeting open to the public on Wednesday, February 5, at 7:00 P.M. at Hotel Eau Claire's Holiday Room in Eau Claire.

Featuring the program was the speaker, Karl O. Werwath, President of the School of Engineering of the University of Wisconsin at Milwaukee. The subject of his talk was "Meeting the Challenge of the Age Through Engineering".

D. E. Gordon, Chairman of the "Engineers' Week" Committee, reported all arrangements for their programs for the week's observance were completed with excellent results and cooperation from local Radio and T. V. Stations.

FOX RIVER VALLEY CHAPTER

ENGINEERS' WEEK PROGRAM

Date: Thursday, February 20, 1958.

Time: Cocktails 6:30 P.M. Dinner 7:15 P.M.

Place: Elks Club, 35 Jefferson—One block East of Main Street—Downtown Oshkosh.

Our chapter celebrated Engineers' Week in a big way. This meeting was a climax to the recog-

(continued on page 62)

Meet the President

JACK H. MAXFIELD is the hustling President of the Southwest Chapter, W.S.P.E. He resides with his family at 4206 St. Clair, Madison, Wisconsin.

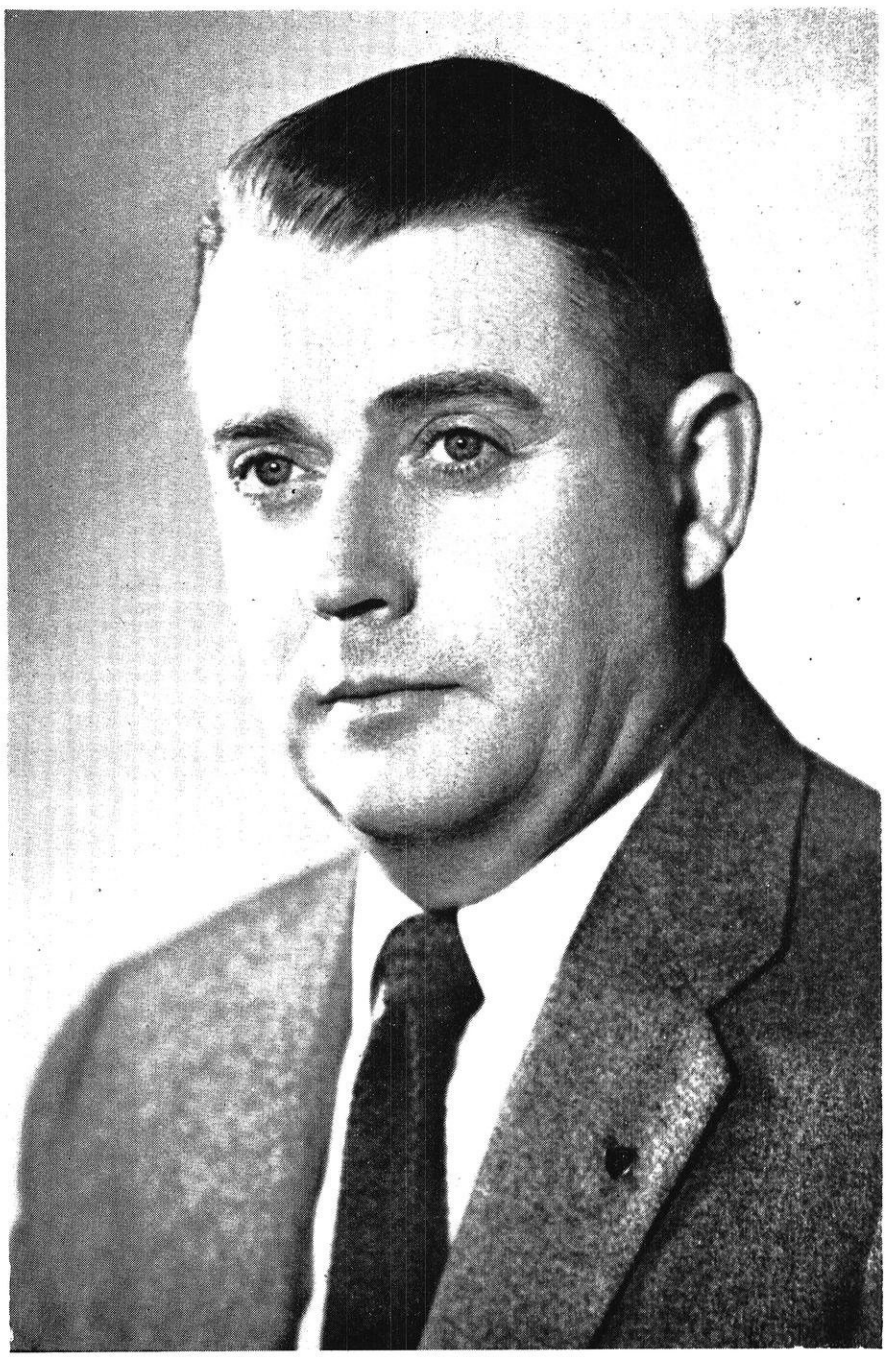
Jack is a graduate in Civil Engineering of the University of Wisconsin, class of 1938. He began his engineering career much earlier, (at the age of 14), however, as a helper to his father, Julian Maxfield, Professional Engineer and Surveyor, Plover, Wisc.

Jack's history as an engineer has had many facets. These include work with the Wisconsin Highway Commission, J. S. Hartt, Consulting Engineer, Chicago, Illinois, Illinois Division of Waterways, Consulting Engineers Crawford, Murphy and Tilly of Springfield, Illinois, and since 1948 he has been a Resident Engineer for the Madison Metropolitan Sewerage Commission.

His work with W.S.P.E. has consisted of serving as Director and as Chapter Secretary–Treasurer. He has also been active in civic affairs in Madison as Boy Scout Committeeman, Area Commissioner and Explorer Advisor.

Jack's oldest son, Jack M., is following in the tradition of the family and is a sophomore in Civil Engineering at Wisconsin. His second son, Frederic 17, is a student at Madison West High School with plans to become a teacher. Jack's daughter, Mary Frances, 9, completes the family and also attends Madison Schools.

Hobbies of Jack, and evidently of Mrs. Maxfield, are square dancing, gardening, and woodworking. Southwest Chapter is proud of its President and of his many activities which combine an engineering career and civic accomplishments.



Jack H. Maxfield.

W.S.P.E.

(continued from page 60)

nition being given us nation-wide and within our own Chapter area.

Program: We were honored to have Mr. W. L. Hinderman, Regional Vice President NSPE. Mr. Hinderman talked on matters that concern all of us individually, namely:

1. Unity among all the different branches of Engineering and our efforts toward Professionalism.

2. Unionism of Professional Engineers. Do you want to join a Union? What are your rights as a professional employee? How does the Taft-Hartley Law provide for you? Mr. Hinderman took part in the recent Minneapolis Honeywell union case at Minneapolis in which Professional Engineers were prevailed upon to join a union.

ENGINEERS HONOR PIERCE G. ELLIS

Pierce G. Ellis, assistant to the president of the Wisconsin Public Service Corp., was presented the annual Outstanding Engineer Award of the Wisconsin Society of Professional Engineers Friday night.

Ellis, of 4245 N. Ardmore Ave., Shorewood, was cited for his "high devotion to the ideals of the engineering profession," his efforts to improve engineering education and his activities in the WSPE.

Admitted to the WSPE in 1945, Ellis is a committeeman and past president of the organization as well as a director and past president of the Engineers Society of Milwaukee. A graduate of the University of Wisconsin, he has been with the Wisconsin Public Service Corp. since 1936.

JANUARY VOTING RESULTS

Result of vote on Amendment to By-Laws, Article III—Dues, was 292 in affirmative, 118 in the negative. Article III is therefore amended and dues are now, retroactive to Jan. 1, 1958, $25.00 for Members and $8.00 for Affiliates.

Results of vote on Amendment to By-Laws, Article VI—Elections, was 344 in affirmative, 15 in the negative. Article is therefore amended and new officers henceforth may be elected by mail ballot during the month of January each year.

The following officers were elected by margins ranging from 513 to 519 votes out of a total of 525 valid ballots cast:

Clifford J. Nelson—President
Harold C. Trister—1st Vice-President
John Gammell—2nd Vice-President
Henry A. Kallsen—Secretary-Treasurer
Herman T. Hagestad—Director
Thomas J. Higgins—Director
A. Owen Ayers—National Representative
Willard S. Cottingham—National Representative

EMPLOYMENT MOTIVATIONS OF THE AMERICAN ENGINEER

What causes an engineer to select one company rather than another as an employer, to remain with a company or leave it, to put forth his maximum effort on the job? The answers to these questions are given in the following three sections as seen by Deutsch & Shea, consultants in the technical manpower field.

Pierce G. Ellis.

Part I: A Conceptual Scheme of the Employment Process, provides a systematic approach to an understanding of the dynamics of the job selection process.

Part II: Motivating Factors in Engineer Job Selection, is concerned with the motivational drives and behavior involved in choosing a job. The factors in choice are analyzed and ranked on the basis of the results of many surveys conducted by Deutsch and Shea, Inc., and a number of other organizations.

Salary, for example, ranked high as a motivational factor in the surveys studied. But, reports this new study, the actual dollars and cents income is not the key factor to the engineer. What is more important to him, psychologically, and what attracts him to a company is his perception that the salary offered is as much or more than that paid engineers on his level. The feeling that he is getting a salary commensurate with what he thinks other engineers with his qualifications receive, and, in some cases, with what other groups of company employees in other fields receive, is often as important or more important to him than the actual amount of his paycheck. In general, when other satisfactions are present, the importance of salary and other material factors diminishes. Thus, in a list of the twelve most important factors in engineer job selection, such career and status values as challenging opportunity, interesting work and opportunities for advancement ranked above company location, regular salary increases and job security.

Part III: Motivating Factors in Engineer Job Satisfaction reports the differences of motivation involved in satisfaction that exist among various types of engineers on the job—research and development, design and product, sales, and administrative. Thus, the motivations of the research and development engineer are subject to distinctive frustrations. For example, one of his strong interests lies in increasing his knowledge and in communicating and sharing his findings with the engineering fraternity. On the other hand his role in industry frequently requires him to work exclusively on problems directly related to products with which his company is at the moment most concerned. Frequently this means that he is taken from a problem in which he is particularly interested and put to work on whatever project has priority.

The following conditions were found particularly to lead to R & D engineer turnover: sterile or monotonous routine, situations in which status aspiration plays an important role, close supervision, heavy non-engineering work (for example e.g. routine paper work, extraditing, routine follow-up,

(continued on page 64)

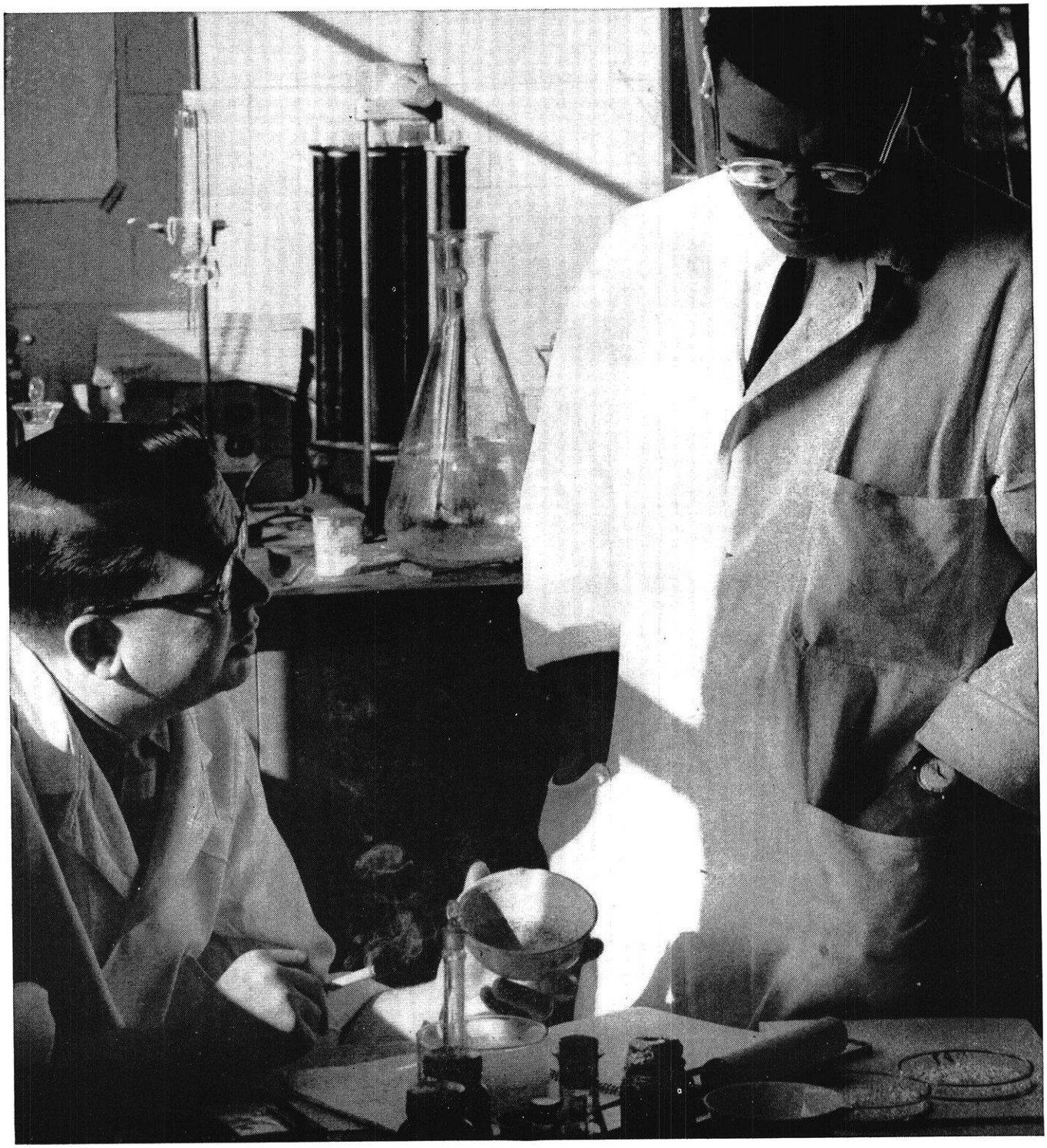
Allied Chemical

What careers are available at Allied Chemical?

