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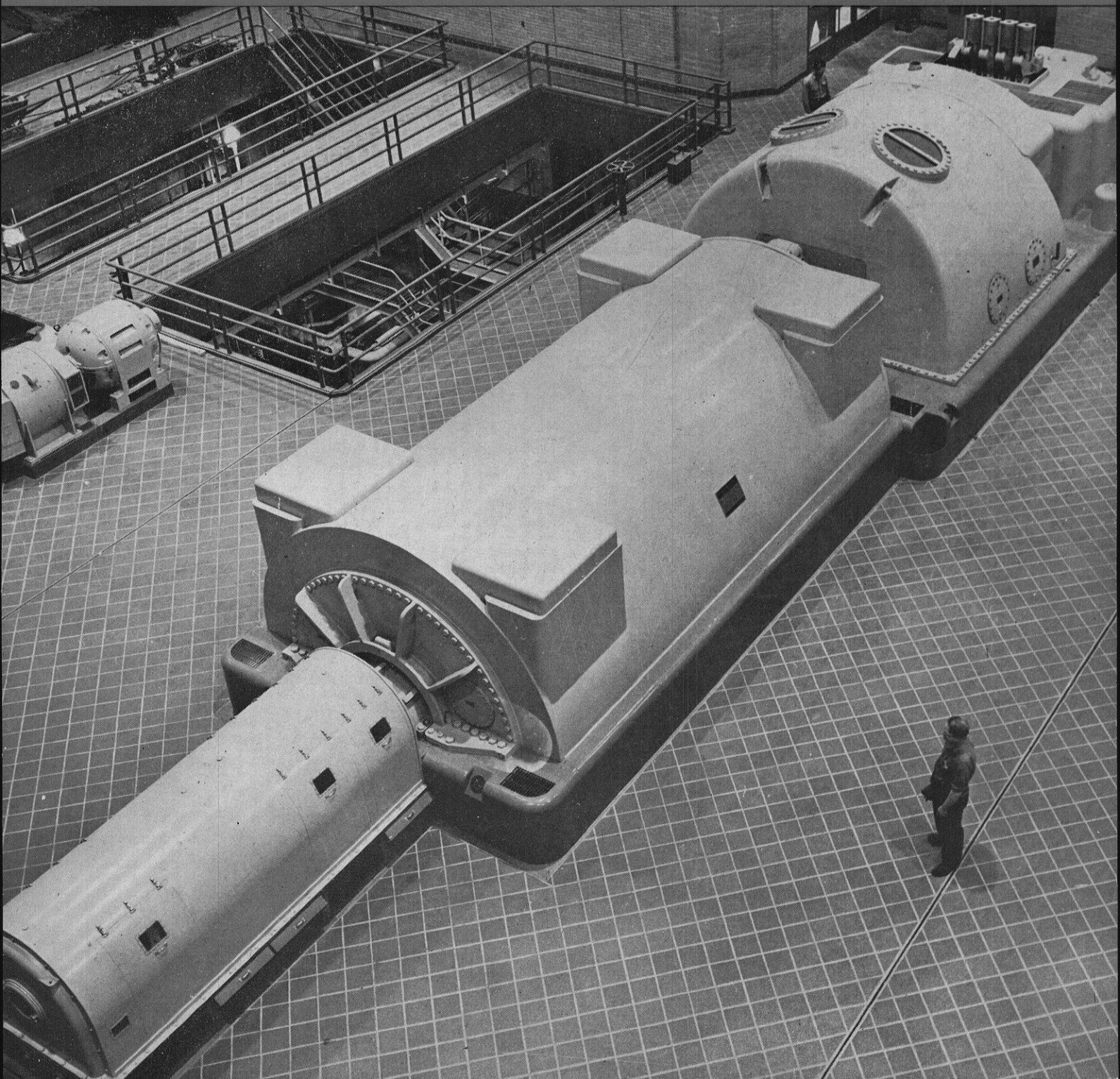
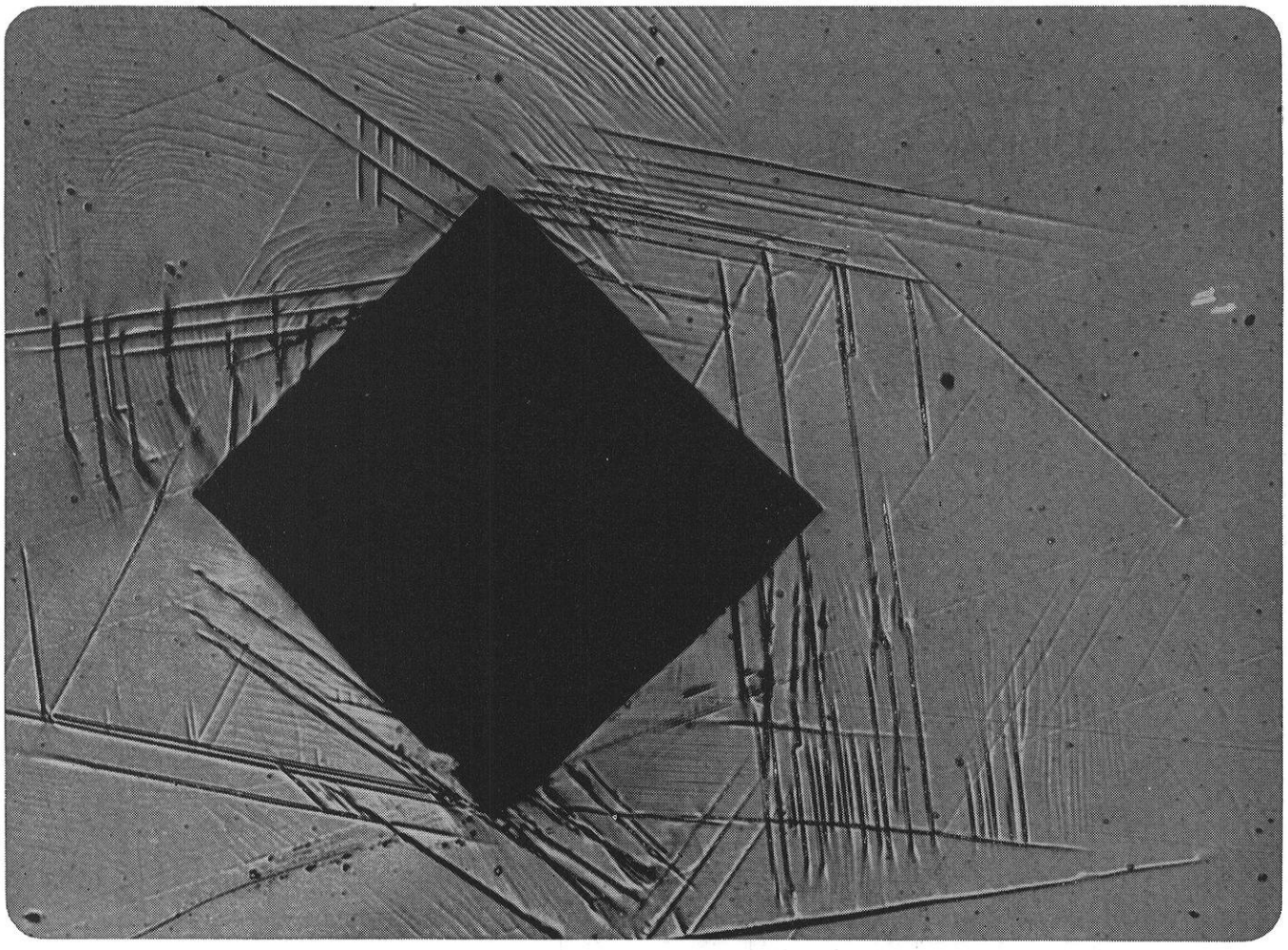
JANUARY
1958
The Wisconsin
25¢

engineer





Did you ever hear atoms move?

The physicist positions a single crystal of age-hardened steel under the sharp diamond penetrator. He touches a pedal, and the pyramidal tip of the diamond squeezes into the polished surface of the steel.

The instant that it touches, things begin to happen inside the crystal. Atoms begin to slip and slide, in layers. Some layers abruptly wrinkle and corrugate. If you listen hard when this happens, you hear a faint, sharp, "click." This is the sound of atoms suddenly shifting within the crystal.

You can see the action, too—or, rather, the results of it. The photomicrograph above shows the characteristic ridges and ripples. The black diamond in the center is the depression made by the penetrator.

By studying these patterns, and correlating the information with other data, scientists at U. S. Steel are trying to learn what happens atomically when a steel is bent, flexed or broken. Thus, they try to develop new and better steels for an exacting and ever-growing steel market.

Research is only one area in which we need high-level scientific personnel. Partly, this is due to the fact that men progress so rapidly at United States Steel. Remember these figures: among the 20,000 members of our management team, 99% attained their position through advancement within the corporation. If you want to take advantage of odds like this, write for our booklet, "Paths of Opportunity."
Write to United States Steel, Personnel Division, Room 5680, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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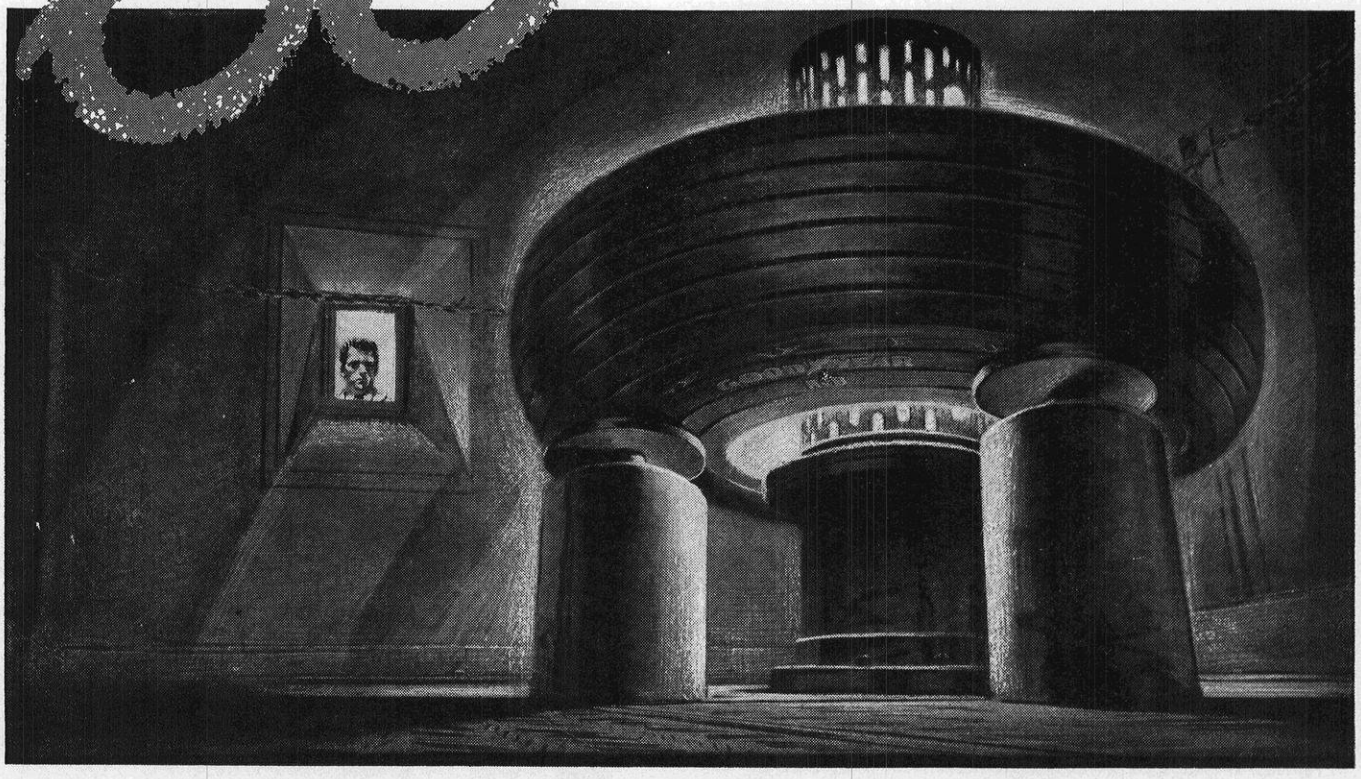
Cobalt 60-

A GREAT NEW FIELD OF RUBBER RESEARCH —AND A FIELD DAY FOR GOODYEAR ENGINEERS



Few materials are more vulnerable to radiation than rubber. So it seems quite certain that atomic-powered aircraft of the future will need radiation-resistant tires.

Such tires may well emerge from the strange and somber room you see here—the "cave" of the new Goodyear Radiation Laboratory.

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Volume 62 JANUARY 1958 Number 4

WISCONSIN ENGINEER

The Student Engineer's Magazine

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Cover

Power to light the world, the turbine-generator set.—Courtesy General Electric.

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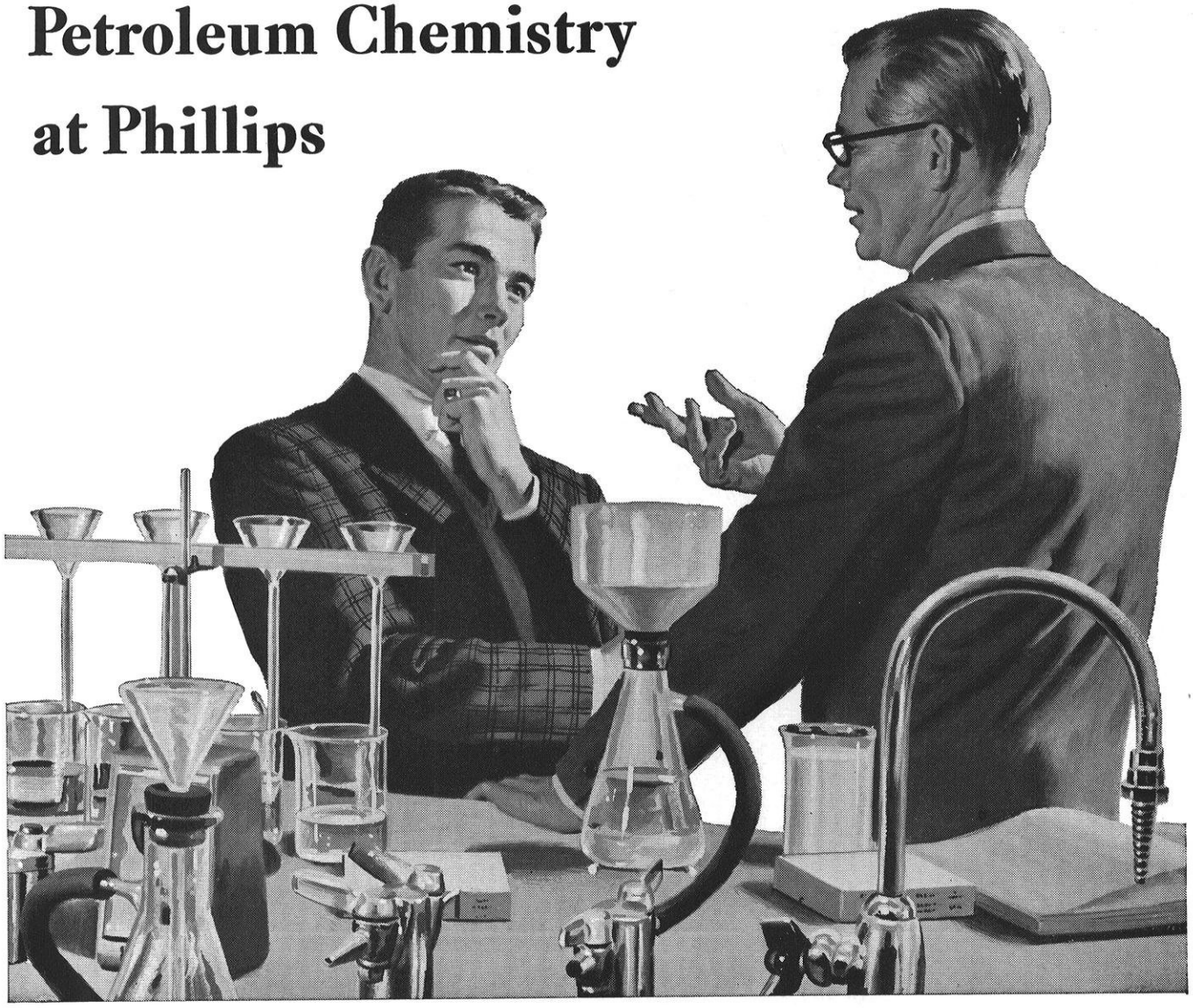

What do you see? Are you helping design a fractionation unit? Developing a new rocket propellent? Perhaps you're constructing a new polyethylene reactor . . . or working on an improved octane number system.

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During the past ten years Phillips has expanded tremendously. Many important new developments are still in the making. So when the Phillips representative comes to this campus, be sure to arrange for an interview. Meanwhile, write to our Technical Manpower Division for your copy of our new brochure, "Career With A Future".

Phillips 66

D. R. McKeithan, Director
Technical Manpower Division
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Harvey Graves (Dartmouth, BA '50, MSEE '51) discusses a reactor experiment at the Westinghouse Reactor Evaluation Center, in Waltz Mill, Pa. As manager of the Nuclear Design Section, Mr. Graves works with Dr. Wilfried Bergmann (Vienna, PhD '51), on right, and other young scientists who operate the facility.

At 30, Harvey Graves directs nuclear design of two major Westinghouse reactors

After completing the Westinghouse Student Training Course in 1951, Harvey Graves attended the Westinghouse Advanced Design Course* and was sent by Westinghouse to the Oak Ridge School of Reactor Technology for one year. Back at Westinghouse again in 1953, Engineer Graves did advanced work on nuclear reactor development.

In 1955, he was promoted to supervisory engineer on the Belgian reactor project. In 1956, he was again promoted to Manager, Westinghouse Nuclear Design Section. Today, Mr. Graves' 24-man section is developing and designing the nuclear portion of commercial reactors for the Yankee Atomic Electric Company and the Center d'Etude de l'Energie Nucléaire in Belgium.

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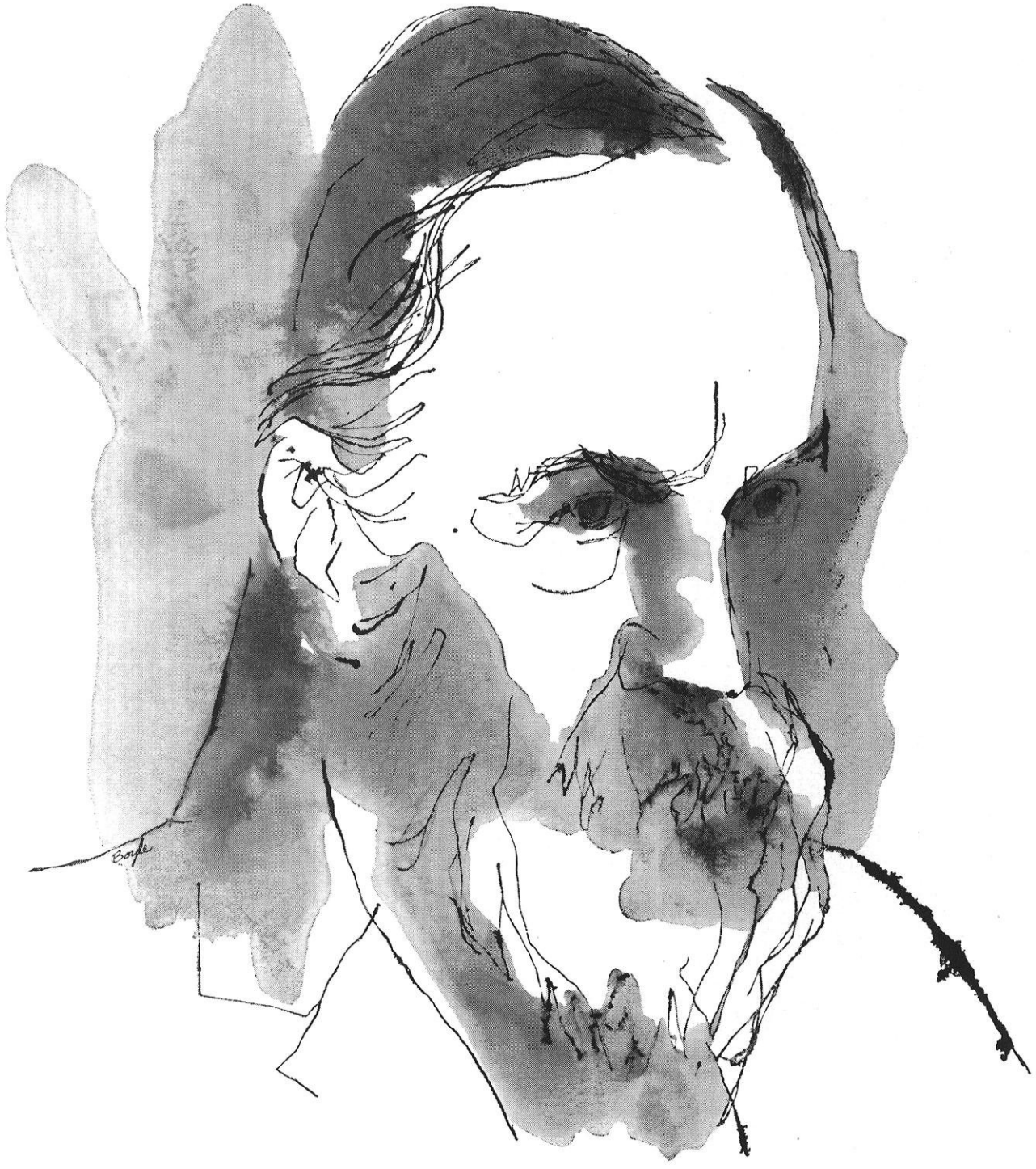
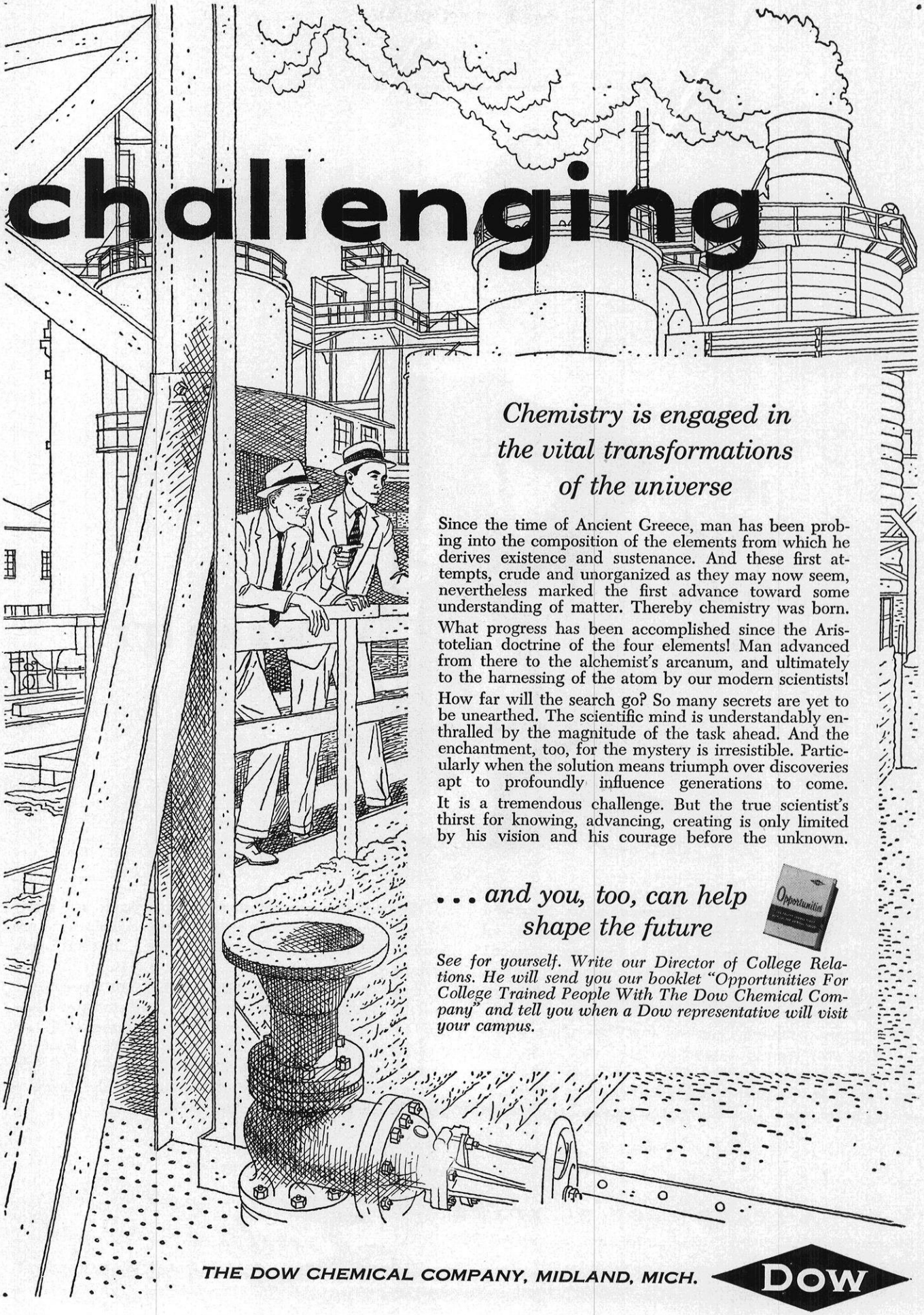


Ernst Mach...on absolutes

"No one is competent to assert things about absolute space and absolute motion; they are pure matters of thought that cannot be produced in experience. All our principles of mechanics, as we have shown in detail, are experienced knowledge concerning the relative positions and motions of bodies. They could not be, and were not, admitted in the areas in which they are now recognized as valid, without previous testing. No one is warranted in extending these principles beyond the boundaries of experience. In fact, such an extension is meaningless, as no one would possess the knowledge to make use of it."

—Die Mechanik in ihrer Entwicklung, 1912



challenging

Chemistry is engaged in the vital transformations of the universe

Since the time of Ancient Greece, man has been probing into the composition of the elements from which he derives existence and sustenance. And these first attempts, crude and unorganized as they may now seem, nevertheless marked the first advance toward some understanding of matter. Thereby chemistry was born.

What progress has been accomplished since the Aristotelian doctrine of the four elements! Man advanced from there to the alchemist's arcanum, and ultimately to the harnessing of the atom by our modern scientists!

How far will the search go? So many secrets are yet to be unearthed. The scientific mind is understandably enthralled by the magnitude of the task ahead. And the enchantment, too, for the mystery is irresistible. Particularly when the solution means triumph over discoveries apt to profoundly influence generations to come.

It is a tremendous challenge. But the true scientist's thirst for knowing, advancing, creating is only limited by his vision and his courage before the unknown.

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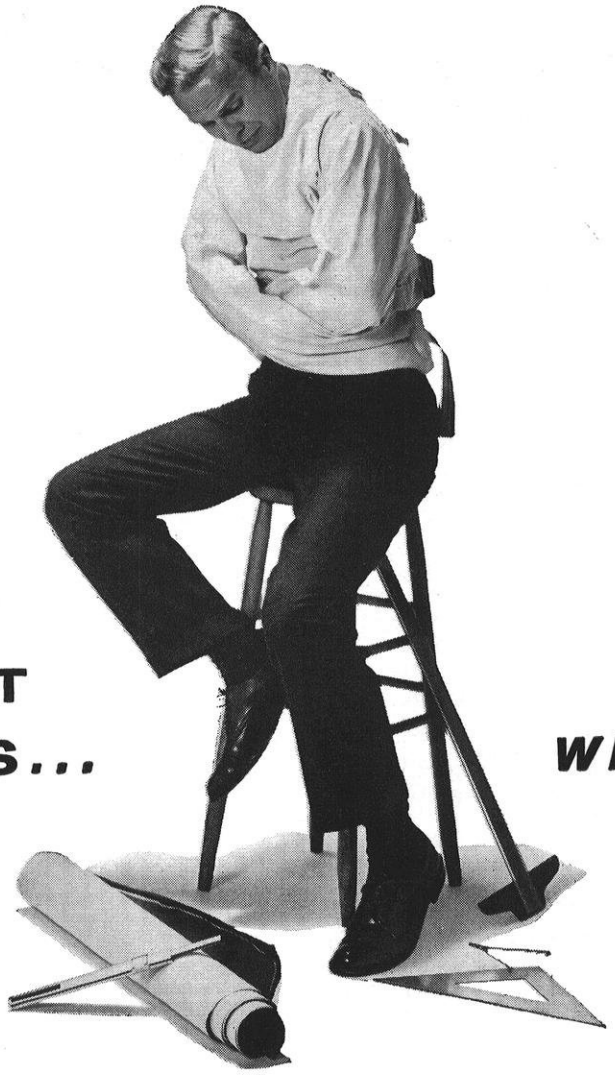

IF THE SUIT FITS... WEAR IT!

Lost to his profession . . . his personal goals destroyed . . . a talented engineer restricted to detail work by an inappreciative management. But it need not happen! Shrewd analysis of the prospective company's future, its leadership and initiative will guide an intelligent person to a rewarding future.

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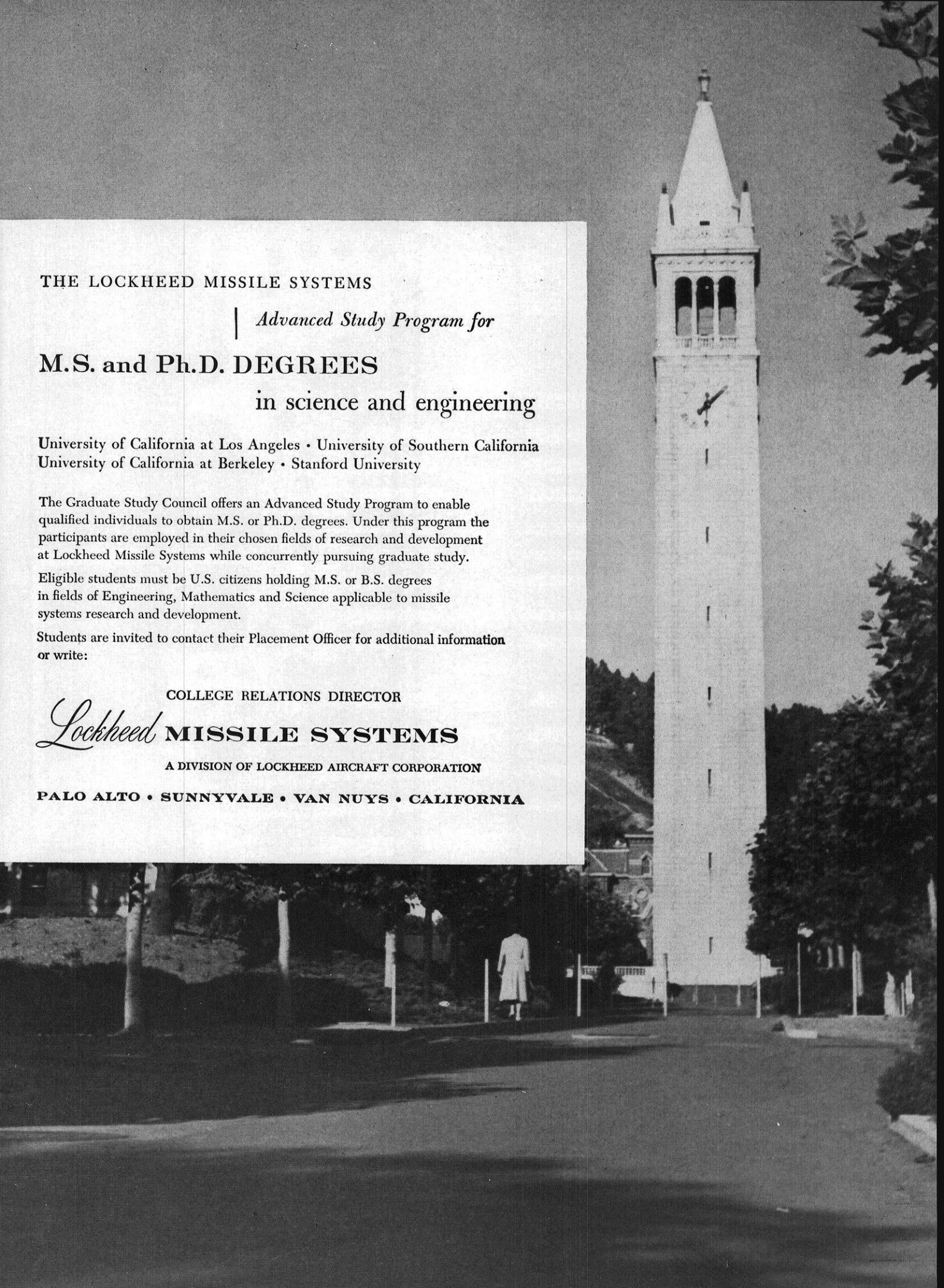

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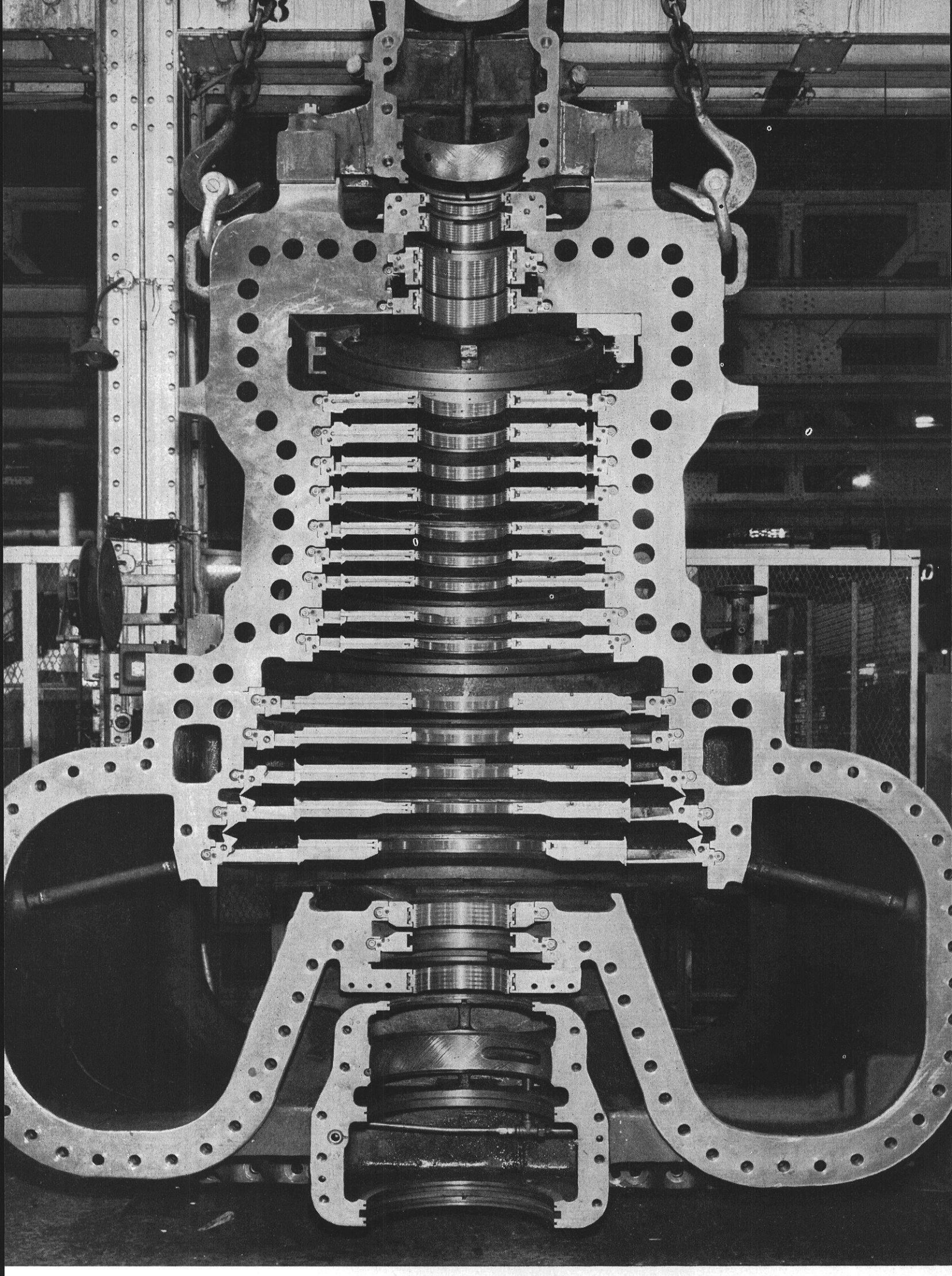

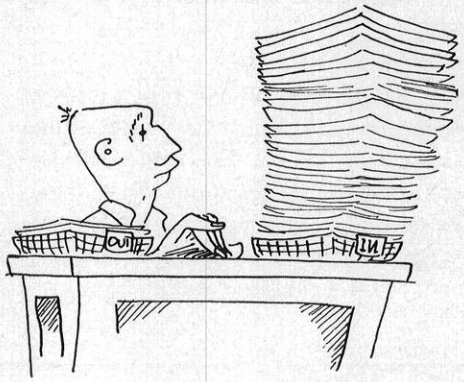

Rambling WITH THE EDITOR

The Engineer is introducing a few innovations this month that I hope will be of interest to the reader. First off, the new Engineer of Yesteryear column has added pictures of the past to the excerpts of the past that have appeared from ancient Wisconsin Engineer magazines. Dick Soref, who compiles the column each month, persuaded Glen Zimmerman, EE senior, to take a number of photos of pictures that appeared in the Engineer around 1900. You'll notice that the Armory looks the same as ever, perhaps even a bit older, as does the steam laboratory. But take a look at that football team! Several of the staff members claim that they recognize some of the front-row players as now being on the faculty, but I'll leave that to the reader's judgment. More pictures of the same type are coming in the months ahead, old advertisements, handlebar mustaches, and the like. I hope that you'll enjoy them.

