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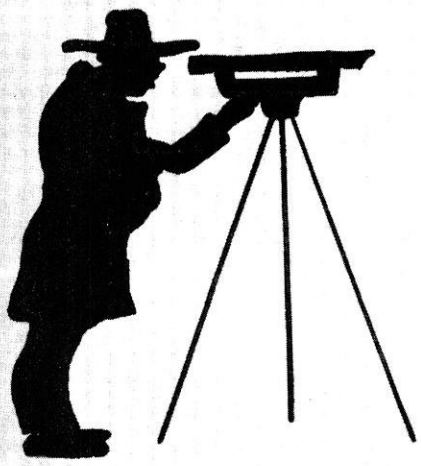
The Wisconsin engineer

May, 1954

25¢



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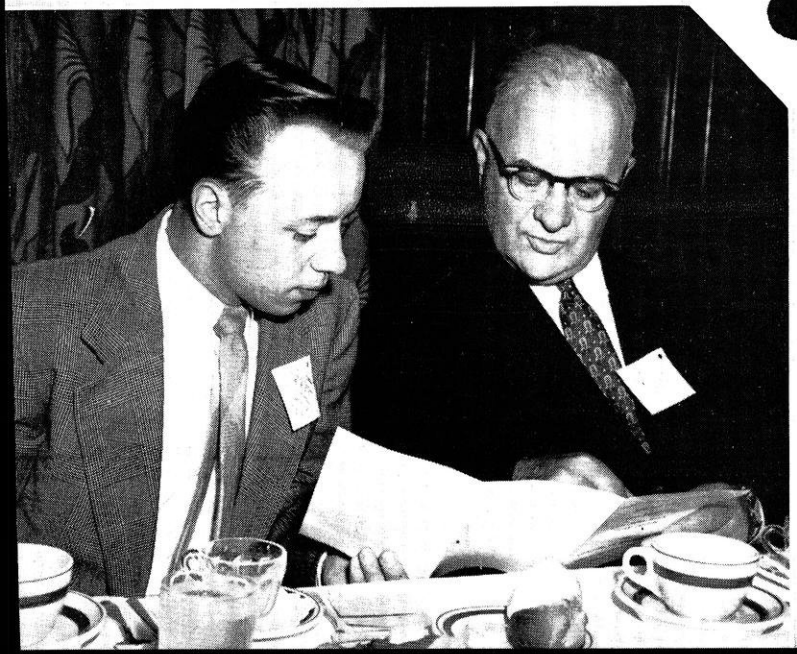
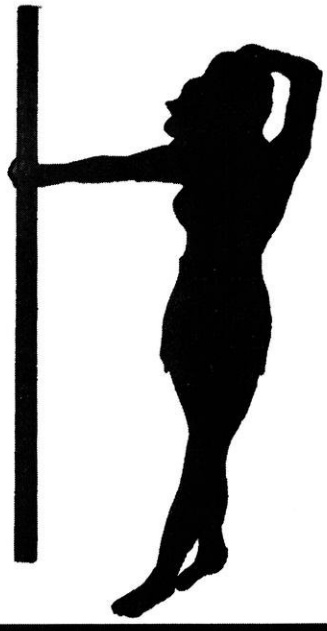
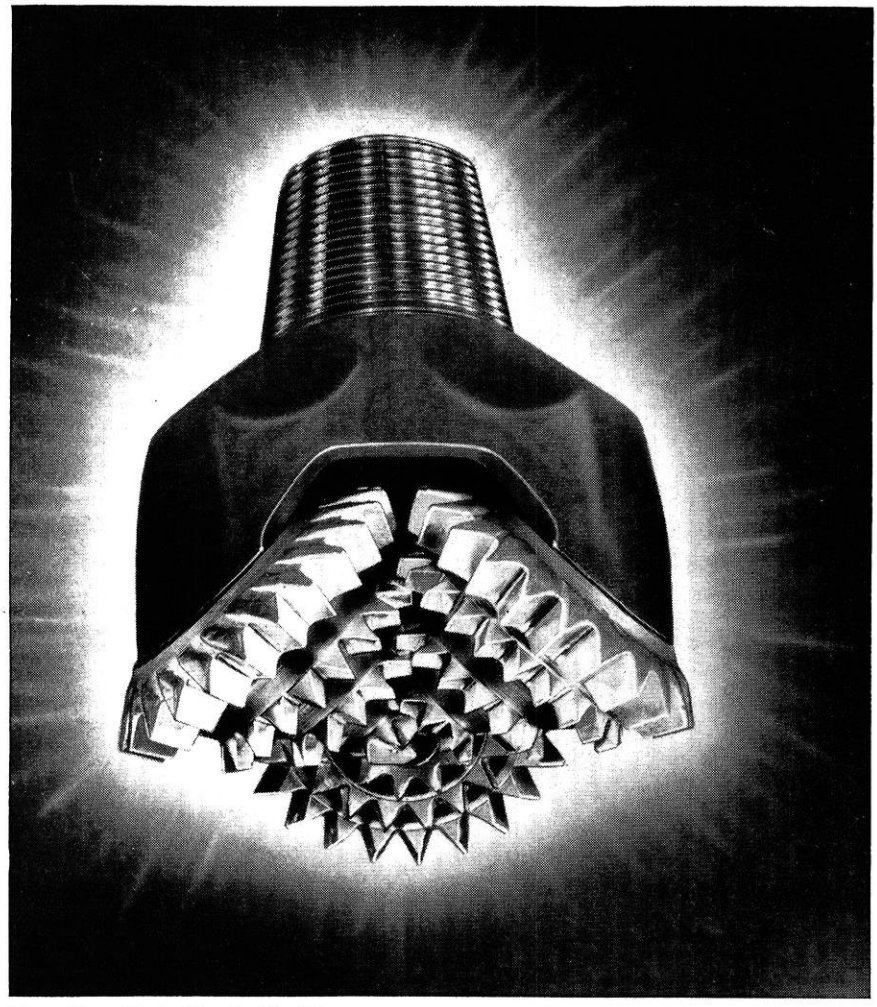
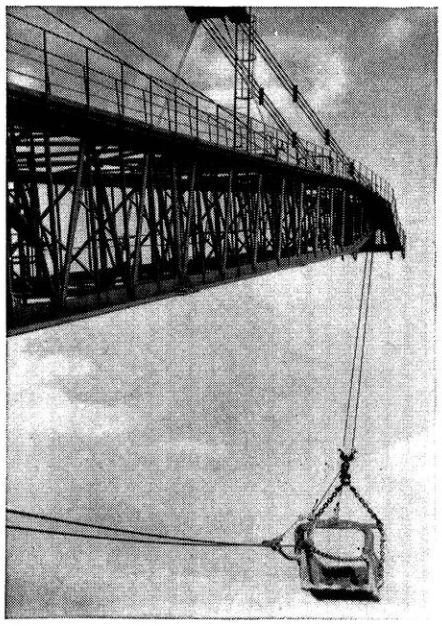




Only STEEL can do so many jobs so well



They Chew Their Way to Wealth. These teeth are capable of chewing through earth, sand and rock for thousands of feet until they reach Nature's buried treasures of gas and oil. Rock bits like this need super-strength, amazing toughness, high resistance to impact, abrasion, and shock. So, many of them are made from USS Alloy Steels. And United States Steel also provides many other essentials for oil drilling, such as wire lines, drill pipe, cement, drilling rigs.



Scoop! And a big one, too . . . it can scoop out 21.5 cubic yards of earth per minute, has a boom 215 feet long! The drag lines, boom support cables and hoisting ropes on a behemoth like this must have great strength, durability, flexibility, fatigue resistance. Tiger Brand Wire Ropes, made by U.S. Steel, meet all requirements.

A Man Needs a Cookie once in a while! And when cookies are kept in a tight cookie tin like this, they'll be fresh and appetizing for him. The can is steel, of course . . . made out of the same USS Tin Plate that is produced by U.S. Steel to make millions of "tin" cans every year for the protection of food, oil, paint and countless other things.

OPPORTUNITIES WITH U. S. STEEL

If you're thinking about what you're going to do after graduation . . . if you're interested in a challenging, rewarding position with a progressive company . . . then it will pay you to look into the opportunities with United States Steel. Your placement director can give you more details, or we'll be glad to send you the informative booklet, "Paths of Opportunity." United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

For further information on any product mentioned in this advertisement, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

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This trade-mark is your guide to quality steel

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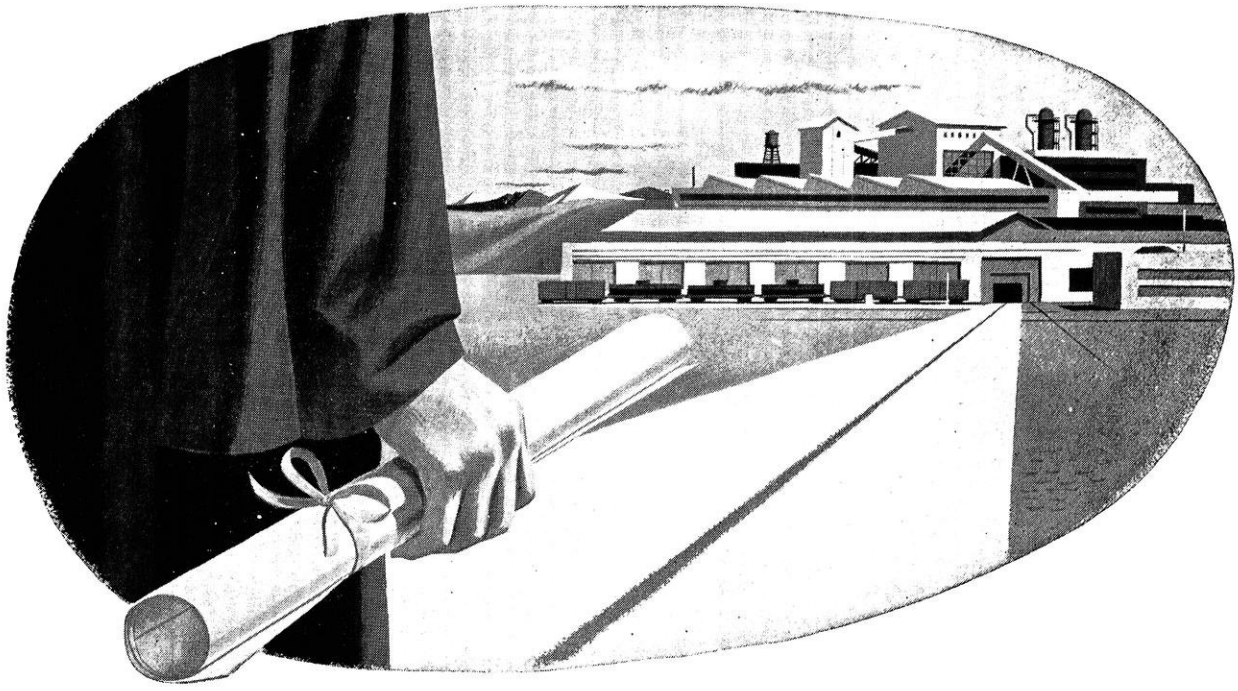
Spring thoughts on the subject of...

rambunctious sheepskins



AN engineering senior can hardly be blamed for feeling rambunctious now that the years of hard study are nearly over and the sheepskin's in view.

But the sheepskin comes at Commencement. Commencement means you're set to start on your career. And that's certainly worth some serious thought.

To help you decide which job to pick, you'd do well to weigh the many reasons for choosing an engineering career at General Motors—reasons like these:

• At GM, an engineer has a real chance to follow his natural bent and work in the field of his choice. That's because GM produces a variety of products – automobiles, trucks, Diesel engines, refrigerators, bombsights, just to mention a few.

• At GM, you get the chance to work closely with top engineers, sharing their knowledge and experience. That's owing to GM's decentralization: 34 manufacturing divisions, 117 plants in 57 towns and cities. Yet each division draws upon GM's vast central research laboratories.

• At GM, there's a congenial climate for the personal and professional advancement of engineers. We respect the engineering point of view, as shown by the number of key GM executives in both divisional and top management who began their careers as engineering graduates on GM drafting boards.

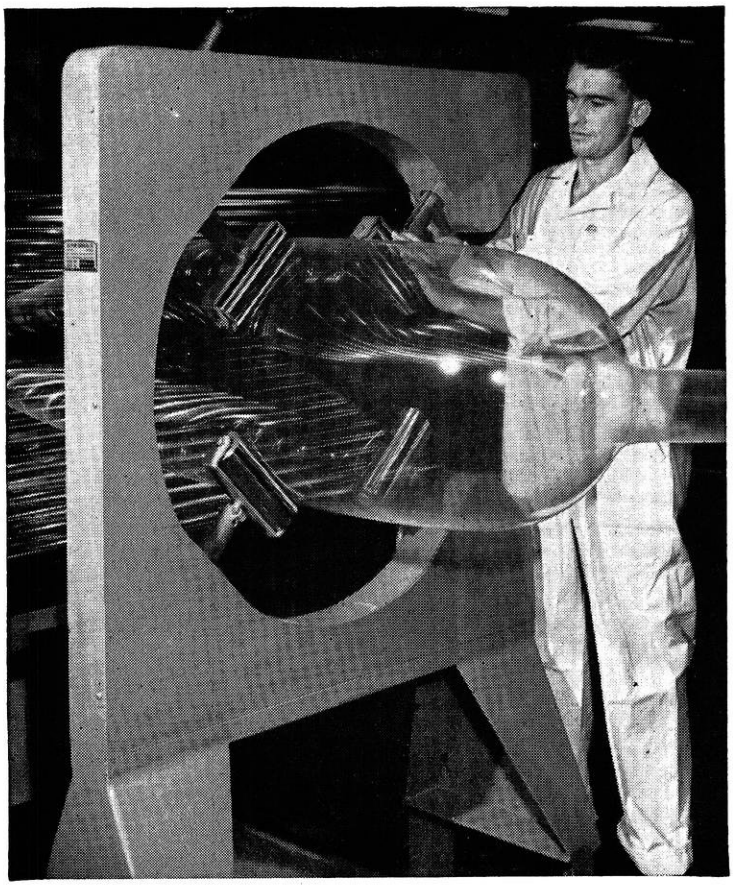
Naturally, all this spells genuine opportunity for the young man who has what it takes. Your College Placement Office can arrange an interview for you with our college representative. Or you can write direct to us.

GM positions now available in these fields:

MECHANICAL ENGINEERING
ELECTRICAL ENGINEERING
METALLURGICAL ENGINEERING
INDUSTRIAL ENGINEERING
CHEMICAL ENGINEERING
BUSINESS ADMINISTRATION

GENERAL MOTORS CORPORATION

Personnel Staff, Detroit 2, Michigan



One of the early steps in the production of Saran-Wrap—the "bubble" that becomes a film after being deflated in a series of rollers.

Colorful display bins are an important part of consumer sales strategy and explain the advantages of Saran-Wrap.

TAKING CHEMICALS TO MANY MARKETS...

Dow succeeds through the careful coordination of group effort in research, marketing and sales

The high consumer acceptance gained by Saran-Wrap is a current example of what happens when extensive research and production planning is followed by coordinated marketing and sales strategy in launching a new product.

This amazing new plastic food wrap is certainly a useful product—but it is much more than that. For Dow it marks another milestone in a continuing effort to move into new fields of endeavor and to increase the variety as well as the size of its operation. Well-planned and executed projects, introducing varied industrial and consumer products, have been responsible for Dow's rapid growth to a position of prominence in the chemical industry.

Whether you choose research, production or sales, you can find a challenging career with Dow. Write to Dow's Technical Employment Department today for the booklet, "Opportunities with The Dow Chemical Company"—you'll find it interesting. THE DOW CHEMICAL COMPANY, *Midland, Michigan.*

you can depend on DOW CHEMICALS

DOW

The Student Engineer's Magazine

WISCONSIN ENGINEER

Founded 1896

In This Issue . . .

Cover

The opening banquet of the Tenth Annual Midwestern ASCE Convention (student chapters) held on the campus, April 30 and May 1, 1954, was highlighted with a speech by Mr Adolf J. Ackerman, noted Wisconsin consulting engineer, who spoke on "Foreign Opportunities for Engineers." On the cover, in the upper right picture: Prof. W. R. Marshall, Jr., Associate Dean of the College of Engineering and Associate Director of the U.W. Engineering Experiment Station; and Mr. Ackerman. In the lower left picture: Charles Brylla, CiE3, convention chairman, who also presided at the banquet, and Mr. N. M. "Nick" Isabella, Past President, Wisconsin Road Builders Association. The banquet was courtesy of the Wisconsin Road Builders Association.

Other phases in the convention, which was attended by 73 delegates from 13 North Central colleges, were several inspection trips, and a stag party and dance at the Union, all held on Friday. Saturday morning the chapter presidents had a "dutch" breakfast at the Union, which was followed by a business meeting in the Mechanical Engineering Building. The convention closed with a dinner at the Park Hotel with Dean Kurt F. Wendt as the honored guest.

Articles

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The Student Engineer's Magazine

WISCONSIN ENGINEER

Founded 1896

Volume 58 MAY, 1954 *Number 8*

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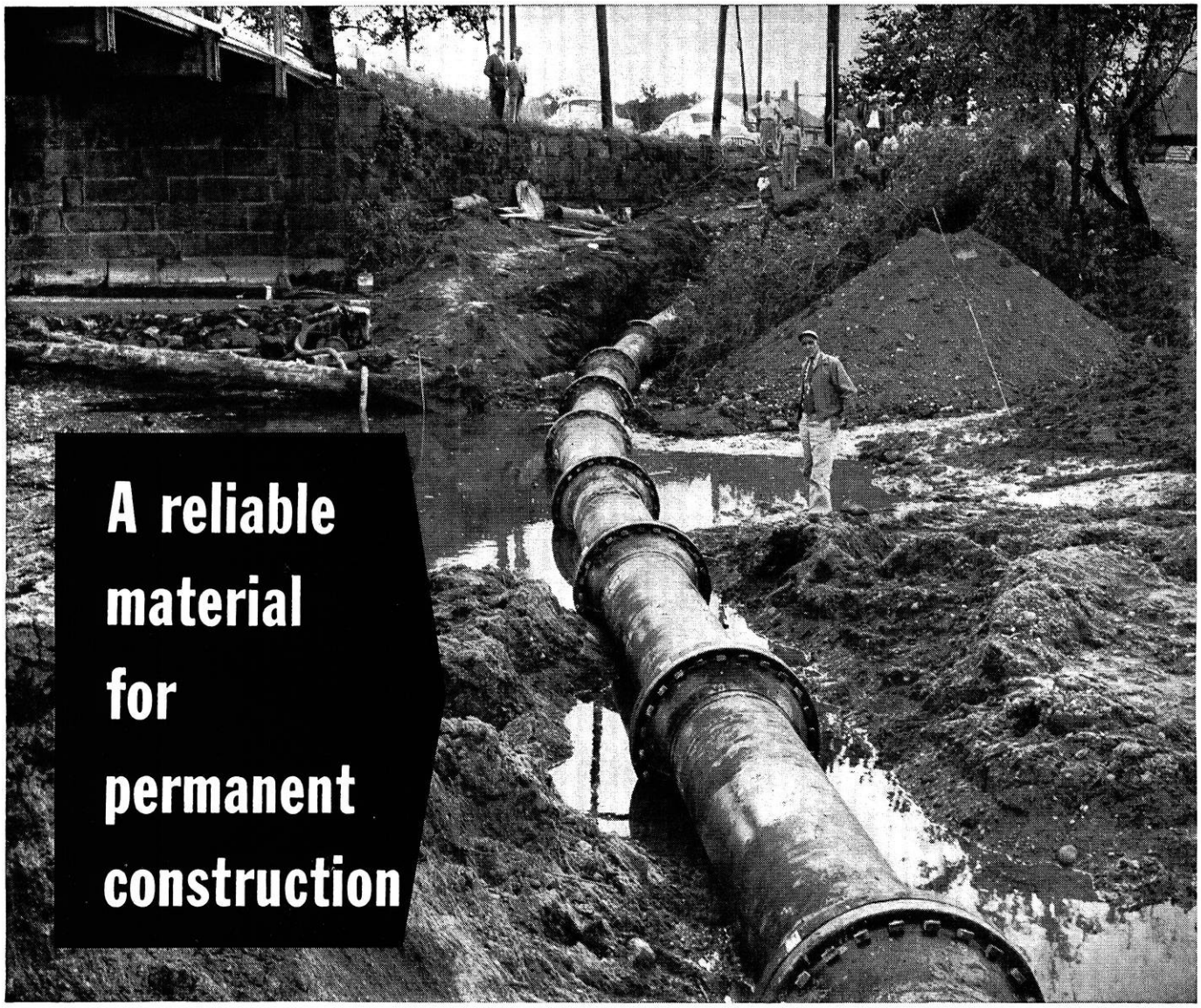
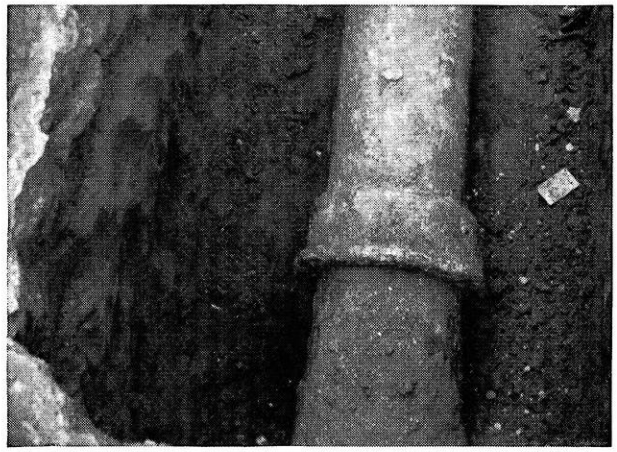


Ball-and-socket joint cast iron pipe for water main crossing river at Newark, Ohio.

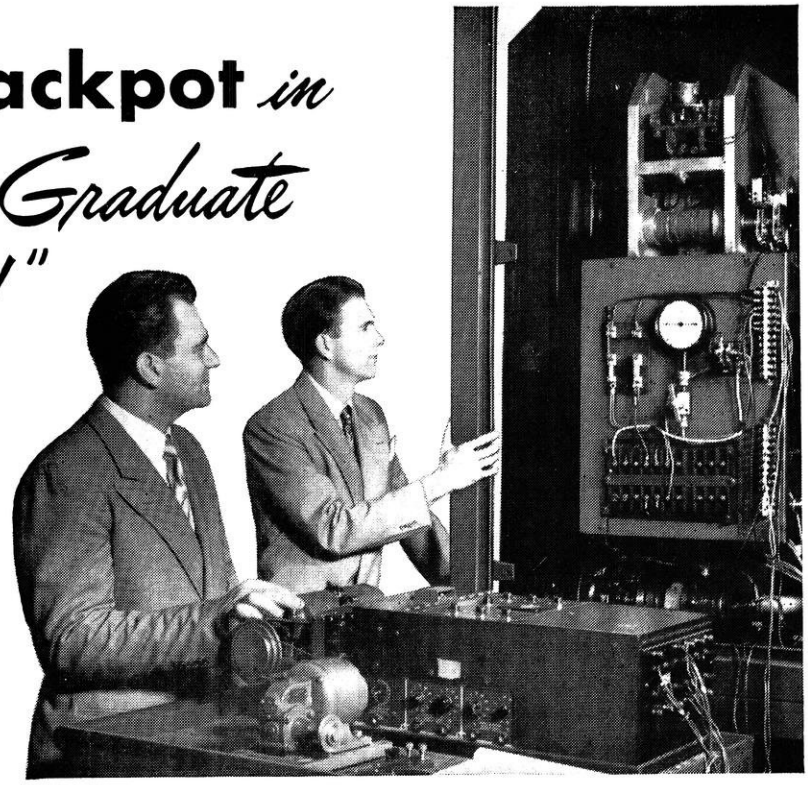
Where installations are planned for long-term service to assure low cost per service year, engineers rely on cast iron pipe as a dependable and adaptable material. Consequently, it is specified for a wide variety of applications, both utility and industrial, including water supply, sewerage, fire protection, process industries and many forms of special construction. Long life and low maintenance cost are *proved* results of the high beam-strength, compressive-strength, shock-strength and effective resistance to corrosion of cast iron pipe. Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3, Ill.



Cast iron water main still functioning in Philadelphia after 135 years of service.

CAST IRON PIPE SERVES FOR CENTURIES

"We Hit the Jackpot *in* Allis-Chalmers Graduate Training Course!"



say N. W. MORELLI

Oregon State College, B.S.,M.E.—1950

and

E. R. PERRY

Texas A. & M., B.S.,E.E.—1950

WHILE taking the course, two engineers developed a revolutionary new circuit breaker mechanism.

"Our experience shows what *can* happen if you work with people open to suggestion. We found men of this kind at Allis-Chalmers, and it has given us a special pleasure in our job.

"We started out like most other graduates with a hazy idea of what we wanted to do. After working in several departments, we requested that part of our training be at the Boston Works of Allis-Chalmers, where circuit breakers are made."

New Design Principle

"Circuit breakers soon became an obsession with us, and we got the idea of designing a hydraulic operator and triggering mechanism for these breakers. Most operators for big breakers are pneumatic.

