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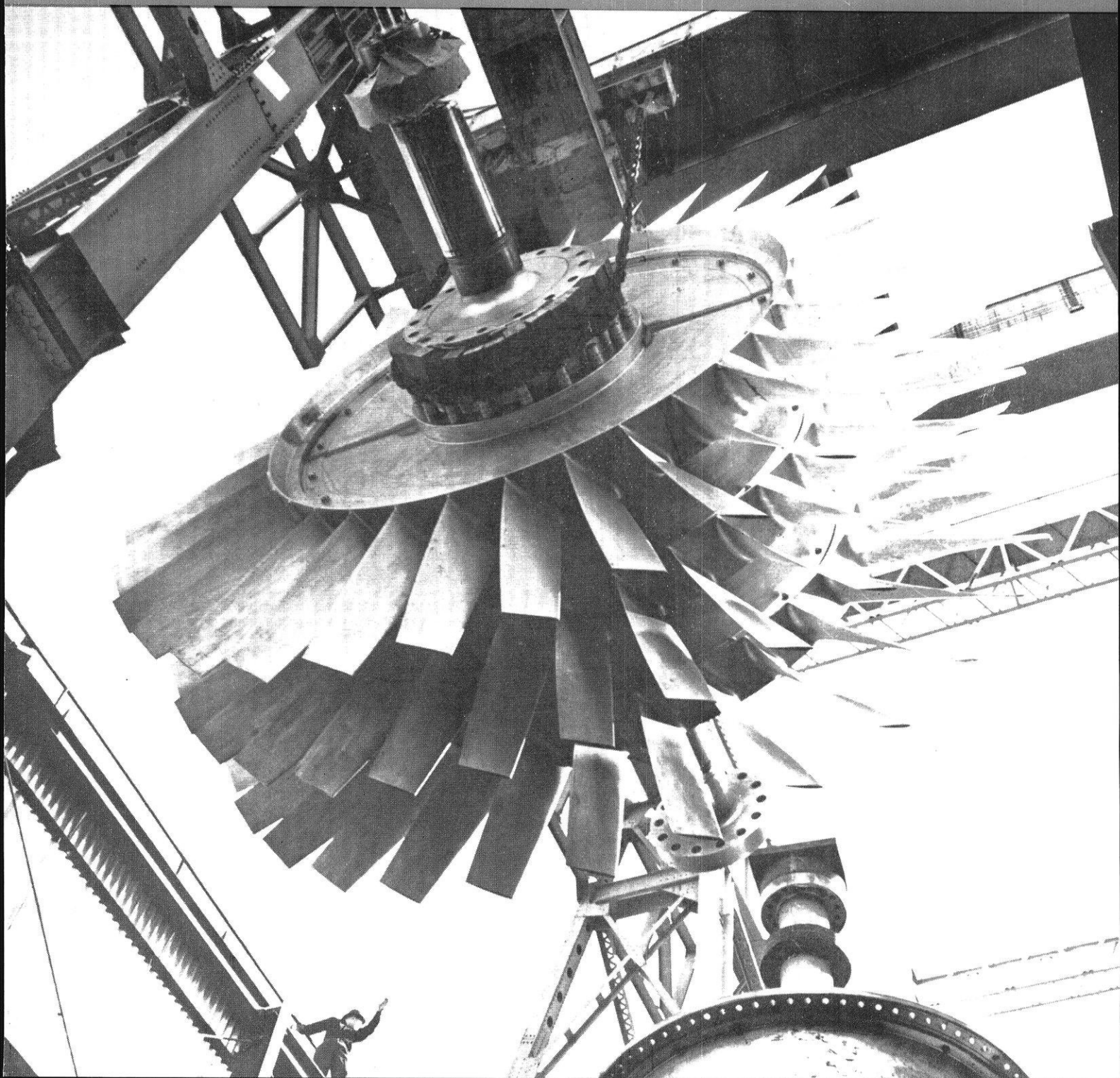
NOVEMBER

1956

The Wisconsin

25¢

engineer



Leroy J. Sauter, class of '49,
speaks from experience when he says:

**“The variety of jobs open to engineers
with United States Steel
offers satisfaction and a great future.”**



IN 1949, Leroy J. Sauter was graduated from the University of Pittsburgh with a B.S. in Metallurgical Engineering. Today, Mr. Sauter holds the important post of Superintendent, Open Hearth and Bessemer Department at National Works of United States Steel's National Tube Division.

Before his college days, and as far back as October, 1939, Mr. Sauter was employed as a chipper, a molding helper, and helper on an electric furnace at the United States Steel's Johnstown Works. Then, from 1943 until 1945, he served in the U. S. Navy. He entered the University of Pittsburgh in 1946, graduating within three years.

In February of 1949, Mr. Sauter was employed by United States Steel as a student engineer. In October, 1950, he became a process engineer in the Open Hearth and Bessemer Department. In April, 1952, he was advanced to practice engineer in the same department, and three months later, July, 1952, Mr. Sauter was appointed Assistant

Superintendent of the Open Hearth and Bessemer Department. His elevation to his present position of Superintendent of this department occurred in December, 1955.

Today, Mr. Sauter supervises 316 men, being responsible for and assuring the productivity, quality of product, and general morale of this group. His responsibility further extends to the complete operation of his department, operating costs, meeting ingot requirements and complete scheduling of equipment.

Mr. Sauter's rapid advancement is not unusual at United States Steel. USS training programs make it possible for men of vision and energy to reach responsible goals within a minimum of time. Mr. Sauter says, "With the vast expansion of the steel industry, opportunities to men presently grad-

uating from colleges and universities throughout the country as engineers are unlimited. United States Steel offers such engineers the opportunity to practice using a large variety and range of specific engineering talents. In the steel industry practically every craft known to man is utilized."

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THE

GOOD YEAR

WORLD

VOL. 2

NO. 2

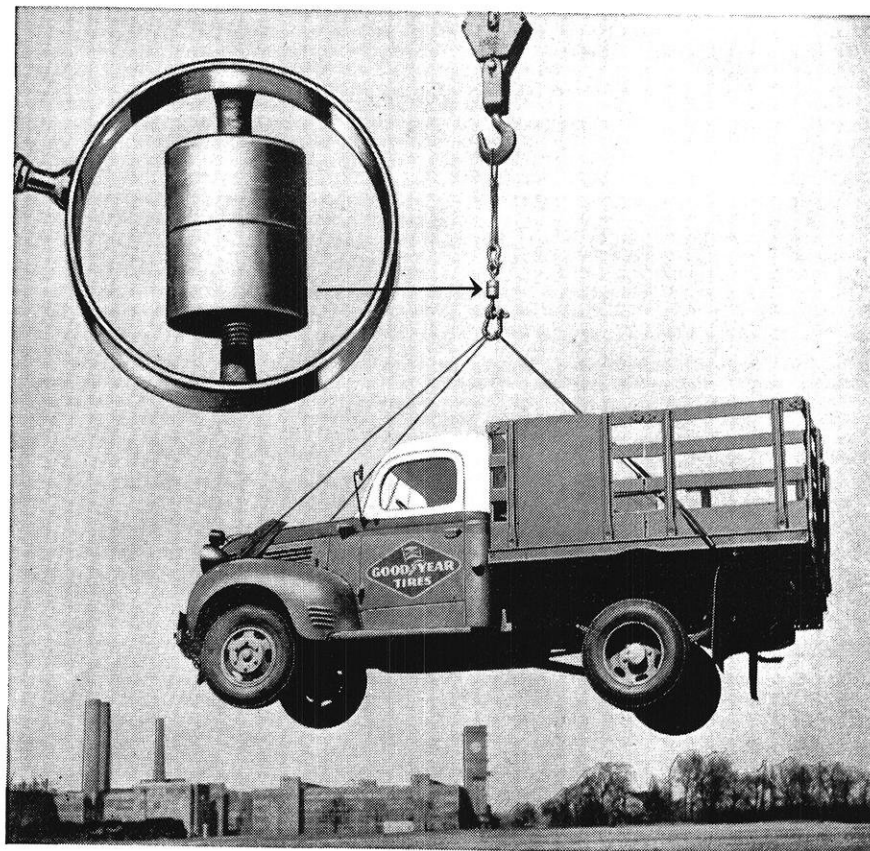
LIQUID CEMENT "WELDS" STEEL BLOCKS

LIFTS 5,000 POUND TRUCK

Akron, Ohio—Some time ago a group of Goodyear engineers assembled at the conference table. They were the engineers who, through creative "imagineering," had combined components of plastics and synthetic rubbers in an entirely new way. The result was Pliobond—a revolutionary liquid cement possessing unique and outstanding adhesive properties.

And now these same engineers had been asked to *demonstrate* these properties—to show 27,000,000 television viewers how Pliobond had earned its enviable reputation as the adhesive that bonds "anything to anything." It was a challenging assignment, indeed. For, with a product like Pliobond, no simple demonstration would do. It had to be novel. And, it had to be convincing.

They decided to bond together two 4-inch steel blocks with a microscopically thin layer of Pliobond. They would place the "welded" steel blocks between a crane hoist and lifting sling. Then they would lift a 5,000 pound truck. The entire



dynamic load of the swinging, swaying truck would be on the nearly invisible layer of Pliobond.

How did it work? Perfectly. They proved their point well. But they did more.

They demonstrated that the combination of imagination and tech-

nical skills—creative "imagineering"—is the *keynote* of significant developments at Goodyear—from acid-resistant hose to "roll-your-own" portable tanks for fuel.

Wouldn't *you* be proud to be a member of this up-to-the-minute engineering team?

Send for your copy of this booklet. It describes in detail your career opportunities at Goodyear. Write Technical Personnel, Dept. 806-W, The Goodyear Tire & Rubber Company, Akron 16, Ohio.



There's a world of opportunity at

GOOD YEAR

THE GREATEST NAME IN RUBBER

Pliobond—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

NOVEMBER, 1956

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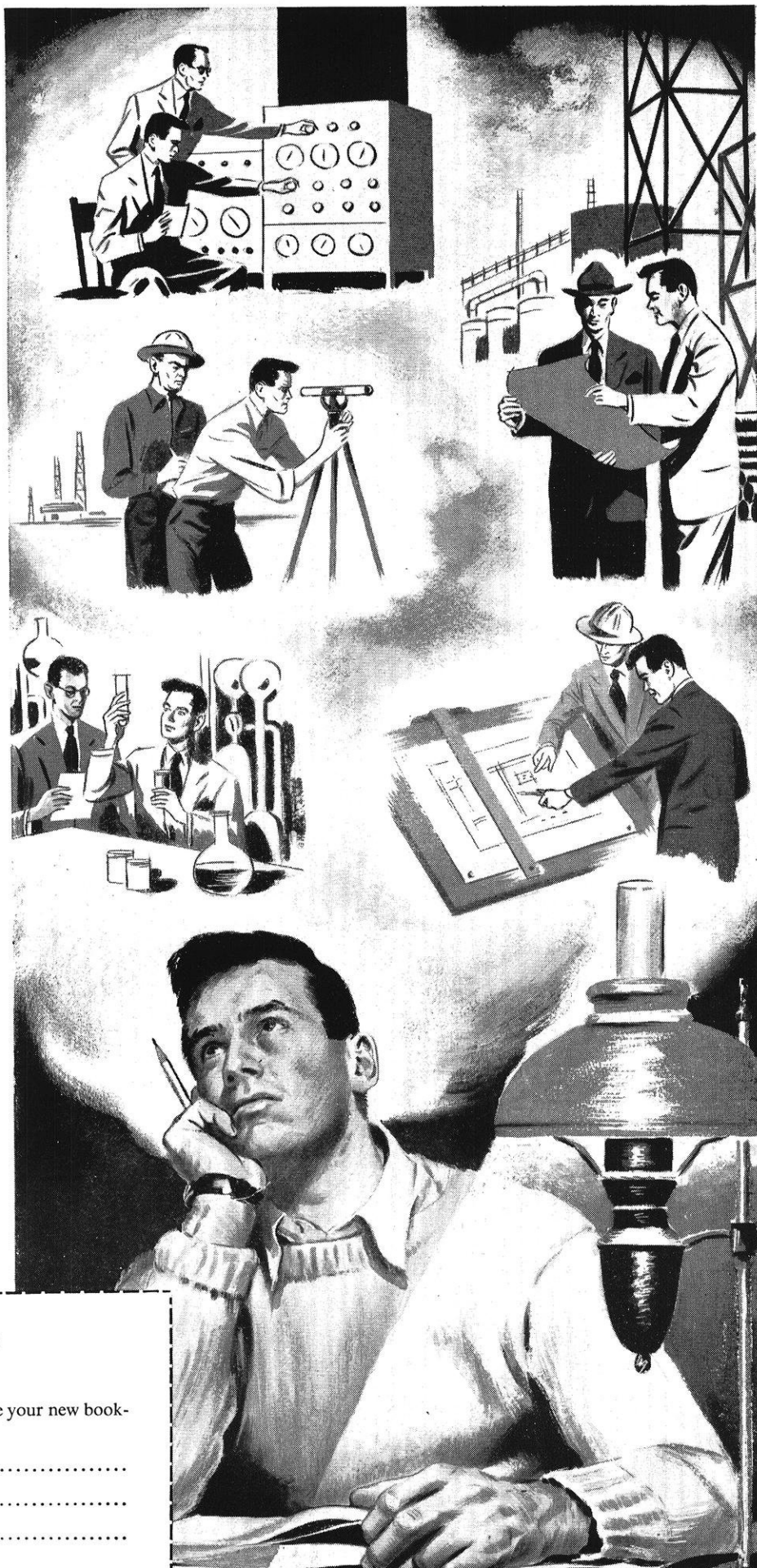
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Dear Mr. McKeithan: Please send me your new booklet "Career with a Future."

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Saran Wrap is stretched by injecting compressed air to form a bubble $\frac{1}{2}$ mil in thickness which is then compressed and wound.

Bubble, bubble, toil and brainwork...

Dow engineers create modern new plant for Saran Wrap production

Demand was multiplying for Saran Wrap,* the clear moistureproof plastic wrap for foods. A new plant was needed . . . and needed fast.

Dow's engineering and technical staff went to work. Production processes were checked and improved. Mechanical engineers designed new machinery. Electrical engineers introduced new fluorescent lighting (shielded by an entire ceiling of corrugated plastic) eliminating glare from Saran Wrap which would have tired the eyes. Modern plant innovations were widely apparent as the blueprints came in from engineer after engineer.

Then the job was done. Hard work and brainwork had

produced an enviable new plant ready to produce in excess of 5,000,000 Saran Wrap rolls a month. Dow-engineered from start to finish, it stands as a testimonial to the depth and talent of Dow engineering and planning.

*TRADEMARK

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WISCONSIN ENGINEER

The Student Engineer's Magazine

FOUNDED 1896

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Frontispiece

This 315,000-kva, 17.3/129-kv generator transformer built by Westinghouse Electric Corporation is the largest ever installed.

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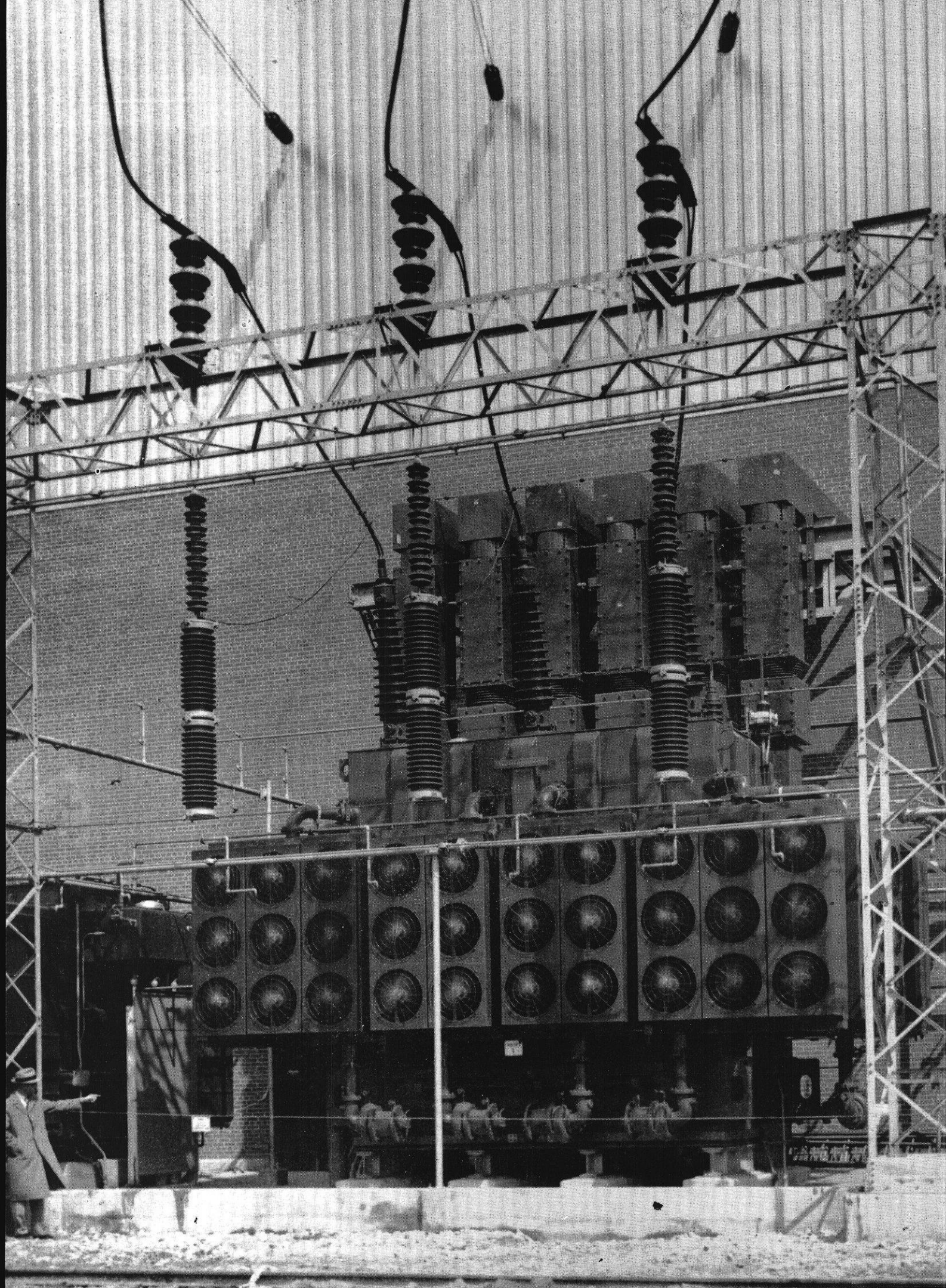
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Rambling

WITH THE

EDITOR

How About Publication Engineering?

Not many of you probably realize that there is such a thing as a "publication engineer" in this day and age of vast technical achievements. All we hear about are new discoveries and improvements in old products that engineers are responsible for. With the ever increasing complications in both products and processes someone has to be responsible for putting pertinent information down on paper in the form of manuals for the consumer, articles for the trade magazine, and instructions for the repairmen. This is where the technical writer fits in. He must study information given to him by other engineers, observe the application of the subject he is to write about, then put down the desired information in written form. In large companies, well paid people with good-sized staffs are handling these functions. Small companies often hire a person specializing in this field to do all these things by himself. Up until now people for these positions have been in the most part transferees from other departments where they have shown some writing aptitude. Now industry wants to hire people trained for this job before they start in some other field and then get transferred. Several schools are offering graduate courses in publication engineering with almost guaranteed job offers upon graduation at salaries near the \$600 per month range. Since this is a new field, advancement opportunities are unlimited. If you desire further information on this subject, contact the ENGINEER and we will be glad to help you. In closing we would like to mention that in preparation for this field good training can be had through your engineering publication, the WISCONSIN ENGINEER.

R. F. S.



S=

what's the magic formula for success?

WHEN YOU WORK with the world's most successful industrial corporation—as we do—people often ask you that question.

Folks are naturally curious to know what accounts for General Motors' rapid and continued progress—they're seeking the magic formula.

Well, we believe we have an answer that should be of especial interest to young engineering seniors just about this time of year.

This answer was stated by a distinguished GM executive, Alfred P. Sloan, Jr., Honorary Chairman of the Board of Directors—and it carries a lot of weight. Here it is:

"The only difference between business success and failure is the people in the business and how they work together . . . We have given the people in General Motors an opportunity to perform. We have given them responsibility with authority. And we have made it worth while for them to do worth-while things."

Those sentiments reflect an attitude that you'll find much in evidence throughout GM's 34 decentralized

manufacturing divisions with 126 plants in 68 U. S. cities from coast to coast.

In this sort of healthful climate, engineering achievement flourishes, and so do engineering careers.

That's all the magic formula there is behind GM's success—and the success of so many young engineers who join us.

Why not ask your college placement officer about opportunities in General Motors? Or write us directly.

GM Positions Now Available in These Fields:

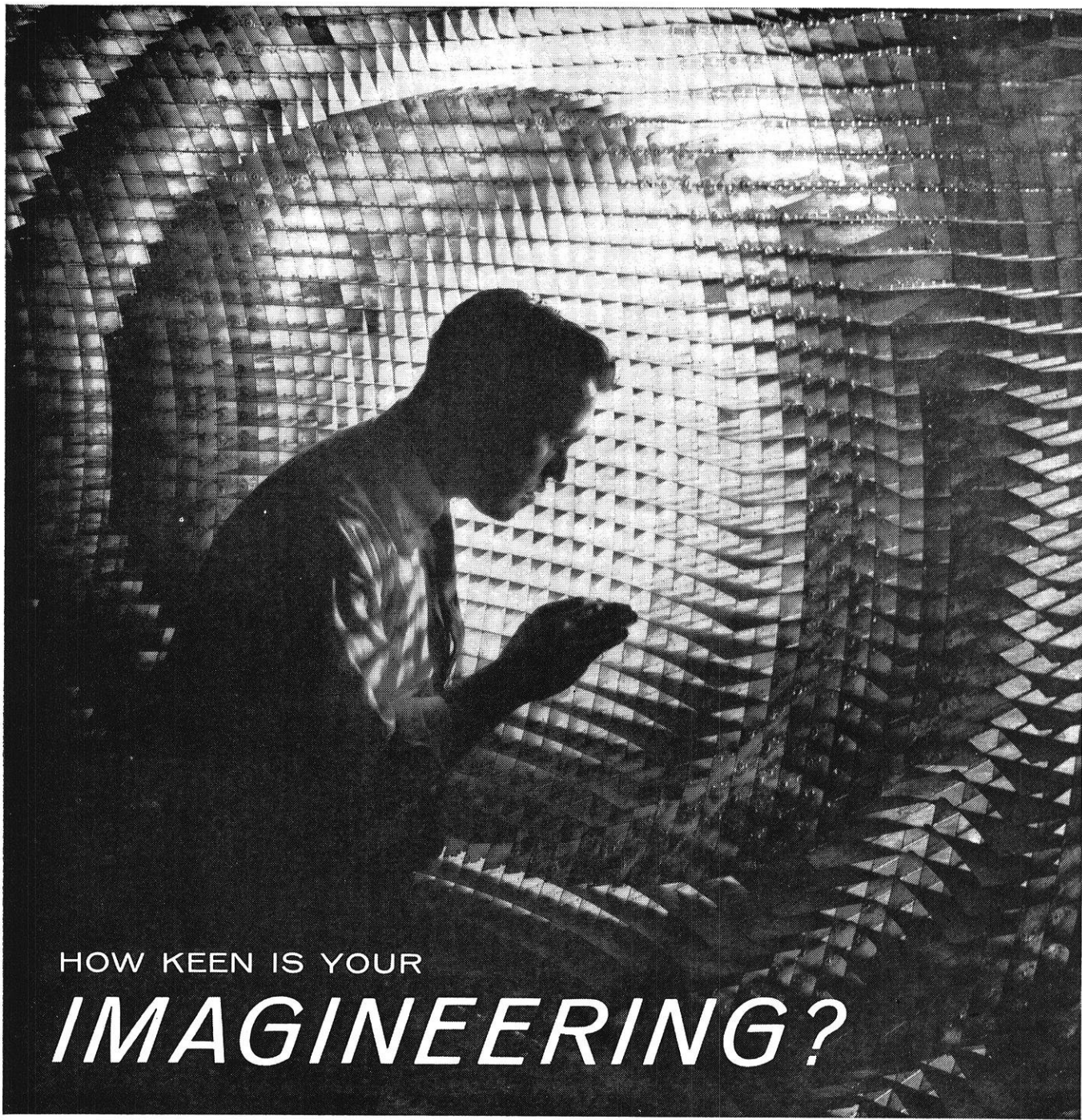
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THE WISCONSIN ENGINEER

421



HOW KEEN IS YOUR *IMAGINEERING?*

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paying your full tuition for advanced or continuing studies.

■ Whether you elect to work with Sperry in its modern plant in Long Island, or in Florida, California, Virginia or Utah, there is a bright future for you at Sperry, and one limited only by your own desire to get ahead.

■ Check your Placement Office for dates when Sperry representatives will visit your school. Make it "a must" to talk with them or write

J. W. Dwyer, Sperry Gyroscope Company, Section 1B5.

P.S. In case you *didn't* identify the equipment shown above, it is part of an 8 ft. Sperry-designed radar antenna for long range missile guidance.

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ahead!



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like this...
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like this?

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Brochures and employment applications are available at your college placement office.

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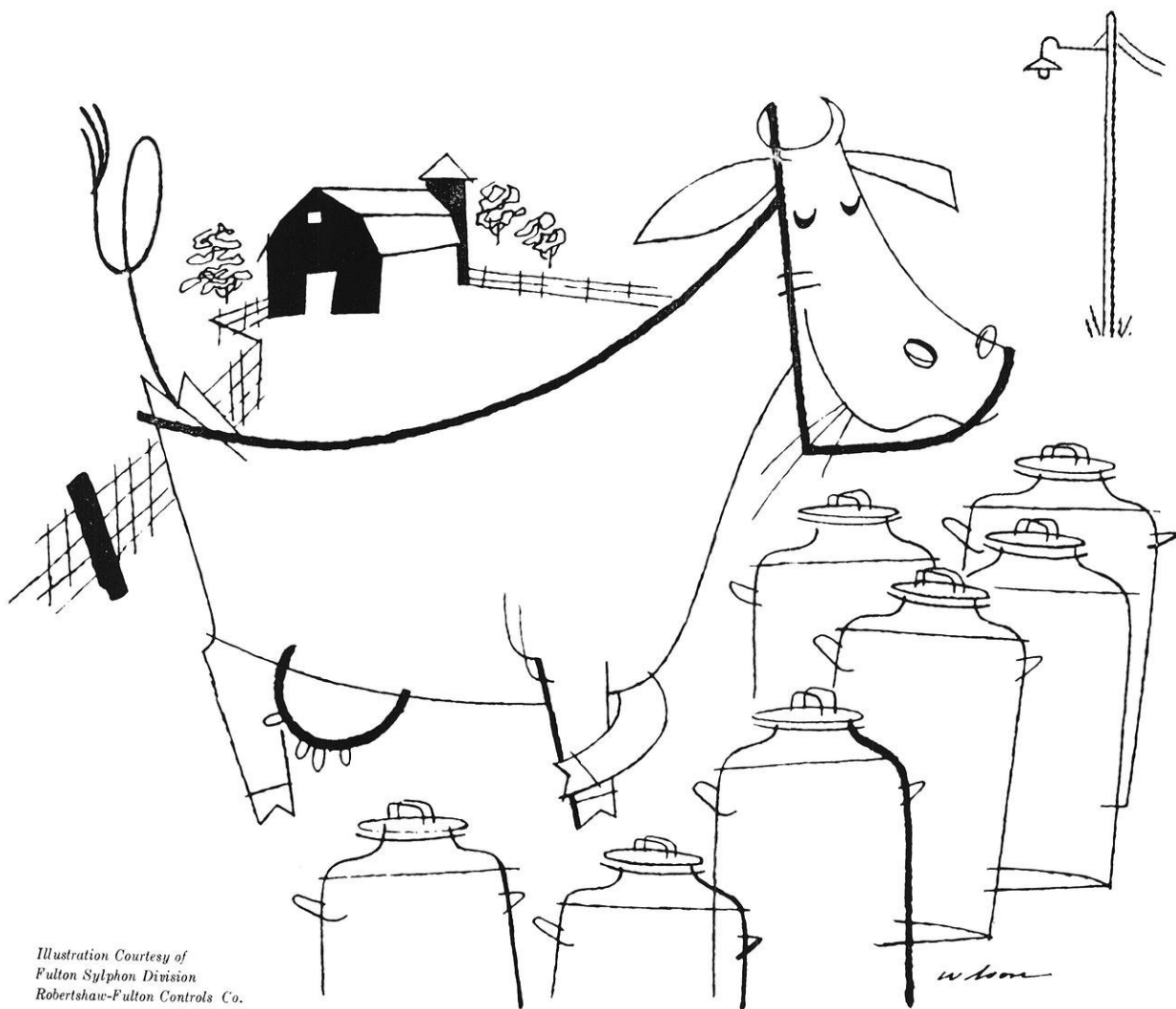


Illustration Courtesy of
Fulton Sylphon Division
Robertshaw-Fulton Controls Co.

There's satisfaction in meeting a challenge

For engineers worth their salt, challenge is stimulating. We live in such an atmosphere at Detroit Edison, a company internationally known for its bold, imaginative engineering. But let's be specific.

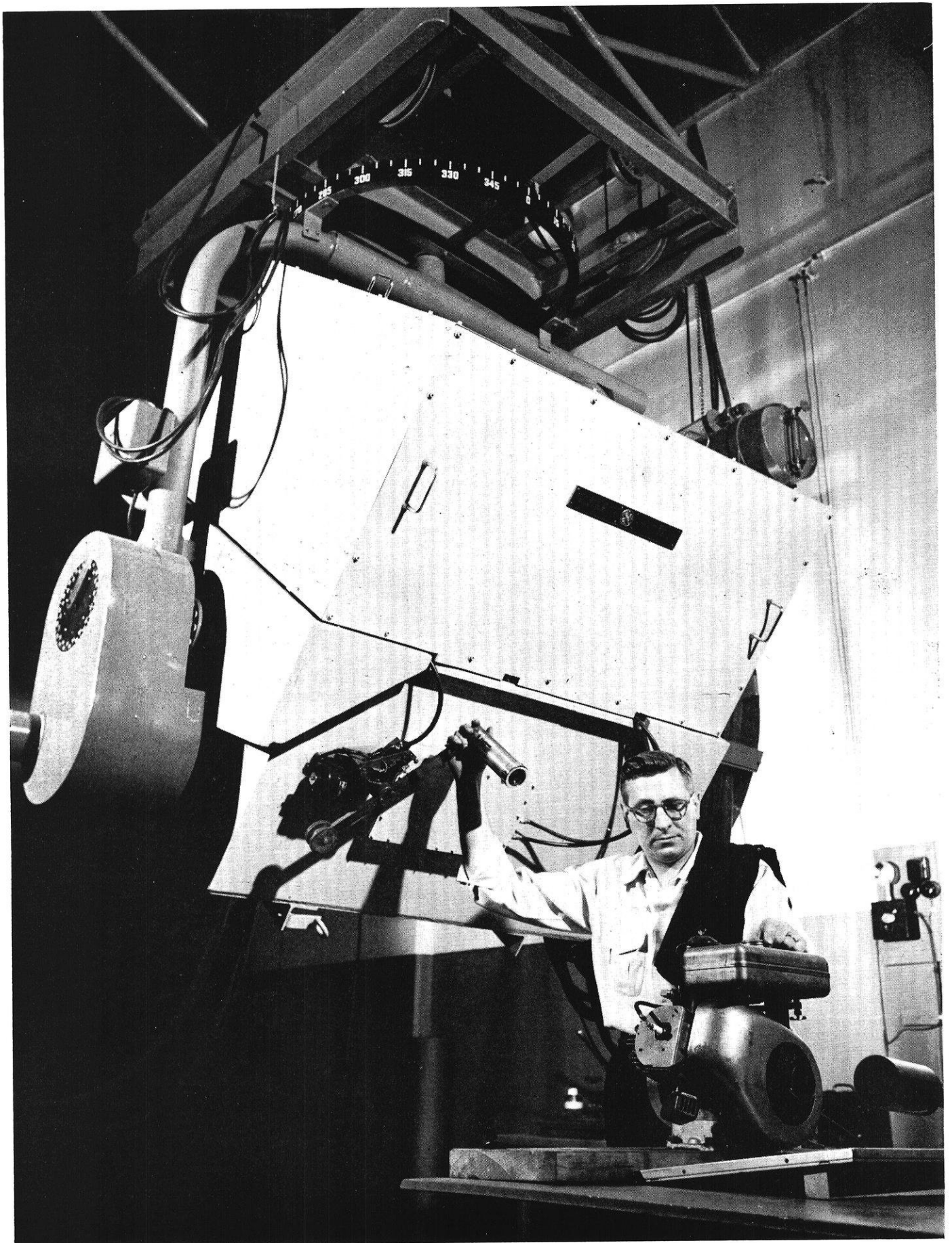
Soon it's going to be sound economics for us to transmit energy at 345 kv. There's not much precedent to draw on; much remains to be clarified about system design, operation, radio interference, line losses, relays, system integration, lightning performance. Where does the challenge stop?

Or take the problem of heat exchange. We're deep in atomic power plant design, where sodium is the primary coolant. Efficient heat exchange is essential! There's the same problem with respect to gas turbines and critical-pressure boilers, too.

We also plan to use our digital computers, and like equipment, in new, untried ways. Applying them to engineering and management problems, for example. But it will take time AND talent to do some creative engineering first.

If these challenges—a few at random—suggest a career that appeals to you . . . well, you appeal to us. Stop at your Placement Office and arrange an early interview.

DETROIT EDISON



X — R A Y S

YESTERDAY AND TODAY

by H. Edward Bills m'57

Almost sixty years ago on a bleak November day a professor of physics at the University of Wurzburg unlocked the door to his laboratory to begin a routine experiment that was destined to shake the world. For when Professor Wilhelm Konrad Roentgen discovered the X-ray that day, he provided the key with which to unlock the doors to countless answers to natural phenomena.

During the eighteenth and nineteenth centuries there was a rebirth of curiosity in man which led to intensive scientific investigation. It was during one of these investigations of cathode rays that Roentgen accidentally discovered the X-ray.

The start of the investigations of cathode rays was in 1859 when Julius Plucker managed to produce a very high degree of vacuum in a tube. When he passed a current through the tube he noticed that a greenish phosphorescence appeared on the walls of the glass tube. He traced the cause back to the cathode and named the rays after it. Other physicists were quick to take up the study of these cathode rays.

In 1869 Johann Wilhelm Ledorf found that the cathode ray could be stopped by placing inside the tube a solid screen fixed between the cathode terminal and the sides of the tube. From this discovery Sir William Crookes developed the theory that the cathode rays were streams of exceedingly small particles of matter, charged and projected with great speed. Crookes found that the rays would turn a vane placed inside a tube.

The Germans disagreed with this idea and Heinrich Hertz (discoverer of electric waves and thus wireless telegraphy) apparently proved that the waves were electricity by putting a small sheet of aluminum in a tube in front of the cathode ray which passed through the sheet and lit up the air behind it. His pupil, Phillip Lenard, continued these experiments and developed rays which could penetrate heavier metals. During one of his experiments he noticed the fluorescent effect of the rays.

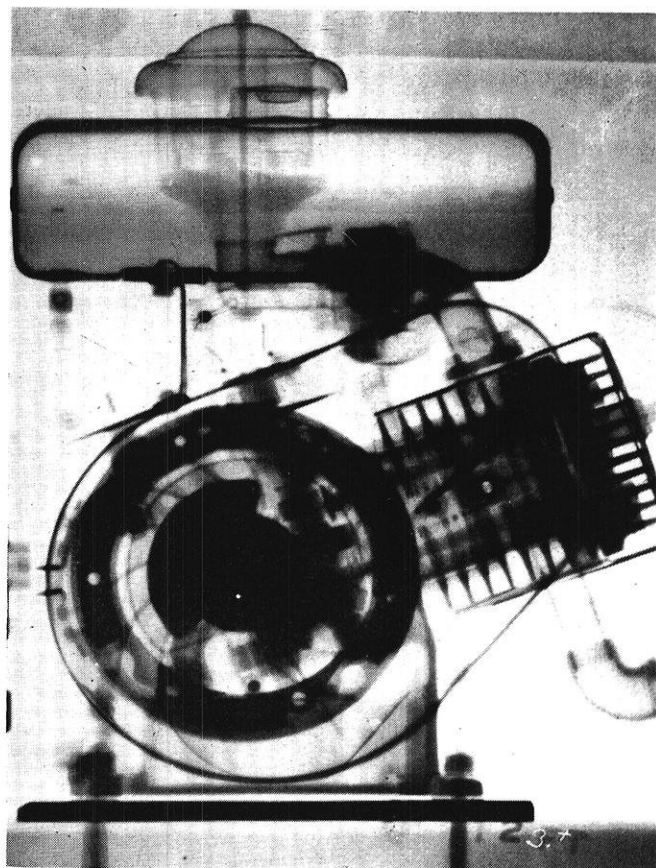
Roentgen was duplicating one of Lenard's experiments to see the fluorescent effect when he accidentally discovered the new ray. He was passing an electric discharge through a highly evacuated tube, and for the detection of the radiation causing the fluorescence he prepared a paper screen covered with crystals of platinum barium cyanide. With the tube completely covered

he found that this screen fluoresced even though it was far across the room. He noticed that when he put his hand between the tube and this screen a skeleton image of the bones was cast on the screen. He named the rays "X-rays" because of their unknown quality.

Roentgen carefully observed the rays and found most of their properties with astounding accuracy. He announced his discovery to the members of the Wurzburg Physical Society January 23, 1896, in a 4,000-word paper. For his work, Roentgen received the Nobel Prize for physics in 1901.

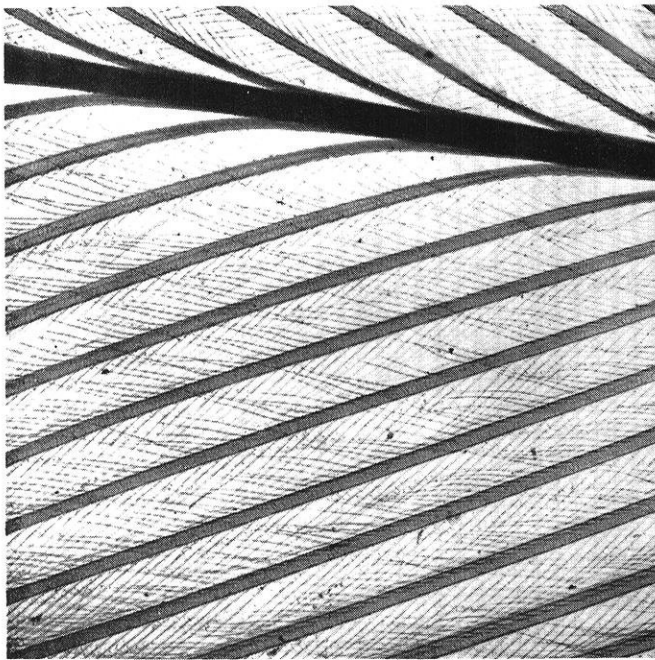
Today much more is known about the actual nature of X-rays than Roentgen surmised. X-rays are a form of radiant energy associated with the sudden change in

(Continued on next page)



—Courtesy General Electric

Combination of 15-million-volt betatron and special strobographic equipment not only sees through steel but "stops" action of running engine and X-rays its moving inside parts.