The second change in the Engineer is a new combination of original cartoons and jokes to replace the old "Static" feature. Tony DiTrapani, ME senior, is the cartoonist and joke reworder, and he will be giving us a two-page feature, "The Ferrous Wheel," from now on. Tony likes to satirize the goings-on in the engine school, so don't be surprised to find take-offs on subjects that are dear to your slide rule. Maybe you'll even recognize yourself once in a while. One more thing while we're on the subject of humor. The cartoons that you saw in last month's magazine were the work of Ed Allen, the Science Hi-Lights Editor. Ed will also have some of his work in the magazine in the months ahead. Together, Tony and Ed will be supplying us with engine school humor that I know you'll enjoy. Perhaps a few years from now, we can say, "We knew them when . . ."

I hope that you'll be sure to read "Previewing Your Career in Industry" on page 14 of this month's magazine. The story material and pictures were compiled by Russ Jacobson, associate editor, who took part in the summer work-shop program that the story describes. Russ, by the way, won the award for the outstanding engineer of the senior class, and the rest of the Engineer staff joins me in offering our congratulations.

"Wheels of the Future" on page 24 was written and illustrated by Ben Felix, our retiring Art Editor. Ben is graduating this February and will no longer be able to supply the Engineer with his art work. Ben is responsible for the Sneedley motif that is followed throughout the magazine, and we hope to keep it for a long time. Getting back to the "wheels" story, the unveiling of the 1958 cars caused Ben some extra work. One of the illustrations in the story is a caricature of the auto of the future, and as it turned out, it looked so much like the 1958 models that it had to be redone and made even more ridiculous than before. The resulting "monster" is pictured on page 26.

There's one more good-by to say before I stop rambling for this month. Pete Reichelsdorfer, assistant editor, is also graduating this February, and is going right into the Navy on sea duty. Appropriately enough, an article by Pete on marine gas turbines will be appearing in the Engineer in a near future issue. Good luck, Pete, and be sure and write us if you ever get to one of those South Sea islands. J.E.S.

A 3,000-pound lower exhausthood for a 12,500 kw steam turbine being readied for hoisting into place. The slots in the center are semi-circular diaphragms which direct steam from one set of turbine buckets to the following stage.
—Photo courtesy General Electric

A DU PONT JOB-FINDER CHART FOR

Here is a sampling of the kinds of engineers and scientists which Du Pont will employ this year with BS-MS training—and their fields of work. The chart is an easy way to match your own interests against job openings at Du Pont.

For example: If you are a mechanical engineer, run your finger across the "Mechanical Engineers" column. The code letters refer to the type of work (Research, Development, etc.). The departments of the Company are listed across the top. The column across the bottom indicates some of the locations where these departments have openings. Du Pont also has opportunities for other engineering and scientific specialties, but space does not permit a complete listing.

DEPARTMENT ▶	ENGINEERING	ELASTOMER CHEMICALS	ELECTRO-CHEMICALS	EXPLOSIVES	EXPLOSIVES, ATOMIC ENERGY DIVISION	FABRICS AND FINISHES
PRODUCTS	Designs and constructs major plant facilities. Conducts research and development, and provides engineering consultation in chemical and mechanical engineering, instrumentation, and materials technology.	Neoprene Rubber Chemicals Organic Isocyanates	Metallic Sodium Hydrogen Peroxide Vinyl Products Sodium Cyanide Chlorinated Solvents Nylon Intermediates	Sporting Powders Blasting Supplies Dynamite Polymer Intermediates	Nuclear Reactor Materials Heavy Water	Coated Fabrics Paints, Varnishes, Lacquers Synthetic Resin Finishes
CHEMICAL ENGINEERS	A, B, C	B	A, B, D, F	B, D	A, B	A, B, F
MECHANICAL ENGINEERS	A, B, C	B		E	A, B	
ELECTRICAL ENGINEERS	A, B, C			E		
METALLURGICAL ENGINEERS	A, B	A, B			A, B	
CHEMISTS			F			A, B, F
PHYSICISTS					A, B	
POSSIBLE INITIAL ASSIGNMENTS	Wilmington, Del., or Plant Locations	Beaumont, Tex. Louisville, Ky. Montague, Mich. Wilmington, Del.**	Memphis, Tenn. Niagara Falls, N.Y. Wilmington, Del.**	Gibbstown, N.J.	Aiken, S.C.*	Newburgh, N.Y. Parlin, N.J. Philadelphia, Pa.

PERSONALIZED INFORMATION—The kind of work you will do and the location of your first assignment depend on your qualifications and the openings available. Since the above chart was prepared, some of the openings listed may have been filled or new jobs may have been added to the list. For up-to-the-minute information about possible jobs for you, see the Du Pont representative when he visits your campus.

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B Development
C Design
D Production
E Plant Engineering
F Sales

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A, B, D, F	A, B, D	A, B, F	A, B, D, F	A, B, F	A, B, D, F	A, B, D
A, B, D, E		A, B, F	A, B, E, F	A, B	A, B, D, F	A, B, D, E
B, D. E. F			E		A, B, D, F	B, D, E
		A, B, F	A, F	F	A, B, D, F	A, B, D
			A		A, B	A, B
Buffalo, N.Y. Circleville, O. Clinton, Ia. Old Hickory, Tenn. Richmond, Va. Wilmington, Del.**	Cleveland, O. East Chicago, Ind. Houston, Tex. Linden, N.J. Wilmington, Del.**	Deepwater, N.J. Wilmington, Del.**	Parlin, N.J. Rochester, N.Y.	Edge Moor, Del. Newport, Del. New Johnsonville, Tenn. Wilmington, Del.**	Charleston, W. Va. Orange, Tex. Parkersburg, W. Va. Victoria, Tex. Wilmington, Del.**	Camden, S.C. Chattanooga, Tenn. Kinston, N.C. Martinsville, Va. Old Hickory, Tenn. Richmond, Va. Seaford. Del. Waynesboro, Va. Wilmington, Del.**

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PREVIEWING YOUR CAREER IN INDUSTRY

compiled by Russ Jacobson ee'58

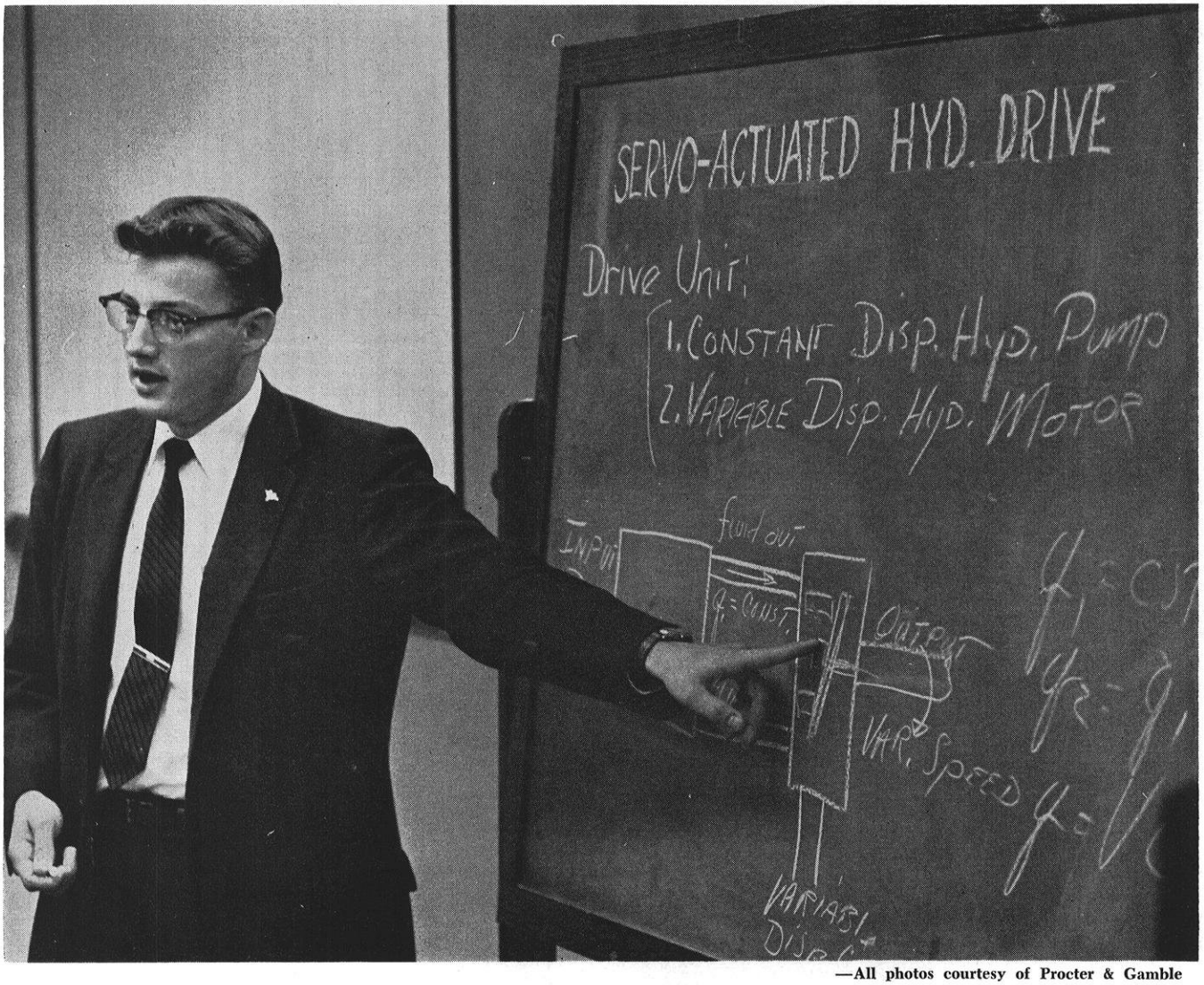
This summer six University of Wisconsin students attended a two week summer workshop program at Procter & Gamble Company. Their experiences, as told by a member of the Engineer staff, who attended the workshop, are an interesting preview of the work of the engineer in industry.

REMEMBER when you were knee-high to a slide rule, older people inevitably asked, "What do you want to be when you grow up?"

Just about any answer would do then.

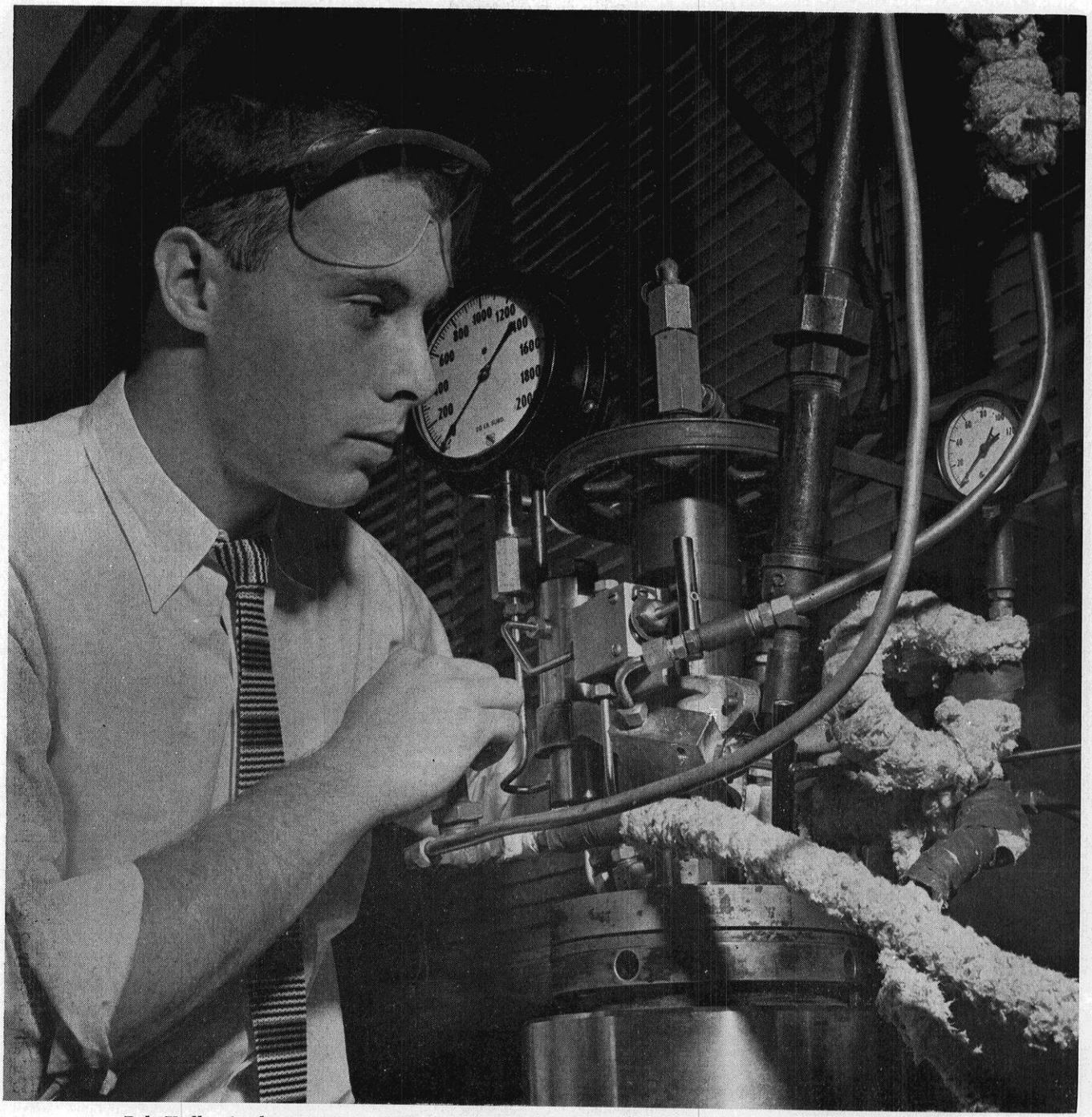
But now that you've decided that the circus or racing to fires is not your aim in life, your career planning has taken on more serious purpose, but actually it's none the less exciting.

In the next few months and years, like thousands of college and university students all over the country, you'll be making the transition from classrooms and labs to your career. With your technical training and interests, it's very likely that you're looking to in-



—All photos courtesy of Procter & Gamble

John Bollinger explains his servo-mechanism solution to the tray drive problem to those in the Engineering Division Workshop.



Bob Kadlec is about to start pilot plant for making fatty alcohol by Ziegler process. Fatty alcohol is a basic raw material for synthetic detergents.

dustry for your career. In industry today is the widest array ever of fields, and specializations within fields, from which to choose.

So the problem is information about industry—the more the better—to help in that important career decision. This article can't tell you the decision to make, but it will tell how six Wisconsin men took advantage of an opportunity to find the answers for themselves. The six are seniors Charles J. Franchino, Russel E. Jacobson, Robert H. Kadlec, Robert L. Roberts, double degree student Vincent Pagliaro, and Wisconsin graduate John G. Bollinger, now in graduate study at Cornell University.

Along with 153 men from more than 40 of the nation's leading colleges and universities, the six participated in summer training programs of The Procter & Gamble Company—programs that combine summer employment with the opportunity to see at first hand the roles of university-trained men in industry.

One of the nation's leading chemical processors, P & G offers a Full Summer Program and a Summer Workshop Program to engineering, business or chemical students who are within a year of receiving an undergraduate or graduate degree.

The Summer Workshop Program, designed especially for college students who can spend only a part of their summer in industrial training because of military, academic or other commitments, is

(Continued on next page)

"Portrait" of the Engineering Division Workshop. Grouped about the Workshop coordinator, center rear, are five Wisconsin participants and men from MIT, Cornell, Michigan, Yale, Purdue, VPI, Columbia, Vanderbilt and Penn State as well as Pierre Mamin of the Ecole Centrale in Paris, first French representative in the Workshop program.

"capsuled" into two weeks just before the start of the school year. The Full Summer Program lasts from five weeks to all summer.

As a "getting to know you" device, young men gain their initial experience in industry, and more important, they have an opportunity to see themselves in context, actually functioning in the field of their choice in an industrial setting. They gain a better understanding of industry and of their own career aims. Workshop participants are paid regular salaries, plus housing expenses and transportation expenses from their homes to P & G locations.

Both programs are designed to furnish the student with a new insight into the activities of company personnel in four distinct career fields: factory management, engineering, industrial engineering, and research and development. In the programs in which they participated each of the Wisconsin students had a chance to examine several possible careers through personal experience in actual work and through close teamwork and discussions with members of company management and fellow student trainees.

Bollinger, Franchino, Jacobson, Pagliaro and Roberts participated in P & G's Engineering Division Workshop held the first two weeks in September at the company's manufacturing and research headquarters in Cincinnati. In the problem-solving situation of the Workshop, each participant developed solutions to two problems of the type company management must face regularly.

Kadlec, a member of Tau Beta Pi, took part in the Research and Development Workshop the same two weeks in Cincinnati. The chemical engineering senior, who's from Racine, Wis., worked with Joseph Obold of the University of Delaware, on a single problem in the two weeks, investigating on a pilot plant a process to make fatty acid by modification of the Ziegler process for making fatty alcohol.

Bollinger, who received his bachelorate in mechanical engineering last June, was assigned in the Engineering Division Workshop to work with David Blatchford of Penn State and Pierre Mamin, graduate engineer from the Ecole Centrale des Arts et Manufactures, Paris, France. Their problem was to develop a new mechanical drive for the temporary storage trays on which warm strips of bar soap are placed to permit operation of the production line at full capacity. His second problem was to establish cooling equipment requirements necessary to maintain stored product at certain temperatures in two company warehouses. Bollinger, who this year is

a Cornell Graduate Fellow at that university, was student president of the American Society of Mechanical Engineers and associate editor of the *Wisconsin Engineer* last school year.

Franchino, a senior in mechanical engineering from Milwaukee, Wis., worked on development of a mechanical device to place minor ingredients of a prepared baking mix into the feed "buckets" of a high speed cartoning machine to permit higher capacity operation of the line. His partner was Pierre Sprey of Yale University. In a second problem, Franchino, member of Tau Beta Pi, designed a mixing valve so that mixing of air with synthetic detergent paste can be controlled automatically by pneumatic rather than by manual means.

Jacobson, who expects to receive his Bachelor of Science degree in electrical engineering next June, teamed with Alfred Hallam of Cornell and Richard Gottlieb of MIT in designing an electrical control system to permit automatic and manual operation of two peanut roasters and their associated equipment, required for improving reliability and consistency of peanut butter production. Jacobson and Robert Roberts (also from Wisconsin) then worked to develop a system for feeding in exact order two large size cleanser cans and one regular size can to a special combination packing machine which binds the three cans together to be sold that way in stores. Jacobson, who's from Cambridge, Wis., is associate editor of the *Wisconsin Engineer* and student chapter president of the American Institute of Electrical Engineers.

Roberts, whose home town is Madison, Wis., in addition to the problem that he worked with Jacobson, was assigned to design an electrical control system to provide automatic speed control of new motor drives being placed in use on certain bar soap production lines. For this problem, Roberts, who expects to receive his bachelorate in mechanical engineering in February (1958), teamed with Robert Dowdy of VPI and James Hyatt of Vanderbilt.

At first gathering on Labor Day afternoon, John Bollinger meets Frank Carlisle, center, of Georgia Tech and Hugh Warner of MIT as they take their first look at Workshop notebooks prepared for each participant.

P & G Workshop problem sponsor, second from left, conducts tour of Ivorydale for John Bollinger, left, Vincent Pagliaro, center, Louis Hemmerdinger (partially hidden) of Columbia and Bob Dowdy of VPI.

First assignment of Pagliaro was to investigate the effect of percentage changes in formulation of a household cleanser product and to determine any necessary changes to the manufacturing equipment. In his second problem, he worked with Robert Dowdy and also Louis Hemmerdinger of Columbia to determine necessary equipment changes to reduce the cycle time of the mixing operation in making synthetic detergent products. Crutching, the term used for mixing detergent paste, is a batch operation which at present "bottle necks" increased detergent production. Pagliaro, who's from Racine, Wis., received his degree in chemical engineering last June and is now studying for a bachelor's

(Continued on page 46)

NEW POWER FOR YOUR CAR

by Otto H. Sharpf

The automotive gas turbine may prove to be the biggest advance in the automotive industry since it began. Here the author discusses the general type of auto gas turbine that may be used and the problems yet to be solved.

THE most striking advance in the automotive industry in recent years has been the development of the gas turbine engine. Although many problems remain, turbines can now compete with conventional reciprocating engines. Experts predict the first gas turbine cars will be on a production basis in 10 years.

The report is separated into the two main areas, problems of construction, and problems of operation.

The term, gas turbine, covers a wide variety of basic types of turbines and accessory equipment. These range from a complicated 200,000 hp powerplant, to a simple 50 hp portable generator.

The type which is most suited for automotive use, however, is the two-shaft turbine . . . as shown in Fig. 2. As the name indicates this design has two small turbines instead of one large one. The first is connected directly to the compressor and extracts just enough power from the hot gases to drive the compressor and engine accessories. The second turbine absorbs as much as possible of the remaining power and delivers it to the output shaft. The two units are mechanically independent. The compressor and its drive turbine are free to run at optimum speed, while the power turbine is geared to the wheels of the vehicle.

The two-shaft turbine also acts as a torque convertor. When the output shaft is stalled, torque is twice that at rated speed. This characteristic permits the gas turbine to replace the combination of piston engine and torque convertor found in many of today's automobiles. This does not, however, completely replace the transmission, as the turbine still needs a simple transmission with a reverse gear and at leas two forward speeds. It will, however, be much smoother in operation.

A regenerative turbine uses a heat exchanger to transfer heat from the hot exhaust to the cooler compressed air. This arrangement reduces the amount of fuel that must be burned to heat the incoming air and also cools the exhaust. Regenerators are a necessity if the turbine is to equal the economy of the gasoline engine. In order to be most effective the heat exchanger should be of the counter-flow type. Here the exhaust heats air which already has been warmed, and the partially cooled exhaust warms the cool air as it enters the heat exchanger. Good regenerators recover 80 to 90 per cent of the exhaust heat.

On an equal production basis, gas turbines will cost less than conventional engines. Turbines are smaller, lighter, and have fewer moving parts resulting in lower material and manufacturing costs. Turbines cost less per horsepower since they are more powerful, pound for pound, than piston engines.

Until recently the biggest cost problem has been the turbine blades. The price has come down considerably, however, through the use of non strategic metals and improved production techniques. A turbine wheel could now be mass produced for less than 25 dollars compared to more than 1000 dollars a year ago. Cheaper and more abundant high temperature materials are being developed. Among these are boron and molybdenum alloys.

Size and weight are the outstanding advantages of the gas turbine. A non-regenerative turbine weighs about one pound per horsepower. This is only one-fifth as much as a conventional piston engine. A regenerator about doubles the weight and cuts this advantage in half.

The Crysler turbine developed recently is 200 lb. lighter than a conventional engine and has one fifth as many moving parts. It is only 32 in. long, 33 in. wide, and 28 in. high. These size and weight reductions are a result of reduced transmission requirements, the absence of a cooling system, and the simplicity of the engine itself.

The smaller size of the turbine allows more freedom for the designer. The engine compartment can be smaller and lower, making possible a lower silhouette. This will be an important factor as automobiles become lower and more streamlined.

Fuel economy is no longer the major problem it was several years ago. The automobile gas turbine uses a regenerator to recover exhaust heat which doubles the fuel economy at full load. At about 10

(Continued on page 20)

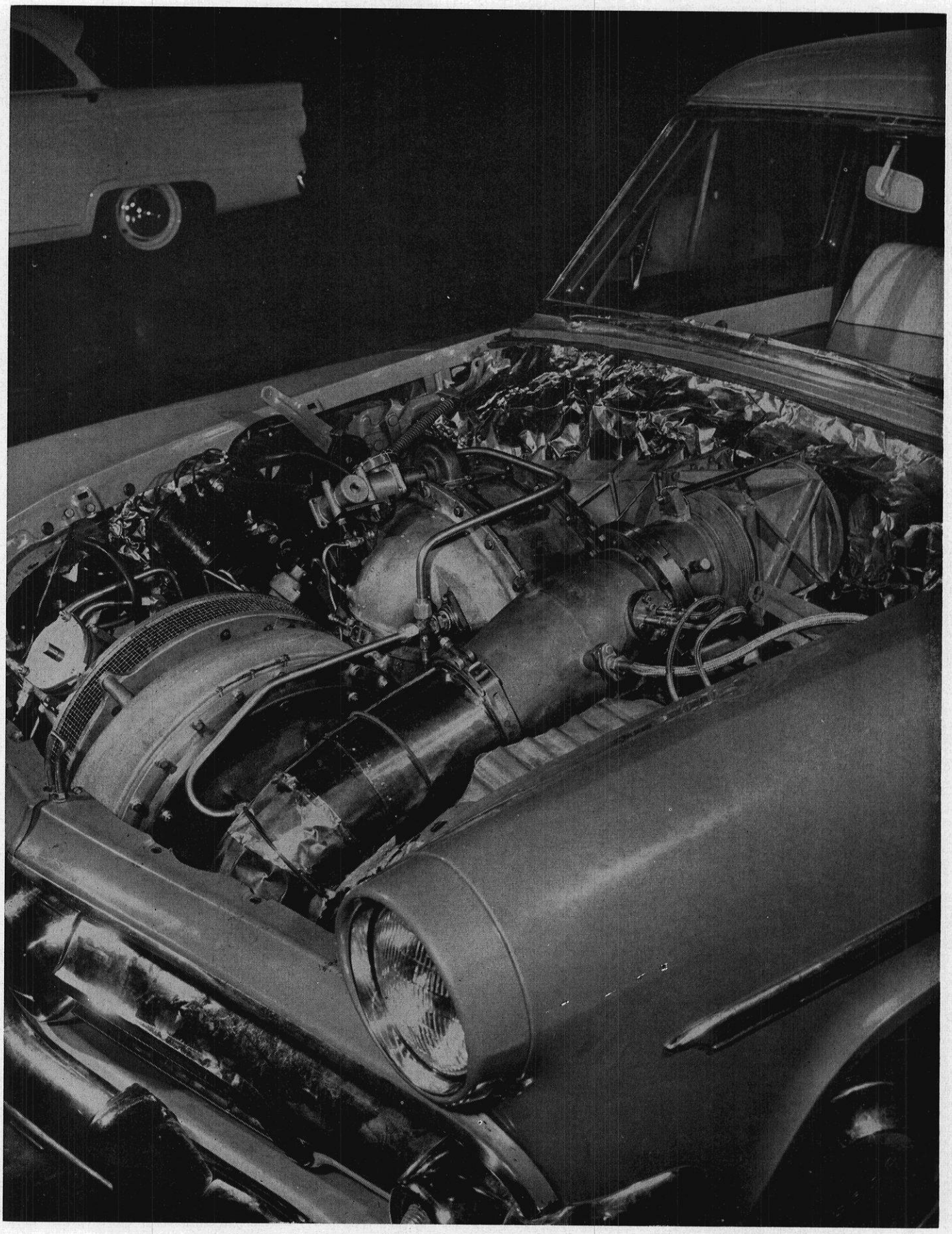


Fig. 1.—An experimental gas turbine engine mounted in a Ford car.

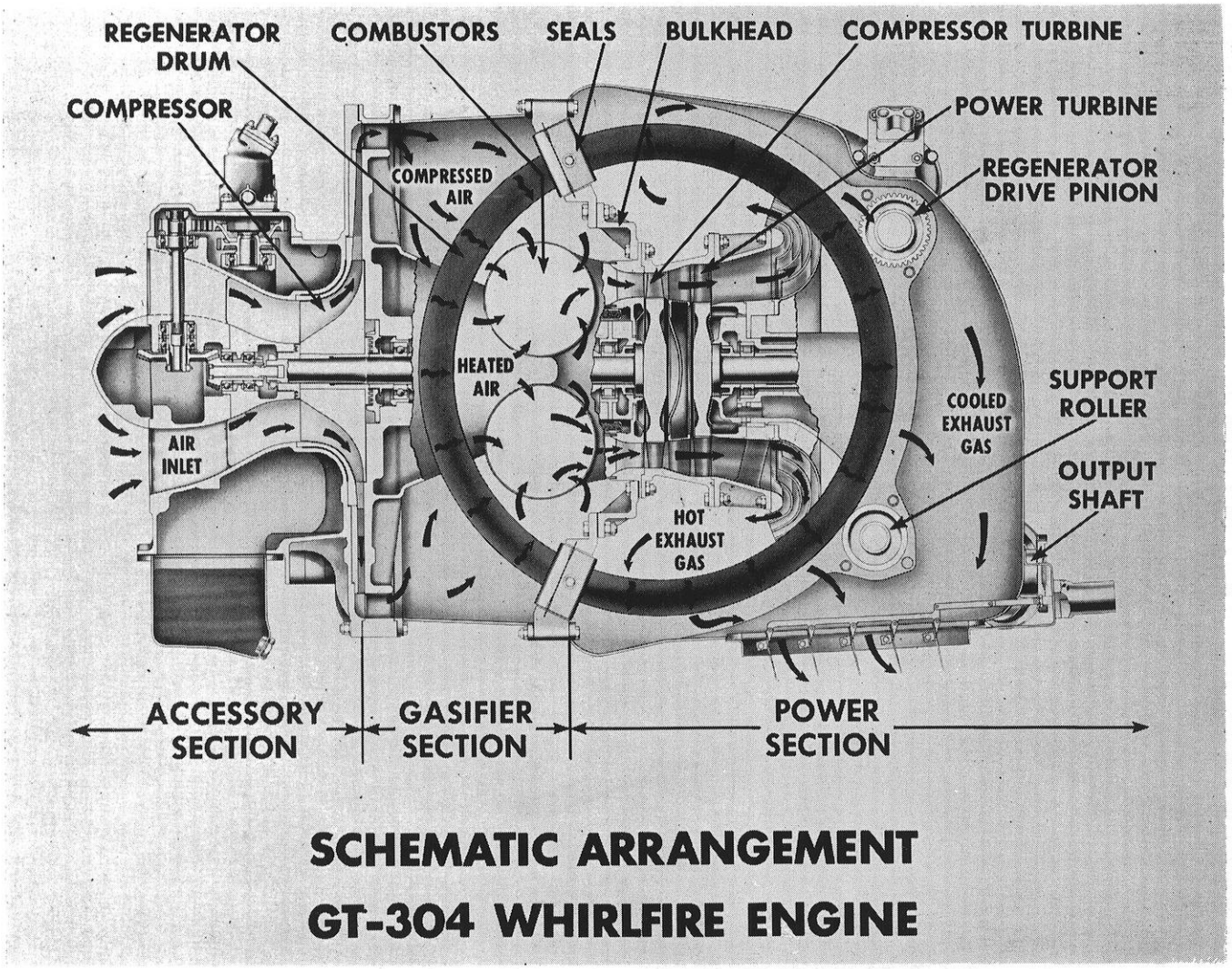


Fig. 2.—Schematic arrangement of General Motors gas turbine showing the two shaft turbine arrangement.

Gas Turbines

(Continued from page 18)

per cent full load, where automobiles operate most of the time, the economy is increased four times over a non-regenerative turbine. Present regenerative turbines about equal the fuel economy of reciprocating engines. These turbines also compare favorably at part load conditions. Installed in an automobile, the turbine is comparatively more economical because it has less transmission losses and no fan losses.

The use of a heavier and cheaper fuel will also aid the turbine in comparison with the reciprocating engine. The turbine will burn almost any fuel, including the heavy fuel oils which are now by-products in the production of highly refined gasoline. Besides costing less per gallon, the fuel has a higher heat content due to its heavier weight. These factors give the turbine an 8 per cent head start to begin with. On a recent cross-country run, Chrysler's test car averaged 14 mpg on regular-grade unleaded gasoline. This will certainly be improved as know-how increases.

Fast starting of the turbine is a problem which has yet to be solved satisfactorily. At idling speed the turbine has more inertial energy than reciprocating engines. Therefore a bigger starting motor is required or a longer cranking period. With improvements in starters, however, 10 seconds or less will be sufficient to start the turbine.

Once the turbine is running it is ready to deliver full power. Because of the lightness of the parts and their high speed, a long warm up period is not required. The turbine will also start at much lower temperatures than a reciprocating engine. This will greatly reduce the cold weather problems of conventional engines.

The gas turbine cannot be expected to surpass the gasoline engine in throttle response, but will approach it closely enough to be acceptable. Throttle response depends on the relation of horsepower to speed. The gas turbine comes much closer to the level road requirements of an automobile than does the gasoline engine . . . as shown by fig. 4. While this increases the efficiency of operation, there is only a small reserve left for acceleration.