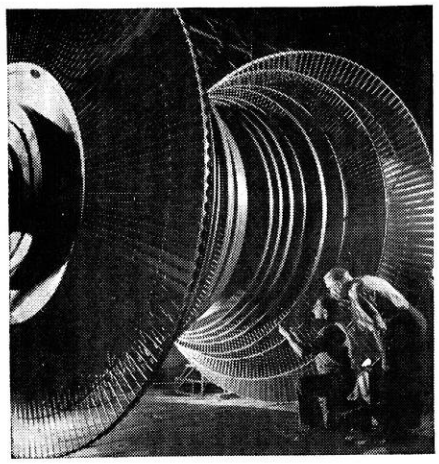
"Unsuccessful attempts had been made in the past by all circuit breaker manufacturers to build hydraulic operators. The important thing is that no one at Allis-Chalmers said, 'Don't try it—it won't work.' "

Start New Era

"To make a long story short, our study of the problem led us to the hydraulic accumulator and high speed valves being used by the aircraft industry. These had not been available when earlier attempts were made to build a hydraulic operator. With these highly developed devices to work with, we were able to build an operator that combined the best features of pneumatic and hydraulic operation. We call it the *Pneu-draulic* operator. Engineers are saying it starts a new era in circuit breaker actuation.

"This fact is important to us, but it is even more important to know that Allis-Chalmers Graduate Training Course is full of opportunity . . . and as we found out, there's opportunity right from the start."

Pneu-draulic is an Allis-Chalmers Trademark.



Low-pressure spindle for a 120,000 kw steam turbine generator. Said to be one of the largest ever built in the United States, this spindle is nearing completion in the Allis-Chalmers West Allis shops.

Facts You Should Know About the Allis-Chalmers Graduate Training Course

1. It's well established, having been started in 1904. A large percentage of the management group are graduates of the course.

2. The course offers a maximum of 24 months' training. Length and type of training is individually planned.

3. The graduate engineer may choose the kind of work he wants to do: design, engineering, research, production, sales, erection, service, etc.

4. He may choose the kind of power, processing, specialized equipment or industrial apparatus with which he will work, such as: steam or hydraulic, turbo-generators, circuit breakers, unit substations, transformers, motors, control pumps, kilns, coolers, rod and ball mills, crushers, vibrating screens, rectifiers, induction and dielectric heaters, grain mills, sifters, etc.

5. He will have individual attention and guidance in working out his training program.

6. The program has as its objective the right job for the right man. As he gets experience in different training locations he can alter his course of training to match changing interests.

For information watch for the Allis-Chalmers representative visiting your campus, or call an Allis-Chalmers district office, or write Graduate Training Section, Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

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C-5675

The Editor's Desk

ENGINEERS DAY

Edited by Richard White

Wisconsin engineers from all parts of the state and nation returned to the University of Wisconsin on Friday, May 7, to help the University's College of Engineering celebrate its sixth annual Engineers Day on the campus. Some 10,000 invitations to visit the college and see it in operation were sent to engineers and industrialists throughout the state and to Wisconsin engineering alumni throughout the nation, according to Prof. Ben G. Elliott, in charge of arrangements.

Wisconsin Engineers Day, born in 1949 as a part of the University's Centennial Year celebration, was so enthusiastically received that it has been continued as an annual event. Last year about a thousand Wisconsin engineers and other men of industry, and more than 8,000 other Wisconsin citizens, visited the campus on Engineers Day and viewed the campus-wide Engineering Exposition at the same time. The Exposition is to be held every second or third year at Wisconsin. A capacity crowd of 500 attended the fifth Engineers Day dinner and saw six outstanding UW engineering alumni and citizens of Wisconsin awarded citations for their accomplishments in engineering and industrial fields.

The Engineers dinner was held this year in the Great Hall of the Memorial Union at 6:30 p.m. on May 7. During the day, visiting engineers and industrialists inspected the University's engineering campus, its new Engineering Building housing the electrical and mechanics departments, its new Chemical Engineering Building now in full use, and viewed and discussed the many research projects now under way in the various departments under Wisconsin Engineering Experiment Station.

At the dinner, John Slezak, under-secretary of the Army, gave the main address, discussing the reorganization of the Army.

Other speakers at the dinner were A. Matt Werner, Sheboygan, president of the UW Board of Regents, and University President E. B. Fred. Prof. Leo Steffens, of the UW School of Music, gave a piano recital at the dinner.

Slezak is one of six outstanding University alumni who was cited for achievements in their fields at the dinner.

Besides Slezak, others honored were Arne J. Asplund, president of the Defibrator Corp., Stockholm, Sweden; Adolph J. Ackerman, Madison, internationally known consulting engineer; Mack C. Lake, president of the Orinoco Mining Co., New York City; David W. McLenegan, manager of technical personnel and education of the Hanford Atomic Products Operation of General Electric Co., Richland, Wash.; and Robert C. Siegel, chief engineer of the Wisconsin Telephone Co., Milwaukee.

This is the first year since the University began awarding the Engineers' Day citations five years ago that all of the engineers honored are graduates of the University. Two of this year's recipients were born in foreign lands—Asplund in Sweden and Slezak in Czechoslovakia —and three of them, Asplund, Ackerman, and Lake, have gained much of their engineering prominence in lands scattered around the globe.

A long career in the nation's armed services as well as in American engineering and industry lies behind Slezak in his present big job as under-secretary of the Army.

Born in Czechslovakia in 1896, Slezak came to the United States in 1916, and graduated from Wisconsin in 1923 with his bachelor of science degree in mechanical engineering. He served in both World Wars I and II, and continued to serve in various capacities in the Army at different times between the wars, in the Ordnance Corps in 1924, in the training division of the Secretary of War Office in 1938, and in the machine tools division of that office in 1940.

From 1942 to 1946 he was on active duty in the Army and was promoted to colonel in 1943. He served with the Chicago Ordnance District for 47 months, was a consultant with the Army and Navy Munitions Board in 1947, has been a director of the American Ordnance Association since then, served as assistant secretary of the Army, and since early this year has served as under-secretary.

Before going to Washington as assistant secretary of the Army, Slezak was a leader in seven Midwest industries. He served as president of two large Chicago industries, and as director of five other big firms in the Chicago area.

●

APOLOGY

We wish to make humble apology to Theodore Kattis, ME 4, who wrote the story "Protect Your Inventions." The author was misstated as being Ken Kulik.

●

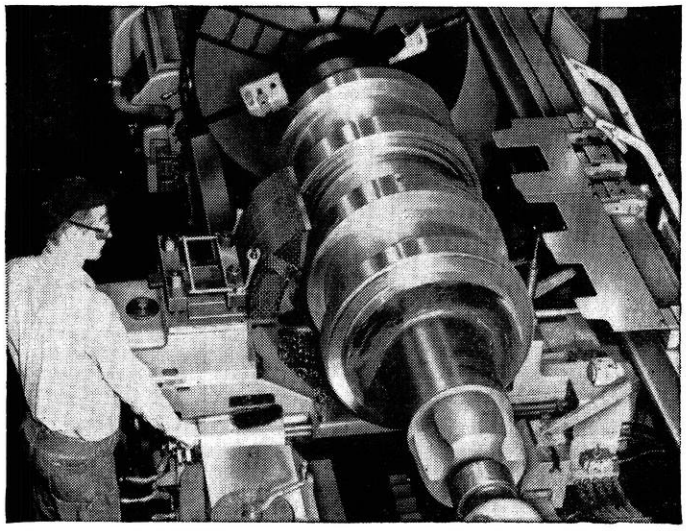
AWARD TO BE GIVEN BEST CORROSION PAPER

For the third year an award of $50, and a commendation will be given to the author whose paper published during 1954 in **Corrosion** is judged to be the best of those by authors under 35 years of age. **Corrosion** is the official monthly publication of the National Association of Corrosion Engineers.

The award, funds for which are supplied by an anonymous donor, will be divided if a paper with multiple qualified authors is judged best. The decision on the best paper is made by a committee named by the president of NACE.

(continued on page 56)

Another page for **YOUR BEARING NOTEBOOK**

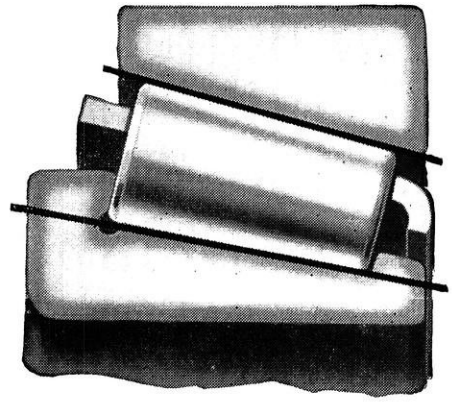


How to hold a heavily-loaded lathe spindle in accurate alignment

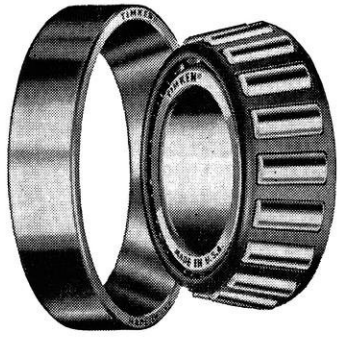
This big lathe machines rolls for steel mills. The roll is rotated by the lathe spindle and it must be machined to very accurate dimensions. So the lathe manufacturer, LeBlond Machine Tool Company, mounts the spindle on Timken® tapered roller bearings. Despite the great weight on the spindle, the Timken bearings hold it precisely in place—because they are made so accurately and have such high load capacity.

Why TIMKEN® bearings have high load capacity

This picture shows why Timken bearings have such high capacity—the load is carried on a *full line contact* between the rollers and races in the bearing. Note also the tapered construction. This permits the bearing to be tightened up (preloaded, we call it) to prevent chatter in rotating parts like the machine tool spindle above.

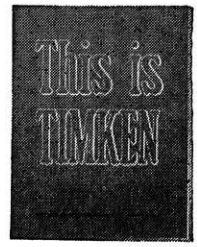


TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



Want to learn more about bearings or job opportunities?

Some of the engineering problems you'll face after graduation will involve bearing applications. For help in learning more about bearings, write for the 270-page General Information Manual on Timken bearings. And for information about the excellent job opportunities at the Timken Company, write for a copy of "This Is Timken". The Timken Roller Bearing Company, Canton 6, Ohio.

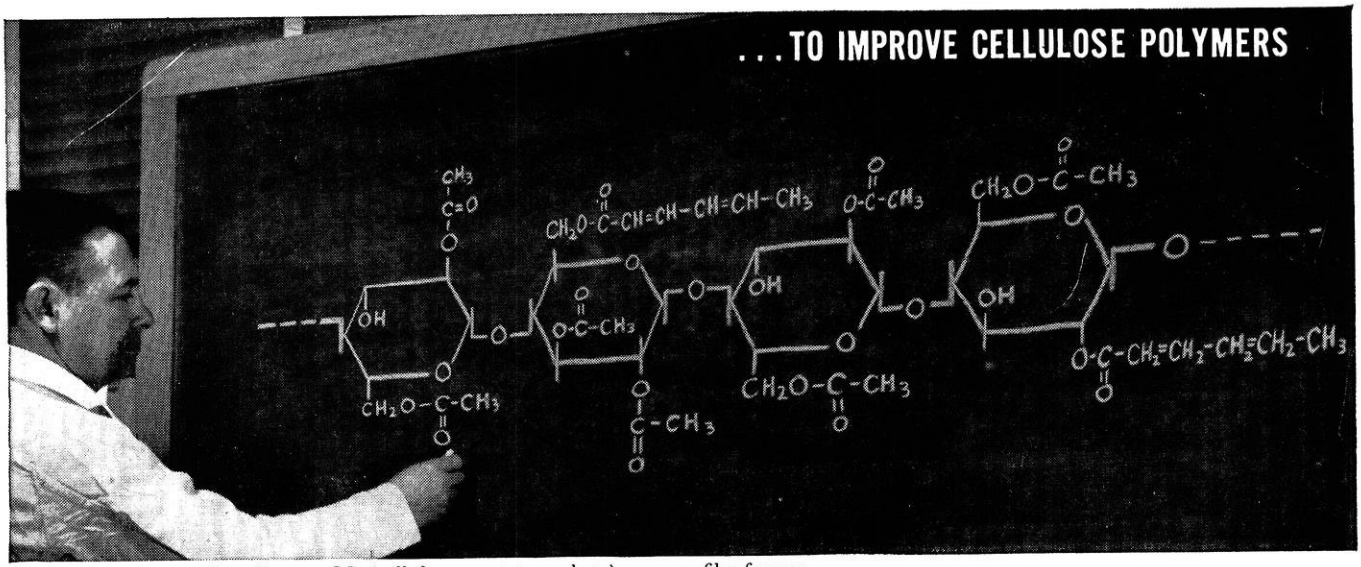


NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⇕ AND THRUST →◎← LOADS OR ANY COMBINATION ✳

A new Hercules plant under construction at Burlington, New Jersey, will make the essential raw material for Canadian production of 'Terylene'—polyester yarn. Known as dimethyl terephthalate, or DMT, this basic chemical for polyester fibers will be made by an entirely new process, and will be available eventually for plastics and other uses.

HOW HERCULES HELPS...

Hercules' business today helps almost everyone's business. It embraces the production of synthetic resins, cellulose products, chemical cotton, terpene chemicals, rosin and rosin derivatives, chlorinated products, and many other chemical processing materials—as well as explosives. Through close cooperative research with its customers, Hercules has helped improve the processing or performance of many industrial and consumer products.



Hercules now offers Hercose®S (cellulose acetate sorbate), a new film-former. Widely soluble, it can be applied as tough, flexible coatings and cured to insoluble condition. Hercose S films have excellent resistance to heat and low temperatures. It is another in the diverse group of Hercules cellulose chemicals offered many industries. Write for details.

HERCULES POWDER COMPANY Wilmington 99, Delaware
INCORPORATED

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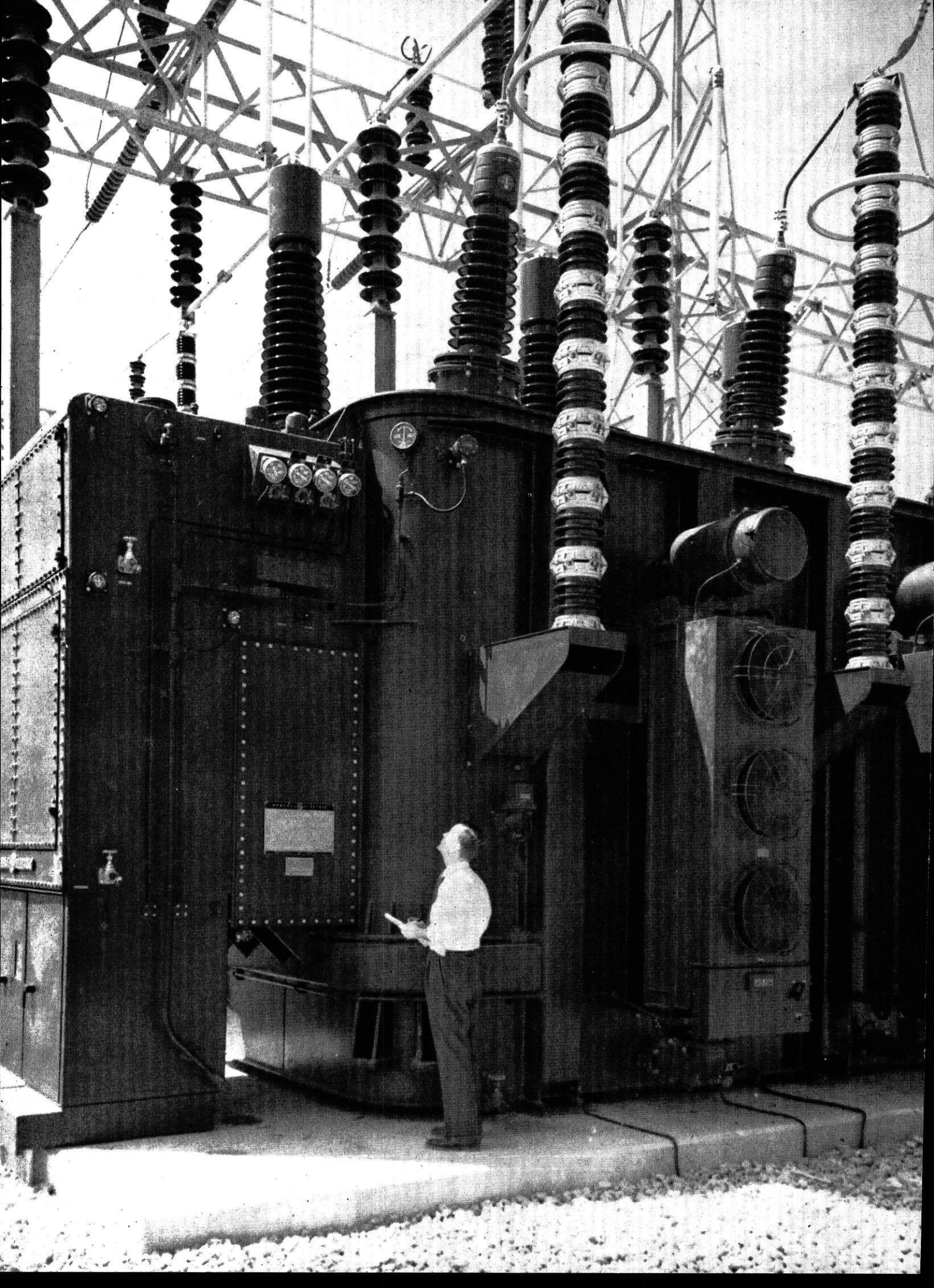


editorial

Each year most seniors in engineering take job interviews with representatives of companies they think they might like to work with after graduation. Yet many know little about the interviews before they take place.

This problem can be corrected, first of all, by learning something about the company involved. Another point to remember—most interviewers expect the student to ask questions about their company. It's their way of determining your interest in working with them. They are flattered and impressed if the student can talk intelligently with them about the company and its products or services.

It's best to actually desire to work with each of the companies you have an interview with—if there is no desire, it's probable that there is little interest in that type of work. Therefore one is unlikely to make a really good impression on the interviewer, or for that matter, unlikely to do a good job with the company.

If a student has no particular preference as to type of work—though he should have by the time he graduates—he would do well to read up on several fields of engineering work and thus develop a desire to work in a particular field. He is unlikely to get into work which he comes to dislike if he knows what field he wants. One who dislikes his work can never do well and should switch to another field. Yet think of the valuable years he lost in finding out his actual job preference—after graduation. In short: be ready for your job interview when the time comes.

K.A.G.

AUTOMATION

by Donald Edwards, m'55

A machine in which conducting circuits are automatically printed on ceramic wafers. This is part of an experimental automatic production process in which electronic components are built up with these basic wafer units.

The fully automatic factory, with raw materials pouring in one end and the finished product rolling out the other, is truly the ultimate in the American dream of production. True, we have not yet reached that goal, but great advances in the field of automation have been achieved during the past several years. Automatic production is not something new and different that appeared on the scene with the recent coining of the word automation, but is a continuation of the trend from hand to machine labor that started with the industrial revolution. This article will point out some of the basic principles of automation and applications of these principles which have been developed as the trend toward automatic production continues.

Automation may be defined as the problem of making a process automatic. This problem of making a process automatic must be approached from two sides, both of which will be discussed in this article.

1) First, it is necessary to design **automatically controlled** production machinery, materials handling equipment, and inspection devices.

2) Second and equally important, it is necessary to **redesign the product** so it can be handled, positioned, machined, and inspected automatically.

Automatic Control

Some of the most spectacular developments of 20th century technology have been in the field of automatic controls. The applications of these developments to production machinery is opening the door to the full potentialities of automation. To gain an understanding of automatic controls, one must know what is meant by self-correcting, closed-loop, feed back, and servo-mechanism controls.

Any control device which is self correcting is a closed-loop control. To put it another way, a closed-loop control system is one in which the energy input to the machine, as regulated by the controller, is a function of the actual performance of the machine.

The thermostatically controlled electric oven will serve to clarify what is meant by a closed loop control system.

The variable which is to be controlled is the air temperature in the oven. A temperature measuring device determines the actual temperature of the air in the oven. This temperature is compared in the controller with the desired temperature or set point of the controller. The difference found in this comparison is translated into a control impulse which results in the electricity to the coils being turned on or off. Thus the energy input (electricity) is a function of the performance (oven temperature).

You, as you drive your car along a winding road, complete a closed-loop control system. The variable to be controlled is the position of your car on the road. The measuring device is your eye. The actual position of your car as detected by your eye is compared in your brain with the desired position on the right-hand side. Any error detected results in a control impulse to your hands which turn the wheel and bring the car back to the right side.

The tendency of your car to fluctuate or "hunt" about the desired position on the road is characteristic of all closed-loop control systems. The development of stable control systems which reduce this "hunting" to a minimum has been the major problem of the systems engineer.

Servomechanisms which were developed during the war for gun remote-position control (R.P.C.), radar scanning, air-craft flight control, etc., are basically closed-loop control systems. Due to differences in terminology and physical locations of the units, the similarity may not be too obvious.

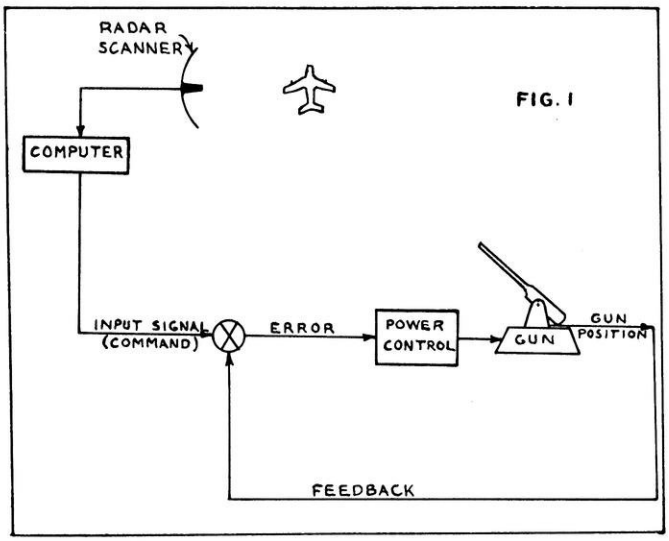
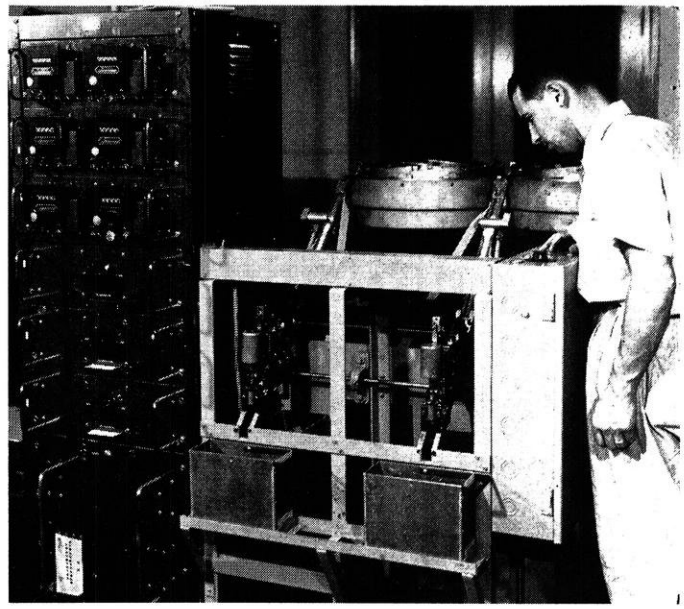


Fig. 1 Servomechanism for automatic positioning of an anti-aircraft gun. This is a closed-loop control system.

Shown in Fig. 1 is a schematic diagram of an anti-aircraft gun positioning system which is a servomechanism. In this system the input signal or "command" is obtained from a computer which is supplied information from a radar tracking system that determines the plane's position. This signal is compared with a "feedback" signal which is a measurement of the actual position of the gun. The difference between these two signals is the "error" which is fed into the power control unit and amplified to cause proper positioning of the gun.



An automatic inspection device used to check the printed circuits made in the machine on the opposite page. The inspection circuit is programmed by a punched card.

This servomechanism may be compared with the closed-loop control for the electric oven to illustrate the similarity. In the oven, the "command" is the set point of the controller. The "feedback" is the actual value of the oven temp. The difference between the set temperature and the actual temperature is the "error" which is amplified by the control mechanism to cause a flow of electricity in the coils that will correct the "error."

The electronic computer, another great technological development of the past decade, is an important component of many control systems. The electronic computer is a device capable of rapidly analyzing a large volume of information to give some comparison, decision, or collation, or to "remember" such information for use in the future. These apparent mental processes are, of course, based on chosen or built-in criteria, the computer having no free-will of its own. The two types now in common use are the analog and digital computers.

In the analog computer, as the name implies, a physical analogy to the problem to be solved is set up in the machine in terms of the value of some physical quantity. This quantity may be an electric voltage or current, or the degree of angular rotation of a shaft. The machine transforms this physical quantity to another physical quantity in accordance with the rules of its construction. Since these rules have been chosen to simulate the rules governing the problem, the resulting physical quantity is the answer desired. If the computer is being used in a control system, the final physical quantity may be used, for example, as the input signal or "command" in a servomechanism.

In contrast to the analog computer, the digital com-

(continued on next page)

puter works by counting. By performing a long series of relatively simple arithmetic calculations at a very high rate of speed and according to the built-in and supplied rules of the machine, highly intricate problems are solved in a short time. Information is fed into the computer on a punched or magnetic tape.