Where would *you* fit into the Allied picture? Perhaps at one of our 12 research laboratories, more than 100 plants, or many sales offices throughout the country. What products would you work on? There are more than 3,000 in all—chemicals, plastics, fibers . . . and new ones coming along every year.

At Allied, there are careers for chemists, chemistry majors, engineers (chemical, mechanical, electrical). Facts about these careers are in a new book, "Allied Chemical and Your Future." Why not write for a copy? The Allied interviewer can also answer your questions. Your placement office can tell you when he will next visit your campus.

Allied Chemical, Dept. C-1, 61 Broadway, New York 6, N.Y.



W.S.P.E.

(continued from page 62)

etc.), trouble shooting duties which disrupt research activities.

On the other hand, it was found that the following "job attraction values" ranked especially high with the R & D engineer: opportunity to keep up with new developments in his field, work in which he can exercise most personal scope, work that is creative and challenging, the stimulation and challenge of complex problems, credit for his ideas.

Design and product engineers share many of the job aspirations of their colleagues in research and development, but they have several that tend to be found most frequently in their own group. For example, they place considerable emphasis on proper programming and scheduling of work assignments, and on clearly defined objectives and planning in detail. They want a planned program of opportunity for self-development and advancement. Unlike many R & D men, they prefer to "follow through" on the job they started. They tend to become considerably upset by delays or inadequate equipment and want the reason for them carefully explained. They put greater emphasis than the typical R & D man on compensation, and economic advancement.

Not surprisingly, the sales engineer puts great emphasis on recognition and the feeling that he is doing highly important work is crucial to him. The social dimensions of his job are as important to him, and sometimes even more important, than the work and career dimensions. He wants to be part of management and have more than a nodding acquaintance with the important top management people.

Status aspiration is the strongest motive of the administrative engineer. He wants freedom to exercise his integrative skills and he is eager to take on ever increasing responsibilities.

ENGINEERING EXAMINATIONS

The Wisconsin Registration Board of Architects and Professional Engineers have announced the dates of their next Engineering Examinations as June 17 & 18, 1958. To be eligible for those examinations, application must be on file in the Board's office on or before April 15, 1958. Application forms and information may be obtained at or by writing to the Board's office, 1140 State Office Building, Madison, Wisconsin.

Examinations will be conducted June 17, 1958, at Madison and Milwaukee, Wisconsin, for those desiring Certification as an Engineer-in-Training. To qualify for certification as an Engineer-in-Training the applicant must in addition to passing the one-day, 8 hour, examination on the fundamentals of engineering have a record of 4 years of satisfactory engineering experience. All of the required 4 years of experience may have been gained by formal education.

Examinations will be conducted June 17 & 18, 1958, at Madison, Wisconsin, for those desiring registration as a Professional Engineer. Holders of certification as an Engineer-in-Training in Wisconsin will be required to appear for examination only on June 18, 1958, while those who are not holders of such certification will be required to appear on both June 17 & 18, 1958. The examination on June 17, 1958, will be on the fundamentals of engineering. The examination on June 18, 1958, covers in the forenoon a field of engineering and in the afternoon a sub-field of the field selected by the applicant for the forenoon's examination. The applicant must choose a field and sub-field which has been established or approved by the Board. Fields and sub-fields for each have been established by the Board as follows:

1. Chemical with the established sub-fields of Chemical Plant, Gas, Sanitary and others to be approved by the Board.
2. Civil with the established sub-fields of Highway, Hydraulics, Municipal, Sanitary, Structural.
3. Electrical with the established sub-fields of Communications, Electrical Machinery, Electric Power-Generation and Distribution, Illumination, Industrial Electronics.
4. Mechanical with the established sub-fields of Air Conditioning-Heating-Refrigeration, Heat Power and Heat Engines, Industrial, Machine and Tool Design.
5. Metallurgical with the established sub-fields of Metallurgical Research and others.
6. Mining with the sub-fields to be approved by the Board.

To qualify for registration as a Professional Engineer the applicant must in addition to passing the 2-day examination have a record of 8 years of satisfactory engineering experience, 4 of which may have been gained by formal education.

The next engineering examination after the June 17 & 18, 1958, examination will be conducted by the Board about February 1, 1959, with December 1, 1958, as the closing date for filing application to enter it.

ANNUAL WINTER CONVENTION—CITATION AWARD LUNCHEON

In Honor of the Science and Mathematics Teachers of the Wisconsin High Schools

Crystal Ballroom—Schroeder Hotel

Milwaukee, Wisconsin—January 18, 1958

Sponsored by the Wisconsin Society of Professional Engineers

CITATION

In tribute to the physical science and mathematics teachers of Wisconsin High Schools for developing an interest in science and mathematics in their students, and

In sincere appreciation for their encouragement of qualified students to continue their education toward professional degrees in science and engineering, and

In recognition of the vital importance of this work in developing scientists and engineers needed to keep America great . . . .

The Wisconsin Society of Professional Engineers presents to the outstanding representative of the science and mathematics teachers of Wisconsin, this citation.

WISCONSIN SOCIETY OF PROFESSIONAL ENGINEERS

Anthony L. Genisot, President

Presentation of Citations

Dean Kurt F. Wendt, College of Engineering, University of Wisconsin

Assisted by

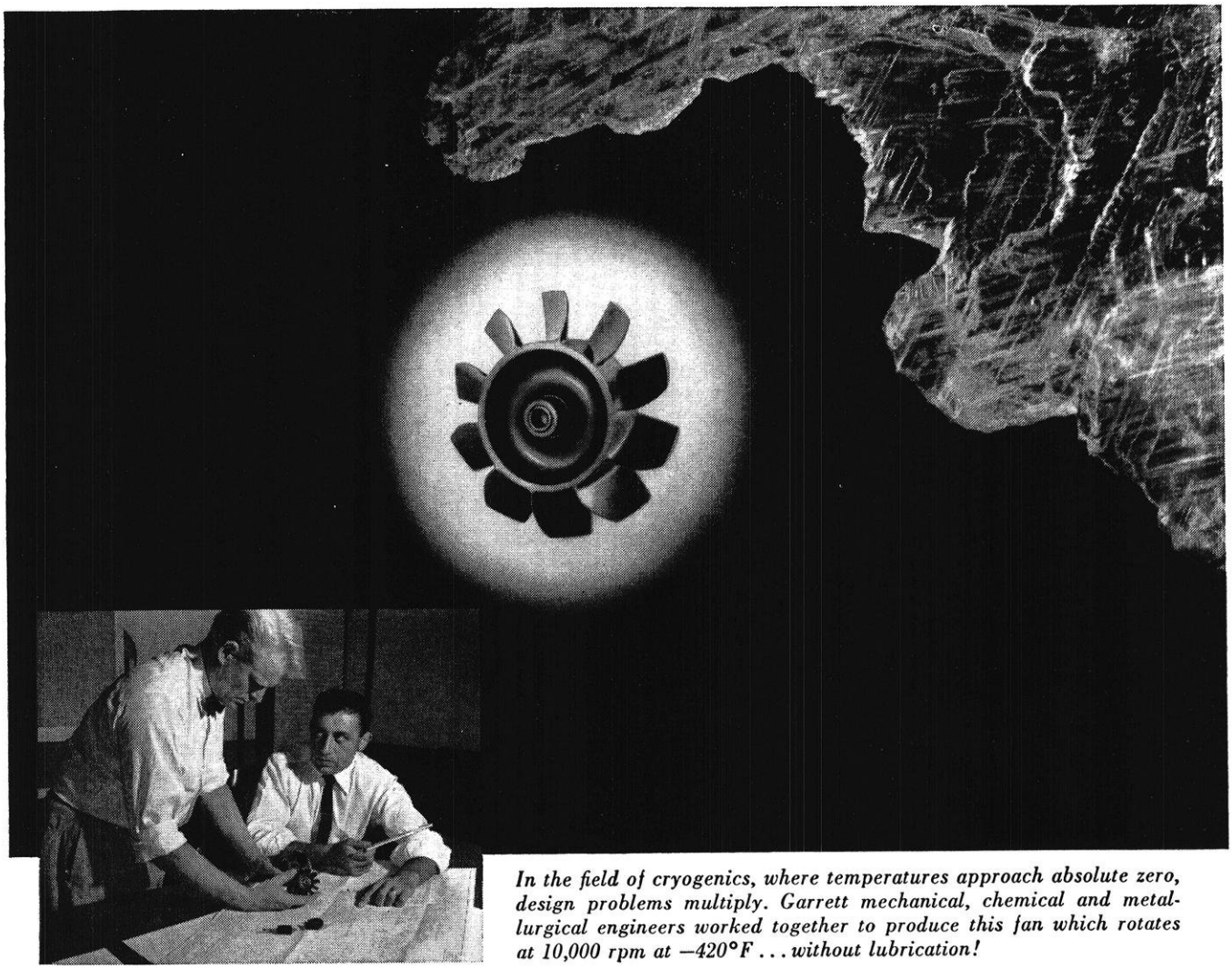
Dean A. Bernard Drought, College of Engineering, Marquette University

Dean Fred J. Van Zeeland, Engineering, Milwaukee School of Engineering

Chairman, WSPE Education Committee, Professor Thomas J. Higgins, Department of Electrical Engineering, University of Wisconsin

(continued on page 66)

Maximum results from a college education...



In the field of cryogenics, where temperatures approach absolute zero, design problems multiply. Garrett mechanical, chemical and metallurgical engineers worked together to produce this fan which rotates at 10,000 rpm at −420°F . . . without lubrication!

Education is the springboard for your future. Couple it with the proper engineering experience, such as you receive at Garrett, and you have the ingredients for a successful career in engineering fields which will be expanding for years.

At Garrett, specific opportunities in aircraft, missile and technological fields include: system electronics; computers and flight instruments; gas turbine engines and turbine motors; prime engine development; cryogenic and nuclear systems; pneumatic valves; servo control units and air motors; industrial turbochargers; air conditioning and pressurization and heat transfer.

In addition to direct assignments, a 9-month orientation program is available to aid you in selecting your field of interest. This permits you to survey project, laboratory and administrative aspects of engineering at Garrett. With company financial assistance you can continue your education at outstanding universities located nearby.

Project work is conducted by small groups where the effort of each individual is more quickly recognized and where opportunities for learning and advancement are greatly enhanced. For complete information, write to Mr. G. D. Bradley.

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AIRESEARCH INDUSTRIAL • REX • AERO ENGINEERING • AIR CRUISERS • AIRESEARCH AVIATION SERVICE

W.S.P.E.

(continued from page 64)

SAM L. MOREAU

Mathematics

Sturgeon Bay High School

Sturgeon Bay, Wis.

Born: Appleton, Wis.—1895
B.E. Wisconsin State College at Stevens Point, 1930
Ph.M. University of Wisconsin, 1938
Taught at the following schools:
Rural Schools—3 years
Hawkins High School, 1923
Crivitz High School, 1925–29
Stevens Point High School, 1931–43
Wisconsin State College at Stevens Point, 1943–44
Sturgeon Bay High School since 1945
Served in World War I. Active in American Legion, P.T.A., and Sturgeon Bay Teachers Council.

ADOLPH A. VORBA

Mathematics and Physics

Marshfield Senior High School

Marshfield, Wis.

Born: Gladbrook, Iowa—1903
B.A., University of Iowa, 1925
M.A. University of Iowa, 1940
Taught at the following schools:
New London High School, 1925–42
Truax Field, Madison, 1942–45
Marshfield High School since 1945
Served as Treasurer of the Wisconsin Council of Mathematics Teachers. Active in several professional educational groups.

JOSEPH M. STEFANKO

Chemistry

West Allis Central High School

West Allis, Wis.

Born: Superior, Wis.—1920
B.S. Wisconsin State College at Superior, 1942
M.A. University of Minnesota, 1950
Taught at the following schools:
Edgerton High School, Edgerton, Minn., 1946–47
Esko High School, Esko, Minn., 1947–49
West Allis Central High School since 1949
Served as Principal of Esko High School (1948–49) and as Vice-President of West Allis Teachers Association. Active in various community groups.

APPLICATIONS FOR MEMBER AND AFFILIATE MEMBER—JANUARY 16, 1958

Name and Position	Address	Reg. No.	Sponsor
MILWAUKEE			
Don R. King, PE Priviate Practice	6505 N. 54th Street	E-6384	F. C. Koehn, PE
Carrol Maguire, PE Associate Robert J. Strass, Inc.	1044–3rd Ave. Grafton, Wis.	E-5589	Robert J. Strass, PE
Thomas Vavra, III, EIT EIT Structural Robert J. Strass, Inc.	225 E. Michigan Milwaukee 2, Wis.	ET-1593	Robert J. Strass, PE
Keith F. Kummer, PE Act. Chrmn. M. E. Dept. Milw. School of Engineering	1236 S. 113th St. West Allis 14, Wis.	E-6552	Karl O. Werwath, PE
LAKE SUPERIOR			
Karl O. McConnell, PE Engr. III Wis. Highway Commission	1517 Clough Ave. Superior, Wis.	E-6559	Leo L. McGauley, PE
SOUTHEAST			
Frederick H. Larson, PE Ass't Commissioner of Public Works City of Racine	730 Washington Ave. Racine, Wis.	E-6274	Norval Johnson, Sr., PE
WESTERN			
Charles D. Anderson, EIT Plans and Resident Engineer Wis. High Commission	1701 Market St. La Crosse, Wis.	ET-1588	J. W. Johnson, PE
SOUTHWEST			
Eugene E. Sheets, PE Engineer II, District I Wis. Highway Commission	4600 Gordon Ave. Madison 4, Wis.	E-6368	Chas. M. Perlman, PE
Clay G. Ashton, PE Sales Representative Butter Mfg. Co.	4442 Hillcrest Dr. Madison 5, Wis.	E-3093	Leo F. Kosak, PE

Total Members 7
Affiliate Members 2

MEMBERSHIP REPORT—JANUARY 16, 1958

As of December 14, 1957:
Members (per correction, Kingsbury) 1191
Dues Exempt 3
Retired (per correction, Kingsbury) 4
Affiliates 119
1317

LOSSES:
Resigned Rueben M. Strand, PE, MILW
Robert J. Griffin, ET, MILW
Walter L. McCann, PE, FRV
Edwin R. Shorey, PE, SW
Donald H. Zillman, PE, NW
Transferred to Missouri:
Earl Marion Sigler, PE, MILW

TOTAL Members 5, Affiliates 1

ADDITIONS:
New Members 7, Affiliates 2

CHANGE OF CLASSIFICATION:
Member to Retired Joseph A. Stransky, PE, MILW
Roland E. Toole, PE, SW
Ray S. Owen, PE, SW

TOTAL Members 3

As of January 16, 1958:
Members 1190 − 5 + 6 − 3 = 2
Dues Exempt 3
Retired + 3 7
Affiliates 102 + 1 + 1 − 18 (correction, Kallsen) = 18
1302

WESTERN CHAPTER OF PROFESSIONAL ENGINEERS

The Western Chapter of the Wisconsin Society of Professional Engineers held its monthly meeting in the Regency Room of the Stoddard Hotel on Tuesday night, January 21, 1958. John Mangan, President, presided at the meeting.