Throttling the air flow to the turbine imposes severe penalties on fuel economy. Therefore the speed of the engine must be increased to provide acceleration. This induces a time lag between the time the accelerator is depressed and the

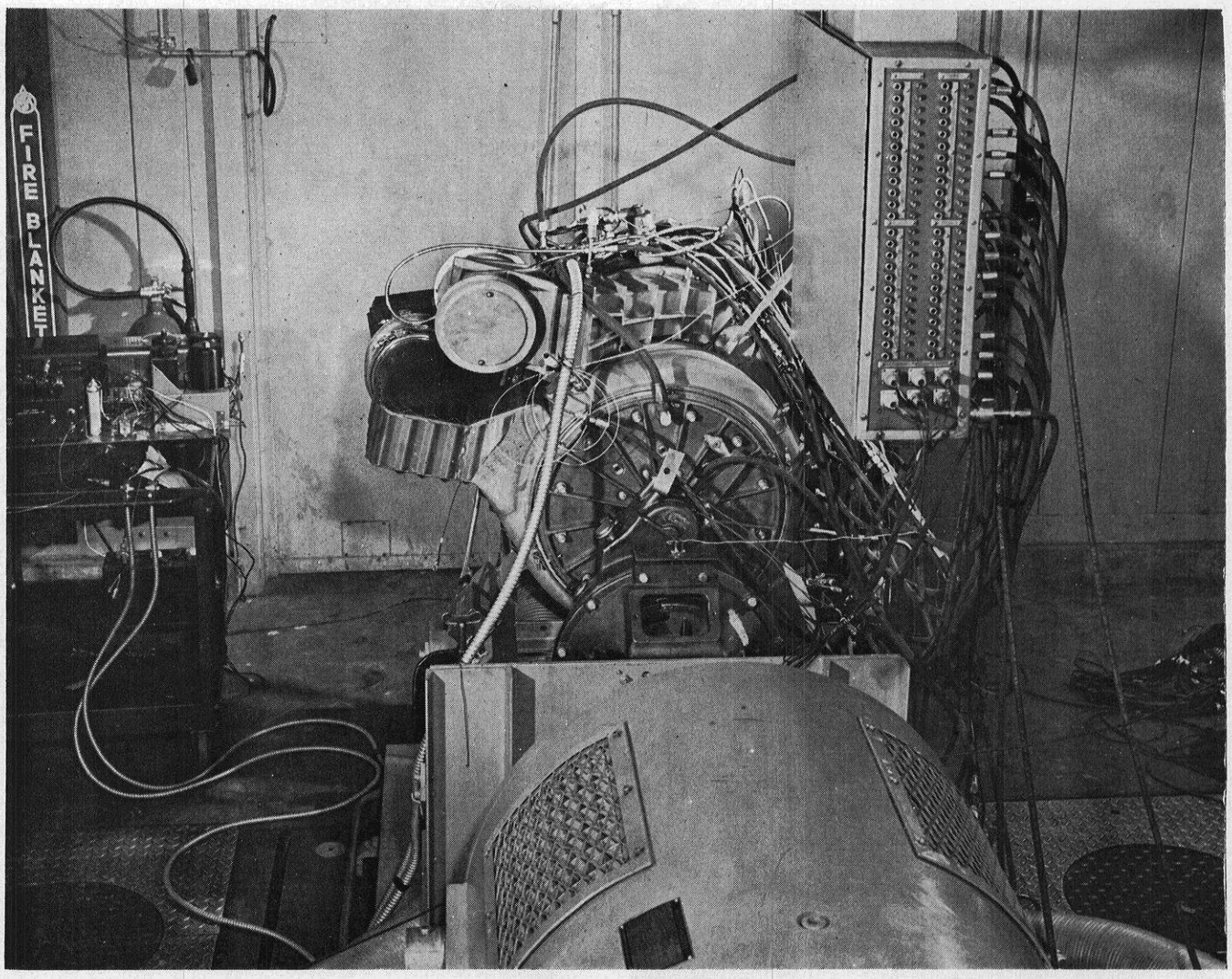


Fig. 3.—An experimentat regenerative experimental has 1 gas turbine on the test stand at the Ford Motor Co. The maze of wires are leads to recording instruments for recording performance data.

car starts to move. However, this lag can be reduced to one or two seconds by reducing rotor inertia, increasing inlet temperatures, and raising the idle speed. The delay from part to full throttle is much less than this.

The exhaust will be cleaner than that from a gasoline engine. It will not emit carbon monoxide or incompletely burned fuel. This is a distinct advantage where air pollution is a problem.

The temperature sensitivity of gas turbines is greater than that of reciprocating engines. This is an advantage at low temperatures where the turbine gains more power and has better fuel consumption. Increasing the ambient temperature from 60° F to 120° F, however, causes a loss of from 15 to 20 per cent in power. This loss is 2 to 3 times that of gasoline engines. (As higher temperatures come into use this effect will be reduced.) Turbine operating temperatures already have been raised from 1500° F to 1800° F.

Maintenance of a gas turbine engine will be much simpler due to the reduction in size and number of parts and their accessibility.

In day to day maintenance, less lubricating oil and fewer oil changes will be required. There is no need for antifreeze, flushes, air filters, carburetors, or fan belts. Less time will be needed for tune-ups and adjustments.

Major overhauls will be less frequent. When they occur, the lightness and simplicity of the turbine will speed the job. However, balance will be very important because of the high rotative speeds. The turbine blades may have to be replaced at periodic intervals to guard against fatigue failures.

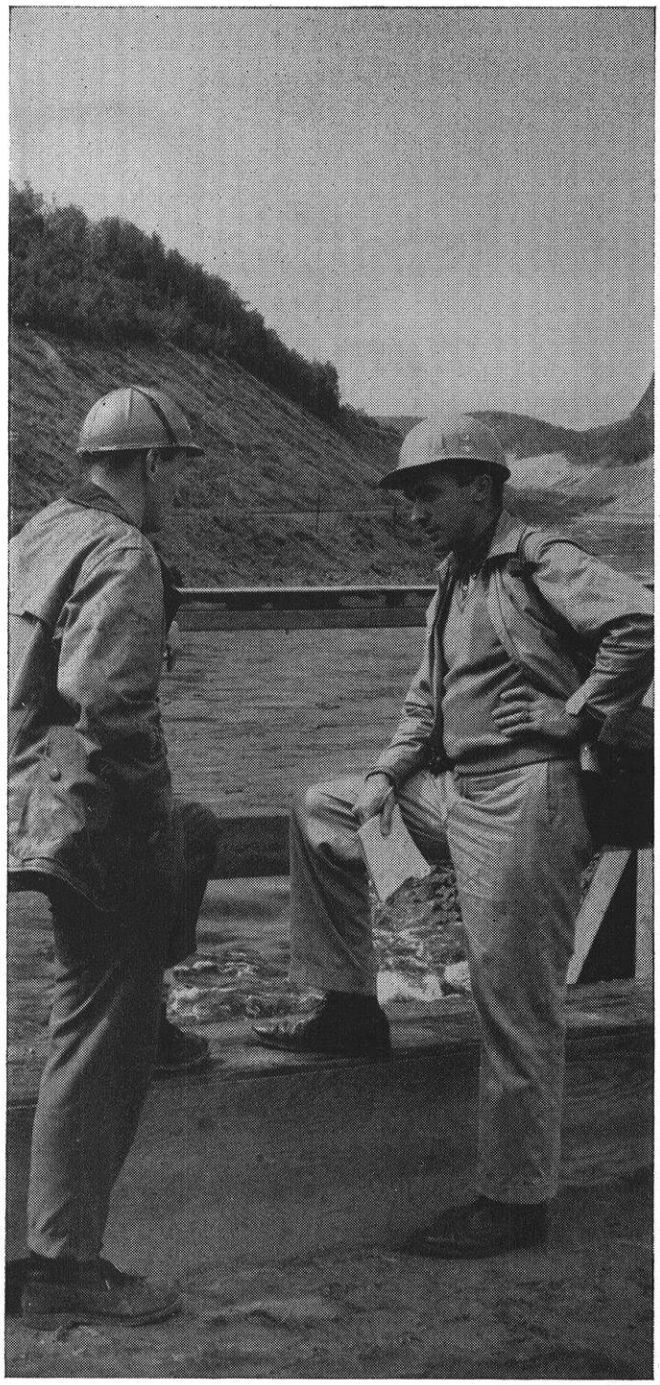
Turbines run much smoother than gasoline engines because there is no reciprocating motion. This reduces vibration to a minimum. As a result passenger comfort and service life of parts is increased. Since there is only a two speed transmission, acceleration is very smooth and free from the jerkiness of conventional engines.

Unmuffled turbines can emit a loud high-pitched noise at the air inlet to the compressor. This sound, which is at a frequency of 2000 to 7000 cps, can easily be absorbed by sound absorbent materials. The exhaust noise of about 150 cps can be silenced by a resonator type muffler and by passing the exhaust gases through the regenerator. High speed gear noises can be reduced through proper lubrication and adjustment.

(Continued on page 66)

This can be YOU...

Art Fox, B.C.E., Manhattan College '47, reaches 77,000 engineers and construction men as a Senior Editor of McGraw-Hill's ENGINEERING NEWS-RECORD



An Editor with a Hard Hat. Art, pictured above at right with Assistant Resident Engineer McCormack, observes progress at the Beaumont Rapids power dam at St. Maurice River, Quebec.

In ten short years, Art has climbed rapidly in his profession. Just back from a 2,500-mile editorial trip to Canada, here's what he has to say:

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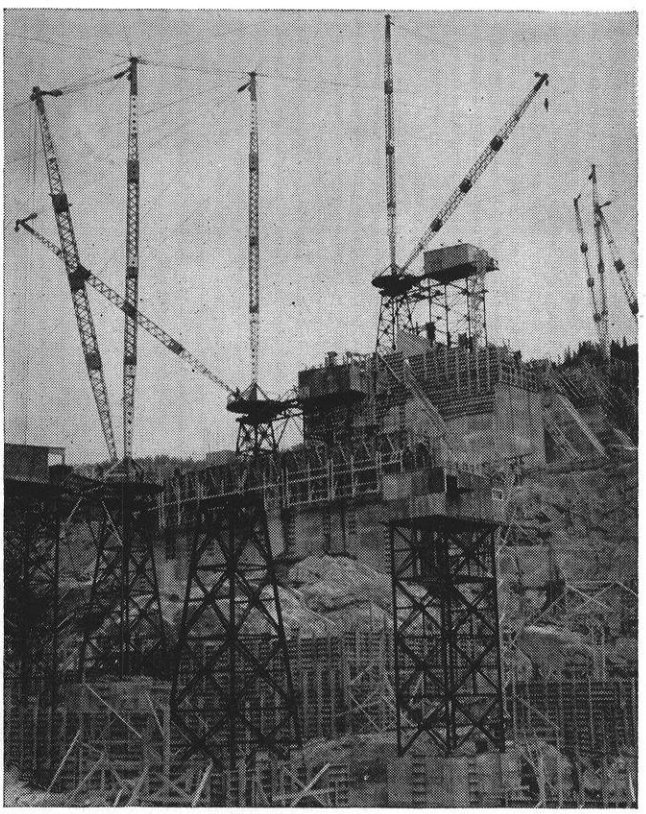
Other than preparing reports in college, Art had no early writing experience. Immediately after graduation, he was employed by a leading firm of consulting engineers. While on the job his appreciation for the inspiration-power of the industrial magazine



Cranes and Concrete. Another view of the Beaumont Rapids project. Art drove 1,800 miles from Montreal to get three on-site stories. Like other McGraw-Hill editors he got his story *firsthand.*

an "Engineer-Journalist"

grew, and in less than a year he applied for a position with McGraw-Hill.

Art started with ENGINEERING NEWS-RECORD in 1948 as an Assistant Editor. Since then, Art has been "up to his neck in engineering" . . . earned his P. E. license while an engineer-journalist . . . been active in A.S.C.E. and other professional organizations.

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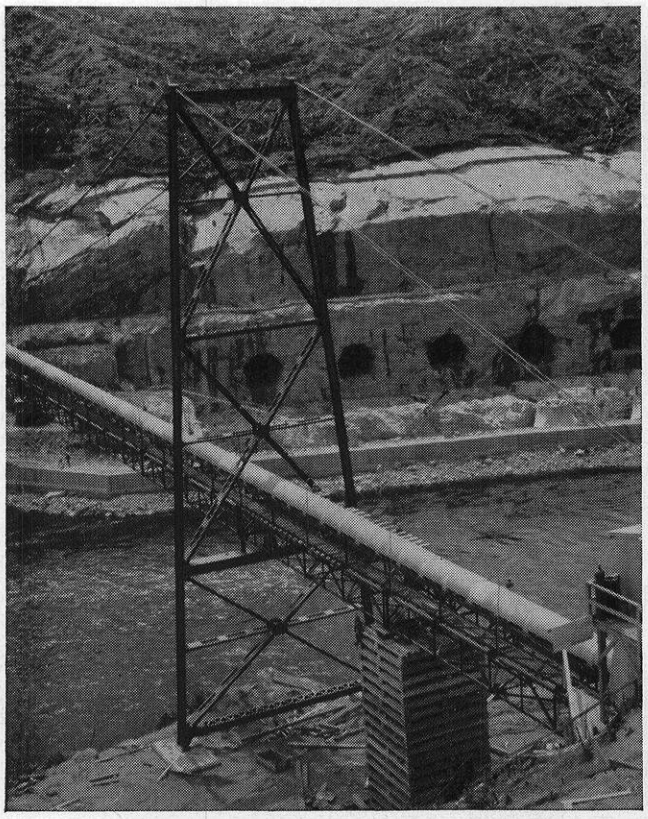
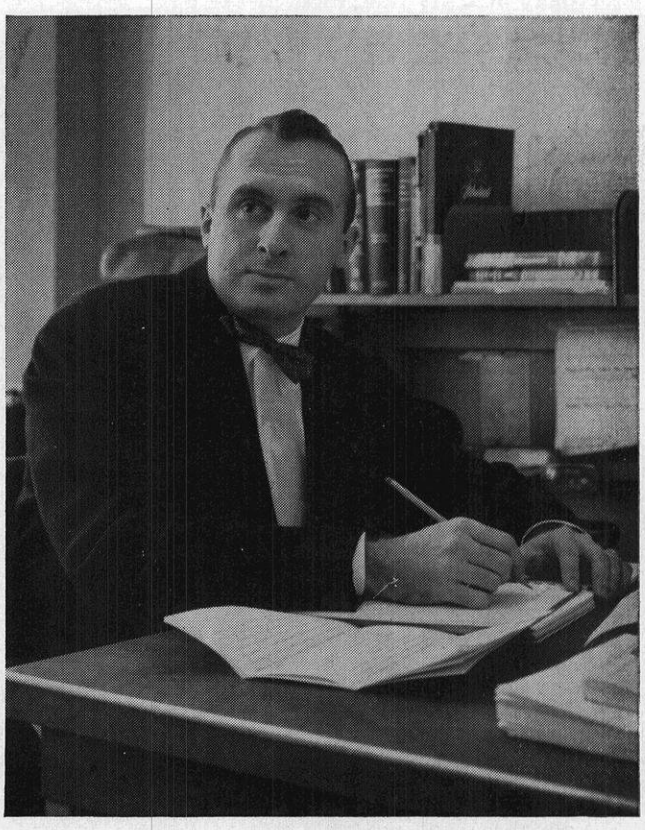


Dams and Tunnels. Here's a shot Art took of work on the Bersimis Powerhouse. As a McGraw-Hill engineer-journalist, you, too, will expand your professional background while reporting to your industry.



Desks and Plans. Here's Art at his desk in the McGraw-Hill Building. You, like Art, will travel, participate in professional societies and advance yourself financially and educationally—as well as serving your industry and profession.

WHEELS OF THE FUTURE

by E. Bennett Felix me'57

Does the shape of things to come in auto design interest you? Here the art editor of the Engineer describes in words and sketches end results of today's auto trends.

TODAY'S trend in automotive design is towards three different types of automobiles; the highway traveler, the city runabout, and the high performance pleasure car. The first two will serve a definite purpose and the third type will have its place in keeping the restless few contented. All three will be described in detail as a specific car of its respective type.

The highway traveler, designed for expressway travel, will be designed for the utmost leisure while driving. Automatic controls will serve an important function and everything possible will be operated hydraulically or electrically. Bonnets and decks will rise at a touch of a button and hydraulic jacks and wrenches will change the ordeal of a tire change from a drudgery to a minor bother.

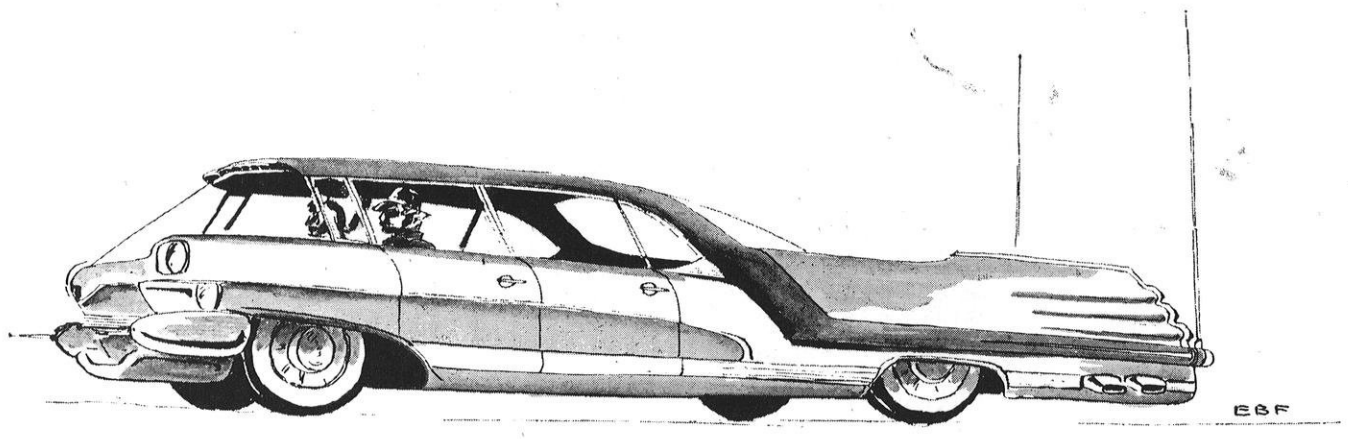
The interior, with such conveniences as refrigerated compartments and eight way automatic seats that convert into lounges and beds, will be designed for one purpose, to keep the passengers happy. Other improvements such as hi-fidelity radios in place of the conventional type will further help to pass the time on long trips.

The car itself will be large, probably twenty-five feet or better, with a power plant consisting of an internal combustion engine of up to 500 cubic inches in size. This engine will probably develop about 500 horsepower of which only about half will reach the rear wheels, the other half being necessary to operate all the power equipment on the car.

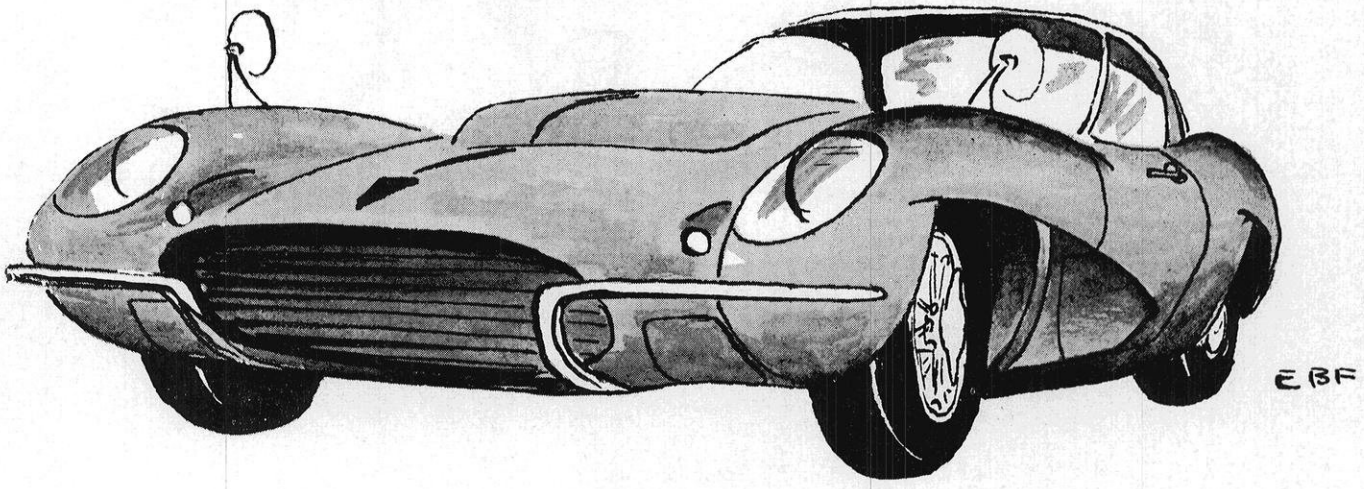
The power that is transmitted to the wheels will be transmitted through an advanced type of automatic transmission with two or more torque converters in conjunction with the usual planetary gearing. By placing it in the rear, the set up for independent rear suspension will be much more desirable than the live rear axle found on most present cars, and also aid in weight distribution.

The question may be asked as to why no mention is made of the gas turbine. True, there is a possibility that this type of power plant could appear in the highway traveler, but even here the chances are slim for quite a while. There are too many difficulties to overcome until it will become as reliable or as flexible as the piston engine.

The suspension on this type of car will probably be the hydraulic type of a highly advanced design.



The highway traveler.



The sportscar.

A central "brain" will control the stiffness of springs, depending on road conditions.

The general outside appearance will be different than today's automobile, but it will be an evolutionary product rather than a new radical design. The car will show in its design the rear power system, and a generous amount of glass will be spread about allowing full vision for the occupants and also be relied upon for more structural strength. Chrome will still be in evidence, but to a lesser degree. The exhausts are liable to spout from the car at any spot, even the front; and four headlights, of a more efficient type, will be incorporated into the styling of all cars.

On some of the more advanced turnpikes electronic controls may be set up allowing this type of car even more automatic operation. Small radio transmitters along travel lanes will send signals picked up in the car by receivers which will automatically convert these impulses into mechanical action that will drive the car. For this reason each car will be driven in the same way at the same speed and accidents will be cut to a minimum. Manual controls would be necessary only for entering and leaving the turnpike, or in case of power failure. Cars would automatically be brought to a slow safe stop in the event of some mishap and could be driven manually until it is remedied.

Other safety devices would be incorporated into the design; like radar brakes so that a following car could never get close enough to the preceeding one to cause an accident, and controls to turn the car off the main travel lanes in the event of a flat tire.

The main purpose of the city runabout will be to give cheap, reliable service in city traffic. With the city traffic problem getting worse, car size will be of primary consideration. The tendency towards smaller cars for this use can be seen by increasing number of European economy cars in this country. It is estimated that over 3% of the car market in 1957 will go to these cars.

This type of car in the future will be a small four passenger economy car, acting in most cases as a second car. It will be fairly cheap to build with a conventional type powerplant, probably four cylinders developing between 40 and 90 horsepower. The air cooled engine has a good chance of becoming popular here. Its compression will not become high, probably never exceeding 8 to 1 and it should never have a displacement of greater than 150 cubic inches. It will not be a fast car, such as the highway traveler, but it will reach 85 mph if the need arises and should get 35 to 40 miles per gallon of gas.

This car will be styled as a small car, to make use of the limited space available. The most common body style will be a four door pillarless sedan, but there will also be other types available. Chrome trim will be minimized for two reasons, price and taste. The four seats will be of the bucket type in front and single bench in back. Safety belts will be required by law and other safety features such as pop-out windshields and padded dashes will appear.

Wheels will be small, even down to 12 inches, but the suspension will be along today's general lines. Air suspension may appear on some models and torsion bars will remain on at least one and may spread to others. The majority of cars, though, will have coils in front and semi-elliptics in the rear.

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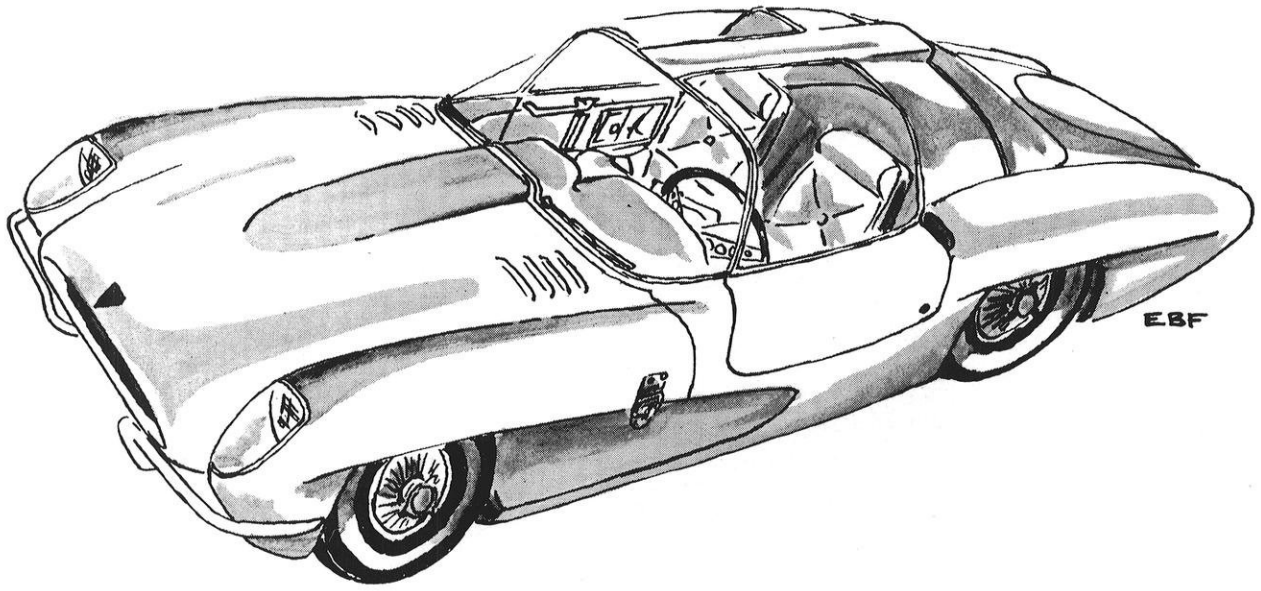


The sportscar.

Independent rear suspension will not appear on this type as its need does not warrant the expense.

Power equipment will not be prevalant on this type for its need will not exist. There will not be weight enough on the front wheels to warrant power steering and the brakes will be efficient, so that maximum breaking will occur with a minimum of breaking pressure.

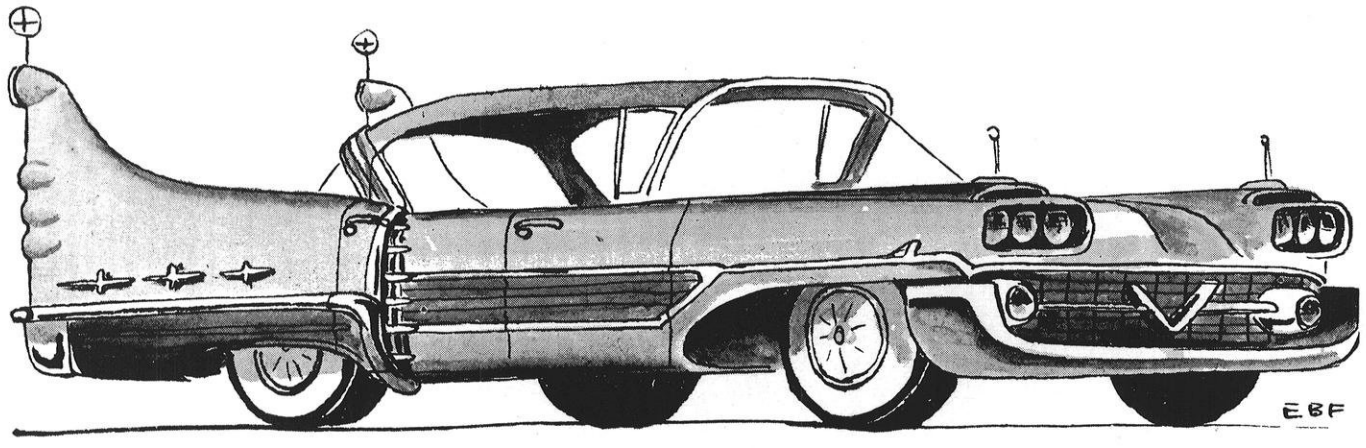
Some form of automatic transmission will be seen. It will be along today's lines; a torque converter coupled to a set of planetary gears. It will be more flexible than today's, however, the driver being able to select any speed range he desires or being able to leave it in full automatic.

The high performance pleasure car is the sports car or hot rod of tomorrow, and will be designed for people who want more out of a car than just transportation. Most of this type will be factory built, but some will be built by the backyard mechanics and many will be factory built, but modified by the owner to fill his own desires.

Its powerplant will be of the conventional piston type as it has the best power to weight ratio of any powerplant known today. The engine displacement will range anywhere from 30 cubic inches to 500 cubic inches, and its power will range anywhere from 60 horsepower to 600 horsepower.

Many ways of developing this power can be used. Fuel injection will be just about universal, and superchargers will be used on some in conjunction with tuned exhaust systems to give breathing of the nth degree. The blocks will be of aluminum with either steel cylinder inserts, wet or dry, or steel lines sprayed on and bonded to the aluminum block. Pistons will be aluminum with high alloy steel connecting rods.

The only other major parts that will be built of steel are the cam-



The monster.

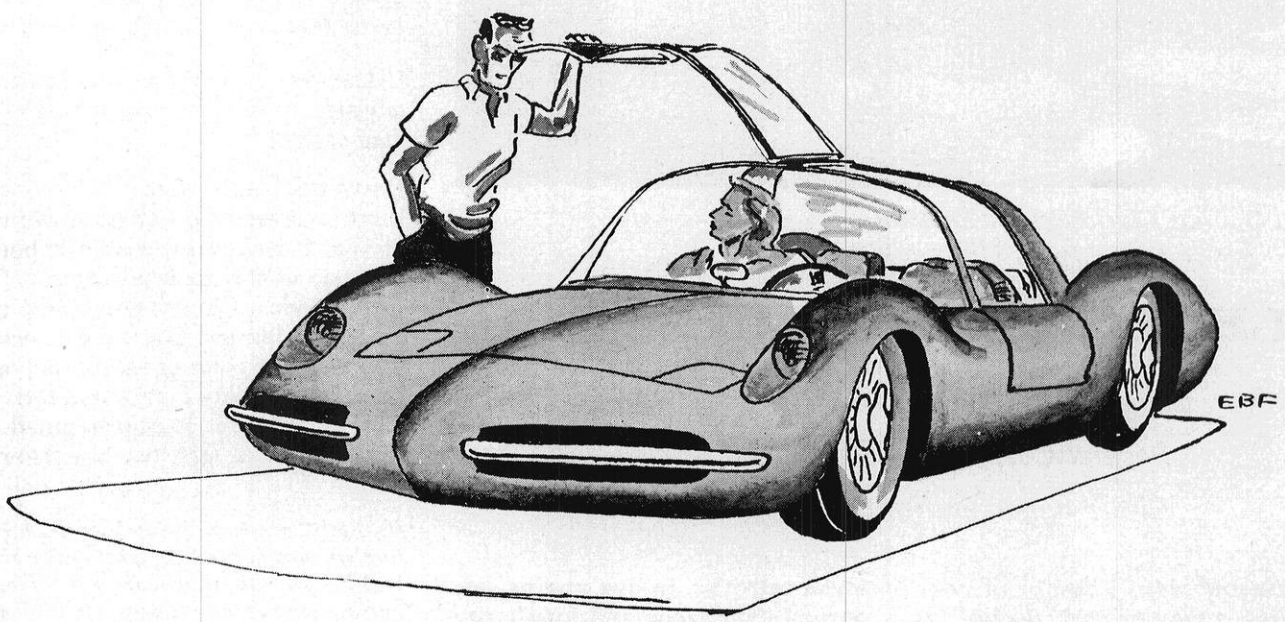
shafts and the crankshaft. The head or heads, the valve covers and the crankcase will all be cast or fabricated from aluminum. The intake manifold will be cast aluminum but will only slightly resemble today's. This is because the fuel will be injected directly into the cylinders, thus the intake manifold will be used to transport air only. Overhead camshafts will be seen on most cars. All in all, the engine will be a highly developed piston engine developing more than one horsepower per cubic inch in the majority of cases.

fancies of the designer. Here a radical design could appear, either as a homemade special or as a production car. Two or four seats (or more) could be incorporated depending upon the needs of the owner. Chrome will be played down to a minimum and the lines will be clean and functional. The body will be made out of some light material, probably aluminum or fiberglass. Magnesium bodies will be becoming as the price of magnesium goes down to a point where it becomes competitive with aluminum or fiberglass. Fiberglass

magnesium getting the nod here due to light weight of magnesium.

These cars will have a tendency to stay away from power equipment although power brakes may be used. These brakes will differ from the now used power brake in that they will not have a set amount of power boost, but the assist would vary as the speed. Therefore, the faster a car goes the more assist the driver will get.

The three above mentioned types will take up most of the market and in time will take up all of the market. Of today's cars, the Ameri-



The city runabout.

The suspension could be just about anything, from air to buggy springs depending upon the whim of the designer or builder. Torsion bars should become increasingly popular, but air or oil systems have good chances of making favorable names for themselves. It will be certain that no matter what suspension is used, the ride will be firm with a minimum of roll and pitch, and yet as comfortable as any other car on the road. The cars will steer at just about the neutral point with a bit of understeer to make them stable on corners. Independent four wheel suspension will be prevalent on this type.

Styling may follow any number of paths, again depending on the

will remain the do-it-yourselfer's favorite because of the comparative ease with which it can be worked. Most designs will feature four headlights and the exhausts are liable to appear anywhere. The major body styles will be roadster, coupe or convertible with a few four or more passenger models.

Transmissions are most likely to be of the four speed manual type with synchromesh on all forward speeds. Overdrives will be used on quite a few of the cars, but only a small few will have automatic transmissions. On most models, the transmission will be placed at the rear of the car for better weight distribution.

Wheels will either be of the wire type or cast magnesium with the

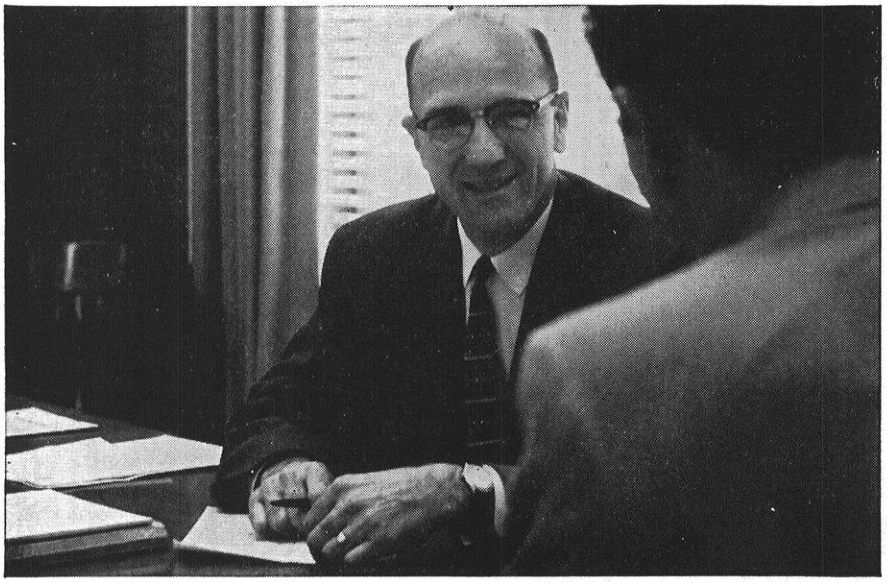
can cars will advance to the highway traveler class, the imported economy cars, and maybe the Rambler, will become the city runabouts, and the sports cars and hot rods will become the high performance pleasure cars. A few special types will still be made, a typical type will be the large luxury wagon of today, but even this one will be of the general highway traveler type.

The future of the automobile looks specialized but bright in the United States at the present time. Of course something could happen and we could end up with a car like the monstrosity shown.

Let's hope not.

THE END

CAREERS WITH BECHTEL



KARL BAUSCH, *Chief Electrical Engineer, Power Division of the Bechtel Corporation.*

ELECTRICAL ENGINEERING

One of a series of interviews in which Bechtel Corporation executives discuss career opportunities for college men.

QUESTION: *Mr. Bausch, in considering a position with Bechtel, or any other firm, isn't it true that what most college men want to know first of all is "What will I be doing?"*

BAUSCH: That's true, and it isn't an easy question to answer. So much depends on individual preferences and abilities and the way a man develops. On joining us, he would be asked if he'd like to work on the drafting board doing layout work. As an alternate, he might prefer a starting assignment involving helping out on calculations, requisitioning materials, writing specifications, etc.

QUESTION: *In other words you try to give the new man some freedom of choice?*

BAUSCH: As far as possible. We know that the beginning period is a difficult one. It takes some time for him to get his feet on the ground and we try to "expose" him to many different activities. In that way he gets needed experience and familiarity that help him decide the work for which he feels best qualified. It also gives us the opportunity to evaluate his potential.

QUESTION: *Assuming a man shows the necessary ability and begins to produce, how does he branch out?*

BAUSCH: Generally, in either of two ways. He may work on the electrical portion of power plants, designing circuits, control and relaying systems, unit protection, etc. The other way is on the physical layout of power plants —that is, location of equipment, conduit and raceway systems, etc. In either case he would be put in charge of one section of the project.

QUESTION: *And his next advance would be...?*

BAUSCH: Assuming he progresses satisfactorily, he would ultimately move into a lead job as a group supervisor in charge of the design of the electrical system of the complete plant.