Applications of Control

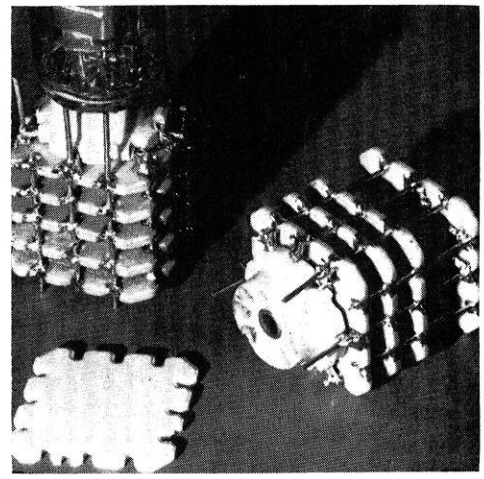
Some industries have, at this time, already reached a very high degree of automation. The continuous process industries (chemical and oil) are an excellent example. These industries are particularly adaptable to automation because a non-varying product flows continuously through the plant. By designing their plants around self correcting feed-back controls, they have been able to achieve almost completely automatic production. Such plants can be operated by a few technicians who watch over the process on a central control console, interfering only when something goes wrong.

In contrast to the continuous process industries are the fabricating industries which produce discrete units of product. Here too, automation has reached a high degree of development where very long runs of non-varying product are involved. The solution to automation in the long-run, non-varying product field has been to build large single purpose machines which automatically perform all the necessary operations. The high cost of such specialized machinery is justified because it can be used for a long time and pay for itself in time and labor savings.

However, in the far more common case where short runs of varying products are involved, it is not economical or practical to use the large specialized machine. Here, in order to achieve automation, it is necessary to design equipment which is both automatic and capable of handling a variety of products. This means designing automatic but versatile materials handling, machine loading, inspecting, and machine tool equipment. Following are descriptions of some newly developed machine tools which are fully automatic and highly versatile.

The Servo Mechanism laboratory of M.I.T. has developed an automatic milling machine which is controlled by a system using punched tape. Dimensions on an engineering drawing are converted with the aid of a computer to blocks of information on a punched tape. The tape is fed into a calculator which interprets the data on the tape and feeds this information in the form of electric impulses into a decoding servomechanism. There are three decoding servos on the machine, one for each plane of motion of the tool. The decoding servos convert the input electrical signals into motions of the tool as was done in the example of the anti-aircraft gun. By preparing a new tape, the machine can be made to do an entirely different job. The director need not be located near the machine and can be used to control more than one machine at a time.

The General Electric Company has developed a system of automatic machine control which uses magnetic tape as a means of storing information. They call this system the record playback program control. In this system, the machine on which the control is to be used is also used to make the record (on magnetic tape) for controlling the machine. A skilled operator goes manually through the machining operation while the record is being made. The information on the tape is actually the angular displacement of each of the feed shafts on the machine at all times during the operation. During the playback, the magnetic tape is run through an electronic amplifier. The recreated electrical signals are fed to a servomechanism which compares the actual angular positions of the feed shafts with the input signals from the tape. The servo then corrects the error, and keeps the machine in step with the dictations of the tape. By simply recording a new tape, a great variety of jobs can be done automatically on such a machine.



An excellent example of product redesign to facilitate automatic production is the modular design of electronic equipment. Each module is composed of four to six wafers bearing printed circuits.

These machines are at present too expensive to be economical, but they seem to be the prototype of the machine tool of the future.

Product Redesign

Redesign of the product is necessary when the extent to which the production process can be made automatic is limited by the nature of the product. When such a situation arises, it is necessary to **rethink** the product in terms of its functions and not in terms of how it has been made in the past. A new product, which will still perform the same functions, but lend itself more readily to automation should be the goal of product redesign.

An especially good example of product redesign is the recently developed automatic production of electronic equipment. Usually, when one thinks of electronic equipment, he thinks of a jumbled mass of capacitors, resistors, tubes, coils, and wires. To think of assembling such a mess any other way than by hand seems quite unlikely. A machine built to duplicate hand motions would be a huge Rube Goldberg contraption unable to produce more than one circuit.

The U.S. Navy saw that in time of war when great quantities of electronic components are needed, the old method of hand assembly and design would be inade-

(*continued on page* 42)

TCP

A NEW GASOLINE ADDITIVE

by John C. Richardson, me'54

1. Introduction. TCP is the abbreviation for tricresyl phosphate, an additive in, and the trademark of, the Shell Oil Company premium gasoline. It was introduced to the market early in the summer of 1953. It is estimated that sales of Shell premium gasoline for automotive use have since increased from 25 to 45 per cent in some areas. In competition with TCP are the following gasolines:

AD by the Sunset Oil Company
DC by the Jenney Maufacturing Company
ETC by the Deep Rock Oil Corporation
RTG by the Frontier Refining Company
TTP by the Petco Corporation

2. A Basic High-Compression Engine Problem Due to Gasoline. With increasing compression ratios in late model automobiles, there has been a demand for higher octane gasoline. Temperature is directly related to increased compression. If the gas-air mixture becomes too hot, it will explode prematurely. This is called pre-ignition, the cause of most engine knock. Knock wastes power, and if severe, can damage the engine.

3. Solution for the Knock Problem. The major solution for the knock problem is to produce gasoline that will not explode until higher temperatures are reached. This can be done by special refining techniques and the addition of ethyl, which is a combination of tetraethyl lead and ethylene dibromide. The result of the TEL[1] addition is an increase in the octane rating of the gasoline, which is a measure of its anti-knock quality.

4. Drawbacks of TEL Addition. Higher octane gasoline for higher-compression ratio engines works well when the engine is new, but as it becomes older, lead and other deposits build up inside the combustion chamber. These deposits are primarily products of TEL and differ widely in their boiling and melting points (see Table A). For example, lead oxide, a common product of combustion of TEL, melts at 1780 °F and will condense on any part of the combustion chamber.

5. Effect of Combustion-Chamber Deposits. The build-up of lead and other deposits cause various troubles:

a. They raise the compression ratio still further by decreasing the volume inside the chamber. This increase may be greater than the octane rating of the gasoline can handle and thus result in knock and loss of power.

b. The deposits insulate the cylinder, thus preventing the heat of combustion from escaping readily. This causes the gas-air mixture to heat up still more and results in hot spots in the accumulated deposits—a cause of pre-ignition.

c. Lead deposits on spark plug porcelains act as conductors and short circuit them. This results in: absence of spark at the affected cylinder, waste of gas-air mixture, loss of power, and uneven performance.

d. Solid or molten deposits of lead compounds on the exhaust valves may cause severe corrosion.

6. Previous Method of Preventing Lead Deposits. Since

(*continued on page 40*)

TABLE A
Properties of Some of the Burned Products Formed from Gasoline Additives

Name	Formula	Boiling Point	Melting Point	Solid
Carbon Dioxide	CO_2	—108F	<0F	No
Water	H_2O	212	32	No
Hydrobromic Acid	HBr	—79	<0	No
Lead Bromide	$PbBr_2$	1684	703	Yes
Lead Chloride	$PbCl_2$	1749	934	Yes
Lead Oxide	PbO	>2500	1780	Yes
Lead Phosphate	$Pb_3(PO_4)_2$	>2500	1857	Yes
Lead Sulfate	$Pb(SO_4)_2$	>2500	2138	Yes

[1] The abbreviation of tetraethyl lead.

Increasing Automobile Engine Performance

by Paul L. Silbert, me'55

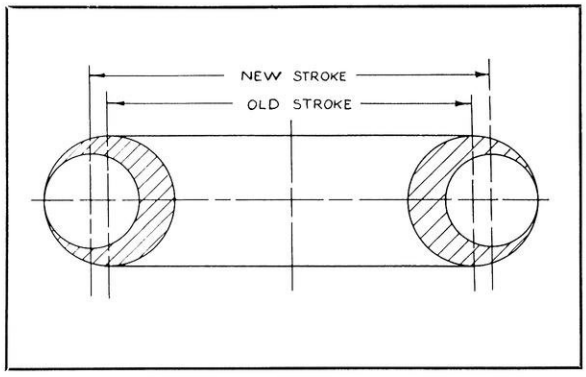


Fig. 1 Crankshaft cross-section. The stroke is increased by grinding away the shaded sections.

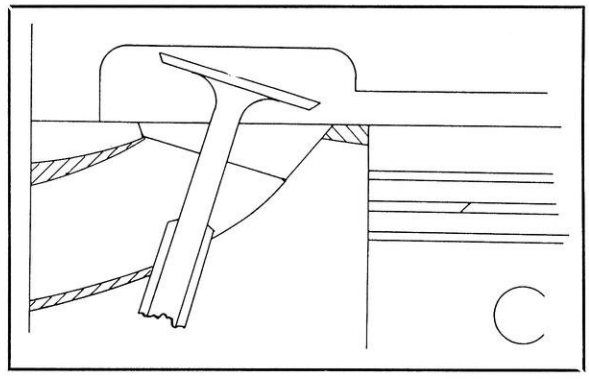


Fig. 2 Porting and relieving. The shaded area is ground away in this operation.

1. What Is Performance? It is necessary to first understand thoroughly the basic fundamentals of engine performance before intelligently discussing methods of improving performance. Performance may be defined, in a general way, as the efficiency with which an engine does the job it is supposed to. The discussion of performance brings immediately to mind power, but this is not the only factor involved. True performance consists of all the factors of engine operation—fuel consumption, horsepower, torque, reliability, engine friction, and wear. These performance factors must be considered over the entire speed range, from idling to peak rpm.

2. Engine Operation. A gasoline engine is essentially a machine for transforming the heat energy of liquid fuel into torque. This energy conversion is accomplished through four cycles of engine operation:

(a) The Intake Stroke. As the piston moves downward with the intake valve open, a vacuum is created in the cylinder above the piston and atmospheric pressure forces air through the carburetor, picking up vaporized fuel, and then through the manifold to fill the space above the piston in the cylinder. Due to pressure losses caused by surface friction and turbulence, the cylinder pressure during the intake stroke does not reach atmospheric pressure, but is somewhat lower. This pressure loss is termed volumetric efficiency, which is defined as the ratio of the volume of air-fuel mixture drawn into the cylinder to the volume of the cylinder.

(b) The Compression Stroke. As the piston moves upward after the intake stroke, the valves are closed and the gases are gradually compressed until they reach a final compression pressure which is dependent on the compression ratio. This compression ratio is the ratio of the total cylinder volume at the bottom of the stroke to the volume at the top of the stroke.

(c) The Power Stroke. Near the end of the compression stroke, the spark is fired, igniting the fuel mixture and causing a rapid increase in cylinder pressure. This pressure drives the piston downward. Through the connecting rod-crank mechanism the crankshaft is turned, giving the engine its power.

(d) The Exhaust Stroke. The exhaust valve is opened as the piston moves upward after the power stroke, forcing out the waste gasses remaining after combustion and leaving the cylinder ready for repetition of the four cycles.

3. Stock Engine Characteristics. The stock American automobile engine is a marvelous compromise between such diverse factors as performance, smooth-silent oper-

ation, economy, and low production costs. Some engines emphasize one of these factors more than the others, but attention must be given to all of them to compete successfully in the automobile market. In 1950, the average engine had a displacement of 256 cu. in. and developed 117 hp with a compression ratio of 7 to 1. These values have changed for 1953 by an increase in horsepower and compression ratio, but a smaller increase in average displacement due to the efforts of engineers to increase engine efficiency.

4. Methods of Increasing Power. There are five basic methods of increasing the power output of an engine. These are to increase: (a) Piston displacement, (b) the weight of fuel mixture drawn into the cylinder during the intake stroke, (c) the efficiency of combustion, (d) mechanical efficiency, and (e) the peak rpm. There is, of course, some overlapping of these methods. Modifications which increase the weight of fuel mixture drawn into the cylinder will tend to increase the peak rpm, as will those used to increase the mechanical efficiency.

5. Boring the Cylinder Block. Theoretically, horsepower output is a direct function of displacement. It would seem from this that it would be possible to obtain any amount of horsepower from an engine by merely increasing the displacement, but in practice this is not possible because of the limitations of size and weight placed on an automobile engine. Also, on any engine there is a limit to the amount which the displacement can be increased, but it is possible to obtain an appreciable gain in power by increasing displacement to a point below this limit. One method of doing this is to increase the cylinder diameter by boring, thereby increasing the piston displacement. The extent to which this can be done on an engine is dependent on the cylinder wall thickness.

6. Stroking the Crankshaft. Another method of increasing the displacement of an engine is stroking the crankshaft, illustration No. 1. This is done by grinding the crankpins off-center with the new center displaced outward from the crank axis. This increases the stroke of the piston by twice the amount of the off-center, and the displacement is increased in proportion to the stroke increase. The crankpin diameter is decreased at the same time and is the factor which limits the extent to which a crankshaft can be safely stroked.

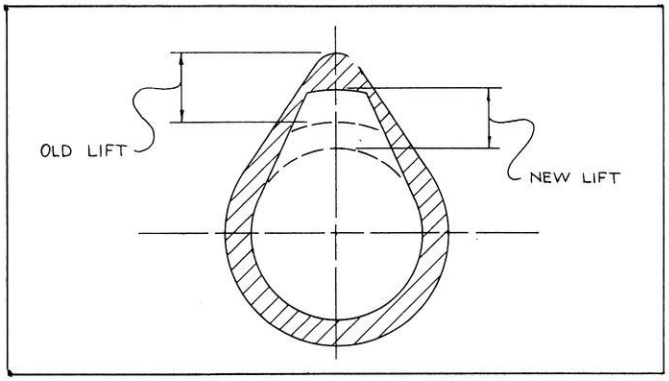


Fig. 3 Cam grinding. The lift and dwell are increased in this operation.

7. Increasing the Compression Ratio. Increasing the compression ratio increases the compression pressure which, in turn, increases the peak combustion pressure giving additional force to the piston during the power stroke. The theoretical increase in power is directly proportional to the increase in compression ratio, but there is a strict limit to the extent which the compression ratio can be increased due to preignition. Preignition is the detonation of the fuel mixture before the spark is fired due to the high temperature and pressure reached in the cylinder. This can be minimized by redesigning the combustion chamber, but it is still a strict limit to compression ratio increase.

8. Effect on Fuel Consumption. Besides increasing the power of an engine, increasing the compression ratio will also decrease fuel consumption. This is a result of more efficient combustion. The fuel is burned at a higher pressure and expands through a greater ratio, so less fuel is needed to produce a given horsepower.

9. Gas Flow. Since one of the methods of increasing engine power is to increase the weight of fuel mixture drawn into the cylinder, the flow of fuel mixture outside the cylinder is important. When any fluid flows through a closed channel there is energy loss due to friction and turbulence. As these losses increase, lesser amounts of mixture will be drawn into the cylinder.

10. Dual Carburetion. The energy loss for fluid flow increases as the square of the rate of the flow. Therefore, if two carburetors and a dual manifold are used, the flow through the manifold passages is reduced by one-half and the energy losses are cut by one-fourth. Another important feature of dual carburetion is that the cylinders of the engine receive more uniform amounts of fuel mixture than can be obtained with a single carburetor.

11. Porting. The installation of a special intake manifold expedites the flow of fuel mixture between the carburetor and the intake ports, but does not affect the flow between the ports and the cylinder. This flow can be increased by porting, illustration No. 2, which is the grinding of the intake and exhaust ports in the engine block to increase and smooth the gas flow path area. This reduces the gas flow losses between the manifold and cylinder during the intake and exhaust strokes of the engine cycle.

12. Relieving. Another method of increasing the flow of fuel-air mixture to the cylinders, which can only be

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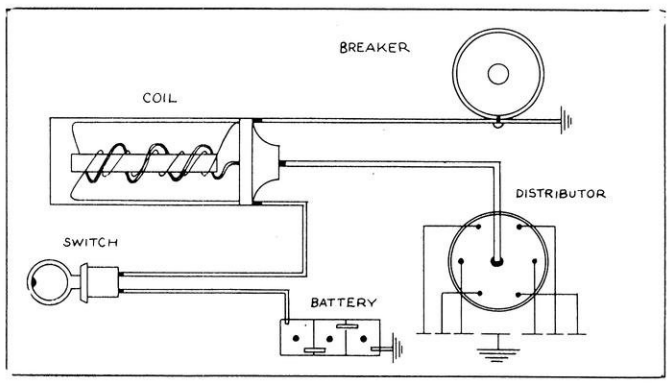

Fig. 4 Ignition wiring diagram.

W.S.P.E.

Edited by Jon Baumgartner, ch'56

20th ANNUAL NSPE MEETING TO BE HELD IN MILWAUKEE, JUNE 9-12

The twentieth annual meeting of the National Society of Professional Engineers will be held in Milwaukee, Wisconsin, June 9-12, according to an announcement made at the Society's Washington, D. C., headquarters by Paul H. Robbins, the organization's executive director. It is again emphasized that the national convention will **replace** the annual fall meeting of WSPE and all Wisconsin members are urged to attend this convention.

Engineer-members of the thirty-nine State Societies affiliated with NSPE will assemble in Milwaukee's Schroeder Hotel to hear National Society officers and committee chairmen report on the past year's accomplishments and exchange views on topics of general interest to the profession.

The full program schedule and the names of the nationally-known engineers who will be among the principal guest speakers will be released at a later date, Mr. Robbins said.

One feature of the meeting will be the installation of new national officers for the 1954-55 administrative year. T. Carr Forrest, Jr., a prominent engineer of Dallas, Texas, is currently serving as president of the National Society, and he will preside at the general business and professional sessions during the Milwaukee meeting.

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Harry Gute reports that the Finance committee is coming along quite well in raising money for financing the 20th annual meeting of NSPE, to be held in Milwaukee June 9th to 12th. However, there are several Major firms still to be heard from. Anyone who could be of help in this regard is asked to contact Harry or Guy Woody.

In fact, many of the committee chairmen could use additional help. If any of you are planning to volunteer your assistance, it is suggested that you do it now, before the directory is printed.

General committee: Harry Gute, general chairman; Paul Robbins, Guy V. Woody, Frederick T. Agthe, Edwin W. Seeger, Arthur G. Behling, Ray E. Behrens, Orrin E. Andrus, Pierce G. Ellis, Harry S. Fullwood, Robins V. Tate, Louis J. Larson, E. C. Koerper, Gordon R. Mercer, W. G. Youngquist, Richard C. Clark, Morton O. Withey, William E. Crawford, Geo. A. Sievers, Geo. P. Steinmetz.

Program & Entertainment: Orrin E. Andrus, chairman.

Publicity: R. W. Smeaton, chairman.

Registration: Ray E. Behrens, chairman.

Finance: Guy V. Woody, chairman.

Greeters: W. C. Lallier, chairman.

Arrangements: Harry S. Fullwood, chairman.

Ladies Entertainment: Co-Chairmen, Mrs. Edwin W. Seeger, Mrs. Harry Gute.

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The National Society of Professional Engineers will present an award for outstanding public service and leadership in the professional development of engineering to Harry A. Winne, former General Electric Vice-President, at its 1954 Annual Meeting to be held in Milwaukee, Wisconsin, June 9-12. The only previous recipients of this award are Herbert Hoover, Dr. D. B. Steinman and Charles F. Kettering.

Harry A. Winne, is one of the country's foremost engineers, best known recently for his atomic energy work both for GE and on a national scale. An electrical engineering graduate of Syracuse University, Mr. Winne has served on various governmental advisory boards, including the Scientific Manpower

Advisory Board of the National Security Resources Board.

At the board of directors meeting March 13, Mr. Harry Gute, General Chairman of the NSPE National Convention Committee, submitted a progress report. He reported that the program and schedules for the Convention had been completed. The Publicity Committee has been active and they plan individual coverage of the membership in April and a story concerning the Convention will appear in the current issue of The American Engineer. The Finance Committee has been active and is in the process of soliciting contributions.

It was moved by Vice President Ayres and seconded by Director Lord that the NSPE Convention, to be held in Milwaukee on June 9, 10, 11 and 12, take the place of the Annual WSPE Fall Meeting and that no meeting be planned for the fall of 1954.

Passed

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BOARD MEETINGS

The date of the next Board Meeting was set for Friday, May 7, 1954 at 10:00 a. m. in the University Club, Madison, Wisconsin. This was held in conjunction with Engineers' Day.

The June Board Meeting is to be held on June 11, 1954 at 2:00 p. m. in conjunction with the NSPE Convention.

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LIMITED

A few hundred seats have been reserved for the Milwaukee Braves-Philadelphia Phillies baseball game the evening of June 11th. This is the "open" Friday night of your 20th annual NSPE convention. Tickets may be obtained by sending $2.50 each (limit two per member) to J. Randall Meyer, 3112 W. Highland Blvd., Milwaukee 8, Wis. Make check payable to J. Randall Meyer, treasurer, and enclose self-addressed envelope. Out-of-Milwaukee members will be given preference.

Meet the Presidents

PIERCE G. ELLIS
State President

The Wisconsin Society of Professional Engineers is proud to claim Mr. Pierce Ellis as its chief executive. Prior to being state president, Mr. Ellis served the WSPE as a member of the board of directors, on numerous committees, and as chairman of the membership and university cooperating committees during his nine years of membership.

Mr. Ellis was born September 18, 1909 in Chicago. He graduated from the University of Wisconsin with an MS degree in chemical engineering. In college, he was honored with membership in Tau Beta Pi, Phi Lambda Upsilon, and Sigma Xi Fraternities.

He remained at the University for five years as an instructor in chemical engineering, and after leaving the university, Mr. Ellis joined the Wisconsin Public Service Corporation as a valuation engineer stationed in Green Bay. Later, he served the company as rate engineer in Oshkosh and budget director at the executive offices in Milwaukee. For the last eight years, he has been assistant to the president of this corporation.

Mr. Ellis is past president of the Engineers' Society of Milwaukee. During his tenure, he succeeded in elevating the attendance at meetings and increasing the membership to an all-time high. He is also a member of the Wisconsin Utilities Assn., American Gas Assn., American Society for Engineering Education, and the Milwaukee Athletic Club.

For the last two years, he has been an assistant scoutmaster and has served as camping director for a troop primitive camping trip to upper Wisconsin. Outdoor sports have long been among his favorite forms of recreation.

On August 17, 1935, Mr. Ellis claimed as his bride Margaret Trayser and he is the proud father of two children, Marion, age 15, and James, age 13.

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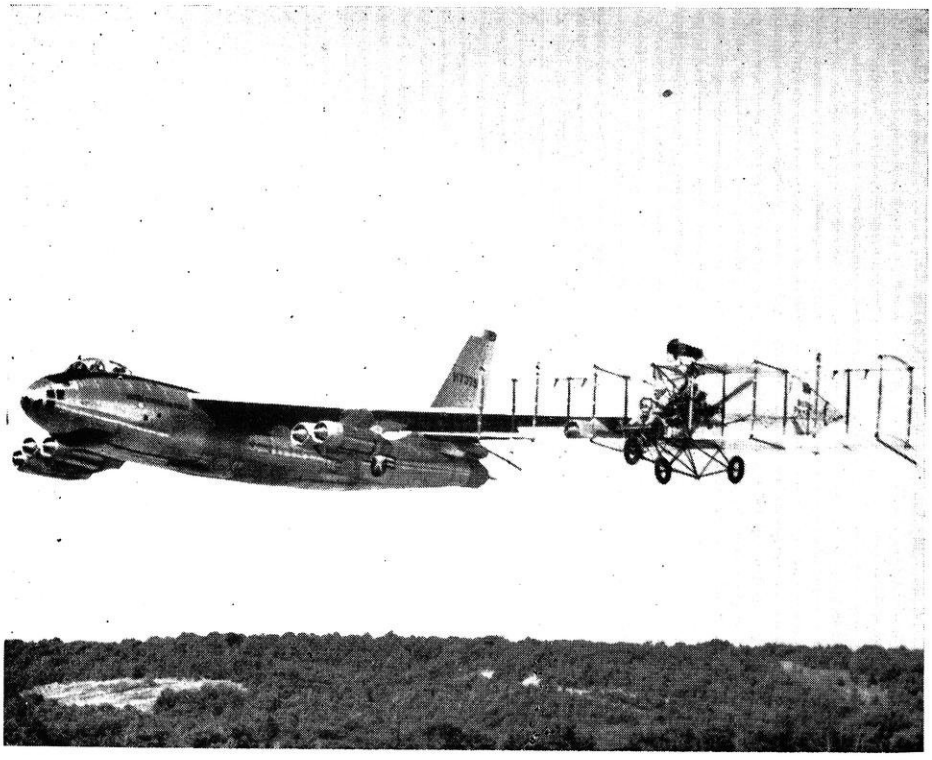
SCIENCE HIGHLIGHTS

Edited by John DuBois, e'56



SYMBOL OF PROGRESS

Dramatic progress in the past 41 years of aviation is depicted here as a jet-powered Boeing B-47 zips past a 1912 pusher-type plane piloted by Billy Parker, owner. Although the 92½-ton swept-wing Stratojet is rated in the "600 miles per hour" class, it has knifed through the stratosphere at a ground speed of 794 miles an hour during an accelerated service test program early this year. The B-47 is powered by six General Electric J-47 jet engines. Mr. Parker can keep his small plane in the air for an hour and a half. His estimated ceiling is between 8000 and 9000 feet, the top speed 65 mph. The Boeing plane, in contrast, has a range of more than 3000 miles and can operate at altitudes above 40,000 feet.

LABORATORY HUMIDITY CHAMBER

With growing demands, particularly by government agencies, for environmental testing, a new humidity chamber has been added to the East Pittsburgh laboratory facilities of the Westinghouse Electric Corporation. Ranges in temperature from 32 to 160 degrees F and in humidity from dry to saturated air are possible. A program controller provides any desired environment cycle. Manipulation of samples within the chamber is possible from outside without breaking the seals.