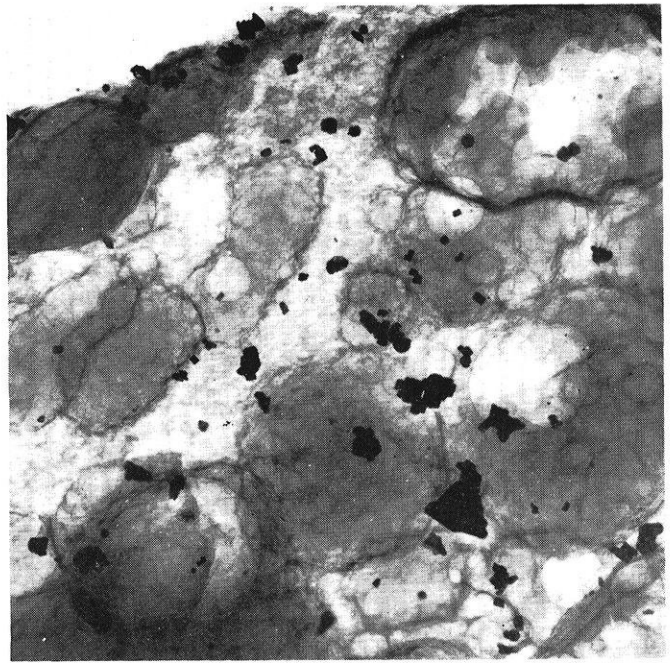
—Courtesy General Electric

An eider duck feather posed for this portrait under a new X-ray Microscope, revealed for the first time by G-E at the National Metals Exposition.

the velocity of free electrons or the transfer from higher to lower energy levels of electrons bound in an atom.

Now just what is radiant energy? By some process energy can be transmitted through space and produce heat at a great distance from the source. This transfer of energy through a great distance to produce heat or energy is known as radiation. The transfer takes place by means of electromagnetic waves.

All radiant energy falls into the electromagnetic spectrum. Radiation is divided into seven regions. They are named in order of decreasing wave length and in-



—Courtesy General Electric

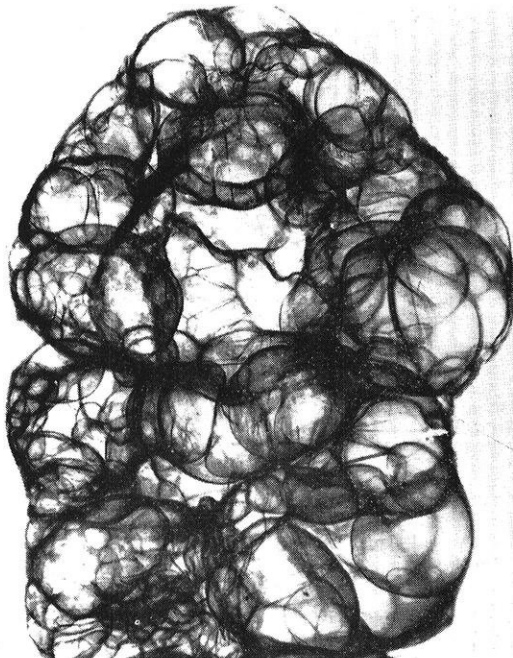
Here's what a potato chip looks like to a bacterium. X-Ray Microscope shows up the salt crystals with unusual clarity and reveals details of texture not easily seen by other means.

creasing frequency; radio, radiant heat, infrared, visible light, ultraviolet, X-rays and gamma rays.

Our eyes respond to only one sixtieth of the known range of the spectrum. Some of the radiations affect us directly in other ways. All keep us warm. Infrared are detected by our skin and X-ray and gamma destroy cellular structure which is exposed for too long a period.

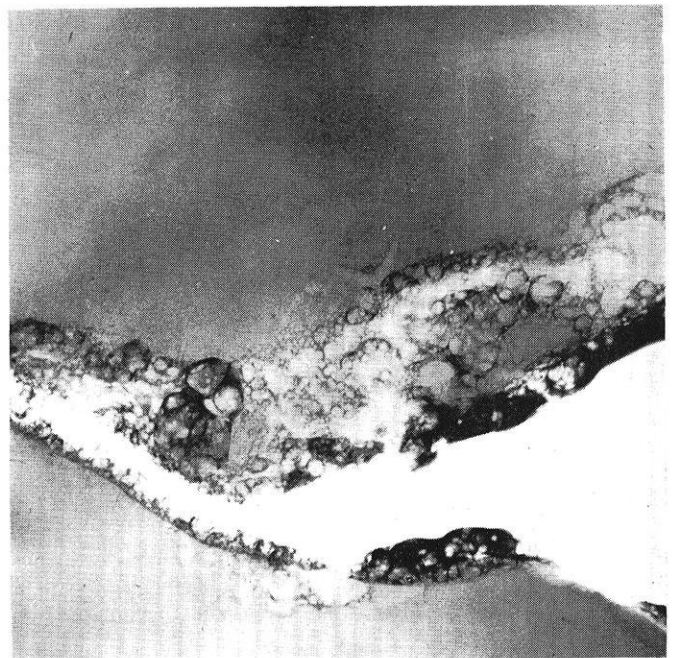
X-rays are among the shortest of all rays. There are two types, the hard which are produced from high volt-

(Continued on page 84)



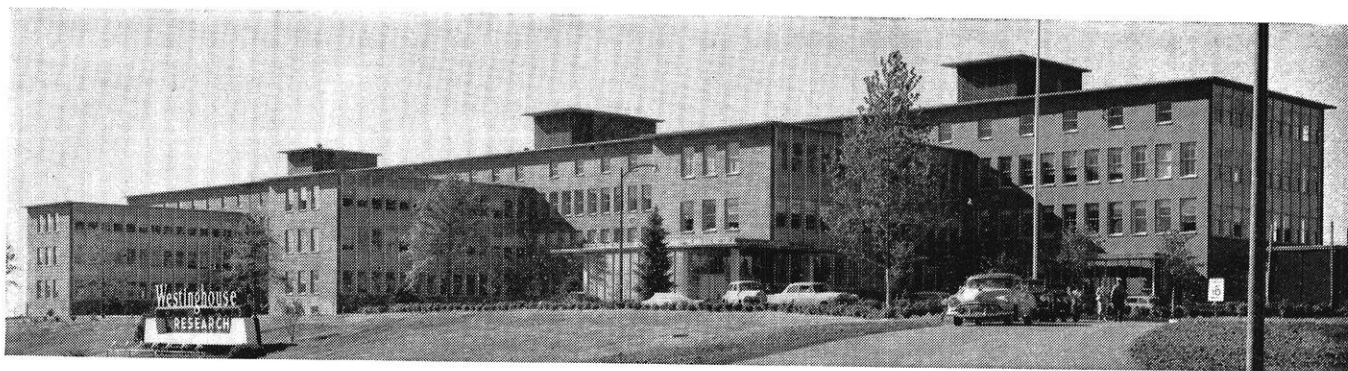
—Courtesy General Electric

Doodling of a drunken drillmaster? Could be, but it isn't. Actually a Rice Krispie, trade name of a popular cereal, taken in three dimensions by X-Ray Microscope.



—Courtesy General Electric

Map of South America? No, this is an x-ray microscopic view of what happens to a piece of mica when it is bombarded by electrons.



Westinghouse Research

... AN INVESTMENT IN YOUR TOMORROW

From its earliest days, Westinghouse has built a farsighted research program knowing that it was an investment in the future of the nation and in scientists and engineers like yourself. Recent evidence of that faith in tomorrow is the new Westinghouse Research Laboratories where more than 750 scientists, technicians and other staff members strive to make the unknown known.

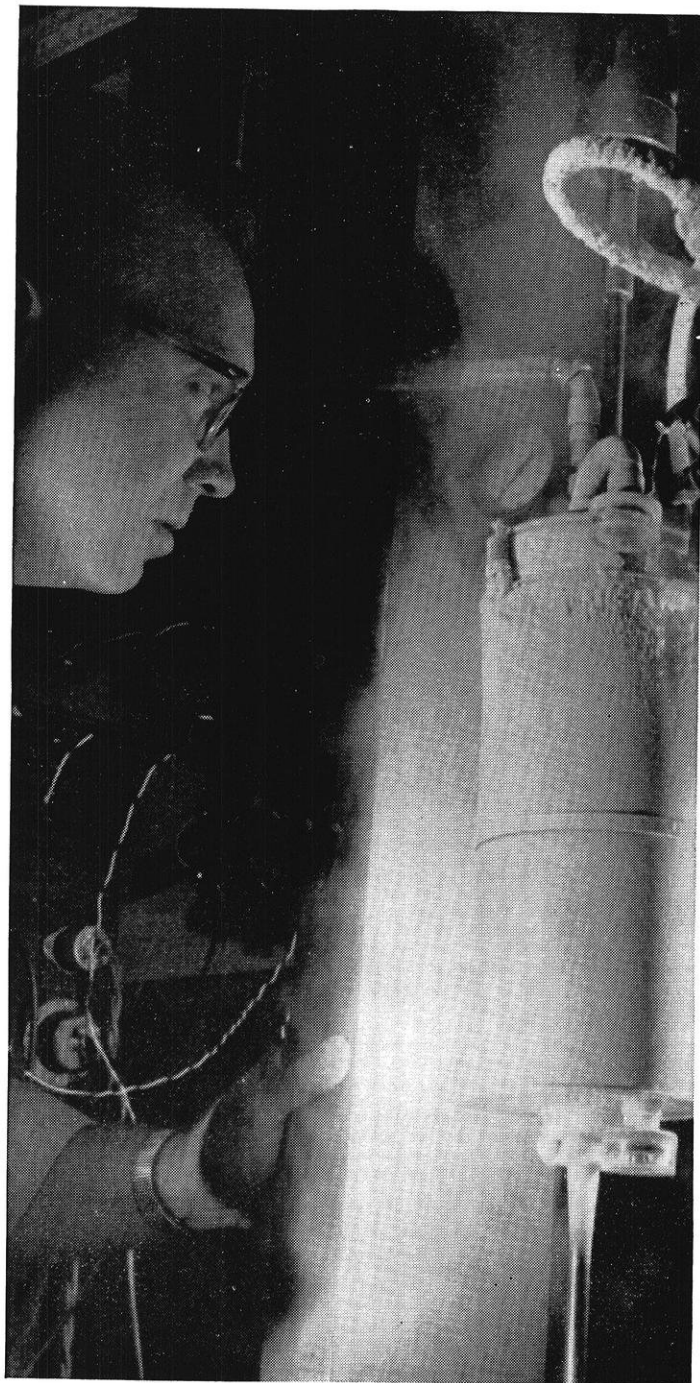
This research facility is an exciting frontier in the fields of Chemistry, Electromechanics, Electronics and Nuclear Physics, Insulation, Magnetics, Mathematics, Mechanics, Metallurgy, Physics, Semiconductor and Solid State Physics, and other technology. Pioneering here affects not only Westinghouse activities, but serves all industry and defense as well.

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Ask your placement officer to arrange a date with the Westinghouse Interviewer who will be on campus soon. Meanwhile, write for *Finding Your Place in Industry*, and *Continued Education in Westinghouse*.

Write: Mr. C. W. Mills, Regional Educational Co-ordinator, Westinghouse Electric Corporation, Merchandise Mart Plaza, Chicago 90, Ill.

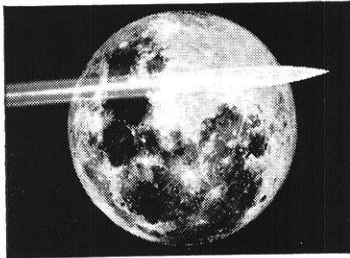
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*Graduates in engineering, physics,
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Careers, like cars, come in various models. And nowadays such things as security, adequate compensation, vacations-with-pay are not "extras" any more—they're just "standard equipment"!



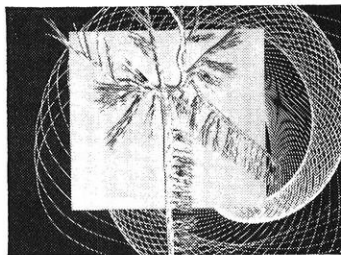
MISSILE DEVELOPMENT

much more than that. Such extras as creative work, advanced technology, latest facilities to implement your work—these all add up to rewards an ordinary job cannot give. You'll work with men of high professional standing. Your personal contribution will earn quick recognition.

It will be worth your while personally, as well as financially, to find out about the **extras** that go with a position in any of these four pioneering fields.

MISSILE DEVELOPMENT ENGINEERING

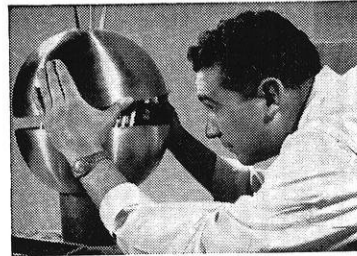
The SM-64 Navaho Intercontinental Missile is only one of the projects here. You can well imagine the exacting standards of the work, the quality of the facilities, the caliber of the men. Here you will deal with speeds well up into multiple Mach numbers, encountering phenomena that were only being guessed at a few years ago.



AUTONETICS

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As an individual, **you** decide whether you want white wall tires or maybe a sportscar. You should do no less in choosing where you want to work. At North American, fringe benefits are second-to-none; but you can get

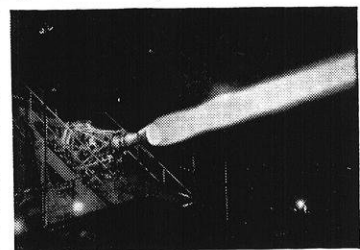


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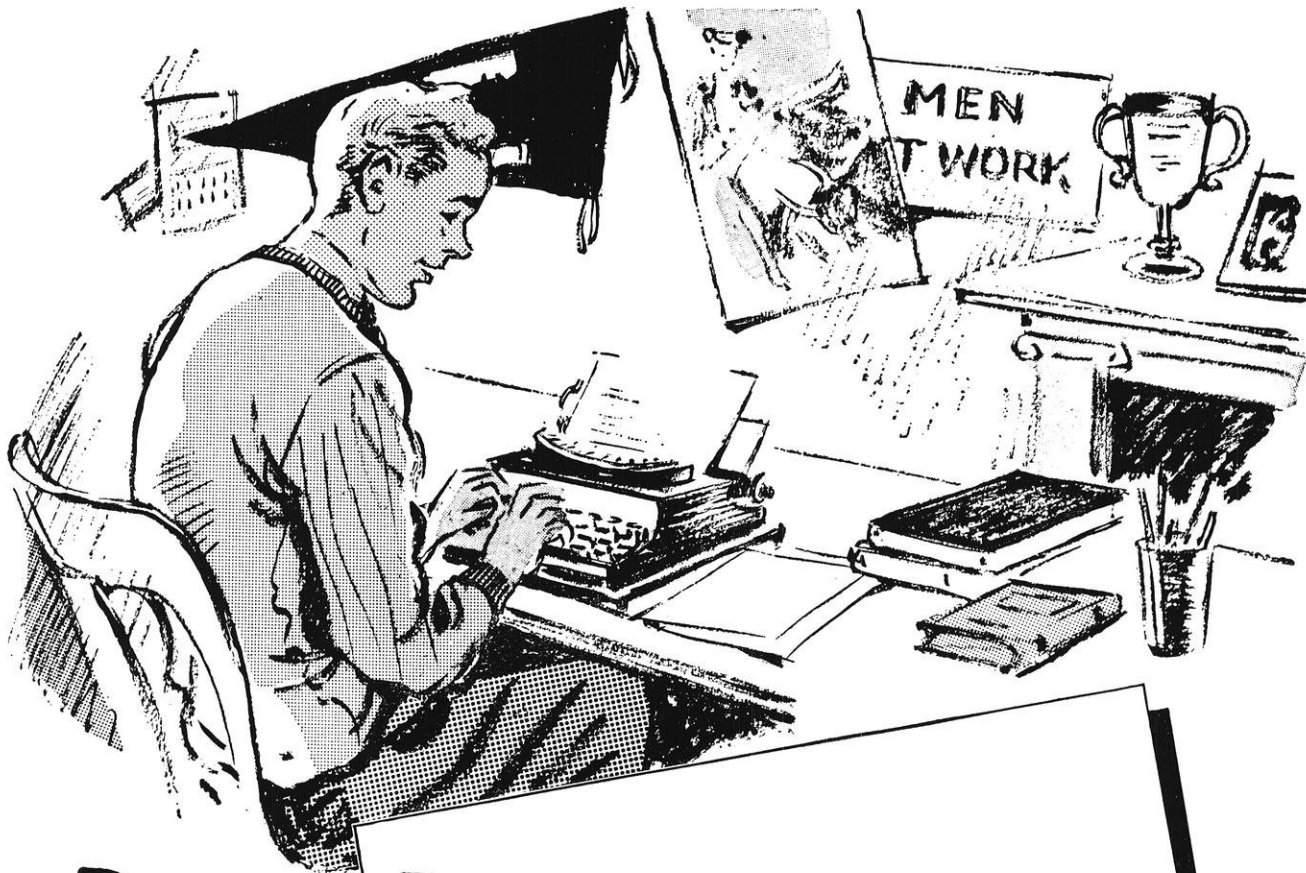
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THE WISCONSIN ENGINEER



Dear Dad,

Since I last wrote to you, I've been thinking about where I would like to live as well as where I would like to work.

Bob - you remember him - comes from New Jersey. He's been telling me a lot about it and it all adds up as a good place to live.

Public Service Electric and Gas Company - one of the country's more important utility companies - serves a section of the state between Philadelphia and New York. The Company has excellent training courses for Cadets in its Electric and Gas Operating Departments, in Sales Engineering, and in Commercial Management work.

As Bob says, New Jersey has everything for pleasant living: seashore and mountains for recreation; New York and Philadelphia for big city culture - the Metropolitan Opera - Philadelphia Symphony, etc. He says home life in smaller localities is happy and congenial (you know how Mary likes that kind of life and, after all, I must take her into consideration).

Don't be surprised if I write to you that I've taken a job with Public Service in New Jersey. It sounds good to me.

Affectionately,

Bill

Representatives of Public Service Electric and Gas Company will visit your campus sometime in the near future. They will be glad to tell you about the company's job opportunities.

Public Service Electric and Gas Company,
Room 2152A, 80 Park Place, Newark 1, N. J.

Please send me literature on New Jersey
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**PUBLIC SERVICE ELECTRIC
AND GAS COMPANY
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'57 CHRYSLER CARS

General Comments on Complete Line

With the roofs of all Chrysler cars lowered by as much as five inches without sacrificing headroom, comfort, accessibility or road clearance, the big question is: How did they do it? Let's look at Dodge's answer.

For one thing, says Dodge Chief Engineer Dean Engle, there is no truth to the frequently-heard statement that the use of smaller, 14-inch tires is responsible. Actually, he explains, the decision to use the smaller but wider tires was based on a desire to get "more rubber on the road" and not to reduce car height.

The use of torsion bars in place of the old and bulky coil front springs permitted many front-end elements to be shifted and made more compact, he said. A new and much smaller paper element air cleaner also helped to lower the car's silhouette, as well as a floor that is recessed in the car frame. Other design changes made better use of previously wasted "dead" space and cut inches from the overall height.

New methods of automotive design and construction, along with the use of new materials, have produced a substantial increase in driver vision and a lower roof line. Stronger than ever, the new roof is also thinner, contributing not only to the sleekness of the car's appearance, but extending glass areas all around. Increases up to 53 per cent have been made in the use of glass in the 1957 Dodge.

The old vertical coil front springs are gone from the 1957 Chrysler products, which presents a new type modern front suspension, Torsion-Aire.

Horizontal steel torsion bars have replaced the upright coil type springs, and the new springing is achieved by slightly twisting these sturdy, straight bars. The torsion bars give a smoother softer ride, last longer, require less maintenance and occupy less space—a major factor in lowering the car's overall height.

The mechanical torsion bars reduce weight by 30 percent. Safety-Sphere joints reduce steering gear friction, greatly reducing steering effort. An anti-brake dip device, which reduces forward pitch by 65 percent, is also standard.

The completely new front suspension and steering system creates a remarkable degree of stability under force of acceleration, braking, and cornering. At the same time, according to engineers, the vehicle is more softly sprung than ever before. For the first time on American passenger cars; ball joints are combined with torsion bar springs to create a unique combination of ride and handling characteristics for all Chrysler cars. A new rear suspension incorporates relocated leaf springs, which contributes to the new better ride.

Total-Contact Brakes

Much safer in operation, easier to use and more economical to maintain, new, floating-shoe, total-contact brakes are standard equipment on all 1957 Chrysler products.

Total-contact brakes, responding instantly to a toe touch on the eight-inch-wide pedal, give 30 per cent longer life and require one-quarter less pedal effort for any braking operation.

Torque-Flite Transmission

Providing faster starts from a standing stop, greater driving economy, and quicker passing response, the new Torque-Flite push-button transmission is available this year on all Dodge V-8's, DeSoto's and Chrysler's.

The Torque-Flite is a combination of a high-performance torque converter coupled to an automatic, three-speed planetary gear box.

Five selector buttons for Torque-Flite are located conveniently on the left side of the instrument panel, with "first", "second" and "drive" forward ranges, plus neutral and reverse. The "drive" range is used for 95 per cent of all driving. "First" provides maximum power for sand or mud, or top engine-braking for descending long, steep hills. "Second" may be used for acceleration or for engine-braking on lesser grades.

Weather Control Is Compact and Simple

Automotive air-conditioning has come into its own with the elimination of all "plumbing" from the trunk.

Elimination of air-conditioning paraphernalia from the trunk gives more storage space and also ends the possibility of damage to piping heretofore required underneath the car. A compact unit, located entirely under the engine hood, it offers ideal inside "climates" regardless of outside weather. It is easily operated by a simple set of dash-mounted fingertip controls and the one system both heats in winter and cools in summer. It dehumidifies incoming air and filters pollen, road dust and exhaust fumes. A unique outlet system provides complete car circulation.

Heating and defrosting equipment is available without the complete, all-weather air-conditioning system, if desired. For maximum defrosting action, warm air can be directed through vents on top of the instrument panel to any portion of the windshield. A rear-window defroster is also available.

THE END

THE WISCONSIN ENGINEER



'57 PLYMOUTH

Power and Styling Highlight This Low Priced Car

Lower, wider and more powerful, the 1957 Plymouth represents a complete change in styling, body structure and chassis.

The new car is the result of a telescoping of Plymouth's forward planning.

Plymouth President J. D. Mansfield announced, "the car we are about to introduce has the style and features of the car we had thought, only a few years ago, as possible for about 1960. We have moved faster than we had hoped. The public has shown an eagerness to accept dramatic change."

1957 Plymouth models are as much as five inches lower than corresponding 1956 models. The wheelbase has been lengthened from 115 inches for all models in 1956 to 118 inches for standard models and 122 inches for Suburban station wagons in the 1957 line.

In chassis design, Plymouth has accomplished its most significant change since the introduction of independent front wheel suspensions with coil springs in 1934. The feature is called Torsion-Aire.

All of the 1957 Plymouths have more powerful engines than 1956 models. The standard V-8 for all models except the Plaza is the new Fury 301, the number signifying displacement. The Plaza V-8 retains a displacement of 277 cubic inches but, like the Fury 301, has a new camshaft, new carburetion, and other innovations to achieve increased performance and economy.

New full-view windshields with 45 per cent greater glass area in sedans and Suburbans and 43 per cent greater in hardtops.

A new line of Suburban station wagons with many advanced features including a rearward facing third seat in nine-passenger models, roll-down tail gate window, wrap-around quarter window, torsion bar tail gate hinge, optional inside concealed luggage compartment with lock on all six-passenger Suburbans, and a fuel tank mounted in left rear fender.

As in the 1956 offering, Plymouth for 1957 offers four lines of standard automobiles. Belvedere is the top line, Savoy the middle and Plaza the lowest-priced. A two-door hardtop is available in the Savoy line and both a two-door and four-door hardtop are available in the Belvedere line.

(Continued on page 72)





'57 DODGE

Entirely New Riding Characteristics

Lower, longer and wider with far-reaching advances for smoother, quieter performance, is the 1957 Swept-Wing Dodge.

New principles of auto design and manufacture, with new applications of materials, have been combined to produce an advanced design 1957 Dodge with "entirely new riding characteristics, virtually free of vibration, noise and road shock."

Five Inches Lower

An all-new suspension system and newly designed frame give the 1957 Dodge a much lower center of gravity, providing road-hugging qualities formerly found only in high priced sports cars.

Not only is this a major contribution to highway safety, but is also enabled Dodge to reduce car height by as much as five inches, so that the new Lancer hardtop stands less than 55 inches high.

The 1957 Dodge features swept-wing rear fenders comparable to the rudders of airplanes or racing boats. Keynote of the Dodge styling theme, they also have the definite functional purpose of stabilizing the car in crosswinds.

Bigger Engines

Dodge offers a new line of engines for 1957. Displacement of the Red Ram V-8 has been increased to 325 cubic inches and the compression ratio to 8.5 to 1. The Super Red Ram engine (power pack) for Custom Royal models is equipped with four-barrel carburetor, dual exhausts and extensions, special distributor, special air cleaner and four-barrel intake manifold. A special D-500 engine, featuring a redesigned intake manifold

and a four-barrel carburetor, also is available. Compression ratio of the Getaway 6 is 8.0 to 1 and the displacement is 230 cubic inches.

Safety Features Retained

Two hold-over features of the 1957 Dodge are the Life-Guard safety door latches and the independent emergency braking system.

The Life-Guard safety door latch automatically secures doors against accidental opening. New recessed door handles pull out with the same simple action used in opening a drawer, and offer no hazard to fingernails.

The independent emergency brake, a Dodge exclusive in the medium price field, gives the driver two completely separate braking systems.

SPECIFICATIONS—1957 DODGE

Dimensions		
	4-door Sedan	2-door Lancer Hardtop
Wheelbase	122.0	122.0
Overall Length	212.2	212.2
Overall Width	77.9	77.9
Engines		
	Red Ram V-8*	Getaway "6"
Displacement	325	230
Compression ratio	8.5 to 1	8.0 to 1
Valve arrangement	Overhead-lateral	in-line
Bore	3.69	3.25
Stroke	3.80	4.63
Recommended fuel	regular	regular

*Super Red Ram engine (power pack) standard on Custom Royal and available on other models (4-barrel carburetor, dual exhausts and extensions, special distributor, special air cleaner and 4-barrel intake manifold). D-500 version has double rocker arms, dual exhausts and extensions, and is available with either one or two 4-barrel carburetors.

THE END

THE WISCONSIN ENGINEER

'57 DE SOTO

New Firesweep Line

De Soto has introduced an all-new, lower-priced Firesweep, a third model that makes the company's 15-car line the largest ever offered in the division's 28-year history.

The new car features many automotive advances, including a revolutionary new suspension system, a newly designed V-8 engine, a triple-range push-button transmission, and an all-weather new air conditioning system.

The Firesweep, which its sister cars, the Fireflite and Firedome, now gives De Soto a price coverage in 91% of today's car market; excepting the very low-priced field.

A highlight feature of the new De Soto Firesweep is a 122-inch wheelbase incorporating a number of revolutionary suspension advances. This results in the smoothest, most comfortable ride possible and is termed Torsion-Aire Ride.

Also contributing to the Firesweep's smoother ride and easier handling are new 14-inch tires with a wider tread for greater traction and better cornering, and requiring only 22 lbs. air pressure. Together with the new "step-down" chassis, they help account for the Firesweep's unusually low silhouette, measuring barely four feet seven and one-half inches from road to roof.

The completely new De Soto Firesweep engine is a V-8 powerplant rated at 245 hp, with a 325 cubic inch displacement, 8.5 to 1 compression ratio and a new "high-intensity" camshaft. Its polyspheric combustion chambers give higher thermal efficiency and prove economical operation with "regular" gasoline.

Five De Soto Firesweep models are offered: a four-door sedan, two and four-door Sportsman hardtops, the Shopper two-seat station wagon and the Explorer, a three-seat wagon based on Chrysler Corporation's "Plainsman" dream car. In the latter, the third (rear) seat faces backward, "observation car" fashion. Third-seat passengers gain entry through a unique tailgate which doubles as an entry step.

The new cars are available in 64 different color combinations, 14 solids and 50 two-tones.

NEW FEATURES OF THE 1957 DE SOTO

General

All new body styling and construction. Styling features long, high-swept tail fins canted outward, terminating in new triad tail lamp cluster. All new front and rear bumpers and grille.

All new trim and interior styling, including new instrument panel design and new fabrics (ladderstitched brocade, ripple cloth, Westminster tweed, textured nylon, silvered brocade, starlight cord, nugget tweed).

All new chassis, including frame, front and rear suspension.

Firesweep Models: New lower cost model line-up in Firesweep Series on shorter wheelbase (122" vs. 126" on Fireflite and Firedome). Same basic bodies as Firedome and Fireflite behind cowl new front end sheet metal.

Station Wagons: New three-seat Explorer station wagons in Fireflite and Firesweep models, with rearward facing third seat.

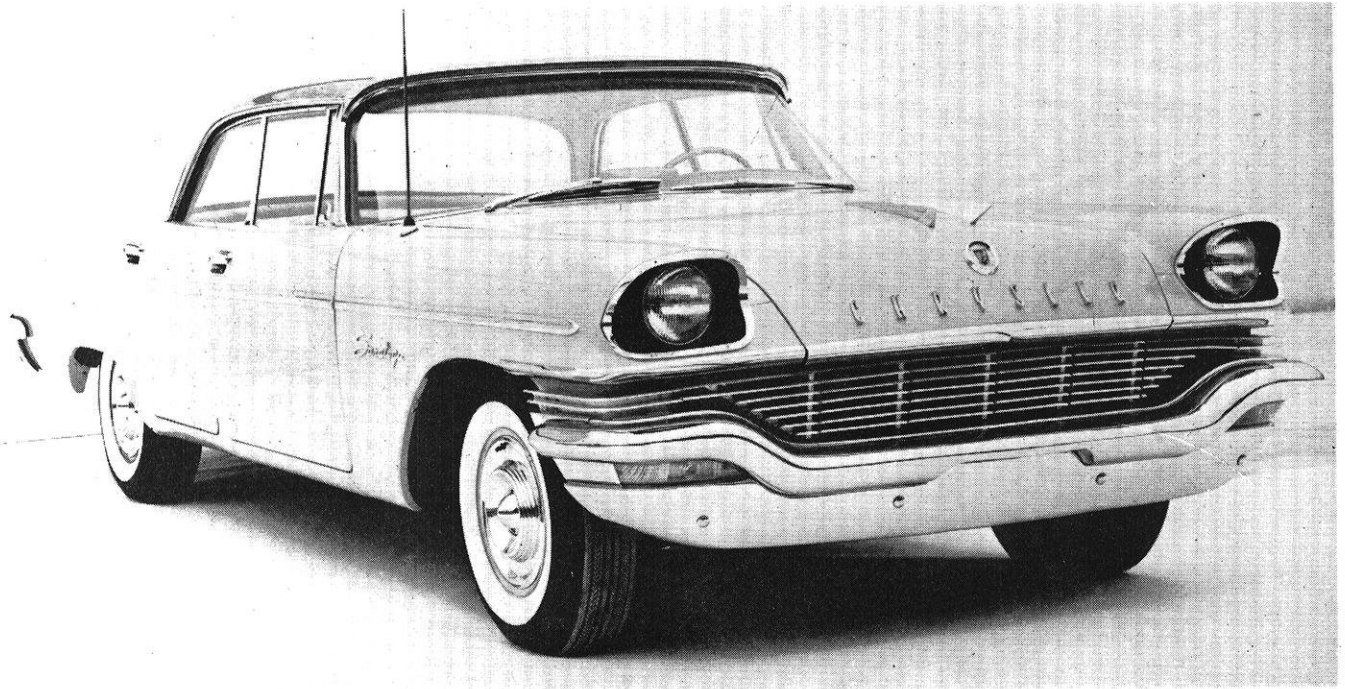
Four-Door Sportsman Hard-Top: New one piece rear door glass drops completely below garnish trim.

Convertible: Fireflite and Firedome convertible models feature compound-curved windshields.

Fireflite Sportsman Coupe: Features distinctive new high rear glass, with optional tint strip at top when equipped with Solar glass.

(Continued on page 74)





'57 CHRYSLER

New Torsion-Aire Suspension

The 1957 Chrysler features a new road-hugging design with floors and seats dropped allowing roofs to be lowered as much as five inches.

Combining such innovations as twin headlights, three-speed pushbutton Torque-Flite transmission and a revolutionary new Torsion-Aire suspension, the '57 Chryslers are offered in the New Yorker and Windsor series, plus an all-new Saratoga series in the middle-price range.

New Suspension, Bigger Engines

Three new V-8 engines—a more powerful FirePower V-8 in the New Yorker series, a new Spitfire V-8 in the Saratoga series and a new improved Spitfire V-8 in the Windsor series—offer higher performance and increased economy.

The 1957 Chrysler also introduces improved full-time coaxial power steering, lower-pressure tires, deep-section safety steering wheel, aluminum-framed window openings on sedans, and improved total contact center-plane brakes, which, Chrysler engineering tests show, have the longest life of any brake yet developed.

The Torsion-Aire suspension system, new lower control arms, easier-steering ball joints, complete rubber isolation and a new front sway bar all contribute to elimination of brake "dip" and give the car the flat-cornering comfort and safer steering control of a sports car. An adjustment screw in the new torsion bar sus-

pension system makes adjustment of the car's front-end height a simple operation.

Three Models in New Saratoga Series

The Saratoga series, a newcomer to the Chrysler line in 1957, is built to market between the Chrysler Windsor and the Chrysler New Yorker. It is offered in a four-door sedan, a two-door hardtop and a four-door hardtop.

The Chrysler Windsor, Lowest-priced Chrysler, is offered in a four-door sedan, two-door hardtop, four-door hardtop and four-door Town and Country station wagon.

The Chrysler New Yorker is offered in a four-door sedan, two-door hardtop, four-door hardtop, convertible coupe and Town and Country station wagon.

Wheelbase measurement of all models is 126 inches. They are available in a choice of 21 contemporary colors and 121 color combinations. Longer, higher flight-sweep fender fins flow forward to suggest a poised dart ready for flight and emphasize the low, sculptured steel motif.

New Power for Greater Safety

Compression ratio of the Spitfire engine in the Windsor series is increased from 8.5 to 9.25 to 1, bore diameter increased to 3.94 inches, and displacement increased to 354 cubic inches resulting in a substantial increase in horsepower.

'57 IMPERIAL

Four Inches Lower—Three Inches Wider

A lower, sleeker and more powerful Imperial for 1957, features rakish, arrested-motion styling, new torsion bar suspension, curved side glass, dual headlights and four-way wraparound windshield.

"Although retaining the elegance and commanding grace of its heritage, the 1957 Imperial sets a new standard in contemporary styling. It incorporates such advanced engineering features as three-speed pushbutton TorqueFlite drive, ball joint torsion-bar front suspension, wider low-pressure 14-inch wheels, infinitely-adjustable six-way power seats, combined air conditioning and heating system, recessed safety door handles and torsion-bar top lock on the first Imperial convertible since 1951.

The 1957 Imperials are nearly four inches lower and three inches wider, yet include more leg room and head room than last year's models.

New Double Wraparound Windshields

A new double wraparound windshield adds 54 per cent more front glass area, for driving ease and safety. Another styling innovation for 1957 is curved side glass, which follows the sculptured lines of the body and emphasizes the car's low center of gravity.

Gunsight Tail Lights Integrated

The rear deck slopes sharply to the bumper between rear tail fins canted outward to emphasize width. A deck lid with molded spare tire impression is available



as an option. Large openings in the wraparound rear bumper house recessed back-up lights, while twin tail pipes are nearly concealed behind the bumper.

Gunsight tail light, Imperial's striking trademark, have been molded into rear fenders for the first time, contributing to the uncluttered classic lines of the car.

Wider Choice of Models Offered

Imperials are available in a choice of four separate series which includes all popular body styles. The Imperial series is offered in a four-door sedan, two-door

(Continued on page 72)



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DESIGN

Introducing “dream car” design, the 1957 Mercurys are distinguished by an unusually low silhouette, a completely new and larger body, choice of 255 hp. Safety-Surge V-8 or 290 hp. Turnpike Cruiser engine and a unique new floating ride which pioneers air-cushion rear suspension on many models.

The new Mercury’s “dream car” styling is based on the XM-Turnpike Cruiser—an experimental model.

The 1957 Mercury is 5 inches longer than the previous model, 3 inches wider and 4 inches lower. Head-room has been increased 2 inches and there is also more hip room and leg room. Wheelbase is up 3 inches from 119 to 122 inches and the front tread is one and a half inches wider.

With sharply reduced car height, the roof has become an integral part of car design. Mercury has imposed a cleancut channel in the center of the roof which continues in the rear deck with the channel extending past the rear window into the package tray. For better vision, total glass area has been increased by 700 square inches.

The 1957 Mercury features are:

New Keyboard Control with Merc-O-Matic transmission which is mounted on the instrument panel to the left of the steering column. It features a “Neutral/Start” button which automatically cancels the previous push button setting and engages the starter when the ignition is in the “On” position. Buttons are illuminated for night visibility.

Air Cushioned Rear Suspension—is featured in many models as part of Mercury’s “floating ride,” designed to smother bumps, vibrations and road noises and provide smooth, effortless driving. An air cushion (at atmospheric pressure) the size and shape of a 6-inch by 1½ inch tire is inserted between the frame and the rear spring front eye and absorbs both driving and braking forces together with bumps and jounces encountered in any type of road. The air-cushion suspension is available in the new series of Mercury station wagons and also on all Monterey and Montclair models

(Continued on page 76)



'57 BUICK

Room To Spare With A Low Silhouette

The new line features all-new roomier bodies, designed in new "dream car" styling, new and more powerful V-8 engines, and a completely new chassis with improved ride and handling.

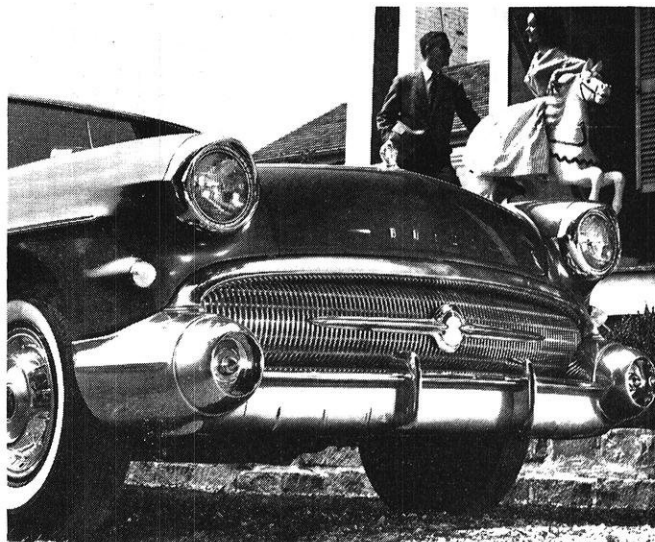
All of the new cars have been reduced in height. Some models are as much as three and three-eighths inches lower than last year, without any sacrifice in ground clearance. Headroom remains the same and legroom has been increased in the four-door hardtops.

The new styling presents new front and rear design, bigger panoramic windshields with a more rakish slant to the pillars, new bumpers both front and rear, and three-piece back windows on the Special, Century and Roadmaster.

One-piece panoramic back windows are standard on Super models and also are optional on the Roadmaster at no extra cost.

Newly designed ventiports, new sculptured sweep-spear molding, and full rear wheel cutouts, Buick hallmarks, have been retained on all models.

The rear body pillar on the Roadmaster and Super series is wider and slopes forward from top to bottom, lending a racier appearance to the overall styling. On four-door models the portion of the body pillar above the doorbelt line is included in the door panel. This



feature, plus the fact that the entire rear door is located forward of the rear wheel cutout, provides easier access to the rear seat.

The lower silhouette of the new Buicks was made possible by changing the frame design to permit the body to nestle between the side rails.

Two entirely new features have been incorporated in the front end suspension system for 1957.

For the first time a ball-joint suspension is used, improving the stability of the car on corners and curves, and a new anti-dive device reduces front end dive on fast stops by approximately 60 per cent.

Coil springs both front and rear are continued on all models.