Frank Carlson and Clayton Connell commented briefly on the meeting of the State Society which was held in Milwaukee, January 17–18, 1958.

Max Peters introduced Charles Sherlock, main speaker of the evening. Mr. Sherlock, a graduate of Rensselaer Polytechnic Institute, and formerly employed by the Koppers Company, is presently the Gas Engineer for the Wisconsin Division of Northern States Power Company.

Mr. Sherlock outlined the factors affecting the natural gas pipe installation in the La Crosse area, as well as citing the reasons for its delay. He stated that Northern States has been attempting to obtain natural gas for the La Crosse area since 1940, and within the next two months the Federal Power Commission shall approve the extension of one of three existing services to the La Crosse area.

The speaker gave a short summary of the FPC's role in approv-

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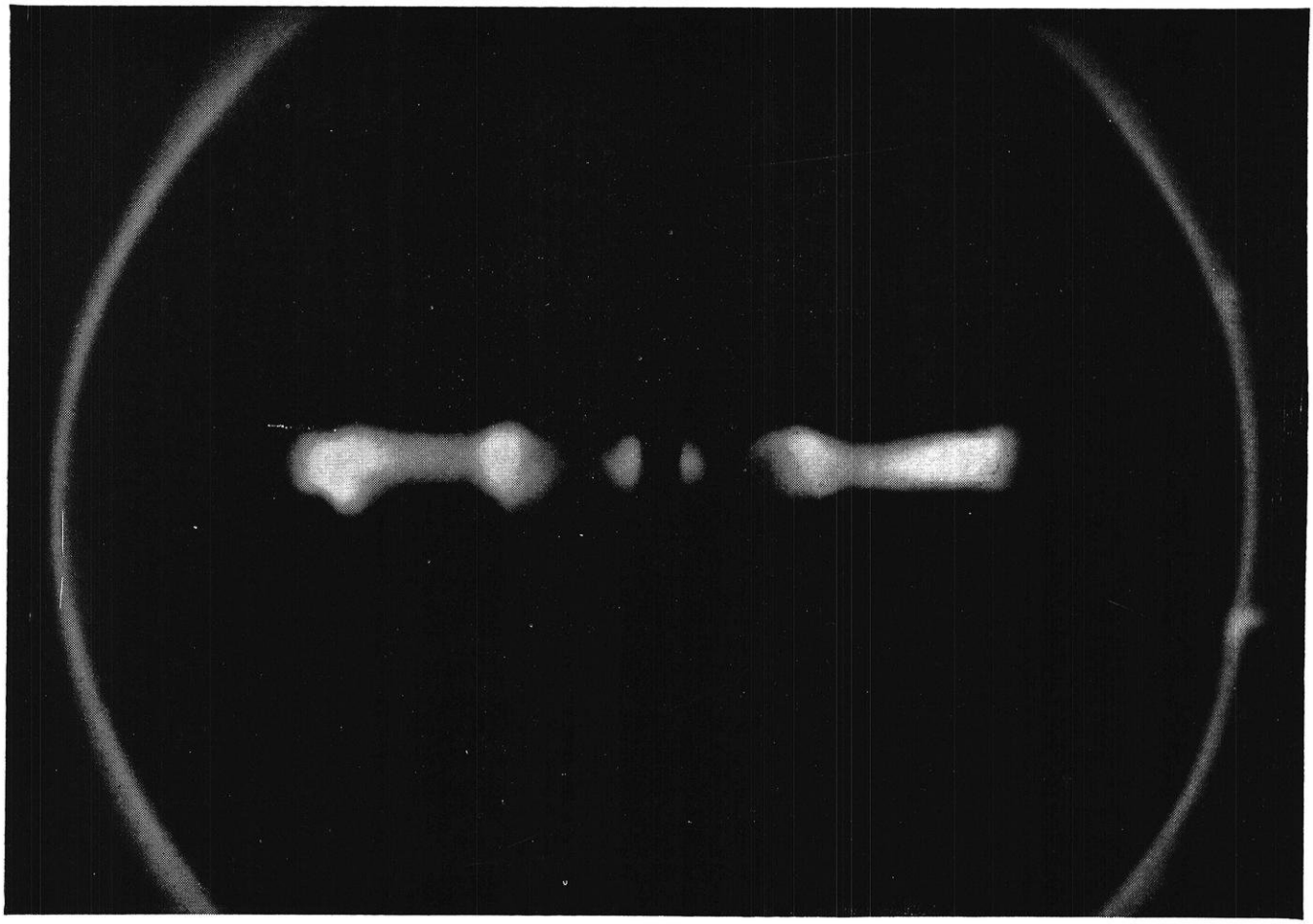


Magnetic fields, acting as a double piston, drive luminous ionized shock waves through transparent tube. One-tenth microsecond exposure in STL's Physical Research Laboratory.

MAGNETOHYDRODYNAMICS and SPACE TECHNOLOGY

Magnetohydrodynamics provides one of the most promising approaches for attaining the velocities and specific impulses that will be required for manned space flight to a planet, landing, and returning.

The critical problem in attaining velocities of hundreds of thousands of miles per hour is the containment of temperatures comparable to those in the interior of stars. Because the temperature of the driving reaction will have to rise as the square of the exhaust velocity, temperatures greater than one million degrees will be encountered in reaction chambers. Magnetohydrodynamics offers a unique solution to the basic problem of containing the reaction without contact with the chamber walls.

Briefly, the physical principles of magnetohydrodynamics are these. Since gas at such temperatures is completely ionized and is an effective conductor of electricity, the introduction of currents in the gas (in this state called a plasma) creates an electromagnetic field. This field makes it possible to control the plasma by applying an external opposing magnetic field which creates a magnetic bottle to contain the charged gas particles. Similarly, a magnetic-field piston can be used to accelerate the particles. Such magnetohydrodynamic reactions are expected to develop exhaust velocities that are an order of magnitude greater than those generated by present chemical rockets.

At Space Technology Laboratories, both analytical and laboratory work are proceeding in the field of magnetohydrodynamics. This work illustrates the advanced research in STL's Physical Research Laboratory, which emphasizes the application of basic physical principles to the requirements of space technology.

In support of its over-all systems engineering responsibility for the Air Force Ballistic Missile programs, and in anticipation of future system requirements, STL is engaged in a wide variety of research and experimental development activity. Projects are in progress in electronics, aerodynamics, propulsion, and structures.

The scope of work at Space Technology Laboratories requires a staff of unusual technical breadth and competence. Inquiries regarding the many opportunities on the Technical Staff are invited.

SPACE TECHNOLOGY LABORATORIES

A Division of The Ramo-Wooldridge Corporation

5730 ARBOR VITAE STREET • LOS ANGELES 45, CALIFORNIA

W.S.P.E.

(continued from page 66)

ing the extension of natural gas service. The principal factor in the FPC's approval is the potential of the utility having a 20-year supply, predicated on annual growth, installation, and economics. A load factor of 84% is deemed the financial break-even point for the utility; otherwise interruptible service is mandatory. The local distributing firm must also justify its market and latent use before the FPC.

Mr. Sherlock stated that the consumption of natural gas in the United States amounted to 10.7 trillion cubic feet last year. As of 1954, the conservative estimate of natural gas reserve was slightly in excess of 22 years, excluding the sources of Canada and Mexico.

THE END

Dean Wendt

(continued from page 36)

duties are common to all engineers. For this reason you will find many courses common to all engineering curricula. As in any profession, success in engineering demands integrity, industry, perseverance, courtesy, and good personality. In addition, interest in and strong aptitude for mathematics, the sciences, and written and oral expression are of primary importance. If you possess these qualities and aptitudes, find the duties of engineers attractive, and are willing to work hard, you can become a successful engineer. The rewards, materially and in personal satisfaction, are substantial. THE END

James Marks

(continued from page 38)

courses are applied in industry. And he may find a special interest in a particular phase of engineering and tailor his selection of courses accordingly. As a result he will be better prepared to continue his career after graduation.

The Engineering Placement Office can be a very important part of the college career of the engineer. Its facilities are always available to the student and he can feel free to take advantage of its services. THE END

Prof. Rosenthal

(continued from page 49)

iron, the pig iron being subsequently refined to steel. The large metal refineries scattered through the country all depend upon metallurgists for their design and operation. New processes, increasing use of low grade ores, new metal requirements, etc., have all added to the scope and importance of the work done by the extractive metallurgists. When the extractive metallurgist has completed his job of reducing the ore to the metallic state, the physical metallurgist takes over to improve the product.

The alchemists of old were constantly striving to change base metals to noble metals. Had their efforts succeeded they probably would be no less spectacular than the efforts of the present day physical metallurgists who have succeeded in greatly improving the mechanical and physical properties of metals by alloying and special treatments. The physical metallurgist finds opportunities in a wide variety of industries. He may be employed by a metal producer and concerned with the improvement of the properties of the products sold. On the other hand, he may be associated with a metal-consuming industry like the automotive industry, the appliance industry, or the aircraft industry, where his primary job is specification, inspection, and control of the various metals and alloys that are used. There are many additional opportunities in the foundry field, welding, and other metal-processing operations. Besides being engaged in production work the metallurgist may specialize in research, teaching, development work or engineering sales.

New requirements for metals and alloys and other materials that have arisen as a by-product of atomic energy, guided missiles, gas turbines and other high temperature applications have greatly expanded the demand for metallurgical engineers. To prepare for these demands, the curriculum includes a good background in physics, chemistry, and mathematics, and a number of courses in alloying, heat treating, metal working etc.

(continued on page 70)

Why Vought Projects Bring Out The Best In An Engineer

At Vought, the engineer doesn't often forget past assignments. Like all big events, they leave vivid memories. And it's no wonder.

For here the engineer contributes to history-making projects — among them the record-breaking Crusader fighter; the Regulus II missile, chosen to arm our newest nuclear subs; and the new fast-developing 1,500-plus-mph fighter, details of which are still classified.

The Vought engineer watches such weapons take shape. He supervises critical tests, and he introduces the weapons to the men with whom they will serve.

Engineers with many specialties share these experiences. Today, for example, Vought is at work on important projects involving:

electronics design and manufacture

inertial navigation

investigation of advanced propulsion methods

Mach 5 configurations

Vought's excellent R&D facilities help the engineer through unexplored areas. And by teaming up with other specialists against mutual challenges, the Vought engineer learns new fields while advancing in his own.

★★★

Would you like to know what men with *your* training are doing at Vought . . . what *you* can expect of a Vought career?

For full information, see our representative during his next campus visit.

★★★

Or write directly to:

C. A. Besio
Supervisor, Engineering Personnel
Dept. CM-6

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

A Vought Vignette
ONE OF A SERIES

The development engineer who exercised his option

When it comes to end products, Bill Crowder never finishes what he starts.

While Bill's colleagues were bringing to completion a missile that he initiated, Bill helped launch eight other major projects and some minor studies. A restless record. But that's his privilege in Chance Vought's Development Section.

Bill's department analyzes requirements for new weapons. Specs come from the military, or from Vought's own Advanced Development Planning Group. They outline an approaching void or shortcoming in our defense structure. It's up to Bill and from three to thirty project teammates to produce an idea that will fill the vacancy.

From Development's desks and bull sessions come new configurations. Some are radically different; others, close to conventional. The best are projected, electronically, into the environments they must dominate.

For example, Bill can forecast a proposed missile's flight behavior by studying analog traces and columns of IBM tabulations. Electronically, he can observe minute performance details such as gust effects on a recoverable missile's landing approach.

Tests like these refine from Bill's own offerings and those of others the configuration that best answers the problem. Once this pattern is "ballparked" for approximate actual size, it's ready for detail design . . . likely to become a full-scale project.

Time now for Bill to exercise an option all Vought development engineers enjoy. He may follow the project he's begun the full route to completion. Or he may remain in Development and accept a new assignment.

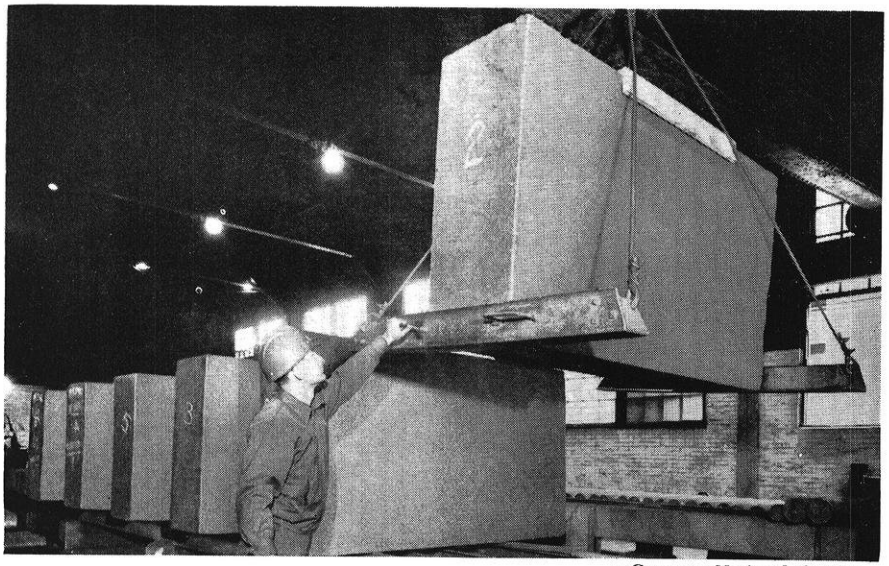
To himself, Bill justifies his choice something like this: "Changing assignments gives me a chance to shift gears . . . to change my approach . . . to broaden myself."