NEW ATOMIC PLANT

Engineering and other office personnel are moving into this new plant of the Westinghouse atomic equipment department. Located in Harmar Township approximately one mile northeast of the Allegheny Valley Interchange of the Pennsylvania Turnpike, the plant is part of the Westinghouse Atomic Power Division which is building the atomic submarine engine for the U.S.S. Nautilus and is developing the first civilian atomic power plant. This new plant will produce component parts and accessories for atomic power plants and represents initially a two million dollar investment.

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SILICONES AGAIN

Reduction of vibration in an automobile engine and elimination of baby's diaper rash may seem totally unrelated tasks, but a new family of silicone fluids just made commercially available by General Electric, can help do both jobs.

Designated Viscasil Fluids, the new silicones are said to be versatile enough to resist high temperatures and mechanical shear breakdown in automotive vibration dampers, and to substantially increase water-repellency in protective skin creams.

Engineers say that these Viscasil Fluids will pour more freely at temperature extremes than any other fluids known today. They are stable, they say, even when exposed to heat at 300°F for thousands of hours.

Other outstanding characteristics ascribed to the new fluid family include unusual chemical inertness, superior release qualities, and physical inertness for use in cosmetics and pharmaceutical preparations.

RADIO SHIELDED LABORATORY

Radio waves are insidious. To build a room that shuts them out entirely borders on the impossible.

Such a room has been provided the East Pittsburgh laboratories of the Westinghouse Electric Corporation. It is 20 feet by 16 feet by 9 feet high. It has a double wall, with heavy, sliding-contact doors. Because it is virtually air tight, air conditioning is essential. The air ducts have carefully designed baffles to filter out unwanted frequencies. It is even necessary to avoid tacks and nails as the points become antennas to carry signals through the screen into the room.

With the advent of television and the stiffening regulations of the Federal Communications Commission, electrical apparatus of all kinds must be more carefully designed not to produce interfering signals. This room will help to that end.

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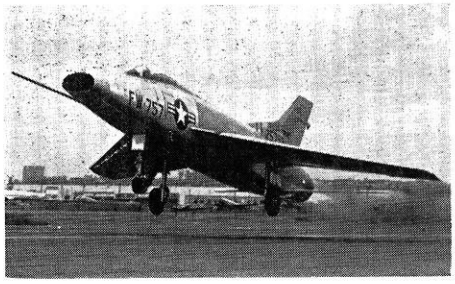
SINGLE PHASE,THREE PHASE—ONE TRANSFORMER

With the rising popularity of air conditioning, power companies are finding need in many of their residential areas to supply some three-phase power in addition to single phase. One way of doing this economically is from a distribution transformer with two dissimilar windings in one tank. Duplex transformers are now being made for this purpose by the Westinghouse Electric Corporation. They can be built for different combinations of ratings, but a common one is 25-kva single-phase, and 5-kva single-phase, which can be connected in open delta to supply 8.66 kva 3 phase and 25 kva single phase or any limited combination of these. The windings are different in size, in keeping with the different load requirements, and are arranged for open star primary connection and



Super Sabre takeoff. North American's F-100 Super Sabre makes first takeoff from Los Angeles International Airport. First production models were trucked from the Los Angeles plant to Edwards AFB for testing in remote areas. The Air Force fighter is capable of faster than sound speed in level flight and holds the official world's speed record of 755.149 miles an hour.

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FILM INSULATION

Irradiated polyethylene, representing a notable advance in heat and chemical resistance over normal polyethylene, is now being offered experimentally in narrow film form by the General Electric Company's chemical division.

Designated "Irrathene," the new material's superior properties result from bombardment of polyethylene with high-energy cathode rays from million-volt electron generators.

Cross-linking or vulcanization of the polymer during irradiation contributes form stability at 300-350 F and resistance to cracking when irradiated polyethylene is stressed and in contact with solvents or other active chemicals.

In the form of insulating tape and packaging film, irradiated polyethylene is expected to be a factor in the development of smaller electrical equipment with improved operating characteristics, and in the creation of radically new heat resistant and sterilizable transparent containers for foods, drugs, and pharmaceutical products.

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NEW TRANSFORMER RAISES GENERATING VOLTAGES

Generating voltages — long stationary at 11 and 13.8 kv, are beginning to rise. Voltages of 15, 18, 21, and even 23 kv are not uncommon. To serve these generating voltages new instrument transformers have become necessary. Air-insulated instrument transformers for these voltages do not exist — and power companies do not want oil-containing apparatus inside powerhouses. A new potential transformer has been developed by the Westinghouse Electric Corporation that is suitable for operating voltages up to 25 kv and impulse levels

(continued on page 48)

MERCURY ARC RECTIFIER

This new sealed ignitron mercury-arc rectifier developed by Westinghouse Electric Corporation is capable of rectifying 1000 kw at 250 volts direct current or 1500 kw at 600 volts using only six tubes, each of which is only 12 inches in diameter.

The new tubes are designed so the welds can be cut, the tube repaired, and then rewelded—a factory operation that makes the tube as good as new.

Light enough to be handled by two men and mounted in neat compact enclosed cubicles, these new tubes simplify rectifier installations in industrial plants, mines, railways, and locomotives.

A CHALLENGE TO THE ENGINEER

L. R. Larson, president, Milwaukee Chapter, W.S.P.E.; P. H. Robbins, executive director N.S.P.E., and H. Gute, meeting chairman, planning 20th annual meeting of the National Society of Professional Engineers—Milwaukee, June 9, 10, 11, and 12, 1954.

Edited by Ken Kulik, me'54

From
Publications of the National Society of Professional Engineers

Occasionally during his four years of formal college training the engineering student hears people talking about professional engineers, or professional engineer registration. Probably you have heard people talking about registration and wondered what it is all about. The purpose of this article is to acquaint the student engineer with something that will be as important to him as his engineering degree,—professional engineer registration.

Only forty-three years elapsed between the time the first engineering registration law was passed in Wyoming in 1907 and the signature of the President of the United States establishing an engineering registration law for the District of Columbia in 1950. During this brief time engineering registration came to the United States, laws were enacted in each state, and today every state, territory, possession, and district of the nation has a statute defining and governing the practice of engineering. More than half of the engineering profession is registered under these laws and it is only a question of time until the entire profession is registered. Engineering registration is an accomplished fact and there is no doubt that it is here to stay. Those graduating from engineering schools now and those already in the profession should know what registration means, how it operates, and why every engineer should register.

In the early history of engineering registration, many engineers voiced violent opposition to registration as a tax on their practice in the field of their competency. Those who are competent have raised no serious objection to having their competency certified, because at the same time they are ridding themselves of competition by the non-competent.

Without registration laws, there is no way to (1) stop the practice of engineering by the non-engineer, (2) stop the misappropriation and abuse of the designation "engineer," (3) oust from the profession those who prove incompetent and unworthy, (4) preserve to the qualified engineer his rights of practice against restriction, encroachment and unqualified competition.

Registration places the force and sanction of the law behind the desire of the profession to maintain a clearly recognizable line of demarcation between the engineer and the non-engineer. It places the agencies of the law behind the efforts and aspirations of the profession to maintain high standards of qualification and ethical practice.

Legal registration of members of the engineering profession is an exercise of the police powers inherent in every state for protection of the public health and public safety. Such registration gives assurance that only those persons who meet fixed educational and experience re-

(*continued on page* 32)

HAM RADIO

87,000 Hams Testify to the Popularity of This Electronic Age Hobby

by Donald L. Dietmeyer, ee'54

What is a "Ham"? A Ham may be thought of as a person having amateur radio as his hobby. And we might define amateur radio as the design, construction, operation, and maintenance of electronic equipment as a hobby. Of course people slightly acquainted with a Ham may have other impressions. They may feel a Ham is some sort of an introvert who enjoys sitting up all night with a pair of earphones on their heads listening to squeals and squawks coming out of a lot of complicated equipment. Or a more recent impression is: "A Ham is the guy wha ruins my television."

A ham radio set owned by Jim Newing, ee'57. The set is in Jim's room in the dorms.

Actually the 87,000 Hams in the United States are quite ordinary people. They range in age from 11 to 70 years, and I wouldn't be surprised at hearing of exceptions to this range. I would estimate that the average age is 35 years. It would be impossible to list all of the occupations of Hams. High school and college students, business executives, housewives, gas station attendants, etc., are only a beginning. Housewife was included to indicate that amateur radio is not the hobby of men only.

The main activity of the amateur is communication with his fellow ham. In the past this was done exclusively by radio. Now several hams are using television and radioteletype. As with all radio communication, the Federal Communications Commission controls the communication of the amateur. The F.C.C. dictates the bands of frequencies that the amateurs may use, and it sets the maximum power of the transmitters to be used. The F.C.C. issues licenses to operate amateur transmitters to persons passing the qualification tests set up by the F.C.C. These licenses indicate the call letters to be used by that person whenever he transmits.

The formal process of becoming a ham is quite standardized. It involves studying for, taking and passing the exams set up by the F.C.C. Passing the exam indicates a knowledge of radio theory and ability to send and receive the International Code at a rate of 13 words per minute. After the F.C.C. decides that the applicant has sufficient knowledge and ability it will issue a license making the operation of an amateur transmitter by the applicant legal.

The informal process of becoming a ham is very much different and more difficult to explain. We might say that a person becomes a ham when he gets the "bug." (Definition of "bug"—extremely great interest in ham radio.) Such occurrence is made apparent by the actions of the person: he will eat, sleep, talk, think continuously of ham radio. In most cases he will go through the formal process of obtaining a license and building or buying the equipment necessary to engage in the normal activities of ham radio. The explanatory difficulty comes in stating why or how a person gets the bug.

Let's consider some of the activities of a normal ham. Communication is the basic activity. It may take several forms, however. Telephone and telegraph (cw) are the two most widely used means of transferring information. CW was employed by a very large percentage of hams before the war. Now with improved equipment "phone" operation is being very extensively used.

"Ragchewing" is the name given to very long communications (QSO's) between two or more hams. Ragchews are equivalent to extended bull sessions. They may take place between hams a few miles apart or between hams hundreds of miles apart. As a result of ragchews many close friendships have been built up between hams who have not and possibly never will meet. The friendship is no less, however, and the two hams will probably meet many times on the air.

What do hams talk about over the air? The answer is: just about anything. Upon "hooking" a ham whom you have never QSO'ed before the most natural topic is

(*continued on page* 50)

RESEARCH IMPROVES AN AGE-OLD PRODUCT

The Development of Vitrified Clay Pipe

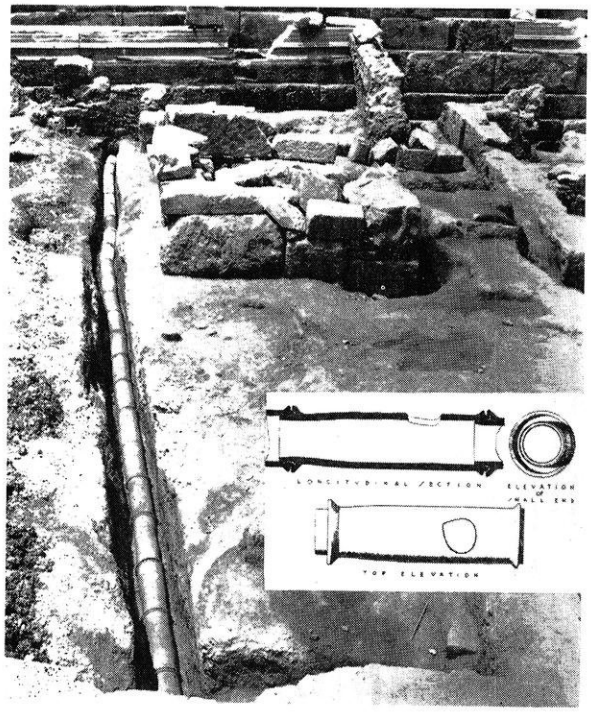
Edited by Gene Worscheck, me'55

American industry, as we know it, has come to flower in the twentieth century. Automobiles, airplanes, washing machines, electronics and atomic fission are notable examples. All have grown of age in the last fifty years.

However, there is one industry, vitally essential and of important size, which has been blooming for centuries. It has served mankind, not only for the past fifty years, but for the past five thousand years—the vitrified clay pipe industry.

Clay is a stiff, plastic earth, composed mainly of aluminous silicate, formed through the ages by erosion and decomposition of rocks. It is found, in some form or other, practically everywhere. And it is as indispensable to modern living today as it was to the ancient Greeks many centuries ago.

No one knows exactly when sewer pipe made from clay was first manufactured and used. Recently, Homer Thompson, Professor of Archaeology of the American School of Classical Studies at Athens, Greece, uncovered a clay pipe line which was installed in the early Fifth Century, B.C., in ancient Athens. The clay pipe line was discovered during excavations of the ruins of Agora, a public square about 25 acres in size, just below the famous Acropolis. (Fig. 1).



Photos courtesy Griswold-Eshleman Co.

Fig. 1 Greek plumbers 2500 years ago really knew their business. This clay pipe line was recently uncovered during excavations of the City of Agora, near the famous Acropolis in Greece.

Greek plumbers 2500 years ago did an excellent job of designing the pipe. A modified bell and spigot was used, which is similar to the house connection pipe used today. Engineers, who examined the pipe after it was excavated, said it was in good enough shape to be put back into use.

Today, the annual volume output of the industry is approximately 2,000,000 tons. In the past five years the industry's capacity has expanded by more than 50 per cent to meet demand from municipalities, industries and other users of clay pipe.

Vitrified clay pipe was first made by machine in this country in 1854. No one knows how much has since been made and used. It is estimated that in the last four decades over 1,000,000,000 feet of clay pipe have been used in this country alone.

Raw clay must have certain qualities to be ideal for pipe making. It should be coarse-grained and uniform, and free from an excess of organic materials and free metals. It should have a long firing range, meaning that heat can be applied to the pipe for a long time period to soften the clay grains to a fusing point, without actually melting the grains. When deposits of clay with these qualifications are obtained, pipe manufacturers then employ modern mining and earth moving machinery to get the raw material to the plants for processing into clap pipe.

At a typical clay pipe plant the clay is pulverized and mixed with water to form a uniform doughy mass. This is pressed through a die and shaped into pipe under tremendous pressures. Both steam and hydraulic pressures are used. The pipe is formed under a vacuum which draws all air from the clay as the pressure is applied. Elimination of air bubbles results in greater strength, truer dimensions, decreased absorption, and elimination of flaking.

The "green" or unburned pipe is dried in temperature-controlled rooms through which hot air is blown for four to seven days. This must be done to "set" the pipe before it can be "burned" and vitrified at high temperatures.

From the drying rooms, the pipe goes to big oven-like kilns, where it is "burned" to a temperature higher than

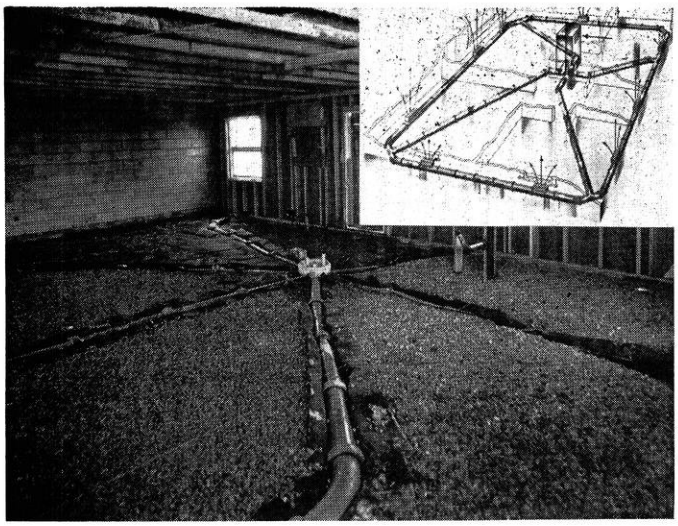


Fig. 2 Many home builders are now using this new and revolutionary system of duct heating for basementless homes. Vitrified clay pipe is used as ducts to distribute warm air.

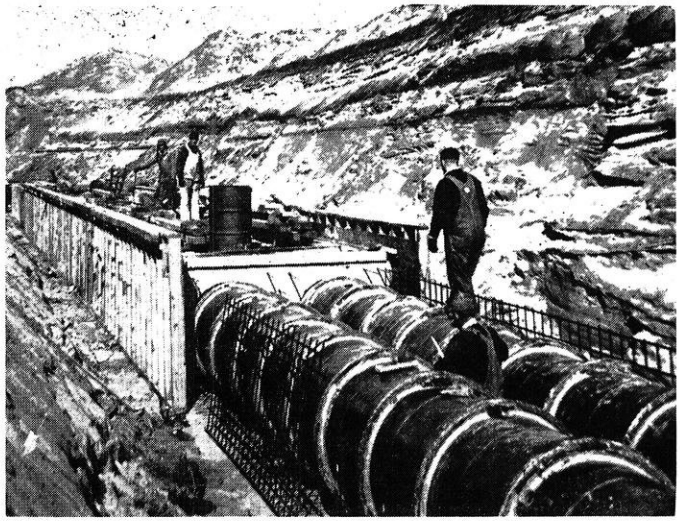


Fig. 3 The huge excavation required for this sewer is clearly shown from this view from the top of the cut. The form work for the concrete is still in place. In front of this is exposed pipe with reinforcing in place ready for forms and concrete.

the melting point of iron, 2,000 F. This burning is known as vitrification, and fuses the clay grains into a hard, impervious pipe which resists the penetration of any foreign substances.

Two main types of kilns are used by clay pipe producers —the "beehive" kiln and the "tunnel" kiln. The beehive kiln is so called because of its remarkable resemblance to a beehive. It is a round-roofed structure 30 to 40 ft. in diameter, and 16 ft. from floor level to the roof peak. Tunnel kilns look just like the name implies. The pipe, after it comes from the drying room, is piled on cars about 12 ft. long. These cars move through the kiln on tracks.

Heat in tunnel kilns is maintained at a constant temperature and may be supplied by oil, gas, or coal. Heat is applied direct with flame from the burners playing on the pipe itself. Slow heating and cooling of the pipe is accomplished by moving the pipe load from the tunnel entrance, through a central fire zone, and on out to the tunnel exit. After the clay pipe is vitrified, and before it is stored or shipped, each length is expertly and carefully inspected.

Research activities for the clay pipe industry are conducted in their own laboratory in Los Angeles under the direction of Dr. Harvey House, nationally famous research chemist. In the years that Dr. House has been supervising this industry's research, he has assembled facilities and equipment without duplicates anywhere, and all specifically designed to study vitrified clap pipe and kindred products. Much of this equipment, Dr. House designed himself to meet testing requirements.

For sewage and drainage work, certain piping has inherent advantageous characteristics. Research determines what these are. For example, in non-pressure installations such as building sewers, vitrified clay pipe is permanent, it is resistant to chemical action of all products of sewage decomposition. It is also resistant to alkaline or acid ground water and to disintegration by chemicals and spent waste.

To substantiate findings of the Los Angeles research laboratory, tests were made at various universities on sections of vitrified clay pipe immersed in sulfuric acid. In Chicago, where additional testing was forwarded, acetic, hydrochloric and nitric acids were used and in none of these tests was the vitrified clay pipe affected.

Because of these outstanding characteristics, engineers are teaching an old product new tricks. For example, the new Health Sciences Building at the University of Washington, which has been called by medical authorities the finest of its kind in the world, contains a unique system of vitrified clay pipe for venting chemical fumes from the medical and dental laboratories. (Fig. 2) In various phases of their study and research, students and researchers find it necessary to cook hydrochloric and nitric acids and other substances which emit powerful fumes. This is especially true of their work with radioactive isotopes. Hoods catch the fumes in the laboratories and direct them into clay

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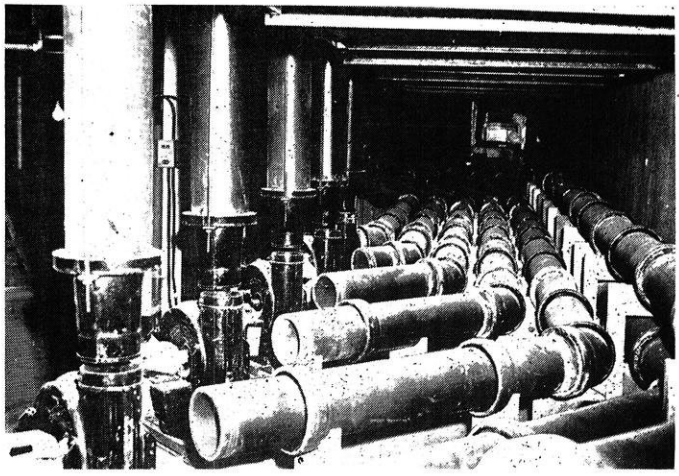

Fig. 4 Over 2200 feet of 8 to 12 inch vitrified clay pipe is used in this installation to draw acid fumes from laboratories. The clay pipe ducts are led to the roof via the inside walls of the laboratories.

Fluorine and Carbon

A Pair with Potential

by Lawrence P. McCormick, ch'55

"Just drain the oil from your car once a year, send the dirty stuff in to be filtered, replace it, and forget about it for the next twelve months."

This line, copied from the Sunday supplement of a large midwest newspaper, illustrates only one of the many spectacular qualities that are being attributed to fluorocarbons. Such a statement is unqualified, but it gives an indication of the importance that may someday be attached to fluorocarbon products.

The potential of fluorocarbons was first recognized when Dr. Joseph H. Simons, then working at Pennsylvania State College, discovered electrofluorination. Today this process is the only cheap and practical method of producing fluorocarbons. Dr. Simons became interested in fluorocarbons when working with Prof. J. H. Hildebrand of the University of California. Although this interest began in 1920, it was not until the beginning of World War II that Dr. Simons conceived the electro-chemical process.

During the war, the Atomic Energy Commission had trouble separating the rare earths and some isotopes. It was found that Dr. Simons' fluorocarbons would do the job and as a result of their usefulness, they became known as "Joe's stuff." Dr. Simons now holds a position at the University of Florida.

Commercial production of the fluorocarbons began at the Minnesota Mining and Manufacturing Co. The company is placing its chips on the Simons process. Many minor improvements have been made on the process itself, and the company's laboratories are finding new uses for the products daily. Mr. R. J. Brice of 3-M has found that addition of oxygen improves the viscosity characteristics of lubricating oil (fluorocarbon oil), giving lower viscosity at low temperatures and higher viscosity at high temperatures. Another 3-M man, Mr. J. D. La Zerte, has found a way to produce perfluoro olefins by pyrolysis of the salts of perfluorocarboxylic acids. 3-M is now working on an Air Force contract and has found that synthetic rubber has a higher oil and ozone resistance if it is fluorinated. This rubber contains almost 50 per cent fluorine and is used in gaskets, hose, and insulation.

Other men who have contributed substantially to fluorocarbon development are: Tarrant and Warner of the University of Florida, who have produced a new, fluorinated styrene; Mr. A. R. Gilbert of General Electric, who made freon by fluorinating chlorinated hydrocarbons; J. B. Dickey of Tennessee Eastman, who has done much work in fluorine substitution in mono-azo dyes; and Mr. Harold Rosenberg of Wright Field, who has found many applications of fluorocarbons in military aircraft production.[1]

There are five basic methods of fluorocarbon production:

1. The Simons method which uses electrolysis.
2. The Swarts reaction which partially replaces Cl and Br with F using SbF_3 and HF. (This was the most common method before the Simons method was discovered.)
3. The addition of HF to olefins.
4. The use of CoF_3 as a catalyst with a reaction similar to the Swarts reaction.
5. Catalytic fluorination with elemental fluorine. (This is a method that is limited to pilot plant size because great heat exchange problems are encountered in a large scale operation.)

The Simons process, because it is the most practical and promising, will be the only method described here.

The Minnesota Mining and Mfg. Co. has the sole operating commercial plant in the country. The $250,000 plant is located in Hastings, Minnesota.

Current is passed through a mixture of organic materials in the presence of liquid anhydrous HF. Hydrogen is formed at the cathode and the fluorocarbons collect at the anode as gases or liquids.

The reaction takes place in a large steel vessel (6 feet high and 4 feet in diameter). Inside is a cooling coil and the electrode pack. The pack is made up of alternate nickel and iron plates, spaced one-half inch apart, iron serving as the cathode and nickel as the anode. The liquids in the cell are maintained at a constant level by means of electric probes.

The cell requires an enormous amount of current, the line requirements being 10,000 amps. at 5 volts.

The cell is normally operated at 20° C. and atmospheric pressure. Operating continuously, with the evolved hydrogen serving as an agitator, gaseous fluorocarbons leave at the top of the cell where the vaporized HF is condensed and recycled while the H_2 is separated with hot CuO. The gases are then cooled and condensed. The liquid fluorocarbon products are drained from the bottom of the cell, (they are heavier than the reactants and settle to the bottom.), and purified by fractional distillation.

One outstanding advantage of the Simons process is its amazing flexibility. The cell can be operated from —80 to +80°C. (At the higher temperatures, pressures must be raised to keep the reactants from boiling.) Water, brine, alcohol, or ethylene glycol may be used in the cooling coil.

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ALUMNI NOTES

Voegel, Merten M., c'43, is now a construction engineer with the U. S. Army in Europe. He was married on February 27 to Francoise Ramarony, in Cauderan, France.

Foxwell, Leo G., m'53, is a development test engineer for the Hamilton Standard Division, United Aircraft Corporation, Windsor Locks, Connecticut.

Dysland, Lloyd S., c'34, was recently appointed engineer for the city schools of Los Angeles, California.

Welch, J. David, c'47, is an engineer on the West Virginia Turnpike at Charleston, West Virginia.