A new 2-section torque tube permits a lower drive tunnel and therefore more legroom and headroom. Frame rails have been widened, spindle ball joints and knuckles inclined inward seven degrees, the front stabilizer strengthened, and new parallel steering linkage improve riding and handling.

Buicks' variable pitch Dynaflo has been redesigned to accommodate the thrust of the 364-cubic-inch engine. Acceleration and smoothness of operation have been improved by (1) a new fabricated steel pump which is completely balanced while the unit is oil filled, and (2) by linking "Low" and "Reverse" with the low-angle stator pitch.

A new 364-cubic inch V-8 engine, with 10-to-1 compression ratio, generates 300 horsepower in the Roadmaster, Super and Century series, an increase of

(Continued on page 78)

'57 OLDSMOBILE

"Rocket" Features Throughout

Oldsmobile for 1957 has distinctive styling innovations and mechanical improvements in every one of the 17 body styles in three series of cars. The body is completely new, with deeper bumpers and a redesigned grille. Mechanical and structural advances include a new wider and heavier chassis, new "pivot-poise" front suspension of a design that resists dipping, improved rear suspension, a new 277-h.p. "Rocket" engine, known as the T-400 due to its high torque throughout the driving range, and new 14-inch wheels.

"More new features and design changes have gone into the 1957 Oldsmobile than any of its predecessors in at least the past two decades. This has made it necessary for Oldsmobile to spend double the amount for the 1957 model change than any previous year."

Four new body styles have been added to the 1957 Oldsmobile line—three Fiesta station wagon models and an economy priced "88" convertible coupe. The division of body styles for 1957 includes seven in the Golden Rocket "88" series, six in the Super "88" series and four in the Starfire "98" series.

Roadability and ride of the 1957 Oldsmobile have been improved using a wider and heavier frame, and the improved front and rear suspension. The frame is eight inches wider than in 1956. Rear shock absorbers have been moved outboard of the frame to a position outside the leaf springs in order to obtain a wider spring base and reduce roll on curves. The new 14-inch wheels and larger tires also contribute to the improved riding qualities.

The 1957 "Rocket" engine has been boosted from 240 to 277 h.p. and the four-barrel quadri-jet carburetor is now standard on all series. Engine displacement has been increased from 324 to 371 cu. in. by lengthening the piston stroke and increasing the bore diameter. Compression ratio has been raised to 9.5 to 1.

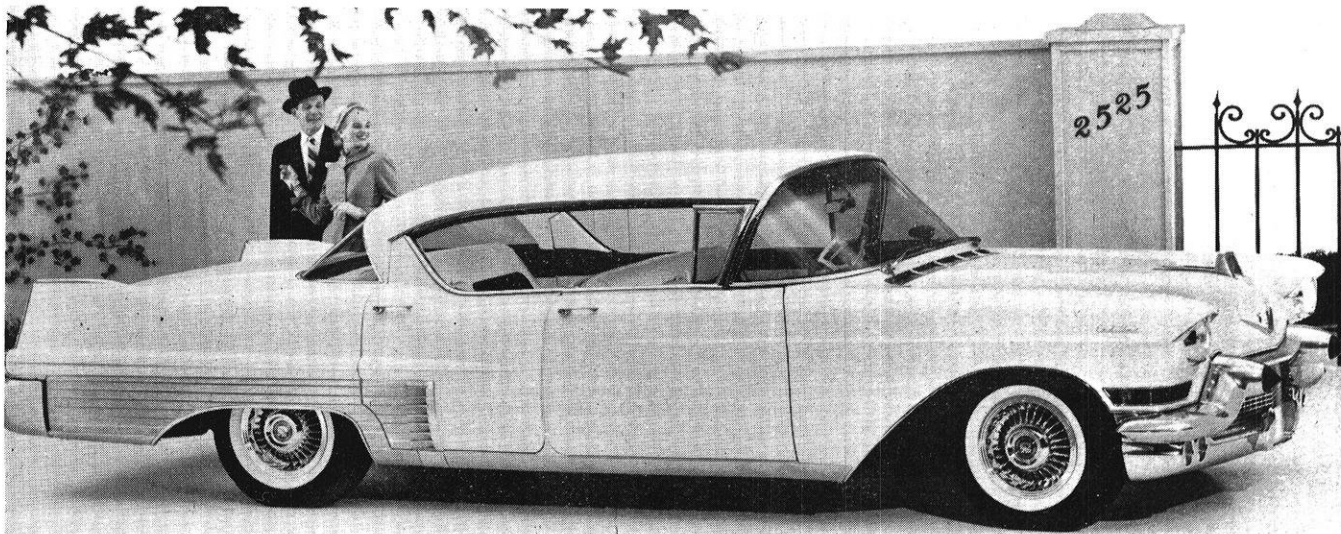
Maximum torque is advanced from 340 or 350 to 400 ft.-lb. at 2,800 r.p.m. New closed skirt pistons, main bearings of aluminum and a snorkel type air cleaner are other new engine features for 1957. A new two-piece propeller shaft has been utilized to assist lowering car height. Jetaway Hydra-Matic Drive, power steering and power brakes are standard on the 1957 Starfire "98".

Engine exhaust ports are 20 per cent larger to improve the scavenging of exhaust gases. Outrigger supports have been added to support the ends of the rocker arm shafts. This reduces shaft deflection, minimizes valve noise and improves valve mechanism durability. Valve guides are bored after rather than prior to assembly, allowing more accurate guide-to-seat relationship and reducing valve seat runout. Exhaust valves are made of an alloy steel which provides greater "hot strength". The exhaust valve head contour has been revised for greater flexibility and durability and reduced weight.

The crankshaft main bearing journal diameter has been increased one-quarter inch to $2\frac{3}{4}$ inches to strengthen the crankshaft and provide more bearing area. The crankshaft flexplate for the Jetaway Hydra-

(Continued on page 92)





'57 CADILLAC

New Frame and Engine Featured in the Prestige Car

From bumper to bumper, from top to bottom, the 1957 Cadillac is completely new.

The over-all silhouette has been lowered as much as three inches; the hood and rear deck are lower than the fender profile; the traditional Cadillac tail fin is restyled and two additional four-door hardtops make their appearance in 1957.

These changes are to be found on seven of the nine models. The two Eldorados, the Biarritz and the Seville, are distinctively different, featuring a rear quarter panel and rear end styling that puts the "dream car" into reality as a limited production car.

A revolutionary new frame has helped achieve the new low silhouette.

A completely new styling innovation in 1957 models is the use of rubber tips on the bumper guards. Matching fog and parking lights are located in the outer ends of the bottom bumper section.

Behind this front end is a 300 horsepower engine, the most powerful engine ever offered by Cadillac as standard equipment. This V-type overhead valve engine has a 10 to 1 compression ratio, a four-inch bore and a displacement of 365 cubic inches.

The Eldorado has the 300 horsepower engine or a modified engine with twin four-barrel carburetors and a 325 horsepower rating.

FACT SHEET ON 1957 CADILLAC

Exterior Differences on 1957 Models

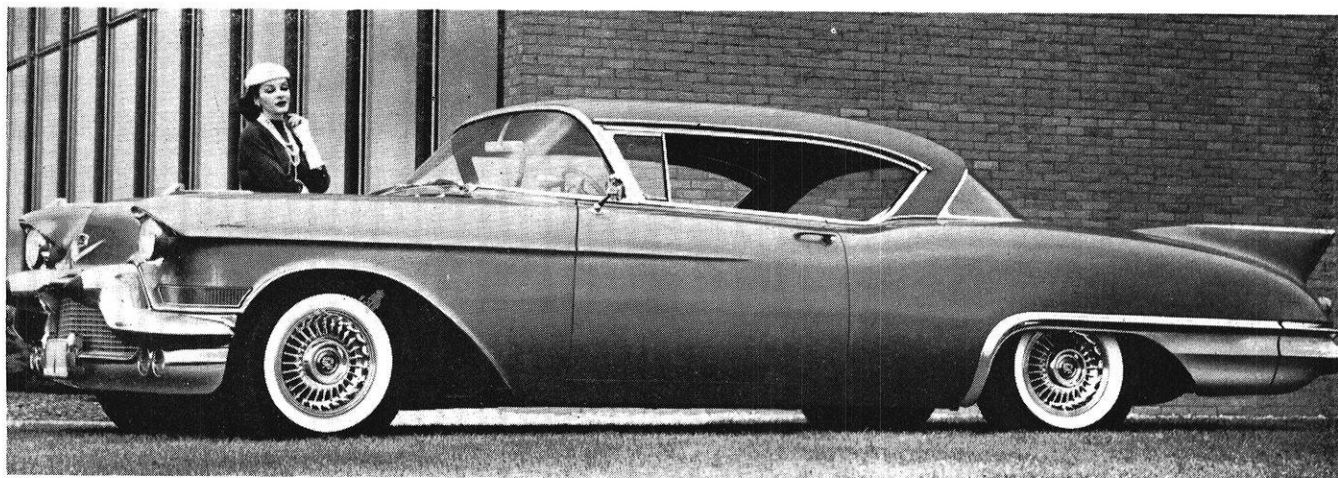
The body is entirely new. The over-all height has been reduced three inches on the 62 Sedan and 60 Special — from 62 to 59.1 inches.

The height of the 62 Coupe, Coupe de Ville, and Convertible is reduced nearly two inches.

Center posts are removed from all models except the Series 75 Seven-Passenger Limousine.

All four-door bodies, except the limousine, have only four side windows and a new curved, one-piece windshield.

(Continued on page 78)



PRINTING

THE FLEXOGRAPHIC WAY

Flexible printing, known as "Flexographic" printing in the trade, is a little known but economical and adaptable means of printing in production amounts. In this article the author follows the process from its beginning in history to its use in today's packaging industry

by Charles M. Larson e'58

The principle of Flexographic printing has been known for many years; probably for as long as men have been using rubber stamps, or the official "chops" of Asiatic countries.

Anything having an image of letters or characters carved on its face and made suitable for printing might be said to employ the flexible printing method. An example of this process that we may be familiar with is finger-printing. In finger-printing, India-ink is rolled out on a smooth surface, our flexible fingers are rolled into the ink, and a print is made of our fingers on a sheet of paper.

Flexible printing, in the jargon of the trade "Flexographic", consists of almost exactly the same methods as finger-printing. Molded rubber plates are stuck on a roller and used to reproduce many designs. The construction of the high speed continuous presses allows printing up to six colors on the same area of paper.

Today, Flexographic printing is not one of the most important nor most widely used processes in terms of annual tonnage of goods finished, but it is by far one of the most economical and adaptable means of printing in production amounts.

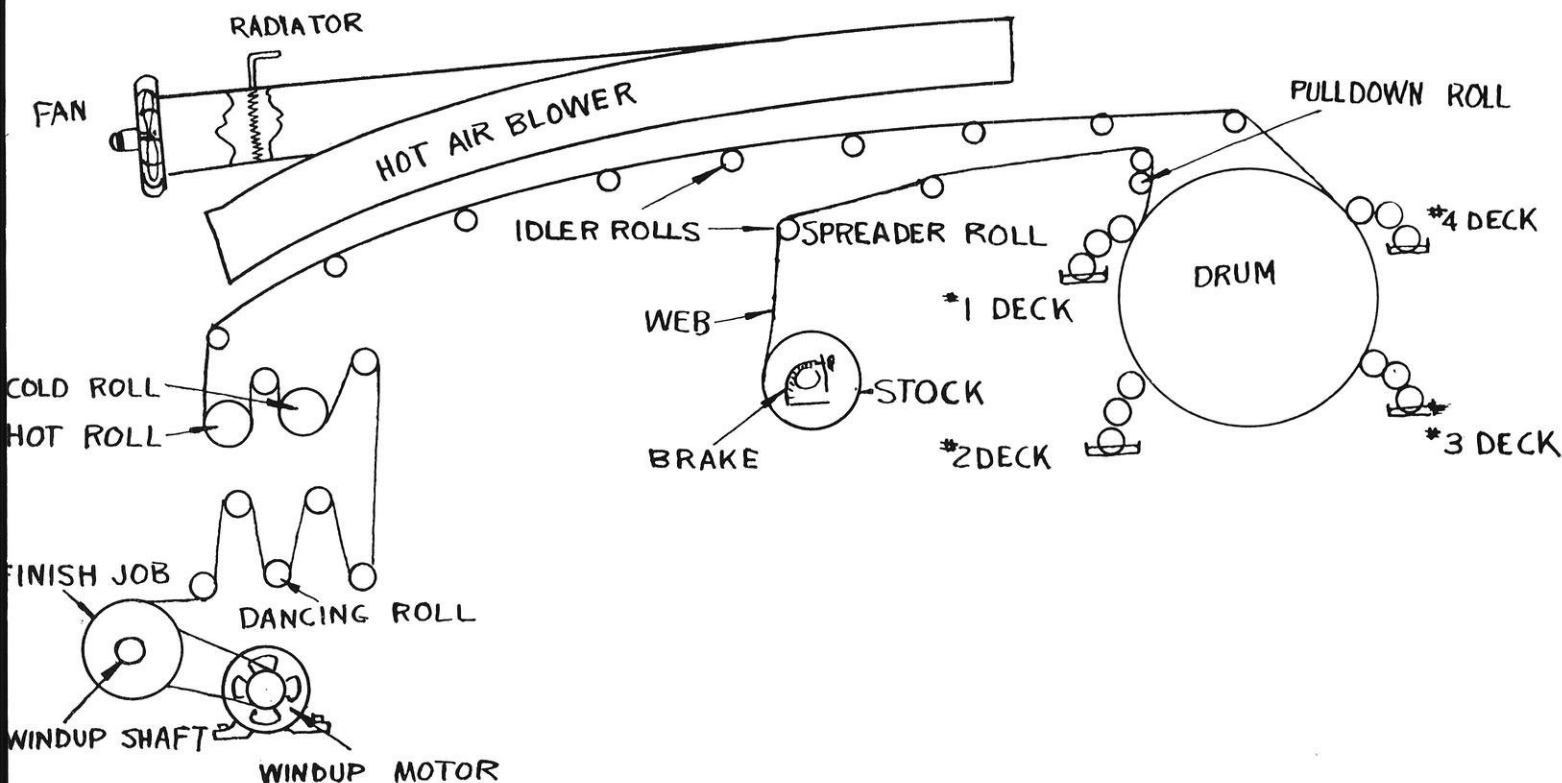
The term "Flexographic" printing is the trade name of printing with rubber plates. In the past people have used pieces of rubber with letters or designs carved

into them to reproduce a mark of some kind. We see many of these in any post office or business office. In Asiatic countries, a small block of wood is carved into characters, usually the owners signature, with this device, called a "chop", the rich man or official affixes his stamp or anything requiring his signature. This makes the document legal and binding in every way. Needless to say, these "chops" are guarded with the owners lives.

These devices employ the flexible method of printing on a small scale. The flexible part of the name comes from different sources. The method is flexible in that it uses rubber plates and these plates can be stretched into fitting the required design.

This stretching and moving process is called "hand registering" in the trade and requires a good deal of skill. The process itself is flexible in that it prints many kinds of papers for many different types of applications. The presses can be set up for different jobs in a short time, thus contributing a flexibility to department scheduling.

The reason for the existence of this type of printing stems from the discovery that acid etches metal plates to produce any given design. This fact was utilized in preparing printing cylinders by allowing acid to eat away metal on a machined cylinder only where it was unprotected by a coating (usually wax). This method



Schematic Drawing of typical four-color flexographic press. Molded rubber plates are stuck on the printing roller and used to reproduce many designs.

proved expensive because once a cylinder was etched with a design, nothing could change it to another design.

From this, progress was towards some cheaper method. The next development was a detachable plate of relatively cheap alloy that could be etched, used, and melted down and recast without any expensive machining of cylinders. This process is still used extensively, primarily in the manufacture of bread wrapping papers.

As anyone who has worn out a penpoint knows, paper is abrasive. A hard piece of alloy metal curved around a cylinder does not wear out very fast but it still costs quite a bit to design and produce, or replace. It is a little known fact, even to the men that work with them, that these metal and rubber plates, made flat, will stretch and enlarge the design circumferentially when curved around the cylinder.

In using the metal plates, this needs to be calculated each time the design goes on a differently sized cylinder. It was found that a master negative of a plate could be made of metal in the flat condition with the enlargement taken into consideration. Then raw rubber plates were heated and pressed into this mold (the negative), and the rubber plate thus produced was found to enlarge the design evenly for all curvatures.

Besides this, a side effect was found which has since

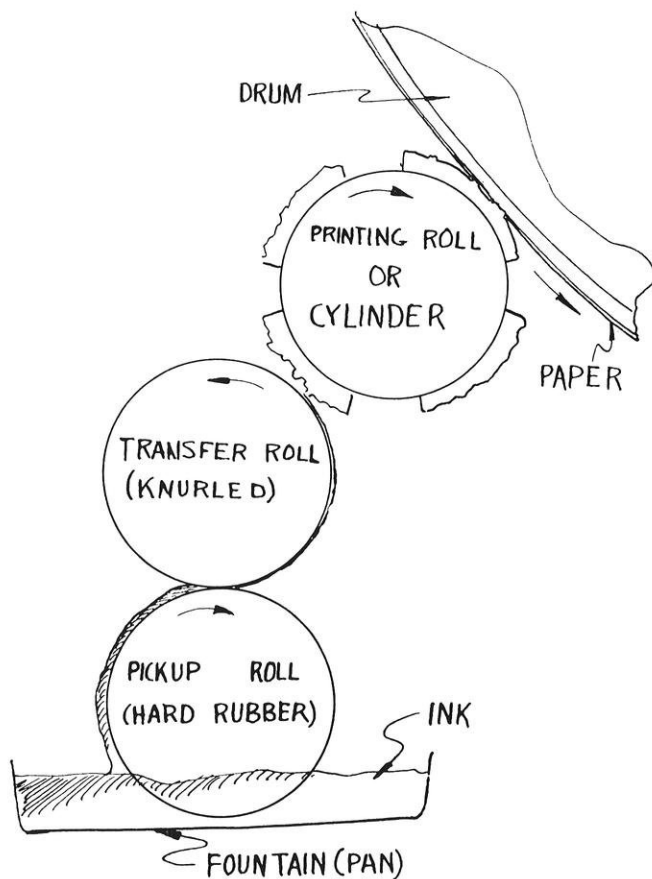
become the most important. The rubber wore well and was much cheaper to replace, merely vulcanizing another plate from the master mold. This economy of operation has become the most important feature in the mass production, competitive market we know today.

There are numerous small customers who cannot use large quantities of printed wrapping products but yet desire the professional look and prestige that a mill printed wrapping gives their product. The preparatory work of the older processes cost enough to make any idea of printed wrappers for small consumers out of the question. The Flexographic method has a very short set-up time and a low material cost. The average sized job today runs about 45 to 50 dollars for set-up which is quite reasonable.

The modern printing processes are carried on with presses that average about ten years in age. The industry is still quite small; two mills, both in Wisconsin, producing the bulk of this type printed matter used in the U. S. and Canada. For this reason, and because of the high original cost of machines, presses are custom built to customers' specifications. A new six-color press being purchased by Marathon Corporation at this time costs, with all the extras, about 300,000 dollars.

Orders that are handled now take anywhere from 10

(Continued on next page)



TYPICAL PRINTING & INKING ROLLERS

Schematic drawing of typical printing roller-transfer roller and inker roller combination.

minutes to 10 days of 24 hours to turn out. This handling of the smallest orders to quite respectable large production runs in the same department is more evidence of the flexibility of the department.

The way that orders are handled has been streamlined so that they take up the least possible mill-time. For example; if a small cheese factory wants a wrapper for their cheese, a salesman from the company helps them decide on a design. Then they decide that they want a wrapper, slightly different, and yet similar for each of six different types of cheese.

It is decided to use the same basic design but changing colors and "slugging in" the different names. "Slugging" is the changing of a small part of the plate so that the end design is different. We may print a wrapper saying "American Cheese" then by cutting out the word American and substituting "Cheddar" we go on and print Cheddar cheese wraps. This process allows us to print different wrappers with a minimum loss of time.

We may also wish to change the color of the design to denote a difference in the contents. If the background of the first job is light green for example, we might make the second job dark green. This would mean simply draining the light ink out of the press and pouring in the dark, without any loss of time by clean-

ing the press out. The next two steps might be a dark blue ink and then to black. In this way we could print four different jobs with a minimum of lost time. The lost time would naturally increase the final cost of the product.

The machines used in the press room can best be visualized by a study of the schematic drawing of a typical four color press.

The press has a large drum about eight feet in diameter and 52 inches wide. This drum is driven by a large electric motor by means of a gearing arrangement. This same gear drives the printing cylinders and their individual inker rollers. All other rollers with the exception of the idlers and the windup are driven by a shaft geared to the large drum. The stock roll of paper or cellophane or whatever is mounted on a shaft in an unwind device which consists of a braking system, either mechanical or hydraulic. This brake puts a tension on the stock being pulled through the press. This stock passes over an idler to the spreader roll. This is a hard rubber roller with two spirals cut into it and starting in the exact center and moving out to the ends of the roll.

This spiral serves to spread the stock (called the "sheet" in the trade) out sideways so it will run through the press without longitudinal wrinkles. Next comes the pulldown roller which is squeezed down on the drum and pulls the sheet off the stock roll or unwind. The sheet then passes between the first printing cylinders and the drum. The printing cylinder with its two inker rollers geared to it is called a "deck".

The transfer roller is a finely knurled steel roller that transfers an ink film from the pickup roller to the plates mounted on the printing cylinder. The plates are mounted on the cylinder by means of a sticky rubber tape much like electricians tape only much wider and sticky on both sides. The two inker rollers, the transfer and the pickup are usually referred to as the "nips" and when a man "sets the nips", he squeezes these two rollers together.

This squeezing wrings the ink out much like a wringer on a wash machine would do. It is from this action that the transfer roller picks up its film of ink. Most nips are provided with a small electric motor to turn them when the press is standing idle so that the highly volatile alcohol ink won't dry on the rollers as they keep rolling in the pan of ink called a "fountain."

The transfer roller touches the rubber plates very lightly and applies a thin coating of ink to them. As the printing cylinder rolls around toward the drum, the plates contact, very lightly, the paper on the drum and leave their impression on it.

This light contact of the printing parts gives rise to the term "kiss printing". This same process is repeated at each deck on the press, each deck printing a differ-

(Continued on page 80)

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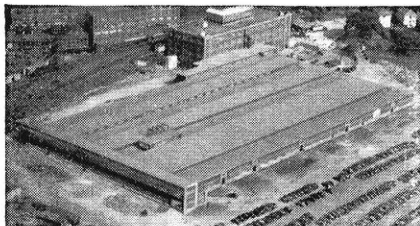
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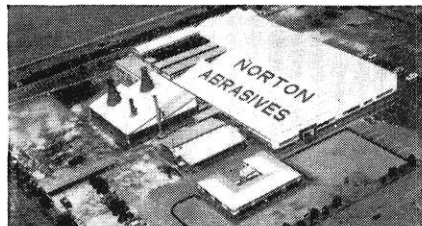
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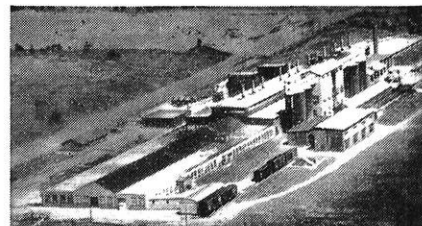


1948 — WORCESTER, MASS. Plant No. 7 in "Norton City" is the largest, most modern ever built for grinding wheel manufacture. Here, revolutionary advancements in processing equipment and techniques produce grinding wheels of unequalled quality and uniformity.

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1951 — ISANDO, UNION OF SOUTH AFRICA. Located in the Transvaal near Johannesburg, and serving all Africa, this Norton plant produces a complete line of abrasive products. Thus Norton anticipates the needs of a continent that, industrially, is just awakening.



1953 — CAP-DE-LA-MADELEINE, QUEBEC, CANADA. Located in a region rich in mineral resources, the electric furnace plant produces CRYSTOLON* silicon carbide for abrasive and refractory uses. Norton's largest plant of this type is in Chippawa, Ontario.

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ELECTRIC FURNACES HELP BOOST TITANIUM PRODUCTION

Electric-resistor furnaces are playing a major part in the drive for increased titanium production. Several score electric furnaces have been built to convert liquid titanium tetrachloride to sponge titanium by reduction with magnesium. The furnaces are pit type, rated 210 kw each, and are divided into three control zones. After the necessary initial energy is supplied, the reaction is exothermic and only a small amount of external heat is required. In connection with these reduction furnaces, electric-resistor-type pipe heaters are used to and from the furnace retort. One set is used to keep the magnesium in a molten state as it is transferred from a previous melting operation. The other set is used to drain off magnesium chloride produced from the reaction that provides the titanium sponge.

The impurities in the titanium sponge are removed by treating in another electric-resistor furnace of a bell type. The retort containing the sponge is placed in the furnace and a vacuum is introduced, which

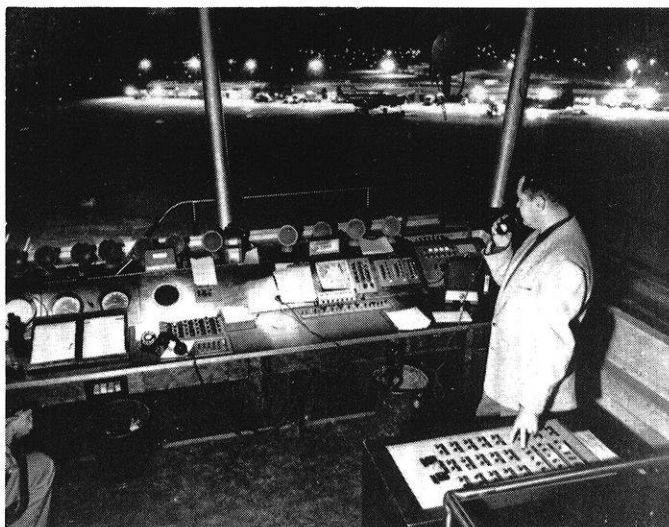
allows the impurities to distill off. These furnaces are rated at 300 kw in three zones. The principal impurities removed are magnesium chloride and titanium tetrachloride.

NEW CONTROL TOWER AT O'HARE FIELD

More than \$65,000 were saved by Chicago's new commercial airport, O'Hare Field, by an installation of supervisory control for the field's lighting system. Installation of the remote control equipment eliminated the need to relocate more than a mile of underground conduit.

apparatus needed to power and switch the lighting were located in a vault beside the old tower. Underground conduits fed from the vault to approach, runway and beacon lights, and control wires extended from the vault to the tower operator's console.

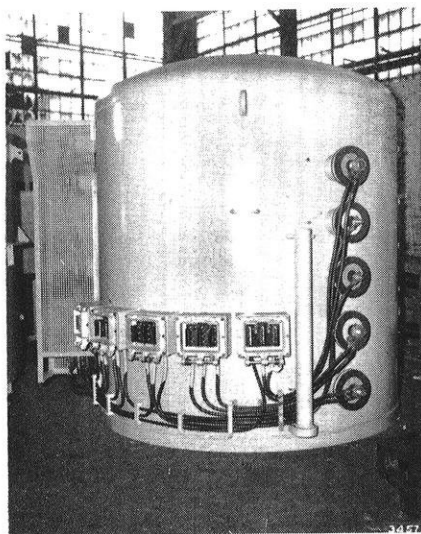
To move either the vault to the new tower site with the necessary relocation of underground conduits, or to extend the control wires 6000 feet from the vault to the new tower would have been both expensive and time consuming. Instead, contact was maintained between the lighting control panel at the new tower site and the old



During the recent enlargement and rebuilding of O'Hare Field, to make it suitable for commercial as well as military operations, municipal airport engineers recommended that the control tower be moved to a better spot about 6000 feet across the field. The original airport lighting had, of course, been operated from the old control tower, since the tower operators, in directing air traffic, must frequently vary the lighting. The transformers, switchgear, and other

vault by using a remote control system needing only a single telephone circuit between the vault and the new tower. This circuit was leased from the local telephone company.

By simply pressing the proper buttons, the tower operator can now by remote control: select any runway; select the approach lights at either end of the runway; adjust the brilliancy of the lights; and switch on or off various wind indicator, and obstruction lights.

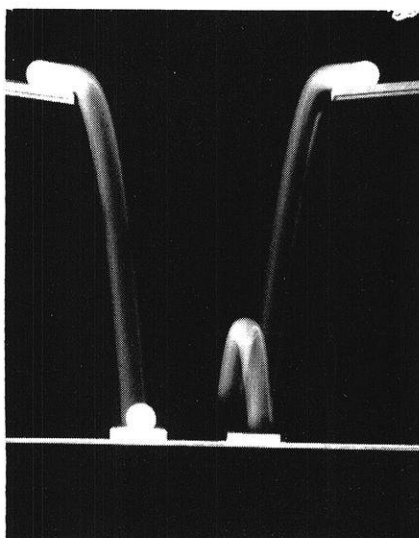


LIGHTS

WESTINGHOUSE SCIENTISTS DEVISE ATOMIC VULCANIZING PROCESS

An ultra-fast method of using atomic "bullets" to vulcanize silicone rubber has been devised.

The process beams two-million-volt electrons at a silicone gun and almost instantly converts it into silicone rubber. Its discoverers say that the technique produces a bet-



ter rubber in two seconds than conventional vulcanizing methods yield in several hours.

"While not yet ready for commercial application, irradiation with high-energy electrons will eventually become an important method of vulcanizing silicones industrially," the discoverer, Dr. Gainer declared. "It duplicates all the good features of chemical vulcanization without introducing chemical agents which remain in the rubber and spoil some of its desirable properties — especially those required for electrical insulation.

"Another advantage of this new 'atomic bullet' technique is the ease and precision with which it can be controlled," Dr. Gainer said. "Curing of the rubber is accomplished by exposure at ordinary room tem-

peratures. No heat, no pressure, no chemicals are required. Control of the process consists merely of regulating the voltage which speeds up the electrons and governing the length of time of exposure to the radiation."

The scientists say the high-energy electrons required for the process can be obtained from a standard electrostatic generator — a high-voltage machine which accelerates electrons and focuses them into a beam. In a way, they explained, this is similar to what occurs in a television picture tube, where electrons are accelerated and then focused on a screen, thereby giving a television picture. However, the voltages used in the television tube are only a fraction as high as those used in the vulcanizing process.

"Vulcanization takes place when the speeding electrons smash into the silicone molecules and cause them to arrange themselves into new patterns," Dr. Gainer said. "This process, often referred to as cross linking, changes the silicone from a non-elastic, putty-like mass into a solid with the bounce of natural rubber."

LONGEST RANGE SHIPBORNE RADAR ANNOUNCED

The most powerful shipborne radar set ever put in service has been installed on the cruiser Northampton, a Navy command vessel for directing the firepower of a task force. At the heart of this powerful radar set is a magnetron. This tube delivers to the radar antenna the powerful pulses of r-f energy which can search out enemy planes over 400 miles away. At peak power, "Big Maggie" delivers over ten million watts, as much electric power as is normally required by a city of 25,000 people.

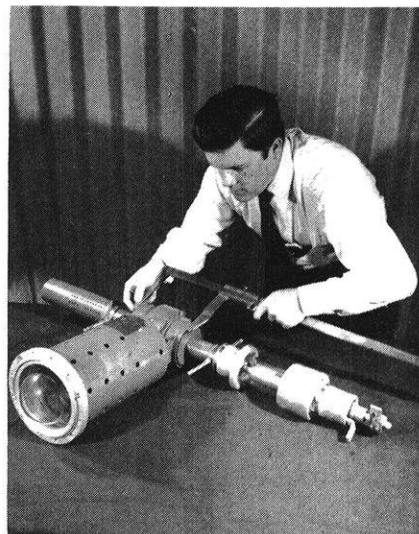


This increased range and power means that interceptor planes will have more time to get into the air, especially important in this era of high-altitude, high-speed aircraft.

"Operation Maggie" started in 1947 when the Navy, foreseeing the imminent need for long-range radar in fleet and home based operations, sponsored the tube development. The goal was a magnetron whose power capacity was at least ten times that of existing World War II magnetrons.

One of the major technical problems facing this new tube development was to generate long pulses of extremely high power in the volume about the size of a football. A complete tube weighs only about 60 pounds; its permanent magnet weighs some 300 pounds.

Another major technical problem was the development of a cathode that could supply the enormous electric current required. The



cathode had to operate at temperatures up to 3100 degrees F, greater than the temperature of molten iron from a blast furnace. Since no existing cathode material could operate at the power levels generated by "Big Maggie," new alloys and fabrication methods were pioneered. New design approaches such as transparent vacuum-tight portholes to allow the release of radar waves were the result. In this instance a special glass window, saucer-size but very thin, had to be developed to withstand the intense heat from the cathode and total pressures as great as 400 pounds. The new magnetron operates as a sealed oscillator, employing water and mild forced-air cooling. No pressurizing or auxiliary gas insulation is needed.

An accomplishment in itself is the power supply for the magnetron. It must supply peak input power pulses of about 23 megawatts at 60,000 volts. Testing equipment for evaluating the new tube was another project requiring major engineering effort. To test each magnetron effectively requires enough test equipment to fill a six-room house.

WATER-MODERATED REACTOR CAN'T RUN AWAY, NUCLEAR SCIENTIST REPORTS

An atomic scientist recently described how the branch of reactor theory known as "reactor kinetics" is being used to speed the development and design of water moderated nuclear reactors in atomic power plants.

Addressing the second annual meeting of the American Nuclear Society, in Chicago on June 2, Dr. A. F. Henry of Pittsburgh, Pa., explained how the mathematical equations of reactor kinetics were being applied to the analysis of experimental data and to the design of power plants that will convert nuclear energy into usable power more efficiently, economically and safely.

"Our equations," he said, "predict that as the temperature of

water in the reactor rises, the fluid will expand so much that too few neutrons will remain in the core to sustain a chain reactor. Experiments have confirmed this phenomenon. As a result we feel that even if all the safety devices fail to function, a water moderated reactor will still automatically shut itself down as the water reaches higher temperatures."

The atom scientist indicated that this inherent stability was a characteristic of many types of reactors currently under study in the United States such as the pressurized water reactor, boiling water reactors and homogeneous reactors that use a water moderator.

Dr. Henry went on to surmise that this unique characteristic of inherent stability might some day be used instead of metal control rods to control the output of nuclear power plants.

He said, "Instead of being forced to use relatively rare, expensive and hard-to-work control materials like hafnium metal to absorb extra neutrons, we may in the future be able to operate power reactors with *steam* control rods which get rid of the extra neutrons by letting them 'leak' out of the core. At present such an idea presents serious difficulties, but we are studying them and it appears that there is a good chance that we shall be able to solve the problems reasonably soon."

"Reactor kinetics," Dr. Henry explained, "is the study of how a reactor and its associated power plant behave in time. In plants where water is pumped through the reactor core to remove the heat produced by fissioning there is a strong interaction between the temperature of the water and the criticality of the core. (A core is which a self-sustaining chain reaction is taking place is said to be critical.) This interaction occurs because the hydrogen in water prevents the neutrons produced by fission from 'leaking' out of the core and thus keeps them near the uranium where they will cause further fis-

sions. Raising the temperature of this water causes it to expand so that more neutrons 'leak' out of the core and the chain reaction cannot be sustained. In reactor kinetics we develop equations which describe this situation and thus predict how the power of the nuclear core will change under a variety of conditions."

THE NEW SUPER CONSTELLATION CAN FLY ONE-FOURTH THE WAY AROUND THE WORLD

The Super Constellation, wearing new long-range wings that will fly it a quarter-way around the world in one hop, has entered a final round of checks to prepare it for first flight in about two weeks.

Due to start service next spring, the new Model 1649A Super Constellation will fly greater nonstop distances than any other transport. It will have the range to fly non-stop from San Francisco to London, from New York to Rome, from Rio de Janeiro to New York, or just about anywhere to anywhere — up to its maximum of about 6300 miles (without consuming reserves).

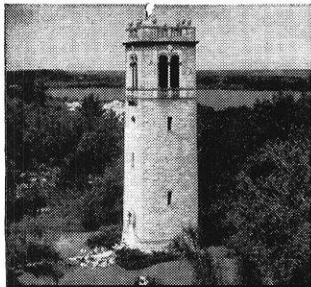
The first 1649A is being readied for six months of government certification test flying to qualify the new type for airline service.

Forty-four of the 350-m. p. h., long-wing series are on order for airlines flying the flags of the United States, France, Germany, Brazil and Italy.

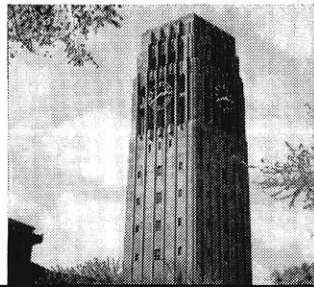
Most notable of the huge airliner's new features is its 150-foot wing, 27 feet longer and one-sixth thinner than on previous Super Constellations. This airfoil provides more area, greater lift and higher speed. It holds 9600 gallons of fuel.

Another improvement is its larger propellers, 16 feet, 10 inches compared with 15 feet, 2 inches. Inboard propellers are spaced 5 feet farther out on the wing, a factor expected to make flight noticeably quieter, engineers said.

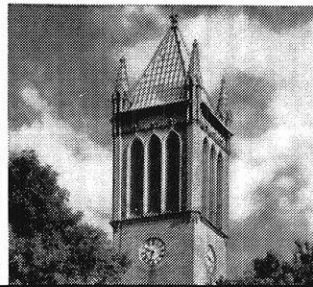
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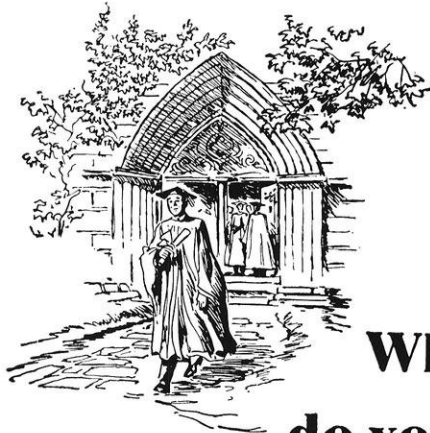
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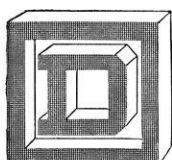
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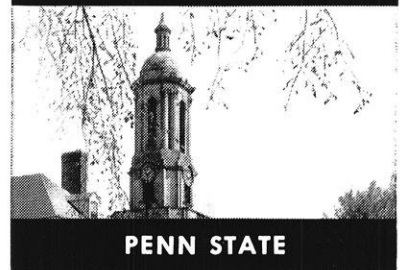
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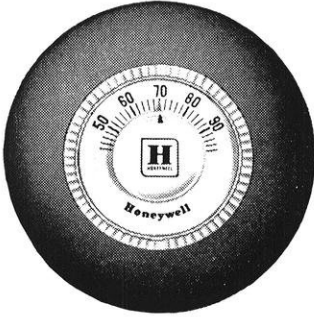
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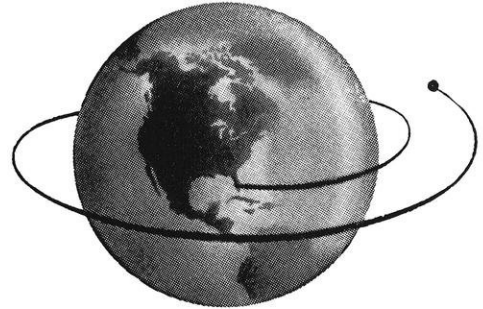
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Two of Honeywell's 12,000 different automatic controls are the Honeywell Round—first entirely new thermostat design in 70 years—and an ultra-sensitive type of inertial guidance system, which will direct the rocket placing the world's first man-made satellite in its orbit.