To project engineers, anxious for him to follow a promising project out of Development, Bill's "no thank you" is practically a matter of course.

They know he's already cleared his desk for the next new challenge.

At Chance Vought the Development Engineer explores a unique variety of configurations and operational environments. He may limit his analyses of land- and sea-based weapons to preliminary design studies, or he may accompany his project through the complete development cycle.

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS



—Courtesy National Carbon

These huge graphite blocks are machined into intricate shapes on which steel panels are molded.

Science Highlights

(continued from page 58)

bine with silver ions, thus initiating the formation of the latent image.

"Latent-image formation is an example of one of those interesting processes controlled by trace amounts of material in a mother matrix which are being recognized as of prime importance today in many branches of chemistry and physics," he said.

PLAN TO INCREASE TEACHERS

A plan to increase the number of young teachers for engineering schools of the United States has been presented to Dr. James R. Killian, Jr., the President's Special Assistant for Science and Technology, by The American Society for Engineering Education.

To encourage more good students to enter graduate study, the period during which most engineering students discover their interest in a teaching career, the ASEE states that basic research in engineering must be expanded and that federal agencies supporting basic research in engineering should greatly enlarge both the number and the amount of the grants. The increased amounts adequately should cover the true costs, including the portion of the faculty salaries required to direct the projects. The contracts also should be for longer periods of time, such as five years, and should provide enlargement of the buildings required.

With this as a fundamental premise, the four-point plan is:

1. A substantial increase in the number of National Science Foundation fellowships for first-year graduate study in engineering.

2. A program of secondary grants to those who fail to qualify for full fellowships under the National Science Foundation program.

3. Supplementary federal grants to holders of National Science Foundation fellowships who take part-time teaching assignments.

4. A new program of awards under the National Science Foundation to increase the financial aid to graduate students who combine teaching with their education and research experience.

ASEE calls particular attention to the important role of basic research in preparing engineering teachers. Federal support of basic research, the Society's report states, "will determine the supply of individuals with the requisite background to educate engineers in an age when basic understanding of scientific principles must replace dependence on intuition and experience."

Until very substantial steps are taken to relieve the critical shortage of teachers, efforts to increase undergraduate enrollments are "highly questionable," says the Society's Committee on the Development of Engineering Faculties.

Already, the Committee says, the U. S. faces a shortage of nearly 1000 engineering teachers. About 9,500 new teachers will be required by 1966.

ASEE's program, says Dean William L. Everitt, of the University of Illinois, who drafted the Society's recommendations to Dr. Killian, represents "an evolutionary but not revolutionary change in present federal policies."

"It would serve to increase the critically inadequate supply of well-educated engineers, and it would provide small additional incentives for a number of these to explore teaching careers."

BIG BUILDING BLOCKS FOR B-58

Six of the biggest blocks of high-grade graphite ever made, each weighing more than two and a half tons, are prepared for shipment by National Carbon Company. Measuring 20 by 46½ by 84 inches, the huge graphite slabs will be used by Convair, a Division of General Dynamics Corporation, in producing the delta-wing B-58 "Hustler," the nation's first supersonic jet bomber. Convair will accurately machine the graphite into intricate shapes on which will be placed stainless steel components to be furnace brazed together at high temperatures to form honeycomb panels. Convair and its subcontractors found graphite to be the only acceptable material for this application because of its dimensional stability at elevated temperatures and its resistance to thermal shock. The aircraft industry has turned to honeycomb sandwich panels in its search for light-weight materials that will withstand the friction heat of supersonic planes, and larger and larger graphite reference forms are required for producing assemblies for today's giant planes.

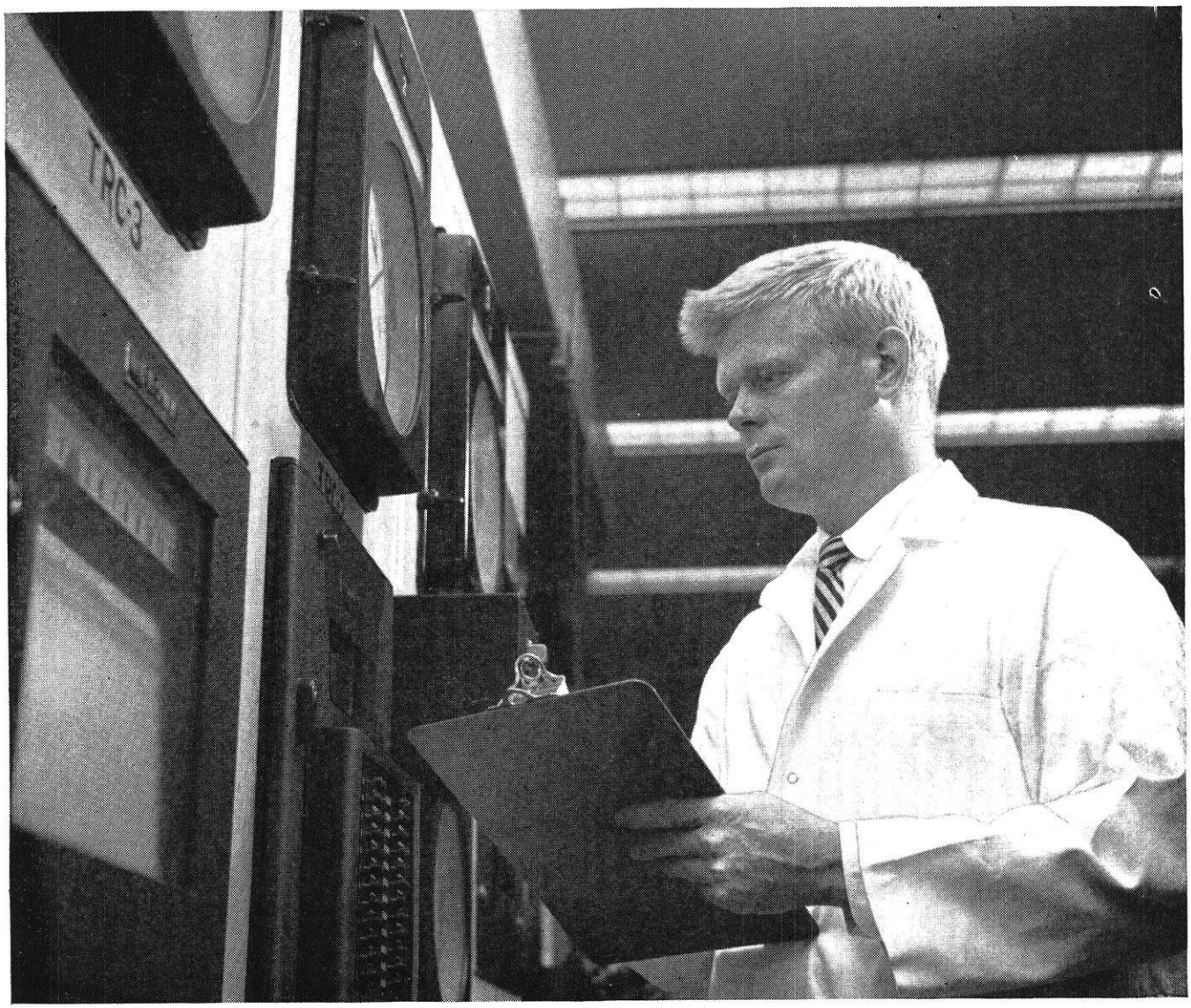
THE END

Prof. Rosenthal

(continued from page 68)

These courses also furnish the necessary training in the use of the microscope, X-ray equipment, mechanical testing equipment and related testing methods. Today many of the men who plan a career in metallurgy are also extending their training by doing graduate work for M. S. or Ph. D. degrees. This extra time gives them a better preparation for the many positions of responsibility that are available.

THE END



Pushing back the frontiers...in chemistry

Exploring new frontiers is still a pretty exciting business, especially in the great scientific and research centers like the Whiting Laboratories of Standard Oil Company. Here men like Dr. Omar Juveland are engaged in important exploratory work such as the search for new and improved catalysts for use in high polymer chemistry. In the photograph, Dr. Juveland is recording data on a polymerization process taking place in this research area.

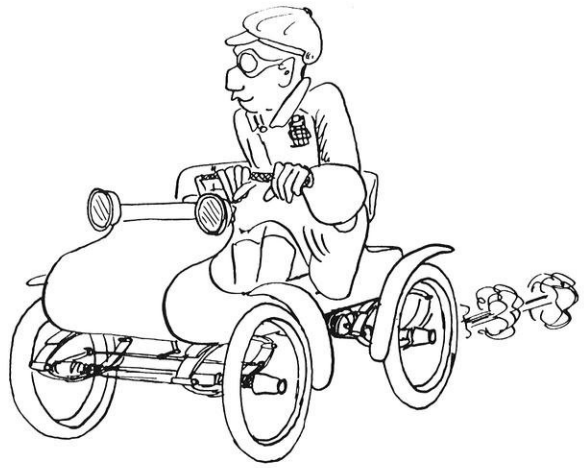
Dr. Juveland is one of the group of young scientists in Standard's Hydrocarbon and Chemicals Research Division. Born in Lake Mills, Iowa, he did his graduate work in organic chemistry at the University of Chicago. He received his BS in chemistry from St. Olaf College, Northfield, Minnesota, in 1950. He is a member of Phi Beta Kappa, Sigma Xi, and the American Chemical Society.

Busy young men like Dr. Juveland have found opportunity and work to their liking in the Standard Oil Laboratories at Whiting, Indiana. They share in the progress and accomplishment which contribute so much to the technical advancement and improvement required by America's expanding economy.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois

STANDARD



THE ENGINEER OF YESTERYEAR

by Dick Soref

November, 1919

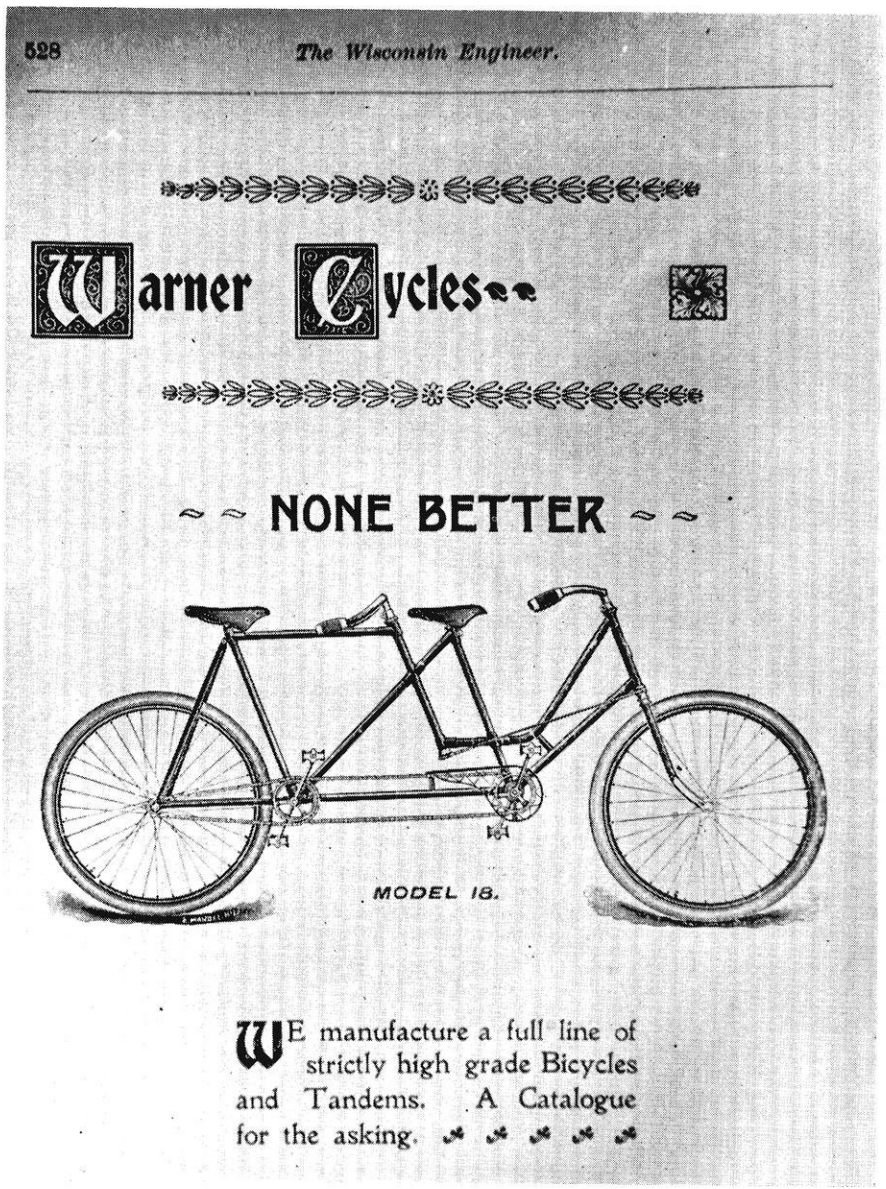
AN ENGINEER for President of the United States! Why not? At a recent reception in his honor, Herbert Hoover was introduced as particularly choice material for the office, and the idea was greeted with tremendous enthusiasm. Certain it is that there is no man in public life at this moment who seems so well fitted for the high office of Chief Magistrate. His training has been of the best and his experience has been broad. He is idealist enough to rise above sordid selfishness and yet he keeps his feet on the ground and accomplishes results that might be classed as miracles. Hoover is the rare prophet who is honored in his own country. His international fame rests upon other than engineering accomplishments and yet he is honored by engineers even more than by those outside of the profession. Placed at the head of this nation, he would, without doubt apply to its affairs the same level-headed and energetic methods that he has employed with such conspicuous success in his previous undertakings. We've tried most everything else as president; let's try an engineer.