Helmke, Edward C., m'35, retiring chairman of the Madison chapter of the American Society of Tool Engineers, was recently named delegate to the national convention in Philadelphia April 23-25, 1954.

Otto, LeRoy, c'51, working with the Central Illinois Electric and Gas Company, recently completed a two year training program which acquainted him with the complete operation of a utility company. Mr. Otto is now in the engineering department working on different assignments concerning both maintenance and new construction.

Houden, Ben, c'51, is employed with the Illinois State Highway Department in Springfield and is making his home in Belvidere, Illinois.

Johnson, Donald R., Ph.D., ch, '53, a research chemist, recently joined the staff of Du Pont's Polychemicals Department Laboratory in Wilmington, Delaware. Prior to joining Du Pont, Dr. Johnson was a research assistant in chemistry at Wisconsin. From 1951 to 1953 he was employed as a chemist in the U. S. Forest Products Laboratory in Madison.

Locher, Fred, c'32, is working as an irrigation specialist with the United States' Point Four Program in Iraq. He is chief engineer for the $7 million Massayib project south of Baghdad.

Slezak, Gustav, m'22, is now in charge of cable manufacturing at the Western Electric Company in Chicago, Illinois.

EDWARD E. BAUER, m'39

Bauer, Edward E., m'39, has been appointed superintendent of regulator manufacturing for the General Electric Company's Power Transformer Department at Pittsfield, Massachusetts. Mr. Bauer, who was formerly manager of transformer apparatus sales, will now be responsible for the manufacture of feeder voltage regulators of both induction and step types, including inductrols and inductrol power packs.

Mr. Bauer is a member of Phi Eta Sigma and Pi Tau Sigma fraternities, the association of Iron and Steel Engineers, and the National Sales Executives.

Walsh, William J., e'34, employed by Western Electric Company of New York, is now engaged in the planning of production in Western Electric factories.

Auby, Lawrence C., m'22, operating supervisor of the Illinois Power Company, was a recent campus visitor in connection with interviewing graduating engineers about future employment with the company.

Milunovich, Daniel, m'37, attended an Industrial Institute at the College of Engineering in December. He is now operating as a consulting engineer in Watertown, Wisconsin.

Plog, Charles B., c'40, is now a construction engineer for Standard Vacuum Oil Company in the Near East. He is in charge of all the company's construction projects in India, and is spending a six months vacation here in the U. S. after five years in the Philippines and in India. A native of Green Bay, Wisconsin, Mr. Plog now resides in Bombay, India, with his family.

On March 18 he visited Madison and spoke to the C.E. 155 (reinforced concrete) class on his foreign work experiences in the various countries of the Near East.

Vernon J. Rexford, c'18, advertising manager for the Johnson Service Company, died February 17 at his home, 200 Spring St., Waukesha, after a short illness. Joining the firm's Chicago office as a sales engineer in 1923, Mr. Vernon was promoted to the vice-president's post in 1933. In 1940 he was transferred to the firm's main office in Milwaukee, and served there as vice-president in charge of advertising until the time of his death.

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COLD RUBBER

Natural Rubber Meets Stiff Competition

by Jim Yurk, che'55

Cold rubber, a synthetic rubber normally polymerized at a temperature of 41°F. or cooler, was first produced commercially in February, 1948. Since then, the interest in this new rubber has increased greatly due to its superiority to natural rubber for tire treads, wire and cable coating, and a great many other items. This rubber is the first vigorous competition, both economically and quality-wise, for natural rubber since the discovery of vulcanization.

Cold rubber is not only new as a product, but is also new technologically speaking. Until recently it was believed that the tropical temperature at which natural rubber is formed would be the correct temperature for the polymerization of synthetics. However, the Germans were aware during World War I that the old methyl rubber, produced by bulk polymerization, was better when produced at room temperature than at the elevated temperature normally used. The trouble lay in the fact that it took several months for the polymerization to take place. When World War II started there was still no way of speeding this reaction, and, in the United States, a temperature of 122°F. was selected to produce the enormous amounts of rubber needed for war.

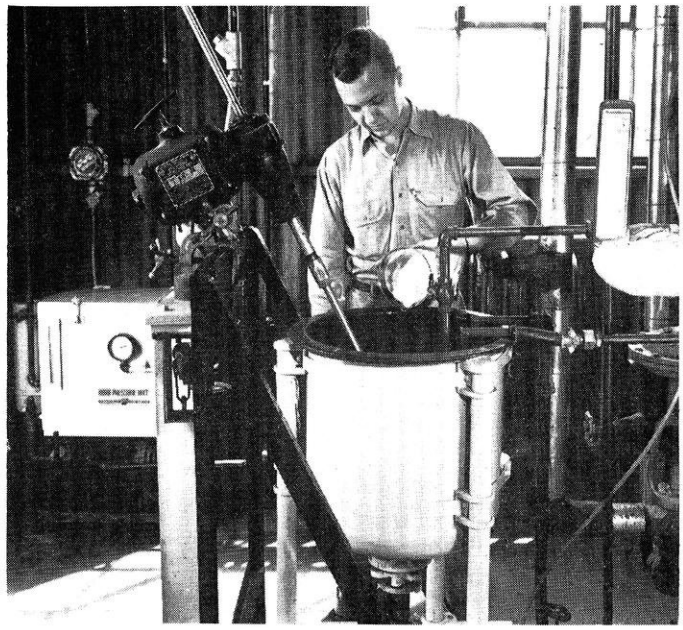
The early indications of an improved product at lower temperatures were based entirely on laboratory tests which often correlate poorly with the properties of the commercially produced product. The Office of Rubber Reserve, in 1943, arranged to have some ordinary synthetic rubber (call letters GR-S) produced at 104°F. and at 86°F. The resulting rubbers showed no outstanding superiority over the GR-S polmerized at a higher temperature and it was then felt that polymerization temperatures was of only minor importance in the finished product. This time the mistake was in the fact that the polymerization temperature had not been low enough, but again, if it had been, the reaction would have been much too slow for practical purposes.

In 1944 a new polymerization recipe was developed which made possible rapid, efficient reactions at temperatures of 65-75°F. The key to this recipe was MDN, a diazothiolic ester [2-(4-methoxybenzenediazomercapto) napthalene] which was an excellent polymerization initiator. Later in 1944, the Rubber Reserve group at the University of Minnesota found that ferricyanide-mercaptan systems reacted rapidly with the addition of MDN, and it was possible to produce rubber at 32°F. in twelve hours.

At the same time, the Germans had been working on a low temperature oxidation-reduction polymerization system which produced a tough rubber, superior to the standard Buna rubber they had been producing. However, this new rubber was hard to process and required a heat softening preceding compounding which destroyed many of the better qualities of this rubber. The Germans never did find a satisfactory method for modifying this product.

Although this German redox system yielded an unprocessable product, it was cheaper than the American MDN-ferricyanide system, and the work was turned toward an improvement of a redox recipe which was being developed in this country simultaneously with the German work. The University of Minnesota Rubber Reserve group came up with the answer again in 1945. Cumene hydroperoxide, (CHP) an activator for rosin soap poly-

Photos courtesy
Phillips Petroleum Company



One of the essential steps in the cold rubber process is the activator make-up. This is carried out in the pilot plant under carefully controlled conditions in the equipment pictured.

The progress of the bottle polymerization is followed by periodically withdrawing a sample in a small syringe and determining the amount of rubber in the withdrawn sample.

highly resistant to cracking. The improvements of cold rubber and the new HAF black were found to be additive and the combination produced tire treads superior to the best natural treads known at that time.

Cold rubber is now being produced by the emulsion copolymerization of butadiene and styrene at a temperature of 41°F. There are essentially three steps in its polymerization; initiation, growth, and termination.

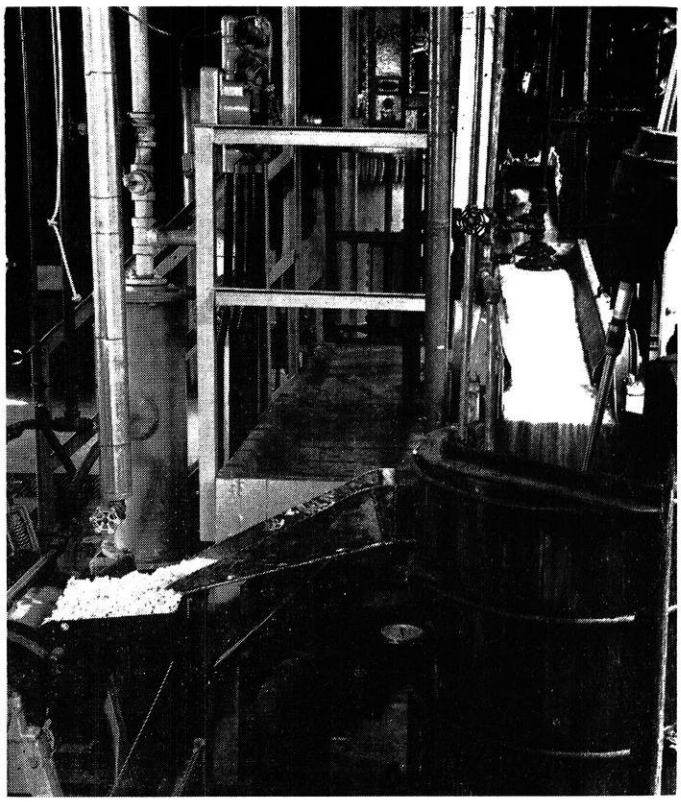
Initiation is effected by the addition of free radicals which are necessary to activate the monomers. These radicals are supplied by the addition of two compounds; one which will decompose to supply the free radicals, and the other which will initiate the decomposition. These free radicals will attach themselves to a monomer thus making it possible for a second monomer to attach itself to the two. Another free radical will attach to this group and another monomer until the chain is stopped by some other agent or "shortstop."

As might be expected, the actual recipe is more complicated than described in the preceding paragraph. The actual activator is usually made from five or six ingredients, and it is the preparation of this activator solution which is

(continued on page 36)

merizations being used by the Hercules Powder Company was used as the oxidant, and mercaptans as the modifiers as before, to produce a soft processable rubber. This recipe was modified and was adapted to large-scale plant production at 41°F. by late 1946. This and the MDN-ferricyanide rubber produced at 41°F. were compared extensively as to factory operations, tire tests, and analyses of the actual product. The strikingly similar quality and properties of the two rubbers of different recipes showed that the polymerization temperature was the important variable in the production of synthetic rubber. The hydroperoxide-redox system is the present method used. An even more powerful polymerization initiator was developed with the discovery of higher molecular weight hydroperoxides. These made it possible to copolymerize a butadiene-styrene rubber at -4°F. in only five hours.

An important factor in the success of cold rubber has been the recent development of a new carbon black. Tire treads contain approximately one third by weight carbon black which until about five years ago was made from natural gas by the channel process. "Furnace" carbon black was also made from natural gas, but this type was softer and therefore less reinforcing. In 1947 a new type of high abrasion furnace black produced in a unique reactor was placed in commercial production. This new HAF (high abrasion furnace) black improved the abrasion resistance of tires greatly and also made the rubber



Latex from the blend tank is coagulated in the continuous operation as pictured. Rubber crumbs formed in the upper tank spill onto a screen which separates the fluid. The crumbs are washed by water sprays and tumble into the "soap conversion" tank below where any remaining soap is converted into fatty acid. The crumbs then tumble onto the rotary filter at lower left where the excess water is squeezed out.

A Challenge to the Engineer - -

(*continued from page 24*)

quirements may practice engineering. Practically every design, every operation and every process undertaken by the engineer has public implication. Engineering, therefore, comes under the police powers of the state. Regulation is achieved in two ways, either by protecting the use of the title or by regulating the actual practice of the profession. Both methods have been declared constitutional by the courts.

Uniformity is difficult to obtain because each state is rightfully an independent commonwealth and has a right to establish its own police power regulations. To obtain a measure of uniformity, however, engineering practitioners have developed a "model law" which has been used as a guide for 30 years. That law has been revised and brought up to date repeatedly since first drafted, the most recent edition having been made in 1946 and bearing the approval of thirteen national engineering societies.

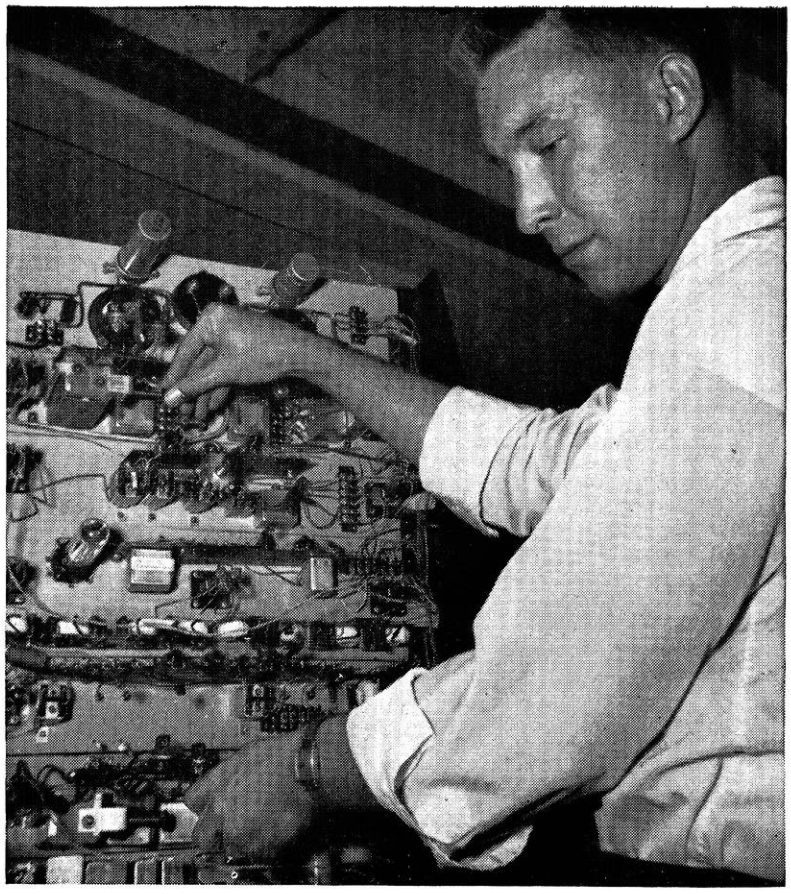
Uniformity, which will permit wider reciprocity, is a goal toward which engineering organizations—and the members of the registration boards through their national organizations—are toiling.

Registration as an engineer takes but a little time and a small amount of money. The issues involved in obtaining registration and maintaining it are worth all of the expenditures. Legal Registration of an Engineer in a state certifies:

1. Eligibility to perform professional service and creative work in the field of engineering.
2. Ability to apply knowledge of the mathematical and physical sciences to engineering design, planning, supervision, evaluation, and investigation.
3. The registrant has taken the first step toward professional recognition. A board composed of his peers has pronounced him competent.
4. Earmarked for professional activity as an arm of management.
5. A principal in design, a referee on construction, an arbiter in operation and a supervisor in maintenance.
6. That the registrant has a legal right to practice and this right can only be denied by law.
7. That those who know him vouch for his education, integrity and ability and that they believe he is competent to undertake works requiring sound judgment and unquestioned ability.
8. That through his state board he may be certified for registration wherever his engineering services are needed.

Registration will not be handed to you on a silver platter. You will have to do something about it. You will find as have the many who have preceded you that it will be well worth your while not to let opportunity slip by you. When you have received your certificate attesting to the fact that you are a Professional Engineer you may take justifiable pride in a real accomplishment. You will have earned your Badge of Competence and you will be proud to display it as evidence of your membership in a great and learned profession.

END



Bob Wilson uses a "breadboard" circuit, studying the electrical properties of a carrier system

"My first assignment at Bell Labs"

Fresh out of school, Bob Wilson, '53, was put to work on a Transistor project at Bell Laboratories. He explains why he never had time to be awed.

(*Reading time:* 39 seconds)

"In some ways it was hard to believe. I had received my B.E.E. at the University of Delaware in June, 1953, and a week later I was working in the world-famous Bell Laboratories.

"But I didn't have time to be awed because they put me right to work. They gave me responsibility fast.

"My group was working on the experimental application of transistors to carrier systems. My assignment was the electrical design of a variolosser for the compressor and for the expandor to be located in the terminals.

"The supervision I received and the equipment I had were tops. I quickly discovered that I had to rely on my ingenuity as much as on the college courses I had taken. Perhaps that's one reason for the great new discoveries continually turned out by the Labs.

"Now I'm in the Communication Development Training Program, continuing my technical education and learning what all the Laboratories sections do and how their work is integrated.

"In a year I'll be back working with the group with which I started."

• • •

Assuming responsibility fast is a common experience among the engineering, physical science, arts and social science, and business administration graduates who join the Bell System. Bob Wilson went with Bell Laboratories. There also are job opportunities with the operating telephone companies, Western Electric and Sandia Corporation.

BELL TELEPHONE SYSTEM

Fluorine and Carbon - -

(continued from page 28)

Almost any organic material can be thrown in the pot and come out a useful product. Reactants used at 3-M are: hydrocarbons, acids, anhydrides, alcohols, ethers, esters, aldehydes, ketones, nitriles, amines, and amides; in other words: "the works."

The most important products are:

Acids: trifluoroacetic, heptafluorobutyric, perfluorosuccinic, perfluororoadipic acids and their derivatives.

Inert gases and liquids: perfluorobutane, perfluorotripropylamine, and perfluorodiethyl ether.

A fluorocarbon derivative, whose trade name is rapidly becoming a household word, is Teflon. The claim has been made that a suit of clothes made of Teflon could not be burned by cigarettes or a low temperature flame. It also would be resistant to wrinkles and would maintain a permanent crease. The price of such a suit would be beyond the reach of the average buyer. Teflon, because of its resistance to corrosion, has been used in gaskets, packing, etc.; but the material lacks many properties that are desireable in this type of service.

It has been found that powdered metals and fillers added to Teflon increases its strength and reduces its cost. Use has already been made of the mixtures as impellers and bearings in chemical pumps. Packing has been made of this metal-fluorocarbon combination, but the material is less rigid than that used in the impellers and bearings.

Metal surfaced Teflon is now available. It is manufactured as follows: Pure Teflon is used as a base material, layers of mixture (metal powder and Teflon) are laid on the base and fused to it. The outer layers have high metal content. This arrangement permits soldering and welding of the mixture. It is also possible to plate or spray pure metal on the surface. The layers are fabricated by mixing metal particles with Teflon powder, compressing at 2000 psi, then baking above 327°C (Teflon's critical temperature) at atmospheric pressure. The result is a homogenous, fused mixture. No finish is needed to protect the material from corrosion, the metal being guarded by an enveloping film of Teflon.

Sheets, rods and moderately complex shapes can be preformed, using the mixture.

Ceramics, calcium fluoride, mica, glass, quartz, and calcium silicate can be used as metal substitutes; effectively reducing the cost.

Other fluorocarbon derivatives have found extensive uses:

The Atomic Energy Commission uses TTA (thenoyl trifluoro acetone) in the separation of the rare earths.

The low surface tension of the perfluoro acids (Perflourocaprilic is an excellent detergent) gives them wide use as foams and electroplating agents. The salts of these acids are used in the manufacture of Teflon.

Properties of highly fluorinated materials (triperflourobutyl amine, diperfluorohexyl ether) are: high specific gravity, low refractive index, non-inflammability, high boiling point (over 500°C.), non-corrosiveness and low dielectric constant. These compounds will find use in precision instruments and as coolants in electrical equipment.

The thermal stability and constant lubrication qualities of trifluorochloro ethylene's liquid polymers makes them ideal lubricants. These are the oils that have been given a tremendous fanfare. They don't vaporize to any great extent, thus the claim that they will last a year in an engine, barring leaks.

The chemical and many other industries have for many years sought a material that will effectively contain hot concentrated nitric acid and still be relatively inexpensive and workable. Such materials are the polymers of perfluoro aldehydes.

Fire-fighters have been plagued by the toxic gases given off by conventional fire extinguishers. New extinguishers utilizing trifluoromethyl bromide, which extinguishes fires without producing dangerous fumes, are now possible.

Analyzing for some metals whose salts are insoluble has been difficult if not impossible. Trifluoroacetic acid, a strong, non-oxidizing acid, forms soluble salts of these metals.

Polyvinyl trifluoroacetate is used in lacquers, varnishes, adhesives for wood, metal, glass, wrapping material; and when pigmented, coating compounds.

Fluorinated azo dyes for cellulose derivatives, silk, wool, and nylon are prepared using the trifluoroacetamido group.[4]

The following uses have been found for fluorocarbons in the aircraft industry:

1. Insulation for electrical equipment is made of polyfluoroethylene derivatives.

2. The problem of fungus growth on fabrics in tropical climates has been licked by using fluorodinitrobenzenes in the material.

3. An effective anti-wear additive for hydraulic fluids is chlorofluoroheptane.

4. Packing which is resilient at low temperatures and yet solvent resistant can be made from Teflon and its sister compounds.

The disadvantages of the fluorocarbons are varied depending on the type of fluorocarbon. Teflon, for example, is non-adherent, but some of the other fluorocarbons are used as adhesives. As in everything, one has to pick the proper material for the job. No one material can ever satisfy all requirements.

The cost of fluorocarbons is still prohibitive for most uses; the key fluorocarbons, trifluoroacetic and perfluorobutyric acids cost $5 and $15 per pound respectively. Power costs are the main stumbling block in the way of industry's endeavor to bring these products onto the public market. Minnesota Minning and Mfg. must move its fluorocarbon plant to a new location where low cost electric power is available. When 3-M makes this move, high

(continued on page 56)

Compatible color television will eventually reach every TV home

The rainbow you can see in black and white!

RCA brings you compatible color TV. Lets you see color programs in black and white on the set you now own!

"When a modern and practical color television system for the home is here, RCA will have it . . ."

Echoing down through the years, these words—spoken in 1946 by David Sarnoff, Chairman of the Board of RCA—have a ring of triumph today.

Behind this great development are long years of scientific research, hard work and financial risk. RCA scientists were engaged in research basically related to *color* television as far back as the 1920's . . . even before *black-and-white* television service was introduced.

Since then RCA has spent over $25,000,000 to add the reality of color to black-and-white TV, including development of the tri-color tube.

The fruit of this great investment is the RCA all-electronic compatible color television system, *a system that provides for the telecasting of high-quality color pictures that can be received in full color on color receivers; and in black and white on the set you now own.*

RCA and NBC will invest an additional $15,000,000 during color TV's "Introductory Year"—1954—to establish this new service on a solid foundation.

RCA color sets are beginning to come off the production lines in small quantities. Although it will probably be another year before mass production is reached, the promise of compatible color television is being fulfilled.

RCA pioneered and developed compatible color television

INTRIGUING OPPORTUNITIES FOR GRADUATING ENGINEERS

You're sure to find the exact type of challenge *you* want in Engineering Development, Design, or Manufacturing at RCA. Men with Bachelor's, Master's or Doctor's degrees in EE, ME, IE or Physics are needed. *You'll find your optimum career work* among the hundreds of products RCA produces for the home, science, industry and Government.

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RCA® *RADIO CORPORATION OF AMERICA*

World leader in radio—first in television

Cold Rubber - -

(continued from page 31)

the most critical operation of the whole process. The ingredients must be carefully mixed and ripened by controlled warming. The activator solution is then stored in sealed bottles under 25 pounds per square inch gage of nitrogen until used.

The reaction is started by the addition of this cumene hydroperoxide and is completed at 41°F. in about 14 hours, at which time it is shortstopped by a polymerization inhibitor which ties the ends of the chains. A conversion of 60 per cent is considered a complete reaction. The unreacted monomers are then removed, and the latex is coagulated, filtered, washed, dried, and baled. Usually before the latex is coagulated, there is an antioxidant added to prevent degradation of the rubber during storage. Some of the rubber has the carbon black added before coagulation to eliminate the necessity of handling it in the processing plant.

Of all the new rubber used annually in the United States, 68 per cent is required for tires. This results in an effort by the technicians in the field to think primarily of tire production in development of new rubbers.

A tire consists of two parts; a rubber tread and a rubber and fabric body. Each part must have different properties. The tread must be tough; resistant to abrasion, cracking, chipping, and cutting. The rubber must also have "tack" so that it adheres to the body of the tire without cement of some type. Cold rubber treads are superior to hot and natural rubber in every one of these categories. Tensile strength of cold rubber exceeds 4000 pounds per square inch while GR-S usually has a maximum of 3000 pounds per square inch. Natural rubber runs near 4000. At elevated temperatures, such as a tire approaches in service, the oxidative degradation of both natural and GR-S is greater than that of cold rubber. The outstanding quality of cold rubber is its great resistance to abrasion. Cold rubber treads usually outwear natural rubber by more than 30 per cent. The main disadvantage, as stated before, is the difficulty encountered in processing cold rubber due to its increased toughness. More power and heat must be used in the equipment to get the finished product.

The rubber in the body of the tire must have two main properties, low hysteresis, and good building tack. Heat buildup is caused by high hysteresis and results in oxidative degradation or fabric failure. Cold rubber is again far superior to GR-S in tire body compounds, but it is inferior to natural rubber in resistance to cracking and building tack. Here the main advantages of cold rubber is its high resistance to oxidative degradation. Special cold rubbers have been developed that approach the resistance to crack of natural rubber, but these synthetics are not yet ready for production.