Over thirty years ago in the *American Mercury* the inimitable journalist H. L. Mencken wrote, "Of all the great inventions of modern times, the thermostat has given me most comfort and joy. Not for a dozen Marconis, a regiment of Bells, or a whole corps of Edisons would I swap the great benefactor of humanity who invented the incomparable thermostat."

Honeywell began in a basement, with the invention of a simple bimetallic thermostat to open furnace dampers on chilly mornings. But extensive research into electricity and electronics, pneumatics, gases, metallurgy, chemistry, plastics, and plain and fancy physics has diversified Honeywell by means of engineering and new-product development into *automatic control for almost every known purpose*.

EXCITING GROWTH: Today, after 72 years, Honeywell has grown and is growing still—the world's leading designer and manufacturer of all kinds of automatic controls. Sales have more than doubled every five years. In the last 7 exciting years alone Honeywell has increased sales more than fourfold—from \$57 million in 1948 to \$244 million in 1955. In these 7 years over 20,000 new employees from all over America have joined Honeywell to find new opportunities. Honeywell now has 31 factories and 160 sales and service offices throughout the world.

MAIN FIELDS: Basically, Honeywell operates in three main fields: heating and air conditioning, industrial instrumentation, and aeronautical controls and ordnance equipment. But the common denominator is always *automatic control*. Heat, color, density, liquid level, humidity, weight, or any other measurable factor—such as attitude deviations of planes or missiles in flight—can all be recorded and controlled.

REMARKABLE DIVERSITY OF PRODUCTS: More than 12,000 different Honeywell products give you an idea of the range within which you can build a highly rewarding career. Because Honeywell is operating in almost all the fields known as growth industries, our continuing drive to provide new markets, new products, and new systems promises you a rewarding future.

SMALL UNITS MEAN OPPORTUNITIES FOR YOU: Our employees operate primarily through *personal contacts* with supervisors and fellow workers. Our small units present multiple opportunities for early managerial experience as (1) project leaders, (2) section heads, (3) foremen, (4) department heads, (5) chief engineers, or (6) sales managers. As Honeywell continues to grow, advanced positions are filled largely by men who have worked up from within. So, as an employee, you too will have real opportunities to fill Honeywell's future managerial needs. And Honeywell needs restless men who can accept and discharge responsibilities.

SCIENTIFIC MANAGEMENT: The men who run Honeywell are a top management-science team. Year after year the American Institute of Management has rated Honeywell "excellent"—the top rating among America's best-managed companies. Honeywell's management recognizes that our growth in the challenging future depends in the largest measure upon the initiative, intelligence, and interest of the young people now starting with us.

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2. Industrial instruments and controls: Complete engineering and manufacturing plants in Philadelphia. There is hardly a processing industry where Honeywell controls do not function as mechanical and electronic

brains regulating processes better than could be done by human hands or judgement. Honeywell instruments, for instance, are presently in use on every U. S. atomic reactor. Instrumentation holds sweeping potentialities as industry becomes increasingly complex and as automation is applied to more and more of its processes. Typical industrial products include indicating, recording and control types of potentiometers, pyrometers, pressure gauges, industrial thermometers and flow meters, electronic control panels, and thousands of other devices.

3. Aeronautical controls: In addition to extensive research, engineering and manufacturing facilities in Minneapolis, another complete plant is being built in St. Petersburg, Florida, expressly for the development and manufacture of inertial guidance systems. There is also a complete Engineering Development Center for aircraft and missile controls in West Los Angeles. Some challenging engineering interests include automatic flight control systems; hydraulic and pneumatic jet, ram jet, and rocket engine controls; instrumentation; and airborne digital and analog computers. Honeywell is a major supplier of automatic pilots, bombing systems, gyroscopes, and integrated weapons systems for aircraft and guided missiles. The Honeywell electronic fuel-measuring system is the standard of the industry, and Honeywell leads in developing transistorized instruments for aircraft.

4. Precision switches: Engineering and manufacturing in Freeport, Illinois; with additional plants in Warren, Illinois and Independence, Iowa; plus research facilities in Denver. Honeywell's 5000 variations of electrical MICRO SWITCH snap-action and mercury switches are used in countless ways. They permit a slight motion or a small physical force to control an electric motor or current. They are particularly useful

where space or weight limitations are important—as in aircraft, missiles and rockets, automatic machine tools, dictating machines, and automatic transmissions for automobiles.

5. Ordnance: Engineering and manufacturing in Minneapolis; a complete new Engineering Development Center for missiles in Monrovia, California; and engineering laboratory facilities in Seattle, Washington. In this Division a great many vital defense products and systems—such as complete missiles and components, fire-control systems, and proximity fuzes are produced.

6. Servo components: Honeywell engineering and manufacturing plants in Boston produce precision synchro motors, gyroscopic instruments, and electro-mechanical servo components for standard use in jet fighters, guided missiles, and bombers. The newest development is a vital control device for the automation of manufacturing processes.

7. Oscillographic and Photographic equipment: The Honeywell plant in Denver produces high speed recording oscillographs, scientific laboratory equipment, and a complete line of Heiland photographic flash equipment.

8. Transistors: The Boston plant develops and manufactures high-output power-type transistors.

9. Research: In a complete Research Center in Hopkins, a suburb of Minneapolis, emphasis placed on fundamentals has led to comprehensive basic research programs in the fields of: solid state physics, metallurgy, ceramics, magnetic and dielectric materials, physical chemistry, electronics, heat transfer, and mechanics. Honeywell is continuing its steadily increasing expenditure for fundamental research.

AT HONEYWELL YOU WILL FIND ADVANCEMENT OPPORTUNITIES IN TECHNICAL AND MANAGEMENT FIELDS:

Research—Development—Production: One of Honeywell's great strengths is the specialized engineering knowledge we can concentrate upon each of many highly technical operations and products. A consistently growing investment in research and engineering projects has in the postwar period increased at a rate almost double that of sales increase. The aggressive policy of "engineering for tomorrow while producing for today" means one out of every ten Honeywell employees is engaged in some phase of our engineering activities.

Almost every type of technical college training can be utilized to advance the art of automatic control. Engineers, scientists, chemists, physicists, metallurgists, and sales engineers are particularly needed. You should possess an intellectual curiosity that compels you to think into and through and around a problem. Yet you should have something more: the faculty of working in close cooperation with fellow engineers on common problems.

Whatever scientific or engineering activity you choose at Honeywell . . . research, design, development, man-

ufacturing, application, or sales . . . you will enjoy the satisfaction of knowing that you are vital to an organization whose growth has helped lead and will continue to lead our country's technical advancement.

Engineering Sales: Honeywell has a great need for the man who likes and wants to sell . . . who is able to find new product applications and expand markets . . . and who can cultivate those markets with consistent energy. You will receive up to five months of special training in one of Honeywell's well-equipped and expertly staffed divisional sales schools.

Honeywell's Training Program: Training at Honeywell is handled in various ways: organized programs for "Learning By Doing"; formal classes during and after working hours; orientation and development programs tailored to individual requirements; and outside study programs, on both undergraduate and graduate levels, with the Company sharing your tuition costs. Honeywell's various locations furnish access to the nation's best technical schools.

NOW, LET US HEAR FROM YOU!

If you would like to know more about the opportunities for you at Honeywell, contact your College Placement Office. Or please write directly to H. T. Eckstrom, Personnel Administrator, (Dept. C56), Minneapolis 8, Minn.

MINNEAPOLIS
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First in Controls



ENGINEERS...

**JOIN THE TEAM THAT
DESIGNED THE NAVY'S TERRIER
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CONVAIR... for over two decades has been a respected name in the aeronautical field and is today the leader in the Guided Missile Field for the design and production of the famous TERRIER an Operational Weapon for the United States Navy.

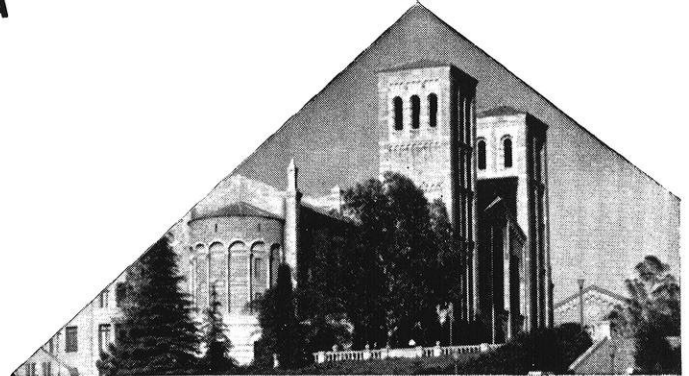
ENGINEERS... vastly accelerated projects in all phases of Engineering including research, design, test and production are now under way at Convair Pomona.

POMONA... just thirty minutes from downtown Los Angeles, lies in the heart of Pomona Valley out of the heavy traffic conditions where California outdoor living is at its best. **Excellent housing is available located within close proximity of Convair's new air-conditioned plant to eliminate unnecessary time of traveling to and from work.**

Write Employment Dept. 4-C

Complete resume desirable
for evaluation.

Information confidential.



EDUCATIONAL . . . opportunities offered by Convair include a formal program with U.C.L.A. leading to a M.S. degree while you are employed at the plant. Also many in-plant courses are taught by top engineers with whom you are working, including transistor electronics, stress analysis, magnetic amplifiers, computers, servo-mechanisms, probability theory, differential equations, engineering mathematics, hydraulics and aerodynamics. These courses are so designed to give you every opportunity to further your career in the engineering field.

EXCELLENT OPPORTUNITIES IN:

**ELECTRONICS
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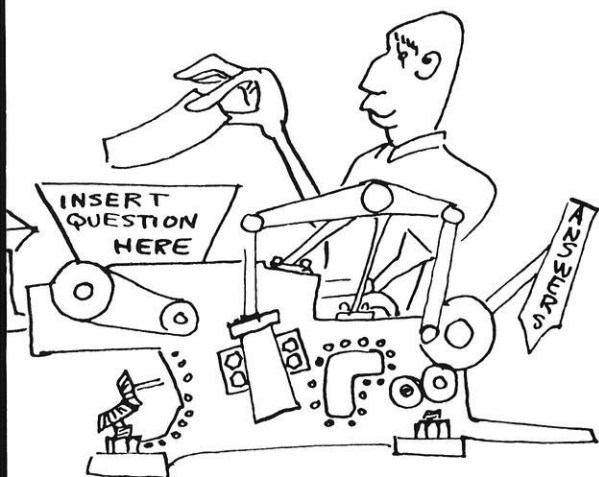


CONVAIR
A DIVISION OF
GENERAL DYNAMICS CORPORATION
(POMONA)

POMONA, CALIFORNIA



THE WISCONSIN ENGINEER



FINAGLE FACTORS

Ed. Note: This feature will be carried each month. You may find this page helpful in the future so why not save the whole series.

Multiply	By	To Get	Multiply	By	To Get
Days	24	hours	foot-pounds per minute	2.260×10^{-5}	kilowatts
Days	1440	minutes	foot-pounds per second	7.717×10^{-2}	Btu per minute
Days	86,400	seconds	foot-pounds per second	1.818×10^{-2}	horsepower
decigrams	0.1	grams	foot-pounds per second	1.945×10^{-2}	kg-calories per min
deciliters	0.1	liters	foot-pounds per second	1.356×10^{-3}	kilowatts
decimeters	0.1	meters	furlongs	40	rods
degrees (angle)	60	minutes	Gallons	3785	cubic centimeters
degrees (angle)	0.01745	seconds	Gallons	0.1337	cubic feet
degrees (angle)	3600	radians	Gallons	231	cubic inches
degrees per second	0.01745	radians per second	Gallons	3.785×10^{-6}	cubic meters
degrees per second	0.1667	revolutions per min	Gallons	4.951×10^{-6}	cubic yards
degrees per second	0.002778	revolutions per sec	Gallons	3.785	liters
dekagrams	10	grams	Gallons	8	pints (liq)
dekaliters	10	liters	Gallons	4	quarts (liq)
dekameters	10	meters	gallons per minute	2.228×10^{-6}	cubic feet per second
drams	1.772	grams	gallons per minute	0.06308	liters per second
drams	0.0625	ounces	gausses	6.452	lines per square inch
dynes	1.020×10^{-3}	grams	gilberts	0.07958	abampere-turns
dynes	7.233×10^{-5}	poundals	gilberts	0.7958	ampere-turns
dynes per square cm	2.248×10^{-6}	pounds	gilberts per centimeter	2.021	ampere-turns per inch
	1	bars	gills	0.1183	liters
Ergs	9.486×10^{-11}	British thermal units	gills	0.25	pints (liq)
Ergs	1	dyne-centimeters	grains (troy)	1	grains (av)
Ergs	7.376×10^{-8}	foot-pounds	grains (troy)	0.06480	grams
Ergs	1.020×10^{-3}	gram-centimeters	grains (troy)	0.04167	pennyweights (troy)
Ergs	10^{-7}	joules	grams	980.7	dynes
Ergs	2.390×10^{-14}	kilogram-calories	grams	15.43	grains (troy)
Ergs	1.020×10^{-8}	kilogram-meters	grams	10^{-3}	kilograms
ergs per second	5.692×10^{-9}	Btu per minute	grams	10^{-3}	milligrams
ergs per second	4.426×10^{-6}	foot-pounds per min	grams	0.03527	ounces
ergs per second	7.376×10^{-8}	foot-pounds per sec	grams	0.03215	ounces (troy)
ergs per second	1.341×10^{-10}	horsepower	grams	0.07093	poundals
ergs per second	1.434×10^{-9}	kg-calories per min	grams	2.205×10^{-3}	pounds
ergs per second	10^{-10}	kilowatts	gram-calories	3.968×10^{-3}	British thermal units
Farads	10^{-9}	abfarads	gram-centimeters	9.302×10^{-8}	British thermal units
Farads	10^6	microfarads	gram-centimeters	980.7	ergs
Farads	9×10^{-11}	statfarads	gram-centimeters	7.233×10^{-5}	foot-pounds
fathoms	6	feet	gram-centimeters	9.807×10^{-5}	joules
feet	30.48	centimeters	gram-centimeters	2.344×10^{-8}	kilogram-calories
feet	12	inches	gram-centimeters	10^{-4}	kilogram-meters
feet	0.3048	meters	grams per cm	5.600×10^{-6}	pounds per inch
feet	.36	varas	grams per cu cm	62.43	pounds per cubic foot
feet	1/3	yards	grams per cu cm	0.03613	pounds per cubic inch
feet of water	0.02950	atmospheres	grams per cu cm	3.405×10^{-7}	pounds per mil-foot
feet of water	0.8826	inches of mercury	Hectares	2.471	acres
feet of water	304.8	kg per square meter	Hectares	1.076×10^5	square feet
feet of water	32.43	pounds per sq ft	hectograms	100	grams
feet of water	0.4335	pounds per sq inch	hectoliters	100	liters
feet per minute	0.5080	centimeters per sec	hectometers	100	meters
feet per minute	0.01667	feet per sec	hectowatts	100	watts
feet per minute	0.01829	kilometers per hour	hemispheres (solid angle)	0.5	sphere
feet per minute	0.3048	meters per minute	hemispheres (solid angle)	4	spherical right angles
feet per minute	0.01136	miles per hour	hemispheres (solid angle)	6.283	steradians
feet per second	30.48	centimeters per sec	henries	10^3	abhenries
feet per second	1.097	kilometers per hour	henries	10^3	millihenries
feet per second	18.29	meters per minute	henries	$1/9 \times 10^{-11}$	stathenries
feet per second	0.6818	miles per hour	horsepower	42.44	Btu per min
feet per second	0.01136	miles per minute	horsepower	33,000	foot-pounds per min
feet per 100 feet	1	per cent grade	horsepower	550	foot-pounds per sec
feet per sec per sec	30.48	cm per sec per sec	horsepower	1.014	horsepower (metric)
feet per sec per sec	1.097	km per hr per sec	horsepower	10.70	kg-calories per min
feet per sec per sec	0.3048	meters per sec per sec	horsepower	0.7457	kilowatts
feet per sec per sec	0.6818	miles per hr per sec	horsepower	745.7	watts
foot-pounds	1.286×10^{-3}	British thermal units	horsepower (boiler)	33,520	Btu per hour
foot-pounds	1.356×10^7	ergs	horsepower (boiler)	9.804	kilowatts
foot-pounds	5.050×10^{-7}	horsepower-hours	horsepower-hours	2547	British thermal units
foot-pounds	1.356	joules	horsepower-hours	1.98×10^6	foot-pounds
foot-pounds	3.241×10^{-1}	kilogram-calories	horsepower-hours	2.684×10^6	joules
foot-pounds	0.1383	kilogram-meters	horsepower-hours	641.7	kilogram-calories
foot-pounds	1.286×10^{-3}	kilowatt-hours	horsepower-hours	2.737×10^5	kilogram-meters
foot-pounds per minute	3.766×10^{-7}	Btu per minute	horsepower-hours	0.7457	kilowatt-hours
foot-pounds per minute	0.01667	foot-pounds per sec	hours	60	minutes
foot-pounds per minute	3.030×10^{-6}	horsepower	hours	3600	seconds
foot-pounds per minute	3.241×10^4	kg-calories per minute			



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HAROLD TRESTOR

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.

W. S. P. E.

NINTH SUMMER CONFERENCE

Nippersink Manor at Genoa City was the headquarters and playground for the 9th Summer Conference of the Wisconsin Society of Professional Engineers on the weekend of September 14, 15 and 16.

Thanks to the hosts, the S. E. Chapter, to Chairman Leo Jesselun and to Karl Werwath, State Program Chairman for a most pleasant and very successful conference.

The Board of Directors met on Friday afternoon to act upon the important affairs of the society. A most elaborate smorgasbord was thoroughly enjoyed by those who like to eat, and who doesn't? "The Dukes" provided the lively music for the evening and everyone enjoyed the mixer dances arranged by a very attractive, petite, personality plus hostess. Mrs. Carl Mohs of Madison and Mr. Ralph Perlewitz of Milwaukee won loving cups as winners of the "statue" dance.

Art Behling, Cliff Nelson, Harold Kingsbury and John Gammell participated in the hat exchange game with Cliff winding up as the winner.

On Saturday forenoon, while others were out on the golf course or relaxing in the sun, the functional groups were hard at work seeking solutions to their many problems.

Following the noon luncheon, Mr. Charles D. Curran, C. E. of Washington, D. C., former Executive Director gave a very comprehensive report on "The Hoover Commission's Look at Engineering in Government."

President Art Behling presided at the Saturday afternoon business meeting. This included committee reports and convention actions. The

following revisions to the Bylaws were acted upon and passed; a) To provide for reduction of dues for retired members, b) To provide for removal of six months "Delinquency" period, c) To provide for reinstatement to comply with N.S.P.E. policy and duplicate it for W.S.P.E.

During the course of the afternoon, the ladies were entertained by a tour of the nearby Honey Bear Farm. Other activities included golf, cards and swimming.

On Saturday evening, the engineers and their ladies assembled in the dining hall for the traditional banquet. Mr. Harold L. Goodwin, Consultant to the Federal Civil Defense Administration, presented an impressive talk on "Special Weapons Effects." Excellent entertainment and dancing followed. From the comments made, everyone was especially pleased with the evening's program.

On Sunday morning, the various State Committees met and outlined their plans for the year ahead.

Everyone enjoyed a great convention at Nippersink Manor. All who were present join in congratulating the Program Committee for an outstanding job well done.

ENGINEERING EXAMINATIONS

The Wisconsin Registration Board of Architects and Professional Engineers have announced the dates of their next Engineering Examinations as February 4 & 5, 1957. To be eligible for those examinations, application must be on file in the Board's office on or before December 1, 1956. Application forms and information may be obtained at or by writing to the Board's office, 1140 State Office Building, Madison, Wisconsin.

(Continued on page 44)

Meet the President



EUGENE POTTER

President, Lake Superior Chapter

Eugene Potter, President of the Lake Superior Chapter, was born in Broadland, South Dakota on July 16, 1898. He received his education at Superior State College and International Correspondence Schools. Mr. Potter was first employed by the Great Northern Railway from 1919 to 1922. Since that time he has been employed by the Douglas county Highway Department. At the present time he is serving as Douglas County Highway Commissioner. While in the field of highway engineering, he developed the first Sufficiency Estimation for County Highway Systems.

Since May 1955, Mr. Potter has been a member of W.S.P.E. and N.S.P.E. He is also a member of the Wisconsin Highway Commissioners Association as well as American Road Builders and Wisconsin Good Roads Associations.

In September 27, 1922, Mr. Potter was married to Ruth Ward. They have one son, Robert E. Potter. Mr. Potter enjoys gardening and his summer cabin.

W.S.P.E.

(Continued from page 42)

Examinations will be conducted February 4, 1957, at Madison and Milwaukee, Wisconsin, for those desiring Certification as an Engineer-in-Training. To qualify for certification as an Engineer-in-Training the applicant must, in addition to passing the one-day, 8 hour, examination on the fundamentals of engineering, have a record of 4 years of satisfactory engineering experience. All of the required 4 years of experience may have been gained by formal education.

Examinations will be conducted February 4 & 5, 1957, at Madison, Wisconsin, for those desiring registration as a Professional Engineer. Holders of certification as an Engineer-in-Training in Wisconsin will be required to appear for examination only on February 5, 1957, while those who are not holders of such certification will be required to appear on both February 4 & 5, 1957. The examination on February 4, 1957, will be on the fundamentals of engineering. The examination on February 5, 1957, covers in the forenoon a field of engineering and in the afternoon a sub-field of the field selected by the applicant for the forenoon's examination. The applicant must choose a field and sub-field which has been established or approved by the Board. Fields and sub-fields for each have been established by the Board as follows:

1. Chemical with the established sub-field of Chemical Plant, Gas, Sanitary and others to be approved by the Board.
2. Civil with the established sub-field of Highway, Hydraulics, Municipal, Sanitary, Structural.
3. Electrical with the established sub-field of Communications, Electrical Machinery, Electric Power-Generation and Distribution, Illumination, Industrial Electronics.

4. Mechanical with the established sub-fields of Air Conditioning-Heating-Refrigeration, Heat Power and Heat Engines, Industrial, Machine and Tool Design.
5. Metallurgical with the established sub-fields of Metallurgical Research and others.
6. Mining with the sub-fields to be approved by the Board.

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

The next engineering examination after the February 4 & 5, 1957, examination will be conducted by the Board about the middle of June 1957, with April 15, 1957, as the closing date for filing application to enter it.

SOUTHEAST CHAPTER DIVIDES

The Southeast Chapter of W.S.P.E. has decided to split into what will be known as the Southeast and Waukesha Chapters. Formal application to W.S.P.E. board of both segments, together with boundaries, and a constitution and bylaws for the newly formed Waukesha Chapter are expected soon.

MEMBERSHIP CONTEST

November 2 and 3 was designated by the Michigan Society of Professional Engineers as the dates on which W.S.P.E. had to settle their accounts for losing the membership drive contest last year. The presentation of a plaque on behalf of W.S.P.E. was made by Owen Ayres, past president of W.S.P.E. at a dinner in Lansing, Michigan. Let's not let this happen again.

CONSULTING ENGINEERS NATIONAL ASSOCIATION

Mr. T. E. Roche, consulting engineer from Minneapolis and membership chairman for the newly formed consulting engineers national association, was in Milwau-

kee several weeks ago to investigate the possibilities of establishing an organization of consulting engineers in Wisconsin. The attendance at the noon luncheon did not meet expectations.

BOARD OF DIRECTORS ACTIVITIES

W.S.P.E. Board of Directors has instructed the Constitution and Bylaws committee to prepare revisions to Bylaws to permit year around operation of Functional Groups.

The names of Delmar Nelson, Herman T. Hagestad and Paul J. Grogan were submitted to the Industrial Commission for recommendation for appointment of one man to the Registration Board.

Mr. Sam Cohen was appointed by the Industrial Commission to the studying of inspection fees.

Mr. Lester Fenlon is a member of the committee on the Gas and Vapor Code.

A resolution committee will be appointed for the annual meeting in January. All resolutions for presentation to the membership will be required to be written and in the hands of the resolution committee for review before the business meeting.

MEMBERSHIP DIRECTORY

The 1956 Membership Directory is in the making. Mr. R. W. Smeaton, directory chairman, and committee are hard at work on this project.

WSPE MEMBERS IN MILITARY SERVICE

Members of the society who are drafted into Military Service may have their dues waived each year by requesting such in writing.

NEW MEMBERS

By the action of the Board of Directors, September 14, 1956 the following engineers became members and affiliate members of W.S.P.E. We welcome you in to our society:

(Continued on page 46)



Behind Man's Conquest of the Skies . . . a Master's Touch in Oil

"Flying Saucer"—experimental military craft today—
—forerunner of your cloud car of tomorrow . . .

First flight in a heavier-than-air machine—the
Wright brothers at Kitty Hawk . . .

First plane over the North Pole, first plane over the
South Pole—Admiral Byrd's . . .

First 'round-the-world flight—U. S. Army . . .

Lindbergh's solo flight, nonstop New York to Paris...

Coast-to-coast propeller plane speed record . . .

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your plane, your farm, your factory, your boat, your
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W.S.P.E.

(Continued from page 44)

THE ENGINEERING TECHNICIAN

KARL O. WERWATH

New requirements of industry, particularly in the fields of aeronautics, automotive, electronics, air conditioning, plastics and nucleonics have created thousands of new technical opportunities. Our nation's supply of engineering technicians has not kept pace with the demand of either industry or the military. Such technical supporting personnel as part of engineering teams performs our engineering functions, and technicians are in even shorter supply in some areas than engineers.

There are some 100 courses accredited by the Engineers' Council for Professional Development or approved by the National Council of Technical Schools in ten fields in which engineering technician training has become prominent. The engineering technician is the product of the technical institute type of course, which is usually of two academic years duration and includes a strong program of technical specialties combined with basic subjects in mechanics, physical science, industrial commerce, language, graphics and general studies.

The Working Group on Technical Supporting Personnel of the National Committee for the Development of Scientists and Engineers has worked out a 12 point program for developing technical institutes of education which should have the nation's immediate attention. Action has already been taken on each of these recommendations:

1. Develop adequate teaching personnel;
2. Increase the number and quality of students;
3. Increase utilization of technical personnel;
4. Improve status of engineering technician;

(Continued on page 50)

Name and Position	Address	Reg. No.	Sponsor
SOUTHWEST Dean Leroy Hunzicker, PE Sales Engineer Hunzicker Engineering Co.	217 S. Midvale Blvd. Madison 5, Wisconsin	E-4376	C. Gauzewitz
John Edward Rosecky, PE Secy-Treas. Carl C. Crane, Inc.	2702 Monroe St. Madison 5, Wisconsin	E-2148	C. C. Crane
FOX RIVER VALLEY John Jacob Mattila, PE Div. Gas Engineer Wisconsin Public Service Corp.	428 E. Mason St. Green Bay, Wisconsin	E-5725	Max Bauer
Leonard Bookbinder, PE Construction Supervisor John E. Somerville, Architect	141 Berger St. Green Bay, Wisconsin	E-6116	L. H. Kingston
John Vernon Henderson, PE Div. Gas Engineer Wisconsin Public Service Corp.	318 Congress St. Oshkosh, Wisconsin	E-4415	T. J. Lambeck
WISCONSIN VALLEY Charles W. Bergland, Jr., PE Manager Taylor County Electric Corp.	217 South Eighth St. Medford, Wisconsin	E-6114	F. L. Carlson
MILWAUKEE Howard John Wright, PE Trainee, Grad., Training Course, Allis-Chalmers Mfg. Co.	124 S. State St. Waupun, Wis.	E-5990	K. Miskinis
Warren Jewel Lancaster, PE Chief Eng., Plant Eng. Robert A. Johnston Co.	4965 N. Idlewild Ave. Milwaukee 17, Wisconsin	E-4147	F. C. Koehn
Thomas Irving Lyon, ET Assistant Professor Milwaukee School of Engineering	1025 N. Milwaukee St. Milwaukee 2, Wisconsin	ET-1375	K. O. Werwath
Arthur Bernard Drought, PE Dean, College of Eng. Marquette University	1515 W. Wisconsin Ave. Milwaukee 3, Wisconsin	E-4742	K. O. Werwath
Charles John Merdinger, PE Off. in Chg. Naval Civil Engrg. Research & Eval. Lab., Port Hueneme, California Public Works Officer, MIRAMAR		E-2491	D. E. Merein
Ralph Anthony Millermaster, PE Vice President Cutler-Hammer, Inc.	315 N. 12th St. Milwaukee 1, Wisconsin	E-1084	T. B. Jochem
John Kerber, Jr., PE Sales Engineer Falk Corp.	1441 N. 26th St. Milwaukee 5, Wisconsin	E-5975	J. E. Born
William Frank Eagan, PE Supervising Eng. Allis-Chalmers Mfg. Co.	Allis-Chalmers Mfg. Co. Box 512, Milwaukee 1, Wis.	E-4574	R. W. Smeaton
Donald Clifford Fleming, PE Project Engineer AC Spark Plug Div. General Motors Corp.	2216 W. Linwal Lane Milwaukee 9, Wisconsin	E-5992	A. H. Graettinger
REINSTATEMENTS Glenway Maxon, Jr., PE Maxon & Moore Consulting Engineers	1744 N. Farwell Ave. Milwaukee 2, Wisconsin	E-1643	J. R. Meyer
John Stanton Wolfe, PE	1728 East Park Place Milwaukee 11, Wisconsin	E-3003	J. R. Meyer
WAUKESHA Charles J. Guthrie, PE Design Engineer Hydraulic Unit, Specialties Corp.	Box 257 Waukesha, Wis.	E-6137	D. C. Bengs
Perry J. Wilder, PE Plant Engineer Waukesha Cement Tile Co.	Box 26 Waukesha, Wis.	E-6196	J. H. Waite
Members.....	16		
Affiliate members.....	1		
Reinstatements.....	2		
Total.....	19		

Total members and affiliate members as of July 14, 1956

Members.....	1181
Affiliate members.....	124
Total.....	1305

LOSSES

Deceased—F. C. Lindeman, Milw.; Richard Ruemelin, Milw.; Harry D. Blake, SW; Richard C. Clark, LS; C. S. Gruetzmacher, Milw., OS.	
Resigned—A. A. Schubert, Milw.	
Non-payment of 1955 dues—A. B. Scott.	
Members.....	7
Affiliate members.....	0

Additions since July 14, 1956

Members—(Prior approval).....	16
Reinstatements, members.....	2
Affiliate members.....	1

Total members and affiliate members as of September 14, 1956

Members.....	1192
Affiliate members.....	125
Total.....	1317



water has many uses

Fortunately, not much water is used like this.

Engineers know that America's greatest natural resource has many other vital uses. Supplying homes and industries with adequate water... today and for the future... is a job both challenging and rewarding... one that merits the talents of America's best young engineers.

Cast iron pipe plays an important part in that job. Today, practically every city in America—large or small—uses it for water and gas mains. Over 70 of our public utilities are still served by cast iron pipe *laid over a century ago*.

That's why engineers turn to cast iron pipe for the efficient, economical distribution of water.

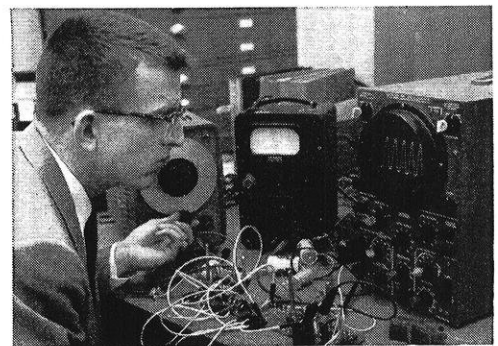
CAST IRON PIPE RESEARCH ASSOCIATION

Thos. F. Wolfe, Managing Director, 122 So. Michigan Avenue, Chicago 3, Ill.

CAST  IRON

CAST IRON PIPE SERVES FOR CENTURIES

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

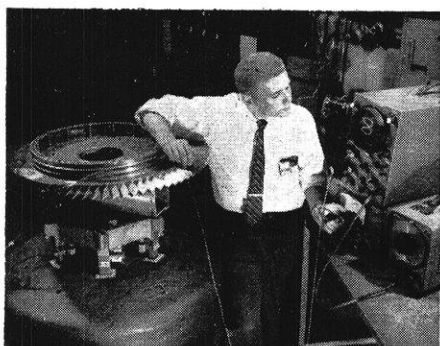
Among the many engineering problems relative to designing and developing today's tremendously powerful aircraft engines is the matter of accumulating data — much of it obtained from within the engines themselves — and recording it precisely. Such is the continuing assignment of those at Pratt & Whitney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

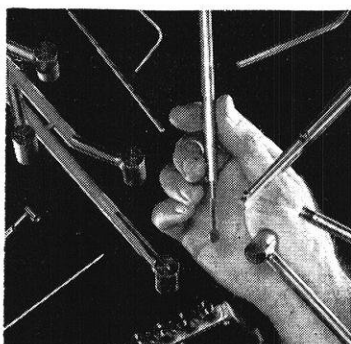
Responsible for assembling this wealth of information so vital to the entire engineering team at

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.

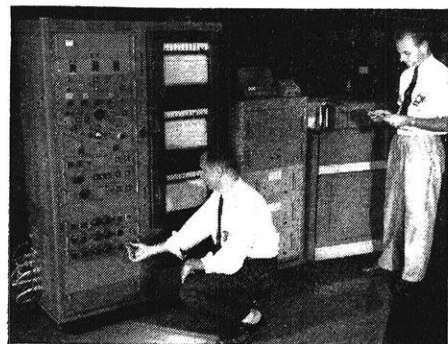
Instrumentation, of course, is only one part of a broadly diversified engineering program at Pratt & Whitney Aircraft. That program — with other far-reaching activities in the fields of combustion, materials problems, mechanical design and aerodynamics — spells out a gratifying future for many of today's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



World's foremost designer and builder of aircraft engines

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation
EAST HARTFORD 8, CONNECTICUT

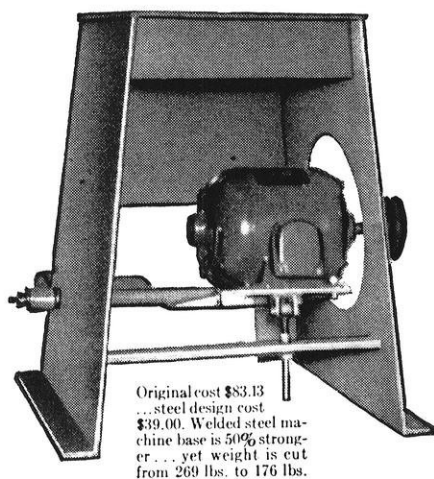
Steel is 2 to 3 times stronger than gray iron
 Steel is 2½ times as rigid as gray iron
 Steel costs a third as much as gray iron
 So products properly designed in steel can be manufactured at savings up to 50%

WHAT MAKES A DESIGNER OUTSTANDING?

TO be successful, a designer must first know how to develop products that are profitable to his company. To be profitable, these products must meet competition, yet be manufactured for low cost.

By taking advantage of the benefits of welded steel construction, the alert design engineer has unlimited opportunities for developing new product ideas. He can add improvements to present products, make them stronger, more serviceable . . . while actually reducing the cost of production, as in the example shown.

HOW COST IS REDUCED



It will pay you to keep pace with the newest developments in steel design. Latest information is in Lincoln Procedure Handbook of Arc Welded Design and Practice. Write.

THE LINCOLN ELECTRIC COMPANY
 CLEVELAND 17, OHIO
 THE WORLD'S LARGEST MANUFACTURER OF
 ARC WELDING EQUIPMENT

W.S.P.E.

(Continued from page 46)

5. Financing of technical institute improvements and expansion;
6. List enrollment and graduate surveys;
7. Appoint specialists in the U. S. Office of Education;
8. Develop a technical institute "unity" organization;
9. Expand Technical Institute Foundation operations;
10. Establish closer relations with the military;
11. Encourage company training programs for upgrading;
12. Analyze relations of technical institute graduates and technical societies.

ENGINEERS CAN HELP IMPROVE THE TEACHING OF SCIENCE AND MATH IN OUR SECONDARY SCHOOLS

An interesting presentation of this subject was given by Mr. T. A. Abbott, Manager, Engineering Research Department, Standard Oil Company, at the Society's "Annual Meeting" in Milwaukee last January.

Karl O. Werwath, State Program Chairman wishes to inform all chapters that he has copies of this subject talk available for distribution. It is his feeling that the facts and materials included in this paper would be a valuable aid to engineers to create interest in local primary and secondary school board activities and parent teachers organizations.

We, as engineers, have not done too good a job advertising the great need for engineers and scientists in this country. Mr. Abbott's paper includes statistical data and slides which engineers can use in presenting the problems to parents and teachers in their localities. These can be had on request from:

Karl O. Werwath
 State Program Chairman
 Wisconsin Society of Professional Engineers
 1025 North Milwaukee Street
 Milwaukee, Wis.

Chapter News

MILWAUKEE CHAPTER

The Milwaukee chapter held its October Dinner meeting on the ninth at the ESM Building. Mr. Glenn Coates of Heft, Brown and Coates spoke on "Engineering Registration—Where do you Stand Today?"

During October Vice President E. C. Koerper served as Chairman on Thursday noon luncheons at ESM Building, 12:00 to 1:00 p.m. sharp. Timely topics were as follows:

Oct. 4—Richard Perrin, Executive Director, Milwaukee Housing Authority. Subject: "Third Ward Redevelopment Program."

Oct. 11—Pierce G. Ellis, P. E., Past President WSPE. Subject: "A Review of the Wisconsin State License Examining Boards."

Oct. 18—J. T. Hanlon, P. E., Mgr. Ceco Steel Products Co. Subject: "Everybody on Deck."

Oct. 25—Dr. and Mrs. John H. Murphy. Subject: "Bangkok to Bali to Tokyo."

FOX RIVER VALLEY

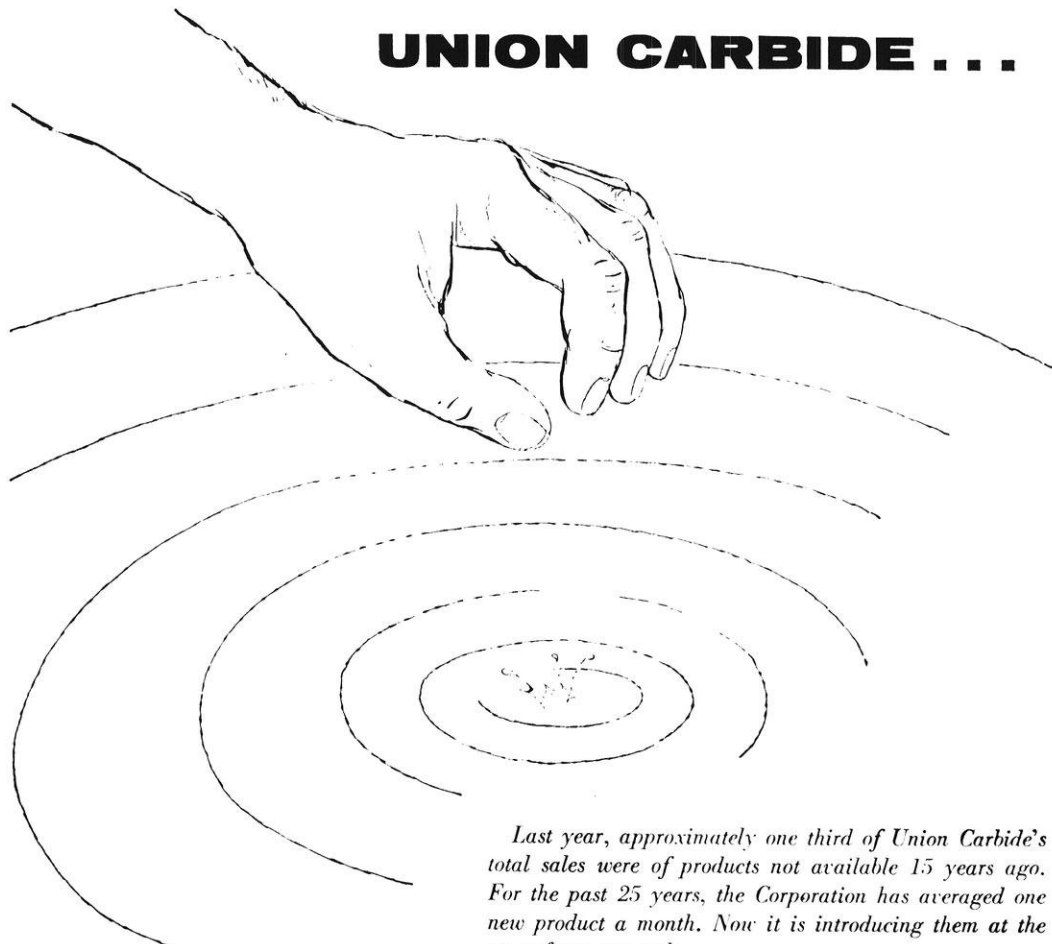
The Kick-off Meeting for the Fox River Valley Chapter was held at the Valley Inn in Neenah. Topics discussed were committee activation and the prospects for the year ahead. A movie, "Steward of the People," was shown before adjournment. Wayne Bryan of Neenah made the arrangements for the meeting.