January, 1920

Shall the inch soon pass into oblivion in favor of its smaller opponent, the centimeter? Shall the pound give way to the kilogram? Shall the quart follow the others and be displaced by the liter? In other words, will our progressive nation, now entering its greatest industrial era, decree that the present antiquated system of weights and measures be junked, and that the metric system be the only lawful standard? . . . Knowing men of the day have said that the coming few years will be the crisis of the battle of measurements. Daily, as our industries grow, the tremendous problem of changing units grows larger. There is a limit to the time that we can wait, and if that limit be passed before action is taken, our nation will be forever separated from all others by a barrier of weights and measures.

May, 1918

Protective coloration, properly termed "Camouflage," as a neces-



sity among armies has never until the present war become a definite and important tactic of defense. On land the modern development of the aeroplane has rendered the spectacular soldiery of former wars impossible, and in its stead have arisen the modern armies that, in order to exist, must strike and then hide. On the ocean the far-reaching submarine has made the former display of power by the battleships fatal, and as a cure for submarine-itis the art of camouflage has been resorted to.

October, 1918

The use of poisonous gases in the present war was first made by the Germans at Ypres in April 1915, in direct violation of the Hague Agreement. The effect of the first gas attack was extremely disastrous to the British soldiers who were entirely unprepared for such tactics, and caused the entire world to stand aghast at the frightfulness of it all. Major S. J. Auld of the British Army, has stated that a deserter from the German Army advised the British that a gas attack was to be made, but this information was not taken seriously because it seemed impossible that any civilized nation would do a thing so frightful. The story regarding the methods of defense against poison gas is full of thrills; the ability, resourcefulness and decision of the British and American scientists and engineers in solving the problem should arouse intense pride in the hearts of all loyal Americans.

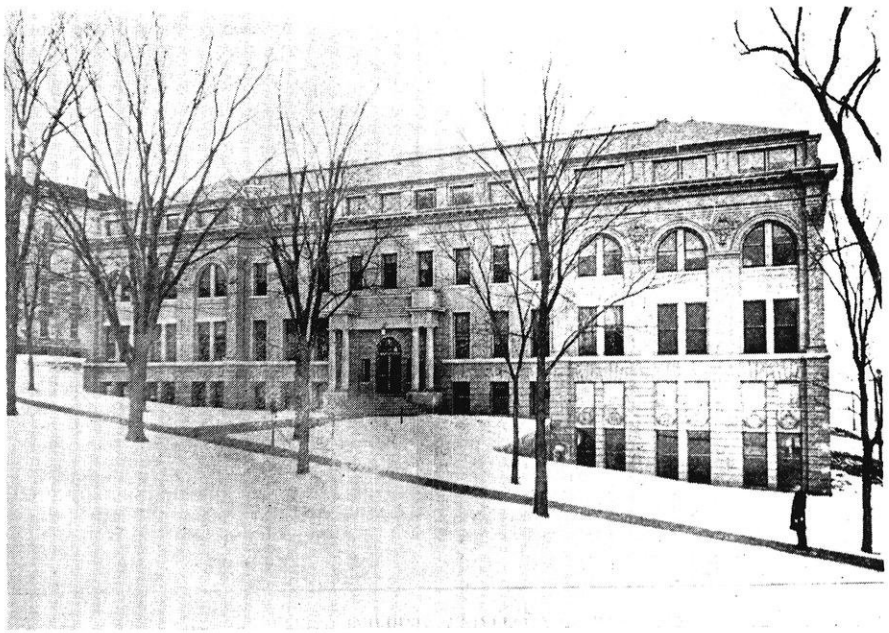
October, 1918

Three years ago most of us thought that a world war could not last long because, however much kings and kaisers might wish to continue, the banker would stop it. But the financiers have not come up to our expectations in this matter, and we have therefore been compelled, unwillingly perhaps, to recognize that money is not the ultimate measure of national strength. National credit is the result and not the cause of intelligent industrial production; the engineer, not the banker, is the real power behind the throne.

December, 1917

A new athletic field and concrete stadium now grace historic Camp Randall. The project though far from being complete when finished according to the present plans will be as fine an athletic field as the country possesses. Coach T. E. Jones, Director of Athletics, declares that the field at present is better than any other one in the United States. Camp Randall is the finest spot in Wisconsin for an athletic field, both because of its history and its situation.

U.W. track team of '96.



The old Engineering building.

November, 1919

Another student publication makes its appearance on the campus this month — the humorous magazine. *The Octopus*. It will be the first issue in two years of a periodical devoted especially to jokes, odd poems, songs, and stories. With the large enrollment of this semester, and on account of the wealth of material in the University, the "Octopus" should be a decided success. The *Wisconsin Engineer* welcomes the newcomer to the field, wishing it a prosperous future. However, it is only fair to warn *The Octopus* that the famous "Campus Notes" of the *Engineer* are entirely protected by copyright.

THE END

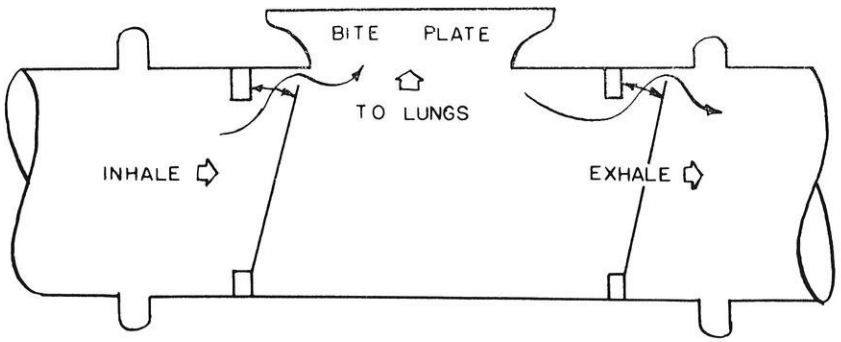
Self-Contained Underwater Breathing Apparatus

(continued from page 21)

much the same as a vest. The outfit is put on by slipping it over the shoulders and tightening it down with a waist strap.

The proper flow of air and the functioning of the regulator are vital to the operator's safety. The operator must understand this flow to be able to judge his equipment properly. He must also be able to prepare his gear before each dive, to insure proper operation on the dive.

In *open-circuit equipment:* when the manifold valve is manually opened, the air leaves the bottle at approximately 2200 psi (full bottle) and enters the high pressure chamber. The spring valve X is set to allow only 60 psi of air to enter the medium chamber. When the diaphragm is pushed in, due to the partial vacuum between the chambers caused by the diver inhaling, the horseshoe valve rotates counter-clockwise. The valve is rotated just enough to allow the entering air to equalize the chamber pressures, destroying the partial vacuum and pushing the diaphragm back out. The demand of the diver therefore regulates the flow of air. The exhaust valve is located near the diaphragm to make the motion of the diaphragm steadier, helping to conserve air.



Open-circuit mouthpiece flow.

In *closed-circuit:* the diver inhales drawing air from, and partially collapses, the breathing bag. The air enters the lungs, exchanges oxygen for carbon dioxide, and is exhaled into the cannister where the carbon dioxide is absorbed by the soda lime. The air next is forced back into chamber and is ready for another cycle. When the diver finds the breathing difficult he opens the cylinder valve, allowing oxygen to enter the breathing bag and refresh the air.

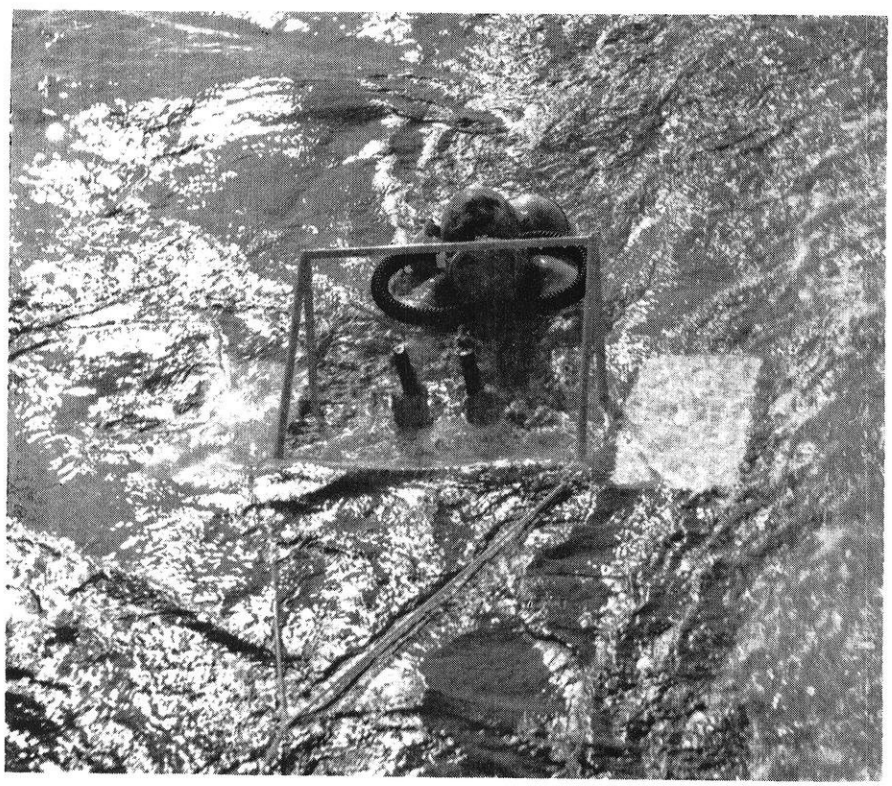
The tank, regulator, and tubes must be checked to be sure they are completely air tight and operate properly in the open circuit. The regulator should not be put on the bottle until immediately before entering the water and after checking the bottle pressure. All checks should be made by the diver. A check list is necessary.

For *closed-circuit:* The breathing bag, cannister, tubes, and all fittings should be visually inspected to insure complete water-tightness. The cannister should not be filled with soda lime until immediately before the dive, to keep it from absorbing moisture from the air. The oxygen bottle should be gaged for the proper pressure, then attached to the harness, and again checked for leaks. Before diving the breathing bag is collapsed and purged of all air by inhaling through the mouthpiece. The bag is then reinflated with oxygen and further regulated as the diver descends in the water.

The operational features, while not directly concerned with the mechanics of the apparatus, are still very important to bear in mind when buying diving equipment. The established safety measures must still be closely followed by the novice even though he may not understand the reason behind them. If possible, every diver should have instruction in diving theory to enable him to set his own safety rules. The cost and use of the gear are of importance to all divers, for safety as well as financial reasons.

SCUBA has been developed to a point where the average skin diver, with proper training, can use it

(continued on page 76)



This underwater "sled" is used for towing divers behind the Madison Diving Club barge. The diver controls the sled by means of the control handles, which move the hydrofoils on either side.

JOB FACTS FROM DU PONT

DU PONT
REG U.S. PAT OFF.
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

LIBERAL EMPLOYEE BENEFIT PROGRAM AT DU PONT INCLUDES INSURANCE, SAVINGS AND STOCK PLANS

WHAT'S YOUR LINE? DU PONT NEEDS ALL KINDS OF ENGINEERS

Du Pont has always needed chemists and chemical engineers, and still does. But today, there's critical need for engineers in almost every other field—civil, mechanical, electrical, instrumental and industrial engineering, to name a few.

Expansion is the major reason. In 1957, for example, sales at Du Pont were nearly two billion dollars. Four new plants were being built. New research programs were being launched. New products were moving into the production and marketing stages. Engineers and scientists of all kinds work in 75 Du Pont plants and 98 laboratories in 26 states. All of this tends to broaden opportunities for the young scientist and engineer at Du Pont.

If you're interested in finding full scope for your ability, and this includes a great many special fields, Du Pont offers you plenty of opportunity to move ahead.

SEND FOR INFORMATION BOOKLET ON JOB OPPORTUNITIES AT DU PONT

Booklets on jobs at Du Pont are yours for the asking. Subjects covered include: mechanical, civil, metallurgical, chemical, electrical, instrumentation and industrial engineers; atomic energy, technical sales, business administration, research and development. Name the subject that interests you in a letter to Du Pont, 2494-F Nemours Building, Wilmington 98, Del.

PERSONALIZED TRAINING

by
C. M. Forbes
Du Pont
Representative

When you join Du Pont as a scientist or engineer, you're given an actual project assignment almost at once and begin to learn your job by doing it. That's the essence of our training philosophy at Du Pont.

Our objective is to give you responsibility at the outset and qualify you quickly for more, because the more we grow, the more we need trained leaders.

Although there is no one training program at Du Pont (each of our many departments runs its own), all have several basic features in common. All are personalized—tailored to the new man's background and interests. All involve close supervision on an informal, day-to-day basis. And all permit periodic evaluation of the new man.

This flexible system helps the new man to move ahead according to his abilities. He gets to know Du Pont and his job quickly. He gets a head-start on future responsibility.

You probably have questions about this program and how you'd fit into it. I'll be glad to try to answer them when I visit your campus. Why not sign up for a Du Pont interview at your placement office now?

Means More Security, Greater Real Income To Young Graduates

Du Pont believes that the employee builds his own job security by the way he does his work, by his contributions to the progress of the Company and by his readiness to accept responsibility.

But Du Pont meets the employee more than halfway with a program of benefits designed to help him as he advances.

Your employee benefits go to work the day you join the Company. They grow and build equity for you as the years go by. Vacations, life insurance, group hospital and surgical coverage, accident and health insurance, pension and bonus plans are all part of the program.

Let's look at a special example, the Thrift Plan. You become eligible for it after one year with the Company. For each dollar you invest in U. S. Savings Bonds, the Company contributes twenty-five cents toward the purchase of Du Pont common stock in your name. Roughly 65 per cent of the Company's 90,000 employees are now participating in the plan.

When you're deciding on a career, security is only one consideration. But it's an important one to you and your family. At Du Pont, security is a bright part of the future awaiting the college graduate.