QUESTION: *Could you give an estimate of the time involved in the various steps?*

BAUSCH: That's impossible. We have no hard and fast schedule. In general, we have found that it takes a man about a year to get his feet on the ground and become a real producer. From that point on, it's up to him.

QUESTION: *In other words, he can advance in keeping with his individual ability?*

BAUSCH: That's right. Of course, there are many other factors involved, including the vitally important one of the great advancements being made in every phase of the electrical industry. These create new jobs and new types of jobs involving new skills. And for every opportunity existing today, it is safe to predict there will be at least two tomorrow.

Bechtel Corporation (and its Bechtel foreign subsidiaries) designs, engineers and constructs petroleum refineries, petrochemical and chemical plants; thermal, hydro and nuclear electric generating plants; pipelines for oil and natural gas transmission. Its large and diversified engineering organization offers opportunities for careers in many branches and specialties of engineering —Mechanical...Electrical...Structural ...Chemical...Hydraulic.

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SALES ENGINEERING

by John Sundstrom me'58

The selective field of sales engineering offers opportunities for advancement and personal development that are unique in the engineering field. Perhaps you are one of those who is willing and qualified to be a sales engineer.

SALES engineering is the art of selling equipment and services that require engineering skill in their selection, application and use.

Engineering skill has been associated largely with design and production. Designing and completing the product are important, of course, but unless the product is sold all the work has been wasted. For this reason the sales engineer may be called a designer and fabricator of sales orders. The ability to create orders requires a great deal of technical knowledge and a knowledge of economics.

The sales engineer must view the problems he encounters in selling with the combined vision of the "technical eye" and the "business eye". He determines his course of action on the basis of economic and technical factors. Although all engineers are concerned with price and cost, the sales engineer's welfare depends entirely on them, and so he must be well versed on the economic variables in his product.

To get a better picture of where sales engineering fits into the practical affairs of industry today, try to visualize the vast number of products on the market, and then categorize them according to the way in which they are ordinarily bought and sold. With this picture it is easy to see the tremendous amount of technical knowledge required of the sales engineer.

The engineer must be concerned with his personality, because as a salesman he deals with many people. For this reason extra-curricular activities are very desirable. Working with other people educates the engineer in the methods of pleasing and understanding the individuals he will encounter during his working years.

Ordinarily the students picked for sales engineering graduate in the upper quarter of their class, and it is even more desirable that a student have an advanced degree. This is more important if it is in commerce or economics, because the sales engineer will there learn much to supplement his technical knowledge. If the student engineer isn't able to obtain this advanced degree he should use his free electives to the best advantage and apply them in the field of human relations.

The most important prerequisite for the sales engineer is that he develop his sales skills. Although most of this is cultivated during his training period, the afore mentioned items create a good sound foundation to develop these skills around.

A small percentage of the engineers who graduate go into sales work, because it is much more difficult to enter this phase of engineering than to enter production or design. The sales engineer's work is far more individualistic than other phases of engineering, and for this reason the sales engineer must be very capable.

To state an example of how few engineers are picked to train in sales, Bethlehem Steel is selecting only fifteen graduates for its sales program for 1957, although they expect to hire nearly 300 engineers all told.

Sales engineering has, as its principal spheres of activity, the selling of technical equipment and services needed in carrying on the following activities:

Raw material procurement, such as:
- Mining.
- Quarrying.
- Lumbering.
- Oil production.

Manufacturing and processing, such as:
- Metal working.
- Wood working.
- Textile manufacture.
- Paper manufacture.
- Chemicals manufacture.
- Foods manufacture.
- Machinery manufacture.
- Petroleum refining.

Transportation, such as:
- Railroads.
- Bus and street car.
- Air.
- Marine.

Power and public service, such as:
- Electricity.
- Gas.
- Sanitation.
- Water supply and control.
- Water power.

Construction, such as:
- Public works.
- Private.

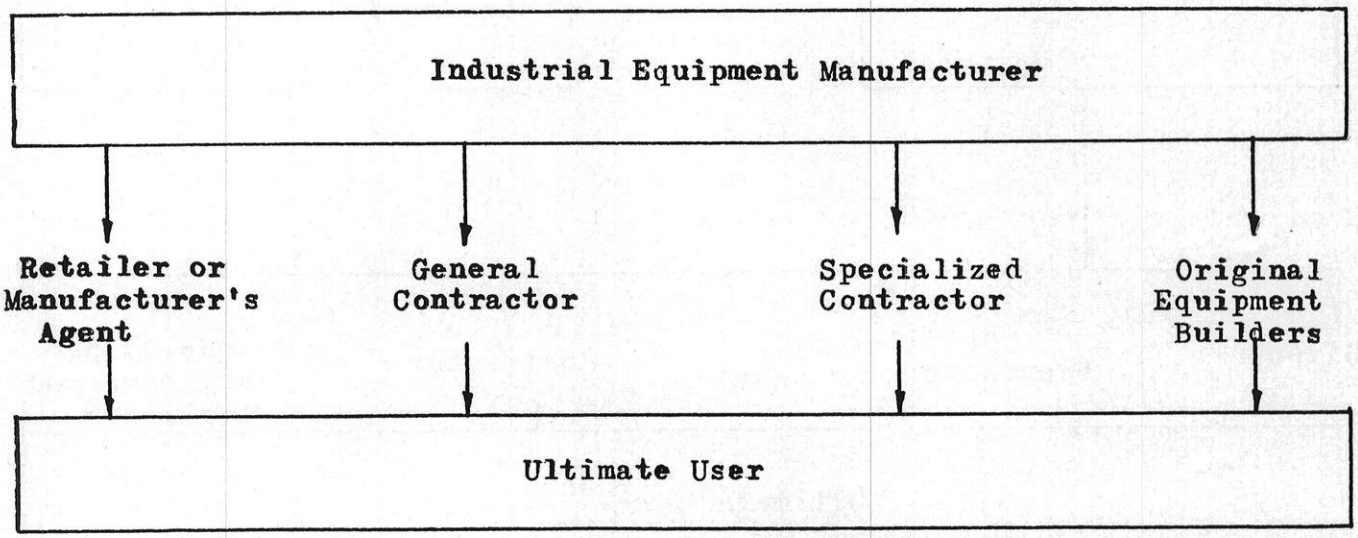

Diagram I.—Illustrating the common paths followed in the flow of apparatus from manufacturer to user.

Specialized processes or services applying to many industrial activities, such as:

Illumination.
Ventilation and air conditioning.
Refrigeration.
Materials handling.
Dust and refuse collection.
Heat treatment—welding.
Painting and finishing.
Water supply.
Power production.

Each of these industrial activities is dependent upon another. Each has its own special problems and processes.

For one industrial producer to sell another, expert knowledge is required not only of what is to be sold, but how the product or service is to be used.

The training program itself is usually quite extensive. It can last for one to five years, with the most quoted figure being two years.

It is well to remember that in the field of selling, the sales engineer has two broad paths of advancement within a company. One is to become continually a better sales engineer and advance largely as an individualist. The other is to develop executive ability, so that he may become, for instance, a district manager or a sales manager, or finally at the very top of the company for which he works.

The sportsman, to be successful, must know where the game is likely to be as well as its characteristics and habits. Similarly, the sales engineer's selling efforts are fruitless unless directed to an existing or potential market. Identifying the potential buyer is often one of the most difficult problems in sales work. Failure in such work furnishes ample opportunity for wasted effort. For this reason the sales engineer should have a thorough knowledge of the buying and selling markets.

The nature of the market changes so rapidly that the successful sales engineer must continually study the market assigned to him, no matter how few or how many customers fall to his lot to serve. If the sales engineer fails to do this, he may lose the confidence of his customers and not be worthy of sharing in the solution of the customer's problems. The sales engineer who knows when customers' needs exist can time his sales effort with the greatest efficiency.

No one sales engineer can become expert in the technical operation of every industry, nor in the various problems met by every industry. Thus the work of the sales engineer is directed to one industry, a few associated industries, or to a definite class of problems or processes common to many industries.

The preceding diagrams show the principal channels of distribution of interest to the sales engineer.

To gain further efficiency in selling, the sales engineer must follow basic principles. Customers are be-

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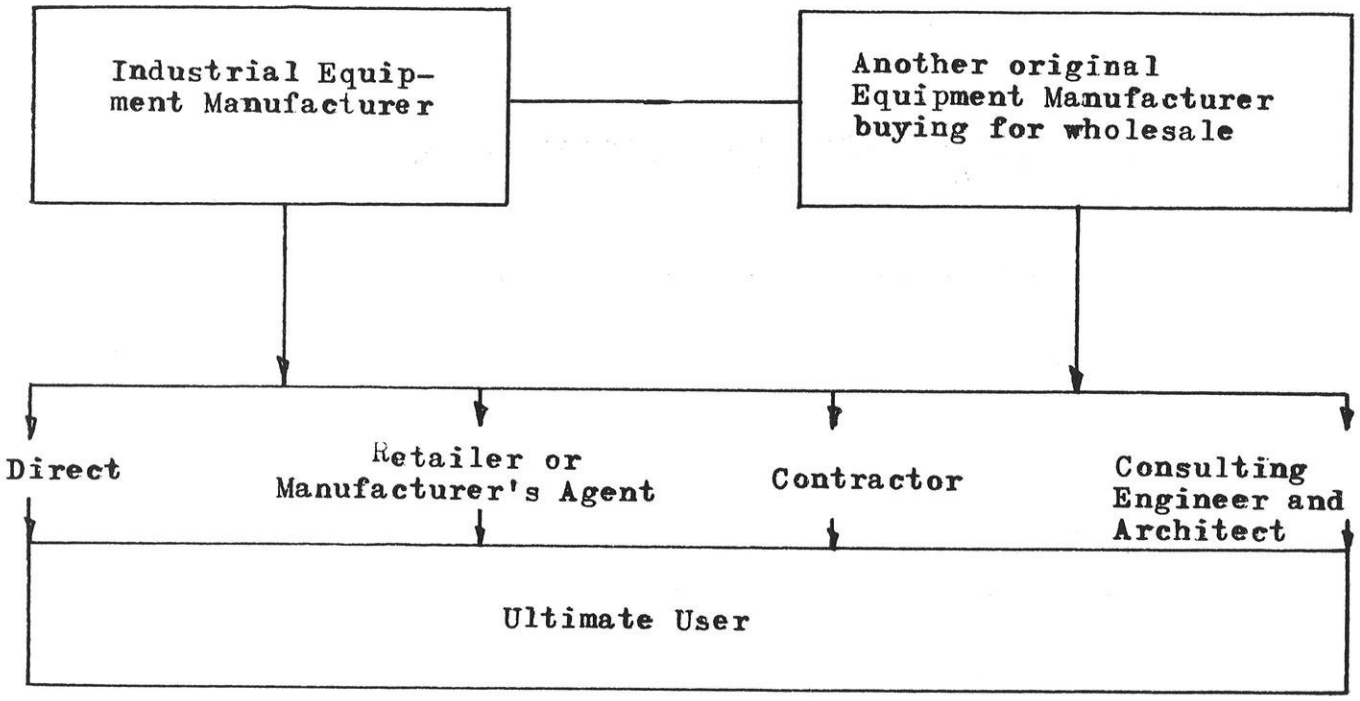


Diagram II.—Illustrating the common paths followed by an equipment manufacturer who sells his apparatus extensively to another original equipment manufacturer, who in turn sells his completed apparatus through similar channels.

coming increasingly weary of the constant effort by many suppliers to obtain business, so if the salesman is concise and quick to state his purpose, without losing any opportunity to apply his sales skills, the customer is more likely to lean toward that salesman's product. This is known as the sales engineer's ability to sell himself.

Personality characteristics play a large role in this phase of selling. However, when these characteristics are supplemented with the following principles, it makes the selling effort doubly effective.

The sales engineer's first step in meeting a sales opportunity is to take an interest in the prospect himself, and then to analyze the technical and business conditions that relate to the prospect's problems. From a study of existing conditions and an evaluation of essential and non-essential factors, the best proposed solution is reached.

With facts for reaching the objectives established, the sales engineer attempts to visualize the special benefits that his customer can derive from the use of the sales engineer's products and services, and makes these stand out as real advantages from the viewpoint of earnings and profits to the customer.

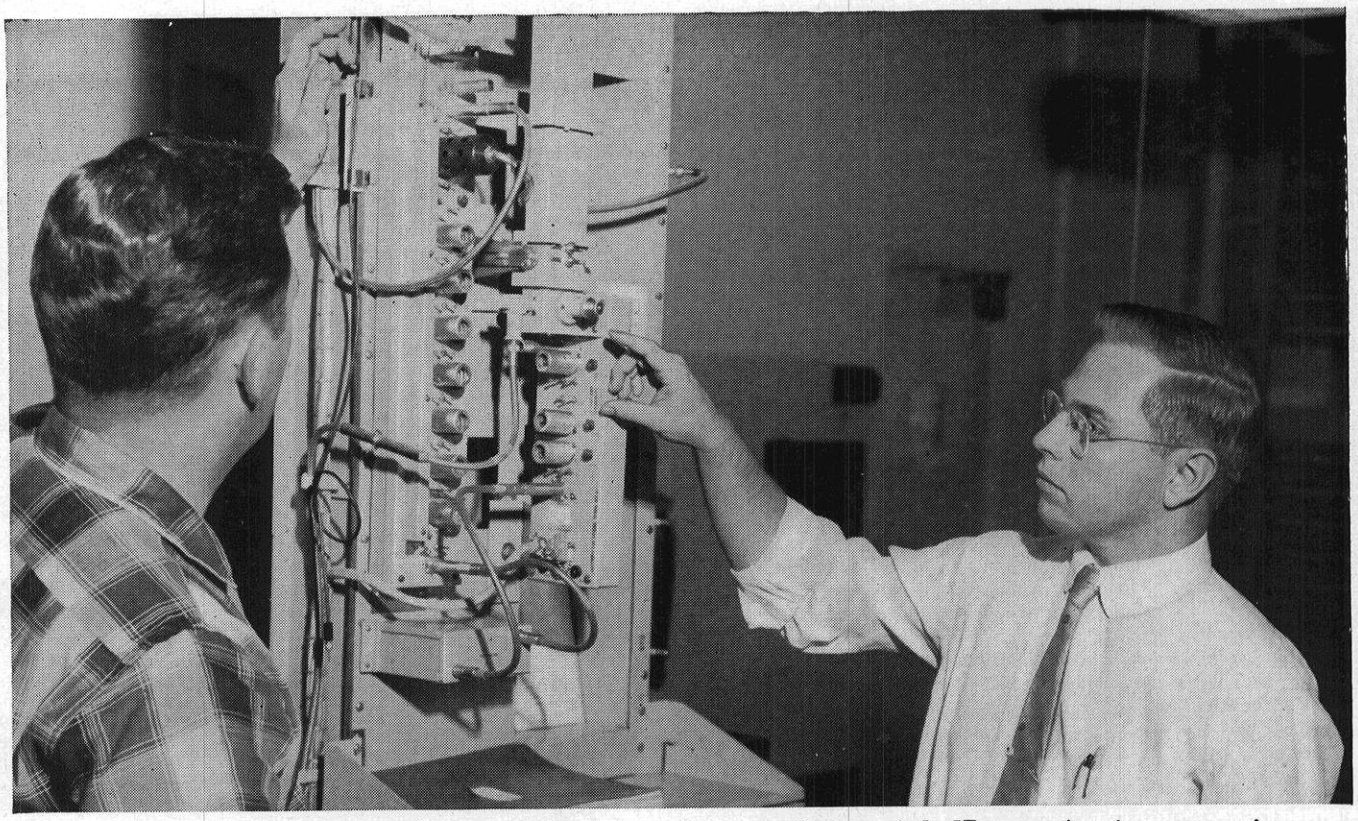
Lastly, since advantages must carry conviction, the sales engineer determines how best he can dramatize the truths he attempts to establish. We all know that the same truth can be expressed in many ways, yet one way may convince whereas another way may fail to influence. Often the simplest, clearest, and homeliest expression carries conviction; the lengthy and elaborate demonstration may leave the listener confused, suspicious, and undecided.

The sales engineer should realize his importance to his company. He is not only the mouthpiece for his employer, but also the ear through which he learns the exact requirements of his customers and interprets their needs to those within his own organization who determine the nature of products and services furnished.

It is only logical, then, that the sales engineer is an individual who is capable of rising quickly on industry's ladder. Ordinarily advancement depends on higher sales ability. However, the road to administration is open to him, and he can rise to sales or district manager, and higher if he shows himself capable.

The individual who has the ability to qualify for sales engineering should give the field serious consideration. For the individual who likes dealing with people, and who has visions of advancing in industry, sales engineering is "the road to plenty".

THE END



John Reiter (right) discusses the route of signals from the wave guide through the IF stages of a microwave receiver

"This was the kind of challenge I was looking for"

John A. Reiter, Jr., B.S. in Electronics, Arizona State College, '54, discusses the biggest project so far in his Bell System career

"One of the reasons I joined a Bell Telephone Company," John says, "was because the engineering would be more interesting and challenging. I knew I'd chosen well when I was assigned to assist in planning a microwave radio relay system between Phoenix and Flagstaff, Arizona. This was the kind of challenge I was looking for.

"It was to be a system requiring five intermediate relay stations, and I began by planning the tower locations on 'line of sight' paths after a study of topographical maps. Then I made field studies using altimeter measurements and conducted path-loss tests to determine how high each tower should be. This was the trickiest part of the job, because it called for detecting the presence of reflecting surfaces along the transmission route, and determining the measures necessary to avoid their effects.

"Not the least part of the job was estimating the cost of each of the five relay stations, taking into consideration tower height, access roads, and the need for special equipment such as de-icing heaters. All told, the system will cost more than $500,000. When construction is finished in December of this year, I'll be responsible for the technical considerations involved in connecting radio relay and telephone carrier equipment. Initially this system will handle 48 voice channels, but can be expanded to 540. In addition to long distance telephone service, it will also provide data transmission circuits.

"This assignment is an example of the challenges a technical man can find in the telephone company. You take the job from start to finish—from basic field studies to the final adjustments—with full responsibility. To technical men who want to get ahead, that's the ultimate in opportunity."

John Reiter is building his career with the Mountain States Telephone and Telegraph Company. Find out about career opportunities for *you*. 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 a copy of "Challenge and Opportunity" to: College Employment Supervisor, American Telephone and Telegraph Company, 195 Broadway, New York 7, N. Y.

BELL TELEPHONE COMPANIES

SCIENCE HIGHLIGHTS

by Ed Allen m'60

BUILDING "HUNG" INSIDE WELDED STEEL FRAME

First structure of its type ever built by internationally-famed architect, Mies van de Rohe, glows strikingly in the dusk at Illinois Institute of Technology on Chicago's South Side. The 220 x 120 foot single-story building is literally turned inside out, with four plate girders (two shown), columns and structural mullions outside the roof and plate glass walls. Virtually every connection in the 285 tons of structural steel is arc welded, partly in the shop, partly in the field. Interior area of 26,400 square feet is completely unobstructed, with concealed air conditioning, recessed lighting. Mullions and columns form 10 foot bays entirely around the structure, each enclosed in floor-to-ceiling plate glass panels.

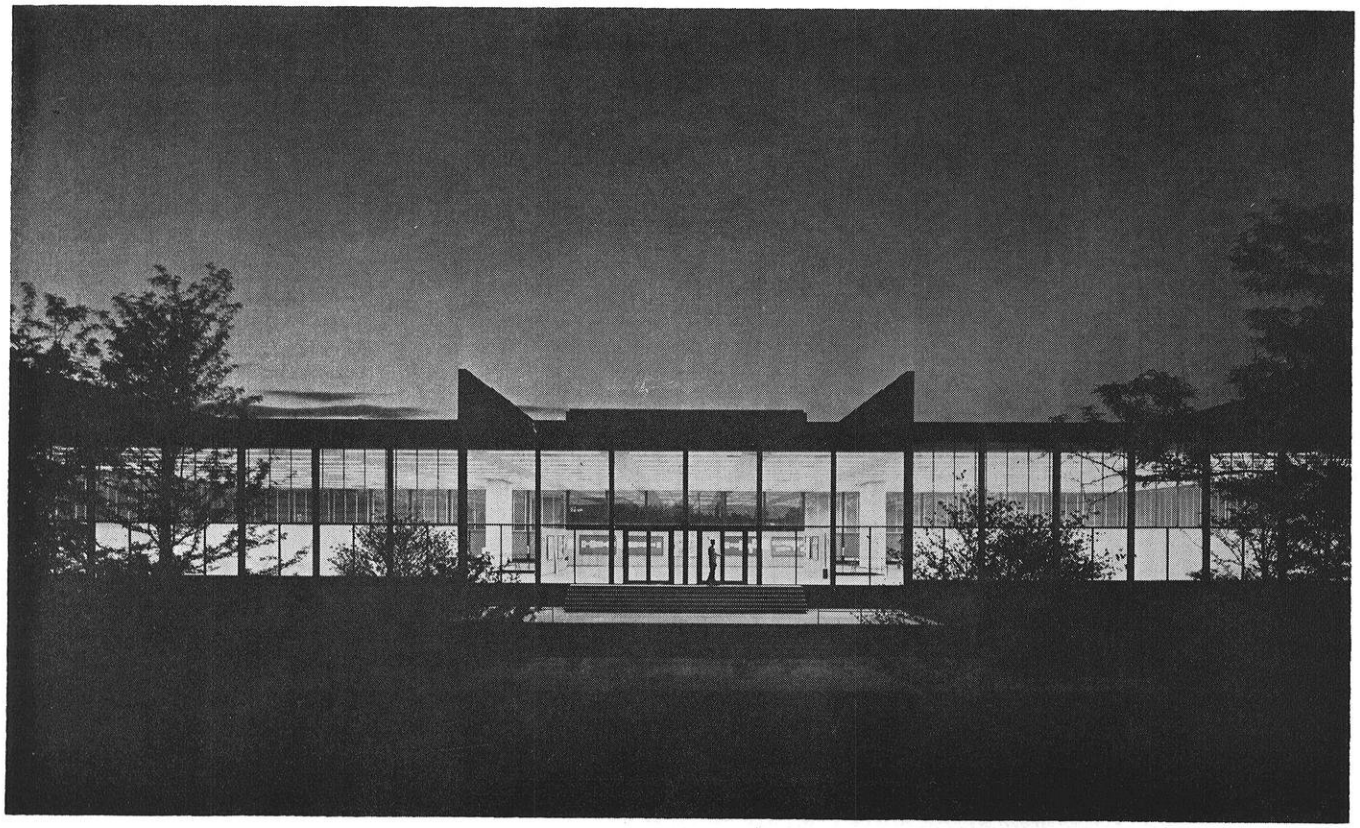
Associate architects-engineers for the $750,000 Crown Hall were Pace Associates; structural engineers, Frank J. Kornacker & Associates; structural fabricator, Hansell-Elcock Company, all of Chicago, Illinois.

FLOAT MOLTEN METALS FREELY IN SPACE

Man's newest "wonder" metals are now being investigated by heating them thousands of degrees above white heat, while they float, freely suspended in space. Called levitation melting, this unique and versatile technique was invented by Westinghouse research scientists and brought to its present state of development by the combined efforts of scientists at the Westinghouse Research Laboratories and the University of British Columbia.

Levitation melting was given its first major public demonstration at the International Amphitheatre during the National Metals Exposition and Second World Metallurgical Congress, sponsored by the American Society for Metals.

At the Westinghouse Research Laboratories, Pittsburgh, Pa., levitation melting is used to prepare



—Photo courtesy Lincoln Electric Co.

highly purified laboratory-scale ingots of niobium, zirconium, titanium, molybdenum and dozens of alloys. Because they melt at very high temperatures, and are extremely active chemically as such temperatures, these metals and alloys are difficult to prepare with equal purity by any conventional method.

In levitation melting, compressed metal powder is placed inside a copper coil which carries a high-frequency current of electricity. Reversing its direction nearly a million times a second, the electric current generates a field of force which floats the metal charge inside the coil. At the same time, it converts the metal into a white-hot molten mass in a matter of seconds. Temperatures of 4500 to 5000 degrees Fahrenheit are achieved in half a minute or less, melting all but the most stubborn of metals.

At white heat, metals such as niobium and titanium are among the most active chemicals known. They react chemically with any known vessel in which they are melted. The traces of impurities they pick up cannot be tolerated in research on the pure metal.

Levitation melting eliminates this problem entirely. No containing vessel is required, since the molten metal floats freely in space, confined only within itself. The whole process is carried out inside a sealed vessel containing an inert gas such as helium or argon, thereby protecting the pure metal from contamination by the air.

Simplicity of apparatus, speed of melting and ease of handling a wide assortment of metals and alloys are other advantages of levitation melting. The molten metal even stirs itself, yielding unusually uniform alloys from mixtures of different metals.

Scientists are using levitation melting to prepare a wide variety of the newest metals and alloys for metallurgical research. Such research with ultrapure metals seeks the fundamental knowledge which lies behind their full-scale use as metals of the future. Thus, in the past few years, titanium has emerged from the laboratory as an important building material in supersonic aircraft and missiles, and zirconium has developed into a vital structural metal in nuclear reactors.

Although not yet "graduated" from the laboratory, the Westinghouse scientists suggest that niobium—the latest "wonder" metal—may soon become an outstanding high-temperature, high-strength structural metal. Levitation melting is one of the few methods known for the preparation of niobium and niobium-alloys in the purity required for fundamental research on the metal.

RECRUITING CODE FOR COLLEGES GAINS WIDE ACCEPTANCE

As did the mustache cup, college recruiting that employs "the fustest with the mostest" tactics is apparently doomed to pass from the American scene. The prediction comes as a result of the promulgation of a set of recruiting principles and practices approved by the U. S. Chamber of Commerce and the College Placement Council, Inc.

In addition to this sponsorship, the code has won the approval of the executive committees of regional placement associations that represent both college and employer groups.

The standards are designed to insure that campus recruiting takes place in an objective atmosphere with a complete understanding of all facts by both student and re-

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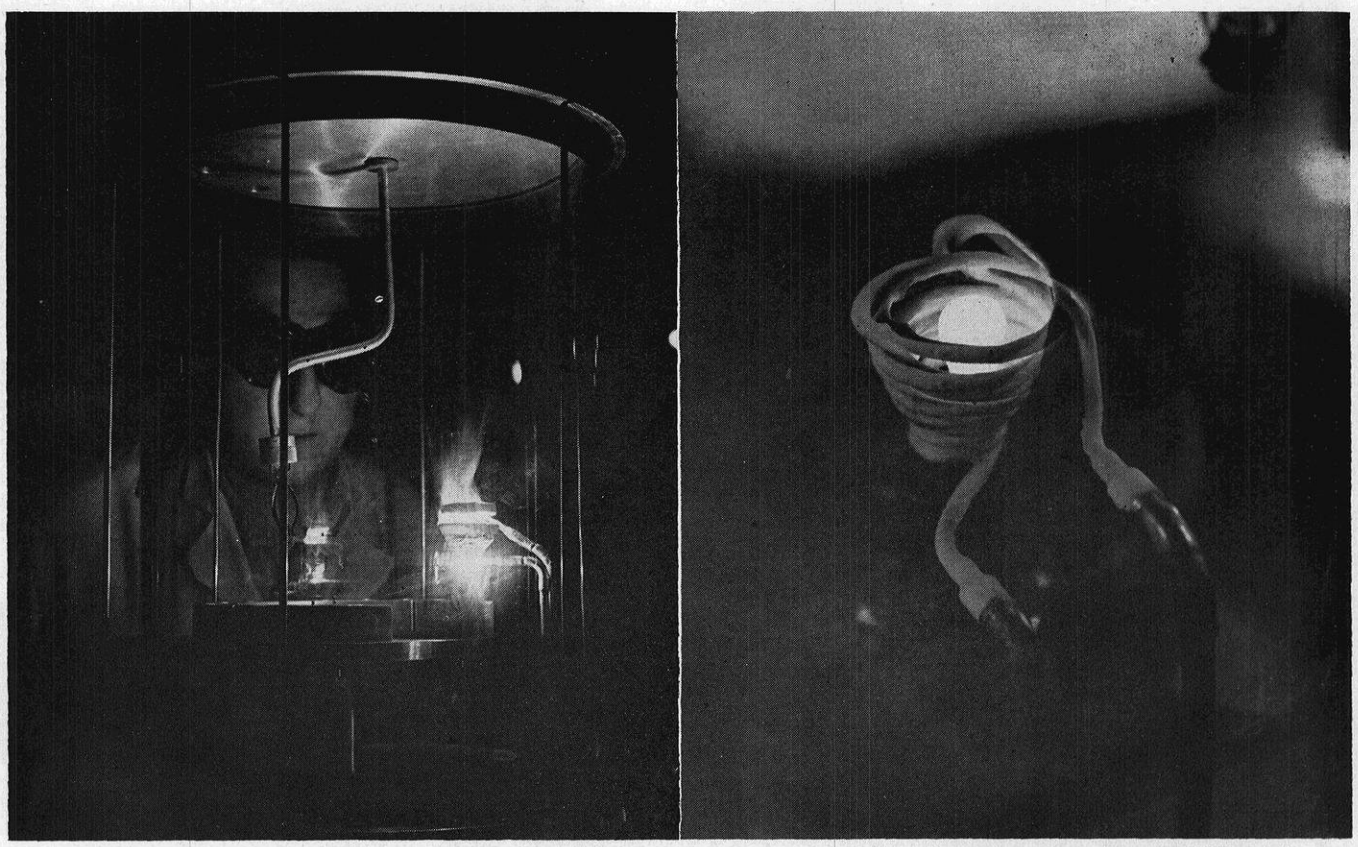
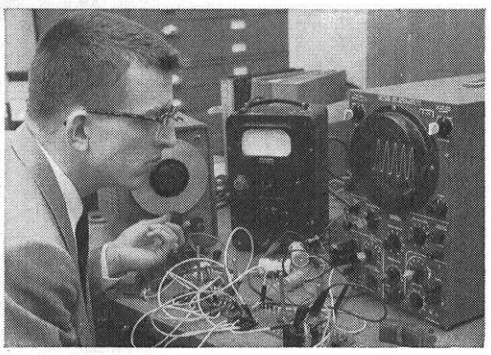


Levitation melting. —Courtesy of Westinghouse

WHAT'S DOING at Pratt & Whitney Aircraft . . .



Pratt & Whitney Aircraft engineer checks a bread board model for a subminiature, encapsulated amplifier built with transistors.

A rig in one of the experimental test cells at P & W A 's Willgoos Laboratory. The six large finger-like devices are remotely controlled probe positioners used to obtain basic air flow measurements within a turbine. This is one of the techniques for obtaining scientific data vitally important to the design and development of the world's most powerful aircraft engines.

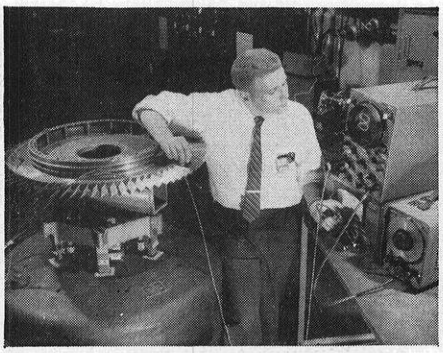
. . . in the field of INSTRUMENTATION

Among the many engineering problems relative to designing and developing today's tremendously powerful aircraft engines is the matter of accumulating data — much of it obtained from within the engines themselves — and recording it precisely. Such is the continuing assignment of those at Pratt & Whitney Aircraft who are working in the highly complex field of instrumentation.

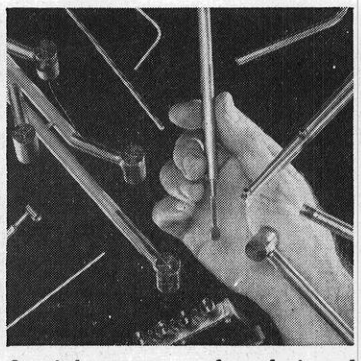
Pressure, temperature, air and fuel flow, vibration — these factors must be accurately measured at many significant points. In some cases, the measuring device employed must be associated with special data-recording equipment capable of converting readings to digital values which can, in turn, be stored on punch cards or magnetic tape for data processing.

Responsible for assembling this wealth of information so vital to the entire engineering team at Pratt & Whitney Aircraft is a special group of electronic, mechanical and aeronautical engineers and physicists. Projects embrace the entire field of instrumentation. Often involved is the need for providing unique measuring devices, transducers, recorders or data-handling equipment. Hot-wire anemometry plays an important role in the drama of instrumentation, as do various types of sonic orifice probes, high temperature strain gages, transistor amplifiers, and miniaturized tape recording equipment.

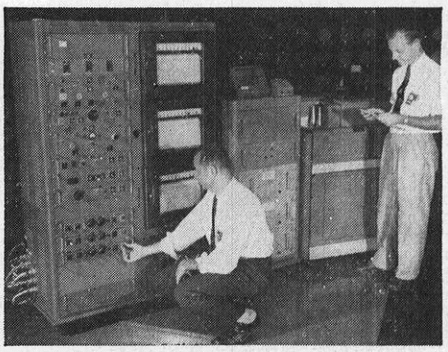
Instrumentation, of course, is only one part of a broadly diversified engineering program at Pratt & Whitney Aircraft. That program — with other far-reaching activities in the fields of combustion, materials problems, mechanical design and aerodynamics — spells out a gratifying future for many of today's engineering students.



Instrumentation engineer at Pratt & Whitney Aircraft is shown investigating modes of vibration in a blade of a single stage of a jet engine compressor.



Special-purpose probes designed and developed by P & W A engineers for sensing temperature, pressure and air flow direction at critical internal locations.



The "Plottomat", designed by P & W A instrumentation engineers, records pressure, temperature and air flow direction. It is typical of an expanding program in automatic data recording and handling.

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

EAST HARTFORD 8, CONNECTICUT

—Photo courtesy Caterpillar

Science Highlights

(Continued from page 35)

cruiter. The code has four basic objectives:

1. To promote a wise, responsible choice of a career by the student.

2. To strengthen in him a high standard of integrity and a concept of similar ethics in the nation's employers.

3. To develop in the student an attitude of personal responsibility for his own career.

4. To minimize interference with the educational processes of the college.

Besides spelling out what the recruiter and the college must do to attain these objectives, the code also spells out what the student must do to remain completely fair with both. In addition, a set of rules is recommended that will permit the recruiter to arrange his interviews and plant tours without interfering with normal college activities.

The code suggests voluntary acceptance of the new standards as a means of eliminating the high pressure recruiting methods too often used on American campuses.

Free copies are available on request from the Manufacturing Chemists' Association, 1625 Eye St. N. W., Washington 6, D. C.

"CATS" WORK ON 62% GRADE

Work rubber-tired scrapers on 525 feet of 62 percent adverse grade? It is possible—and profitably so—when an alert company uses its ingenuity. Usually it is possible to take the long way around and work an easier grade. The Guy F. Atkinson Company, South San Francisco, was not permitted outside the grade stakes on the reconstruction of 4.4 miles of US 101 from Dyerville to Redcrest, in northern California. This is deep in the heart of the Redwoods, and every attempt is being made to preserve the natural beauty of the virgin forests.

More than 1,400,000 yards—half the total yardage on the job—are being hauled out of this one side-hill cut, 480 feet deep and 1300 feet long. Most of the material must be hauled across the Eel River, at the foot of the cut, to fill in a river bar for the north approach to the bridge. Hauls average 3500 feet, but run as high as 7000 feet. And all the grading on this cut must be completed before the winter rains turn the clay into a quagmire, because a detour around the base of the hill, now extending 2200 feet up the river, must be removed by then to prevent diversion of the flood current against the opposite bank and undercutting some of the giant trees.

(Continued on page 40)

When you graduate, do you want a

JOB?

Sure you want a job . . . but you want more than just a job. You want a job with opportunity, a job that offers a challenge. Union Carbide offers such jobs.

Jobs with opportunity for what? Advancement, for one thing. Union Carbide is introducing new products at the rate of one every fifteen days. Each new product opens up new avenues of advancement. Not only that; markets for our present products are expanding at an exciting rate too.