The Fox River Valley Chapter has a big year ahead—in fact, many big years. While our meetings may be few, there is a tremendous amount of work done back of the scenes. The whole-hearted help of every member is needed to accomplish the very things we as a professional society have talked about for years. Come on out to *your* FRV meetings and hear what it's all about.

(Continued on page 52)

Ideas grow and grow at

UNION CARBIDE . . .



Last year, approximately one third of Union Carbide's total sales were of products not available 15 years ago. For the past 25 years, the Corporation has averaged one new product a month. Now it is introducing them at the rate of two a month.

.....
UCC DIVISIONS INCLUDE:

Bakelite Company
Carbide and Carbon Chemicals Company
Electro Metallurgical Company
Haynes Stellite Company
Linde Air Products Company
National Carbon Company
Silicones Division
Union Carbide Nuclear Company

Ideas born in Union Carbide Laboratories grow . . . from exploratory and fundamental research to applied research and product and process development . . . through pilot plants to production to sales. In all these fields the Divisions of Union Carbide need engineers, chemists, physicists, and business and liberal arts majors. For more information write Co-ordinator of College Recruiting.

UNION CARBIDE

AND CARBON CORPORATION

30 East 42nd St. **UCC** New York 17, N. Y.

W.S.P.E.

(Continued from page 50)

We welcome John J. Mattila, PE, 438 E. Mason St. Green Bay; Leonard Bookbinder, PE, 141 Berger St., Green Bay; and John V. Henderson, PE, 318 Congress St., Oshkosh. These new members were approved by WSPE Sept. 14, and were sponsored by Max Bauer, Lyle Kingston, and T. J. Lambeck, respectively. Glad to have you with us, fellows.

Congratulations to John R. Wagner, PE, upon his change of status. We received word in July that John now "has it made", having stepped up from EIT to PE.

SOUTHEAST CHAPTER

The officers and committee chairmen for the SW Chapter met Friday, October 5, at the University Club, Madison, to outline the scope of each committee's work, discuss the plans for the coming year, and to just get acquainted.

Two of the new ideas for the coming year are (1) to have each chairman watch his committee for the selection of a good hard worker who shows interest in chapter activities, to be chairman for the next year, and (2) to place at each plate at the dinner meetings a sheet giving a short resume of the experience and educational background of each new member to be welcomed into the chapter.

The October 16 meeting of the Southwest Chapter was held at the Nakoma Country Club with 86 members and guests in attendance. New members were presented with pins in accordance with the current practice of the Chapter.

The toastmaster for the evening, Mr. Fay Morgan, introduced Karl O. Werwath, President of the Milwaukee School of Engineering and of the Milwaukee Chapter of WSPE, as the speaker for the evening. Mr. Werwath discussed "The Role of the Scientific and Technical Supporting Personnel." The subject is one in which Mr. Wer-

wath has a definite interest, and no small amount of information, because he is the Chairman of the (look out, here comes a long one) Working Group on Supporting Technical Personnel for Scientists and Engineers of the National Committee for the Development of Scientists and Engineers.

Mr. Werwath told us how we can best use the abilities of the non-professional, but highly and semi-highly trained technical person in "development, design, production, distribution, operation and service of technical production." He also gave us some information on the activities of his Working Group of President Ike's Committee.

William J. Kerttula, formerly Urban Supervisor, District #1, Wisconsin State Highway Commission, now Acting Chief of Design and Planning, District #1, Wisconsin State Highway Commission.

Robert A. Johnson, formerly Resident Highway Engineer, District #1, Wisconsin State Highway Commission, now acting Urban Supervisor, District #1, Wisconsin State Highway Commission.

James A. Jarvis and Robert G. Craig became members of the corporation of Mead and Hunt, Inc. this past August.

Henry J. Hunt, Vice President of Mead and Hunt, Inc. recently made Chairman of the newly inaugurated Consulting Engineers Functional Group in the State. The object of this group is to serve as a forum for effective "discussion and united action on the part of members grouped according to type of professional employment, for the enhancement and betterment of professional recognition and status, conditions of employment, and other matters of mutual welfare". One of the possible projects of this group will be the compilation of a directory of all private consulting engineers in the State of Wisconsin.

Did you know that one of the principal features of the Individual State Civil Defense Plan is that,

(Continued on page 66)



3 BIG STEPS

to success as an **ENGINEER**

- 1. AMBITION**—it is assumed you have this in abundance or you wouldn't be where you are.
- 2. GOOD SCHOOL**—you are fortunate studying in a fine school with engineering instructors of national renown.
- 3. THE A.W.FABER-CASTELL HABIT**—shared by successful engineers the world over. It only costs a few pennies more to use CASTELL, world's finest pencil, in 20 superb degrees, 8B to 10H. Choose from either imported #9000 wood-encased, Locktite Refill Holder with or without new Tel-A-Grade degree Indicator, and imported 9030 drawing Leads.

If you hope to be a master in your profession, use CASTELL, drawing pencil of the masters. If your College store is out of CASTELL, write to us.

A.W.FABER-CASTELL
PENCIL CO., INC. NEWARK 3, N. J.





RCA—First to bring your home the stereophonic sound you've heard at movies

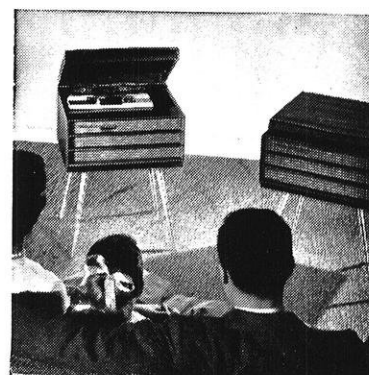
Now in your own home you can hear music in *perspective*, just as in the concert hall. Strings from the left. Brass from the right. The secret lies in amazing new RCA Victor Stereophonic Tape, pre-recorded with 2 sound tracks. The RCA High Fidelity Stereotape Player reproduces sound through two separated groups of speakers . . . gives recorded music new dimensions.

RCA, originator of many other "firsts" in sound, continues to pioneer in "Electronics for Living" at its David Sarnoff Research Center in Princeton,

New Jersey—"trains" the electron to make life fuller, easier, happier.

WHERE TO, MR. ENGINEER?

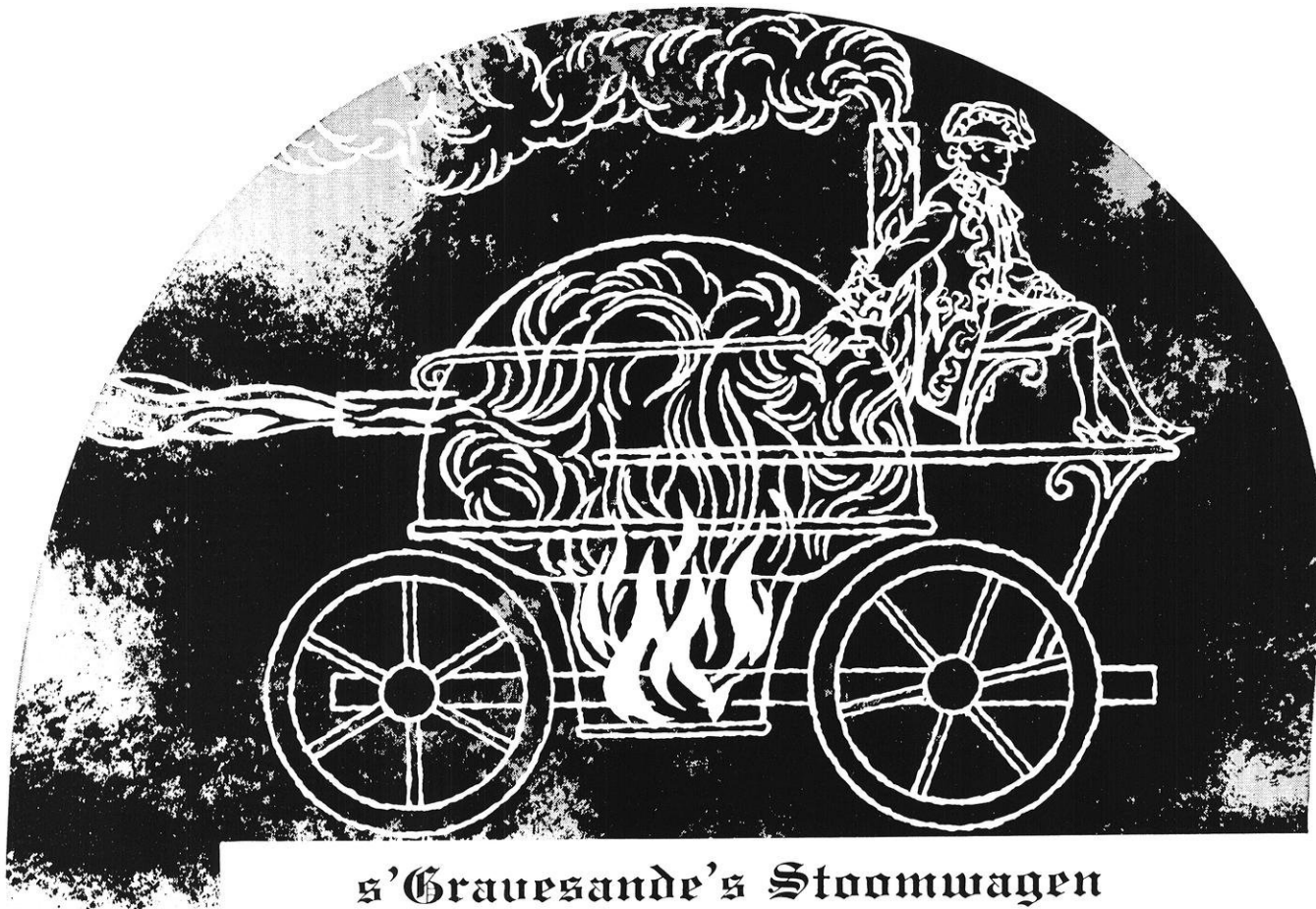
RCA offers careers in research, development, design, and manufacturing for engineers with Bachelor or advanced degrees in E.E., M.E. or Physics. For full information, write to: Mr. Robert Haklisch, Manager, College Relations, Radio Corporation of America, Camden 2, New Jersey.



"VICTROLA" Stereotape Player. Two units—tape transport, amplifiers and 3 speakers in one; 3 speakers in other. 8STP2. Both, complete, **\$350.00**. Available also in matched luggage-styled cabinets at **\$295.00**.



RADIO CORPORATION OF AMERICA
ELECTRONICS FOR LIVING



s'Gravesande's Stoomwagen

s'Gravesande's Steam Reaction Car

In 1721 Jacob Willem s'Gravesande of Delft, stimulated by the recently enunciated Third Law of Motion, astounded the Royal Society by constructing a practical steam reaction car. The vehicle actually moved several times its own length, a distance of about two meters.

In 1956 the goal is no longer meters, but hundreds, and even thousands, of miles. Aerojet-General Corporation, leader in American rocket propulsion for more than a decade, is proud to participate in man's first assault on the frontiers of outer space—Project Vanguard.

Aerojet-General CORPORATION

A Subsidiary of
The General Tire & Rubber Company



AZUSA, CALIFORNIA
SACRAMENTO, CALIFORNIA

We invite you — the engineer, the scientist — to participate at Aerojet in the creation of tomorrow's realities from yesterday's dreams.

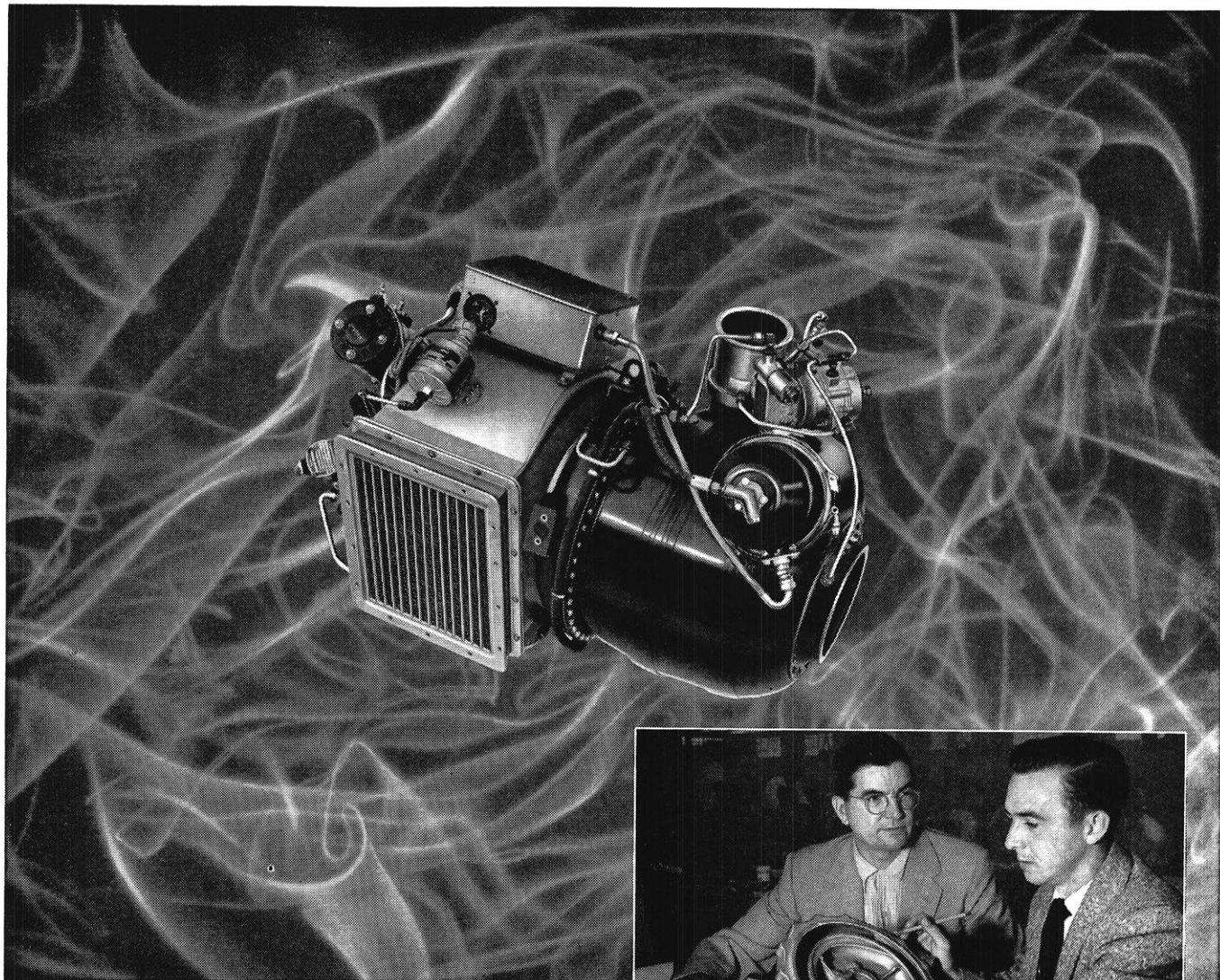
Mechanical Engineers
Electronic Engineers
Chemical Engineers

Electrical Engineers
Aeronautical Engineers
Civil Engineers

Chemists
Physicists
Mathematicians

An Aerojet-General representative will be on campus shortly.
Contact your Placement Office for details.

To the creative engineer...



AiResearch two stage lightweight gas turbine compressor provides pneumatic power for aircraft main engine starting and serves as auxiliary power source for a variety of ground and in-flight services.

► The rapid scientific advance of our modern civilization is the result of new ideas from creative minds that are focused on the future. Our engineers not only have ideas but have the ability to engineer them into products.

That's why The Garrett Corporation has grown in both size and reputation to leadership in its areas of operation. That's why we are seeking more creative engineers to help

us maintain and extend our leadership. If you fall in that category, you'll find working with us fulfilling in stimulation, achievement and financial rewards. In addition, financial assistance and encouragement will help you continue your education in the graduate schools of fine neighboring universities.

All modern U.S. and many foreign aircraft are Garrett equipped. We have pioneered such fields as refrigeration systems, pneumatic valves and controls, temperature controls, cabin air compressors, turbine motors, gas turbine engines, cabin pressure controls, heat transfer, electro-mechanical equipment, electronic computers and controls.

We are seeking engineers in all categories to help us advance our knowledge in these and other fields. Send resume of education and experience today to: Mr. G. D. Bradley



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



ROBERTS, U. W. JUNIOR, WINS ENGINEER HONOR

Robert L. Roberts, 509 Oak St., a junior in the mechanical engineering department, received a \$50, fifth-place award in the ninth engineering undergraduate award and scholarship program of the Lincoln Arc Welding foundation for a design of an all welded steel axle support.

Roberts is married and the father of two sons.

His father, J. Frank Roberts, Oconomowoc Lake, is vice-president of Allis Chalmers Manufacturing Co. The senior Roberts is a graduate of the university's engineering school and was a winner of one of the school's early Engineers' Day awards to outstanding graduates.

NATIONAL SCIENCE FOUNDATION GRADUATE AND POSTDOCTORAL FELLOWSHIPS IN SCIENCE FOR THE ACADEMIC YEAR 1957-1958

The National Science Foundation has announced its plans to award approximately 800 graduate and 175 postdoctoral fellowships for scientific study during the 1957-1958 academic year. These fellowships will be awarded to citizens

ENGINE EARS

by Dave Rex m'57

of the United States, selected solely on the basis of ability. They are offered in the mathematical, physical, medical, biological, engineering, and other sciences including anthropology, psychology (other than clinical), geography, certain interdisciplinary fields, and fields of convergence between the natural and social sciences.

Graduate fellowships are available to those who are working toward the masters' or doctoral degrees in the first, intermediate or terminal year of graduate study. College seniors who expect to receive a baccalaureate degree during the 1956-1957 academic year are also eligible to apply. Post-doctoral fellowships are available to individuals who, as of the beginning of their fellowships, have a Ph.D. in one of the fields listed above or who have had research training and experience equivalent to that represented by such a degree. In addition, holders of the M.D., D.D.S., or D.V.M. degree, who wish to obtain further training for a career in research, are eligible provided they can present an acceptable plan of study and research.

The annual stipends for graduate Fellows are as follows: \$1600 for the first year; \$1800 for the intermediate year; and \$2000 for the terminal year. The annual stipend for postdoctoral Fellows is \$3800. Dependency allowances will be made to married Fellows. Tuition, laboratory fees and limited travel allowances will also be provided.

Further information can be had by leaving a note in the Wisconsin Engineer mailbox in the Mechanical Engineering Building.

ATTENTION ENGINEERING STUDENT GROUPS

Mrs. Hoffman, 208 Mechanical Engineering Bldg., announced that the following *Speakers and Movies* are available to you.

1. "Lecture Topics for College Students 1956," a brochure of selected topics and speakers for your review published by the U.S. Naval Ordnance Laboratory, White Oak, Maryland.

2. "Speakers Bureau Listings for the 1956-57 Academic Year," a brochure from the McDonnell Aircraft Corporation.

3. "Coming Out of the Woods," a 16 mm motion picture in sound and color presented by Timber Engineering Company. (The TECO story of new products — new uses — new wonders in wood — through engineering and research).

SOCIETIES

THE NEW A.S.M.E.

Along with the latest in new cars, the Student Section of the American Society of Mechanical Engineers has that new look in '57. For some time the senior sections of the society have been looking for a means of becoming more familiar with students and prospective Mechanical engineers and increasing the activity and interest within the universities themselves. Following an exhaustive study of student memberships throughout the country the society has adopted a new plan that will offer a host of opportunities to the individual student engineer and ultimately strengthen the organiza-

tion with young people of the profession.

The new program will offer each student member a full years subscription to Mechanical Engineering, a Student Member pin, membership card, a book of five coupons for securing technical papers free of charge, and information regarding meetings and activities for the Section in which his school is located. At the beginning of the senior year each Student Member will receive, compliments of the Old Guard, a copy of "The Unwritten Laws of Engineering", and prior to graduating, ten coupons for technical papers, Associate Membership and pin and a copy of the "Professional Guide for Junior Engineers".

The new plan should help all Mechanical Engineers realize the value in their professional society and take part in its increasing activity.

The first meeting of the Student Section of A.S.M.E. was held on October 4, in Tripp Commons of the Union. The speaker for the evening was Dr. Gilson of The University of Wisconsin. His topic, "BeYond Hi-Fi", and demonstration brought all four walls into tune at near natural frequencies—an event which helped to relieve the internal frustrations of all "college room" sound enthusiasts present. Refreshments were served—Milwaukee style.

REPORT ON THE MONTHLY A. I. Ch. E. MEETING

At the first A. I. Ch. E. meeting of the semester it was generally agreed that this years panel of officers deserved a round of congratulations for "getting out the vote". Indeed, latecomers arriving at the Union's Top Flight room less than fifteen minutes prior to the start of the meeting found themselves out in the hall looking on an assembly where not even standing room was available. As a result, the meeting was adjourned to Great Hall.

The speaker for the evening was Mr. Melvin W. Butenhoff, a Wisconsin alumnus, (Ch.E. '40), and now with the Polychemicals Division of the Du Pont Company. His topic was, "The Experiences of a Chemical Engineer with Du Pont", and on this he enumerated the various lines of work open to engineers. Mr. Butenhoff illustrated his talk with slides showing some of the typical projects and problems encountered by Du Pont engineers and closed with an elaboration of some of the company policies designed to broaden the background and experience of its engineers.

At the conclusion of the meeting some twenty five intelligent, new, dues paying members were gladly welcomed into the organization while liquid refreshment along with Coke and Chips was served.

AIEE, IRE NEWS

The first meeting of the fall semester for the student branch of AIEE, IRE was held Thursday evening, October 18. The first part of the meeting consisted of an introduction of the new officers which are; President-Earl Strandt, Vice President-Norman Posopanko, Secretary and Treasurer-John Pozorski, Corresponding Secretary of IRE-Richard Sobocinski, Corresponding Secretary of AIEE-Lloyd Martinson, Polygon Board IRE representatives-Jack Hauser and Ben Hoy, Polygon Board AIEE representatives-Dave Hartman and Richard Kraemer.

Several committees were formed for this semester to help the organization run smoothly throughout the semester. They are the Program, the Publicity, the Refreshment, the Membership and the Student Paper Committees. Part of the new business was an announcement by Ken Stahl, President of the Polygon Board, stating that the AIEE, IRE will receive 560 dollars from the Polygon Board for the Electrical Engineers share of the profits from the 1957 Engineering Exposition held last semester.

After the business was completed the guest speaker was introduced; He was Emil Martin of Collins Radio Company. He gave a very interesting talk on automatically tuned transmitters. Mr. Martin explained in semi-technical terminology how the tuning was performed with the aid of discriminator and servomotor.

After Mr. Martin's talk was completed, coffee and donuts were served. With this the first meeting was ended.

"TAU BATES" HOLD NATIONAL CONVENTION

Two Wisconsin men, Larry Barr, ME-4 and Bob Kruse, ME-4, recently attended the Annual Tau Beta Pi National Convention at the University of Kansas in Lawrence, Kansas.

Tau Beta Pi is the all-engineering honorary fraternity, with chapters at 99 schools in 46 of the 48 states. Barr and Kruse are, respectively, the president and vice-president of the Wisconsin Alpha chapter.

This year's convention, lasting three days beginning October 11, passed two resolutions of interest to the University of Wisconsin. One of these resolutions was to allow women to be voted in as members in what was here-to-fore an all male organization.

This resolution was passed by the margin of one vote, and requires three-fourths chapter ratification for full approval. It may be interesting to see what happens to this resolution when it is received by the members of the individual chapters.

The combined efforts of The University of Wisconsin and Marquette delegates effected the approval of the second resolution to bring the 1957 National Convention to Wisconsin. This means that the Convention will be held two days in Madison and two days in Milwaukee. Next year's delegates will have but a short walk for each day's business meetings.

(Continued on next page)

Engine Ears

(Continued from page 57)

ALUMNI

Wallace W. McDowell, vice president in charge of engineering and research of the International Business Machines Company, announced the appointment of **Dr. Emanuel R. Piore** as the company-wide director of research.

A distinguished physicist, Dr. Piore was formerly chief scientist of the Office of Naval Research. As top civilian in ONR, he had a personal hand in instituting projects through which this organization gained general recognition as the leading research arm of the government. His most recent post was as research vice president for Avco Manufacturing Corp. where he was engaged mainly in the direction of scientific programs and for whom he remains a consultant.

At IBM, Dr. Piore will head a company-wide research effort presently being carried on in laboratories located in New York and California and in Zurich, Switzerland.

Magnetic cores, transistors and other advanced developments

found in IBM electronic computers owe much to research conducted in the area of solid state and surface physics, Dr. Piore's primary field. He has also done notable work in thermionic, photoelectric and secondary emission. While with the Office of Naval Research, he was instrumental in helping the government attain a prominent role in the use of general-purpose digital computers and in developing programs in applied mathematics and numerical analysis.

Born in 1908 in Wilno, Russia, Dr. Piore came to this country at the age of nine. He received his A.B. from *Wisconsin* in 1930, remaining there as an instructor until 1935. In that year he earned his Ph.D. and joined RCA, later moving to CBS as engineer-in-charge of the Television Laboratories. He is associated with some of the early work on color TV.

Dr. Piore is a consultant for the Science Advisory Committee, Office of Defense Mobilization, a Fellow of the American Physical Society, and a Fellow and member of the administrative committee of the Institute of Radio Engineers. He also holds membership in the Society of Naval Engineers, Science

Research Society of America and the Washington Academy of Sciences. He is married and the father of three children, the eldest 16.

As director of the several IBM research activities, he will make his headquarters in New York City.



Louis A. Lemke.

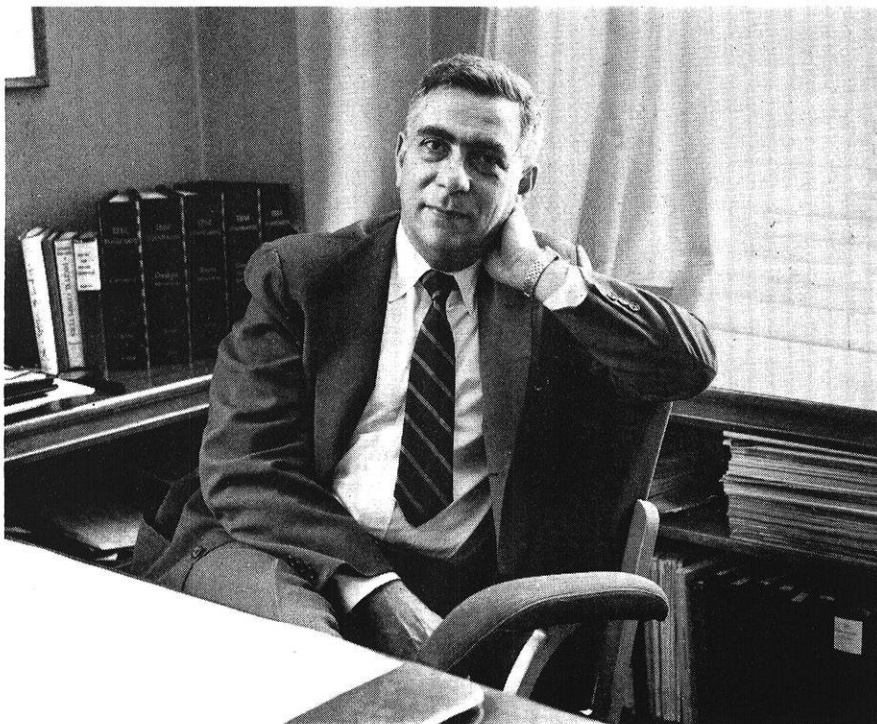
Louis A. Lemke is manager of tape record coordinator test department of the International Business Machines Corporation. He joined the company as a final test engineer early in January of 1955. In March of this year Mr. Lemke was appointed to the status of associate engineer.

Mr. Lemke is a graduate of the University of Wisconsin with a Bachelor of Science degree in electrical engineering.

Paul J. Demet has been appointed Dealer Sales Supervisor of the Twin Disc Clutch Company. His responsibilities include promoting product sales through authorized dealers; establishing dealers in the United States, Canada, Mexico and U. S. Possessions; training dealer personnel; warehouse stock scheduling; and processing of dealer orders.

He was graduated from the University of Wisconsin as a mechanical engineer, and came to Twin Disc in 1940. He has worked as a design engineer at Racine, at the Hydraulic Division in Rockford, Ill., and at Twin Disc's Cleveland office.

(Continued on page 60)



Dr. Emanuel Piore.

Communications Super-highways of the Future

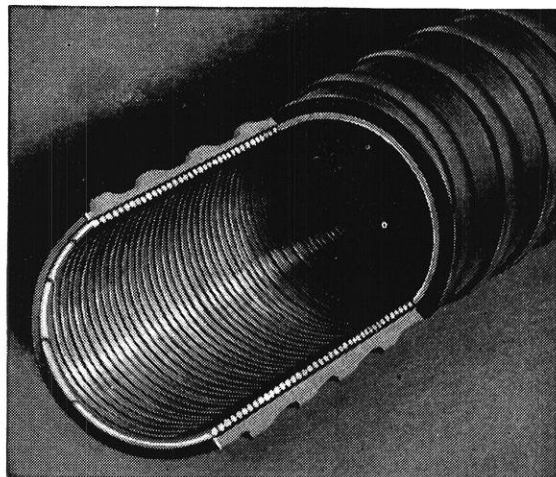
Another example of the pioneering opportunities at Bell Telephone Laboratories

Careers with Bell Telephone Laboratories offer young engineers and scientists the chance to take part in pioneering exciting new developments in the field of communications—developments that look ahead to the needs of the future.

For example, the Bell System anticipates greatly increased demands for the transmission of telephone conversations and TV pictures. Communication links of giant capacity will be needed. Bell Labs scientists and engineers are experi-



One type of guide, designed to be flexible, is bent on wooden forms to study effect of curvature on transmission. Left is A. C. Beck, Radio Research Engineer, E.E., Rensselaer Polytechnic Institute. Right is A. P. King, Radio Research Engineer, A.B. in Physics and Engineering, California Institute of Technology.



Experimental waveguide, of tightly coiled copper wire in jacket, takes waves around bends. Solid wall pipe can be used for straight runs.

menting with a new kind of long distance transmission medium which consists of round waveguides—empty pipes—and is theoretically capable of carrying hundreds of thousands of telephone conversations simultaneously with hundreds of television programs.

A crucial difference between this new waveguide system and present systems is that the *higher* the frequency of the waves transmitted, the *less* the attenuation. This is exactly the reverse of what is true for other forms of long distance transmission, such as the coaxial cable. To explore at frequencies higher than any now used, Laboratories scientists are devising new techniques and apparatus. Thus, they have developed a new reflex klystron tube able to generate a wide band of frequencies near 60,000 megacycles per second.

This new waveguide system is another result of the Bell System's unending effort to anticipate America's future communications needs. Projects like this are typical of the challenges that offer absorbing careers to able, imaginative young engineers and scientists. Your placement officer has more information about careers with Bell Telephone Laboratories, and also with Bell Telephone Companies, Western Electric and Sandia Corporation.

BELL TELEPHONE SYSTEM



Engine Ears

(Continued from page 58)

INSTITUTES SURVEYORS INSTITUTE November 28, 29, 30

With lectures by such famous men as Dr. Arthur D. Kidder and Mr. W. L. Ege, the annual institute for surveyors will feature information on the legal aspects of land surveying, modern surveying equipment and practices, surveys for special purposes and on other new pertinent material.

Dr. Kidder was born in Quincy, Michigan, graduated from Rose Polytechnic Institute and worked as editor-in-chief of The Manual of Instruction for the Survey of Public Lands of the United States in 1947, 1930, and 1919. His knowledge of active surveying was furthered by his service as chief surveyor on the Colorado and New Mexico boundary. He is now actively engaged in practice with Mr. J. C. Thomas in Washington, D. C.

This institute provides an opportunity to review, keep abreast, and to tell others of one's own practice. For further information or to register, write to Mr. Leonard F. Hillis, Institute Coordinator. The registration fee will be \$20.

WEDNESDAY, NOVEMBER 28

A.M.

8:30 Registration

9:00 Movie

9:30 Welcome—Kurt F. Wendt, Dean,
College of Engineering, The
University of Wisconsin

9:40 Administering the Registration of
Land Surveyors in Wisconsin

10:30 Recess

10:45 United States Land Subdivision;
Rules and Legal Precedents

P.M.

12:20 Lunch

1:30 The Use of Aerial Mapping by the
State Highway Commission of
Wisconsin

3:20 Recess

3:40 Surveying by Contract for the
State Highway Commission of
Wisconsin

4:40 Adjourn

7:30 Smoker and Discussion

THURSDAY, NOVEMBER 29

A.M.

8:30 Movie

9:00 Platting Land and Recording Plats
in Wisconsin

State Regulation of Platting
State Highway Commission Regu-
lations and Approvals

State Board of Health Regula-
tions and Approvals

11:00 Recess

11:20 Regulation of Platting by Munic-
ipalities

P.M.

12:20 Lunch

1:30 Are Changes in Chapter 236 or
Platting Procedures Desirable?
Discussion

3:15 Recess

3:30 Field Checking Subdivision Plats

4:30 Adjourn

7:00 Annual Meeting of the Wisconsin
Society of Land Surveyors in
Building T-16

FRIDAY, NOVEMBER 30

A.M.

8:30 Movie

9:00 Getting the Most from Your Sur-
veying Instruments

(Continued on page 62)

CREATIVE ENGINEERING CAREERS

Here's Your Opportunity for Long-Term Success in the Fast-Growing Automatic Control Industry

THE INDUSTRY

The automatic temperature, humidity and air conditioning control field is one of today's leading growth industries. Continued rapid expansion in the years ahead is inevitable in this age of air conditioned buildings and mounting construction activity. That means abundant opportunity for you to grow—and prosper, too!

THE WORK

For graduates in any branch of engineering, with or without experience, Johnson has immediate openings in sales engineering, product design and development, research, production and application engineering. All involve assignments of responsibility and offer unlimited possibilities for personal development and advancement.

Strictly an engineer's company, we deal entirely with individually designed control systems. You'll find yourself working with the nation's top architects, consulting engineers, contractors and building owners.

THE COMPANY

Johnson established the automatic temperature control industry when we developed the room thermostat over 70 years ago. Johnson is the *only* nationwide organization devoted exclusively to planning, manufacturing and installing automatic temperature and air conditioning control systems.

As the industry's specialists, with 100 fully staffed branch offices, we've done the control systems for most of the nation's better buildings—skyscrapers, schools, industrial plants, hotels, hospitals and other large buildings. The work is diversified, exacting, with plenty of challenge for your engineering ability.

THE REWARDS

At Johnson, you'll be able to realize your full potential as an engineer, in the work of your choice. You'll enjoy ready recognition of your accomplishments. Your work will be sufficiently important for you to retain your identity as an individual *always*. Salaries, insurance, pension plan and other company-paid benefits are attractive.

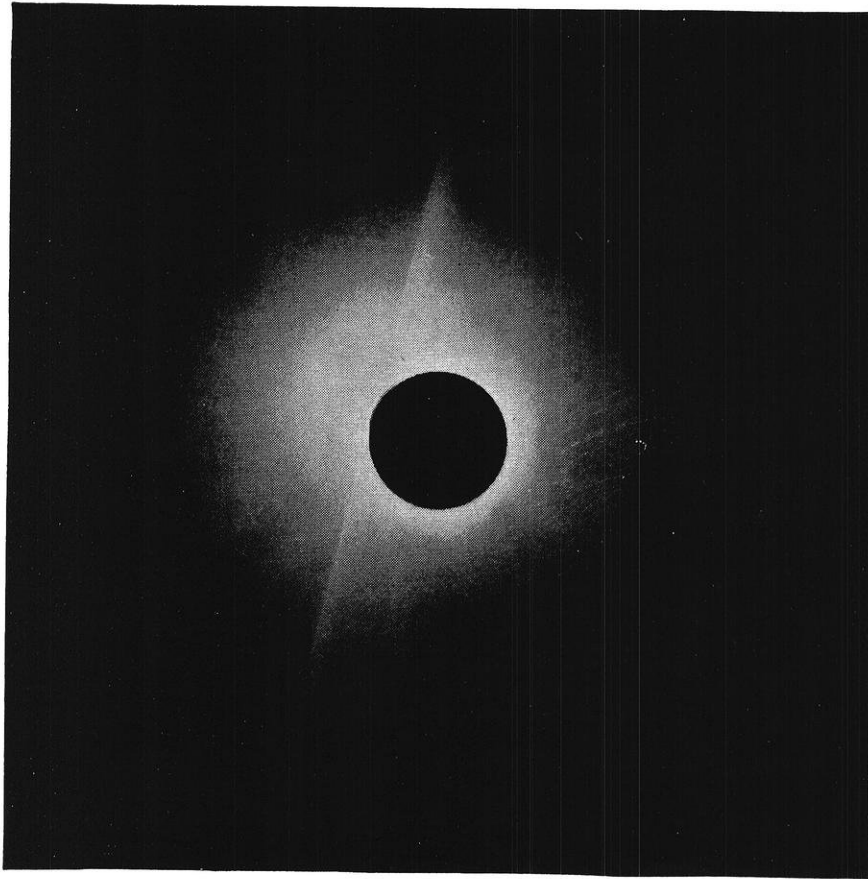
Our "Job Opportunities Booklet" contains details of our operation and shows where you'd fit in. For your copy, write J. H. Mason, Johnson Service Company, Milwaukee 1, Wisconsin.

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Because of an unmatched record of scientific experience in upper-air research as builders of the Viking Rocket series for the Navy, Martin was awarded the prime contract on the project known as ESV VANGUARD—the Earth Satellite Vehicle that will take its place in history as man's first exploratory step in the conquest of the final frontier, space itself.

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summer employment
program for...

Experimental Physicists	Analytical Chemists
Nuclear Physicists	Inorganic Chemists
Theoretical Physicists	Physical Chemists
Mathematicians	Mechanical Engineers
Metallurgical Engineers	Electrical Engineers (Electronics)
Chemical Engineers	

Summer employment opportunities at the Laboratory are open to approximately 100 graduate students majoring in various physical sciences, and undergraduates receiving their degrees next June who intend to continue their advance studies.

The program provides for well-paid summer work with renowned scientists in one of the nation's most important and finest equipped research laboratories.

Summer employees will become familiar with several phases of vital scientific research and development activity related as closely as possible to the individual's field of interest. This experience will enable students to appraise the advantages of a possible career at the Laboratory.

In addition to interesting work, employees will enjoy delightful daytime temperatures and blanket-cool nights in a timbered, mountainous area, only 35 miles from historic old Santa Fe.

Interested students should make immediate inquiry. Completed applications must be received by the Laboratory not later than February 1, 1957, in order to allow time for necessary security clearance. Applicants must be U. S. citizens.