★ ★ ★

More than 700 of the some 1100 degree-granting colleges and universities in the U. S. are represented at Du Pont. Of these 700, more than half are the smaller liberal arts colleges.

Self-Contained Underwater Breathing Apparatus

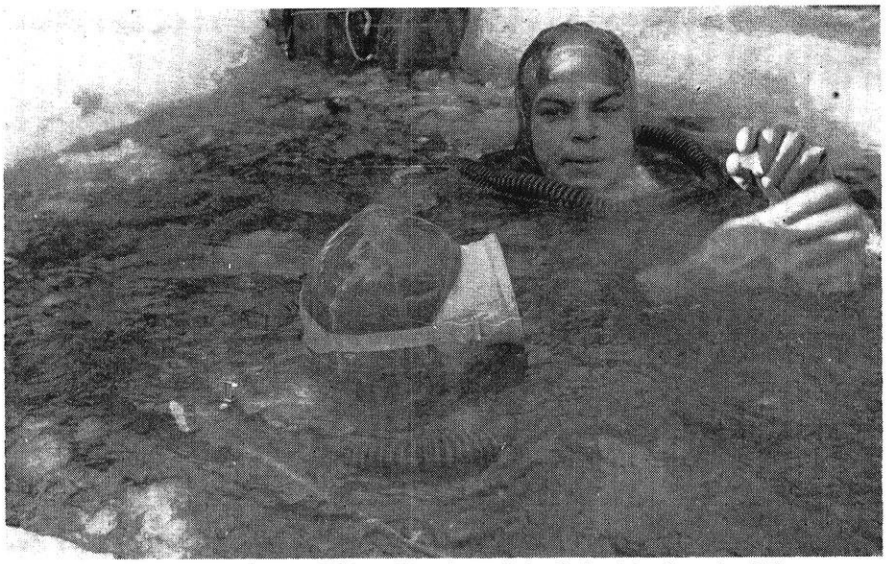
(continued from page 74)

with a high degree of safety. The ease with which most SCUBA can be used may invite the untrained person to use them, not realizing the dangers involved. Several points must be considered to assure safe diving with the free swimming apparatus.

Both types of gear are perfectly safe if properly used. The swimmer must have sufficient instruction in the use of SCUBA, and know its limitations, before attempting any diving. The producers of the SCUBA gear have instruction booklets with which the prospective diver must become familiar. These booklets describe all the parts of the apparatus, how it works, how it should be used, and its upkeep and repair.

The cost is important to all but the well financed diver. Cost must not, however, overshadow quality. The savings are not much good to the dead diver. A diver should always purchase the best gear he can afford, but be sure what he can afford is adequate. Maintenance costs are variable but usually small if the diver takes proper care of the equipment. Unless one is well qualified in repair, he should not attempt to fix his own gear.

The use to which the apparatus will be put will decide whether to buy open or closed SCUBA. If one is going to do salvage work in deep water, then the open-circuit is best. For shallow water diving and fishing the closed-circuit is probably the best. Both types have their advantages and disadvantages.



Madison divers at the ice-fishing "Percharee" in Lake Mendota in February.

The open-circuit SCUBA is the more common type. It is easier for the novice to learn to use and requires less careful handling. The apparatus can be used for depths up to 150 ft. and is well adapted for hard work. The main disadvantage is in its short air supply. Every time the diver exhales, a large quantity of air goes out into the water as air bubbles and is replaced by air from the bottles on the next inhalation. The air is thus not reusable. This greatly cuts down the diving time, especially on the deep dives where the air is compressed and is therefore used up faster.

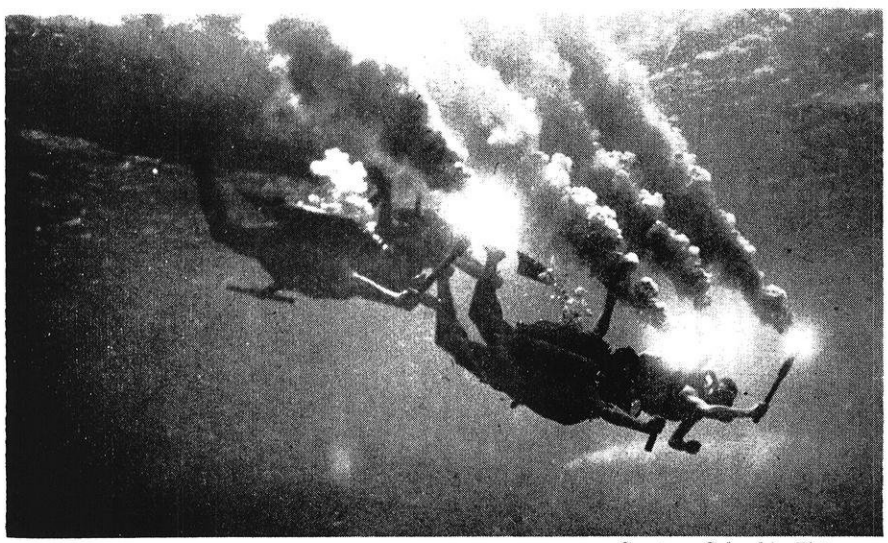
The bubbles are inconvenient only to the spearfisherman. The bubbles scare away the fish making the hunting much more difficult. If the gear is to be used for shallow dives and for fishing, the diver might better buy the closed-circuit type SCUBA.

Up until last year, the closed-circuit SCUBA was not used in the United States except by the Navy and some of the more qualified skin divers. Recently more divers have been experimenting with the closed-circuit and have found that it is much better for sport diving. This model does not give off any bubbles, and the oxygen supply will last up to four hours. The only disadvantage is that one cannot dive deeper than 33 ft. To go deeper increases greatly the chance of oxygen poisoning and possible death. Also, greater care is required so as not to get water into the system.

The choice between closed-circuit and open-circuit SCUBA will at first seem difficult. One should not go out and purchase the first type he may see. Many of the sporting goods stores, in diving areas, will rent both types of gear for nominal prices. The diver should try both types, under varying conditions, to help determine which type to buy.

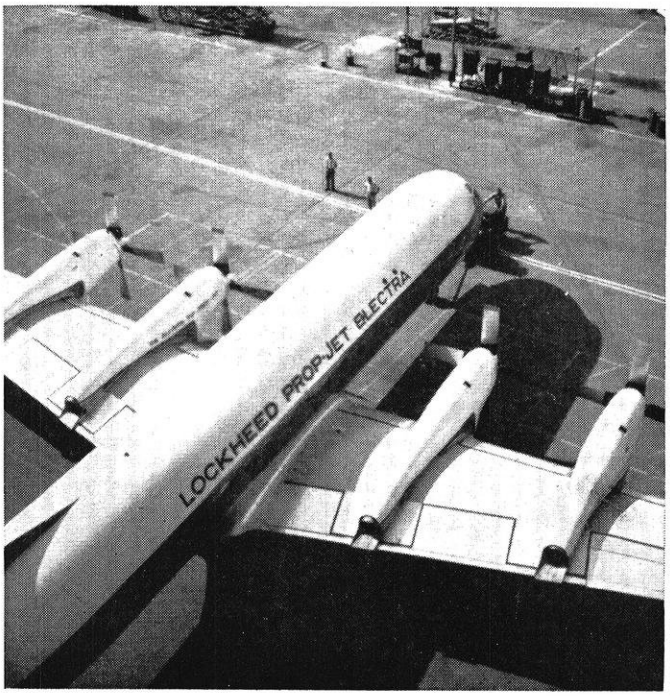
The open-circuit is best when the dives are deep and the bottles are easy to recharge. The closed-circuit is best for shallow dives and when it is not so easy to recharge. Both types are safe and easy to operate. The final decision is up to the individual diver.

THE END



—Courtesy Columbia Pictures

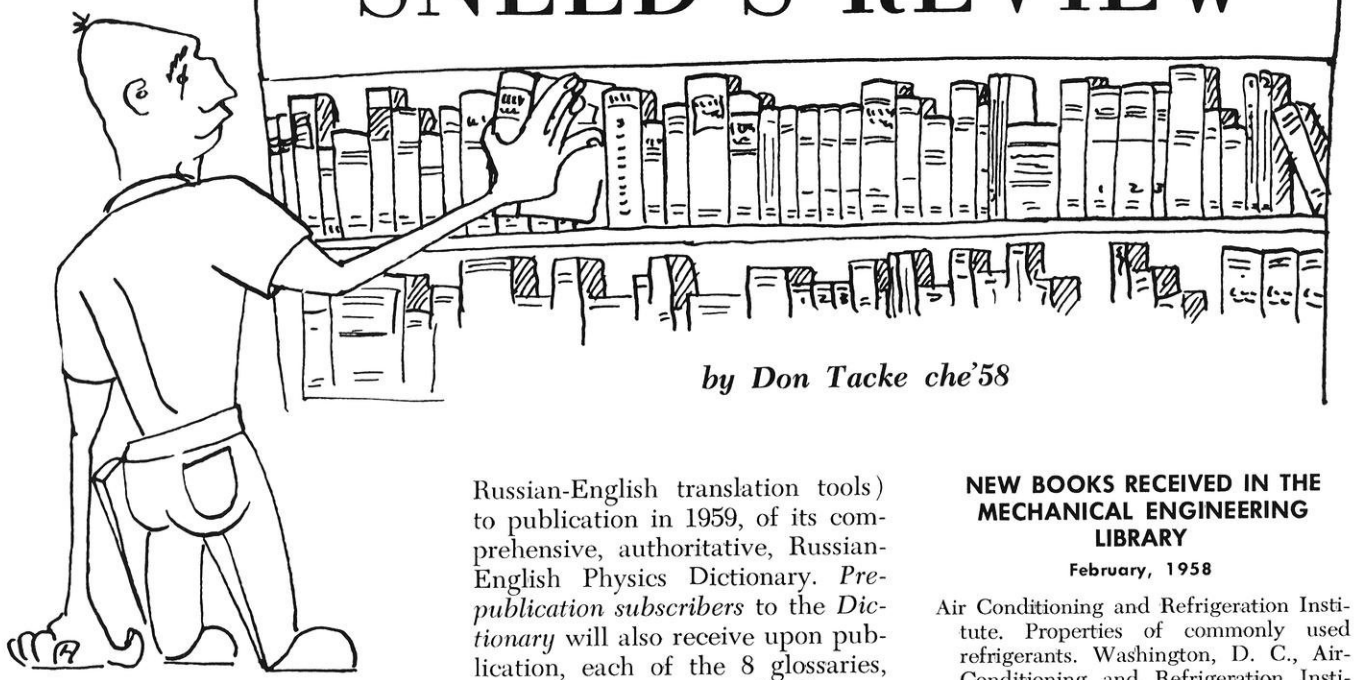
The Silent World.



INDIANAPOLIS, IND.: (Special) Lockheed Aircraft Corporation and the Allison Division of General Motors Corporation have teamed up to produce a commercial passenger transport that promises to revolutionize air transportation on the medium-and-short-range flights. Cruising at more than 400-mph the Allison Prop-jet Lockheed Electra will bring jet-age speed and comfort to passengers and set new standards of operating economy for air lines of the world.

Teamwork within Allison, just like the Lockheed-Allison team, is highly prized by newly graduated engineers. If you would like to know more about the Allison team, write Personnel Department, College Relations, Allison Division of General Motors Corporation, Indianapolis, Indiana.

SNEED'S REVIEW



by Don Tacke che'58

RUSSIAN-ENGLISH ELECTRONICS AND PHYSICS GLOSSARY

By Consultant's Bureau, Inc. $10.00

This Glossary, while incorporating all previously published Electronics Glossaries, eliminates duplications, and adds thousands of new terms, including idioms and selected general vocabulary. A 10 page appendix covers US-Soviet vacuum tube equivalents, unit equivalents, circuit components and notations, abbreviations; the text specifies fields in which terms are used as explained. The new terms result from the combined experience of Consultants Bureau's physicist-translators working for US Government agencies, private industry, and the American Institute of Physics. Many of these terms were encountered in the course of translating the following Soviet journals: Automation and Remote Control; Journal of Technical Physics; Electricity; Radio-Engineering and Electronics; Proceedings (Doklady) of the Academy of Sciences, USSR; Journal of Acoustics; Communications Journal.

The Electronics Glossary is part of a series of 8 *interim* glossaries on specialized fields of physics being published by Consultants Bureau as a preliminary (in order to meet the current urgent need for Russian-English translation tools) to publication in 1959, of its comprehensive, authoritative, Russian-English Physics Dictionary. *Prepublication subscribers* to the *Dictionary* will also receive upon publication, each of the 8 glossaries, all for only $50.00; each Glossary sells separately at $10.00. The Glossaries, the first 3 of which are now available, are: Nuclear Physics and Engineering; Solid State; Electronics and Physics; Electricity and Magnetism; Liquids and Hydraulics; Acoustics and Shock Waves; Mechanics and General Physics; Atomic Physics, Spectroscopy, Optics.

* * *

NUCLEAR CHEMICAL TECHNOLOGY

By Manson Benedict and Thomas H. Pigford McGraw–Hill, $9.50

This is the first comprehensive treatment of the chemical engineering aspects of nuclear technology. Summarizing most of the relevant information on the chemical processes used in nuclear technology, the book also presents hitherto unpublished methods for designing isotope separation plants and for estimating the change in composition and reactivity of nuclear fuels during irradiation. The authors have combined an account of the scientific and engineering principles of separations technology with a descriptive account of the materials and processes of importance. The book, destined to become an authority in its field, serves as both a text for classriom instruction and as a source of information for all specialists in nuclear technology.

NEW BOOKS RECEIVED IN THE MECHANICAL ENGINEERING LIBRARY

February, 1958

Air Conditioning and Refrigeration Institute. Properties of commonly used refrigerants. Washington, D. C., Air-Conditioning and Refrigeration Institute, 1957.

American Institute of Electrical Engineers. Directory of Consulting Engi- Systems. New York, Amer. Inst. of Elec. Engrs., 1957.

American Society of Mechanical Engineers. Diretory of Consulting Engineers. New York, Amer. Soc. of Mech. Engr., 1957.

Anderson, L. Bibliography, Dr. Nikola Tesla. Minneapolis, Tesla Society, 1956.

Astury, N. Introduction to electrical applied physics. New York, Philosophical Library, 1957.