Jobs with what kind of challenge? Union Carbide has always operated on the frontiers of science. The challenges are the challenges of that frontier—the challenges of new ideas. Union Carbide is already among the largest U. S. producers of titanium—will tantalum be the next "wonder metal"? Union Carbide pioneered the two major plastics, vinyl and polyethylene—is another major break-through in the making? Challenging questions, and Union Carbide people are answering them.

Representatives of Divisions of Union Carbide Corporation, listed below, will be interviewing on many campuses. Check your placement director, or write to the Division representative. For general information, write to V. O. Davis, 30 East 42nd Street, New York 17, New York.

BAKELITE COMPANY Plastics, including polyethylene, epoxy, fluorothene, vinyl, phenolic, and polystyrene. J. C. Older, River Road, Bound Brook, N. J.

ELECTRO METALLURGICAL COMPANY Over 100 ferro-alloys and alloying metals; titanium, calcium carbide, acetylene. C. R. Keeney, 137—47th St., Niagara Falls, N. Y.

HAYNES STELLITE COMPANY Special alloys to resist heat, abrasion, and corrosion; cast and wrought. L. E. Denny, 725 South Lindsay Street, Kokomo, Ind.

LINDE COMPANY Industrial gases, metal-working and treating equipment, synthetic gems, molecular sieve adsorbents. P. I. Emch, 30 East 42nd Street, New York 17, N. Y.

NATIONAL CARBON COMPANY Industrial carbon and graphite products. PRESTONE anti-freeze, EVEREADY flashlights and batteries. S. W. Orne, P. O. Box 6087, Cleveland, Ohio.

SILICONES DIVISION Silicones for electrical insulation, release agents, water repellents, etc.; silicone rubber. P. I. Emch, 30 East 42nd Street, New York 17, N. Y.

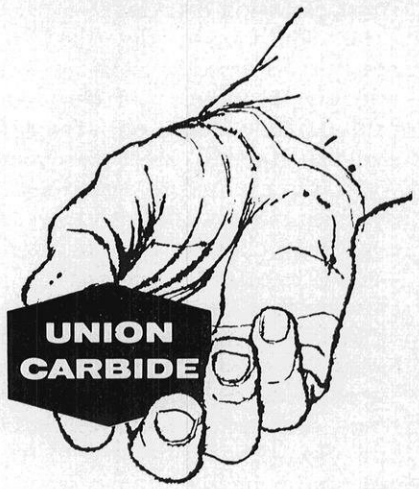
UNION CARBIDE CHEMICALS COMPANY Synthetic organic chemicals, resins, and fibers from natural gas, petroleum, and coal. W. C. Heidenreich, 30 East 42nd St., New York 17, N. Y.

UNION CARBIDE INTERNATIONAL COMPANY Markets UNION CARBIDE products and operates plants overseas. C. C. Scharf, 30 East 42nd Street, New York 17, N. Y.

UNION CARBIDE NUCLEAR COMPANY Operates Atomic Energy Commission facilities at Oak Ridge, Tenn., and Paducah, Ky. W. V. Hamilton, P. O. Box "P", Oak Ridge, Tenn.

VISKING COMPANY A pioneer in packaging —producer of synthetic food casings and polyethylene film. Dr. A. L. Strand, 6733 West 65th Street, Chicago, Ill.

GENERAL OFFICES—NEW YORK Accounting, Electronic Data Processing, Operations. Research, Industrial Engineering, Purchasing. E. R. Brown, 30 East 42nd Street, New York 17, N. Y.



Science Highlights

(Continued from page 38)

To complete the work in time, the Atkinson Company set up a schedule of 20,000 yards a day from this cut. And they are meeting this schedule by "yarding" 18 big Caterpillar DW20 Tractor-Scrapers up the 62 percent slope.

STRANGE CRYSTAL GROWTH MAY EXPLAIN STEEL FAILURE

Crystals, which grow as delicate plates from the surface of stainless steel, may explain, for the first time, a destructive failure of the metal known as "stress-corrosion cracking." This new theory was revealed by an international authority on corrosion, Dr. Earl A. Gulbransen, advisory chemist at the Westinghouse Research Laboratories in Pittsburgh, Pa. Dr. Gulbransen spoke before the Second World Metallurgical Congress, at the International Amphitheatre, Chicago, under sponsorship of the American Society for Metals.

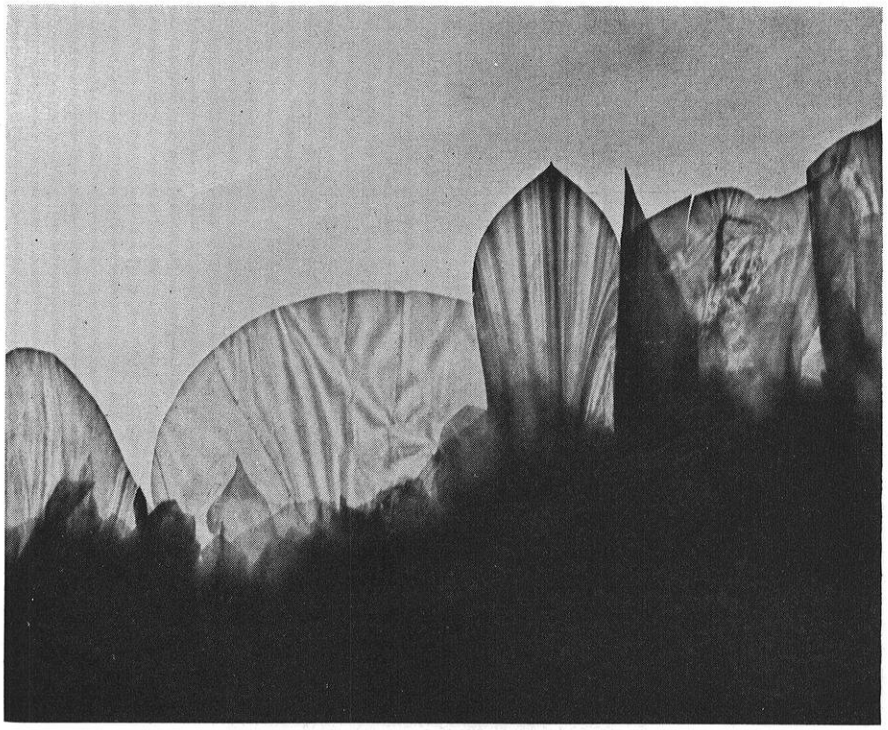
Stress-corrosion cracking can occur in metal structures which are chemically corroded while under an internal or applied stress, such as a pull or twist. It can cause complete failure of the structure.

Stress-corrosion cracking can be triggered even by such mildly corrosive substances as steam or human perspiration; and it occurs in objects subjected only to the internal stresses left in them during their manufacture. Stainless steel pipes, tubine blades—even coffee urns and cooking vessels can fail by stress-corrosion cracking.

Dr. Gulbransen described the newly discovered crystals as "submicroscopic platelets of chromium oxide." They form on strongly stressed stainless steel specimens which are exposed to corroding atmospheres containing traces of negatively charged chlorine atoms —more properly referred to as chloride ions.

"We believe that this unique crystal growth has important bearing on the whole general problem of stress corrosion," Dr. Gulbransen said, "for it has suggested to us a mechanism on the atomic scale to explain such corrosion.

"We think that this growth of platelets on the surface of the steel could lead to a chemical cutting of the metal. Minute crevices, therefore, might grow downward into the metal surface as the platelets thrust themselves above it. This, we believe, may lead to concentration of stress at the base of the crevices and eventually to failure of the metal."



—Photo courtesy Westinghouse

Crystals on stainless steel.

Working with Dr. Gulbransen in the experiments which led to the new theory were T. P. Copan and Dr. Daniel van Rooyen, research engineers at the Westinghouse Research Laboratories. The experiments are inherently quite simple, but extremely delicate and precise.

In a typical experiment, a small piece of stainless steel wire, nine thousandths of an inch in diameter and subject only to the residual stresses it normally possesses, is exposed to a carefully controlled atmosphere of oxygen and water vapor at a red-hot temperature of 1100 degrees Fahrenheit.

A small disk of stainless steel, five thousandths of an inch thick and having a hole six thousandths of an inch in diameter, substitutes for the wire in some experiments. After corrosion by the hot atmosphere, the wire or disk is examined and photographed with the electron miscroscope. The pictures which result are startling.

Using very pure oxygen and water vapor, the surface of a typical sample of stainless steel erupts with billions of oxide "whiskers." Only about one or two millionths of an inch in thickness, these whiskers grow to a height 300 or 400 times their diameter. Their density is about six billion per square inch of metal surface. These dimensions can be visualized by imagining a three-foot chimney built to a height of 1000 feet. The vast number of whiskers on the metal surface is apparent when it is realized that the average human head of hair contains only about 100,000 hairs.

"Completely unexpected changes occur in this crystal growth simply by prestressing the stainless steel and adding only the slightest trace —less than five parts per million— of chloride ions to the atmosphere," Dr. Gulbransen said.

Instead of long thin filaments, we discover rows of thin, upright, parallel plates growing along a definite crystallographic direction.

Under the electron microscope, these crystals are easily penetrated with a 60,000-volt beam of electrons, placing their thickness at half a millionth of an inch or less. Analysis shows them to have the characteristic structure of an oxide of chromium Cr_2O_3. Chromium is a metal normally present in stainless steels, and each tiny plate appears to be a single crystal of its oxide.

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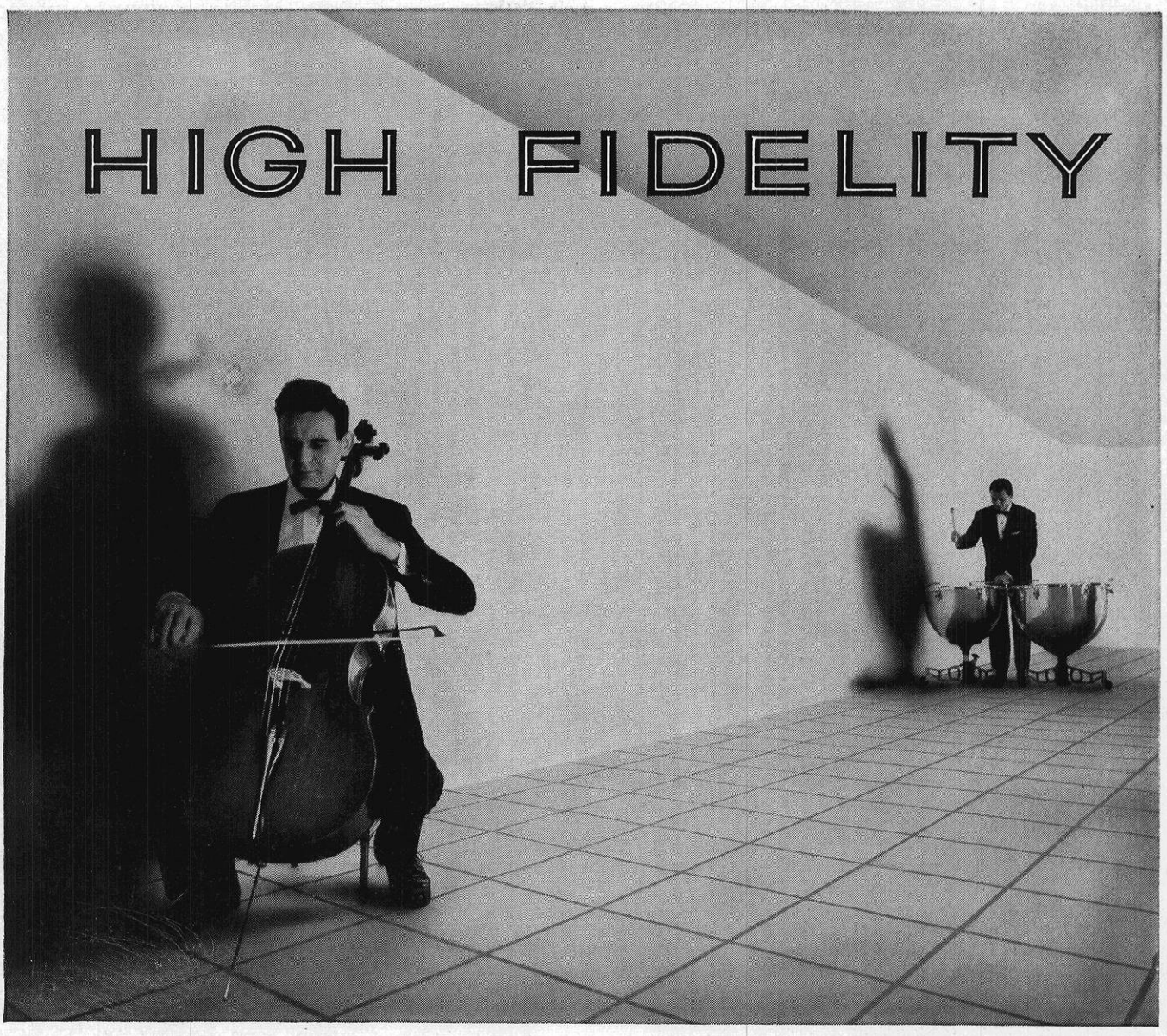


How RCA brings a richer, wider range of musical sound to your home

Before high fidelity, the sound of recorded music was limited—much as piano music would be if you could hear only the notes played on the center of the keyboard. No rich bass notes, no keen, vibrant highs.

RCA achievements in the science of sound and acoustics changed all that. Today, with RCA Victor records and high fidelity "Victrolas," the *full range* of sound is reproduced so faithfully that you can enjoy music almost as though you were *there*.

And now, Stereophonic Sound! A new and dramatic dimension in recorded music is also yours to enjoy on RCA high fidelity instruments. Stereophonic units can be added to most "Victrola"® Hi-Fi systems any time you choose.

In this, as in almost every area of electronic progress in home entertainment, defense and industry, the leadership of RCA serves you. RCA *means* electronics at its best!

WHERE TO, MR. ENGINEER?

RCA offers careers in research, development, design, and manufacturing for engineers with Bachelor or advanced degrees in E.E., M.E. or Physics. For full information, write to: Mr. Robert Haklisch, Manager, College Relations, Radio Corporation of America, Camden 2, N. J.

RADIO CORPORATION OF AMERICA

Science Highlights

(Continued from page 40)

For some time scientists have known that the chloride ion is a major factor in producing stress-corrosion cracking of stainless steel. It would now appear that chloride ions could stimulate the growth of these unique, plate-like crystals in a strongly stressed metal, which growth might result in cracking and the ultimate failure of the steel.

"Corrosion in all its forms is a major national problem, costing American industry an estimated $5,500,000,000 annually in replacement costs alone," Dr. Gulbransen added. "Our experiments, we think, are typical of a new approach to this whole problem—an approach which seeks a better understanding of the fundamental mechanisms involved in corrosion.

"Such an understanding, we believe, will only come from carefully controlled experimentation on the atomic scale, not from observations which depend upon massive effects under relatively uncontrolled conditions."

UNIFIED HIGHWAY SIGN PROGRAM

More than one million dollars worth of all-aluminum highway signs, supporting structures, and road markers are being constructed in the largest single, unified highway sign program in the nation, designed to make the new 129-mile, $460 million Connecticut Toll Road one of the safest and most clearly marked turnpikes in America.

Some 4,000 dark blue and dark green signs with intensely reflective letters, and employing a number of highway sign advances, will guide motorists on the new highway, and its many interchanges and four-leaf clover intersections. About 3,000 two-piece trailblazers, distinctive emblems with arrows which point the way to the superhighway along its feeder roads are also on order. In addition, 12,000 delineators—small silver and amber-colored prismatic "cat's eyes"—will clearly mark the shoulders of the roadway and all curves and intersections. Federal Sign and Signal Corporation, the nation's largest highway sign manufacturer, is constructing and erecting all of the signs and supporting structures under contract with the Connecticut State Highway Department.

The giant Connecticut Toll Road sign program involves approximately 200,000 lbs. of aluminum for the signs, and 500,000 lbs. of steel for the sign support structures. A highly mechanized construction task force, operating from a field base in New Haven, is preparing the sign sites, erecting support structures, and installing the signs. Mobile equipment in the sign erection force's fleet of 45 vehicles includes self-propelled overhead cranes, bulldozers, trucks, tractors, and four-wheel drive earth auger trucks which have drilled as many as 485 foundation holes in a single day. Federal also has welding, painting, storage, and shipping and receiving facilities at its job site.

When completed late in December, the new highway will form a busy, major link in the proposed Maine to California turnpike system. It extends from the New York line near Greenwich in the southeast corner of the state east along the shore of Long Island Sound, and winds northeast to Killingly on the Rhode Island border.

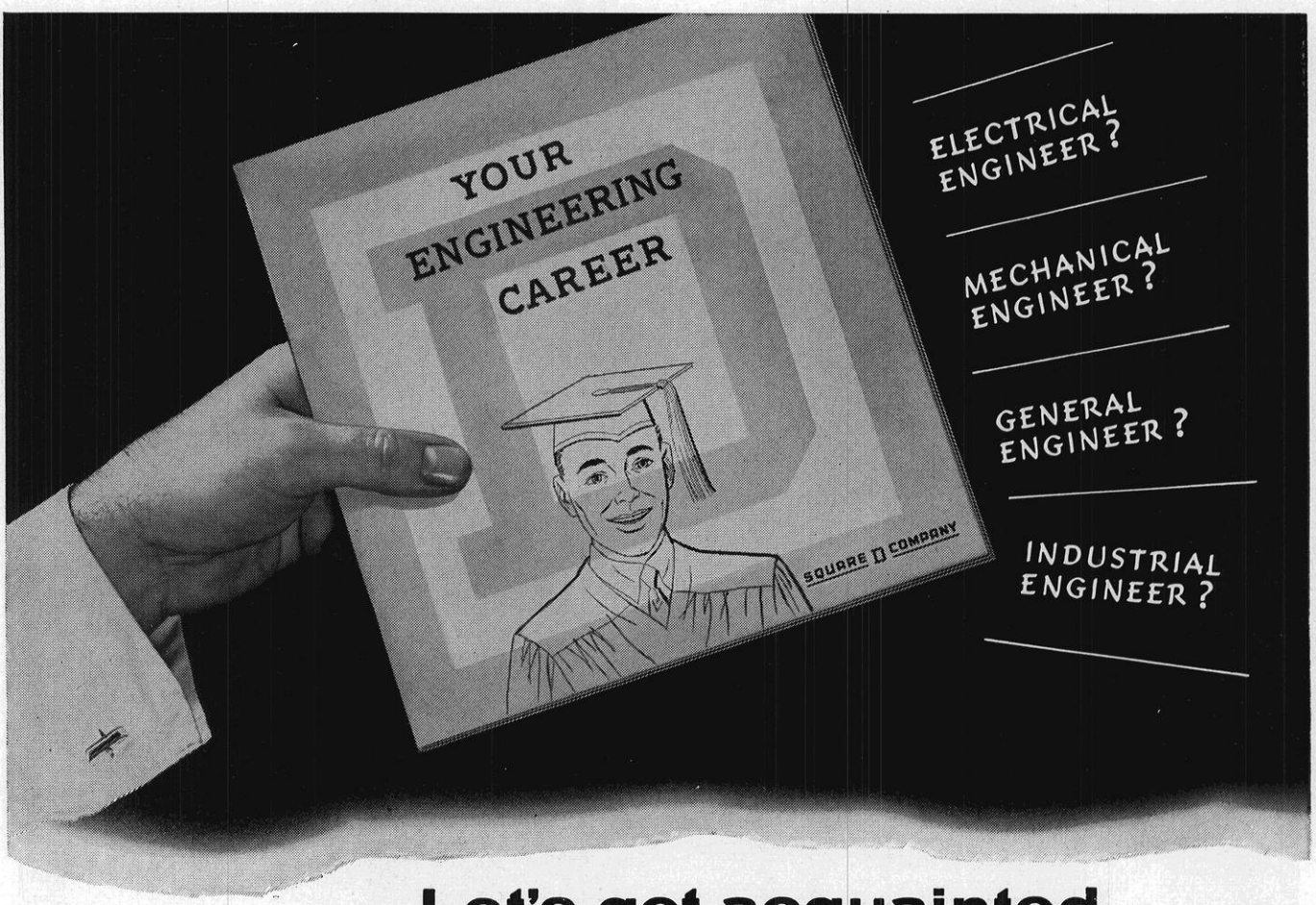
A number of highway sign advances incorporated in the Connecticut Toll Road program include extensive use of interlocking aluminum extrusions to provide maximum strength and durability. About 440 of the signs employ a new type of special reflective sheeting on the background which multiplies the ability of the entire sign to catch the eye of motorists traveling at high speeds. Some 330 brightly illuminated fluorescent signs installed on 110 overhead steel spans and 87 cantalevers will help direct traffic at toll booths and special interchanges.

All of the reflective letters, numerals, and borders on the signs are demountable for easy maintenance. At night, prismatic optical lenses set into all letters, numerals, and borders will cause them to shine almost as brightly as car headlights.

A further safety feature, the "cat's eyes" mounted on steel posts four feet, six inches above the pavement to mark both sides of the roadway throughout its entire length, were also engineered for maximum night time spot reflection as an added highway safety device. Double rows of amber-colored delineators signal caution at all curves and intersections.

THE END

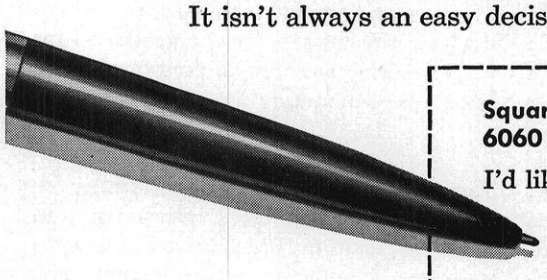
Connecticut toll road signs being fabricated in Federal Sign and Signal Corporation plant. Note the reflectors embedded in the lettering and the use of aluminum extrusions.



Let's get acquainted...

• These are important days for you. You're coming down the "home stretch" of your college training. And you're probably wondering just where you can best start on a productive, satisfying engineering career. There are many directions in which you can go. You want to be sure you select wisely. It isn't always an easy decision.

From our many experiences, we've found that our brochure "YOUR ENGINEERING CAREER" has proved to be very helpful reading to men confronted with exactly the same questions and decisions you're facing right now. Why not mail the coupon for your copy? It's packed with down-to-earth information which may help you...plenty.



Square D Company, Dep't EM
6060 Rivard Street, Detroit 11, Michigan

I'd like a copy of Square D's brochure, "YOUR ENGINEERING CAREER"

I am primarily interested in ☐ Research, Design & Development Engineering ☐ Manufacturing Engineering ☐ Sales Application and Field Engineering

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SCHOOL_____ CLASS_____

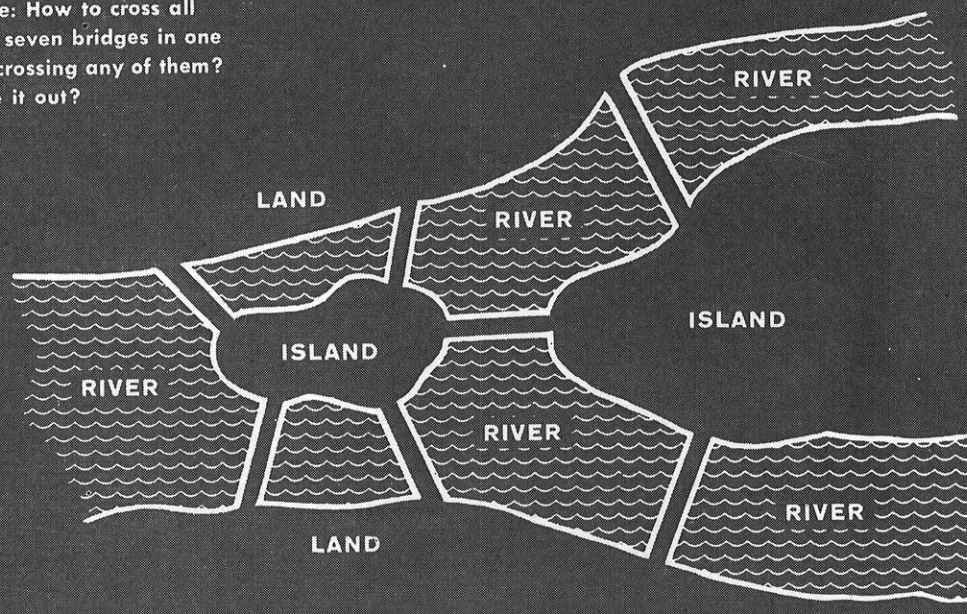
ADDRESS_____

CITY_____ ZONE____ STATE_____

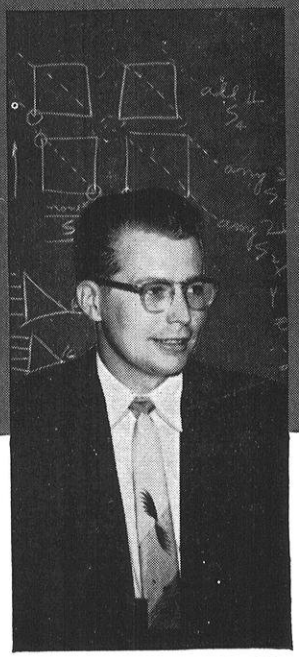
SQUARE D COMPANY

CAN YOU FIGURE IT OUT?

223 years ago, the good townspeople of Koenigsberg amused themselves with this puzzle: How to cross all of their town's seven bridges in one trip without recrossing any of them? Can you figure it out?



*"Solution" at bottom of page



Robert G. Hildenbrandt tells what it's like to be . . . and why he likes being . . . an Electronic Circuit Designer with IBM.

FIGURING OUT A CAREER?

Selecting a career can be puzzling, too. Sometimes, as with the seven bridges, the answers aren't always available. In engineering and research, it's just as important to discover that no solution may be possible as to find the solution. It is equally true in career selection that some companies can provide solutions . . . opportunities for growth . . . not always available in all companies. Here's how Bob Hildenbrandt *found* the solution to his career problem—at IBM: "Since joining IBM," Bob says, "I've seen some amazing developments in advanced circuitry. In my opinion, transistorized digital airborne computers represent one of the most progressive assignments in electronics today. As we enter the missile age, the technology of packaging and miniaturization will take on increasing importance. Transistorized computers offer an excellent chance for development work in computer circuits . . . high-frequency power supplies . . . magnetic amplifiers, regulators, storage devices. Challenge? It's tremendous—for we're working not only on present systems, but those of the future!"

* * * *

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,

JUST WRITE TO:

Mr. R. A. Whitehorne
IBM Corp., Dept. 852
590 Madison Avenue
New York 22, N. Y.

***"SOLUTION"**

This is one of the celebrated problems of mathematics, dating from the 18th century. That it CAN'T be done was proved by the great mathematician Euler in 1735. Euler's "solution" founded the science of topology, important today in electronic circuit design.

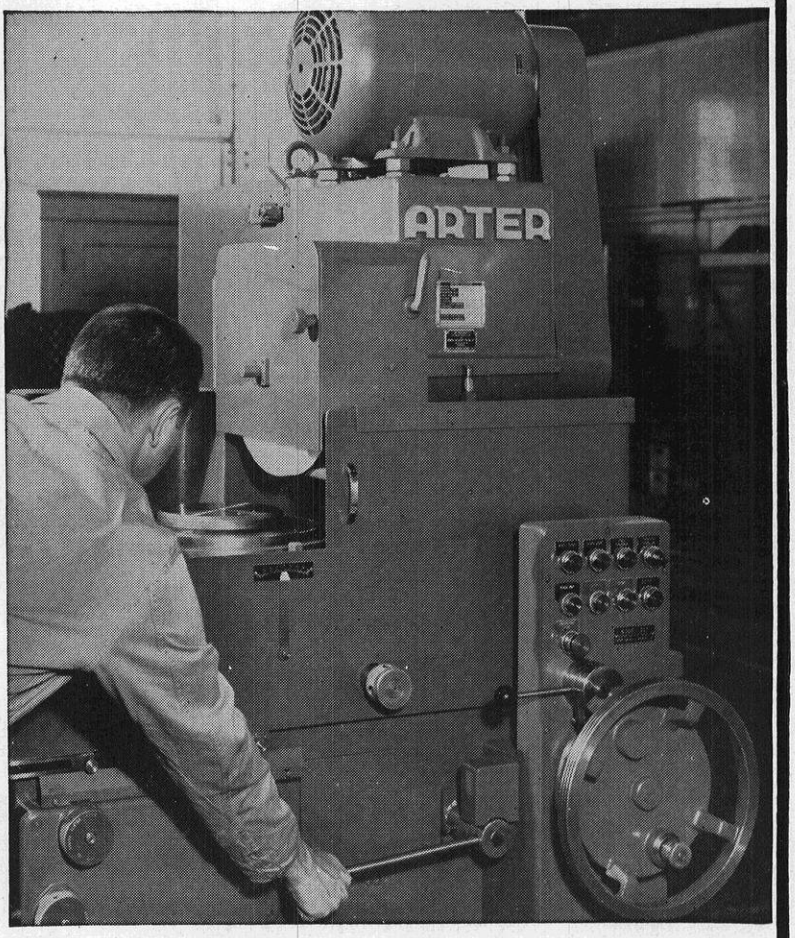
IBM **INTERNATIONAL BUSINESS MACHINES CORPORATION**

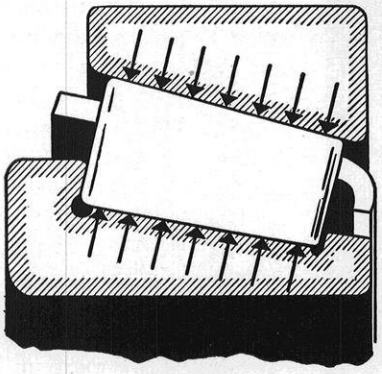
DATA PROCESSING
ELECTRIC TYPEWRITERS
MILITARY PRODUCTS
SPECIAL ENGINEERING PRODUCTS
SUPPLIES
TIME EQUIPMENT

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

How to get higher spindle accuracy, cut costs too

The engineers who designed this new surface grinder had to be sure of the highest spindle accuracy in order to get the smooth spindle operation required for extreme precision work. To hold the work and wheel spindles rigid, maintain highest accuracy, the engineers specified Timken® "00" tapered roller bearings. Timken "00" bearings make possible the closest machining tolerances ever achieved. Run-out is held to 75 millionths of an inch. And they gave the manufacturer greater capacity in less space, cut manufacturing costs ⅓ over earlier spindles used.





How Timken bearings hold shafts rigid to maintain accuracy—The full line contact between Timken bearing rollers and races gives shafts rigid support over a wide area. Shaft deflection is minimized. And the tapered design of Timken bearings permits them to be set up with the most desirable amount of end play or preload that gives the best performance.

Want to learn more about job opportunities? Timken bearings help make better machines. Better machines enrich our lives, give us more spare time. It's what the Timken Company calls Better-ness. Want to help create Better-ness? If so—write for your free copy of: "BETTER-ness and your career at the Timken Company". The Timken Roller Bearing Company, Canton 6, Ohio.

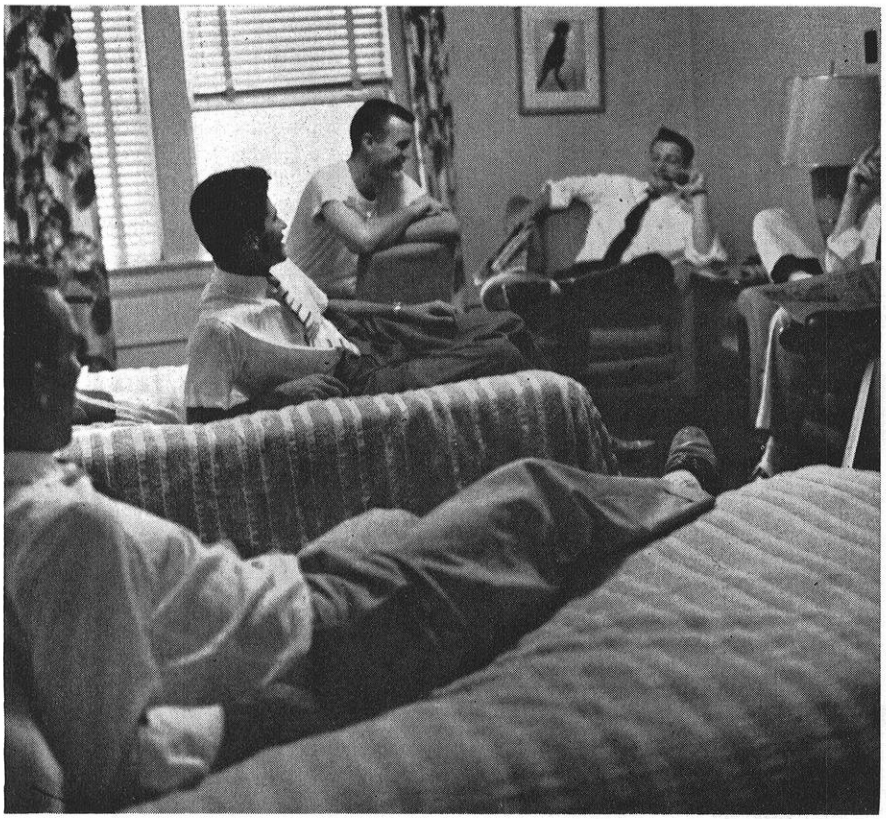
TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL ◯ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ↕ AND THRUST →◎← LOADS OR ANY COMBINATION →✳←

P & G Workshop coordinator points out to John Bollinger the major buildings and process areas of the Company's Ivorydale factory in Cincinnati. The two stand high atop P & G's St. Bernard factory which is adjacent to Ivorydale.



At hotel where Workshop men stay there's further opportunity for friendly exchange of information between students from widely separated parts of the country. In an after hour "bull session" in one of the students' rooms are Hugh Warner (MIT, Research and Development Workshop), Pierre Mamin (Ecole Centrale, Engineering), Paul Miller (Cornell, Industrial Engineering), John Bollinger (Wisconsin, Engineering) and Roger Middlekauff (Cornell, Ivorydale Factory Management).

Your Career

(Continued from page 17)

degree in business administration which he expects this coming June.

Some other typical problems which Workshop students were assigned are:

Evaluate a modification which has been made on a pilot plant in synthetic granules production and determine the best operating conditions for producing detergent paste using the modification.

Find the source and determine how to correct excessive dust and product loss through the vacuum filter system on a high-speed synthetic detergents packing line.

Determine fixed and variable portions of electrical power usage in several plant departments so that accurate charges may be made to the departments and to operations.

Develop a method and design equipment to accomplish economically a special short-run production.