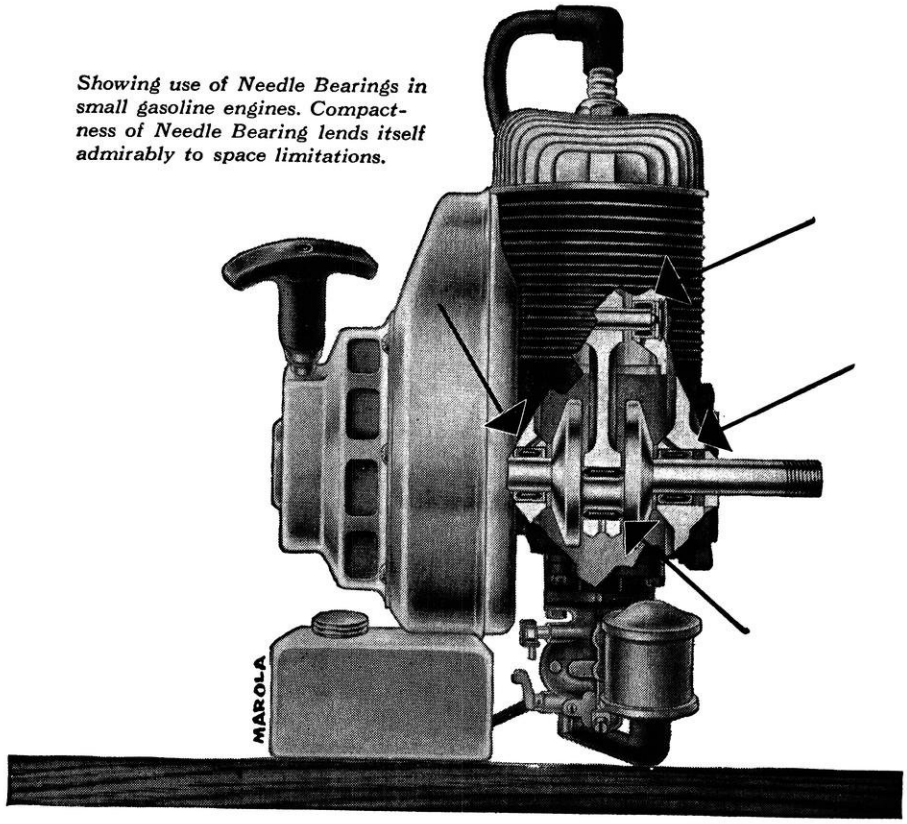
Future work in the development of cold rubber will be turned towards the development of a tire body superior to natural rubber in every way.

END

Torrington Needle Bearings save weight and space in many designs

Because of its unique construction—a full complement of small diameter rollers retained in a one-piece thin drawn outer shell—the Torrington Needle Bearing has a small cross section. This makes it extremely useful in bearing applications where space and weight are at a premium.

For a given load capacity, the Needle Bearing is the smallest and most compact anti-friction bearing available, giving the designer many opportunities to reduce the size and weight of surrounding members without lowering performance.



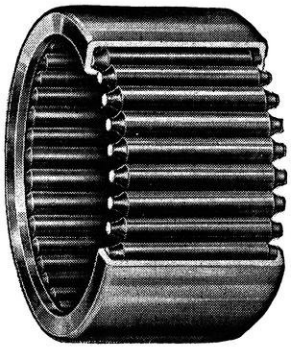
Showing use of Needle Bearings in small gasoline engines. Compactness of Needle Bearing lends itself admirably to space limitations.

Smaller, lighter products

In an application like the small gasoline engine illustrated, Needle Bearings help keep overall size and weight to a minimum. Housings can be made smaller and lighter without sacrificing shaft stiffness and strength. What's more, the Needle Bearing's low coefficient of starting and running friction plus its ability to retain lubricants results in increased power output.

Simpler designs

Since a press fit in a simple straight housing bore is all that is required to locate a Needle Bearing, the use of complex retaining shoulders or rings is unnecessary. And, since the Needle Bearing usually runs directly on a hardened shaft—without an inner race — additional savings in space and weight are gained.



THE TORRINGTON COMPANY

Torrington, Conn. • South Bend 21, Ind.

District Offices and Distributors in Principal Cities of United States and Canada

TORRINGTON NEEDLE BEARINGS

NEEDLE • SPHERICAL ROLLER • TAPERED ROLLER • CYLINDRICAL ROLLER • BALL • NEEDLE ROLLERS

Alumni Notes - -

(*continued from page 29*)

Karth, James M., m'53, is now at the Allison division of General Motors Coporation as a test cell engineer.

Cretney, Robert W., ch'21, was recently promoted to vice-president and general manager of the Thermatomic Carbon Company at Sterlington, Louisiana. Mr. Cretney, who resides in Monroe, La., started with Thermatomic two years after graduation as a chemical engineer and was plant superintendent and plant manager prior to assuming his present duties. He has been an active participant in community activities ever since he arrived in Monroe. He is past commander of the A. L. Smith Post, American Legion; vice-chairman of the board of trustees of the G. B. Cooley Tuberculosis Sanatorium; an elder of the First Presbyterian Church; member of the Lotus Club; and past grand master of the Grand Lodge, State of Louisiana, Free and Accepted Masons. Mr. Cretney has also kept active in the professional societies related to his business, being a member of the American Institute of Chemical Engineers and the American Chemical Society.

He succeeds **Clark C. Boardman,** m'10, who was recently retired after 32 years with Thermotomic.

Christianson, Thomas K., ch'39, was recently named pilot plant manager and head of fine chemicals department for the Ansul Chemical Company in Marinette, Wisconsin. Mr. Christianson was formerly assistant production manager in the chemical division.

Wade, Irving L., m'23, is chief engineer of power operation at the Ridgeland Station, Chicago, Illinois; and makes his home in Western Springs, Illinois.

Bachman, Carl J., c'37, is an engineer-draftsman with the New York Central System in Chicago, Illinois. END

Foreground: Boeing RB-47E, world's fastest day-or-night long-range reconnaissance plane. *Background:* Standard B-47E six-jet bomber.

What do you want most in an engineering career?

Is it room to grow? Then join a company that's *growing*. Boeing, for example, has grown continuously throughout its 37-year history of design, production and research leadership. There's always room up ahead—and Boeing promotes from within. Regular merit reviews are held to give you steady recognition.

Do you want long-range career stability? Boeing today employs *more* engineers than even at the peak of World War II. Here you'd work on such projects as pilotless aircraft, research on supersonic flight and nuclear power for airplanes, on America's first jet transport, and the world's outstanding jet bombers.

Do you want variety of opportunity? Aviation is unique in this respect. It offers you unmatched variety and breadth of application, from applied research to production design, all going on at once. Boeing is constantly alert to new materials and new techniques, and approaches them without limitations. In addition, Boeing's huge subcontracting program—requiring engineering co-ordination—offers you contacts with a cross section of American industry.

Boeing engineering activity is concentrated at Seattle, Washington, and Wichita, Kansas—communities with a wide range of recreational opportunities as well as schools of higher learning. The company will arrange a reduced work week to permit time for graduate study and will also reimburse tuition upon successful completion of each quarter's work.

There are openings in *all* branches of engineering (mechanical, civil, electrical, aeronautical and related fields) for DESIGN, PRODUCTION and RESEARCH. Also for physicists and mathematicians with advanced degrees.

For further information,
consult your PLACEMENT OFFICE, or write
JOHN C. SANDERS, Staff Engineer — Personnel
Boeing Airplane Company, Seattle 14, Wash.

BOEING

TCP - -

(continued from page 17)

lead oxide deposits from TEL are common and troublesome, EDB[1] has always been added to TEL in equal quantities with the expectation that the bromine will react with the lead to form lead bromide—a gas at relatively low temperature—which is eleminated in the exhaust.

7. How TCP Eliminates Lead Deposits. Where does TCP fit in? The phosphate in TCP is non-combustible and also combines with the lead. The cresol makes this product soluble in gasoline. In a relatively new or clean engine, this reaction, together with the bromine lead reaction, prevents the formation of most conductive deposits. Lead phosphate deposits, which do form, are more easily broken loose and are non conductive. In an engine with many deposits, the phosphate in TCP replaces the oxide or sulphate in the their respective lead compounds, making them non-conductive.

8. TCP Application. TCP was originally developed to cope with spark plug fouling in aircraft engines. Automotive applications have since become very prominent.

9. TCP Performance Claims. As a result of the use of TCP, increases in power to 15 per cent, and consequently more mileage, is possible according to the Shell Company. Spark plug life may be increased as much as 150 per cent according to Shell. To be more specific, Shell claims that in congested city driving, spark plugs need to be replaced every 2,500 miles; with TCP, this period can be extended to 5,000 miles. With normal driving, replacement is needed about every 6,500 miles and can be increased anywhere from 10,000 to 15,000 miles with TCP.

10. What TCP Does. According to unbiased reports, the effects of TCP on power, mileage and spark plug fouling are as follows:

a. TCP will not boost engine power unless spark plugs are so fouled that they misfire or unless engine deposits force a reduction in spark timing to prevent preignition and knock.[2]

b. To cite an example of TCP mileage performance:[3] "One subscriber, who was told by his service station operator that use of TCP premium gasoline would more than offset the price difference over regular gasoline in better gasoline mileage, kept a careful record of his gasoline consumption on a 3,100 mile trip. He used regular gasoline for the first half of the trip and Shell TCP for the return journey; both ends of the route were at an elevation fairly close to sea level. This consumer did not find a significant difference in miles per gallon on a Studebaker Champion with overdrive when TCP was used, as compared with 'regular' gasoline."

c. The claims concerning spark plug life made by Shell do not seem spectacular when considering the fact that spark plug manufacturers recommend cleaning plugs at 3,000 to 5,000 miles and replacement at 10,000 mile intervals to maintain the engine at good efficiency and to anticipate the possibility of failure. Most mechanics agree that very rarely do spark plugs need replacing before 10,000 miles, but usually serve satisfactorily to 15,000 or more miles on cars with moderate compression ratios, regardless of the type of gasoline used. Plugs have been known to serve from 20,000 to 40,000 miles without failure. Spark plug life is generally lower, however, on cars with high compression ratios, the most important use for TCP. Under a high plug fouling condition, where high octane gasoline is required, spark plug life may be increased up to 75 per cent, according to tests conducted by the Society of Automotive Engineers. These test results were based on tests with four different model automotive engines, using one or two parts of TCP to ten parts of ethyl.

1. The abbreviation of ethylene dibromide.
2. Science and Mechanics, Feb., 1954, page 110.
3. Consumer's Research Bulletin, Sept., 1953; page 61.

TABLE B

B-36 Spark-Plug Fouling Rates

Engine	Fuel	Plug Fouling Rate Per 100 Hr.	Per Cent Reduction in Unscheduled Plug Removals
R-4360-41	Regular (1.0)	7.20	
R-4360-41	0.8÷0.2	0.73	89
R-4360-41	1.0÷0.1	2.43	67
R-4360-53	Regular	1.41	
R-4360-53	1.0÷0.1	0.36	75

11. Results of TCP Tests in Aviation. Flight tests with military and civilian aircraft show that TCP alleviates spark plug fouling. The results of these tests are as follows:[1]

a. The optimum TCP scavenger composition seems to be 1.0÷0.1.[2]

b. Fuel containing 0.1 units of TCP can be used advantageously in certain engines to reduce spark plug fouling without adverse secondary effects.

c. Fuel containing TCP cannot be used indiscriminately in aircraft engines with exhaust turbos, due to added deposits.

d. TCP is effective in controlling spark-plug fouling under conditions of extreme manual leaning.

e. The greater the extent of spark plug fouling, the more relief offered by TCP.

12. Conclusion. The value and effectiveness of TCP depend upon:

a. The use of the engine
b. The type of engine
c. The condition of the engine.

TCP is capable of preventing and reducing spark plug fouling. Power increases with the use of TCP are dependent on engine deposits. TCP is of definite value to the aircraft industry and will no doubt, become more valuable with increased research and testing.

1. SAE Journal, September, 1953; page 36.
2. The ratio of EDB to TCP present in a fuel. It is assumed that 2 mols of TCP combined with 3 mols of TEL to form lead phosphate.

END

Ever Study

TERRESTRIAL ENGINEERING?

Probably not. As far as we know, there isn't such a term. Even so, the terrain of a manufacturing plant may have a vital effect on the design and location of its engineering equipment.

It certainly did in the case of our Belle, West Virginia, plant, which is just across the road from a flat-topped hill, 750 feet high.

Perhaps you'd like to match wits with Du Pont engineers, for we feel that this problem was interesting—and its solution ingenious.

Briefly, the situation was this: Carbon dioxide was to be removed from a mixture of gases by bringing them into contact with water in "scrubbers" operating at 450 psi (gauge). The inlet gases contained about 25% CO_2 by volume. Because of its greater solubility, most of the CO_2 would leave the scrubbers dissolved in the water.

It was necessary to reduce the pressure of this water to atmospheric and recover the dissolved carbon dioxide, since CO_2 was needed for use in a chemical synthesis. The degasified water then had to be pumped back into the pressure scrubbers, to repeat the scrubbing cycle.

Still like to match wits? How would you design an economical closed system for this scrubbing water? After you've thought out your solution, you might like to compare it with the one given below.

Du Pont engineers made use of the precipitous terrain in this way: pressure on the water leaving the scrubbers was sufficient to force it up to the top of the hill for CO_2 recovery. The returning water thereby provided a pressure of approximately 325 psi (750 feet of head) at the base of the hill. This gift of pressure on the suction side of the water pumps resulted in considerable energy saving.

Do unusual problems such as this one challenge you and stir your enthusiasm? If they do, we think you'll be interested in technical work with the Du Pont Company.

Watch "Cavalcade of America" on television

DU PONT

REG. U. S. PAT. OFF

E. I. du Pont de Nemours & Company (Inc.)

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Automation - -

(continued from page 16)

quate to meet the demand. To remedy this situation, the National Bureau of Standards was commissioned in 1950 to redesign electronic equipment so it could be produced automatically.

The subsequent rethinking of the design of electronic equipment resulted in the system known as modular design of electronics (MDE). The system establishes a series of mechanically standardized and uniform modules (or building blocks), produceable with a large range of electrical characteristics.

Each module consists of 4 to 6 thin ceramic wafers bearing various circuits associated with an electronic stage. Circuits are "printed" on these wafers automatically according to a master punch card which controls the machine. Tape resistors and capacitors are automatically cut and placed on the wafers. The wafers are moved from machine to machine automatically. The circuits on the wafers are automatically 100% inspected. The modules are assembled from the wafers in a machine controlled by punch cards to give a wide variety of module characteristics. The composition of these modules into major subassemblies of electronic equipment is possible because there is great similarity between circuits and parts of circuits in modern electronic equipment.

A pilot plant which will produce complete modules from the raw materials is now in operation. This is certainly an outstanding example of automation achieved through product redesign.

END

Research Improves - -

(continued from page 27)

pipe ducts. Acid proof fans pull fumes up to the root and disperse them harmlessly into the upper air. Vitrified clay pipe was chosen for the ducts because it is completely immune to the disintegrating action of acids and other chemicals.

Many home builders are now using this new and revolutionary system of duct heating for basementless homes. Vitrified pipe is use as ducts to distribute warm air. (Fig. 2).

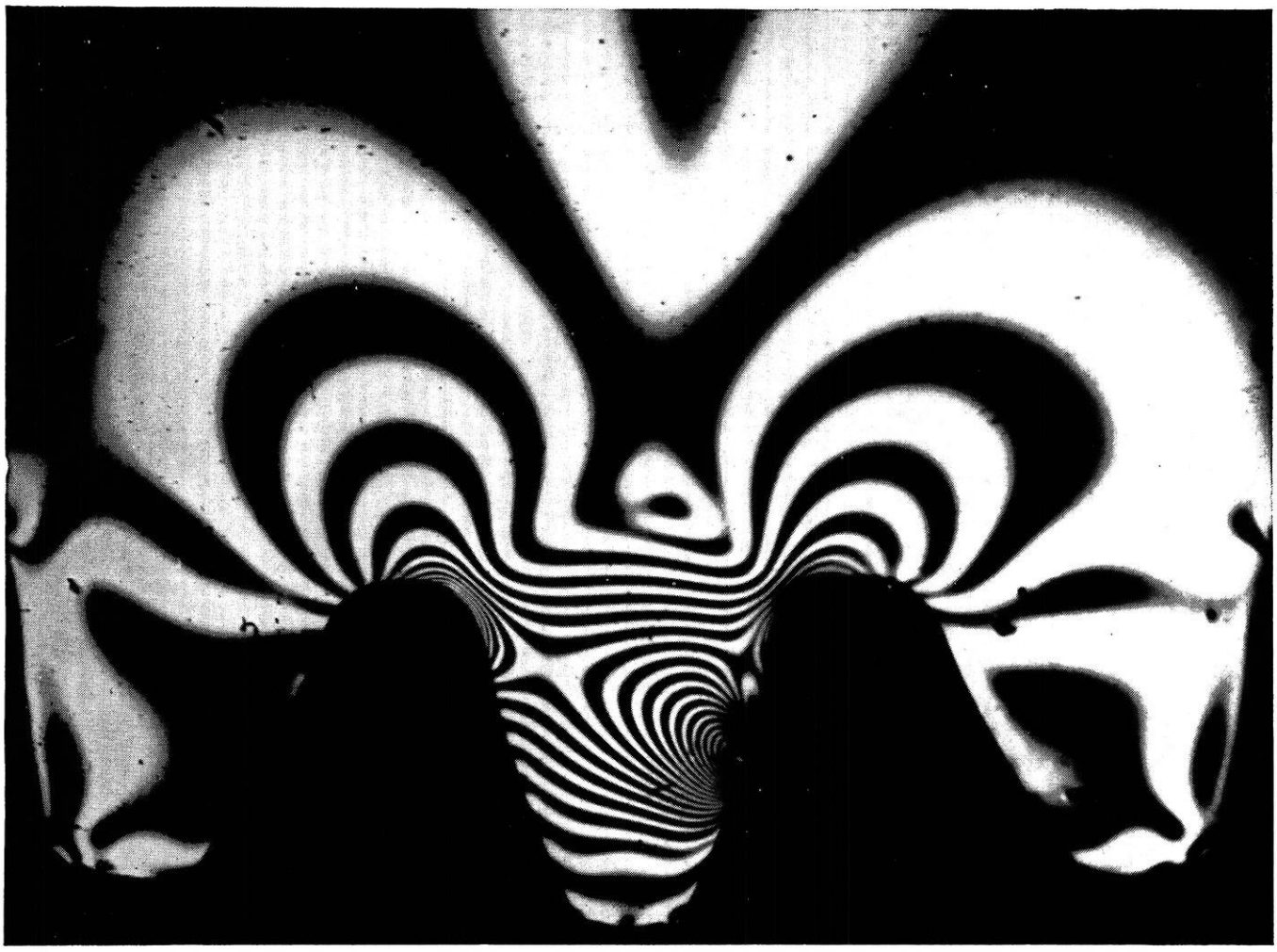
This heating method economically combines the favorable factors of radiant heat with forced warm air perimeter heating. Clay pipe is the ideal duct material. It is inexpensive and easy to install and never wears out.

In specifying pipe for many large industries, the engineers realized that the lines would be carrying weak acids and other chemical wastes. Hence, they chose vitrified clay pipe, which is proof against chemical attack.

There was a complicating factor, however. Clay pipe is made no larger than 36 inches in diameter, and the volume of wastes to be carried here required more capacity than this. Yet rather than consider other pipe materials which are available in larger sizes, the engineers preferred to use multiple clay pipe lines. (Fig. 3).

The vitrified clay pipe industry is alert to its responsibilities. It must anticipate the needs of a growing nation. Research is meeting this challenge and will continue to do so.

END



teeth for a 1000 h.p. bite . . .

Undoubtedly you will recognize this application of a familiar technique for studying stresses. In this case, it was used to develop gears that are less than 5 inches in diameter yet easily transmit over 1000 horsepower.

Inherently, the design and development of aircraft engines offers unusual opportunities for applying basic engineering principles learned in school. In few other places can a technical graduate utilize his education and abilities more fully — gain recognition and advancement.

Many of our engineers who had important roles in developing the most powerful jet engine known to be in production — rated in the 10,000-pound thrust class — are still in their twenties.

To those young graduates who can see the career possibilities in the rapidly evolving field of aircraft propulsion, we can offer a real opportunity for growth and professional development.

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation

East Hartford 8, Connecticut

McCormick's

Engine-Ears

by Larry McCormick, ch'55

"James, more hot water! Pour it easy-like now. Take it slow, these tootsies are valuable, bus fare is going up to 15c and old feets have to get me to my 7:45 every morning," quoth myself, the morning after the ChE's junior inspection trip. What a heat exchange problem These feet (large economy size 12½) nicely cover the bottom of a laundry wash tub. On this trip, my group covered 99⅞ of the Badger State. Now I know why the badger is built so low to the ground; his legs are worn off from walking. Moreover, I'm convinced that half the walking was done on late evening, early morning, unscheduled tours around the city of Milwaukee, looking for "hot" spots (another phase of heat engineering).

•

TRIANGLE

Triangle fraternity helds its annual Founders Day banquet, Saturday evening, May 1stfl The event took place at the Monona Hotel with Mr. George Steinmetz of the Public Service Commission as the main speaker. Professor Ben Elliott served as toastmaster. A big feature of this banquet was the installation of officers. They are: president, Dick Martin; vice-president, Cauncey Reider; secretary, Bob Kohn; treasurer, Jule Bergauer. May 29 will see the fraternity's Spring Formal at the Lorraine Hotel.

•

AIChE

The Union Topflight room was the scene for the April meeting of AIChE. The meeting on Wednesday, April 28, was highlighted by a talk and film by Mr. C. E. Berry of the Du Pont experimental station. Nominations for next term's officers together with plans for the annual picnic, were discussed.

•

AIEE - IRE

Here is the winnah! AIEE and IRE have sponsored a student paper contest and Tom Benedict, president of the joint clubs, took first place with his discussion of the Laplace transform of the Fourier series. Don't ask me to explain this phenomenon; Tom tried, but the whole thing went right over my pointed little head.

Almight reader, you may suspect graft or sumpin' awful like that, but the president didn't choose the best paper; a staff of qualified faculty members did the job. Prof. Harold A. Peterson, chairman of the electrical engineering department; Assistant Prof. David K. Reitan and Charles Davidson, research associate, judged the oral discussions and Bernard King, research assistant; John B. Miller, instructor, and John Asmuth, instructor, judged the papers from the writing angle.

As a consequence of winning this contest, Pres. Benedict and Donald Shulz are taking a junket out to Fargo, North Dakota to present the paper at the sectional meeting of AIEE. Winner of second place was Don Dietmeyer, who wrote on "Mechanical Considerations in a Radio Transmitter."

AIEE members went on an inspection trip of WKOW-TV's transmission plant and studios May 19th.

•

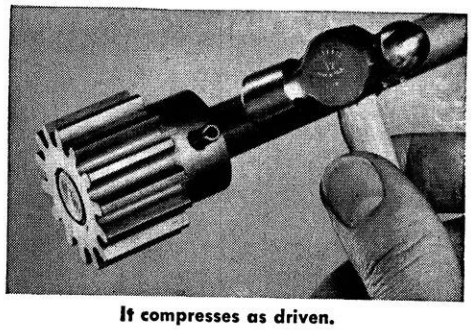
ATOMIC LABORATORY

Madison is being considered as a site for a new $25,000,000 atomic laboratory. If chosen, a senate investigating committee will probably hit town on the coattails of building contractors. Look out for secret police! Get your beer cards renewed, for security reasons, of course.

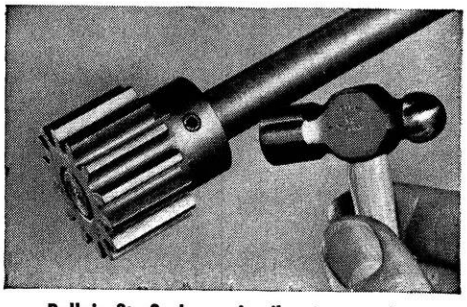
Where will you use this simple fastener?

Rollpin is driven into holes drilled to normal production-line tolerances.

No threading, peening or precision drilling with ROLLPIN



It compresses as driven.



Rollpin fits flush . . . is vibration-proof.

Rollpin is the slotted tubular steel pin with chamfered ends that is cutting production and maintenance costs in every class of industry.

This modern fastener drives easily into standard holes, compressing as driven. Its spring action locks it in place—regardless of impact loading, stress reversals or severe vibration. Rollpin is readily removable and can be re-used in the same hole.

* * *

If you use locating dowels, hinge pins, rivets, set screws—or straight, knurled, tapered or cotter type pins—Rollpin can cut your costs. Mail our coupon for design information.

Elastic Stop Nut Corporation of America
Dept. R16-CM, 2330 Vauxhall Road, Unon, N. J.

Please send me the following free fastening information:

☐ Rollpin bulletin

☐ Elastic Stop Nut bulletin

☐ Here is a drawing of our product. What fastener would you suggest?

*Name*_____ *Title*_____

*Firm*_____

*Street*_____

*City*_____ *Zone*_____ *State*_____

(continued from page 21)

CHALLENGE FROM MINNESOTA

I've got us way out on the end of a limb!

Question: Are you going to let Minnesota saw it off?

Winn Hindermann, President of the Minnesota Society, has challenged us to a contest between Minnesota and Wisconsin for the largest number of new members (including EITs) during our respective terms of office, and I have accepted.

The payoff is five pounds of the loser's homestate cheese at the NSPE convention luncheon on Friday, June 11, in Milwaukee. This luncheon is in honor of WSPE and it would be tragic indeed if we had to knuckle under to Minnesota on that otherwise auspicious occasion.