Mail inquiry to:
Department of Scientific Personnel

Travel expenses
are paid to and
from Los Alamos.

los alamos
scientific laboratory

OF THE UNIVERSITY OF CALIFORNIA

LOS ALAMOS, NEW MEXICO

Engine Ears

(Continued from page 60)

10:30 Recess

10:45 The Use of Altimeters in Surveying

P.M.

12:15 Recess for Lunch

12:45 Annual Closing Luncheon

1:45 An American Engineer in Saudi Arabia

2:45 Awarding of Certificates

3:00 See You Next Year

INDUSTRIAL PLANT MAINTENANCE INSTITUTE

December 4, 5, 6, 1956

This institute is planned for plant engineers, plant managers, maintenance supervisors, and others concerned with maintenance problems. Recent advances in planning and scheduling procedures, preventive maintenance, and application of industrial engineering to maintenance activities will be featured and discussed.

The speakers have been selected with the guidance of the local chapters of the Plant Engineers Society and are notable for their excellence in speaking and leading discussions

Fee: \$25. Ralph D. Smith, Institute Coordinator.

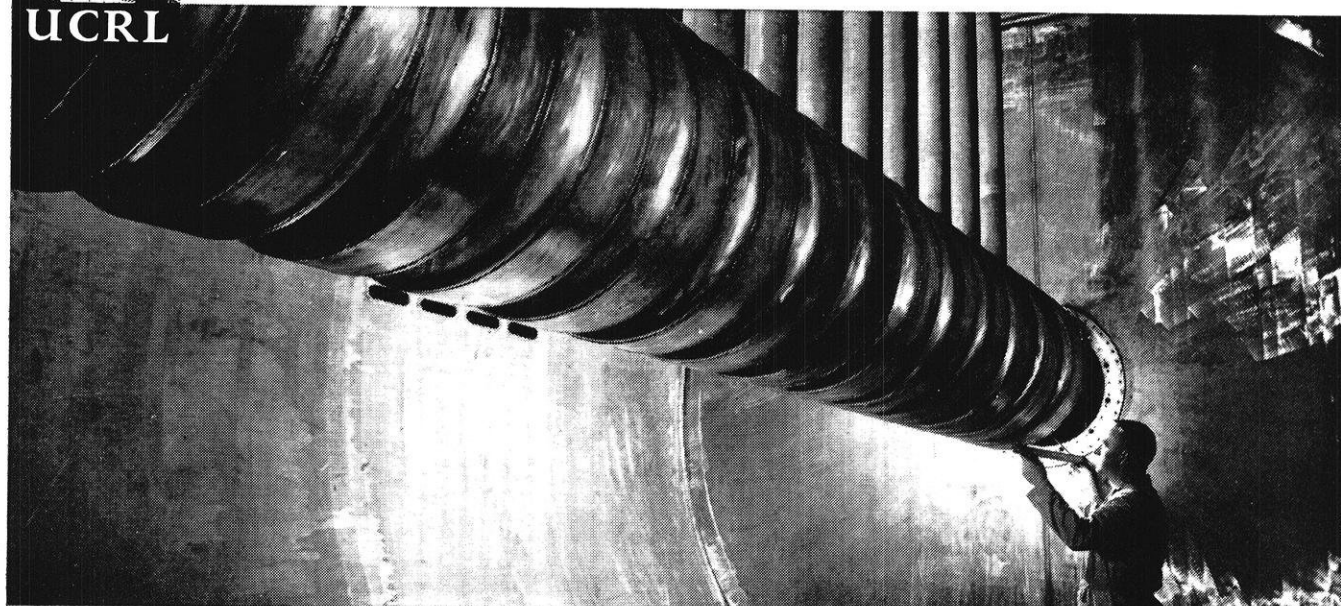
INSPECTION ORGANIZATION INSTITUTE

December 11, 12

With emphasis on administrative problems and procedures, the inspection organization institute will be of special interest to inspection department managers and other engineers concerned with these subjects. Such topics as the internal organization of the inspection department, its relationship with other departments, personnel problems and means of increasing the effectiveness of the inspection force will be discussed in this institute.

For more complete information or to register, write to Mr. Robert A. Ratner, Institute Coordinator. The fee for this institute will be \$20.

THE END



At UCRL's Livermore, California, site—interior view of drift tubes in high-current linear accelerator designed to deliver 250 ma of 3.6 Mev protons or 7.8 Mev deuterons

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If you are a **CHEMIST** or **CHEMICAL ENGINEER**, you will work on investigations in radiochemistry, physical and inorganic chemistry and analytical chemistry. The chemical engineer is particularly concerned with the problems of nuclear rocket propulsion, weapons and reactors.

If you are a **PHYSICIST** or **MATHEMATICIAN** you may be involved in such

fields of theoretical and experimental physics as weapons design, nuclear rockets, nuclear emulsions, scientific photography (including work in the new field of shock hydrodynamics), reaction history, critical assembly,

nuclear physics, high current linear accelerator research, and the controlled release of thermonuclear energy.

In addition, you will be encouraged to explore fundamental problems of your own choosing and to publish your findings in the open literature.

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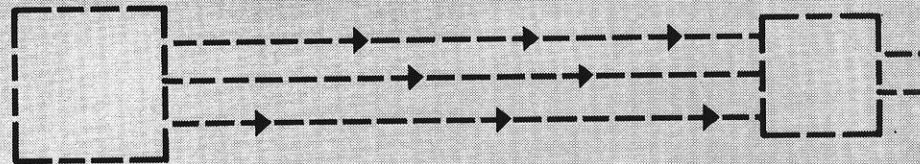
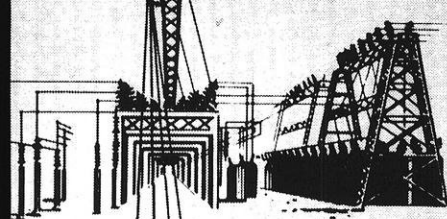
My fields of interest are _____

Name _____

Address _____

City _____ Zone _____ State _____

1-1-1



The Importance of

Coverings and Sheaths for

THE TERM "COVERINGS", as applied to insulated electrical wires and cables, refers to a relatively continuous homogeneous layer or layers of impervious and inert material, applied over an insulated conductor or conductor assembly for the purpose of protecting such conductors from moisture, chemical attack and mechanical damage. Coverings may be colored to indicate circuit identification. Chemical attack refers to damage to the insulation resulting from acids, alkalis and other chemicals in the atmosphere, the ducts or soil in which the cables may be installed. Mechanical damage may result from the abrading, compressing, cutting and tearing forces to which the insulation may be subjected during installation and service.

Coverings may be made of metallic or non-metallic materials. Metallic coverings may be, (1) a continuous metal tube over the insulated conductor, usually made of lead and known as a lead sheath, (2) metal tapes applied spirally about the insulated conductor and referred to as an armor or a shield, depending on the purpose for which it is used, or, (3) metal wires applied spirally either in one direction or in the form of a braid, and again known as an armor or a shield. Armor is a covering applied primarily for mechanical protection or to add strength while a shield is applied to protect the insulation from electrical stresses or for safety purposes. Non-metallic coverings may consist of, (1) a continuous layer of vulcanized rubber or rubber-like material, generally neoprene, or a thermoplastic material, called a jacket, (2) spirally applied, moisture-resistant fibrous yarn, usually cotton or jute, (3) moisture-resistant fibrous tapes, or, (4) moisture-resistant fibrous braids. Combinations of two or more of these may be used as explained later.

The kind and number of coverings used is determined largely by the size of the conductor or cable, the type of insulation on the conductor and the installation conditions. The following is a brief outline of the types of coverings required for the more important types of insulations and installation conditions.

INSTALLATION in DRY CONDUITS and DUCTS

Single-conductor rubber and varnished-cambric insulated cables require a covering over the insulation consisting of a moisture-resistant cotton braid on the small sizes and a double braid or tape and braid on the large sizes for protection against mechanical damage. On 600 volt cables for installation in buildings this covering must be flame-resistant, and is usually colored for circuit identification. A thin layer of neoprene may replace such fibrous coverings on rubber-insulated cables. Paper-insulated cables require a lead sheath for retention of the impregnant and for mechanical protection. Single-conductor polyvinyl chloride insulated cables usually require no coverings since they are generally considered resistant to flame and chemical and mechanical damage.

Multiple-conductor cables which consist of two or more single conductors assembled as a unit are protected by an outer covering. The individual conductors of multiple-conductor rubber insulated cables are generally protected by a single fibrous covering. The outer covering of multiple-conductor cables usually consists of a tape and moisture-resistant cotton braid on rubber and varnished-cambric insulated cables. A neoprene jacket may replace the outer braid on rubber-insulated cables. A polyvinyl chloride jacket is generally used on polyvinyl chloride insulated multiple-conductor cables. Multiple-conductor paper-insulated cables have a lead sheath over the assembled insulated conductors.

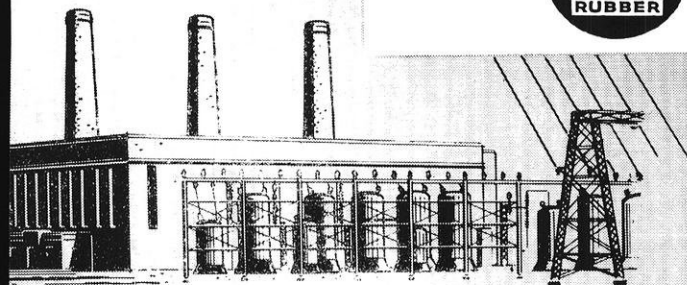
INSTALLATION in WET CONDUITS and DUCTS

The coverings described for use in dry locations on both single- and multiple-conductor cables are suitable for use in wet locations, except that a lead sheath is required over varnished cambric, paper and non-moisture-resistant rubber and polyvinyl chloride insulations.

Moisture-resistant rubber insulation requires mechanical protection in the form of a fibrous covering or coverings or a neoprene jacket. A neoprene jacket is preferred because of its greater resistance to deterioration in wet locations. Moisture-resistant polyvinyl chloride may be



United States Rubber





Insulated wires and cables

used without a covering on single-conductor cables.

AERIAL INSTALLATIONS

The types of coverings described for use in wet locations are generally suitable for aerial installations but greater thicknesses of non-metallic coverings, particularly for single-conductor cables, are required. Fibrous coverings for aerial use are usually made of moisture-resistant jute, sisal or loom-woven cotton of large size. Neoprene jackets on single-conductor cables for aerial installations are about 50 per cent greater in thickness than those used for duct installations. These thicker covers provide the additional mechanical protection required for aerial installations. Neoprene jackets are generally preferred over fibrous or rubber jackets because of their greater resistance to weathering. Lead-sheathed cables with the same sheath thickness as used for duct installations are suitable for aerial installations. A lead alloy containing small amounts of antimony or tin is used instead of pure lead to reduce failures due to crystallization.

DIRECT BURIAL

For direct-burial installations, rubber, rubber-like or thermoplastic jackets and lead sheaths are generally used. The jacket or sheath thicknesses are the same as those used for aerial installations. Lead sheaths require protection against mechanical damage. This usually consists of two servings of moisture-resistant jute yarn immediately over the lead, followed by two steel tapes over which are applied two servings of moisture-resistant jute.

SUBMARINE and VERTICAL CABLES

Submarine cables require protection against mechanical damage and additional strength over that provided by the conductors to prevent them from being broken by dragging anchors or other objects. Vertical cables frequently require greater strength for their support than that provided by the conductors. This additional strength and mechanical protection is usually provided by a serving of steel wires which completely covers the surface of the cable. This is known as a wire

armor. A bedding consisting of two moisture-resistant jute servings is provided between the non-metallic jacket or lead sheath and the armor wires.

PORTABLE INSTALLATIONS

Cables for portable installations such as those used on dredges, shovels and mining equipment must be flexible and their sheaths must be resistant to abrasion, cutting and tearing. Tough wear- and - weather - resistant rubber or rubber-like jackets are therefore used. Such jackets are generally made in two layers with a reinforcing braid of high-strength cotton yarn between them. The jacket thicknesses for such cables are generally greater for a given size of cable than those of cables for non-portable installations.

SHIELDING

Shields consist of one or more conducting layers on insulated electric power cables, the purpose of which is to confine the dielectric field to the insulation on the individual conductors. The two most important functions of shields are, (1) to protect the insulation against harmful electrical stresses and discharges at its surfaces, and, (2) to reduce hazards of shock.

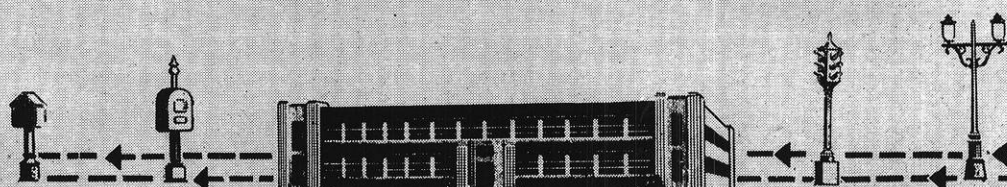
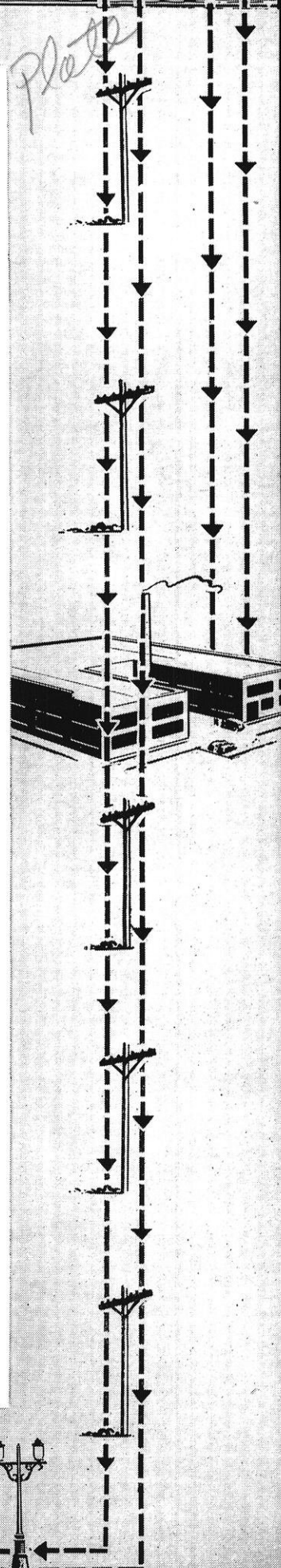
Since harmful electrical stresses can occur at both the internal and external surfaces of an insulation, particularly on stranded conductors, at high voltages, it is necessary to provide shields at both surfaces. Internal shielding in the form of a semi-conducting fibrous material is generally used immediately over the conductor for operating voltages above 2000. External shielding usually consists of a semi-conducting fibrous layer immediately over the insulation over which is applied a layer of metallic material. External shields are generally used at voltages above 3000 for non-metallic jacket cables and above 10,000 for lead-sheathed cables.

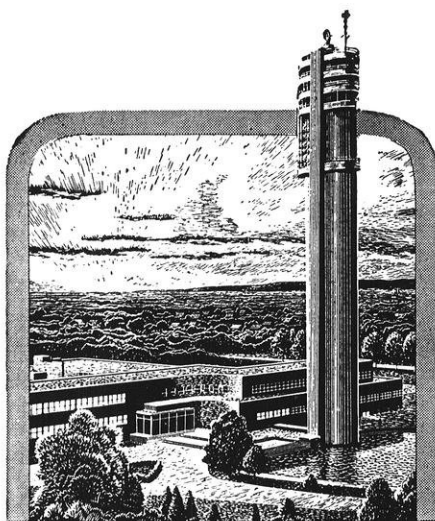
Metallic shields are made of non-magnetic materials such as aluminum or copper and are applied as tapes on cables for non-portable installations and as braids for portable cables. External shields must be grounded at all joints and terminals.

For reprints of these pages write to address below.

Electrical Wire and Cable Department

Rockefeller Center • New York 20, N. Y.





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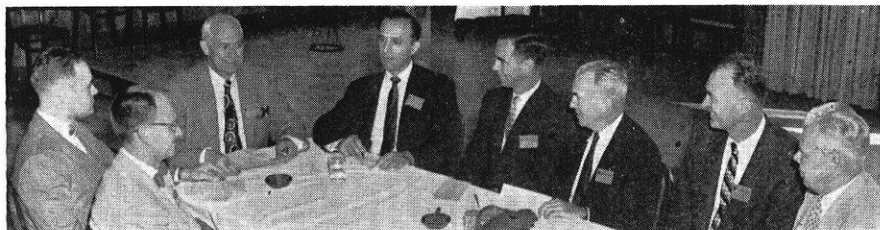
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Meeting of the W.S.P.E. Industrial Functional Group at the Ninth Summer Conference. V. Robins Tate, Chairman.

W.S.P.E.

(Continued from page 52)

on the declaration of an emergency by the Governor of a State, all the water utilities within the State will be operated as one unit? And that the sewerage utilities will be similarly operated? Mr. John H. Bunch, our SW Chapter Civil Defense Committee Chairman, not only has the problem of Madison's traffic and of meeting with his committee, but he also has, under his plan, an interest in every water and sewerage utility in the SW Chapter's eight county area. WOW!

And speaking of water utilities, the water industry is the largest industry in the world with respect to the weight of production handled.

NORTHWEST CHAPTER

The October meeting of the Northwest Chapter of the Wisconsin Society of Professional Engineers was held Wednesday, Oct. 3, at the Hotel Eau Claire.

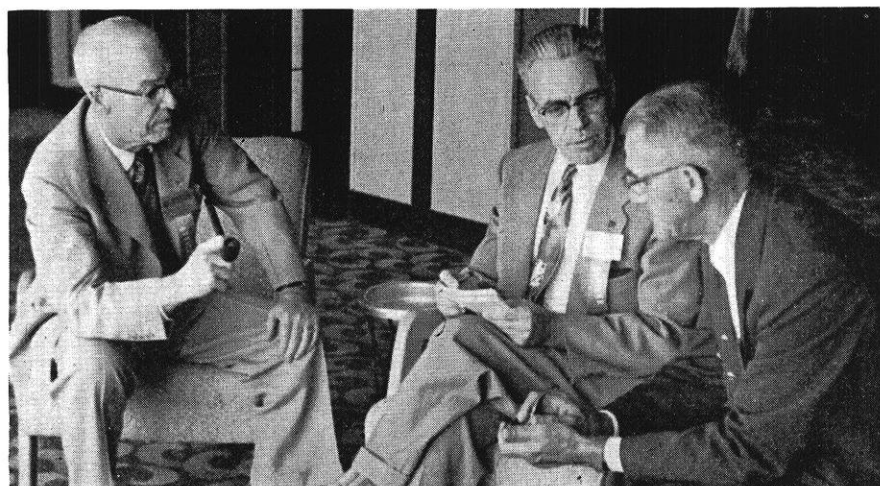
The guest speaker was Mr. Dean Hanson, of the Mark Hurd Aerial

Survey Co., who discussed the techniques of aerial photography and "photogrammetry"—the art of preparing survey and contour maps from aerial photographs.

Mr. Hanson stated that contour maps can be prepared with an accuracy of one foot in elevation, at a cost of a fraction of that required for ground surveys. The system was used for preliminary work on the new Eau Claire-Hudson section of U. S. Hwy. 12, and has been extensively used by Northern States Power Co. for determining transmission line routes.

According to Mr. Hanson, the method was developed in Europe by Swiss and German scientists, and consists basically of taking a sequence of overlapping photographs. The overlapping portions make up a pair of stereoscopic pictures, which are placed in a special precision machine. The operator of the machine determines the ground contours with the aid of a few known elevations which are measured by ground crews.

(Continued on page 89)



Discussing future plans for W.S.P.E. at Nippersink Manor during the Ninth Summer Conference are left to right A. Owen Ayres, Past President; Arthur G. Behling, President; and Edwin J. Kallevang, Chairman of the Awards Committee.



Success is a journey...

At Wisconsin Electric Power Company, success is a *journey* . . . not a *destination*. Since all of our engineering work is performed by our own engineers, each step along the way is marked with the kind of opportunities that breed success.

Problems are here for you to solve . . . rewards are here for you to earn. Opportunities for personal growth and advancement are unlimited . . .

... at Wisconsin Electric Power Company

You will find working at Wisconsin Electric Power Company a very satisfying experience because most of your time will be spent on actual engineering problems. For example, you may be engaged in designing and building power plants, substations, transmission and distribution lines. You may be called upon to solve a wide variety of chemical engineering problems.

You may be engaged in creating rate schedules, in special engineering and economic studies. You may work with the challenging engineering problems of our industrial and commercial customers.

As you grow in stature, you may design electric systems, supervise operations. It is quite possible you may take part in the

development of the exciting new techniques of producing electric power from the atom.

If you have a desire to put your education to work and to keep on learning . . . success is bound to accompany you every step of the way in your Wisconsin Electric Power Company career. We cordially invite you to find out more about the many advantages we have to offer *you*.

Ask for "You and Your Future".

Find out more about career opportunities at Wisconsin Electric Power Company by picking up a personal copy of the interesting booklet, "You and Your Future" now available at your Placement Office. At the same time, check the interview schedule for dates when our representative will be on the campus.

WISCONSIN ELECTRIC POWER COMPANY

231 WEST MICHIGAN STREET, MILWAUKEE 1, WISCONSIN



Here is the first photo of Lockheed's new Model 1649A Super Constellation with a record-length, 150-foot wing as it is towed out of the final assembly hangar.

Science Highlights

(Continued from page 36)

Right after rollout, the first plane went to the weight hangar for symmetry check, weighing and balancing to corroborate its original design.

Next came a gas soak check, where fuel tanks are filled and emptied and the entire fuel system exhaustively examined.

Then comes a test of the new, high-pressure hydraulic system designed to give safer and finer flight control, the company reported.

Meantime inspectors are going over the entire ship from its radar nose to triple-finned tail. When they mark it ready, it will be turned over to flight test engineers. About 10 days later it will be finished with ground taxiing tests and cleared for its first takeoff.

ULTRA-THIN, PRECISION-GAGE METAL STRIP

Ultra-thin metal strip held to exceptionally close thickness tolerances is now being produced. This strip can be furnished in widths up to 4 inches and in thicknesses from .010-inch down to .00012-inch, with thickness guaranteed uniform to a tolerance of .00005-inch. In addition, techniques for rolling this strip insure a high degree of uniformity in thickness (freedom from

camber) across the width of the strip.

This cold rolled, ultra-thin, precision gage strip can be produced in a wide range of metals, from the very hard high-temperature resistant alloys down to the very soft light metals.

WORLD'S LARGEST INERTIA DYNAMOMETER

The world's largest inertia dynamometer for laboratory testing of

full-scale railroad wheels is now in operation, on which standard railroad wheels from 30 to 48 inches in diameter can be tested under normal or exaggerated conditions simulating factors of loading, braking and tracking encountered in actual service.

The dynamometer consists principally of a mill-type electric motor, a variable-weight fly wheel, a

(Continued on page 70)



Rolling extra-thin, precision gage metal strip on specially designed Sendzimir mills at Hamilton Watch Company's Allied Products Division. Elaborate electronic and hydraulic controls on these mills permit continuous adjustment of strip tension and rolling pressure, thus make it possible to roll strip as fine as .00012-inch with thickness held to a tolerance of .00005-inch.



Boeing engineers design America's first jet transport

Pictured above is the full-scale cabin mock-up of the Boeing 707, America's *first* jet transport. In developing this interior, Boeing engineers helped design features and innovations as advanced as the 600-mile-an-hour performance of the aircraft itself.

Pioneering revolutionary new types of aircraft like the 707 is one of the sources of excitement — and satisfaction — that engineers and scientists enjoy at Boeing. This new jet-age transport has already been ordered by 10 major overseas and domestic airlines. These commercial orders, together with Boeing's tremendous backlog of military contracts, mean that this company will continue to expand during the years ahead.

Growth is a Boeing habit. During the past 10 years, for instance, the number of Boeing engineers has increased 400%.

Expansion at this rate spells job stability — and plenty of opportunity to move ahead. Boeing promotes from within, and holds merit reviews every six months to give each engineer a *personal* opportunity for recognition, advancement and increased income.

Boeing engineers don't get lost in the crowd. They work in small integrated teams — on such projects, in addition to the 707, as the advanced B-52 and B-47 multi-jet bombers, the BOMARC IM-99 guided missile, the 502 gas turbine, and other developments still under security wraps.

Qualified engineers and scientists of *all* types are needed at Boeing — now. You'll find high starting salaries, and stimulating contact with men outstanding in the world of engineering. Other advantages include liberal insurance and

retirement plans, and a choice of modern, young-spirited communities in which to live. Boeing helps arrange special work schedules for engineers taking graduate studies, and pays all tuition and fees. You're missing a bet if you don't at least *find out* how Boeing can help you get ahead in your engineering career.

*For further Boeing career information
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Boeing Airplane Company, Seattle 24, Wash.

F. B. WALLACE, Staff Engineer — Personnel
Boeing Airplane Company, Wichita, Kansas

A. J. BERRYMAN — Admin. Engineer
Boeing Airplane Company, Melbourne, Florida

BOEING

Aviation leadership since 1916

Seattle, Washington Wichita, Kansas Melbourne, Florida

Science Highlights

(Continued from page 68)

track wheel, a spring loading device, a braking mechanism, ultra-modern instrumentation and both automatic and manual controls. The entire device, a two-story installation of about 125 tons of steel-reinforced concrete and 100 tons of machinery, rests on a mounting specially designed to reduce vibration to a minimum. The bulk of the installation is below ground.

The direct-current, mill-type electric motor has a power output up to 450 horsepower. It can be rotated at various controlled speeds up to 1500 revolutions per minute.

This is equivalent to 161 miles per hour on a 36-inch-diameter wheel. Deceleration as well as acceleration rates can be closely controlled.

The new dynamometer is a completely integrated unit. Direct current is supplied by a 250-kw motor generator with a 200 per cent overload rating. Auxiliary units supply forced lubrication, hydraulic pressure and pneumatic pressure.

The variable-weight fly wheel is made up of a series of removable discs that fit on a tapered shaft and are bolted to each other. With all 14 discs in place, the motor will bring the dynamometer up to top speed in less than six minutes. When rotating at top speed, a max-

imum energy of 68,500,000 foot-pounds can be imparted to the test wheel. This is enough energy to throw a 16-pound bowling ball from New York to Chicago, or to lift the ocean liner "Caronia" one foot from a dry dock cradle.

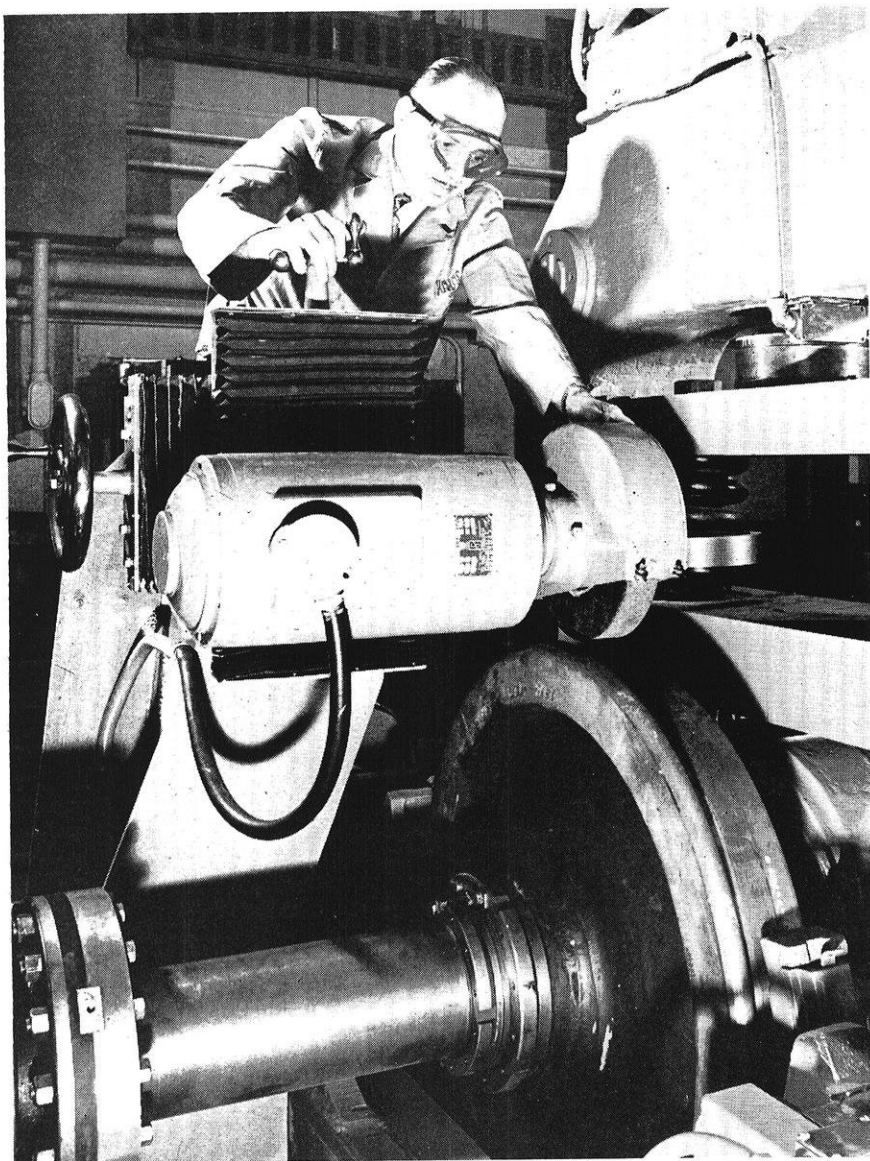
With such high kinetic-energy levels available, tests may be conducted at more than twice the levels encountered in modern railroad service. For example, each 40-inch-diameter wheel under the largest present-day diesel locomotives carries a static load of about 30,000 pounds. If the locomotive is traveling at a top speed of 120 miles per hour, in braking to a stop, each wheel must dissipate about 15,000,000 foot-pounds of energy. A 40-inch-diameter wheel being tested on the dynamometer at a speed equivalent to 120 miles per hour can be given an energy potential of 30,000,000 foot-pounds.

A unique feature of the new machine is the ability to simulate the loading and tracking of a wheel on a rail. A nine-foot-diameter track wheel with the head of a standard 132-pound rail around the periphery is rotated by frictional contact with the test wheel. Radial loads up to 40,000 pounds can be imposed on the journal of the test-wheel axle through a special bearing. The same bending moment and the same wheel-rail contact pressures that are encountered in actual service may be produced on the test wheel.

The dynamometer can also be used for fatigue testing of standard railroad axles. Full-scale axles of various sizes from 4 to 10 inches in diameter can be mounted in the machine in place of the test-wheel axle and loaded as a rotating cantilever.

The new installation will be used not for quality control but as a research tool for the development of railroad wheels of improved composition and mechanical design.

THE END



The world's largest inertia dynamometer for testing full-scale railroad wheels is installed at U. S. Steel's Applied Research Laboratory in Monroeville, Pennsylvania. A laboratory technician is shown adjusting the heavy grinder for dressing the tread on a wheel to be tested.

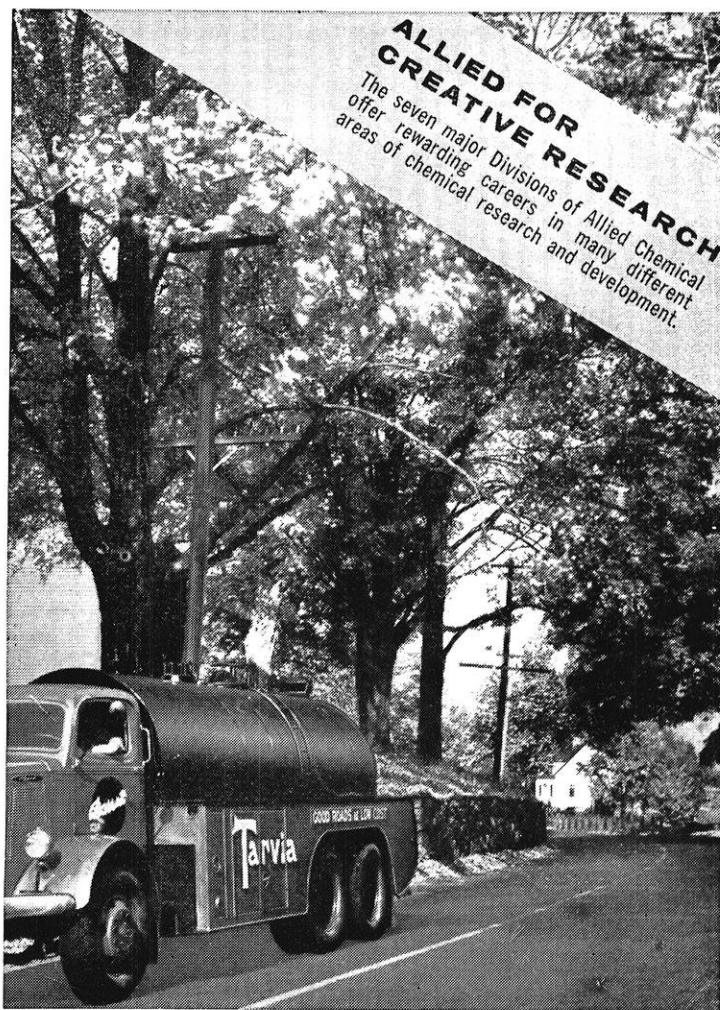
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61 BROADWAY, NEW YORK 6, N. Y.

Imperial

(Continued from page 23)

Southampton hardtop and a four-door Southampton hardtop.

The new Imperial Crown series is available in a four-door sedan, two-door Southampton hardtop, four-door Southampton hardtop and convertible coupe.

The new Imperial LeBaron, a four-door sedan, is out done in luxury only by the commanding Imperial Limousine, traditional car-of-state.

Lever-Type Door Handles Introduced

New lever-type inside door handles are easier to open, are recessed into door panels above built-in armrests. On Imperial LeBaron and Imperial Crown series models, the armrest also serves as a concealed storage compartment, which can be opened by lifting the hinged, padded top.

Luggage compartments are lighted automatically and contain rich carpeting in harmonizing shades. An infinitely adjustable six-way power seat is standard equipment on the Imperial LeBaron and Imperial Crown series, and is available as optional equipment on the Imperial series.

All four series of Imperials are powered by a new, large, hemispherical combustion chamber FirePower engine for maximum performance, ease and safety.

THE END

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Plymouth

(Continued from page 19)

SPECIFICATIONS OF THE NEW PLYMOUTH V-8 Models

Engine type: New, bigger displacement, higher compression Fury "301" V-8 with overhead valves. 301 cu. in., 3.91 bore, 3.13 stroke. Higher (8.5 to 1) compression ratio. New automatic choke. New, quiet, quick lift camshaft. Adjustable valve tappets. Spool-type rubber shear engine mounts. The Fury "301" is available in Belvedere, Savoy and Suburban V-8 models. Plaza V-8 models have an improved 277 cu. in. Hy-fire V-8 engine. Fury "301" engine with Power-Pak on all models, at moderate extra cost.

Powerflow 6 Models

Engine Type: 6-cylinder L-head valve arrangement. Increased compression ratio (8 to 1). Automatic choke. Redesigned 3-point engine mounting. Counterbalanced crankshaft with 4 main bearings. Chain driven camshaft. Aluminum alloy pistons. Top compression ring chrome-plated. Adjustable valve tappets with heat-resistant alloy steel exhaust valve seat inserts.

Body Specifications: (Except Suburbans): Wheelbase 118". Over-all length 204.6". Over-all width 78.2".

Construction: All-steel welded, completely rust-proofed and insulated body. Box-section reinforcements around window and door openings. Baked enamel finish.

Steering: Worm and roller-type steering gear. Idler arm steering linkage for maximum controllability. Ball-joint steering knuckles.

Ventilation: Permanent cowl air intake. Ventilating wings in each front door. New swivel-mounted defrosters and heater (optional) can be directed where you need warm air.

Chassis: New full-length boxed steel frame with wider frame rails. Five cross members.

Front Suspension: Combined torsion bar springs and ball joints. Lower unsprung weight. Wide-angle lower control struts. Rubber isolated pivot mountings. Redesigned Oriflow Shock Absorbers.

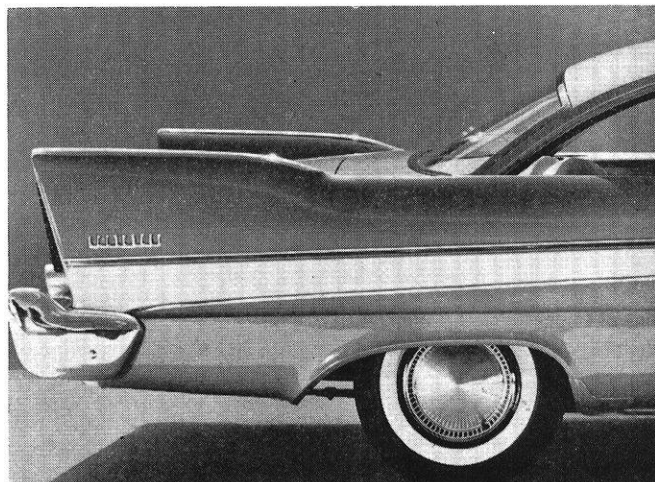
Rear Suspension: Outboard mounted, Asymmetric stub spring design. Larger, soft jounce cushioners. Rubber isolated rear springs.

Drive: Hotchkiss drive with hypoid rear axle.

Brakes: New, 11" Total Contact Brakes.

Tires and Wheels: New, large volume tires (10% greater air volume). Size 7:50 x 14, 8:00 x 14 on 9 passenger Suburbans. Safety-Rim wheels.

THE END



Plymouth's contemporary rear fin styling.

THE WISCONSIN ENGINEER



SLIDING DOWN THE WAYS at Groton, Conn., goes the USS Nautilus, newest and fastest member of our undersea fleet. During welding, Worthington heavy-duty turning rolls rotated the hull sections.

How the world's first atomic sub was welded

Welding the hull of the USS Nautilus, world's first atomic submarine, presented a tough problem.

Submerged-arc automatic welding seemed to be ideal for the job. Question was—could you rotate the hull sections of the Nautilus to take advantage of this fast, high-quality welding method?

Worthington's answer to General Dynamics Corporation's Electric Boat Division, builder of the Nautilus, was the largest turning roll ever built.

The result? Welding of the Nautilus hull was accomplished in record-breaking time — and cost less than originally estimated. Unchanged, the Worthington roll

set-up is also being used in the construction of the nation's second atomic sub, the USS Sea Wolf.

Turning rolls for submarines aren't all that Worthington makes. The long list of Worthington-designed, Worthington-built equipment includes air conditioning units, construction machinery, compressors, Diesel engines, steam power equipment and, of course, pumps of all kinds. For the complete story of how you can fit into the Worthington picture, write F. F. Thompson, Manager, Personnel and Training, Worthington Corporation, Harrison, New Jersey. You may be glad you did.

4.25 B

See the Worthington representative when he visits your campus

See the Worthington Corporation exhibit in New York City. A lively, informative display of product developments for industry, business and the home. Park Avenue and 40th Street.

WORTHINGTON



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LIQUID METERS • MECHANICAL POWER TRANSMISSION • PUMPS • STEAM CONDENSERS • STEAM-JET EJECTORS • STEAM TURBINES • WELDING POSITIONERS



A composite view of the new De Soto features.

De Soto

(Continued from page 21)

Brakes

Total-contact Center-Plane modified to accommodate new smaller 14" wheels. 12" x 2 1/2" on Firedome and Fireflite. 11" x 2 1/2" on Firesweep.

Wheels and Tires

New Super-Soft Cushion low pressure (22 psi) tires 8:50 x 14" standard on all Fireflite and Firedome models — 8:00 x 14" standard on all Firesweep models — New wider wheel rim 6" on Fireflite and Firedome — 5 1/2" on Firesweep — New Cap-tive-Air nylon tires standard on all Explorer (3-seat) Station Wagons.