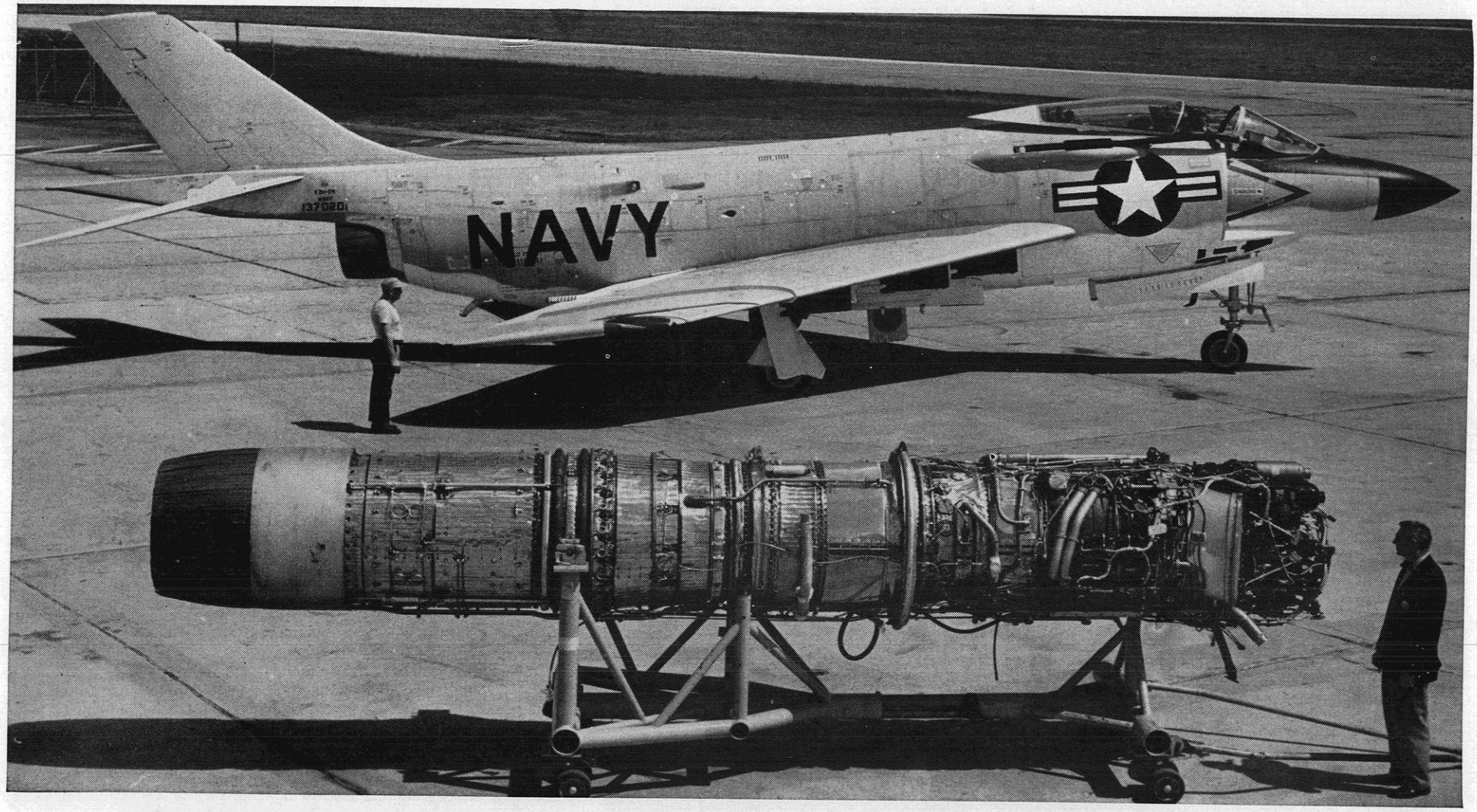
Prepare a multi-factor incentive plan for a production operator.

In addition to the staff division Workshops in Engineering and in Research and Development an Industrial Engineering Workshop was held at Cincinnati and Summer Workshops dealing principally in Factory Management were held at company plants in Long Beach, Calif., Dallas, Tex., and Quincy, Mass., as well as at the Ivorydale factory in Cincinnati.

Divided into the various Workshops in 10- to 18-man groups by career area, the men participated in seminars at the completion of each problem. Each workshop man presented a report on his problem to the others in his group and to members of company management; the group reports give each student an over-all picture of the company's technical and engineering operations in his Workshop area.

And the two weeks wasn't all work. Friendships formed quickly in the exchange of information between men coming from different colleges. Evenings and during the single week end the men were free to enjoy the sports, cultural and social facilities and historical points of interest in and around the city they were in.

(Continued on page 66)



INDIANAPOLIS, IND.: (Special) It takes a lot of teamwork to carry out the missions of carrier-based fighter pilots of our New Air Navy. And, it takes a lot of teamwork to design, develop and produce a fighting machine for these dedicated men. Such teamwork is exemplified in the Allison J71 turbo-jet engine with afterburner (above) which powers the Navy F3H-2N Demon all-weather fighter-interceptor. Many Allison engineers--out of school only a few years ago and now well entrenched on the Allison Division team of General Motors Corporation--contributed to the operational success of this powerful engine. If you would like to know more about the Allison team, write Personnel Department, College Relations, Allison Division of General Motors Corporation, Indianapolis, Indiana

Where young men work on big jobs

It takes a lot more than electronic calculators and push buttons to run a big refinery like ours at Whiting. It takes scientifically trained and skilled men. Take, for example, Bill Nemec, who shares in the responsibilities of our Refinery Economics Division Technical Service group.

A chemical engineer, Bill came to us from the University of Michigan. He and his associates work on problems involving chemical engineering, economics, cost control and sound advance planning. Facing new situations daily, they work with many people in the Research Center and in the refinery. As a result, they gain an ever-widening knowledge of refinery operations.

Sound interesting? Bill Nemec is one of hundreds of young men with widely varied backgrounds, talents and responsibilities building careers at Standard Oil's progressive Whiting, Indiana, laboratories.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois

STANDARD

HOW TO "BREADBOARD" YOUR FUTURE ... AT RAYTHEON

Right at the start, it's nice to feel you "belong"—to know what your job is, and the kind of future open to you.

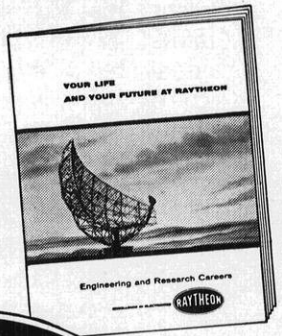
At Raytheon, while we recognize the importance of trying your skills in various places, it's company policy to make you a producing engineer as soon as possible.

Career opportunities exist for engineers, physicists and mathematicians to man important projects in: missiles, radar, communications, transistors, microwave and cathode ray tubes, physics, infrared, metallurgy, servomechanisms.

You enjoy pleasant living in one of many attractive communities. Through Raytheon's graduate programs you can continue your studies at one of several convenient centers of learning in the Boston area.

WRITE FOR THIS HELPFUL BOOKLET

Raytheon conducts campus interviews at many colleges. Check with your placement officer for more information. Write to William J. Howells, Jr., for a copy of "Your Life and Your Future at Raytheon" —no cost or obligation.



RAYTHEON MANUFACTURING COMPANY

Waltham 54, Massachusetts

RAYTHEON *Excellence in Electronics*

Wisconsin Society of Professional Engineers

WAUKESHA CHAPTER

RICHARD P. JAHNKE

The November meeting of the Waukesha Chapter was different in that it included a tour following dinner, rather than the usual speeches or movies. The tour, arranged by Vice-president, Perry Wilder, was of the facilities at Milwaukee County's Mitchell Field, and the dinner was served in Mitchell Field's Viscount Room.

Following dinner, a short business meeting was held, and then the controls were turned over to R. J. Schmitz, assistant airport manager. He briefed us on the physical layout and the operating problems encountered at the field and on what the future held in store for commercial aviation.

Our tour started in the control tower where we viewed the radar screen, learned how it worked, what each of the "dots" on the screen represented, and heard directions being given to the pilots of incoming and outgoing planes.

Next came the weather bureau where we viewed the machinery duplicating the current weather maps. Then, we toured the field's air express facilities, were shown through North Central Airlines office and unique ticket reservations facilities, and inspected one of Capital Airlines' jet-airliners, the Viscount.

Unfortunately, our chapter president, and a pilot in his own right, Joe Kuranz, could not attend. He was laid low by pneumonia but is now well on the road to recovery and should be back soon.

SOUTHWEST CHAPTER

JAMES A. JARVIS

The December meeting was held at the Cuba Club on Thursday, December 12, with 71 members and guests in attendance. W.S.P.E. President, Anthony L. Genisot was present and briefed the chapter on business of the society at the State level. President Genisot announced that the state public relations committee plans to sponsor a contest at high school level in all chapters of Wisconsin. The contest will be an essay entitled, "My Future in Engineering". Two prizes are to be awarded in each chapter.

President Genisot presented Mr. Ralph Purucker of the Public Service Commission with an award for his outstanding work in public service and for a job well done.

The members were reminded of the Muegge-Motl High School scholarship fund and contributions of $76.00 were received from the membership at the meeting.

President Maxfield introduced the speaker of the evening, Prof. Ben G. Elliott, Chairman, U.W. Department of Mechanical Engineering who talked on the subject "Unity in the Engineering Profession". Prof. Elliott gave a short history of the unity movement followed by selected references from the various proposals submitted by separate engineering organizations. This talk was of special interest to all engineers desiring a stronger national voice, professional recognition and other benefits derived from the unified action of one organization.

The Southwest Chapter held a Directors meeting following the program. Business included programing for January and Engineering Week in February. Two applications for retired membership status were approved.

WISCONSIN VALLEY CHAPTER

CARL W. GIESLER

The Wisconsin Valley Chapter, WSPE, met at Wausau on December 7, 1957. The engineers toured the Marmet Corporation, makers

(Continued on page 52)

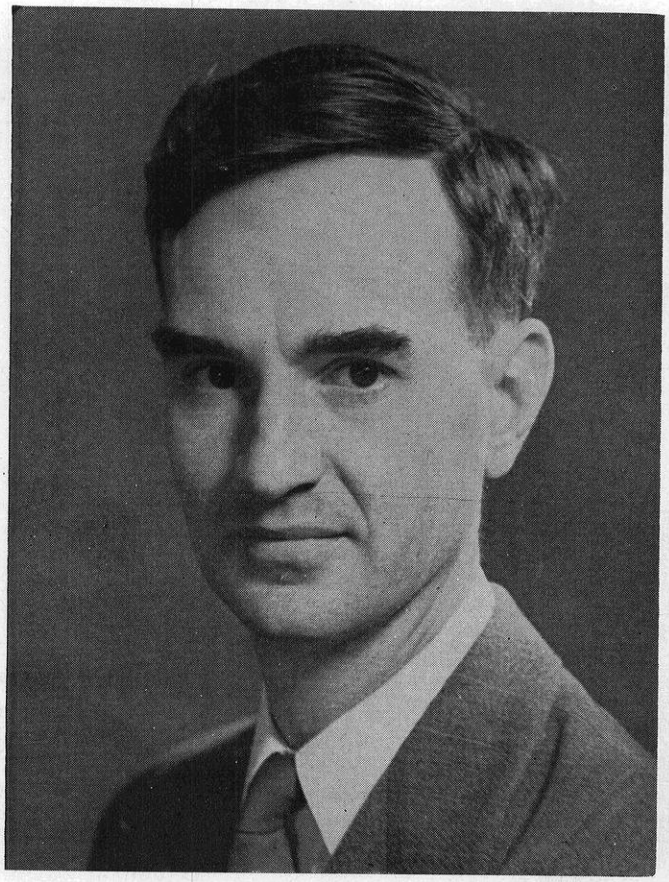
ENGINEERS' CREED

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

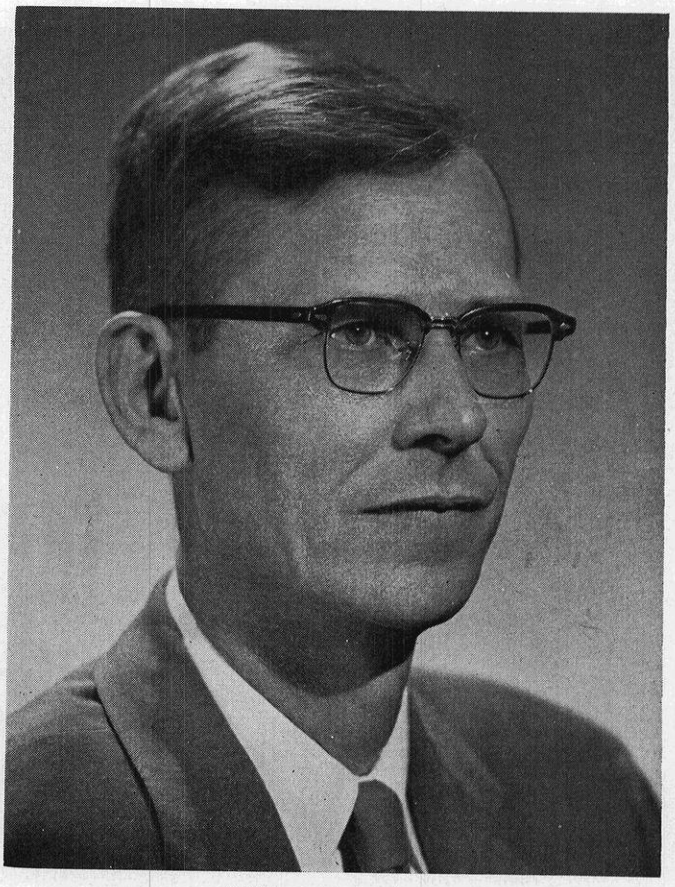
I PLEDGE

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.

Meet the Presidents



John R. Mangan.



William F. Steuber.

JOHN Richard Mangan, president of the Western Chapter, was born in Chicago, March 17, 1918. He entered the cooperative course in engineering at Illinois Tech, and worked at the Buda Company, Harvey, Ill., while studying. At Tech he was active in boxing; he was also a member of the Black Horse Troop. After graduation, in 1942, he continued with the Buda Company until 1943, when he went to Goodyear Aircraft, Akron, Ohio, where he remained until 1947. After a year in consulting practice in New Canaan, Conn., John joined The Trane, La Crosse, Wis.

After several years in charge of refrigeration assembly, John was given responsibility for all assembly operations in Plant 2 of The Trane Company. In 1955 he was made Superintendent of Plant 2, one of the company's two largest plants.

John has been active in the Western Chapter for a number of years, and has served as Treasurer and Vice-President. In addition to WSPE, he is a member of ASRE.

In July, 1945, John married Charlotte Ann Knight. They have two children, Preston, three years old, and Nancy, two.

John's main extracurricular activity is boating and fishing. He spends most of his free time, in the summer at least, out on the Mississippi in his boat. He has also been active in the Toastmasters' Club.

Though John's work has been concerned mainly with production, he has a deep interest in the more technical aspects of engineering. As an indication of this, he holds a patent on a reciprocating compressor design.

BILL Steuber, Southwest Chapter WSPE, says he has the best engineering job in existence. As Chief of Public Information for the State Highway Commission of Wisconsin, his work is writing and talking about what highway engineers do.

The State Highway Commission has just announced a construction program totalling $134 million for 1958. It represents a lot of right of way to be bought, a lot of plans to be drawn, a lot of machines excavating yardage and laying pavement. It also represents many columns of print in the newspapers, many articles in the trade papers, letters from concerned citizens to be answered, speeches to be written and delivered. The work of the Public Information Section is to provide as many of these services as possible and in a manner to maintain the best of good will.

(Continued on page 58)

W.S.P.E.

(Continued from page 50)

of aluminum products, between 4:00 and 5:00 P. M. At 5:00 P. M. they met back at the Wausau Hotel to hold their winter business meeting. The primary item of business was the setting in motion of plans for Engineers Week. A committee was appointed by Mr. Paul Schroeder, President, to judge the high school student entries in the "Future in Engineering" contest. Members named to this committee are: Carl W. Giesler and Murvin Johnson, Co-Chairmen, Henry Olk, John Crook, Clarence H. Perry, Waldemar Neilsen, Jesse M. Holderby, Gordon Morrison and Al Pearson. This committee is instructed to meet as soon as entries are all received, pick a 1st and 2nd place winner and submit the 1st place entry to Mr. Al Genisot, State President, for state wide judging.

While the engineers were engaged in the above activities the engineer's ladies played cards or toured Wausau's shopping areas doing some Christmas shopping.

After dinner the group was entertained by a chalk talk given by Mr. Arnold Diedrickson and a presentation by the Franklin School Fun Band.

Mr. Louis L. Sheerar and Mr. Harold Erickson of Wausau handled arrangements for the meeting.

WISCONSIN STATE P. R. COMMITTEE NEWS

CARL W. GIESLER

At the Milwaukee, Wisconsin, November 30, 1957 board meeting of the Wisconsin Society of Professional Engineers our State Board took steps to set up an essay contest for high school students throughout the state.

Interested students will submit essays on: "The Future in Engineering For Me". Each chapter will select a 1st place winner from its area and present this student with a $25.00 bond. The second best entry from each chapter area will be given $10.00 in cash. The first place winner from each chapter then becomes eligible for consideration for the $50.00 bond first place in the state. All prize money both state and chapter will be supplied by the state organization.

This activity is so timed that prizes can be presented the area and state winners at chapter meetings during engineers' week. Statewide publicity is being given this contest with about 400 newspapers, radio and TV stations participating. The contest officially opened December 16, 1957 and will close January 21, 1957. This will give time for the nine chapters in Wisconsin to judge their entries and submit their first place entry for judging at the state level. About 550 high schools in the state have been asked to have their students participate in this venture. Response from school administrators in the state has been very favorable and they have expressed a great satisfaction in seeing our society enter this field of activity.

It is planned that some of the award presentations can be made over some state radio and TV networks, and we feel this is a good activity around which we will center our Engineers' Week Program.

STATE NEWS

Change of Meeting Date

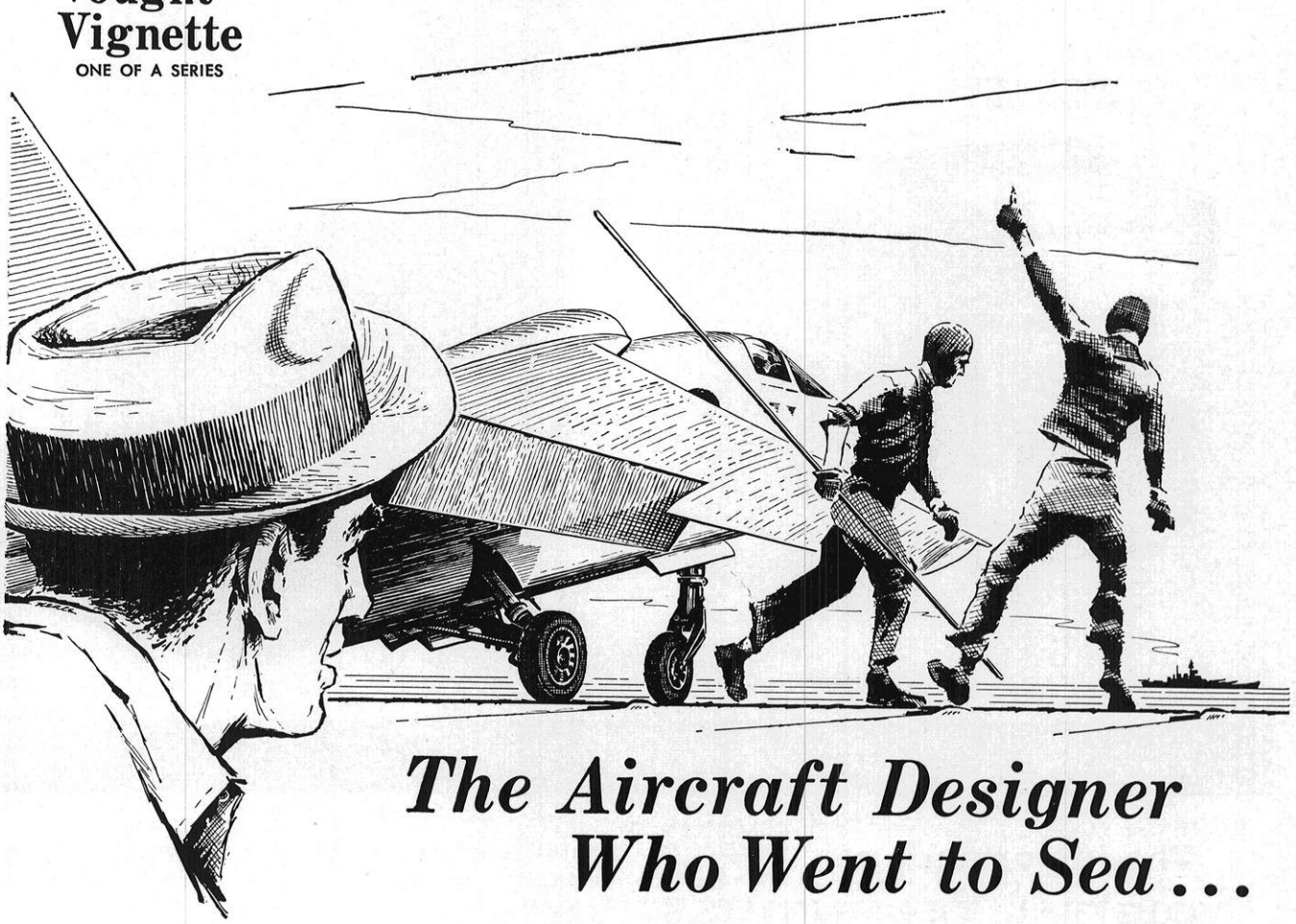
The Board of Directors for some time has felt that January is not the proper time to hold our annual meeting. Probably the big reason concerns the program of the society. The chairmen of the different committees are asked to give a report on the activities of the committees in the middle of the operating year. When this report is made they have found it rather difficult to continue interest in the committee work. The board also felt that a meeting later in the business year would also increase attendance at the meeting. The business meeting starting in 1959 will be held sometime during April, May or June.

Election of Officers

In order to elect officers so that they can make plans for the next year, it is proposed to have elections held by mail at the usual time. There will be a proposed amendment to the constitution presented to the membership for approval in December. It will be necessary to send the proxies back to the new secretary's office so they may be counted as soon as pos-

(Continued on page 64)

A Vought Vignette
ONE OF A SERIES



The Aircraft Designer Who Went to Sea . . .

IT WAS A ROUTINE CRUISE for the *Bon Homme Richard.* But for Wayne Burch, it was a memorable climax to months of hard work. Aboard the carrier with the Chance Vought design specialist was the white-lacquered fighter he'd worked on so long.

★

Wayne had joined the Crusader dayfighter project in Preliminary Design, on alighting and arresting gear. He'd transposed his initial drawings into detail design and, later, he'd watched his gear pass jig and aircraft drop tests. At the Navy Test Center, the Crusader's gear absorbed maximum sink speeds and arresting tension, and Burch once more was there.

★

Now, Navy pilots on the *Bon Homme Richard* were taking the Crusader to sea, and Burch was going along. This time his assignment was simply to watch, and this time the Crusader was to be just part of the picture. Vought wanted him to experience carrier life and to see how his new weapon fitted in. For Wayne, whose sea log began and ended with one day's fishing from a 20-foot launch, it promised to be an eye-opening voyage.

For six days the designer shared quarters with Navy fighter pilots and had coffee with maintenance men. He studied aircraft spotting and catapulting, and he learned the sign language of the LSO (Landing Signal Officer). He marveled at the fingersnap timing of the Navy's deck handlers and at the *Bon Homme Richard's* mid-voyage refueling of two bobbing destroyers.

★

Wayne calls it "one of the most enjoyable weeks of my life" . . . and, as other sea-going Vought engineers have discovered, "one of the most profitable, too.

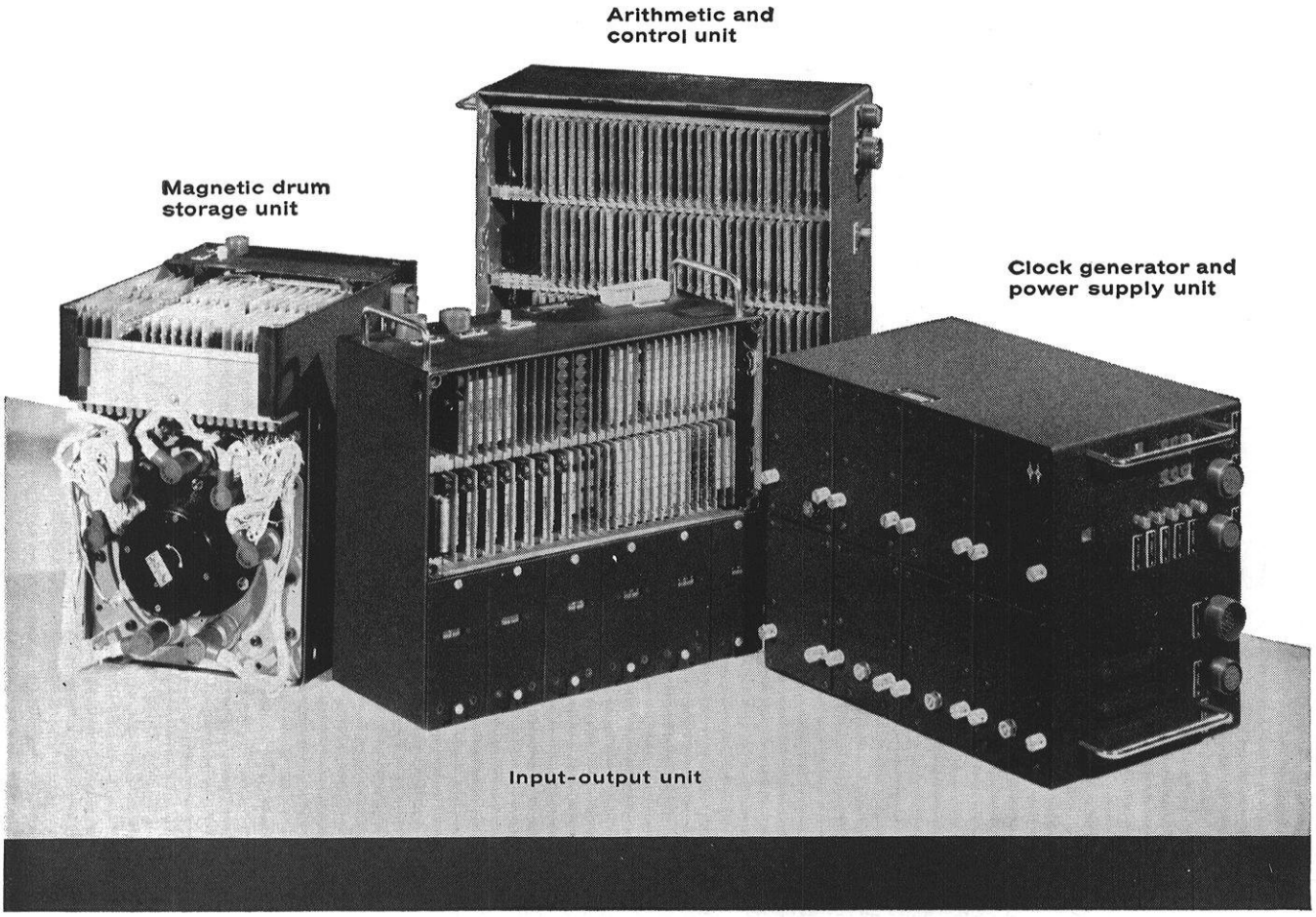
"Now I know the pilot's job, what maintenance wants . . . how really big the operation is.

"It's something you don't get if you stick too close to design.

"I guess you'd call it *perspective.*"

At Chance Vought the designer stays in touch with his product . . . Contact begins in development, extends through test and includes, when possible, a study by the designer of the tactical environment in which his weapon will serve.

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS



The Importance of
DIGITAL TECHNIQUES

Digital techniques constitute one of the important developments which have made possible the recent advances in computers and related equipment for computation, data processing, and industrial and military electronic control.

Digital computers for scientific computation range from small specialized units costing a few thousand dollars, to large general-purpose computers costing over a million dollars. One of these large computers is a part of the Ramo-Wooldridge Computing Center, and a second such unit is being installed early this year.

Electronic data processing for business and industry is rapidly growing based on earlier developments in electronic computers. Data processors have much in common with computers, including the utilization of digital techniques. A closely related field is that of industrial process control. To meet the needs in this field, Ramo-Wooldridge has recently put on the market the RW-300 Digital Control Computer.

The use of digital techniques in military control systems is an accomplished fact. Modern interceptor aircraft, for example, use digital fire control systems. A number of Ramo-Wooldridge scientists and engineers have pioneered in this field, and the photograph above shows the RW-30 Airborne Digital Computer.

The RW-30 is an example of what can be accomplished through the application of digital techniques in conjunction with modern semiconductor components. It performs complete mathematical operations, including multiplications, at the rate of 4000 per second (as fast as large scientific computers). Yet it occupies only 4.19 cubic feet, weighs 203 pounds and uses 400 watts power. It is packaged in four separate units to facilitate installation in aircraft. The magnetic drum memory has a capacity of 2607 21-bit words.

The versatility inherent in digital techniques makes it possible for the RW-30 to handle such varied military aircraft problems as navigation, armament control and bombing, and combinations of these problems, without changes in the RW-30 itself.

The RW-30 also serves to illustrate the balanced integration of systems analysis and product engineering which is a principal objective at Ramo-Wooldridge. Similar programs are in progress on other airborne and electronic control systems, communication and navigation systems, and electronic instrumentation and test equipment. Engineers and scientists are invited to explore openings in these fields at Ramo-Wooldridge.

The Ramo-Wooldridge Corporation

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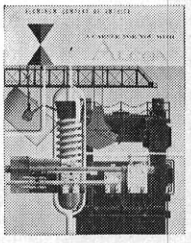

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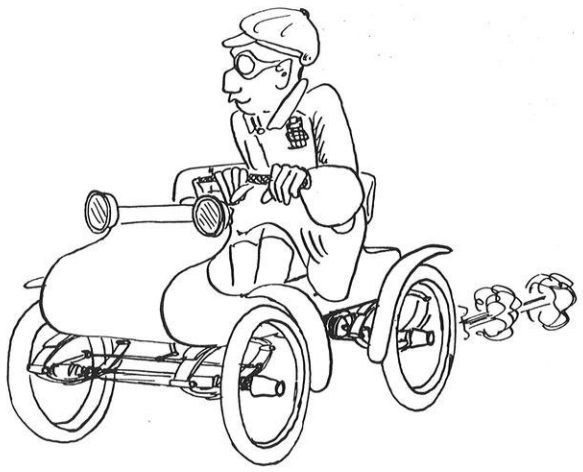


THE ENGINEER OF YESTERYEAR

words by Dick Soref ee'58

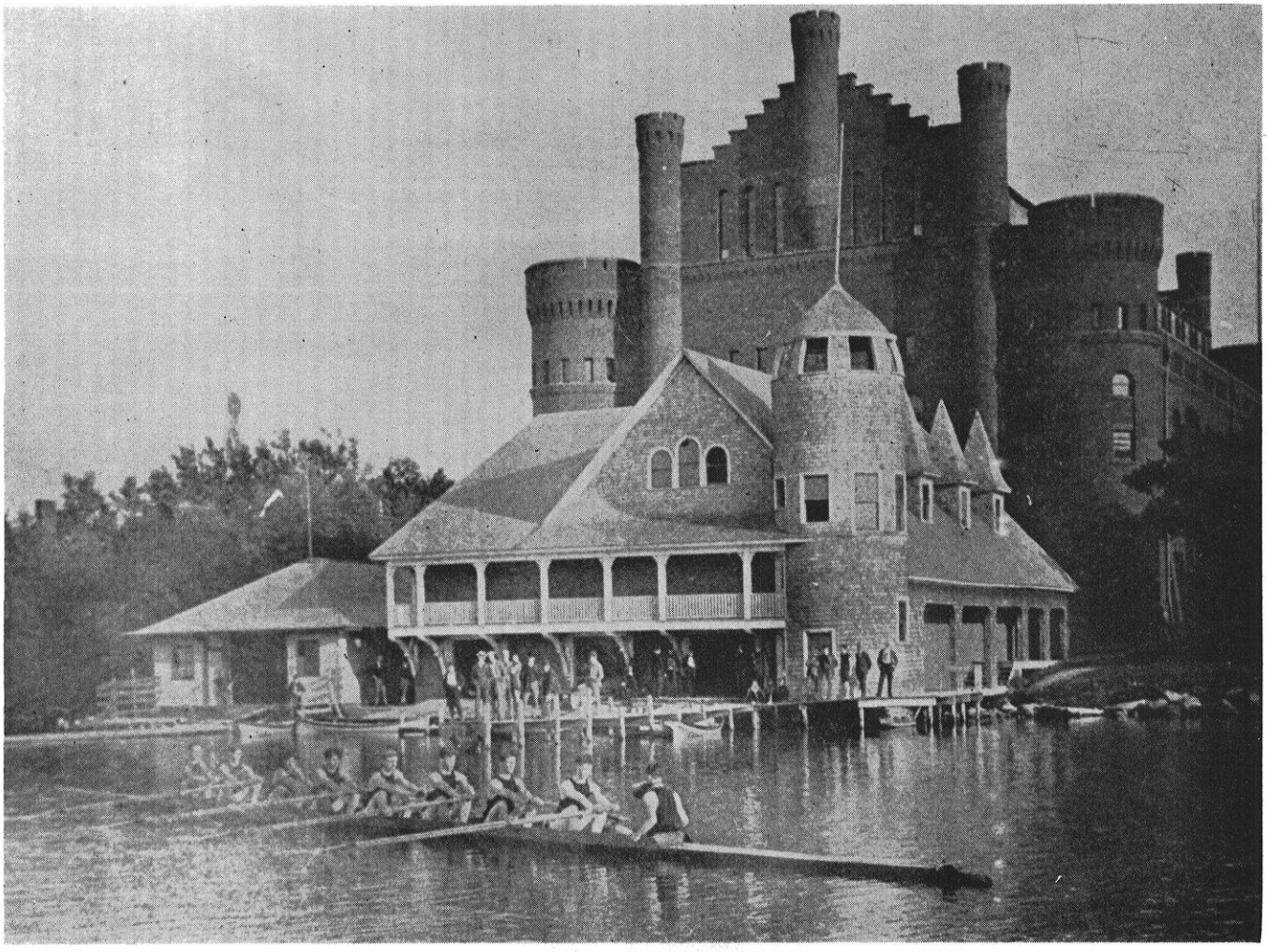
photos by Glen Zimmerman ee'58

February 1903

WITHOUT question the minstrel show given by the senior engineers on March 5th was a "howling success." The show took the place of one of the regular engineering sociables, the financial backing being furnished by the social committee. It was therefore possible to issue invitations to all engineering students and their ladies, so that no difficulty was experienced in filling the house. It must be said in this connection however that there were large numbers of "Hill" students making inquiries as to the price of admission who were evidently very anxious to gain an entrance.

December 1901

The one crying weakness of our engineering graduates is ignorance of the business, social, and political world, and of human interests in general. They have little knowledge in common with the graduates of our literary colleges, and hence often find little pleasure in such associations. They become clannish, run mostly with men of their class, take little interest in the commercial or business departments of the establishments with which they are connected, and so



The varsity boat houses and gymnasium as they appeared in 1901.

The University of Wisconsin Football team of 1899.

become more and more fixed in their inanimate worlds of matter and force. I beseech you, therefore while yet students, to try to broaden your interests, extend your horizons now into other fields, even but for a bird's-eye view, and profit, so far as possible, by the atmosphere of universal knowledge which you can breath here through the entire period of your college course.

January 1900

That the automobile, especially the electric, has come to stay cannot be doubted, but to what extent remains to be seen. We know that there certainly cannot be the same sympathy and affection between the owner of a vehicle and his motor as there is between him and an intelligent animal. As to the pleasure of operating a controller or holding the reins, that lies with the tastes of the individual, but it cannot be doubted that where dollars and cents are involved and not the love of horseflesh there are many reasons why the automobile should supersede our present methods of traffic. The cost of doing the same work by the motor vehicle as compared with horses is much less.