Benson, Frank. Voltage stabilized supplies. London, Macdonald, 1957.

Brace, A. Magnesium Casting Technology. New York, Reinhold, 1957.

British Electrical Development Association. Induction and Dielectric Heating. London, 1957.

British Interplanetary Society. Realities of space travel. London, Putnam, 1957.

Butler, Stanley. Engineering Hydrology. Englewood Cliffs, N. J., Prentice–Hall, 1957.

Camm, F. Amplifiers: design and construction. London, G. Newnes, 1957.

Chesters, J. Steelplant refractories, testing, research development. Sheffield, England, United Steel Companies, 1957.

Draper, Alec. Electrical machines. London, New York, Longmans, Green, 1956.

Freese, Stanley. Windmills and Millwrighting. Cambridge, Univ. Press, 1957.

Hausner, H. Materials for nuclear power reactors. Reinhold Pilot Book #7. New York, 1955, Reinhold.

Houghton, P. Jig and fixture design. Loudon, Chapman & Hall, 1956.

Now on many supertankers, ductile iron is a new material widely used by today's engineers in designing heavy-duty equipment.

Ductile Iron... another Inco Research first

Over five miles of ductile iron pipe going into many of today's supertankers

A deep sea tanker takes many a heavy beating when waves are rough.

With each pitch and roll, she has to *weave*. And her five or more miles of piping have to weave with her.

If it is ductile iron piping, every pipe length *gives* without break or leak.

Bends without breaking

Ductile iron is not only ductile, but also tough. And resistant to the corrosive action of sea water and sulfur laden crude oil.

In some tankers, gray cast iron pipe resists corrosion for ten years or more. Sometimes, though, it's cracked and broken by the pounding of heavy seas that overtax its strength.

In other tankers, steel pipe outrides such storms without damage. But it corrodes so badly it may have to be replaced every three or four years when handling sour crudes.

Ductile iron pipe, tanker owners find, combines the low cost and demonstrated corrosion resistance of cast iron with the tough strength of carbon steel.

So today, many of the newest tankers carry pipe and fittings of ductile iron.

Ductile Iron also under city streets

The properties that prove ductile iron pipe suitable for tankers also commend it to municipal and utility engineers. So this shock-and-corrosion resisting pipe is used for water and gas mains. It may soon be under the streets in your town.

Ductile iron has many uses—from plowshares to jet plane parts. And cost-conscious industry is constantly finding new ways to use this versatile money-saving, Inco-developed material.

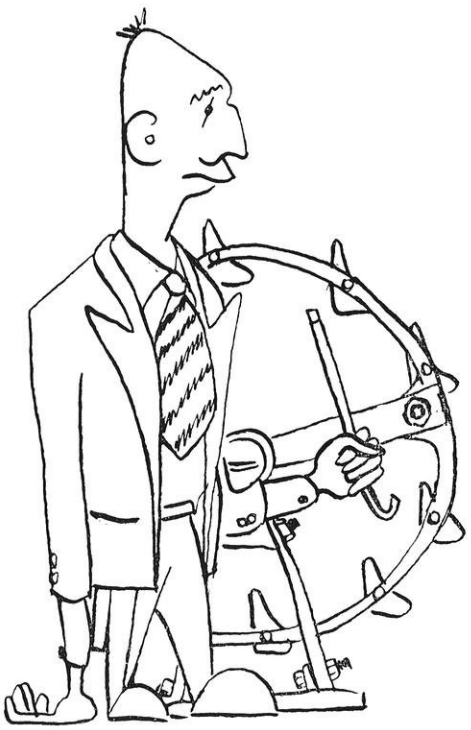
For free booklet, "Engineering Properties and Applications of Ductile Irons," write: Dept. 232G, Educational Service, Development and Research Div.,

The International Nickel Company, Inc.
New York 5, N. Y.

©1958, T. I. N. Co., Inc.

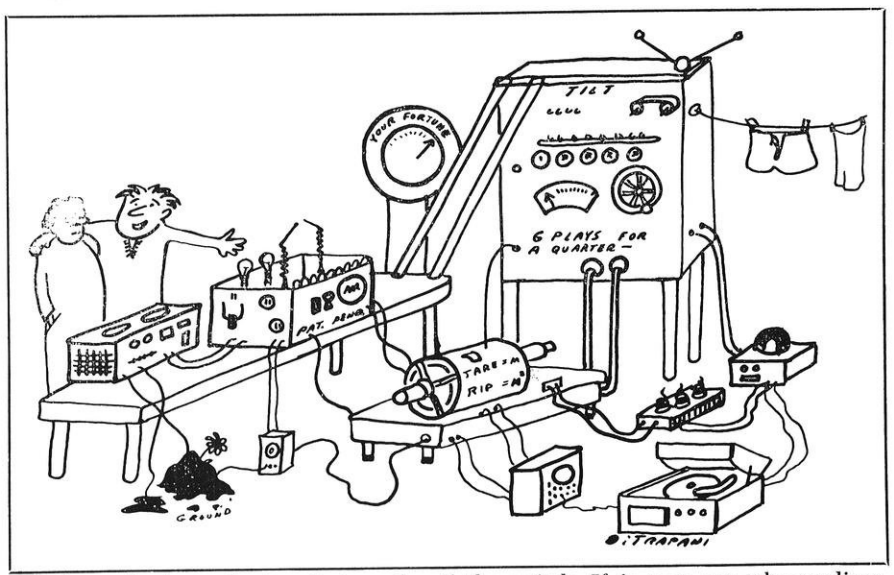
INCO **International Nickel**

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 and Platinum, Palladium and Other Precious Metals

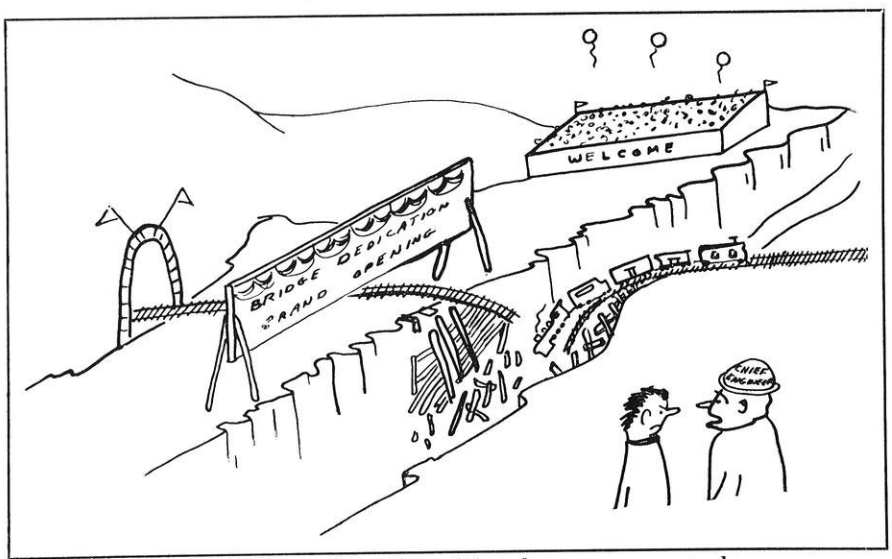


THE FERROUS WHEEL

exhumed and cartooned
by Tony DiTrapani



We fasten leads to the terminals and pull the switch. If it runs, we take readings. If it smokes, we sneak it back and get another one.



That's one thing about those slide rules—you never can be sure about the decimal point.

Cook: "Say, the garbage man is outside."

Mess Sergeant: "Tell him to leave two cans today."

* * *

"I quit engineering because of ill health."

"What was the trouble?"

"I made people sick."

* * *

Salesman: "Sir, I have something here that's guaranteed to make you the life of the party, allow you to win friends and influence people, help you to forge ahead in the business world, and in general make life a more pleasant and invigorating experience."

Engineer: "I'll take a quart."

* * *

And as they say in mechanics—"Every couple has its moment."

* * *

The only thing worse than being a bachelor is being a bachelor's son.

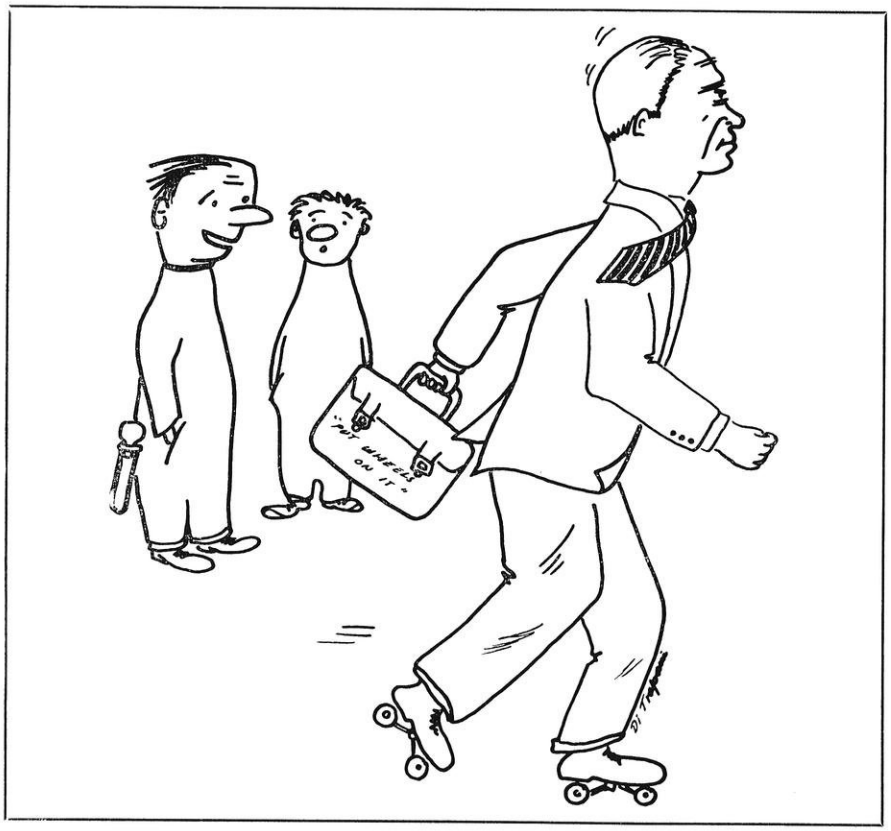
* * *

I serve one purpose in this school
On which no man can frown.
I quietly sit in every class
And keep the average down.

* * *

Prof: "If, in running down this ramp I gain 5 feet per second, what will be my condition after 25 seconds?

EE: "You'll be a centipede."



There goes that materials handling prof. again . . .

A circle has no corners.

An oval has no corners too.

But not so nearly no corners as a circle has.

* * *

ME: "Say, Bruce, that sorority gal you've been going with really wants to get married. If you go home, take a bath and get cleaned up, I'm sure you could win her for your wife."

EE: "Yeah, Don, but suppose I took a bath and got cleaned up and then she wouldn't marry me, then what?"

* * *

Frosh: "What do you mean by shooting the bull?"

Soph: "To shoot the bull is to prevent the professor from realizing that you are saying practically nothing in a great many words.

Junior: "To shoot the bull is to say very little in a great many words so as to give the impression that you are familiar with the material that the test is covering."

Senior: "To shoot the bull is to say as much as possible in carefully chosen words so as to convey the impression that you are familiar with the material under examination even though you have been unable to devote sufficient effort to study adequately an unduly difficult assignment."

* * *

Her: "I'm Yvette, the Oriental dancer."

Him: "Shake."

* * *

The excited voice of a Slichter resident came over the phone: "Two boys are trying to break into my room through the window."

"Listen, lady, this ain't the police department, it's the fire station."

"I know," she replied, "but my room is on the second floor and they need a step ladder."

* * *

CE: "Your girl is spoiled, ain't she?"

EE: "Naw, that's just the perfume she's wearing."

* * *

The guy was doing his best, leading a goat with one hand, carrying a cane with the other, and loaded down with a laundry basket on his back and a chicken under his arm.

His girl hesitated when they came to the woods, saying, "I'm afraid to walk with you in there. You might try to molest me."

"How could I?" the guy assured her. "Look at all the stuff I'm carrying."

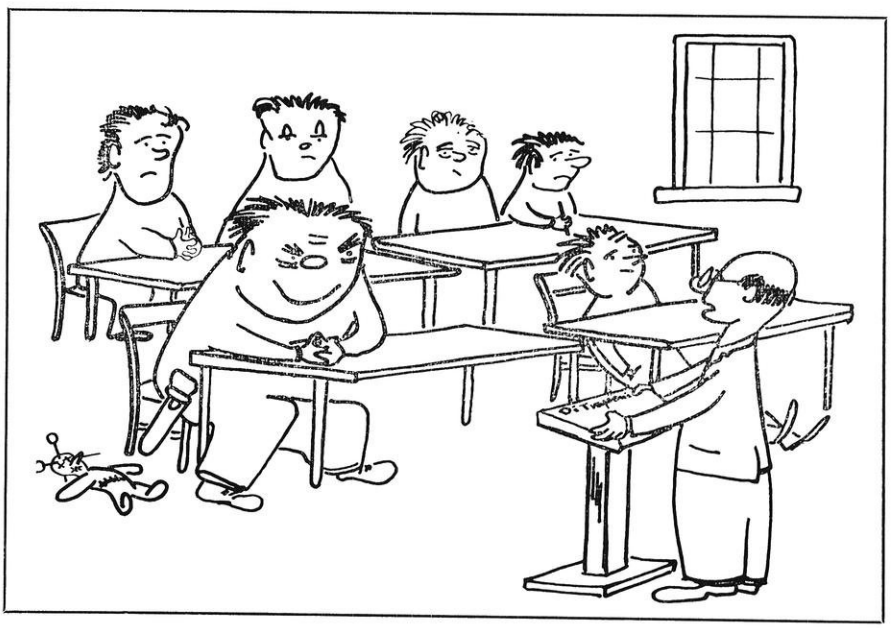
"But you could put the chicken under the laundry basket, stick the cane in the ground, and tie the goat to it."

* * *

Since we call professors "profs" it's a snap to figure out what we ought to call assistants.