Suspension

Entirely new Torsion-Aire ride has Safety-Sphere ball-joints, Torsion-Bar suspension, Anti-brake dip design and rubber insulated steering and suspension pivots.

New design rear prisngs, 3 inches longer, mounted outside and parallel to frame side rails.

New design rear springs, 8 inches longer, mounted outside

New Oriflite front shock absorbers and sea leg mounted Ori-flow rear shock absorbers.

Dimensions

Overall length of all Fireflite and Firedome models (except Station Wagons) — 218.0"; Firesweep — 215.8". Station Wagons — Fireflite — 219.5"; Firesweep — 217.3".

Height of Sportsman models — 55.0" on Firedome and Fire-flite (was 59.9"). Firesweep — 54.7". Four-door Sedans, Fireflite and Firedome — 57.0" (was 60.6") — Firesweep 56.7".

Engine

Bore and Stroke: Fireflite and Firedome bore increased from 3.72" to 3.78" — Stroke remains at 3.80". Firesweep 3.69" bore — 3.80" stroke.

Displacement: Increased from 330 cu. in. to 341 cu. in. on Fireflite and Firedome. Firesweep — 325 cu. in.

Compression Ratio: Increased from 8.5 to 9.25 — Fireflite and Firedome. Firesweep — 8.5.

Horsepower: Fireflite, 295; Firedome, 270; Firesweep, 245 (260 with power pack).

Torque: Fireflite — 375 ft. lbs. at 2800 r.p.m.; Firedome — 350 ft. lbs. at 2400 r.p.m.; Firesweep — 320 ft. lbs. at 2400 r.p.m. (335 ft. lbs. at 2400 with power pack).

Crankcase: Oil capacity increased from 4 qts. to 5 qts. — all models.

Drive (Fan) Belt: Power steering pump driven independently of generator or air conditioning compressor — when so equipped.

Other Revised Engine Components Include: Oil strainer, crankcase oil pan, air cleaner with high-efficiency replaceable paper element, water pump and housing, chain case cover, oil pump, generator mounting, power steering pump, crankcase vent, oil level dip stick, left exhaust manifold, starter ring gear, throttle linkage, air conditioning compressor.

Transmission

New Torqueflite three-speed fully automatic transmission. Standard on all Fireflite models and optional on Firedome and Firesweep models. Five push-button console on left side of instrument panel — Coasting gears provided in "1" or "2" push-button positions.

Powerflite two-speed fully automatic transmission offered as optional equipment on all Firesweep models.

New three-speed manual shift transmission standard on all Firedome and Firesweep models; high capacity ball bearings, shot-peened sliding gear. 1st gear ratio 2.31 to 1.

Propeller Shaft

New improved propeller shaft has greater capacity on all models.

THE END

THE WISCONSIN ENGINEER

LEFT FRONT MOUNT FORE AND AFT REACTION

$$R_{fxl} = -\frac{1}{2}(S_x + P_x + N_x W) - \frac{K_d d_z}{\sum K d_z} [-d_s S_y - d_p P_y - N_y W d_x + T_z]$$

RIGHT FRONT MOUNT FORE AND AFT REACTION

$$R_{fxr} = -\frac{1}{2}(S_x + P_x + N_x W) + \frac{K_d d_z}{\sum K d_z} [-d_s S_y - d_p P_y - N_y W d_x + T_z]$$

MOUNT SIDE REACTION

$$R_{fy} = -\frac{d_z}{d_r}(S_y + P_y + N_y W) + \frac{K_d d_x}{\sum K d_x} [-d_s S_y - d_p P_y - N_y W d_x + T_z]$$

GRADUATE TRAINING AT ALLISON PICKS UP WHERE CAMPUS LEAVES OFF

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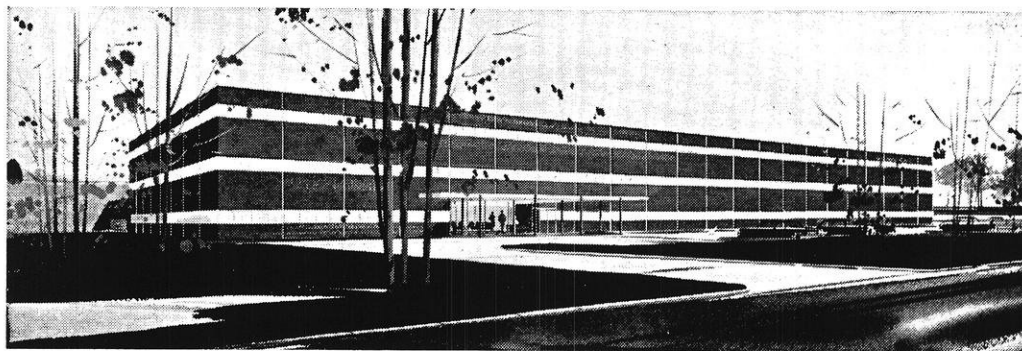
Should you want to work toward an advanced degree, you can, for we have arrangements with an outstanding engineering school which conducts classes within the plant. You get your Master's degree in engineering while you continue to work and earn.

A variety of refresher courses at college level and other specialized, non-credit courses are always available at Allison. Lectures on current problems and practices are conducted by prominent university men, consultants and Allison's own specialists in their respective fields.

We'd like to tell you more about the many benefits, advantages and unlimited opportunities awaiting you at Allison. Write for full information: Personnel Dept., College Relations, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.

OUR ENGINEERS WORK HERE

This is our new Administration Building, hub of the new Allison engineering Research and Development Center in Indianapolis.



Mercury

(Continued from page 24)

(except convertibles) equipped with the extra-cost, 290 hp. Turnpike Cruiser engine.

An Improved Ride which provides jolt-free comfort at all times and includes new, improved springing action with longer, softer front coil springs and more flexible rear leaf springs; swept-back ball-joint front suspension through which the front wheels are *pulled over*, rather than *pushed into* bumps; a lower center of gravity and scientific weight distribution which contribute to better ride, easier handling and more responsive steering.

New Chassis—for increased safety, durability and improved road-handling qualities; new, stronger, bow-shaped frame (12.5 inches longer and 14.5 inches wider) permits lowering the floor in combination with a new straddle-mounted rear axle with increased offset drive pinion, lower floor tunnel and reduced height with more headroom.

New 14-Inch Wheels—have extra low-pressure tires on wide-shouldered 6-inch rims which contribute to improved ride and lowered car height.

New Power Booster Fan—which saves up to 17 horsepower, boosts performance, saves fuel and reduces engine sound—on Montclairs, Colony Park and Voyager station wagons with 255-hp engine. The fan has a hydraulic coupling element using silicone fluid, controlled thermostatically.

New 4-Barrel Carburetor with low silhouette and dual intakes which control carburetor air temperature in summer and winter driving. Also a new high-lift camshaft for wide-opening valves which improve engine breathing. A new paper pak aircleaner maintains high efficiency for longer periods, and dust and dirt can be removed from it easily by tapping the cartridge.

New Body Features—include new high-level, controlled cowl ventilation with fresh air taken into pas-

senger compartment away from the exhaust air level; new, high density, fibreglass roof insulation which absorbs all types of noises and protects from heat and cold, combines with increased body insulation which prevents road noises from entering the car; body also is cradled between live rubber, improved body mounts.

Choice of Engines

New engineering advances assure spectacular performance from either of Mercury's two engines offering up to 290 horsepower. Compression ratio in both is 9.75 to 1.

Most powerful is the Turnpike Cruiser V-8 engine, offering 290 horsepower and 405 foot pounds of torque, with a displacement of 368 cubic inches. It is optional with automatic transmission.

A V-8 engine with 312 cubic inch displacement which delivers 255 horsepower is standard on the Mercury line for 1957. It has torque of 340 foot pounds at 2600 rpm, and compression ratio of 9.75 to 1.

Heating, Ventilating, Air Conditioning

Mercury has developed a compact, front-mounted combination air conditioning and heater system. All parts are located either in the engine compartment or under and on the instrument panel. The heater core and the evaporator core share the same housing, blower fan, controls and ductwork.

The two-speed blower can deliver refrigerated air to the passenger compartment at the rate of 280 cubic feet per minute. This changes the passenger compartment air twice a minute.

The two-cylinder compressor is installed on the right side of the engine and is driven by two belts from the crankshaft pulley. When the compressor is not needed for cooling, its magnetic clutch is disengaged automatically.

SPECIFICATIONS

Exterior Dimensions

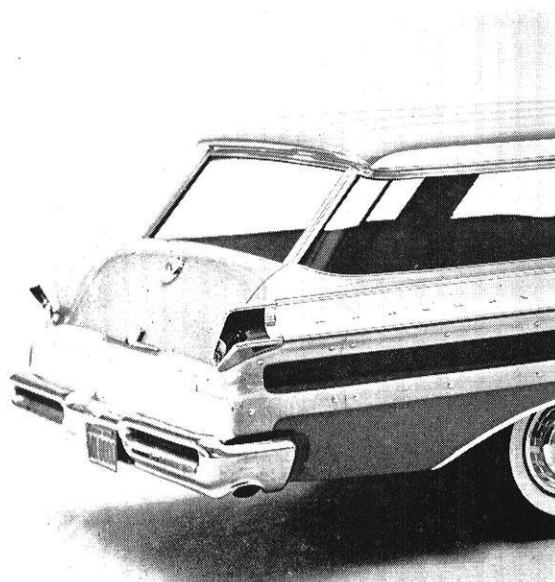
Monterey & Montclair

	Closed Cars	Convertibles	Station Wagons
Wheelbase	122 inches	122 inches	122 inches
Overall length	211.1 inches	211.1 inches	212.3 inches
Overall width	79.2 inches	79.2 inches	79.2 inches
Overall height	56.5 inches	57. inches	58.3 inches
Tread (front)	59.4 inches	59.4 inches	59.4 inches
Tread (rear)	59 inches	59 inches	59 inches

Mercury Engines

255 H.P. Safety-Surge V-8	290 H.P. Turnpike Cruiser V-8
312 cubic inches	Displacement 360 cubic inches
9.75 to 1	Compression Ratio 9.75 to 1
3.80 inches	Bore 4.0 inches
3.44 inches	Stroke 3.66 inches
340 ft. lbs @	Torque 405 ft. lbs @ 2800
2600 RPM	RPM
255 at 4600 RPM	Horsepower 290 at 4600 RPM

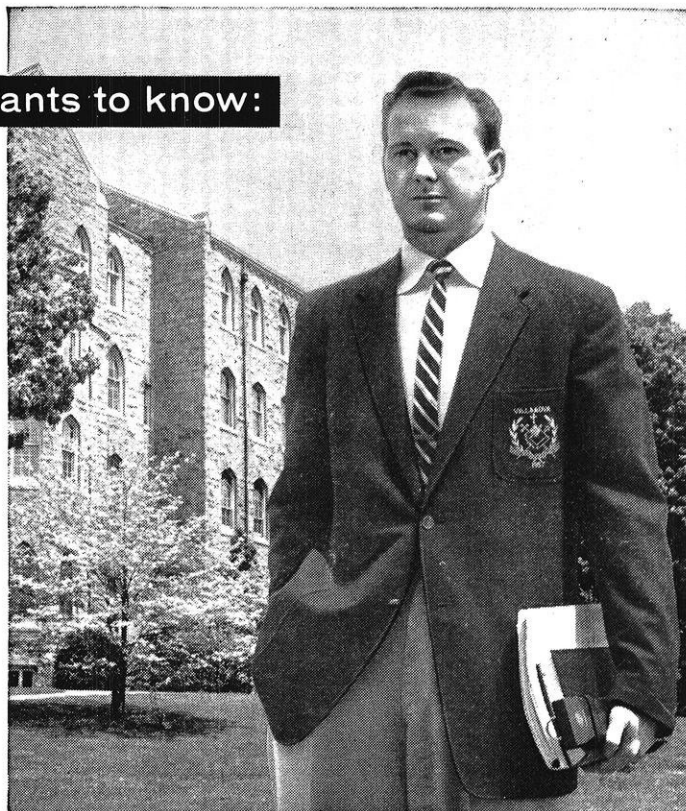
THE END



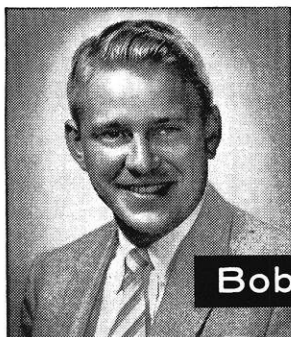
Hardtop styling in Mercury's new station wagon

John Nettleton wants to know:

How would a graduate degree affect my chances for advancement at Du Pont?



John C. Nettleton expects to receive his B.S. in chemical engineering from Villanova University in June 1957. He has served as president of the student chapter of A.I.Ch.E., and as secretary of Phi Kappa Phi fraternity. John is now wondering about the pros and cons of advanced study in his field.



Bob Buch answers:

Robert J. Buch, M.S., Ch.E., came to the Engineering Development Section of Du Pont's Grasselli Research Division from the University of Louisville four years ago. Since then, he has engaged in many kinds of chemical engineering work, from pilot-plant operation to evaluation of the potential of proposed research programs. Within the last year, Bob has taken the responsibility of procuring B.S., M.S., and Ph.D. technical graduates in all phases of chemistry and chemical engineering for the Grasselli Research Division.

AN advanced degree would undoubtedly have a *favorable* effect in technical work, John, but let me enlarge on that just a little. In your own field (and mine, too) a higher degree is considered to be evidence of ability in carrying out original research. It is therefore helpful in obtaining work in research and development, where that skill is definitely important. You might say that it gives a man a head start in proving his ability in those areas.

It's less important in some other areas, though. For example, in production or sales work ability for handling human relationships is just as important for advancement as technical competence. If an engineer is sold on production work or sales, a graduate degree in marketing or business administration might be more helpful to him than advanced technical training in getting started.

But I've noticed this at Du Pont. Once a man lands a job in his chosen field and actually begins to work, his subsequent advancement depends more on demonstrated ability than on college degrees. That's true throughout the entire company—in scientific work, administration, or what not.

So an advanced degree is not a royal road to anything at Du Pont, John. But when coupled with proven abilities, it is unquestionably helpful to a man in research and development work. It often gets him off to a faster start.

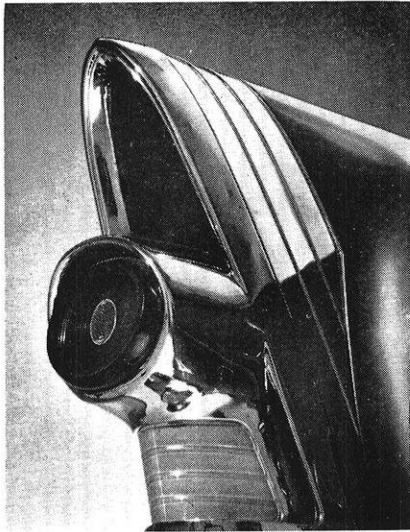
Are you interested in research work?

About 2,000 Du Pont scientists are currently engaged in research, aided by some 3,500 other employees. Laboratory facilities of the highest quality are available at the Du Pont Experimental Station near Wilmington, and elsewhere throughout the country. Information about research at Du Pont is given in "Du Pont Research." Write for your copy of this free 28-page booklet to the Du Pont Company, 2521 Nemours Building, Wilmington, Delaware.



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

Watch "Du Pont Cavalcade Theater" on television



New taillight design on 1957 Buick.

Buick

(Continued from page 75)

45 horsepower over last year. The Special, which also has a 364-cubic inch engine, with 9.5-to-1 compression ratio, has a maximum horsepower rating of 250, compared to 220 last year.

The horsepower increase was obtained by enlarging the cubic displacement of the engine from 322 to 364 inches and by increasing the compression ratio.

New interior design includes a new steering wheel, new padded instrument panels, which are standard on the Roadmaster, Super and Century, and optional on the Special, and a larger glove compartment, located near the center of the instrument panel.

Optional on all models is a safety minder which buzzes constantly when a pre-determined speed is reached. The safety minder can be set at any speed desired by turning a knob on the instrument panel.

Buick's 1957 line comes in 20 body styles with a two-and four-door hardtop and a convertible in each series. A two-and four-door sedan are offered in the Special series only.

Three estate wagons, two of them in the four-door hardtop styling, are offered in the Century and Special series.

Special series estate wagons are offered in both the four-door hardtop styling and the regular design which features a center pillar.

SPECIFICATIONS

	Special	Century	Roadmaster
Displacement	364 cu. in.	364 cu. in.	364 cu. in.
Horsepower	250 @ 4400 rpm	300 @ 4600 rpm	300 @ 4600 rpm
Torque	380 @ 2400 rpm	400 @ 3200 rpm	400 @ 3200 rpm
Compression Ratio . . .	9.5 to 1	10.0 to 1	10.0 to 1
Dynaflow Rear Axle Ratio	3.07 to 1	3.07 to 1	3.07 to 1
Over-all Length	208.4 in.	208.4 in.	215.3 in.
Over-all Width	74.8 in.	74.8 in.	77.6 in.
Wheelbase	122.0 in.	122.0 in.	127.5 in.

THE END

Cadillac

(Continued from page 27)

The hood is lowered 3 1/2 inches so that in profile view it is below the fender line.

Rear deck also is below fender line of the rear quarter panels.

Mechanical Differences on 1957 Models

Chassis: A new chassis obviously is required to make this 1957 body possible. Included in this are:

Frame: A new tubular center — X frame has been developed. It is without conventional side rails and permits lowering the floor and car three inches while increasing torsional rigidity. The body is secured to "outrigger" mounting brackets.

Front Suspension: A spherical joint suspension with braking dive control is used. The front tread is increased to 61" for better cornering and roll stability.

The editorial staff would like to thank FRANK ADAMS of the business staff for collecting, editing and assisting in the layout of this year's new car features. His name was inadvertently left out of the October issue.

Rear Suspension: The semi-elliptic springs are moved outboard, closer to the wheels and parallel the center of the car to give more stability with narrower rear tread. As a result of the increase to 61 inches of front tread it is possible to decrease rear tread by two inches to the same 61 inches.

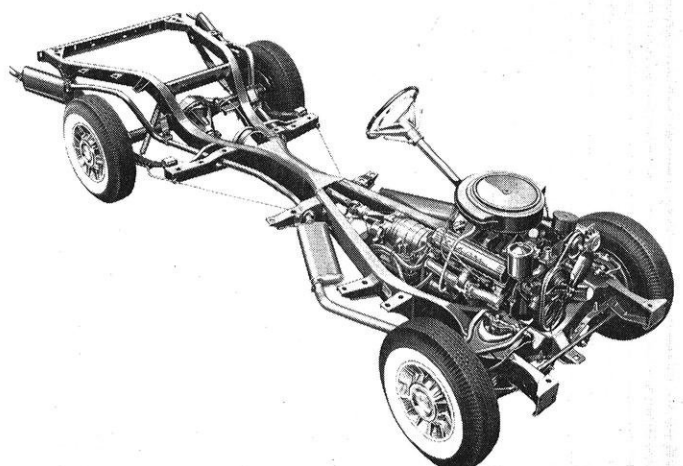
Rear Axle: A new rear axle and axle housing is required for the narrower rear tread. A new 3.07 ratio gearset has a 50-degree helix instead of 45 degrees as in 1956, for quieter operation.

Propeller Shaft: Cadillac uses a two-piece propeller shaft in 1957 models for lower tunnel height.

Engine Efficiency is Improved: This results from better combustion which is achieved by a larger diameter combustion chamber. Compression ratio is increased to 10 to 1.

Output is Increased: Horsepower is stepped up to 300. This is achieved through "better breathing" in a new, lower carburetor with larger secondary bores and a wider bore spread. Additionally, intake valves are 1/8" larger and the exhaust valves are 1/8" smaller.

THE END



Cadillac's new concept in automotive frame design.

THE WISCONSIN ENGINEER

In the 17th CENTURY

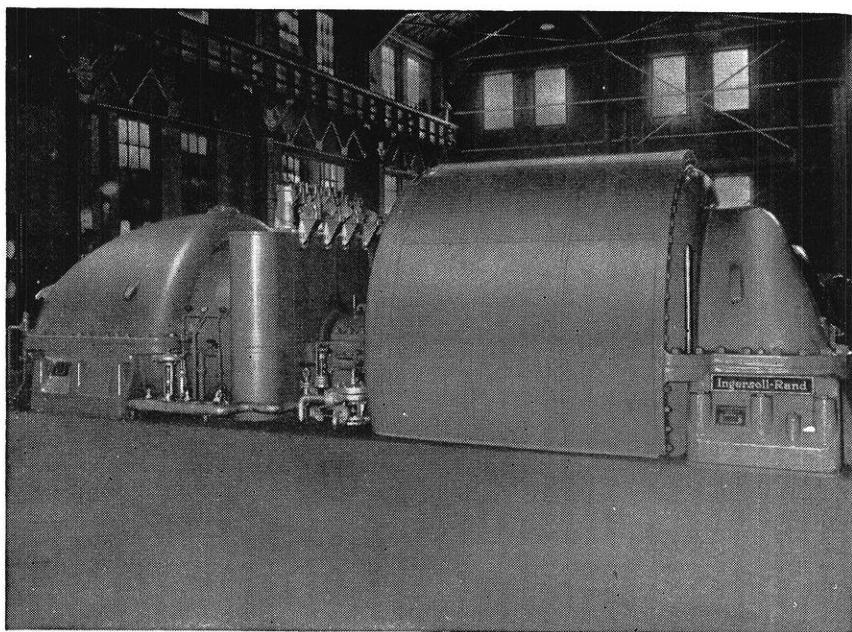
this was the last word in blast furnace blowers

HAND-OPERATED plungers in hollowed-out tree stumps provided a crude but workable source of compressed air for this primitive African iron foundry — marking an early step in the mechanization which permitted man's evolution from the stone age to the iron age.



TODAY *it's the* TURBO-BLOWER...

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If you'd rather *make* industrial history than read about it, be sure to look into the fine job opportunities available with Ingersoll-Rand. For further information contact your Placement Office or write Ingersoll-Rand.

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COMPRESSORS • BLOWERS • GAS & DIESEL ENGINES • PUMPS • VACUUM EQUIPMENT • AIR & ELECTRIC TOOLS • MINING & CONSTRUCTION EQUIPMENT

NOVEMBER, 1956

Printing

Continued from page 39)

ent part of the required design until the design is finished. Six color presses are also used but they are much more complicated.

From the printing decks on the drum the sheet or "web" is fed into the bank of "heaters" which are nothing more than hot air blowers and serve to dry the ink on the sheet. After it passes through the blowers, the web passes over the "hot" roll which is a driven steam heated roller that seals the ink onto the stock. From this hot roller the sheet goes over the cold roller where running cold water cools the roller, which in turn cools the hot sheet.

From this, the sheet runs over two idlers which hold the sheet out for inspection by the operator. The inspection is continuous while the press is running, either by the unaided eye or by means of a stroboscope setup, which makes the sheet appear to be halted to allow easy inspection.

After passing over another roller, the sheet passes under the "dancing" roller. This roller moves up and down depending on the tension in the sheet. It is connected by chains to a rheostat which governs the speed of the windup motor. This linkage produces an even tension in the sheet no matter what size the roll on the windup is. The tension is very important here because it is the windup that pulls the sheet from the pulldown roller through the press, and because films such as cellophane stretch. This stretch, found in all stock to a certain degree, would raise havoc with the measurements of the finished wrappers if it was uneven throughout the roll. More important, the stretch must be controlled between decks so that the differently colored parts of a design print where they are supposed to and do not overlap.

The stock used in Flexographic printing is varied. Cellophane is printed to produce cheese wrappers, candy wrappers, and any applications of a printed yet transparent material. Saran is a trade name for a stretchy cellophane type material used for wrapping things like chunks of cheese shaped into balls.

Paper of a wide variety is printed. The heaviest paper printed is cupstock, the material used in making paper coffee cups. The thinnest used is a lightly waxed tissue paper used in drive-in restaurants to wrap hamburgers. Another lightweight paper is a tissue which is solidly colored in many different shades and subsequently rubberized and slit to produce the rolls of Floral tape used by florists to wrap flower stems for corsages and the like.

Aluminum foil is widely used to wrap foodstuffs like smelly cheese (limburger) so that it will keep on the grocers' shelves and yet not smell up the store. Also, the rich silver color is desired by many customers. Lead foil is usually laminated to sheets of tissue paper to provide strength and then printed to produce medicine wrappers. This type of wrapping can be sealed for sterility.

Because of the flexibility of the rubber plates involved, process or "screen" work is not satisfactory. This type of printing is accomplished by using a plate with many tiny dots punched in it. These dots are thick where the color is to be heavy and thin where it is to be light. In this process work many colors are printed on top of each other to produce the finished picture. The work is done best on the Rotogravure presses such as produce the Sunday newspaper supplements. This work calls for absolutely perfect register.

The "register" of the design on a Flexographic press can only be expected to stay within a certain limit. The machinery and the rubber plates are incapable of coming any closer to the absolute register mentioned. Register is the trade term meaning the fitting together of the various parts of a design to produce the entire design.

Improvements that have been incorporated into the presses have been mostly of a quality improving nature. It is thought that anything that will improve the general quality of the work is good because it will give the company an edge over their competitors.

One thing that has been under constant improvement in the past few years is the windup on the presses. The windup, as mentioned before, affects the way the press prints. So far, the most reliable wind-up has been one that was developed about fifteen years ago by a Master Millwright. The company recently spent 25,000 dollars in one year on two windups that did not prove entirely satisfactory.

Another angle of attack has been to make the job easier to do. Pressure has been from the Union and from the company itself due to the shortage of experienced men. The registering of the job after it is in the press has been done entirely by hand by using a pipe-wrench and muscle to turn the cylinders. Now a system whereby the cylinders are turned by electric motors and push buttons allow the press operators to adjust the register while the press is running. In order that the operator can see the job while the press is running a system of electric eyes and a stroboscopic light is used. This makes the job appear to be standing still.

Due to the installation of the stroboscope scanning methods, it has been possible to increase the running speed of the presses up to 600 feet per minute, where formerly it was a very sharp eyed operator who could see his job at much more than 350 feet per minute. The stroboscope works with an electric eye scanning device that "sees" a printed marker on the sheet. Every time the marker passes under the eye, the light flashes so it creates the illusion that the work is standing still. This allows the operator to keep a constant check on the work without undue eye strain.

One item that takes up a considerable amount of time is the fact that the presses must be stopped at the end of every roll of stock so the assistant can change stock rolls. A device used for many years in the newspaper pressroom will be incorporated in newer presses.

(Continued on page 82)

"When I look over the fence..."

"Since the day when man made his first brief airborne flight, the advance in aeronautics has been little short of fantastic. Tremendous achievements have opened new avenues of progress that were but idle dreams of yesteryear. We live in a new dimension!

"To the young men of today, these new avenues of progress in aeronautics and the related sciences reveal almost limitless opportunities for success. As an engineer in quite another field I am constantly drawn to look over the fence to see what I see. And

I am fascinated with the great and fast-growing opportunities that are there. So much so, that to the potent message of a previous century, 'Go West, young man,' I am prompted to add... 'Look up, young man, reach for the stars, for they lead to great things.'"

CHARLES LUCKMAN

Partner — PEREIRA & LUCKMAN

Planning — Architecture — Engineering



Out of his own successful engineering career, Charles Luckman sets a sure course for today's trained young man when he says "reach for the stars."

In the aircraft industry, the expression is strikingly exemplified by the records of thousands of far-seeing young men who have graduated into secure positions that offer lasting success. What was yesterday's single field has today come to include a multitude of specialized sciences.

At Northrop Aircraft — world leader in the design and production of all-weather and pilotless aircraft — the young engineer is provided a host of activities from which to choose. Each offers success opportunities positively unbounded.

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NORTHROP

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**From an address to
the American Society
of Civil Engineers,
Los Angeles, California*

Chrysler

(Continued from page 22)

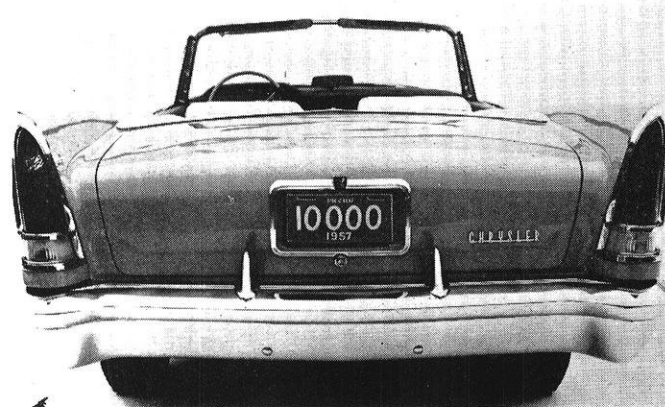
Spitfire engines in Saratogas include four-barrel carburetors and dual exhausts.

The more powerful FirePower engine in the New Yorker has a new compression ratio of 9.25 to 1, a bore diameter of 4.0 inches and increased displacement of 392 cubic inches.

Advanced full-time coaxial power steering requires one-tenth the effort required in manual steering, and effects a reduction in steering drive ratio.

Dual Headlights

Acclaimed by safety experts, Chrysler's new dual headlight system provides more light on the highway ahead for safer night driving. The two outside lamps have two filaments—one for high beam and one for low beam driving. The two inner lamps have high-



1957 Chrysler features canted tail fins. Soaring stabilizer-like tail fins of all 1957 Chryslers are canted outward to terminate in tall tapered safety tail lights and back-up lights. Tests reveal that the fins give greater stability in cross winds at highway speeds. The cars are available in Windsor, Saratoga and New Yorker series in a selection of 21 contemporary colors and 121 color combinations.

beam filaments only—for a combined four-lamp total of 150 watts of high beam light on the road.

Windsor and New Yorker Town and Country station wagons are of new design. Tall tail fins lower apparent roof height. Wrapped-around rear quarter windows eliminate rear corner pillars.

A new feature of the wagons is a concealed locking storage well under the cargo deck behind the rear seat—space made available by moving the gas tank to a new location in the left rear fender. Captive-Air tires are optional.

Among a complete range of power, luxury and safety equipment are power brakes, power steering, power windows, six-way power seat, seat belts, instant-heat aircraft-type heater, HiWay HiFi record player, instrument panel safety cushion, Solex tinted glass, and power radio antenna.

THE END

Printing

(Continued from page 80)

It is called a "flying paster" system. By use of this device; the press, once started, need never be stopped until the job is finished (except for breakdown). The device is actually a rack on which there are three unwinds just like the one illustrated. These three unwinds will allow the press to run one roll, have a second one ready to run, and have the third one in the process of being changed. When the first roll is depleted, the press is slowed down, the second roll starts to roll forward and a hot paster is made instantaneously to the tail end of the first roll. Then the press is speeded up again to running speed. This device is said to save up to ten minutes in the hour.

Presses are being developed to print from a 50 inch roll of cupstock. The design of the paper cups will be printed and instead of rolling it up on the front end of the machine as is done presently, the machine will take the stock, slit it, punch out the individual cup blanks, and form the cups. That means that a large roll of white stock can be put on one end of the machine and boxes of paper cups will be coming off the other end.

The primary reasons for the importance of Flexographic printing are the economy and versatility of the operation. Today this process produces many-colored packaging papers, tissues, foils, and films. The presses print every manner of packaging from cheese wrappers to sterile medicine wrapping papers.

The process is adaptable to the use of various films, such as cellophane and Saran, plain papers ranging from Poster board to paper napkins, and the metallic foils of aluminum and lead. The printing is done with two types of inks, using aniline dyes; alcohol base and water base. The inks can be blended to reproduce any color in the spectrum.

The problems facing the industry are; the competitive nature of the product which necessitates strict cost control, the very nature of the process and mechanism used which imposes an upper limit on the quality of the finished product, and the shortage of the relatively highly skilled men necessary due to the lower wages that have to be paid as a matter of cost control.

The problems facing this part of the industry are under constant research in the laboratory as well as on the factory floor. A recent development is the application of more automation, decreasing the demands on the personal skill of the operators. This has been effected by the extensive use of electric eyes and electronic machine controls as well as improvements in the existing components of the printing presses. Other new developments that promise some relief are the speeding up of the presses and the increasing of production standards. These two ideas applied together will produce more finished goods in a given amount of time and may thereby, reduce the cost of production.

THE END

THE WISCONSIN ENGINEER



Four top scientists discuss creative thinking before fellow research men and engineers at a Joint Technical Conference held in French Lick, Indiana, by Standard Oil and its affiliates. Panel members were, left to right above, E. L. d'Ouille, G. W. Ritter, P. C. White, and T. A. Abbott. Moderator was Joseph K. Roberts, left inset, general manager of research and development for the parent company.

The Very Idea!

PETROLEUM scientists and engineers have a habit of coming up with the *very* idea to solve a problem at the very moment it is needed. They have created hundreds of new products and have improved others, putting the petroleum industry in the van of American industrial progress.

The contributions of Standard Oil scientists, working in extensive laboratories and with the finest equipment, have been outstanding. To give them even greater opportunity to exchange and develop ideas, Standard Oil uses the most modern tech-

niques for stimulating creative thinking.

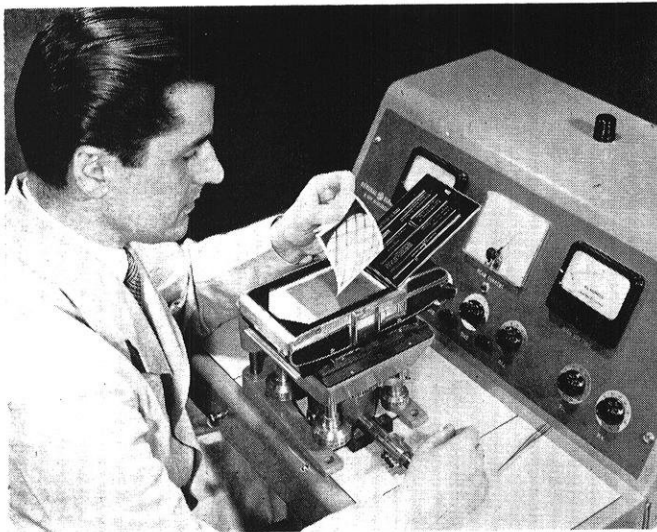
Groups of our scientists now meet in informal and relaxed creative sessions. Through "brainstorming" and similar devices, they contribute fresh, new thinking to the solution of specific problems. These men are creative by nature, and they "pop" even more ideas, faster, at sessions where one idea stimulates another.

In such an atmosphere of progress, young scientists and engineers find great opportunities to make positive contributions and build interesting careers.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois





—Courtesy General Electric

Shown peeling a picture off a Polaroid camera is a laboratory worker testing new X-Ray Microscope. The microscope can be used either for direct-viewing or for camera photography.

X-Rays

(Continued from page 14)

age machines and have deep penetrating power, and the soft with low penetration.

Wave lengths of the electromagnetic radiations are measured in angstroms which are equal to 1×10^{-8} cm. X-rays are 1000 to .1 units long.

The wave length of X-rays is measured in a complicated process involving their diffraction from molecular crystals. This can be found by an exacting process of exposure of the rays on a photographic screen.

X-rays act like waves in certain respects, but in the photoelectric effect and the Compton effect they behave as discrete particles of energy (quanta) traveling in a straight line with the velocity of light. Let us see how it is different from other radiant energy.

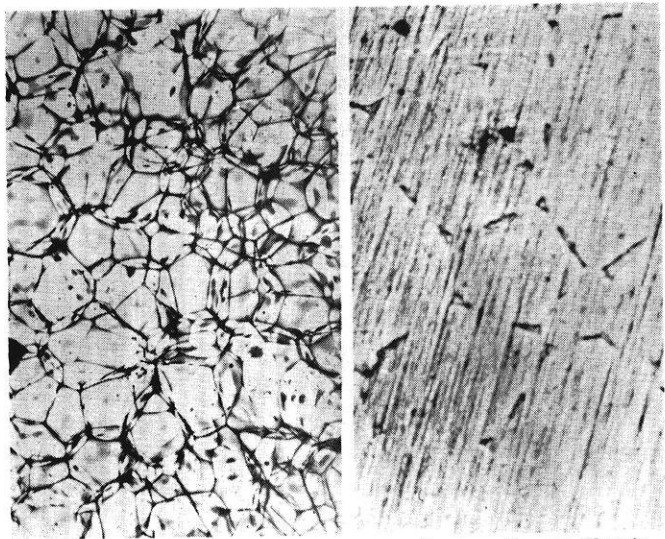
The intensity of a beam of X-rays is measured by the amount of energy which crosses a unit or place perpendicular to the beam in one second. This intensity is measured by passing a beam of X-rays through air and then measuring the resulting ionizing currents.

X-rays are partly absorbed by every substance through which they pass. The amount depends upon the voltage applied to the tube and the atomic structure of substance. If the atoms are close together few pass through. Very soft rays are used on flowers and petals while hard rays are used on steel rails, and because of structure have similar effect.

The quality is equal to the product of their intensity and the time they are emitted which is a coefficient expressing the ability of the rays to cause ionization.

When X-rays strike a substance they set the atoms of this substance into forced vibration, causing it to emit more rays. This scattering of X-rays is known as Compton's effect.

Examining the physical properties of X-rays and studying the more important ones, we find:



—Courtesy General Electric

Only surface scratches and a few tin lines appear to the ordinary light microscope, when it is trained on an aluminum-tin alloy (left). However, when the X-Ray Microscope is used (see view at right), there is revealed the complete grain outline of the alloy.

1. They are invisible.
2. They move in a straight line.
3. They are not affected by electric or magnetic fields.
4. They may be reflected, refracted, or polarized.
5. They move with velocity of light.
6. They affect photographic plates.
7. They can produce fluorescence and phosphorescence.
8. They are differentially absorbed.
9. They are able to stimulate and kill living material.
10. They produce spectra.

The most notable of the X-ray properties are: ionization of a gas through which they pass; penetration through various thicknesses of all solids; production of secondary rays; and action on photographic plates and fluorescent screens.

The radiation of X-rays shows marked effects on various substances. Because X-rays are such an intense form of energy when they strike living tissues, several results take place. The cause of the changes in the body functions brought about by X-rays is not fully understood. The energy given to the body tissues produces both physiological and biological results. It is believed that when the rays strike the tissues they cause the atoms in the tissue to emit secondary radiation which tears down the cells of the tissue.

X-rays, like other forms of high energy radiation, can affect heredity. When the rays are absorbed by the genes which control heredity, many transformations can take place in the genes and result in the birth of various types of mutations.

X-rays are sometimes so intense that an atom of the substance which they are striking will be split into various component parts. Besides this notable aspect,

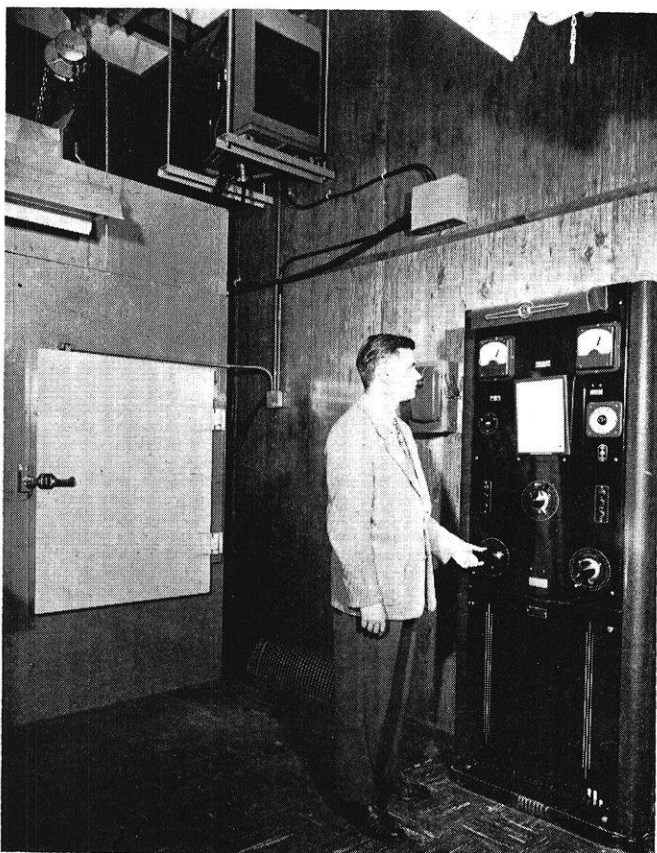
atoms will release secondary rays when struck by X-rays.