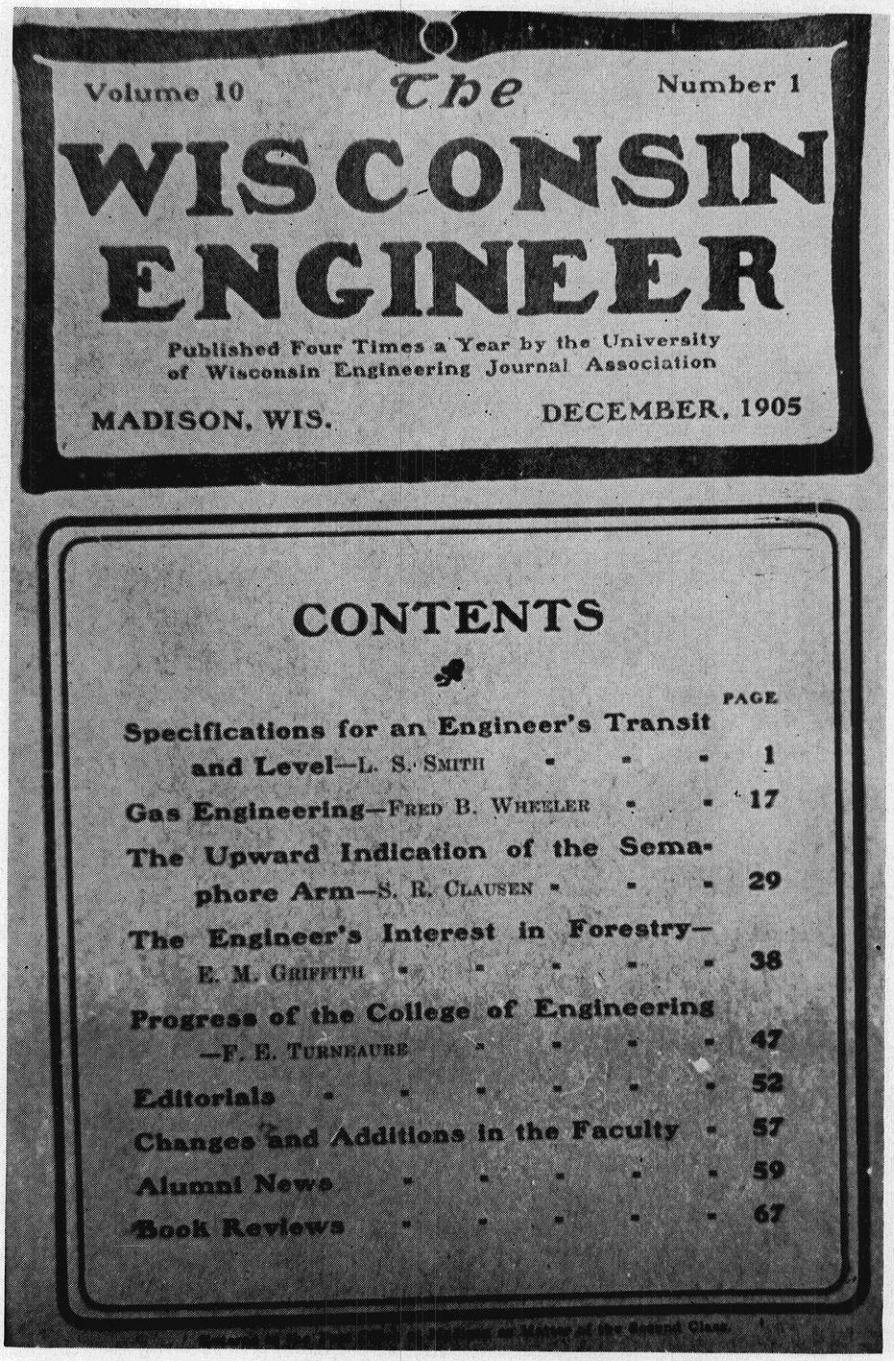
The advantages from a sanitary point of view are also not to be forgotten. Think of the refuse which 100,000 horses in our large cities, both in stables and on the street, create. Also consider the condition of our paved roads due to the wear and tear of these animals. How much simpler the problem of the maintenance of good roads would be.

February 1899

It would certainly be very detrimental to an American boy to take his entire course in engineering in a German polytechnicum, but if he hopes to teach engineering subjects he would do well to go abroad and study a year or two after completing his studies at home and after having a taste of home practice. This would perfect him in his use of the German language, and add to his theoretical accomplishments in some directions.

There is now so much of real value to Americans which can be found only in the German technical literature, that every teacher of

(Continued on next page)



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MADISON, WIS. — DECEMBER, 1905

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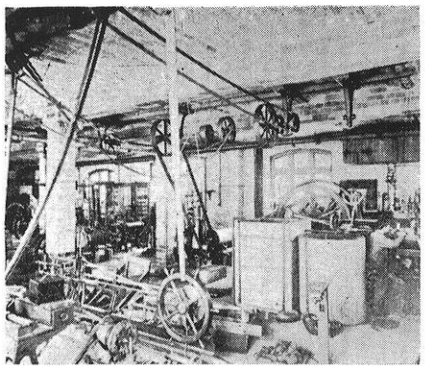
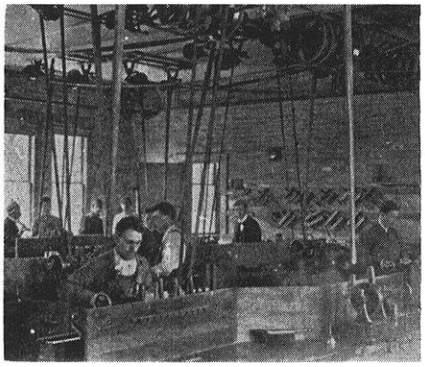
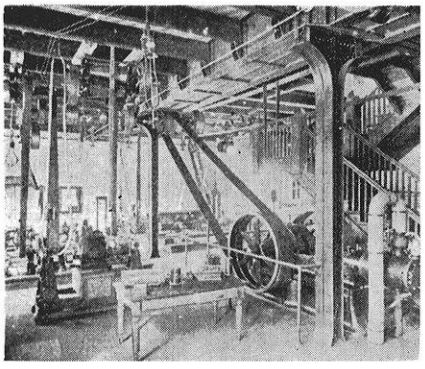


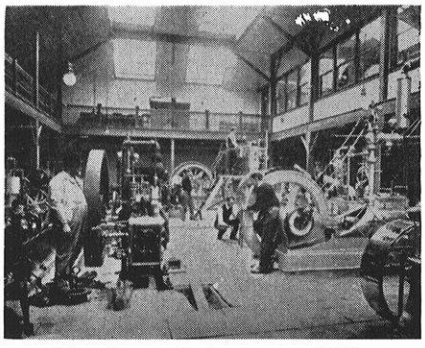
The Steam Engineering Laboratory of 1900.



The Wood Shop—1901.



The Dynamo Laboratory of 1899.



The Steam Laboratory—1902.

engineering in this country should be able to at least read the current German literature in his own department of work. A year can be spent at a German university as cheaply as in America, and this would give one a familiarity with the language, the methods of teaching, and the subjects taught, besides broadening one in many ways. It is now a wise policy, if one anticipates a career as a teacher of any subject in science or engineering, to spend at least one year at a German university or polytechnicum after having finished his studies at home.

June 1900

Within the nineteenth century a greater change has been wrought in our modes of life than in all the preceding centuries. We have accustomed ourselves to look without surprise on the mechanical wonders that surround us; on our railroads that transport millions upon millions of men; on our steamers that cross the seas; on the annihilation of space by telegraph and telephone; all these are the achievements of this century and mainly of its latter half. Stages of development which once it took centuries to pass through, which at the beginning of this century it took decades, are now passed through within fractions of a year; debasing superstition, destructive fanaticism, these arch-enemies of man and of true civilization, recede before the marching-on of science.

When we search for the cause of superiority of our time over that which has gone before, we must see it in the union and interaction of science and technics. We also see it in our institutions for the advancement of knowledge, which, standing between science and practical life, by cherishing the one, and by being in contact with the other, take care of the onerous task of supplying with the experience of the past generations those who are about entering the arena of life.

May 1899

Professor R. Wood of the university has a new method of photographing in natural colors. He produces the colors by diffraction, a method not hitherto tried, and though at present the production of the first finished picture is a somewhat tedious, though not difficult process, when it is once made duplicates can be printed from it as easily as ordinary photographs are made. The pictures are on glass, and are not only colorless, but almost invisible when viewed in ordinary lights, but when placed in a viewing apparatus, consisting of a convex lens on a light frame, show the colors of nature with great brilliancy.

THE END

President

(Continued from page 51)

Today, Steuber's surveying is of situation rather than of line and his designing goes into speeches rather than into structures. "From Wye levels to words wasn't an unusual transfer at all," he says, "I took a combination of engineering and English at the University of Wisconsin."

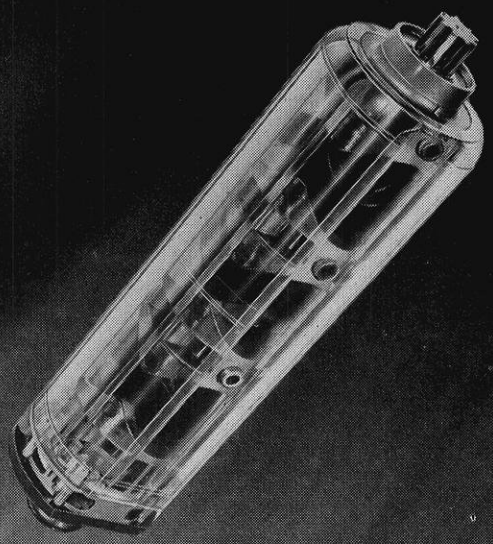
The combination has worked well. After graduation in 1930, Bill went to the Highway Commission's district office at La Crosse where he ran road surveys, designed highways and was resident engineer on the construction of others. He was brought into the Madison office and put into highway safety work just before World War II. He held a war service appointment as a technical writer at the Forest Products laboratory. At the war's close Steuber returned to the State Highway Commission as Assistant to the State Highway Engineer.

In 1953 General Motors Corporation announced an essay contest on "How to Plan and Pay for the Safe and Adequate Highways We Need." Steuber prepared an entry emphasizing the importance of a National System of Interstate Highways and urged its immediate construction. His essay won a national honorable mention and $3,000.

In the reorganization of the staff of the State Highway Commission three years ago, a Public Information Section was created and Steuber was named to head it.

Outside his deep interest in highways, Bill Steuber writes novels. *Us, Incorporated,* 1953, is a nostalgic story of boyhood. *The Landlooker,* published this past fall by Bobbs-Merrill of Indianapolis, Indiana, is a Wisconsin best seller. It pictures the exploitation and opportunism in the boisterous frontier days of our state in the early 1870's. THE END

The Challenge of Progress



Recently AiResearch engineers were called upon to develop an accessory power motor for aircraft and missiles which would operate at +1000°F.... a temperature area where present-day hydraulic and electrical devices fail.

Their answer was this cam piston air motor, pictured above in a specially built transparent shell. Operating on hot air or gas, its efficiency actually increases as temperatures rise.

This problem and its solution are typical of many encountered at AiResearch in aircraft, missile, nuclear and electronic fields. Specifically, you'll find them in system electronics; computers and flight instruments; gas turbine engines and turbine motors; cryogenic and nuclear systems; pneumatic valves; servo control units and air motors; industrial turbochargers; air conditioning and pressurization; and heat transfer.

Upon your employment, 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 the project, laboratory and administrative aspects of engineering at Garrett. Also, with company financial assistance, you can continue your education at outstanding universities located nearby.

Project work is conducted by small groups where individual effort is more quickly recognized and opportunities for learning and advancement are enhanced.

• *For full information write to Mr. G. D. Bradley.*

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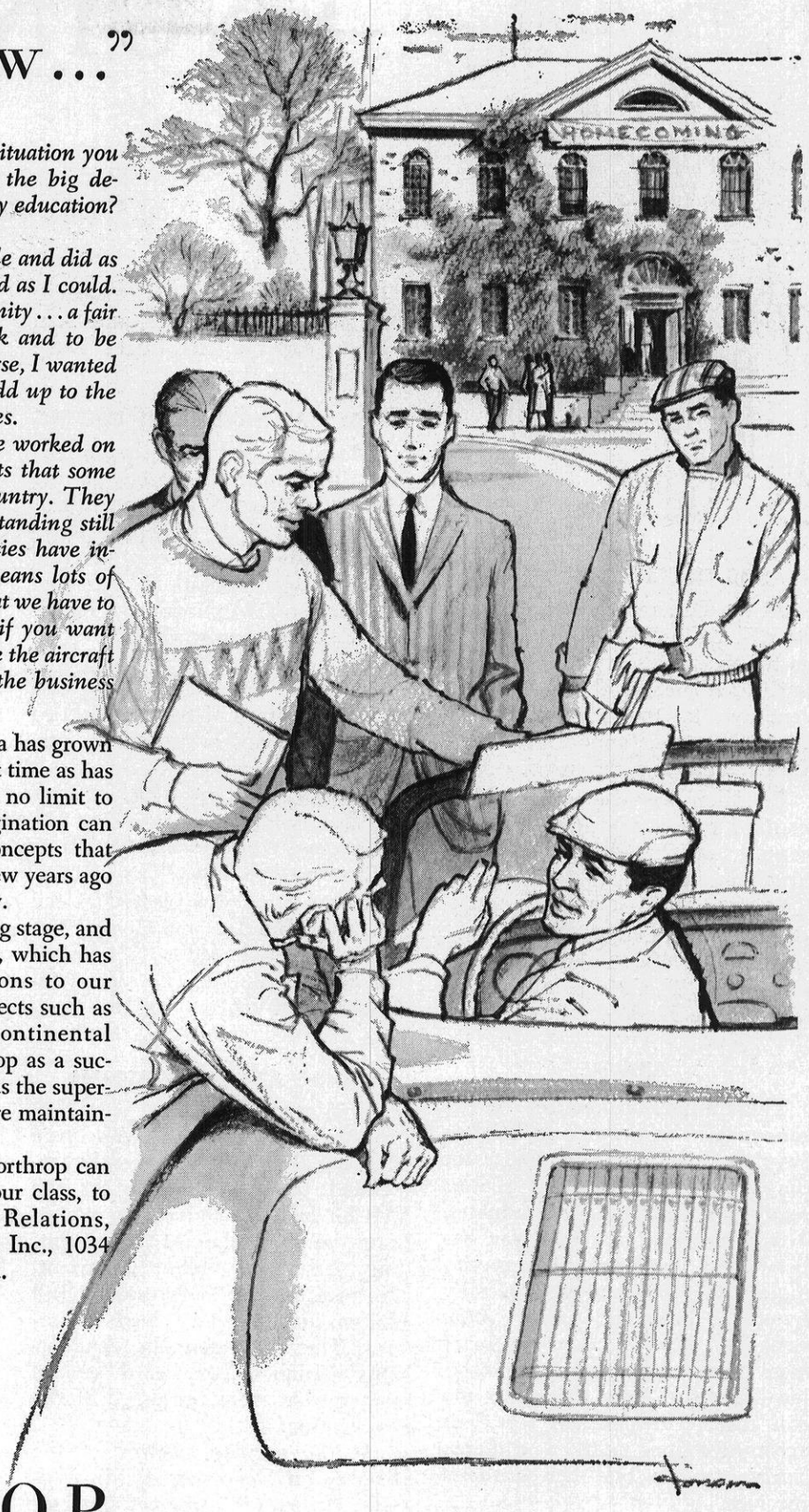
"I'm in the business and I know..."

"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 18 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.

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ENGINE EARS

by Wayne Rogers, me'59

ASME ELECTS ALLEN, TRIELOFF

At the December meeting of the ASME, Sally Trieloff was elected as the new secretary for the group and Ed Allen was chosen as representative to the Polygon Board. Plans for the annual St. Pat's Dance were also discussed.

Ed Allen was also named chairman of this year's annual speech contest, which will be conducted next semester.

Mr. Conovan of Bakelite Company, the main speaker of the evening, spoke about and showed a movie on "The Mechanical Engineer in the Plastics Industry."

AIEE–IRE

The diploma committee of the society has been working hard to have their first PHT diplomas for the wives of graduating seniors ready for the January graduates. This is the first year this plan has been tried, but already it is receiving considerable interest, especially by those married men whose struggles as a student engineer have been made easier by their loyal spouses. Now the wives too can receive recognition for their accomplishment with a diploma similar to the one her husband receives.

Don Clarson was elected as St. Pat's candidate at the last meeting. Being selected as representatives to the Polygon Board were Al Goshaw for the AIEE, with George McCormick as alternate, and Tom Damm for the IRE, with Dave Chapman as alternate.

ASME, SAE HAVE JOINT MEETING

"Research and Development" was the topic discussed in the January fourteenth joint meeting of ASME and SAE in Tripp Commons. This was an open meeting with special invitations extended to interested freshmen and sophomore engineering students.

ASCE ELECTS OFFICERS

The members of the ASCE have elected the following officers for the second semester:

President—Duane Hinz, '58
Vice President—Larry Mouty, '58
Secretary—Walt Powzukiewicz, '58
Treasurer—Bob Baker, '59

Dick Steiner was elected as the St. Pat's candidate and George Novenski was selected as a member on Polygon Board. The official installation of officers will be January 15.

AIChE ATTENDS NATIONAL MEETING

Three officers of the Wisconsin chapter of AIChE recently attended the Student Day of the AIChE National convention in Chicago on December 11. Representing Wisconsin were: President, Norman Dahl; Vice President, Bill Dawn; and Secretary, Barb Northern. They attended the Student-Day banquet and heard several papers that were presented at the convention.

At the regular meeting of the Society on December 4, Mr. William H. Decker, a project engineer with Sinclair Research lab, Inc. of Harvey, Illinois spoke on "A Case History of a Chemical Engineering Project."

ASCE PRESIDENT SPEAKS HERE

The newly elected president of the American Society of Civil Engineers was the speaker at the annual initiation dinner of Chi Epsilon, national honorary civil engineering fraternity on the University of Wisconsin campus.

Louis R. Howson, Chicago, Wisconsin engineering graduate who was recently elected president of ASCE, gave the main address at the banquet at 7:30 p. m. Wednesday, Dec. 11, at the Sherwood Forest Club in Madison.

The title of Howson's address was "Success and Its Challenge."

Howson, who graduated from the Wisconsin College of Engineering in 1908, received an honorary membership in the Wisconsin chapter of the national civil engineering fraternity at the banquet. Howson is now a member of the Chicago engineering consulting firm of Alvord, Burdick, and Howson. He originally joined the firm on his graduation from the University.

Howson has served as adviser on water supply problems for such large cities as Milwaukee, Chicago, New York, Montreal, and Denver, and has also served as consultant on waste disposal problems for the Milwaukee Sewerage Commission, for both Winnipeg and Toronto in Canada, and for many other U. S. cities.

Howson has recently been serving as chief sanitary expert for Wisconsin, Minnesota, New York, Pennsylvania, Michigan, and Ohio in U. S. supreme court hearings involving diversion of Lake Michigan water and sewage treatment by the city of Chicago. He is also a widely recognized authority on matters of public utility and valuation rates.

Shown here is a group of conferees who attended the Plant Engineering institute. From left to right are: Bion Hutchins, Director of Maintenance Division, Ninth Naval District, Great Lakes, Illinois; Harold Anderson, editor, Plant Engineering magazine; B. J. Robichaud, The Toni Company, St. Paul, Minn.; Paul H. Darmer, The Chemstrand Corporation, Decatur, Alabama; R. A. Melton, Chrysler-Outer Drive Stamping Plant, Grosse Pointe, Michigan; Harry J. Marks, Sunbeam Corporation, Chicago 50, Illinois; Louis Long, Greenlee Bros. and Co., Rockford, Illinois.

PLANT ENGINEERS ATTEND PLANT MAINTENANCE CONFERENCE

Eighty plant engineers from fifteen states, the District of Columbia, and Canada attended the three day conference on Industrial Plant Maintenance at the University of Wisconsin on December 9–11, 1957.

Dean Kurt F. Wendt set the keynote of the conference in his welcome address when he stated that Plant Maintenance was becoming increasingly important because of the complexity of automatic machines.

The discussion of maintenance operations which followed emphasized this importance: The part that maintenance plays in effective plant production.

The program included a discussion of the staffing, programming, and implementing a Maintenance Department by Mr. W. H. Dorrance, manager of the Plant Engineering Department, Ford Motor Company; Organization of the Maintenance Force by Col. Edwin M. Eads, Chief of Maintenance, Department of the Air Force; Maintenance Records by Lt. Col. Alfred F. Vogler and Mr. Ashby Williams, Properties and Installation Department, Office of the Assistant Secretary of Defense, Washington, D. C.; Work Simplification in Maintenance by Leo Kornfeld, Senior Associate, Cresop, McCormick and Paget, Management consultants, New York, N. Y.; The Future Role of Atomic Energy in Industrial Operations by Paul J. Grogan, Chairman of the Engineering Department, University Extension Division, University of Wisconsin; Planning and Scheduling by Richard Blair, Maintenance Superintendent, Columbia Southern Chemical Corporation, New Martinsville, West Virginia; Contract Maintenance versus Plant Maintenance by Alan McCone, Assistant to the President, Catalytic Construction Company, Philadelphia, Pennsylvania; Area Maintenance and Centralized Maintenance by W. G. Meier, Asst. Director of Engineering, Parke, Davis, and Company, Detroit, Michigan; Techniques for Training Maintenance Workers by Clayton G. Orcutt, Industrial Management Institute, University Extension Division, University of Wisconsin; Performance Measurement of the Maintenance Department by John V. Schen, Esso Standard Oil Co., Linden, New Jersey.

Enrollees were unanimous in their comments concerning the value of the opportunity to hear the excellent speakers and to exchange ideas with other plant engineers.

Although the problems of the enrollees varied, since their maintenance forces ranged from a low of 25 workers to a high of 11,000 employees, the basic principles of organization, planning, and scheduling and performance measurements were common to all.

The plant engineers had several questions for the panel shown in

(Continued on next page)

Moderated by Paul J. Grogan, standing at right, this panel discussed the part that preventive maintenance plays in plant operations and answered questions raised by conferees at the recent Engineering Institute at the University of Wisconsin.

the picture who discussed preventive maintenance. Mr. Grogan, the moderator of the panel, also conducted discussion from the floor on this important phase of plant maintenance.

AFS

The American Foundrymen's Society recently enjoyed visits to unique foundries in the Milwaukee area. They spent one day, December 6, seeing Pelton Steel Castings Company, where they had lunch in their famous basement that contains a large recreation room and bar. They also visited Evenrude Motors the same day, where the whole foundry uses a highly mechanized shell molding process for producing their crankshafts.

THE END

W.S.P.E.

(Continued from page 52)

sible. The details on the amendments will be mailed in December.

Dues

An amendment to be considered in January is the matter of raising dues effective immediately. The proposal is to raise a member's dues to twenty-five dollars a year of which the state will retain eleven dollars and each chapter will retain four dollars.

The Nominating Committee consisting of R. W. Stieg, Clintonville, Chairman; T. M. Basterash, Superior; W. Baumgartner, Eau Claire; T. J. Riebath, Milwaukee; G. L. Elmergreen, Milwaukee; W. W. Warzyn, Madison; H. E. Johnson, Elkhorn; and F. A. Fosdal, Waukesha, named the following for the offices of W.S.P.E. for 1958–1959:

President: Clifford J. Nelson, Black River Falls

1st Vice Pres.: Harold C. Trester, Oshkosh

2nd Vice Pres.: John Gammell, Milwaukee

Secretary-Treasurer: Henry A. Kallsen, Madison

Director 1958–1960: Herman T. Hagestad, River Falls

Director 1958–1960: Thomas J. Higgins, Madison

National Representative 1958–1959: H. O. Ayers, Eau Claire

National Representative 1958–1959: W. S. Cottingham, Madison

The membership has the right petition for nominations of persons of their choice to be added to the ballot. It is necessary to have twenty-five members sign the petition. The deadline date for these petitions was Dec. 7.

THE END

Left to right, Pierre Mamin, graduate engineer of Ecole Centrale des Arts et Manufactures, Paris, France, John Bollinger and David Blatchford of Penn State work on solutions for their problem to develop a new mechanical drive for temporary storage trays used in production of Ivory Soap.

Your Career

(Continued from page 46)

Why should a large chemical processing company spend money and time on a plan essentially designed to aid men still in college? Trained men are needed in industry, today more than ever before. Some technically trained people don't find industrial careers simply because they are not sure that careers satisfying to them exist in industry. The Workshop problem-solving situation helps to clarify the thinking of men soon to make their career decision as well as show the technical and management opportunities within an industrial company.

Industry is looking for men who know what they want, what they like and what they will be doing when they are hired.

Career surveys, like Procter & Gamble's summer employment programs, help students make these decisions. They help pick the right job. They help industry get the right man. **THE END**

Gas Turbines

(Continued from page 21)

The two areas where safety is a problem are the hot exhaust gases and the rotating turbine wheel. Both of these have been completely solved however.

Gas turbine exhaust at 400° F is cooler than the 1200° F exhaust coming from the cylinder of a gasoline engine. The gasoline engine exhaust, however, cools faster in the exhaust pipe. The exhaust of the regenerative gas turbine is quite cool and not a problem.

Turbine blades are designed for twice the normal operating speed. They can never exceed this speed and are therefore very safe. Even if a failure occurs, it is not the major catastrophe sometimes imagined.

The gas turbine is the automobile engine of the future. This is due to the many advantages the gas turbine has over the conventional reciprocating engine.

Full scale production of gas turbine automobiles can be expected in 8 years, according to a spokesman for Chrysler. A European sports car with a gas turbine is expected in a year or two. Here in the United States all major automobile companies have research programs well underway. After about 1970 build up of gas turbine cars will be very rapid. **THE END**

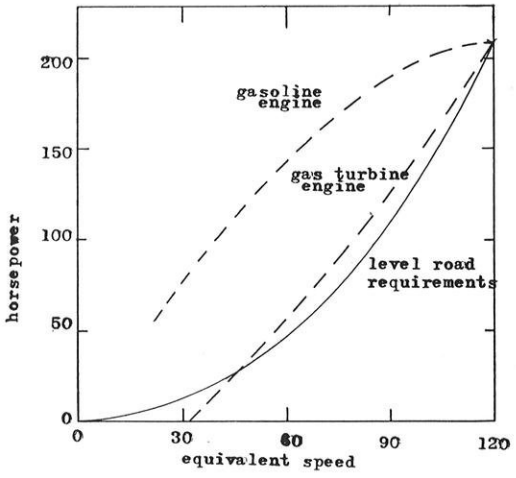


Fig. 4.—The gas turbine's output more closely approximates the automobiles level road requirements, but there is less horsepower reserve for acceleration.

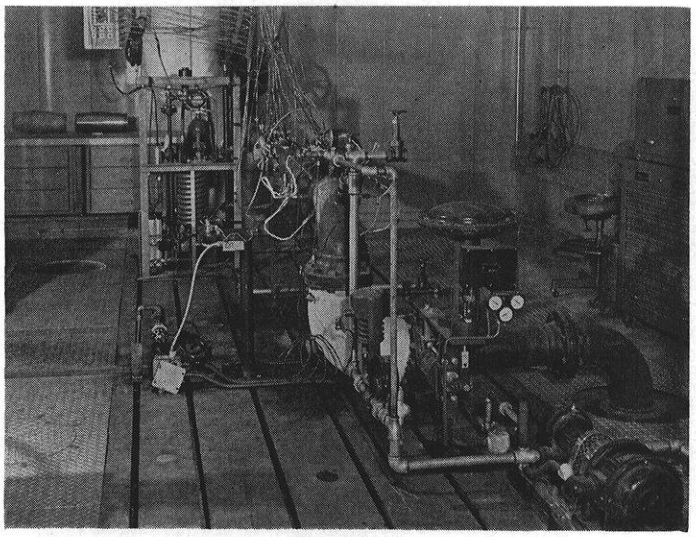
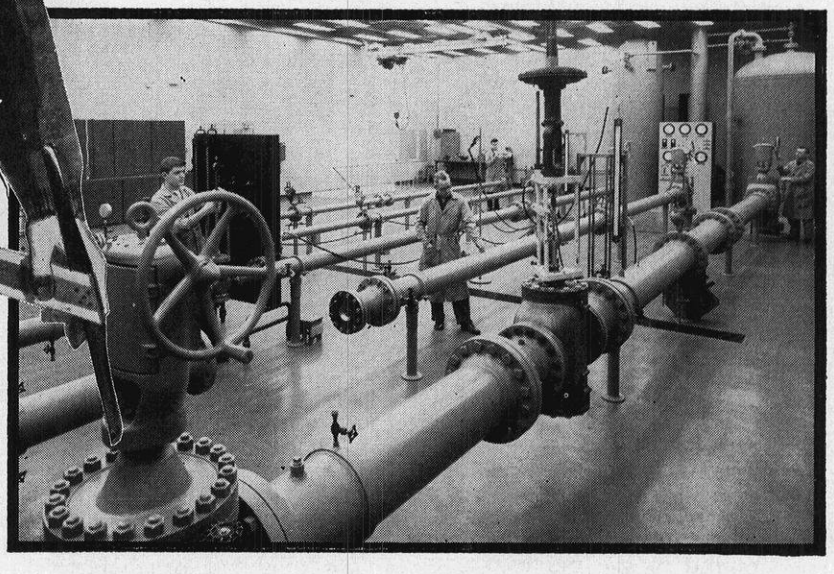


Fig. 5.—An experimental gas turbine engine burner on test.

Ambitious young engineers

thrive in this ideal "growing" environment

WORLD'S LARGEST RESEARCH CENTER FOR AUTOMATIC PRESSURE AND LIQUID LEVEL CONTROL



Modern research laboratory at Fisher includes high and low pressure flow lines in sizes up to 12 inches

During the past three quarters of a century, the Fisher research and development departments have produced some of the outstanding developments in control instrumentation and automation.

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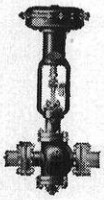
If you are looking for challenge, opportunity and a future that will touch practically every basic industry in the world, consult your placement office or write us about the opportunities Fisher holds in store for you.



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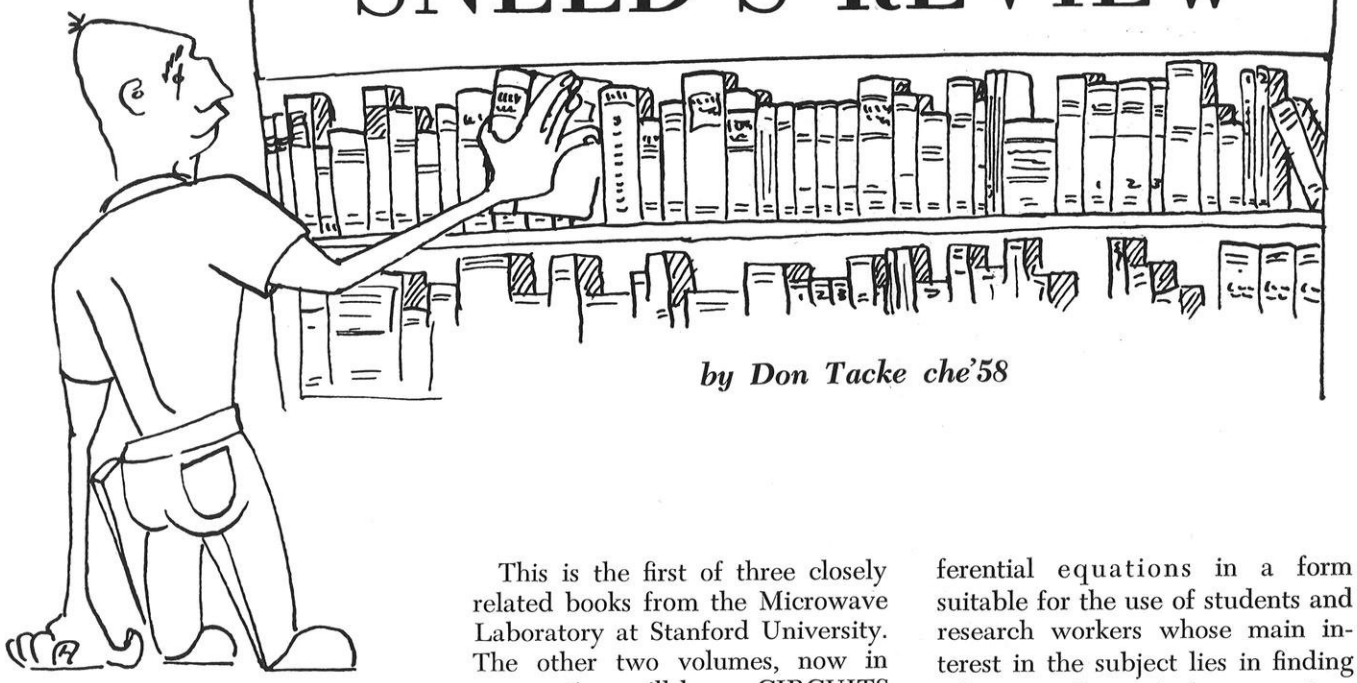
SINCE 1880

SNEED'S REVIEW



by Don Tacke che'58

MICROWAVE MEASUREMENTS

By Edward L. Ginzton
McGraw–Hill $12.00

This book, by the professor of applied physics and electrical engineering and director of the microwave laboratory at Stanford University, is concerned with the basic forms of electrical measurements encountered in the microwave region of the electromagnetic spectrum. Emphasis is on fundamentals, and the topics discussed provide a background for all common microwave measurements, as well as for more specialized applications. However, such special fields as the measurement of dielectric constants, antennas, and transmitter and receiver characteristics are omitted.

Since the laboratory study of microwave phenomena requires an adequate knowledge of electromagnetic theory and practice, the elements of the theory needed to describe the behavior of electromagnetic waves in bounded regions are presented briefly, to justify the generalized impedance concept and the use of generalized transmission line theory. These topics are developed sufficiently to make the application of the impedance concept, transmission line theory, and the equivalent circuit approach plausible and logical.

This is the first of three closely related books from the Microwave Laboratory at Stanford University. The other two volumes, now in preparation, will be on CIRCUITS and TUBES, respectively.

THE PSYCHOLOGY OF EFFECTIVE MANAGEMENT: UNDERSTANDING MEN AT WORK

By Alfred J. Marrow
McGraw–Hill $5.00

A practical and illuminating book dealing with the ever increasing role that psychology plays in the field of industry. The author, a trained psychologist and head of a manufacturing company employing more than 1,000 people, has had more than 20 years of firsthand experience with industrial psychology. The book deals with the complex problems common to all managements and shows how the methods of inquiry available to the psychological sciences can be successfully applied to their solutions. The book translates the special language of psychology in terms of the daily life in the shop and in the factory, thus enabling managers and workers alike to gain an understanding and knowledge of human nature without which they cannot function at their best.

ELEMENTS OF PARTIAL DIFFERENTIAL EQUATIONS

By Ian N. Sneddon
McGraw–Hill $7.50

In this book are found the elements of the theory of partial differential equations in a form suitable for the use of students and research workers whose main interest in the subject lies in finding solutions of particular equations rather than in the general theory. Although the treatment includes a logical development of the theory of the subject, emphasis is on the numerous powerful applications of the equations to the solution of a wide variety of problems in physics and engineering.

The first chapter is devoted to ordinary differential equations in several variables and the use of Carathéodory's theorem in the foundations of thermodynamics. In the second chapter, an account is given of first order equations with applications to physics and biology. The remaining four chapters are concerned with higher order equations, in particular with equations of mathematical physics: Laplace's and Poisson's equations, the wave equation, Maxwell's equations, diffusion equation, etc.

The entire field of partial differential equations is covered, with modern techniques introduced as they arise naturally. A novel feature is the treatment of "advanced" topics by elementary methods. Many worked examples and practical problems for solution by the reader are included.

THE END

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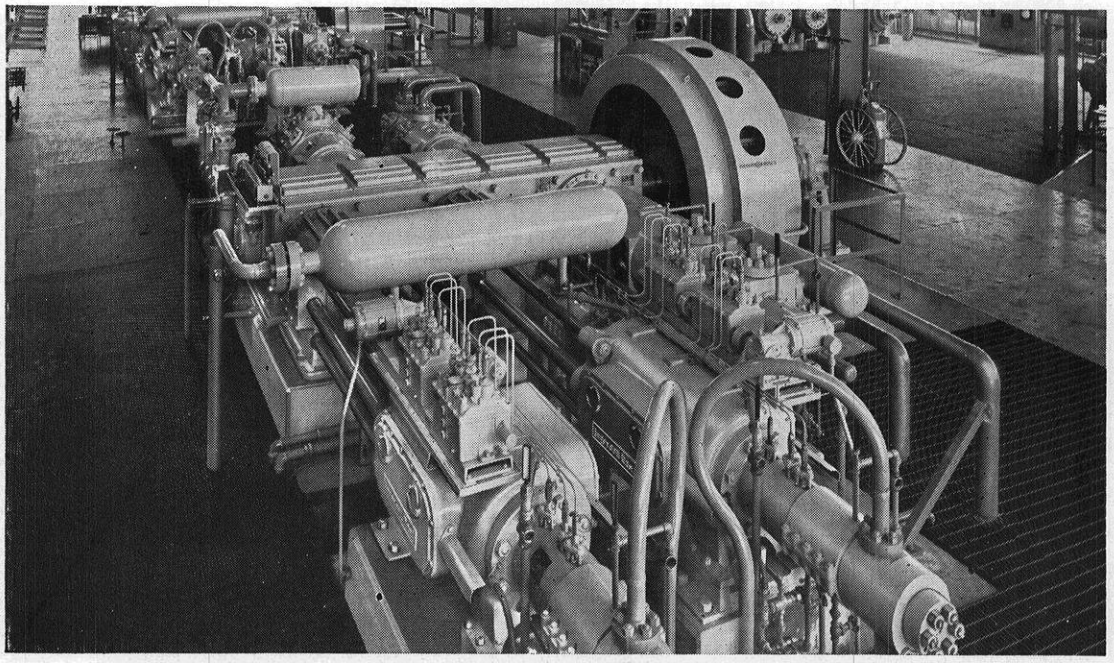

Seven electric-driven Ingersoll-Rand reciprocating compressors totaling 21,900 horsepower are at work in this large ammonia synthesis plant. The units in the foreground compress mixed gases to more than 12,000 pounds per square inch.