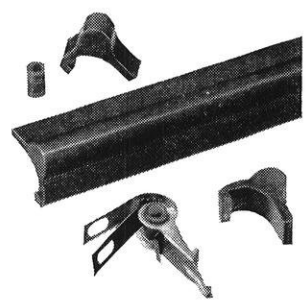
* * *

Anyone who thinks he's indispensable should stick his finger in a bowl of water and notice the hole it makes when he pulls it out.



Our regular speaker will not be with us today—he is home in bed with a severe headache.

Readin', 'Ritin', and Reliability



Synthane plastic laminated bushings and breaker arms for automotive ignition.

Dependable operation of a school bus, a truck, or your own car involves the functioning of many parts. One breakdown can wipe out the memory of ten thousand trouble-free miles.

Some of these parts are made of laminated plastics. They're usually unseen, unsung, small in size yet efficiently performing their job.

Their cost is relatively insignificant when compared with the cost of equipment in which they work, but it should be sufficient to insure dependability.

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So You Think You're SMART!

by Sneedly bs'61

SNEED had the pleasure of talking to a Hill Student last week who was rather unique. This Hill Student, Al Borak, by name, had unusual abilities in mathematics, including such complex manipulations as finding square roots, multiplication of fractions, etc. Sneedly commented on this fellow's digital dexterity, and Al Borak replied in defense of the Hill people, that while most of them couldn't add or subtract, he had observed that even Engineers seem to have some shortcomings. Sneed poo-poohed this bit of slander, but when pressed for specifics, Al Borak claimed that the Engineering curriculum is so narrow that Engineers know nothing about Literature, History, Art, Music, and in general have no talents except writing reports and working problems. Al was downright nasty and Sneed said that he'd show him where he was wrong. The trouble is this: Sneed can't. He wants some help from you. Let Sneed know what you think about the question: "Do Engineers Receive A Narrow Education?" Send your idea to:

SNEEDLY
℅ Wisconsin Engineer
Mechanical Engineering Bldg.
Madison 6, Wis.

The January $10.00 prize went to two ME's, Bob Campshure and Barney Lamers. Incidentally, their set of solutions had the latest postmark; all earlier entries had errors and had to be eliminated. So get them right and get them in fast.

The correct solutions for February's problems are given below, and the winner or winners will be named next month.

1. When the four flies meet at the center they have each walked a distance equal to a side of the square.

2. a. 10π

b. The total surface area of the figure is 302.75 square inches. The formula for computing this area is: $A = \pi r \sqrt{r^2 + h^2} + \pi r^2 + 12.57R^2 (1/1\text{-}K^2)$, where r is the radius of the cone's base, h is the height of the cone, R is the radius of the largest inscribed circle, and K is the Proportionality constant of the inscribed circles' radii (for this problem the value is .46).

c. The percentage of the isosceles triangle covered by the inscribed circles is 73.25. Note: The area of the circles is approximately 29.3 square inches. The formula $A = \pi r^2(1/1K^2)$ is used for this computation with the symbols having the same meaning as in part b.

3. The problem of the bee, Bill, and Dave is easy if you first calculate how long it takes for the boys to meet. Since they are approaching each other at the rate of 8 MPH, it takes 5 hours. Therefore the bee flies 5 hours $\times$ 20 MPH = 100 miles.

* * *

Now for this month's problems, again worth $10.00 to the sender of the correct solutions with the earliest postmark. Sneed is indebted to Litton Industries and to Dick Williamson of Litton Industries for sending the following three problems in response to Sneed's recent plea for assistance. Here they are:

1. A tennis club invites 32 players $(2)^5$ of equal ability to compete in an elimination tournament. If both John and Jim Smith are invited, what is the chance of their playing each other during the tournament?

2. Three round grapefruits and one round orange lie on top of a table with every fruit touching each of the other three. If each grapefruit is six inches in diameter, how large is the orange?

3. Two places are taken at random in the Northern Hemisphere; find the chance of their distance exceeding 90° of a great circle.

Tear out this page for **YOUR BEARING NOTEBOOK...**

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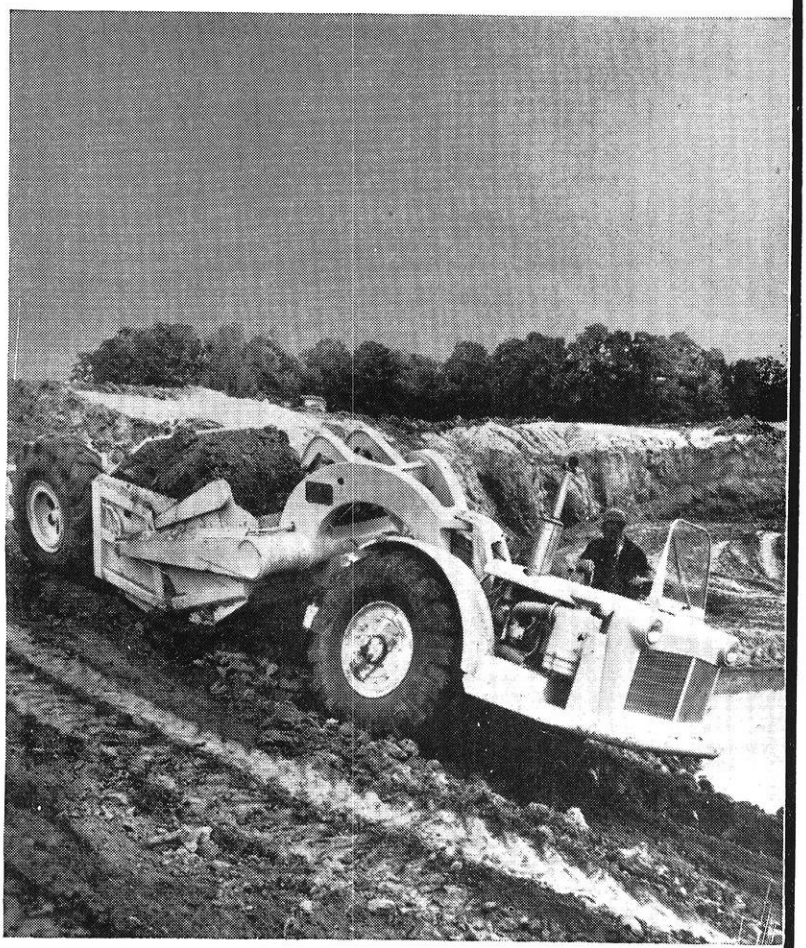

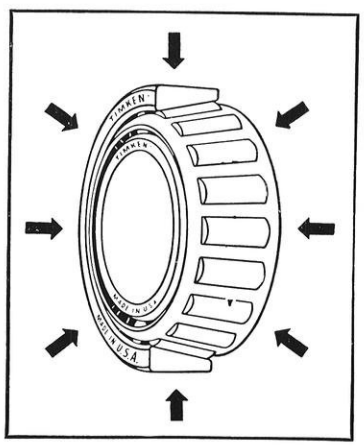

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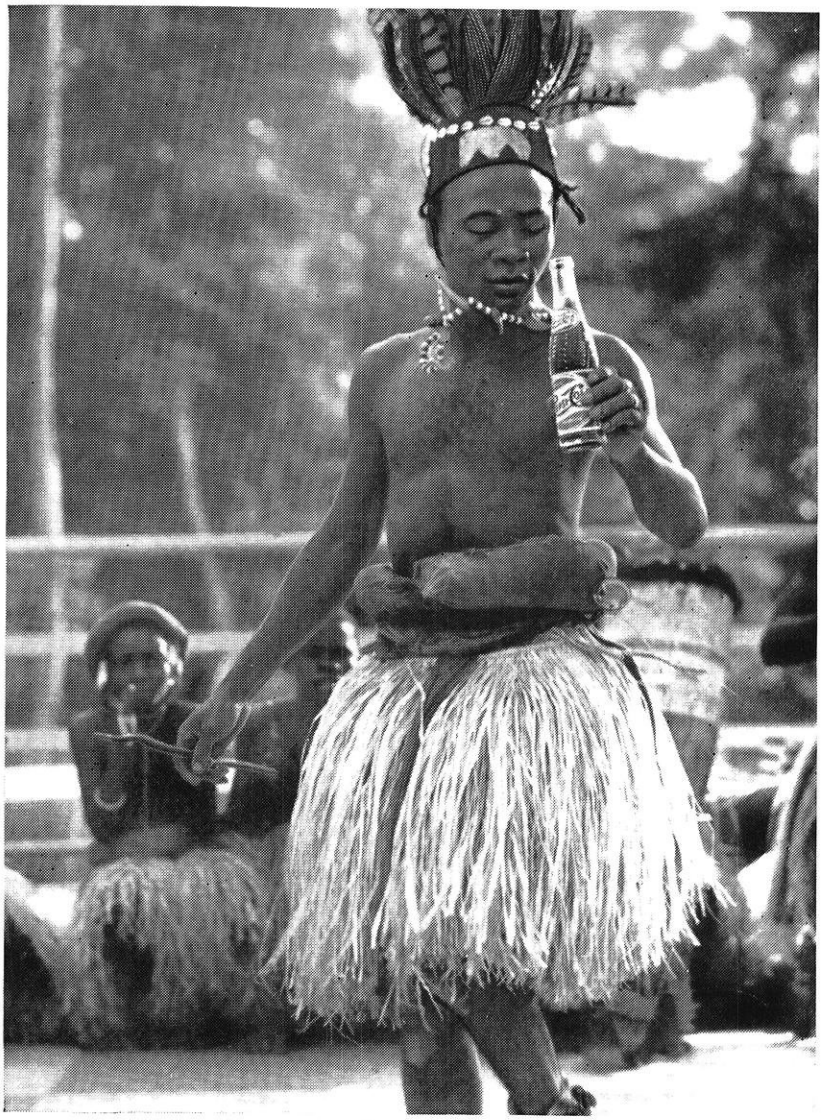

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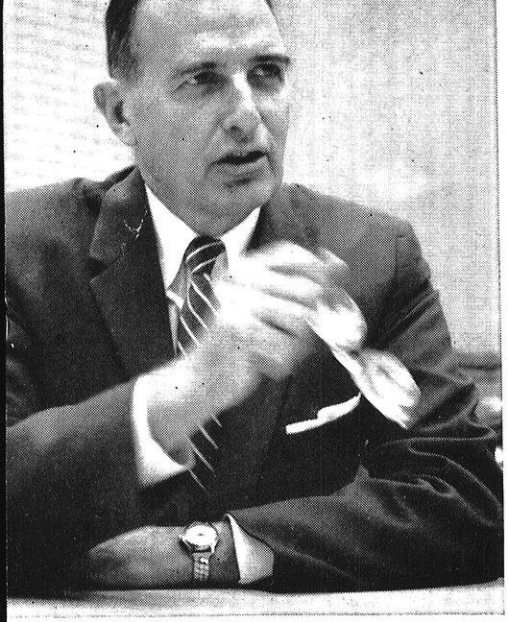

One of a series*

Interview with General Electric's W. Scott Hill Manager—Engineering Recruiting

Qualities I Look For When Recruiting Engineers

Q. Mr. Hill, what can I do to get the most out of my job interviews?

A. You know, we have the same question. I would recommend that you have some information on what the company does and why you believe you have a contribution to make. Looking over company information in your placement office is helpful. Have in mind some of the things you would like to ask and try to anticipate questions that may refer to your specific interests.

Q. What information do you try to get during your interviews?

A. This is where we must fill in between the lines of the personnel forms. I try to find out why particular study programs have been followed, in order to learn basic motivations. I also try to find particular abilities in fields of science, or mathematics, or alternatively in the more practical courses, since these might not be apparent from personnel records. Throughout the interview we try to judge clarity of thinking since this also gives us some indication of ability and ultimate progress. One good way to judge a person, I find, is to ask myself: Would he be easy to work with and would I like to have him as my close associate?

Q. What part do first impressions play in your evaluation of people?

A. I think we all form a first impression when we meet anyone. Therefore, if a generally neat appearance is presented, I think it helps. It would indicate that you considered this important to yourself and had some pride in the way the interviewer might size you up.

Q. With only academic training as a background, how long will it be before I'll be handling responsible work?

A. Not long at all. If a man joins a training program, or is placed directly on an operating job, he gets assignments which let him work up to more responsible jobs. We are hiring people with definite consideration for their potential in either technical work or the management field, but their initial jobs will be important and responsible.

Q. How will the fact that I've had to work hard in my engineering studies, with no time for a lot of outside activities, affect my employment possibilities?

A. You're concerned, I'd guess, with all the talk of the quest for "well-rounded men." We do look for this characteristic, but being president of the student council isn't the only indication of this trait. Through talking with your professors, for example, we can determine who takes the active role in group projects and gets along well with other students in the class. This can be equally important in our judgment.

Q. How important are high scholastic grades in your decision to hire a man?

A. At G.E. we must have men who are technically competent. Your grades give us a pretty good indication of this and are also a measure of the way you have applied yourself. When we find someone whose grades are lower than might be expected from his other characteristics, we look into it to find out if there are circumstances which may have contributed.

Q. What consideration do you give work experience gained prior to graduation?

A. Often a man with summer work experience in his chosen academic field has a much better idea of what he wants to do. This helps us decide where he would be most likely to succeed or where he should start his career. Many students have had to work hard during college or summers, to support themselves. These men obviously have a motivating desire to become engineers that we find highly desirable.

Q. Do you feel that a man must know exactly what he wants to do when he is being interviewed?

A. No, I don't. It is helpful if he has thought enough about his interests to be able to discuss some general directions he is considering. For example, he might know whether he wants product engineering work, or the marketing of technical products, or the engineering associated with manufacturing. On G-E training programs, rotating assignments are designed to help men find out more about their true interests before they make their final choice.

Q. How do military commitments affect your recruiting?

A. Many young men today have military commitments when they graduate. We feel it is to their advantage and ours to accept employment after graduation and then fulfill their obligations. *We have a limited number of copies of a Department of Defense booklet describing, in detail, the many ways in which the latter can be done. Just write to Engineering Personnel, Bldg. 36, 5th Floor, General Electric Company, Schenectady 5, N. Y.* 959-8

***LOOK FOR other interviews discussing: • Advancement in Large Companies • Salary • Personal Development.**

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