I don't know where the Minnesota boys stand today when Hindermann called, as he wouldn't tell (neither did I) but I think we have a chance to win if we bring in **an additional 100 members by June 11.** We have admitted 78 new members in the last three months, which means we must do better than that in the next three months in order to win.

It can be done! The additional effort is going to have to come at the Chapter level. Frank Carlson, our indefatigable Membership Chairman, is doing everything he can to assist, as you well know.

I'd like nothing better than to dish out some Minnesota cheese to you and your Chapter Membership Chairman at that June 11 luncheon.

How about it—if you are behind me and want to assure me your Chapter will bring in its share of the needed memberships, let me hear from you promptly!

Hopefully yours,
Pierce G. Ellis
President

MEMBERSHIP REPORT
March 13, 1954

January 1, 1954 to March 12, 1954

New applications approved for membership	42
New applications approved for affiliate membership	6
Reinstated Members	0
Reinstated Affiliate Members	0
Total	48

Losses January 1, 1954 to March 12, 1954

Members deceased	1
Members dropped	0
Members resigned	3
Members transferred	1
Affiliate members deceased	0
Affiliate members dropped (includes transfer to full member)	1
Affiliate members resigned	1
Affiliate members transferred	0
Total	7
Net Gain	41

•

TREASURER'S REPORT
March 13, 1954

Cash Balance January 28, 1954		$6,940.88
Income January 28 to March 12, 1954		
Dues	$5,047.00	
State Convention	2,089.50	
	$7,136.50	
Expenditures	7,008.19	
	128.31	
Net Gain		128.31
Cash Balance March 12, 1954		$7,069.19*
Cash Balance March 12, 1953		2,813.32

*Approximately $3,000.00 of this is due to NSPE and Chapters.

ERNST BAARS, 74, IS DEAD

Ernst Baars, 74, a professor at the Milwaukee School of Engineering and an expert in the refrigeration field, died of a heart attack Thursday morning at his home, 730 W. Scott st.

Born at Stollhamm, Germany, in 1880, Mr. Baars was graduated from a technical school in Saxony in 1901. He did postgraduate study in refrigeration and diesel engineering in Munich before coming here in 1903.

In May, 1949, Mr. Baars was selected "engineer of the month" by the Engineering Society of Milwaukee, of which he was a member 40 years. He also was a member of the American Society of Refrigeration Engineers, the Wisconsin Society of Professional Engineers, the American Society of Professional Engineers, the American Ordnance association and the Refrigeration Engineers' society.

Helped War Effort

During World War II, Mr. Baars was regional engineer for the fuel efficiency program of the federal bureau of mines.

A widower, Mr. Baars is survived by four sons, Bernhard and Walter, Milwaukee, Carl, Muskego, Wis., and Kurt, Albuquerque, N. M.

CHAPTER NEWS

MILWAUKEE CHAPTER

CLYDE R. ETHIER
Reporter

The April meeting of Milwaukee chapter WSPE featured a talk by Paul H. Robbins, Executive Director of NSPE. The excellent speech, which lasted about 45 minutes,

(continued on page 54)

"I chose Worthington for opportunities in international trade"

• "Worthington was my choice," Mr. Berger says, "because of the excellent training and the unusual experiences that are possible with a manufacturer having a worldwide reputation, and worldwide distribution. Then, when a company has seventeen divisions, including air conditioning, refrigeration, turbines, Diesel engines, compressors and pumps of all kinds, construction machinery, and power transmission equipment, a graduate engineer's chances for getting into his chosen field are even better.

"Supporting these divisions are research, engineering, production, purchasing, and sales, domestic and export. The real opportunity, however, is in Worthington itself. This is a company that is growing, just as it has for more than a century. It is always looking for new, related products and good men to engineer, produce, and sell them—at home and abroad.

"I began my career with Worthington's training program in the Research and Development Laboratory, where full-scale equipment is designed, tested and improved. This experience gave me an understanding of the tremendous part the company plays in the everyday life of millions of people. Within fourteen months I was sent to Mexico to inspect the facilities of our distributors there.

"The opportunities for first-hand laboratory experience, sales training and contact, travel and field trips, among many others, make Worthington a first-rate company for the young engineer with a desire to learn and progress in his work."

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

8.26

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

WORTHINGTON

THE SIGN OF VALUE AROUND THE WORLD

Science Highlights - -

(continued from page 23)

of 150 kv. Following successful experience with units for lower voltages, these transformers are compound filled—with extra precaution to keep air out. Air is withdrawn under heat and vacuum and then filled with a compound that itself has been stored under vacuum.

•

HAFNIUM CARBIDE AS A REFRACTORY

New data on the properties of hafnium carbide have been provided by recent work conducted by the Ceramics Department of Oak Ridge National Laboratory, Oak Ridge, Tennessee, operated by Union Carbide for the Atomic Energy Commission. Literature reference indicate that hafnium carbide is a super-refractory compound, and is among the hardest materials known; not a great deal of information is available, however, because of the comparative scarcity of pure hafnium, since its similarity to zirconium ordinarily makes the separation of these two elements difficult. Recent processes developed at Oak Ridge National Laboratory have stepped up the production of pure zirconium and hafnium. Hafnium carbide tested at ORNL for use as a refractory material was synthesized from carbon and pure hafnium oxide available at the laboratory.

Pellets of dry-pressed carbon and hafnium oxide were heated in a graphite crucible from 2000 to 2400 degrees Centigrade over a two-hour period, with a five minute period at over 3000 degrees to volatilize any impurities and to increase the crystal size by recrystallization. The product was a loosely coherent mass of blue-black crystals.

Hafnium carbide is still in the laboratory stage, but it has become of interest in recent years for possible application in high-temperature equipment, and for cutting tools and grinding media. The growing availability of hafnium will probably make hafnium carbide of increasing importance for applications where a material of high hardness is required, although present indications do not recommend it for high-impact requirements. Finely powdered hafnium carbide can be hot-pressed into desired shapes in graphite dies at pressure on the order of 1500 pounds per square inch and temperatures in the vicinity of 2000 degrees Centigrade.

•

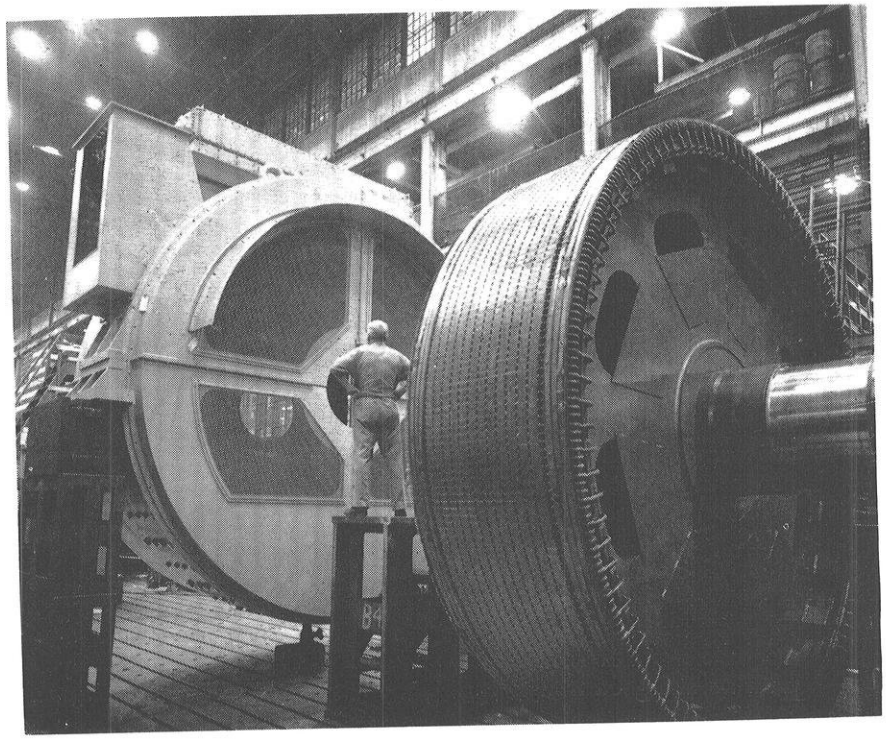
CIVIL DEFENSE RADIO

A small radio receiver, which can be worn like a hearing aid, has been developed by two General Electric engineers. W. F. Chow and J. J. Suran, who built the radio in the company's electronics laboratory, said it was designed primarily for use in civil defense where a compact, lightweight receiver, operating from a minimum number of standard flashlight batteries, is desired.

The radio, described as an experimental model, is tuned to a single broadcast frequency, 1240 kilocycles, which is one of two channels to be used by radio stations in broadcasting civil defense instructions to the general public during emergency periods.

The radio has a hearing-aid type earphone and weighs about five ounces. It can be slipped into a shirt or vest pocket, and is said to be capable of continuous operation for more than a month without battery replacement.

Two tiny batteries, like those used in a pen-size flashlight power the radio. Long battery life is accomplished through use of germanium devices (a transistor and double-based diode) which do the radio detection and amplifying work with less power requirements than conventional radio tubes.



ICEBREAKER MOTOR

This 10,500-horsepower giant — world's largest capacity single-armature direct current motor — is readied for shipment at Westinghouse Electric Corporation's East Pittsburgh plant. Together with its twin, the huge motor is part of Westinghouse marine propulsion equipment soon to be installed in the U. S. Navy's newest and fastest icebreaker. At right is the armature or rotating part of the motor which will fit inside the frame at left. The giant motors will be powered by 10 diesel-driven 1700-kilowatt generators to propel the 8,600-ton icebreaker.

END

PROGRESS AND SCIENCE GO HAND IN HAND

OUR recently published annual report to stockholders tells more than the financial story of the progress of Standard Oil and its subsidiary companies in 1953. Its facts and figures also reflect the achievements of engineers and chemists.

For example, the report points out that:

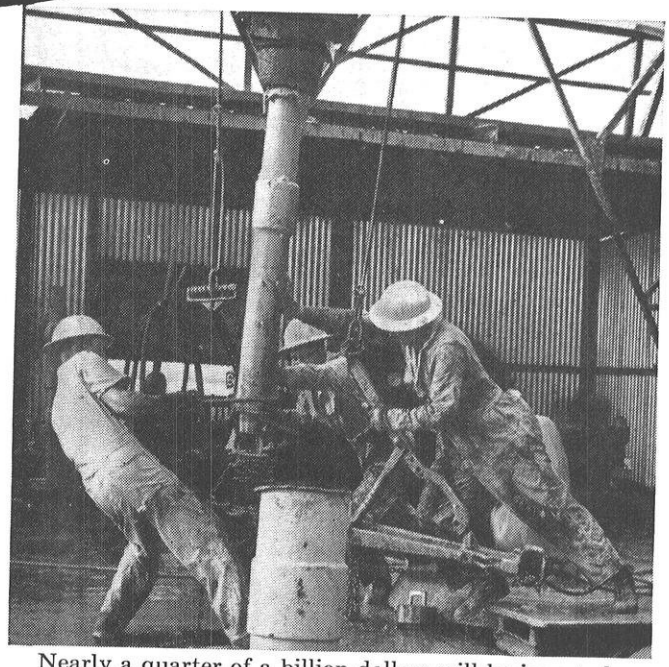
More new and improved products were introduced by our company last year than in any other year since World War II.

Our scientists developed the Ultraforming process, a new and better catalytic reforming method for improving the quality of the straight-run portions of gasoline.

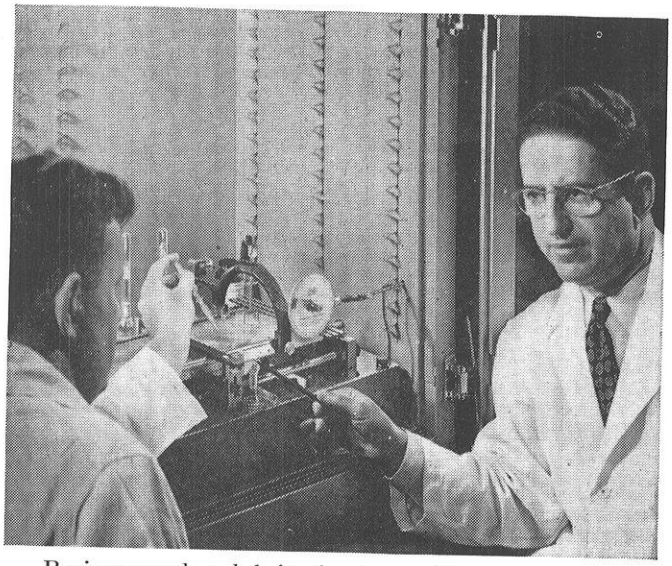
Three new research laboratories were completed.

More than $200 million was invested last year in new and improved facilities. (This year and next we expect to invest a total of about half a billion dollars.)

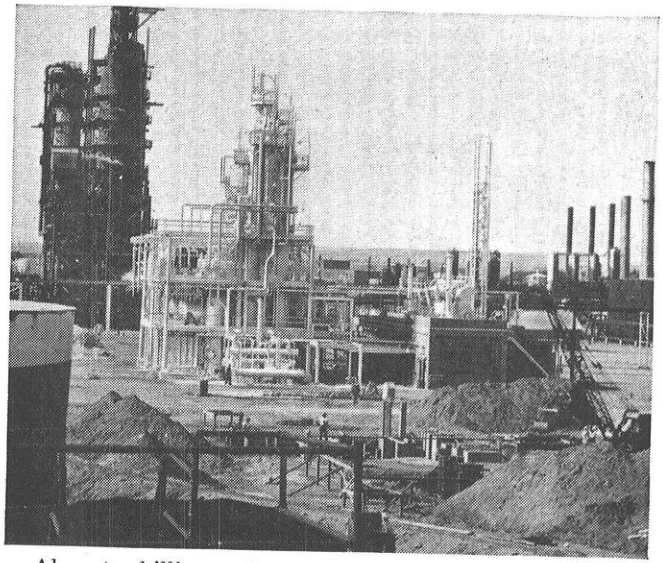
This continuing program of physical expansion and product development at Standard Oil provides many opportunities for engineers and chemists. Men with technical and scientific training have found great personal and professional satisfaction in our steady industrial advance.



Nearly a quarter of a billion dollars will be invested during 1954 and 1955 in development of new crude oil production and reserves.



Basic research on lubrication is one of the many activities at Standard Oil's extensive Whiting laboratories.



Almost a billion and a half dollars has been invested in expansion and improvement of facilities since 1945.

Standard Oil Company

910 South Michigan Avenue,
Chicago 80, Illinois

STANDARD

Ham Radio - -

(continued from page 25)

the subject in which both amateurs are interested in—ham radio. The first transmission by each amateur generally includes the name (handle) and address (QTH) of the ham, a report on how the other fellow's signal is being received and possibly the weather. Subsequent transmissions will probably include information on the equipment being used by each amateur. From then on there is no standardization of subject matter.

The extreme opposite of a ragchewer is the DX-man. He is not interested in talking to just anyone; he wants to communicate with very distant stations to which he has never talked before. This may necessitate spending a lot of time just sitting, tuning the receiver and listening. Often conditions for communication with distant stations are favorable only during the early hours of the morning. DX-ers will get up at three or four in the morning to talk with someone in China or Tibet.

The conversation of a DX-man is quite different from that of a ragchewer also. It will include the handle and QTH and signal report. A plea of "QSL? Please" is generally included. (A QSL is a written confirmation of the contact. It will include the time, date, frequency used and signal report along with anything else the sender may wish to include.) But that is the extent of the QSO, and immediately the DX-man is listening for another station which is even farther away.

A contest-man is very similar to a DX-man in many respects. At various times throughout the year organized amateur societies sponsor contests. Most outstanding among these are the American Radio Relay League sponsored Field Day and Sweepstakes, and CQ sponsored DX contest. The details of these contests differ; the underlying objective is the same—to communicate with as many different hams in as short a period of time as possible. The final score of any stations is a very good indication of the operating skill of the amateur.

Many amateurs have found it fit to install radio equipment in their automobiles. Some have more equipment in their cars than in their homes. But regardless of where the equipment is installed it is used for the same purpose. The style of a QSO from a mobile is slightly different, however. The length of transmission must be kept to a minimum to save the battery. DX'ing from a mobile unit may consist of talking to someone in the next state or across the country. Contest operation from a mobile station has recently been successfully accomplished.

Possibly you have seen mobile units with special license plates on their car. These plates were authorized by the state legislature for a very special purpose. In time of disaster the amateur has time and again proven his value in providing communication. Mobile units extend the range and effectiveness of the amateur's operation. The special license plates are to make the unit's identity clear. The preparedness of amateurs along civil defense lines is much greater than mobile units. Organized networks covering a state, a section of the country, or the nation meet every day. These nets handle messages for those aware of their existence, but their main purpose is to develop a technique of handling messages in an efficient manner.

There are several pieces of equipment needed by the amateur if he is to engage in the activities mentioned above. Very fundamental is the receiver. A receiver is a high class "radio" built to tune the short wave bands and the ham bands in particular. A good communication receiver has circuits built in it to provide for listening to very weak signals and separating signals that are very close to one another.

Whether the amateur will build his own receiver or buy a commercially built one depends on the experience and finance available. A good receiver is a high quality piece of electronic equipment and to get it working properly requires considerable knowledge of radio theory and considerable test equipment. Thus most hams buy a commercial receiver. The price range on commercial communication receivers is $50 to $950, and the performance of the receiver selected is very nearly proportional to the price paid. Thus the amateur must decide before purchasing a receiver, exactly what he wants to get out of the receiver and compare this with the money he has available.

For communication two other things are necessary—a transmitter and a good antenna. Very simple transmitters can be built, which give good performance. Thus most hams build their first transmitter. As they progress they may want a high power transmitter or a phone transmitter or other special innovations. Commercial transmitters are available which include many of these, and commercial transmitters are more and more being accepted by the amateur. The percentage of home made units is still very high, however.

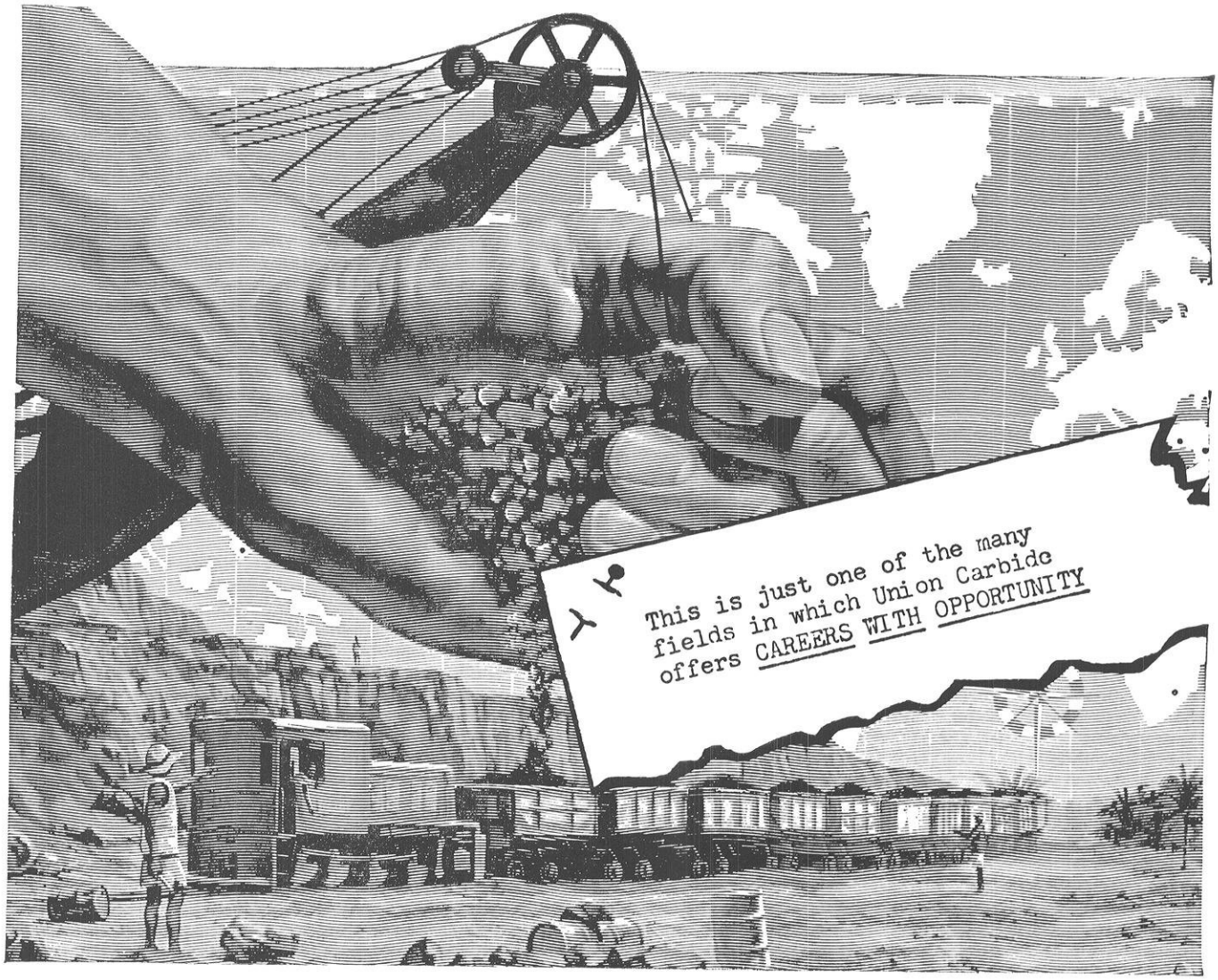
Commercial transmitters are widely used in mobile installations. High efficiency and compactness are desired in mobile units. Often the commercial manufacturer can provide these things much more easily than the ham.

One field that uses ham built equipment almost exclusively is portable equipment. To further extend the range of civil defense operation many amateurs have built very small receivers and transmitters which can easily be carried around. The Detroit Radio Club went to far as to set up an assembly line to mass produce a small portable transceiver for each of its members. Each member did his fair share of the work and paid for the components used in the unit he received.

The cost of a transmitter can be almost anything. A transmitter can be built for a few dollars or thousands of dollars can be invested in very elaborate equipment. An old criterion of value was "dollar per watt output" for a cw transmitter. The price can be almost doubled if the transmitter is to be a phone transmitter. The figure mentioned is perhaps low, considering today's prices.

The third important piece of equipment is the antenna. A low power transmitter and a good antenna is much

(continued on page 56)



The metal that thrives on punishment

Steel serves you better when manganese is added —because the harder it works, the tougher it gets

EVER WATCH a power shovel bite into earth and rock? And wonder how the teeth of the steel bucket can endure such punishment? The amazing answer is that the teeth not only endure such treatment—they actually get harder because of it!

MANGANESE HOLDS THE SECRET—The story behind this remarkable steel is the unusual metal called *manganese*. The hundreds of thousands of tons of manganese required each year by steel and other metal-making industries are obtained by refining huge quantities of ore that come from mines in widely scattered points across the face of the globe.

ADDED TO STEEL—All steel contains manganese. A small amount "cleanses" molten steel and removes impurities. A larger amount of manganese makes the steel tougher and stronger.

FROM ORE TO ALLOY—Transforming raw ores into a variety of manganese alloys for the metal-producing industries is one of the many important jobs of the people of Union Carbide.

STUDENTS AND STUDENT ADVISERS: *Learn more about career opportunities with Union Carbide in* ALLOYS, CARBONS, CHEMICALS, GASES, *and* PLASTICS. *Write for booklet C-2.*

UNION CARBIDE
AND CARBON CORPORATION

30 EAST 42ND STREET UCC NEW YORK 17, N. Y.

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UCC's Trade-marked Products include

ELECTROMET Alloys and Metals
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PYROFAX Gas
PREST-O-LITE Acetylene
PRESTONE Anti-Freeze
EVEREADY Flashlights and Batteries
BAKELITE, VINYLITE, and KRENE Plastics
SYNTHETIC ORGANIC CHEMICALS
DYNEL Textile Fibers
LINDE Oxygen

So You're Smart

A Few Brain-Crackers For Your Spare Time . . . Try Some!

An orderly arrangement of the facts helps here.

Ten years from now Joe will be twice as old as Mary was when Jack was nine times as old as Joe. Eight years ago Jack was half as old as Mary will be when Mary is one year older than Joe will be at the time when Jack will be five times as old as Joe will be two years from now. When Joe was one year old, Jack was three years older than Joe will be when Mary is three times as old as Jack was six years before the time when Mary was half as old as Joe will be when Jack will be ten years older than Jack was when Mary was one-third as old as Joe will be when Jack will be three times as old as he was when Mary was born. What are the ages of these people?

•

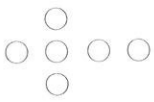
How do you and calculus get along?

A cow is tethered on a rope to one point on a silo. It so happens that the silo is twenty feet in diameter and the maximum distance that the cow can reach from the silo is thirty feet. Now tell us what the maximum grazing area the cow has, down to six decimal places.

•

Let's see how much you can do with money.

There are six coins arranged in the following fashion:



In one move can you make two rows of four coins out of this arrangement?

•

If you're a string-saver, this may spur you on to greater achievements.

If the earth is assumed to be a sphere of radius four thousand miles and a string is presumed to have been laid along the earth's equator, how much would the string have to be lengthened if it is to be raised to uniform height of one foot above the earth's surface.

Answers to Past Brain Crackers

DILL PICKLES

One of our readers has turned in a precise answer to the question in the March issue about the woodpecker with the wooden leg and the duck with the rubber bill. Here it is:

"A bicycle because a vest has no sleeves!"