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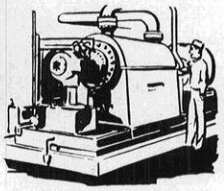

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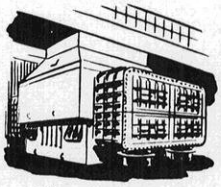

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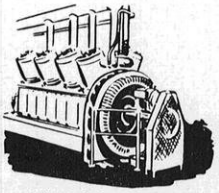

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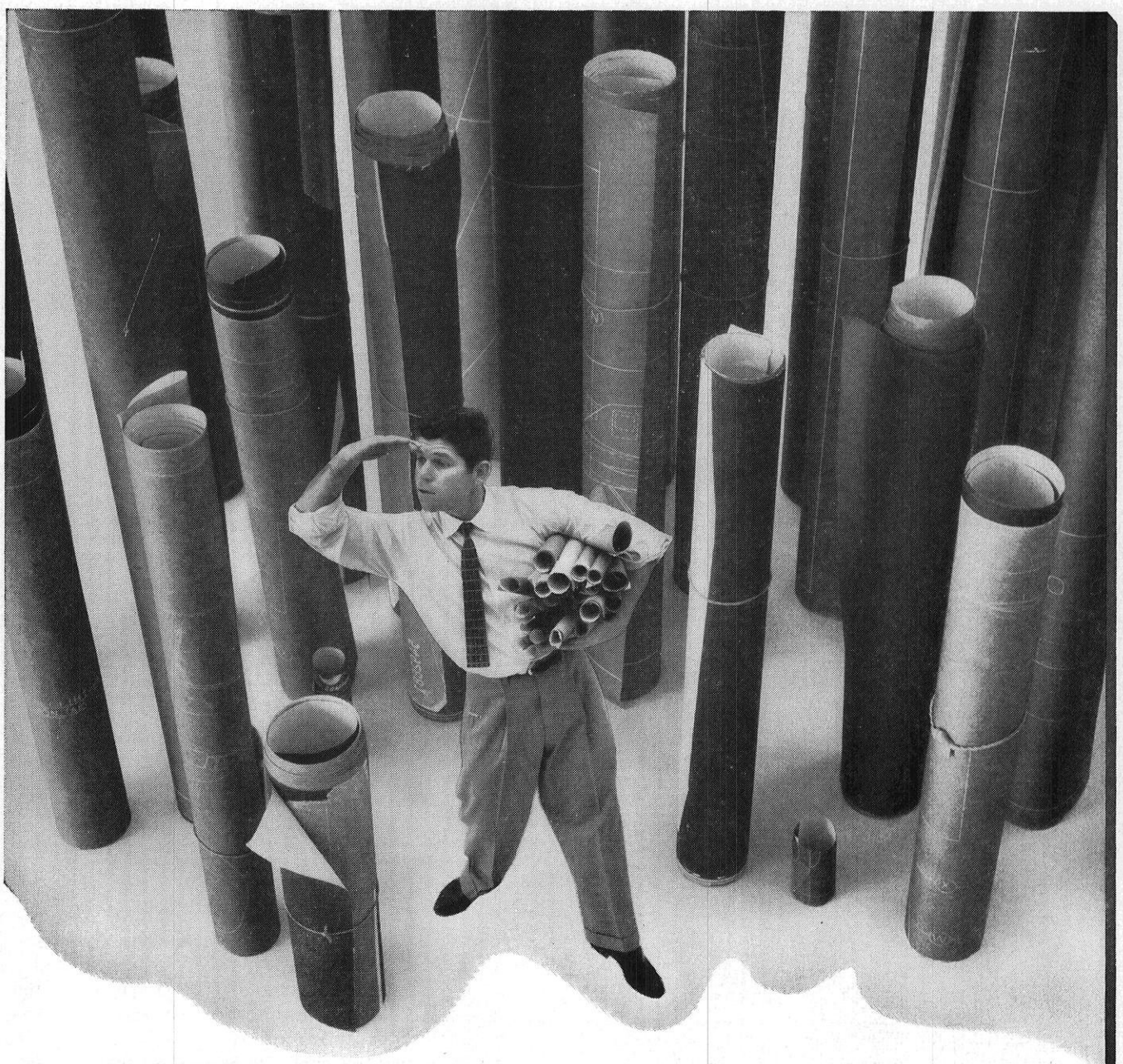

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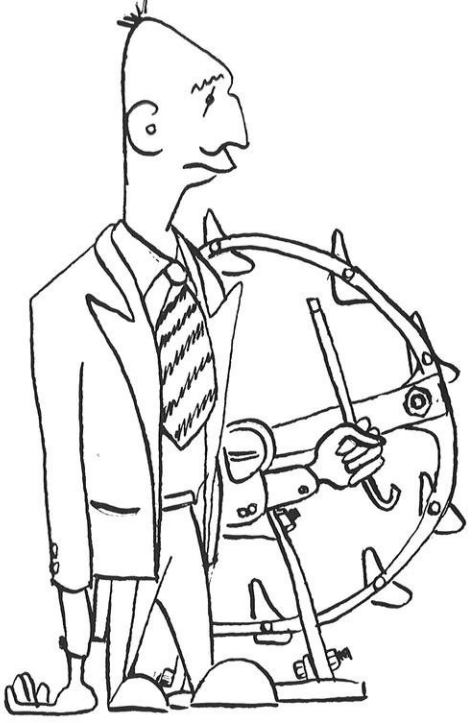
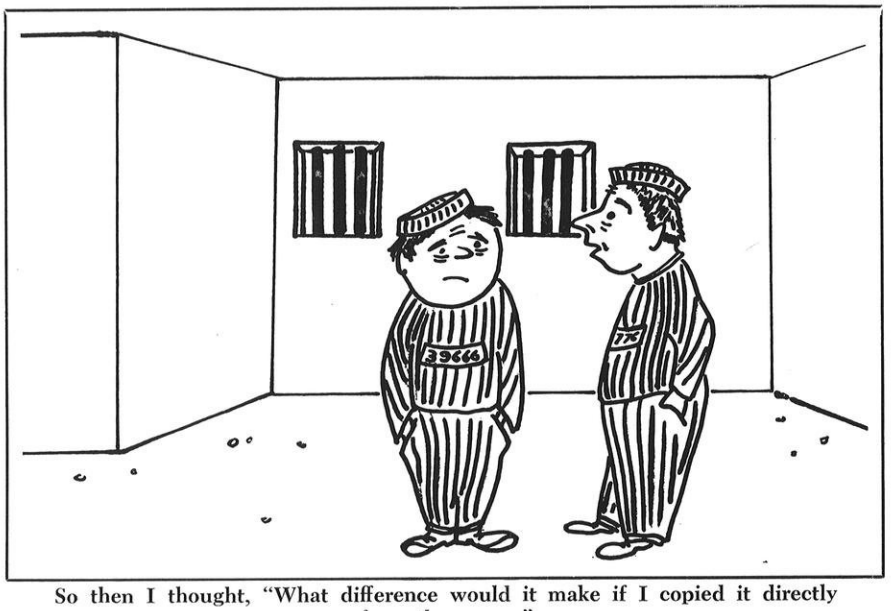
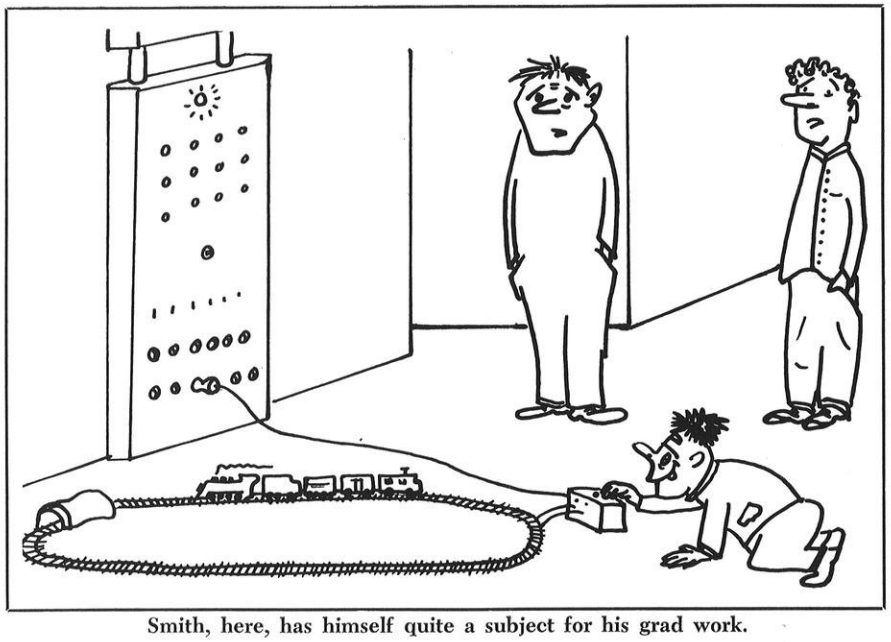


THE FERROUS WHEEL

words and pictures
by Tony DiTrapani



So then I thought, "What difference would it make if I copied it directly from the gouge."



Smith, here, has himself quite a subject for his grad work.

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

* * *

And then there was the woman who shot her husband with a bow and arrow because she didn't want to wake the children.

* * *

Did you hear about the cannibal that passed his brother on the trail?

* * *

Something to Think About
Happiness can't buy money.
A penny saved is time wasted.
If your parents have never had any children, chances are you won't either.
The trouble with lying around and doing nothing is that you can't stop and rest.

* * *

Her: "I'm perfect."
Him: "I'm practice."

* * *

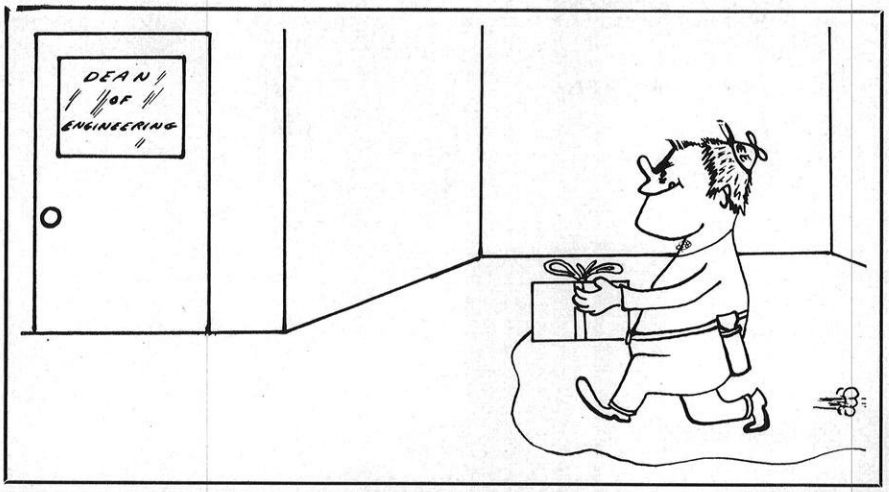
1st guy: "You got a beer stein for Christmas?"
2nd guy: "No, for drinkin'."

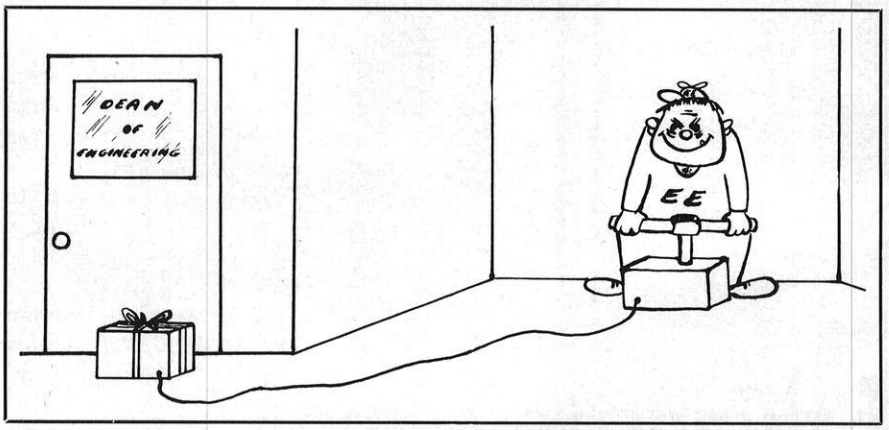
* * *

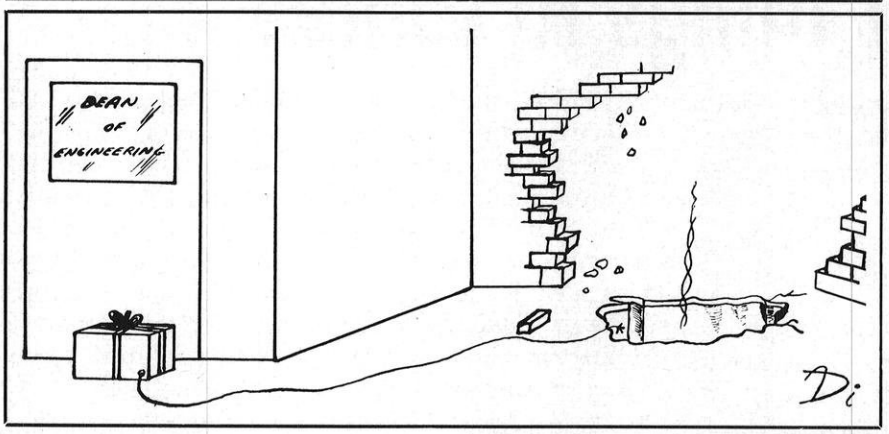
The trouble with most engineers is that they have too much blood in their alcohol stream.

* * *

1st Ch.E.: "You know anything about nitrates?"
2nd Ch.E.: "Well, they're higher than day rates."







Enzyme—little bug that chews up sugar and spits out alcohol.

* * *

Moron: Something which in the winter time, girls wouldn't have so many colds if they put.

* * *

A man walked up to the hotel desk and asked for a can opener. In exchange for a dime he was given two nickels.

* * *

"Really, Bill, your argument with your wife was most amusing."

"Wasn't it though? When she threw the axe at me, I thought I'd split."

Did you hear about the engineer that thought he was a big gun just because he finished every week with a report?

* * *

Any of you guys hear about the engineer who didn't buy any Christmas seals because he couldn't afford to feed them?

* * *

Prof.: "Are you troubled by thoughts that you might flunk out of engine school?"

E.E.: "No, I rather enjoy them."

* * *

1st M.E.: "You cuttin' machine design Friday?"

2nd M.E.: "Nope, I can't. Need the sleep."

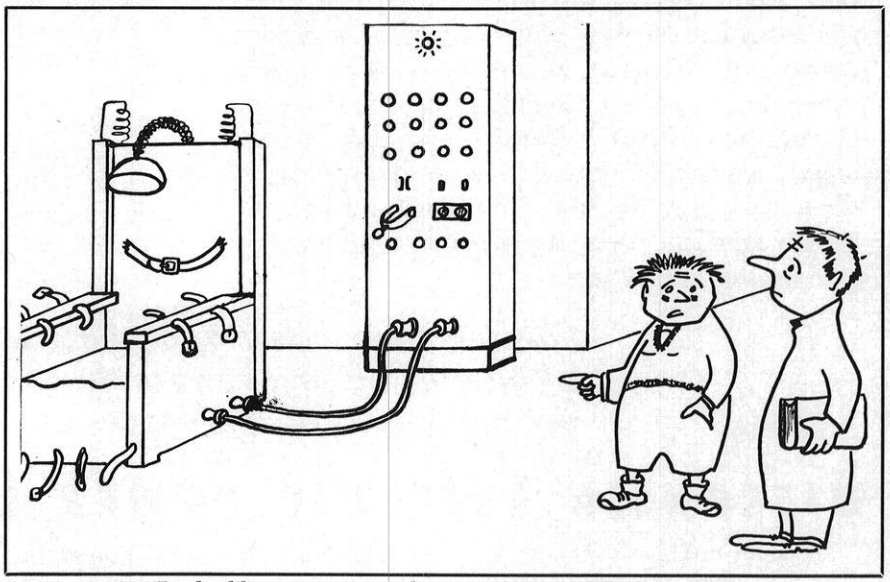
* * *

Been doing quite a bit of research on the origin of old sayings and phrases, and think I've stumbled upon the beginning of that great old cheer, "Hoorah for our side!" I guess it was first heard on the day Lady Godiva rode side saddle through the streets of Coventry.

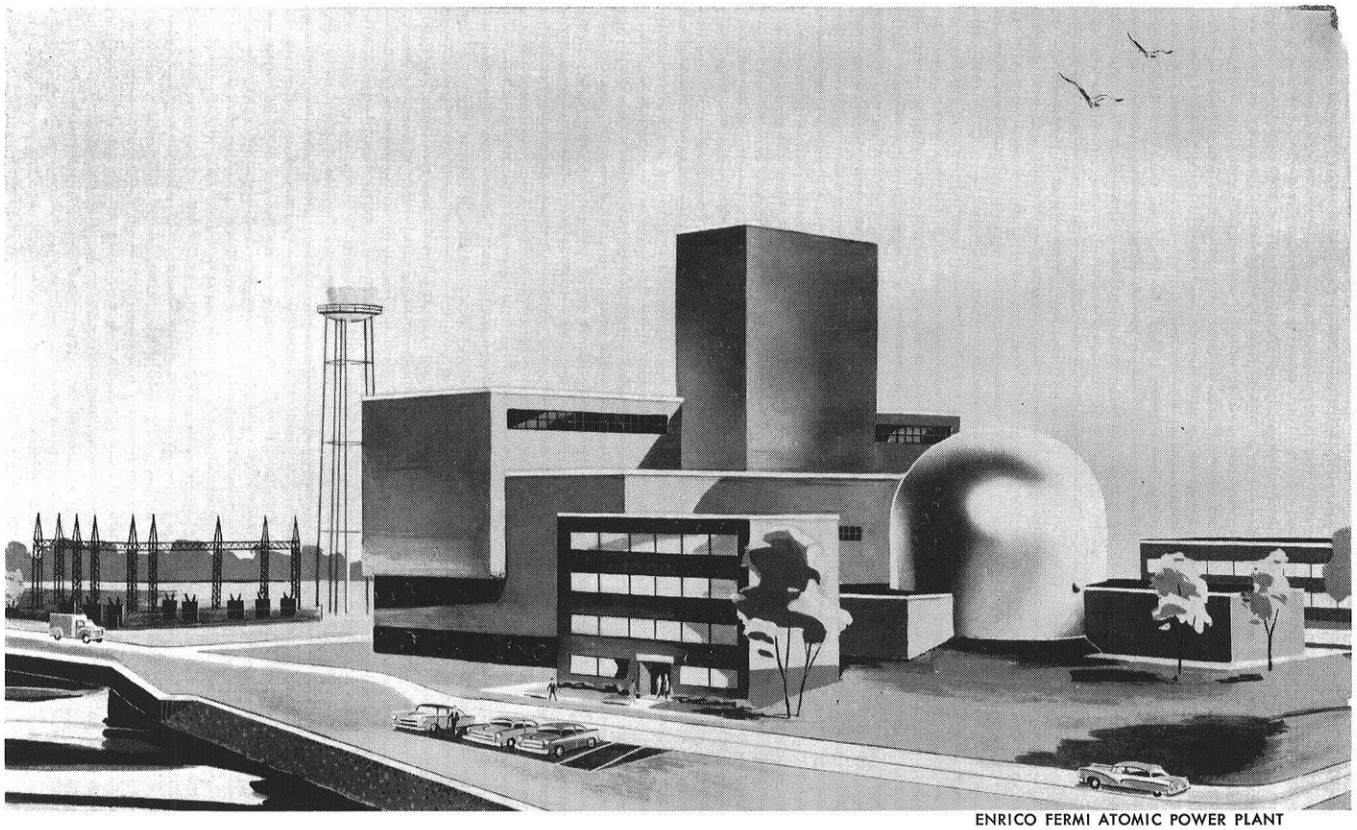
* * *

Engineer's date: "For heaven's sake, Ray, are you spitting in the punch bowl?"

Ray: "No, hon, but I'm coming pretty close."



Looks like a pretty tough experiment in EE this week.



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At Wisconsin Electric Power Company you will have a chance to use your engineering skills in a wide variety of fields — electrical, mechanical, civil, chemical, statistical, research, sales, administrative, etc. Opportunities are available both in our Milwaukee metropolitan area and in many of the smaller communities of the Wisconsin Electric Power Company system which extends from the Wisconsin state line on the south into upper Michigan on the north.

If you are interested in good wages, interesting work, excellent working conditions, numerous employe benefits, exceptional opportunities for advancement — and most of all, a chance to learn and grow in your chosen profession — then find out more about the Wisconsin Electric Power Company system. Make it a point to see our representative when he visits your campus. Find out more about "the shape of things to come" as they may affect your personal career.

For complete information on a wide variety of interesting and rewarding careers . . . see our representative when he visits your campus.

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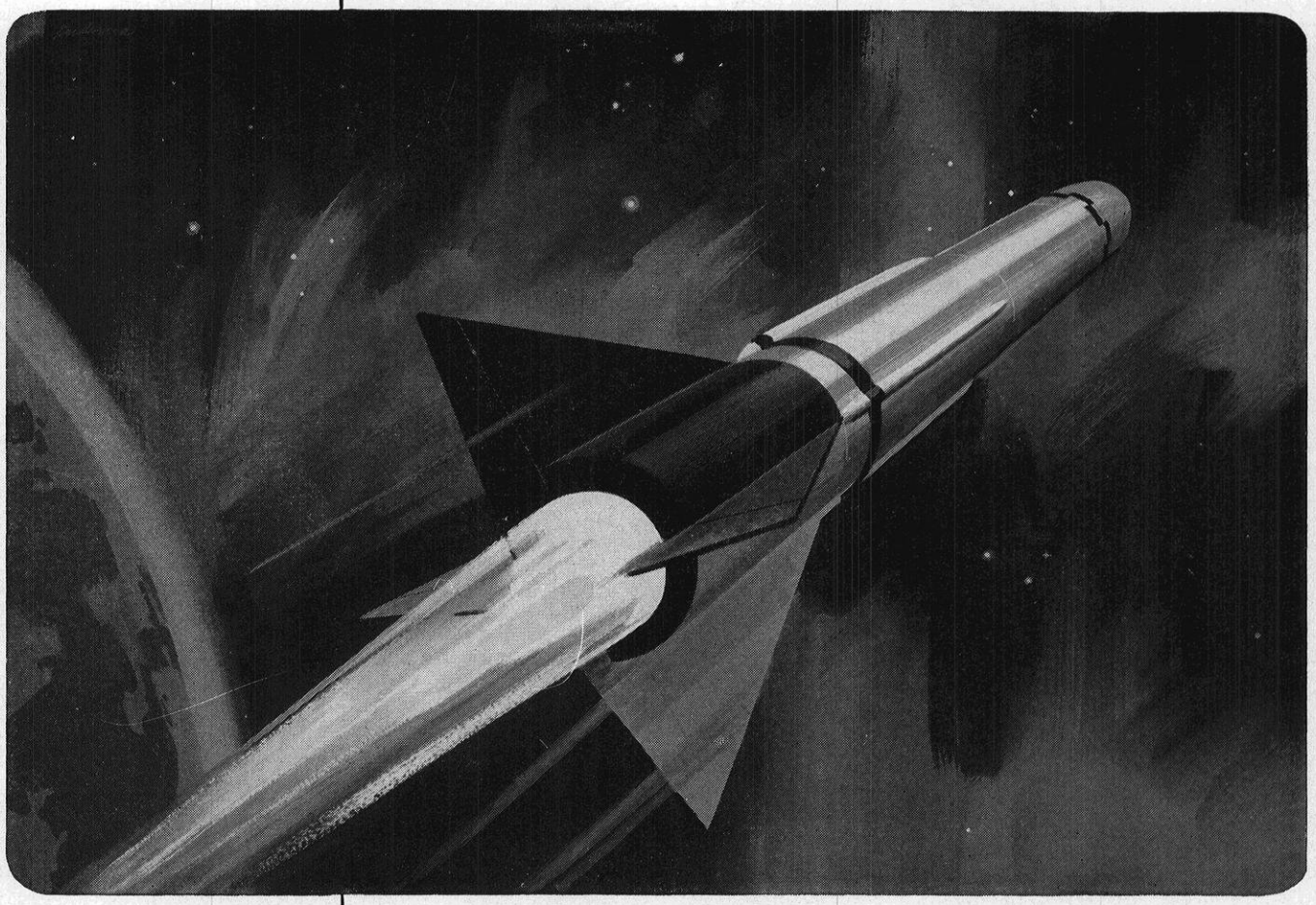
IMPORTANT DEVELOPMENTS AT JPL



The Jet Propulsion Laboratory is a stable research and development center located north of Pasadena in the foothills of the San Gabriel mountains. Covering an 80 acre area and employing 2000 people, it is close to attractive residential areas.

The Laboratory is staffed by the California Institute of Technology and develops its many projects in basic research under contract with the U.S. Government.

Opportunities open to qualified engineers of U.S. citizenship. Inquiries now invited.

Weapons Systems Responsibility

In the development of guided missile systems, the Jet Propulsion Laboratory maintains a complete and broad responsibility. From the earliest conception to production engineering—from research and development in electronics, guidance, aerodynamics, structures and propulsion, through field testing problems and actual troop use, full technical responsibility rests with JPL engineers and scientists.

The Laboratory is not only responsible for the missile system itself, including guidance, propulsion and airframe, but for all ground handling equipment necessary to insure a complete tactical weapons system.

One outstanding product of this type of systems responsibility is the "Corporal," a highly accurate surface-to-surface ballistic missile. This weapon, developed by JPL, and now in production elsewhere, can be found "on active service" wherever needed in the American defense pattern.

A prime attraction for scientists and engineers at JPL is the exceptional opportunity provided for original research afforded by close integration with vital and forward-looking programs. The Laboratory now has important positions open for qualified applicants for such interesting and challenging activities.

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So You Think You're SMART!

by Sneedly bs'61

CAN you use some spare cash once in a while? If you can, then solve the following puzzlers and drop the answers with the solutions in the mail. The first correct set of solutions to be received wins $10.00. The earliest post-mark breaks any tie.

Sneed has been getting so many solutions sent in by readers that he has decided to show his appreciation, so get your answers in the mail and don't forget to include your solutions in readable form. Solutions are necessary to win.

* * *

The table in last month's problem has a diameter of 58 inches. A quadratic solution yields answers of 58 or 10 inches, the second answer is eliminated because of the stipulation that the spot be nearest the corner.

* * *

The second problem, of the conical wine glass, has solutions of 2.8 inches for the height of the glass and 1.0 inch for the diameter of the ball.

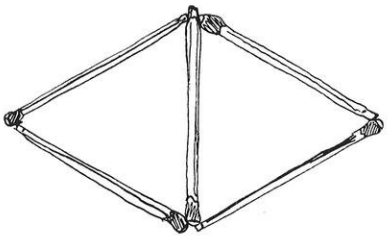
* * *

The candles had been burning for three and three-quarters hours. One candle has one-sixteenth of its original length left while the other has one-fourth.

The casks can be divided in one of two ways. Either (2, 3, 2), (2, 3, 2), (3, 1, 3) or (3, 1, 3), (3, 1, 3), (1, 5, 1) will satisfy the conditions of the problem.

* * *

Now for this month's problems, and starting with the hardest one: three identical matches will form one equilateral triangle. Two additional matches will form two equilateral triangles as shown. Now with the addition of one match, form four such triangles.

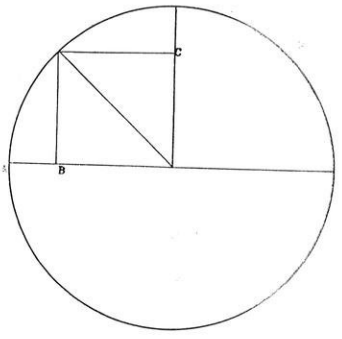


A door to door salesman lives between two large cities and is happy to work in either one. He allows his decision, as to where to work, to be determined by the first subway train to arrive at his station each morning. Trains leave both cities on the hour and every ten minutes on a regular schedule. The salesman arrives at his subway station every morning in an entirely random pattern between 8 and 10 A. M. Over a year's period, his records show that he visited one city 4 times as often as the other. How can the phenomenon be explained?

A farmer has a square piece of property which, in his will, he left to his wife, daughters, and three sons. The will specified that the wife should receive one-fourth of the area in the form of a square. The balance was to be equally divided between the four children, each receiving identically shaped areas. Furthermore, the daughter's section could not border or touch the outer perimeter of the original area, How was the land divided?

* * *

In the diagram shown, the diameter of the circle is 8 inches. If AB is 1 inch, how long is BC?



Now, all you have to do is solve the four simple problems and send solutions and answers to: Sneedly, c/o The Wisconsin Engineer, Mechanical Engineering Bldg., Madison 6, Wisconsin.

Solutions need not be suitable for framing but must be neat enough so that Sneed can follow it. First post-marked solution of the problems wins, so don't delay.

PHOTOGRAPHY AT WORK
No. 30 in a Kodak Series

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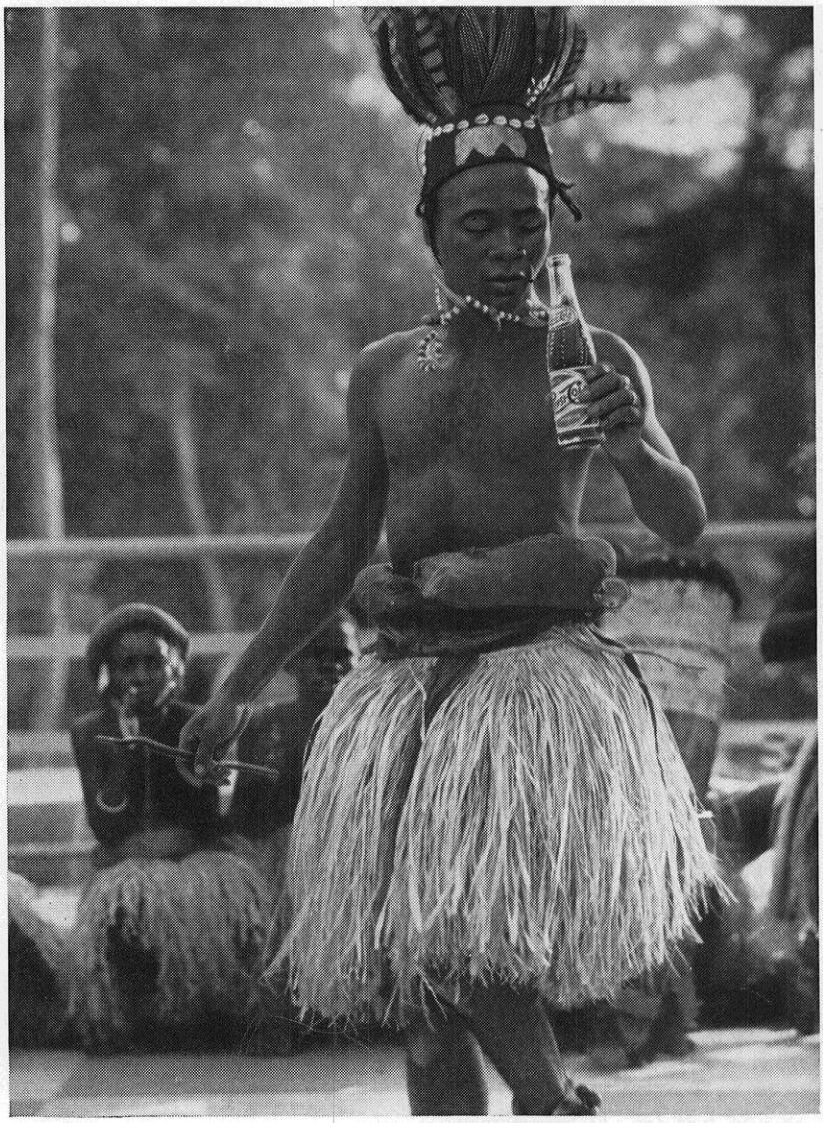

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TRADE MARK

One of a series*

Interview with General Electric's Earl G. Abbott Manager—Sales Training

Advancement in a Large Company: How it Works

Where do you find better advancement opportunities—in a large company or a small one? To help you, the college student, resolve that problem, Mr. Abbott answers the following questions concerning advancement opportunities in engineering, manufacturing and technical marketing at General Electric.

Q. In a large Company such as General Electric, how can you assure that every man deserving of recognition will get it? Don't some capable people become lost?

A. No, they don't. And it's because of the way G.E. has been organized. By decentralizing into more than a hundred smaller operating departments, we've been able to pinpoint both authority and responsibility. Our products are engineered, manufactured and marketed by many departments comparable to small companies. Since each is completely responsible for its success and profitability, each individual within the department has a defined share of that responsibility. Therefore, outstanding performance is readily recognized.

Q. If that's the case, are opportunities for advancement limited to openings within the department?

A. Not at all. That's one of the advantages of our decentralized organization. It creates small operations that individuals can "get their arms around", and still reserves and enhances the inherent advantages of a large company. Widely diverse opportunities and promotions are available on a Company-wide basis.

Q. But how does a department find the best man, Company-wide?

A. We've developed personnel registers to assure that the best qualified men for the job are not overlooked. The registers contain complete appraisals of professional employees. They enable a manager to make a thorough and objective search of the entire General Electric Company and come up with the man best qualified for the job.

Q. How do advancement opportunities for technical graduates stack-up with those of other graduates?

A. Very well. General Electric is recognized as a Company with outstanding technical skills and facilities. One out of every thirteen employees is a scientist or engineer. And approximately 50 per cent of our Department General Managers have technical backgrounds.

Q. How about speed of advancement? Is G.E. a "young man's Company"?

A. Definitely. A majority of all supervisors, managers and outstanding individual contributors working in the engineering function are below the age of forty. We believe that a job should be one for which you are qualified, but above all it should be one that challenges your ability. As you master one job we feel that consideration should be given to moving you to a position of greater responsibility. This is working, for in the professional field, one out of four of our people are in positions of greater responsibility today than they were a year ago.

Q. Some men want to remain in a specialized technical job rather than go into managerial work. How does this affect their advancement?

A. At G.E. there are many paths which lead to higher positions of recognition and prestige. Every man is essentially free to select the course which best fits both his abilities and interests. Furthermore, he may modify that course if his interests change as his career progresses. Along any of these paths he may advance within the Company to very high levels of recognition and salary.

Q. What aids to advancement does General Electric provide?

A. We believe that it's just sound business policy to provide a stimulating climate for personal development. As the individual develops, through his own efforts, the Company benefits from his contributions. General Electric has done much to provide the right kind of opportunity for its employees. Outstanding college graduates are given graduate study aid through the G-E Honors Program and Tuition Refund Program. Technical graduates entering the Engineering, Manufacturing, or Technical Marketing Programs start with on-the-job training and related study as preparation for more responsible positions. Throughout their G-E careers they receive frequent appraisals as a guide for self development. Company-conducted courses are offered again at all levels of the organization. These help professionals gain the increasingly higher levels of education demanded by the complexities of modern business. Our goal is to see every man advance to the full limits of his capabilities.

If you have other questions or want information on our programs for technical graduates, write to E. G. Abbott, Section 959-9, General Electric Co., Schenectady 5, N. Y.

***LOOK FOR other interviews discussing: • Qualities We Look For in Young Engineers • Personal Development • Salary.**

GENERAL ELECTRIC