How are these X-rays produced? It is a fundamental law of the electromagnetic field that when a charge experiences an acceleration or a deceleration it radiates energy in the form of electromagnetic waves. It is by this principle that X-rays are produced, either naturally or artificially.

Roentgen discovered X-rays while working with cathode rays which, unlike radio waves, consist of billions of electrons which are fired through the air due to high potential. The cathode ray is electricity in a strong mass acting as particles of matter. When this stream of electrons strikes an object it causes the object to emit radiant energy.

The atom is electrically neutral; the positive charge of the nucleus equalling the negative charge of the electrons. But it must not be forgotten that electrical kinetic energy is constantly present in atoms. There is an actual vibration dependent on the excitation of the atom. There is a terrific binding energy between the electrons and the nucleus as shown by the formula, $E = mc^2$ (change in energy equals loss of mass times speed of light squared).

The excitation of an atom occurs when the electron in some inter orbit is ejected by some external supply of energy. Thus we have an atom in which the electrons are forced out of their normal positions by the bombarding of the cathode rays. Later the electrons



—Courtesy General Electric

X-Ray exposure of the xeroradiographic plate is accomplished in the conventional manner. Shown here is an operator at the control of a 250,000-volt machine. Note heavy lead door and room partition protecting personnel from radiation.



—Courtesy General Electric

Before the xeroradiographic plate is exposed to x-ray, it must be given a charge of static electricity

return to a lower energy level giving off X-rays as the energy differential.

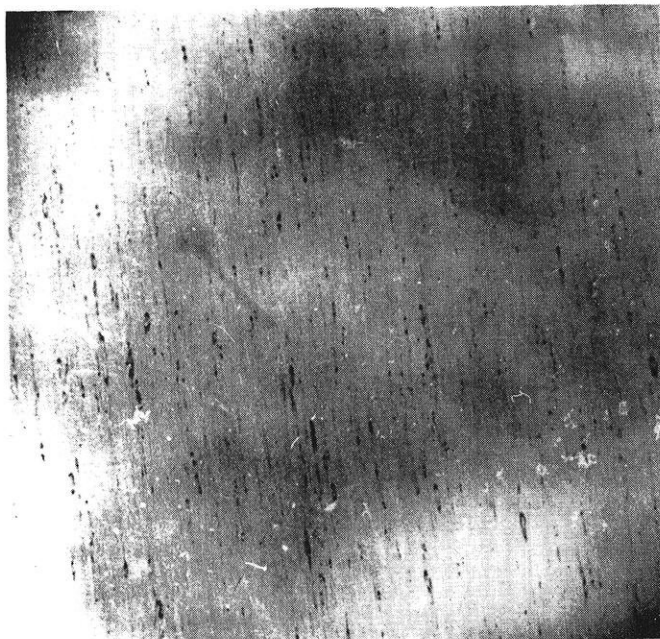
The energy of the X-rays released depends upon the energy of the atom releasing them, and the velocity and intensity of the cathode rays bombarding the atom.

Production of X-rays artificially is accomplished by the impact of cathode rays on a metal target in a vacuum tube. Gradually it has evolved from its simplest form which is an X-ray tube consisting of a vacuum bulb containing two electrodes. The first was Crooke's tube with which Roentgen discovered the rays. In this tube the electrons were driven from the concave surface of the cathode and focused on a heavy metal plate, placed in the center of the tube at a 45 degree angle to the stream. The Crooke's tube produced a very diffused source of X-rays and often enough heat to melt the tube. To alleviate this difficulty Jackson in 1896 suspended a metallic substance focusing the cathode stream upon this target or anticathode.

The most common tube is of the type developed by Coolidge. It has a vacuum about one billionth of an atmosphere, a tungsten wire cathode, electrically heated, extremely high voltage, and water cooling system.

The line focus tube was introduced in Europe in 1916. The principles of the tube are based on the fact that if a two-dimensional rectangle is viewed from the

(Continued on next page)



—Courtesy General Electric

Leaded steel is a most difficult structure to reveal by ordinary microscopy, but is easily shown by X-Ray Microscope.

small end at an acute angle it is foreshortened and a much higher loading capacity can be obtained. Timers were developed that could make 1/120 second exposure to X-rays and it became necessary to devise a means of distributing the energy over the tube target so the atoms of the target would not be prematurely destroyed. The solution was a rotating target.

The rotating target tube is an induction motor with the rotor serving as the target. It is enclosed in oil for cooling.

Machlell's tube is the most powerful known. This tube has a magnetic lens to focus electrons in much the same way the electron microscope does. The efficiency of X-ray production is very low, about .2% of the electrical energy applied is converted to X-rays and the rest into heat.

High voltage tubes of several types are among today's modern equipment. Scientists use X-ray tubes 12 to 16 feet high, to which, using an electrostatic generator, 4 million volts can be applied. The latest development in this field is the betatron which can produce 100-million volt X-rays. These ultra-hard rays will penetrate many inches of steel and shatter nuclei of atoms.

Why was the discovery of X-rays such an important event? Because besides the many applications of the rays, they have done much to advance scientific research; unlocked the secrets of atomic energy, and revealed the family relationship of the chemical elements.

The diffraction of X-rays by crystals has given new life to crystallography and the study of the fine structure of matter. Through the X-ray spectra Moseley's law has rendered the unity of the structure of chemical elements indisputable and supplied the Bohr atom its strongest support.

(Continued on page 88)

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Have your new suits tailor
made.

Look sharp for your inter-
views.

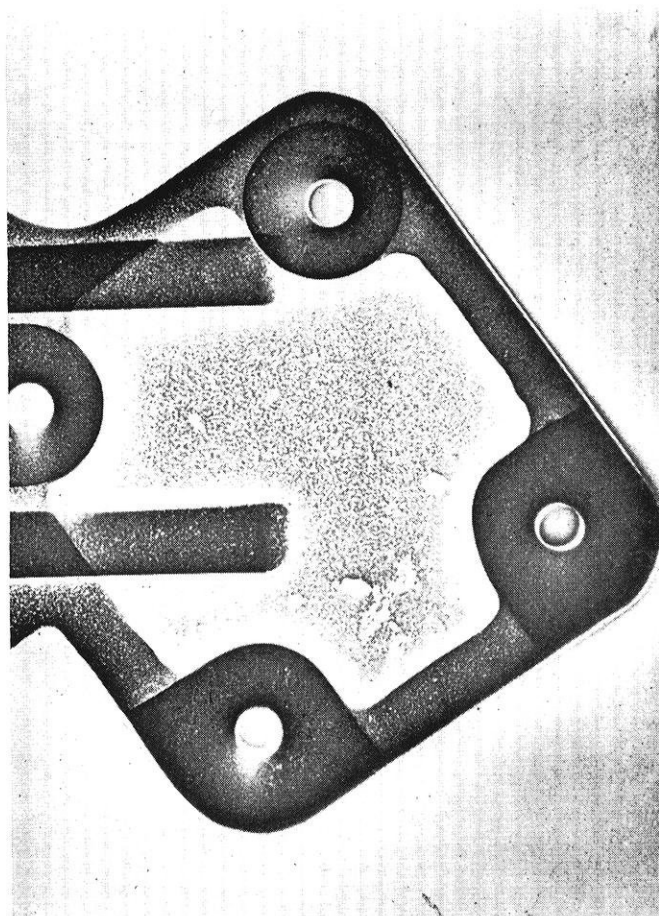
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DIAL ALPINE 5-9919



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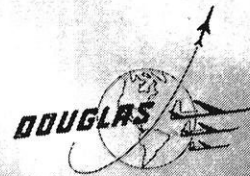
Xeroradiograph of casting clearly reveals voids caused by shrinkage during cooling. (Indicated by white blotches)

THE WISCONSIN ENGINEER

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CHANCE
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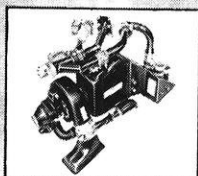
BOEING



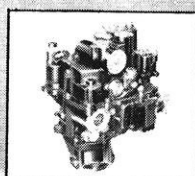
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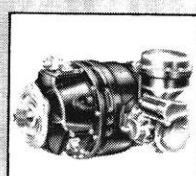
Hamilton Standard products



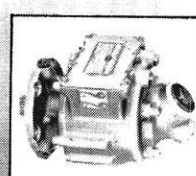
REFRIGERATION UNIT



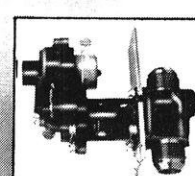
JET FUEL CONTROL



PNEUMATIC STARTER



HYDRAULIC PUMP



ANTI-ICING VALVE

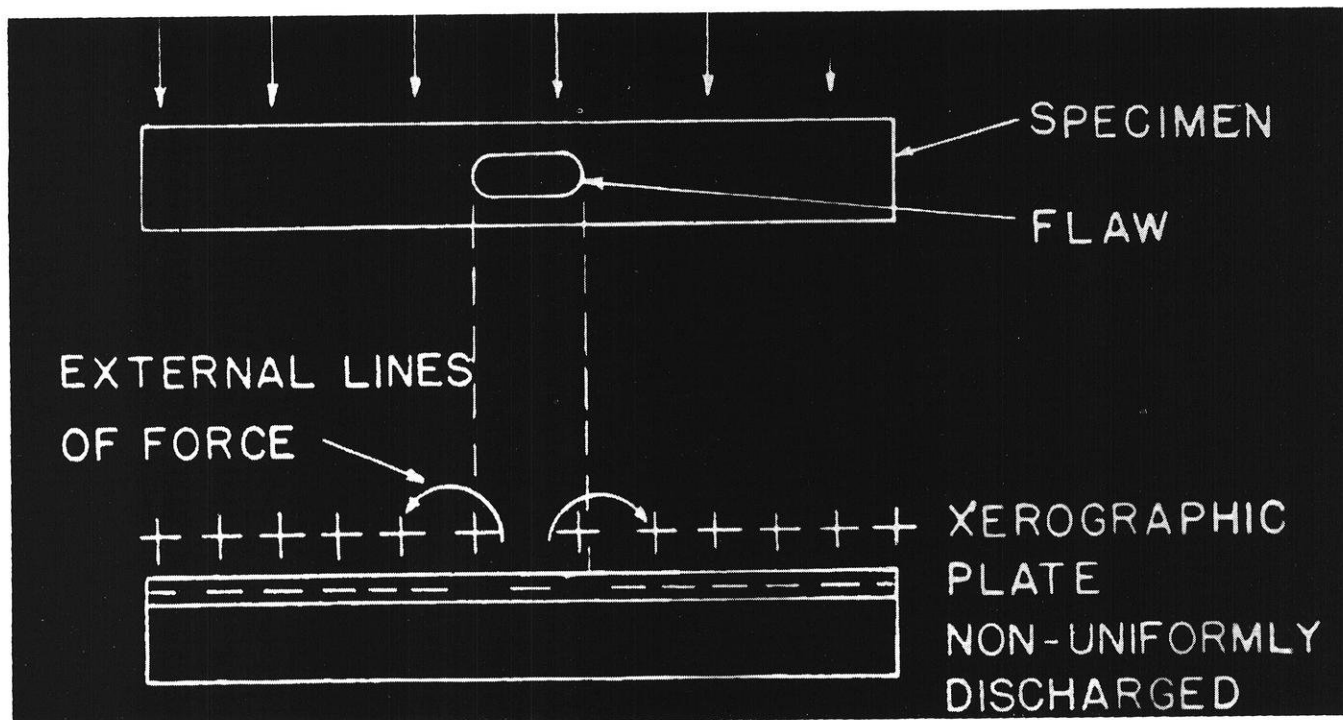
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—Courtesy General Electric

Diagram explaining the principle of xeroradiography, based on selective dissipation of the electrical charge as a result of exposure to x-radiation.

X-Rays

(Continued from page 86)

X-rays, like light, have a spectra or energy level diagram. More energy is required to keep electrons further from the nucleus in an atom. Therefore the heavier

the element the more penetrating the rays produced. This is the principle of the X-ray spectra.

This spectra, discovered by Moseley, is extremely regular. Each element exhibits a spectrum identical with that of the other elements except the scale of the wave length. This led to finding still other new elements.

It was X-rays then, which caused the classification of elements by atomic numbers, because this grouping came after Moseley observed that the frequency of the X-rays increased with elements and that this shift was always in the same magnitude.

X-rays are of the greatest importance to medical science. Their use in this scientific area is diagnostic and therapeutic. Briefly, X-rays 1) enable doctors to examine the internal structure of the body and correctly diagnose various diseases by the use of radiography and fluoroscopy; 2) dentists use rays to determine the condition of teeth deep inside the bone, and 3) the effect of the rays on tissue is useful in treating certain diseases.

There are countless application of X-rays in various fields of industry. Some of the interesting uses are: 1) they reveal inner cracks, blowholes, cavities, and strains in castings improving the foundry practice, 2) they reveal imperfect welds for engines and imperfect binding of rubber in tires, 3) they reveal in electrical apparatus air bubbles or foreign bodies in conductors. 5) they can aid in examining old paintings for authenticity, and 6) customs officials use them to find hidden objects.

With this growing reliance upon the rays, more and better X-ray equipment is being made, bringing many new applications. With these new applications will come more and more dependency until X-rays are assured of a still higher place in tomorrow's world.

THE END

THE WISCONSIN ENGINEER

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Opposite University Hospital

Apparel for Men, Women & Children

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WE RENT FORMAL WEAR

HI-FI AUDIO SYSTEMS

McIntosh, Sherwood, Grommes, Presto, Pickering, Gray, Components Corp., Electro-Sonic, Stan White Speakers, and DYNA-KITS.



The executive council of the *Wisconsin Engineer*, from left, Bob Walters, Business Manager; Ron Schroeder, Editor; John Bollinger, Associate Editor.

THE EXECUTIVE COUNCIL EXTENDS THEIR CONGRATULATIONS

TO

RICHARD WHITE c'56
ARTICLE EDITOR

ROBERT HENTGES ch'e'56
EDITOR-IN-CHIEF

AND

THE REST OF LAST YEAR'S STAFF
FOR WINNING THREE AWARDS AVAILABLE TO
COLLEGE ENGINEERING MAGAZINES

BEST WRITTEN MAGAZINE—1ST PLACE

BEST TECHNICAL ARTICLE—2ND PLACE

BEST NON-TECHNICAL ARTICLE—HONORABLE MENTION

NOVEMBER, 1956

W.S.P.E.

(Continued from page 66)

The use of aerial photography for "flat" map making and aerial inspection was also discussed. Mr. Hanson stated that if President Eisenhower's Open Sky proposal was adopted, it would permit very detailed information to be gathered. According to Mr. Hanson, the quantity and nature of materials moving into or out of a city can be measured very accurately; even buried factories can be analyzed as to their output, number of employees, etc., by the skillful interpretation of various telltale signs which will be left above ground. Mr. Hanson said that even a pipeline which has been buried fifty years can be accurately mapped from the air; the disturbance of the earth causes a change in the "texture" of the ground and vegetation which never completely disappears.

THE END

CHRISTMAS Gift Suggestions

- W-Blanket
- Beer Mug
- Telescope
- Chess Set
- Microscope
- Sweat Shirt
- Lettering Set
- Steiff Animals
- Parker "61"
- Addiator

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by Sneedly, bs'61

This is the time of year that *almost* makes engineers wish they were tramps or even hill students. It's pleasantly cool on the golf courses; the Northern pike are hitting French spinners like mad; the local pub is offering a combination of World Series and cool refreshing beverages to suit every taste. But engineers must stick with their slide rules and so it is with Sneedly.

* * *

Yesterday morning as Sneedly stopped in at a University Avenue bar and grill at 5 A.M. for breakfast, he noticed two fellow engineers, Bogall Cornell and J. C. Stauss, sitting at the far end of the bar. As he made his way across the room to join them, a score of whimpering hill students, filled with terror at the sight of three engineers in the same room with them, picked up their poached eggs and yogurt in their withered hands, and fled into the street. Sneedly ordered his usual breakfast, four fingers of bourbon, and greeted his friends; whereup he was presented with a problem.

* * *

It seems that Stauss and Cornell had invested some money in a small grove of box elder trees and now were having some trouble among themselves. They had been talked into the venture by Hic Krysinger and Bill Bahlin, two timber engineers who spent the summer in the forests of the West. Bogall Cornell, who, by the

So You Think You're SMART!

way, was once a forester, planted the 25 box elders as shown:



J. C. Stauss agreed to water and care for them. He was aided in this by Dr. Almer Mirth, who checked constantly for the presence of harmful bacteria. But now Bogall and J. C. had agreed to divide them as follows: Bogall would have 8 trees; J. C. would have 5 trees; and they would use 12 trees as a refuge for homeless box elder bugs. This would have been easy enough but J. C. Stauss wanted his five trees in the shape of a perfect cross, so that he could pretend they were a set of coordinate axes and run up and down them while doing velocity and acceleration problems. (J. C. is a bit eccentric.) He also demanded that a fence be placed completely around his trees and the fence not touch any of his 5 box elders. Bogall Cornell, of course, didn't want the fence touching any of his 8 trees, either. It looked like a knotty problem but old Sneedly solved it with ease. Can you?

* * *

Now for the solution to the problem in the October issue.

The dalquid holds more blumph than the quiddal. It holds exactly 4 times as much. Reducing the dufis to their equivalent in plups, we find that a quiddal holds only four cubic plups, while the dalquid, whose top is 16 square plups, has a content of 16 cubic plups, since it is one plup deep. If blumph is liquid or granular, the dalquid holds exactly 4 times as much as the quiddal. However, if blumph comes in chunks measuring more than one cubic plup each, none at all would fit into the quiddal, whose top is only one square plup. Each of these is a PARALLELEPIPEDON.

* * *

Well Sneedly has only given you one problem to solve this month and most of you would probably like more. Sneedly hopes you would like more and he repeats the invitation he gave you in the October issue. Send in *your* problems, together with how you solved them. Try to stump your cronies around the campus and around the state.

THE END

1957-1958

The Ramo-Wooldridge Fellowships
for Graduate Study at the
California Institute of Technology
or the
Massachusetts Institute of Technology

Leading toward the Ph. D. or Sc. D. degree as offered by each institution

Emphasis in the study program at the California Institute of Technology will be on Systems Engineering, and at the Massachusetts Institute of Technology on Systems Engineering or Operations Research.

The Ramo-Wooldridge Fellowships have been established in recognition of the great scarcity of scientists and engineers who have the very special qualifications required for work in Systems Engineering and Operations Research, and of the rapidly increasing national need for such individuals. Recipients of these Fellowships will have an opportunity to pursue a broad course of graduate study in the fundamental mathematics, physics, and engineering required for careers in these fields, and will also have an opportunity to associate and work with experienced engineers and scientists.

Systems Engineering encompasses difficult advanced design problems of the type which involve interactions, compromises, and a high degree of optimization between portions of complex complete systems. This includes taking into account the characteristics of human beings who must operate and otherwise interact with the systems.

Operations Research involves the application of the scientific method of approach to complex management and operational problems. Important in such application is the ability to develop mathematical models of operational situations and to apply mathematical tools to the solution of the problems that emerge.

The program for each Fellow covers approximately a twelve-month period, part of which is spent at The Ramo-Wooldridge Corporation, and the remainder at the California Institute of Technology or the Massachusetts Institute of Technology working toward the Doctor's degree, or in post-doctoral study. Fellows in good standing may apply for renewal of the Fellowship for a second year.

ELIGIBILITY The general requirements for eligibility are that the candidate be an American citizen who has completed one or more years of graduate study in mathematics, engineering or science before July 1957. The Fellowships will also be open to persons who have already received a Doctor's degree and who wish to undertake an additional year of study focused specifically on Systems Engineering or Operations Research.

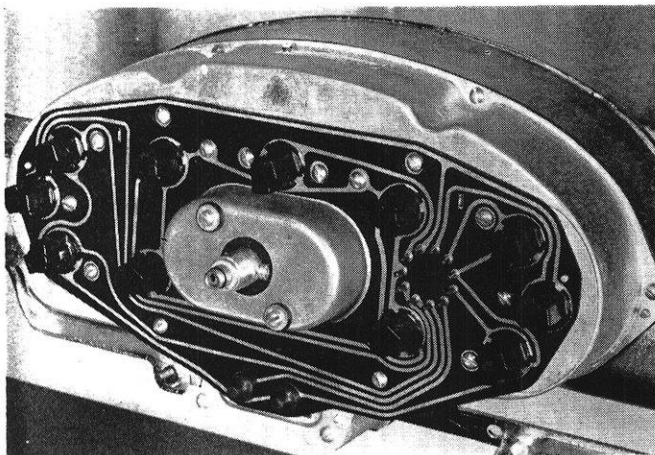
AWARDS The awards for each Fellowship granted will consist of three portions. The first will be an educational grant disbursed through the Institute attended of not less than \$2,000, with possible upward adjustment for candidates with family responsibilities. The second portion will be the salary paid to the Fellow for summer and part-time work at The Ramo-Wooldridge Corporation. The salary will depend upon his age and experience and amount of time worked, but will normally be approximately \$2,000. The third portion will be a grant of \$2,100 to the school to cover tuition and research expenses.

APPLICATION PROCEDURE

For a descriptive booklet and application forms, write to The Ramo-Wooldridge Fellowship Committee, The Ramo-Wooldridge Corporation, 5730 Arbor Vitae Street, Los Angeles 45. Completed applications together with reference forms and a transcript of undergraduate and graduate courses and grades must be transmitted to the Committee not later than January 21, 1957.

The Ramo-Wooldridge Corporation

5730 ARBOR VITAE STREET, LOS ANGELES 45, CALIFORNIA • LOS ANGELES TELEPHONE: OREGON 8-0311



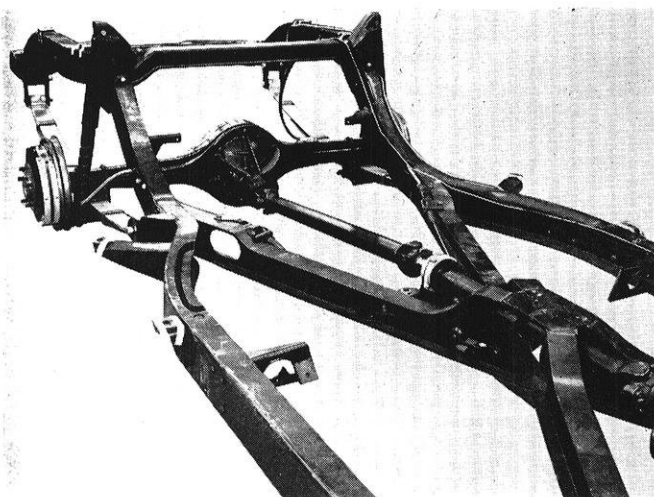
Oldsmobile's exclusive printed electric circuit for the instrument cluster, first in the industry, represents a major advance in automobile instrument wiring. By printing a pattern of flat copper circuits on an insulating plate that forms the reverse side of the instrument panel, Oldsmobile has obsoleted the complicated maze of wiring formerly used. A single wire leads to the instrument cluster, replacing 14 separate connections. This reduced the hazard of short circuiting, assures trouble-free operation of the electrical circuits and greatly simplifies maintenance.

Oldsmobile

(Continued from page 26)

Matic transmission has been redesigned from a square to a round type, improving the alignment, flexibility and durability.

Four of the five main bearings now are made of aluminum instead of Durex alloy. The aluminum bearings are capable of absorbing higher loads with less wear. Connecting rod bearing material has changed from Durex to aluminum for the same reason. The camshaft column diameter has been increased $\frac{1}{8}$ in. to $1\frac{1}{4}$ inches for greater strength and less deflection.



Rear shock absorbers have been relocated outside the rear springs, thus permitting a much wider base for controlling spring action. The shock absorbers are 16 inches farther apart at the top and 6 inches farther apart at the bottom. This broadened base contributes to riding comfort by reducing the tendency of the car body to sway on curves or in cross winds. Their vertical outboard location gives them improved straight line control over up-and-down wheel movements. The new L-Bow propeller shaft, redesigned to permit lowering of the car body, has a three-joint construction with the center joint mounted in rubber.

The hydraulic valve lifters have been increased in diameter by 9 per cent for greater cam durability. The new lifter also incorporates an anti-varnish feature in its design that prevents the piston from sticking in the down position due to formation of gum or varnish.

The 1957 pistons are a new design of the closed skirt type instead of the open skirt type. Skirt stiffness of the new piston is increased and there is a heavier head and ribbing, resulting in greater durability. A wider second compression ring and an entirely new four-piece oil ring minimize power loss and reduce oil dilution and consumption.

The engine front cover has larger water inlet openings and a revision in the shape of the outlet for better water flow and better temperature balance between cylinder heads. Breathing characteristics of the engine have been improved through larger intake manifold ports. The air cleaner has been redesigned to decrease its height, lowering the engine height by $2\frac{1}{4}$ inches. It now surrounds the carburetor. The new air cleaner has a single front snorkel type opening.

In lowering the body for 1957, a two-piece propeller shaft with three joints has been utilized. The new three-joint shaft greatly reduces the transmission of axle noise to the chassis. The two-piece shaft is less sensitive to high speed roughness because its smaller diameter makes it easier to balance.

Most marked interior change is the strut-mounted instrument panel adapted from Oldsmobile's experimental Delta. This strut panel, which extends from one side of the body to the other, is set back from the windshield base or cowl panel and leaves an air space back of the windshield for better air circulation and instrument accessibility. The steering wheel is deeply recessed for improved interior safety.

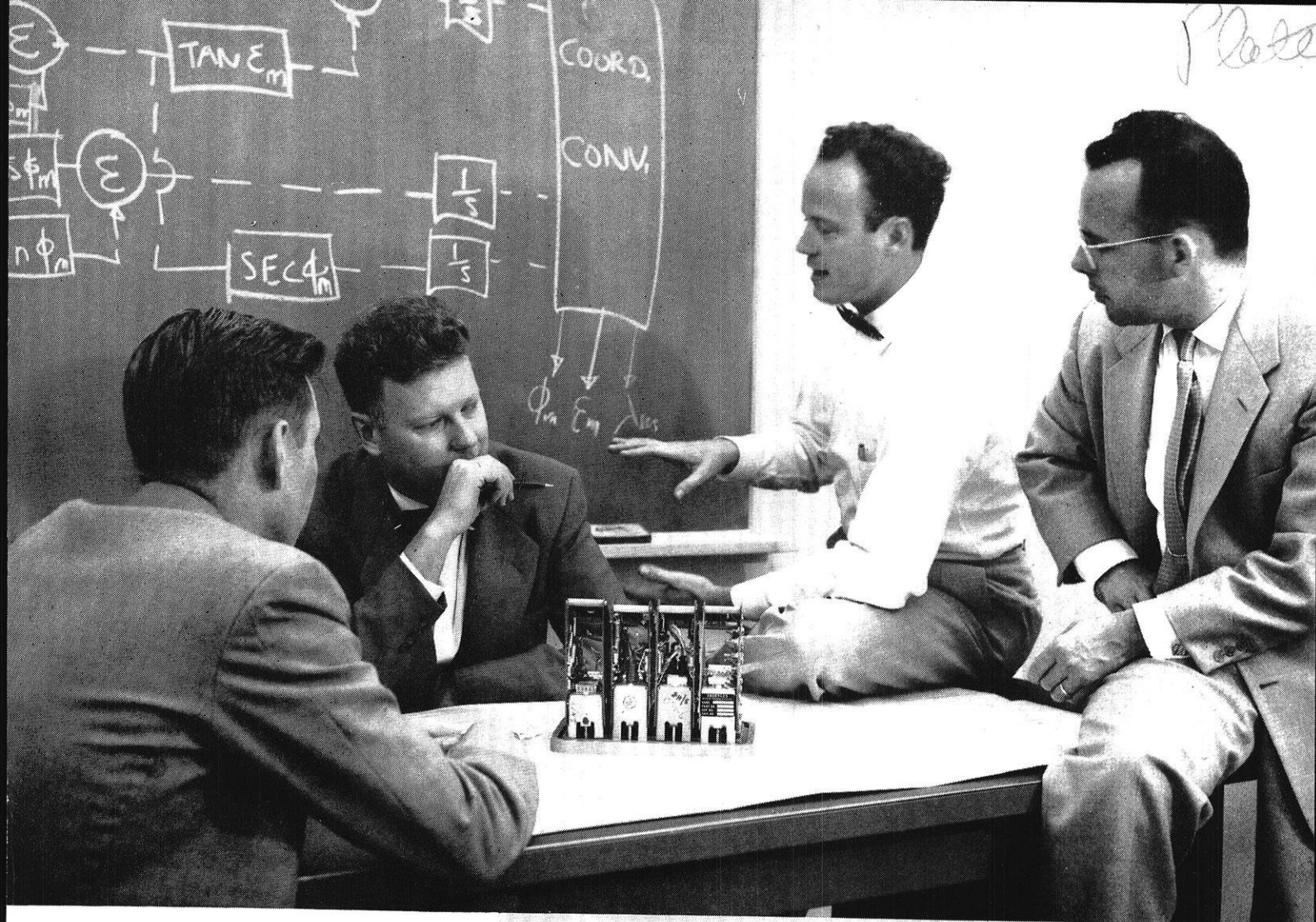
A printed electric circuit, first in the industry, has been developed for the instrument cluster, simplifying maintenance of electrical connections through use of a single connection instead of 14 connections.

MAJOR SPECIFICATIONS OF 1957 OLDSMOBILE MODELS

	Golden Rocket "88" Series	Super "88" Series	Starfire "98" Series
Wheelbase	122"	122"	126"
Overall Length	208.2"	208.2"	216.7"
Overall Width	76.38"	76.38"	76.38"
Overall Height (Holiday coupe)	56.97"	56.97"	56.97"
Number of cylinders . .	8	8	8
Bore and stroke	4" x 3 11/16"	4" x 3 11/16"	4" x 3 11/16"
Compression ratio . . .	9.5:1	9.5:1	9.5:1
Piston displacement . .	371 cu. in.	371 cu. in.	371 cu. in.
Taxable horsepower . .	51	51	51
Maximum brake horsepower	277 @ 4400 RPM	277 @ 4400 RPM	277 @ 4400 RPM
Maximum torque	400 ft.-lb. @ 2800 RPM	400 ft.-lb. @ 2800 RPM	400 ft.-lb. @ 2800 RPM
Rear axle ratio (synchromesh)	3.64 to 1	3.64 to 1	N.A.
Rear axle ratio (Hydra-Matic)	3.23 to 1	3.42 to 1	*3.42 to 1
Shipping weight (4-door sedan)	4000 lbs.	4049 lbs.	4347 lbs.
Curb weight (4-door sedan, Hydra-Matic)	4264 lbs.	4313 lbs.	4511 lbs.

THE END

THE WISCONSIN ENGINEER



G. D. Schott (second from left), Flight Controls Dept. Head, discusses new techniques in the mechanization of autopilots with R. D. Wertz (left), Flight Controls Research Engineer; R. J. Niewald, Flight Controls Analysis Section Head, and B. C. Axley, Servomechanisms Analysis Group Engineer.

MISSILE SYSTEMS FLIGHT CONTROLS

One of the most critical problems encountered in the development of a successful missile system involves attaining rapid responses of controls *consistent with system stability*. Moreover, it is a problem of increasing importance as new aerodynamic configurations require major advances in flight controls performance.

At Lockheed, Flight Controls engineers are developing unique control methods to cope with this growing problem. Their expanded activities have created new positions for those possessing experience and a high order of ability in:

- Hydraulic servomechanisms
- Circuit design
- Aerodynamic stability and control
- Flight analysis
- Autopilot simulation

Positions are open in flight controls and virtually every field of engineering and science related to missile systems.

Lockheed **MISSILE SYSTEMS DIVISION** *research and engineering staff*

LOCKHEED AIRCRAFT CORPORATION

VAN NUYS • PALO ALTO • SUNNYVALE, CALIFORNIA

STA



TIC

The designer sat at his drafting board;
A wealth of knowledge in his head was stored;
Like "What can be done on a radial drill,
Or a turret-lathe or a vertical mill?"
But above all things, a knack he had
Of driving gentle machinists mad.
So he mused as he thoughtfully scratched his bean
"Just how can I make this thing hard to machine?"
If he made this body perfectly straight,
The job ought to come out first rate.
But t'would be so easy to turn and bore
That it would never make a machinist sore.
So he'll put a compound taper there,
And a couple of angles to make 'em swear,
And brass would work for these little gears,
But it's too damned easy to work, he fears,
So just to make the machinist squeal,
He'll make him mill it from tungsten steel!
He'll put those holes that hold the cap
Down underneath where they can't be tapped;
Now if they can make this, it'll be just luck.
'Cause it can't be held in a dog or chuck,
And it can't be planed and can't be ground,
So he feels his design is unusually sound,
And he shouted in glee, "Success at last!
This damned thing can't even be cast."

* * *

It was that sleepy time of the afternoon. The prof
droned on and on about formulae, constants and fig-
ures. An engineer, sitting in the second row, was
unable to restrain himself any longer and gave a tre-
mendous yawn. Unfortunately as he stretched out his
arm he caught his neighbor squarely under the chin,
knocking him to the floor. Horrified, he bent over the
prostrate form just in time to hear a murmur. "Hit
me again, Sam, I can still hear him."

* * *

"Do you want to sell the horse?"

"Yep!" replied the farmer.

"Can he run?"

"Can he run! Look." Thereupon he slapped the part
of the horse sometimes used for that purpose, and off
trotted the horse at full speed, running just as prettily

as could be. Suddenly the horse ran full speed into a
tree.

"Is he blind?" asked the startled would be purchaser.

"Why, hell no," replied the proud farmer, "he just
don't give a damn."

* * *

Gas station attendant (pointing to choke lever): "You
say your car uses too much gas? Know what this is for?"

Woman (airily): "Oh, that! I never use it, so I keep it
pulled out to hang my handbag on."

* * *

THE ENGINEER'S PSALM

Professor Drought is my instructor, I shall not pass.
He maketh me to exhibit mine ignorance before the
whole class.
He telleth me more than I can write,
He lowereth my grade.
Yea though I walk through the corridors of knowledge,
I do not learn.
He tries to teach me;
He writeth the equations before me in hopes that I will
understand them.
He bombardeth my head with integrations,
My sliderule freezeth up,
Surely enthalpies and entropies shall follow me all the
days of my life,
And I shall dwell in the College of Engineering forever.
—Unanimous

* * *

Professor interrupted during important lecture by
sneeze.

"Who sneezed?"

No answer.

Prof. "There will be a 4 hour exam tomorrow."

No reply.

Prof. "I guarantee to flunk half the class."

From back of room, "I did it sir."

Prof. "Gesundheit."

* * *

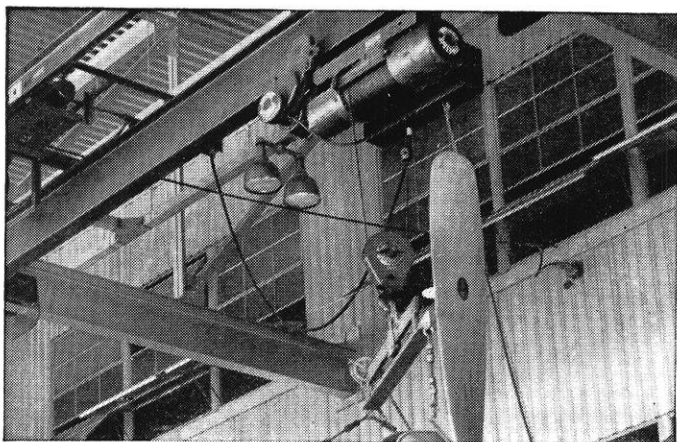
Instructor: "I suppose you wish I were dead so you
could spit on my grave."

E.E.: Not me, I hate to stand in lines."

Another page for

YOUR BEARING NOTEBOOK

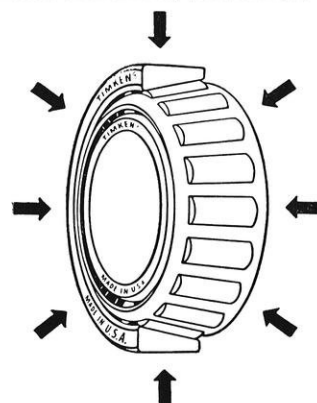
How to keep cranes flying



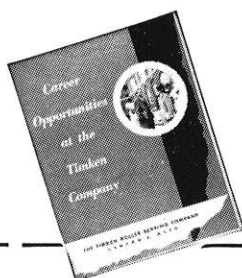
When engineers designed the overhead cranes for the world's largest line maintenance hangar, they faced the problem of taking the enormous thrust and radial loads imposed by swinging aircraft engines. To assure dependability, keep the cranes on the job, and keep the engines moving, they specified Timken® tapered roller bearings.

Tapered design lets Timken® bearings take both radial and thrust loads

Because of their tapered design, Timken bearings can take radial or thrust loads or any combination. And because the load is carried along a full line of contact between rollers and races, Timken bearings have extra load-carrying capacity.



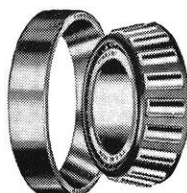
Want to learn more about bearings or job opportunities?



Some of the engineering problems you'll face after graduation will involve bearing applications. For help in learning more about bearings, write for the 270-page General Information Manual on Timken bearings. And for infor-

mation about the excellent job opportunities at the Timken Company, write for a copy of "Career Opportunities at the Timken Company". The Timken Roller Bearing Company, Canton 6, Ohio.

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TAPERED ROLLER BEARINGS



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THE WISCONSIN ENGINEER



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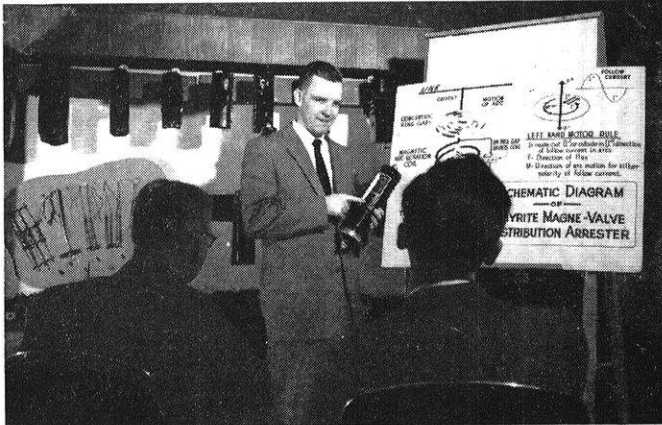
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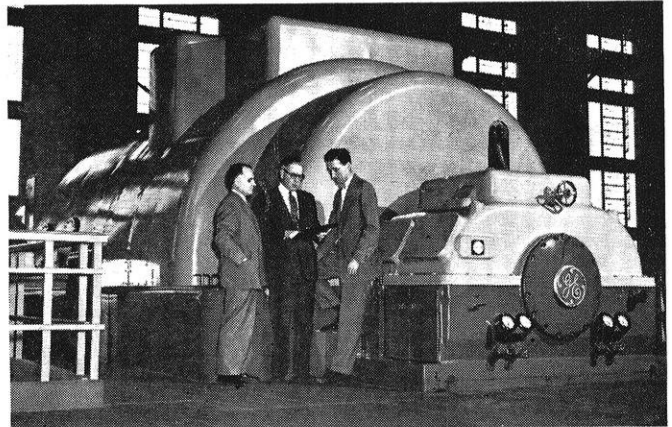
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