•

COUNTERFEIT COINS

Using an analytical balance, place three coins on each of the two pans. If the pans balance, the counterfeit coin is in the remaining six and can be found by balancing four of these six coins, two on each pan. If the pans balance again, the coin is one of the unweighed two. Balance either of these remaining two against one of the genuine coins. If the coins balance, the last remaining coin is counterfeit; if they do not balance it was the second to the last coin.

Now assume that a state of unbalance existed in the second weighing. The counterfeit coin will be on the light side because counterfeit coins are lighter than their genuine counterparts. Again, balance either of these two coins against one of the known genuines; a state of balance indicates that the coin not in the pan is counterfeit and unbalance, of course, means that the coin in the pan is counterfeit.

The same procedure can be used if the scale does not balance on the first weighing, working in this case with the first six coins weighed.

•

CIRCLE TANGENT TO THREE OTHERS

Since there are so many solutions, you are bound to discover at least one. Therefore we won't publish any.

NEEDED--- A NEW APPROACH!

HE HAD ONE

McDonnell engineers have again demonstrated their pioneering spirit. The problem—how to land a speedy, transonic airplane—normally requiring a mile or more of runway—in the short space available on an aircraft carrier deck. This is but one of the many complex problems successfully solved by M. A. C. engineers in developing the new Navy F3H Demon, now in production.

Youthfulness is another characteristic of this progressive engineering team, the average age being under thirty. Engineering graduates find working with men of their own approximate age group greatly facilitates getting acquainted and gaining that "feeling of belonging" more quickly.

If you're looking for our type of engineering—we're looking for you. Check your Placement Office for dates when our representative will visit your school. Ask him about the McDonnell Graduate Study Plan. You may also write to:

Technical Placement Supervisor
Box 516, St. Louis 3, Missouri

VERNON E. NETHERTON
Design Engineer—Airplane Division
B.S.A.E. U. of Illinois 1947

Vernon had a fresh approach to the problem of landing high-speed jet aircraft on carrier decks and was responsible to a large degree for an improved landing hook now being used on McDonnell airplanes.

Starting his engineering career "on the board" as a Draftsman in 1947, Vernon is now a key member of a design group concerned with the F-101 Voodoo airplane.

If your interests lie in the field of airplane development, a challenging career awaits you at McDonnell. We need more young men like Vernon Netherton—*engineers with a new approach.*

BUILD YOUR FUTURE WITH A COMPANY . . . . YOUNG IN YEARS, YOUNG IN SPIRIT AND IDEAS

McDONNELL Aircraft Corporation

Manufacturers of AIRPLANES AND HELICOPTERS ★ ST. LOUIS 3, MO.

(continued from page 46)

touched on many subjects of vital interest to engineers, but the discussion, which lasted over an hour, was devoted almost entirely to unionization and the engineer. Mr. Robbins clearly defended the professional approach to advancement in industry. A union president in the audience provided most of the opposition to his views. A very enjoyable time was had by all who attended.

At a luncheon meeting held April 1st at the Schlitz Brown Bottle, WSPE member Ray Behrens was presented with a plaque inscribed:

Presented to Ray Behrens
In recognition of distinguished service as president 1948-1950

Six other former presidents were similarly honored.

Milwaukee government Service League is an organization of city and county employees whose motto is: Better service to the public—Better understanding by the public.

●

SOUTHEAST CHAPTER

H. J. CARLIN
Reporter

Harold T. Rudgal, 50, of Gary, Indiana, Vice President & General Manager of the Gary-Hobart Water Corporation, passed away unexpectedly on February 25, 1954 in Philadelphia, following a heart attack.

Described by his friends as a dynamic energetic man, Rudgal had never previously been ill, and his sudden death came as a surprise.

From 1947 until he came to Gary, Rudgal had been Superintendent of the Sewage Treatment Plant and Water Department at Kenosha, Wisconsin. For seven years prior he had served as Superintendent of the Sewage Treatment Plant and Assistant Superintendent of the Water Department.

He was a member of the First Presbyterian Church of Gary, Rotary Club, on the Board of Directors of the Gary Chamber of Commerce —for which he was Chairman of the Health & Welfare Committee—and Assistant Secretary of the Gary Industrial Foundation.

He belonged to the American Waterworks Association and the Wisconsin Society of Professional Engineers.

A member of the Gary Country Club, Rudgal was a golfer. In connection with his hobby of amateur photography, his photographs have won honors in Wisconsin and have been displayed in Chicago exhibits.

The regular Quarterly Dinner Meeting of the Southeastern Chapter of WSPE was held on March 31, 1954 at the Rainbow Room of the Racine Hotel in Racine, Wisconsin.

Among the guests in attendance were Mr. Arthur G. Behling, National Representative, NSPE and Mr. Pierce G. Ellis, President, WSPE.

Rev. S. B. Witkowiak, Principal of St. Catherine's High School in Racine, Wisconsin, gave an interesting talk on "Communism". A considerably amount of discussion ensued following Rev. Witkowiak's talk.

●

WESTERN CHAPTER

D. W. GRUNDITZ
Reporter

The March meeting of Western Chapter was held jointly with the La Crosse Committee of the ASME at the Cerise Club, La Crosse, on Wednesday, March 24. The short meeting following the dinner was highlighted by the passage of a resolution joining the medical, dental and legal professional groups of La Crosse in supporting fluoridation of the city water supply. Philip S. Davy presented the resolution after opening of the meeting by Arnold Medbery, chairman of the ASME group, and remarks by Willard J. Bell of Wallace and Tiernan Company, manufacturers of the fluoridation equipment owned by the city, who described the operation of the fluoridation equipment. Engineers have been in the forefront of pro-fluoridation activities.

Dr. Francis Tatnall, Director of Testing Research for Baldwin-Lima-Hamilton was speaker of the evening on the topic "Making Things Stronger by Making them Lighter". Many interesting applications of the strain gage along with photoelastic, brittle lacquer, and other experimental stress analysis techniques were described to the group of 76 members and guests attending the meeting.

On March 25 the Western Chapter Board of Directors appointed John R. Mangan as secretary-treasurer to fill the vacancy created by the transfer of Fred R. Hayden to Madison. Mangan will fill the present unexpired term of Hayden and the coming term commencing July 1 for which Hayden had been re-elected.

Fred Hayden has been appointed director of the newly reorganized secondary roads department of the State Highway Commission.

LeRoy C. Zignego, who has been an engineer of District 5 of the State Highway Commission at La Crosse for the past 4 years, has resigned his position to enter into a contracting partnership with his brother Vernon Zignego, formerly associated with White Construction Company of Milwaukee.

The partnership will contract for asphalt and concrete construction in the Milwaukee area and plan to develop a consulting practice in addition to their contruction work.

The most recent meeting of the Western Chapter was held April 20th at the Cerise Nite Club in La Crosse. Mr. Pierce G. Ellis, President of WSPE, and Mr. E. J. Kallevang, national representative, discussed professional organization and problems.

FOX RIVER VALLEY CHAPTER

R. E. LEE
Reporter

The season's gayest meeting was held for Professional Engineers, EIT's, and their wives at Chilton, Thursday, April 15th.

We had the unusual pleasure of hearing Clifford L. Lord, Director of the State Historical Society, on a subject of interest to wives and Engineers.

Date — Thursday, April 15th, 1954.

Place—The Hickory Hills Golf and Country Club of Chilton.

Speaker—Clifford L. Lord, Director of the Wisconsin State Historical Society talking on "The Engineer and the Historian".

●

WISCONSIN VALLEY CHAPTER

J. M. ABERNATHY
Reporter

The Wisconsin Valley Chapter WSPE met Saturday, March 20, at the Hotel Wausau in Wausau. Twenty members were present at the business meeting held at 4 p.m. Due to conflict with the National Convention date and the Antigo meeting, it was voted to hold the Antigo meeting on July 17. The chapter voted $50.00 for the expense of the National Convention when and if needed. Mr. W. E. Roubie, P. E., Watertown, N. Y., a member of Jefferson-Lewis Chapter of New York State, being a guest of the hotel, joined with us in the business meeting. The banquet which followed was attended by 44 members, wives and guests. After the banquet entertainment followed, the speech coach of the Wausau High School and two of his star pupils doing the entertaining. During my recent vacation in the south I had the pleasure of visiting four members of the Chapter. Ralph Kucera and D. Christensen at Jessup, Georgia where they are completing the construction of a pulp mill; Robert Mortensen at his motel at Fort Meyers, Fla., and Chas. Grau who has moved into his new home at Mt. Dord, Fla.

Henry Olk.
President Wis. Valley Chapter

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SOUTHWEST CHAPTER

C. H. GAUSEWITZ
Reporter

The Southwest Chapter held its March 24th meeting at the Nakoma Country Club of Madison. The speaker of the evening was Dr. Robert G. Sachs, professor of physics at the University of Wisconsin, who spoke on "Nuclear Power and the Engineer".

In virtue of his academic training, his war-time scientific activities, his work as consultant to the Aberdeen Proving Ground, the Argonne National Laboratory of the AEC, and to the Office of Scientific Research and Development, and his own research, Dr. Sachs ranks as one of the country's foremost nuclear physicists. One of his particular areas of activity has been the development of the applications of nuclear power.

Dr. Sachs sketched the principles of nuclear-power reactor design, with emphasis on the engineering problems involved, showed slides illustrating some of the reactors now in operation, and discussed the potentialities of the application of nuclear power for providing submarine, ship, locomotive and aircraft propulsion. He also remarked on the principle of thermonuclear Fusion and how it is used to effect the vast energy output of the hydrogen bomb. All in attendance felt that the talk was stimulating and well presented.

●

NORTHWEST CHAPTER

R. N. MORRIS
Reporter

No news reported.

END

Fluorine and Carbon - -

(continued from page 28)

volume production will result, with a subsequent decrease in fluorocarbon prices.

Everyday, new uses are being found for this enormous diversity of products, and someday the Teflon suit and a crankcase full of permanent oil may be numbered among the average American's possessions.

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END

Ham Radio - -

(continued from page 50)

more effective than a higher power transmitter connected to an inefficient antenna system. A good antenna need not be elaborate, but if it is carefully constructed and placed in the most advantageous position it will prove very satisfactory.

Many of the actions and the language of hams may seem very strange to one not well acquainted with amateur radio. In talking to a ham such a person may get the impression that it is necessary to be an engineer to construct and operate the equipment. However, as one gets interested in the hobby and begins to ask questions and read about amateur radio he will soon find himself talking the language and learning the necessary theory. From then on such things as spare time or extra finance will not exist. All his time will be taken up either in operation of his own equipment or building new equipment. All of his money will be taken up by new equipment.

However, the person will gain much pleasure from his new hobby. Many new friends will be made; new skills will be developed. He will find that his is an active hobby which is as useful to the entire community as it is to himself.

SO VRY 73's (Best Regards) OM (Old Man)

BEST OF LUCK ES (And) DX, HPE TO C U ON THE AIR SN.

DE (From)
W9HHE

The Editor's Desk - -

(continued from page 8)

Further information and a copy of the association's "Guide for the Preparation and Presentation of Papers" may be obtained on request from A. B. Campbell, Executive Secretary, National Association of Corrosion Engineers, 1061 M & M Building, Houston 2, Texas.

●

FINANCIAL REPORT OF POLYGON BOARD
For Year 1953-1954

Bank Balance (October 12, 1953)		**$1,612.36**
Expenses		
Fall picnic		$ 6.50
Campus Chest		20.00
Polygon keys		58.80
Wisconsin Badger		40.00
Post cards		2.00
St. Pat's Dance		
Buttons	$192.16	
Tickets	4.68	
Programs	23.50	
Orchestra	235.00	
Publicity	50.80	
Decorations	7.25	
Wisconsin Union	130.00	
Prizes	38.67	
Miscellaneous	5.00	
	$687.06	687.06
Total		$ 814.36*
Income		
St. Pat's Dance		
Buttons sales	$397.25	
Ticket sales	430.00	
Total	$827.25*	
Net Profit for year		**$ 12.89**
Bank Balance (April 10, 1954)		**$1,625.25**
(Plus $500 in U.S. bonds)		

●

Rolland R. Roup, M.S. (met) '35, was installed as vice-president of The American Ceramic Society at its annual meeting in Chicago, April 19-23. He will also become president-elect of The National Institute of Ceramic Engineers. He was elected to these offices by mail ballot earlier this year. Roup is chief engineer for Globe-Union, Inc., Milwaukee.

●

The appointment of **Peter Kirchhoff** to the position of technical assistant to the superintendent of their steel plant was recently announced by the Babcock and Wilcox Company. He is married and holds a Bachelor of Science degree in metallurgy from the University of Wisconsin. Mr. Kirchhoff was a metallurgical process development engineer before his appointment.

END

Increasing Engine Performance - -

(*continued from page* 19)

used for valve-in-block engines, is relieving the block. This consists of grinding a shallow tapered channel at the top of the cylinder block between the valves and the inside edge of the cylinder to increase the flow.

13. Exhaust Gas Flow. The amount of waste gases left in the cylinder after the exhaust stroke depends on the back-pressure caused by the exhaust system. The gases which remain in the cylinder contaminate the incoming fuel-air mixture and also increase the engine temperature. Aside from porting the exhaust passages in the cylinder block, the pack-pressure can be greatly reduced by the installation of a dual exhaust system. This consists of dual exhaust manifolds and two mufflers which reduce the volume of exhaust gases in each side of the system, thereby reducing back-pressure.

14. The Camshaft. Modification of the camshaft profile will have a greater effect on horsepower output than any other single improvement. The cam affects the volumetric efficiency of an engine in three ways:

(a) The Rate of Valve Opening and Closing. To obtain the greatest amount of gas flow through a valve, the period of time it is open should be a maximum. This means that the time necessary for opening and closing should be short as possible. The rapidity with which the valves can be opened and closed is limited by the force which the valves and tappets can withstand.

(b) The Length of the Valve Open Period. The intake valve is opened before the piston starts downward on the intake stroke to allow it time to open fully and also to benefit from the exhaust jet effect to draw in the fuel mixture.

(c) The Amount of Valve Lift. The valve lift is kept comparatively small, illustration No. 3, since high speed operation tends to keep the valves open after the cam lobe has passed, even though heavy valve springs are used.

15. Stock Ignition Components. A battery-coil ignition system is used on stock automobile engines. This consists of: (a) a battery to supply the necessary current, (b) a breaker to open and close the circuit, timing the spark to correspond with the engine speed, (c) a coil to build up the battery voltage to the required spark voltage, and (d) a distributor to direct the high-voltage current to the proper spark plug.

16. Ignition Operation. With the ignition switch closed and the engine running, the ignition cycle starts when the breaker points close and battery current flows through the primary coil circuit. A magnetic field builds up around the wires of the primary coil, and when the breaker points open, the field collapses inducing a high voltage current in the many turns of the secondary coil. This high voltage current passes from the coil to the distributor where a rotating arm connects it with the proper spark plug, illustration No. 4.

17. Increasing Ignition Efficiency. When an engine is operating at high speeds, the period of time during which the breaker points are closed is very short and there is little time for the magnetic field to build up. Also, the spark voltage requirements of an engine increase as the speed increases. Because of the short period during which the breaker points are closed the engine loses power and will misfire as the engine speed increases. This can be remedied by installing two coils and breakers in the ignition system. The time available for building up the primary magnetic field is doubled, and at high rpm the available spark voltage is double that produced by a single, stock ignition system.

18. Lubrication. An important item when considering improving the performance of an engine is lubrication. In an automobile engine the lubrication system is designed to accomplish three things: (a) decrease friction, (b) limit the rate of wear, and (c) help cool the lower portion of the engine. Since heavier demands are usually placed on a modified engine, it is necessary to increase the lubrication capacity. This can be done by increasing the output pressure of the oil pump through adjustment of the oil pump relief valve.

19. Conclusion. The extent to which any of the methods of improving engine performance should be carried out on a given engine is dependent on the purpose for which the engine is intended. Some of the steps can be done readily with little expense, while others are costly and time consuming. The methods are merely outlined here, and a detailed report on each would be necessary before attempting to carry them out.

END

STATIC

BY I. R. DROPS

Two Wisconsin M.E.'s were on their way for vacation on a very cold day. They were riding a motorcycle, and the fellow in back was freezing, so when they stopped for gas, he took off his coat and put it on backwards, buttoning it up to keep out more wind. Soon after they started off again they ran smack into a telegraph pole.

The policeman who called in about the accident reported the following to the police chief: "The man riding in front was killed instantly. The man who was riding in back was still alive when we got there, but he died when we straightened out his neck."

•

The professor who comes in 15 minutes late is rather rare; in fact, he is in a class by himself.

•

British sailor (bragging about his ship): "'y say! Our flagship is so big the captain uses a car to drive around the deck."

NROTC Middie: "That's nuttin', our flagship is so big the cook uses a submarine to go through the stew seeing if the potatoes are done."

•

The old gray mare had her faults. That's why they put dashboards on the buggies.

•

God made a machine, the machine made men,
Doctors, lawyers, priests, and then,
The devil got in and stripped the gears
And turned out the first batch of ENGINEERS.

First Drunk: "Shay, do you know what time it is?"

Second same: "Yeah."

First D.: "Thanksh."

•

"Who was the cleverest inventor?"

"Edison. He invented the phonograph so that people would stay up all night burning his light bubs."

•

The drunk was crawling around on his hands and knees at three a.m. A cop ambled along and asked him what he was looking for.

"Lookin' for a pal o' mine," drolled the drunk.

"Why don't you stand up to look for him?" inquired the cop.

"I'm afraid I'll miss him that way. He's much shorter than I am."

•

E.E.: "Who spilled mustard on my waffle?"

Wife: "Oh John! How could you? This is lemon pie."

•

"Give me a match, Bill."

"Here."

"Well, can you beat that? I've forgotten my cigarettes."

"S'too bad; gimme back my match."

•

"I a v o i d girls. They are so biased."

"Biased! What do you mean?"

"It's always bias this and bias that until I'm broke!"

•

The height of bad luck—seasickness and lockjaw.

He who laughs last has found a meaning the censors missed.

•

Ch.E. (from back of room): "Are you sure this third test question is in the book?"

Prof: "Certainly I am."

Ch.E.: "Well, I can't find it."

•

The other day we met a man who had just reached the depths of disillusionment. He had spent two hundred dollars on a permanent cure for halitosis. Then he found out that no one liked him anyhow.

•

Fraternity Active: "Did you know that we maintain seven homes for the feeble minded?"

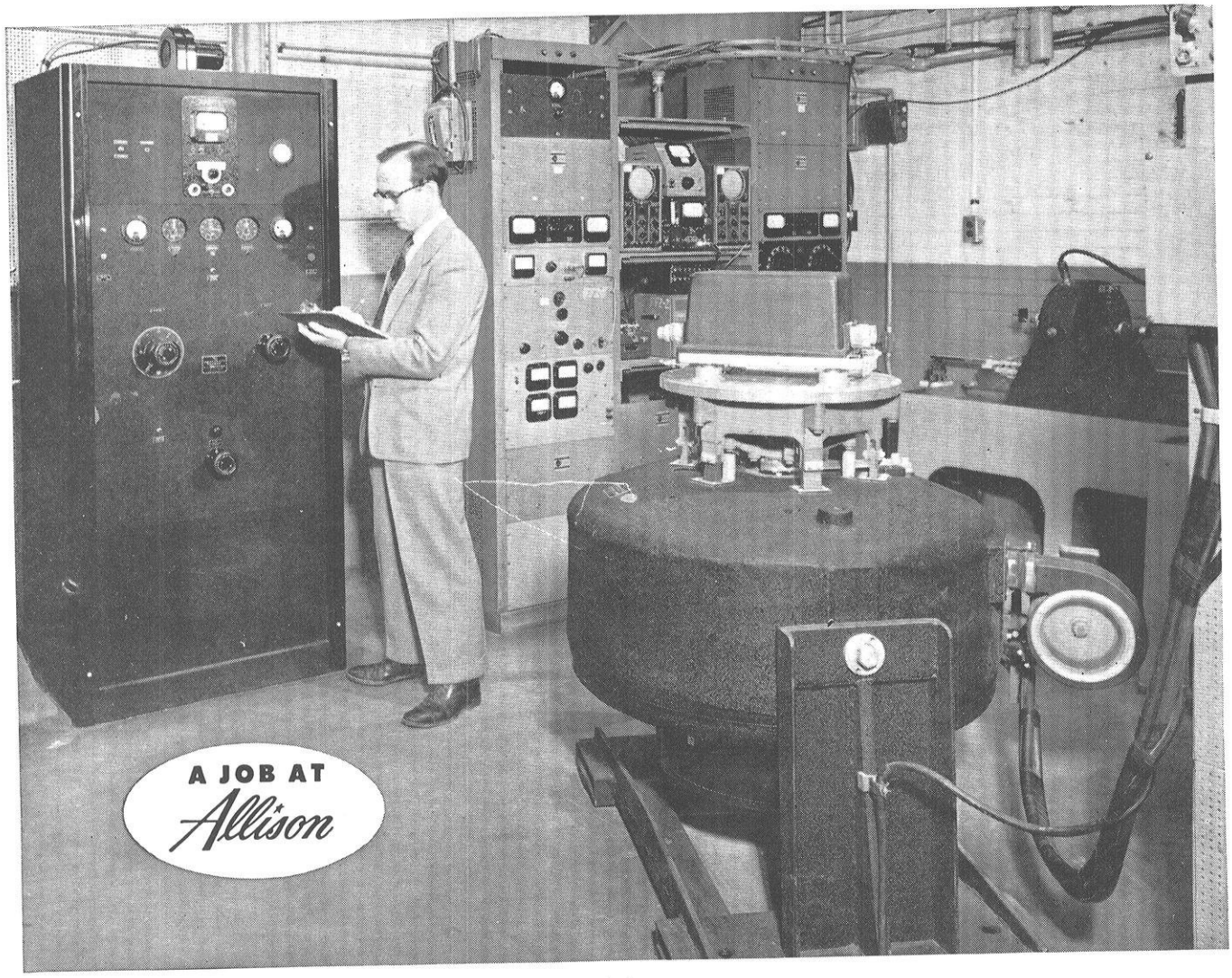
Pledge: "I thought you had more chapters than that."

•

Drink and the world drinks with you; swear off and you drink alone.

•

Getting out a joke column is fun, but it's no picnic.
If we don't print jokes, we are too serious.
If we do print jokes, we are silly.
If we take them from other magazines, we are too lazy to write them ourselves.
If we don't print contributions, we don't appreciate true genius.
If we do print them, the pages are full of junk.
And now, like as not, someone will say we stole these from some other magazine.
We did.



● Cort Kegley received his Masters Degree in Physics from Connecticut Wesleyan in 1951.

When the above picture was taken he had been on the job less than a month, and was one of a group of young graduates then in training at Allison.

Much of the experimental and test equipment at Allison is entirely different from any other. And, Cort—like other new engineers on the job—must first learn about these various facilities which he will be using in instrumentation and testing.

He is pictured here getting acquainted, so to speak, with some of the equipment used in vibration and shock qualification testing. One of the many electronic accessory units used with the Allison jet engines is here undergoing a "shake test" on the large MB vibration exciter shown in the foreground.

A turbo-propeller governor is bolted to the shake table of the exciter, which is controlled from the panel at the left, to determine if simulated engine vibration will cause the unit to malfunction. The large MB exciter has the capacity to exert a vibratory force of 2500 pounds, with a frequency range up to 500 CPS. A smaller MB exciter, shown on the bench in the background, is rated at 50 pounds peak force available to 2000 CPS.

• • •

Our long range program calls for additional engineering personnel. Why not plan early for your engineering career at Allison where unlimited opportunities are offered to young graduates, especially to those with degrees in Mechanical Engineering, Electrical Engineering, Aeronautical Engineering and Industrial Engineering.

For further information about YOUR engineering career at ALLISON, discuss it with your Placement Counselor and arrange for an early interview with the ALLISON representative the next time he visits your campus. Or, write now for further information: R. G. Greenwood, Engineering College Contact, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.

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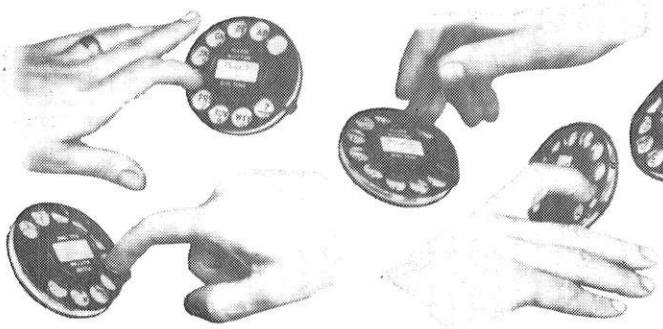
PHOTOGRAPHY AT WORK—No. 7 in a Kodak Series



Photography reads the meters *2500 an hour!*

Dial a call—an accurate register counts it—then each month photography records the total, precisely right, ready for correct billing.

TWENTY-FOUR hours a day, hundreds of thousands of dial phones click their demands in many central exchanges of the New York Telephone Company.

Little meters keep careful tally of the calls. Then the night before each bill is dated, photography reads the up-to-the-minute totals in a fraction of the time it could be done in any other way. Here is an idea that offers businesses everywhere simplification in copying readings on meters, dials or other recording instrumentation.

Photography fits this task especially well for two reasons. It is lightning fast. It can't make a mistake.

This is another example of the ways photography saves time, cuts costs, reduces error, improves output. In large businesses—small businesses—photography can do big jobs. In fact, today so many new applications of photography exist that graduates in the physical sciences and in engineering find them valuable tools in their new occupations. Other graduates—together with returning servicemen—have been led to find positions with the Eastman Kodak Company.

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

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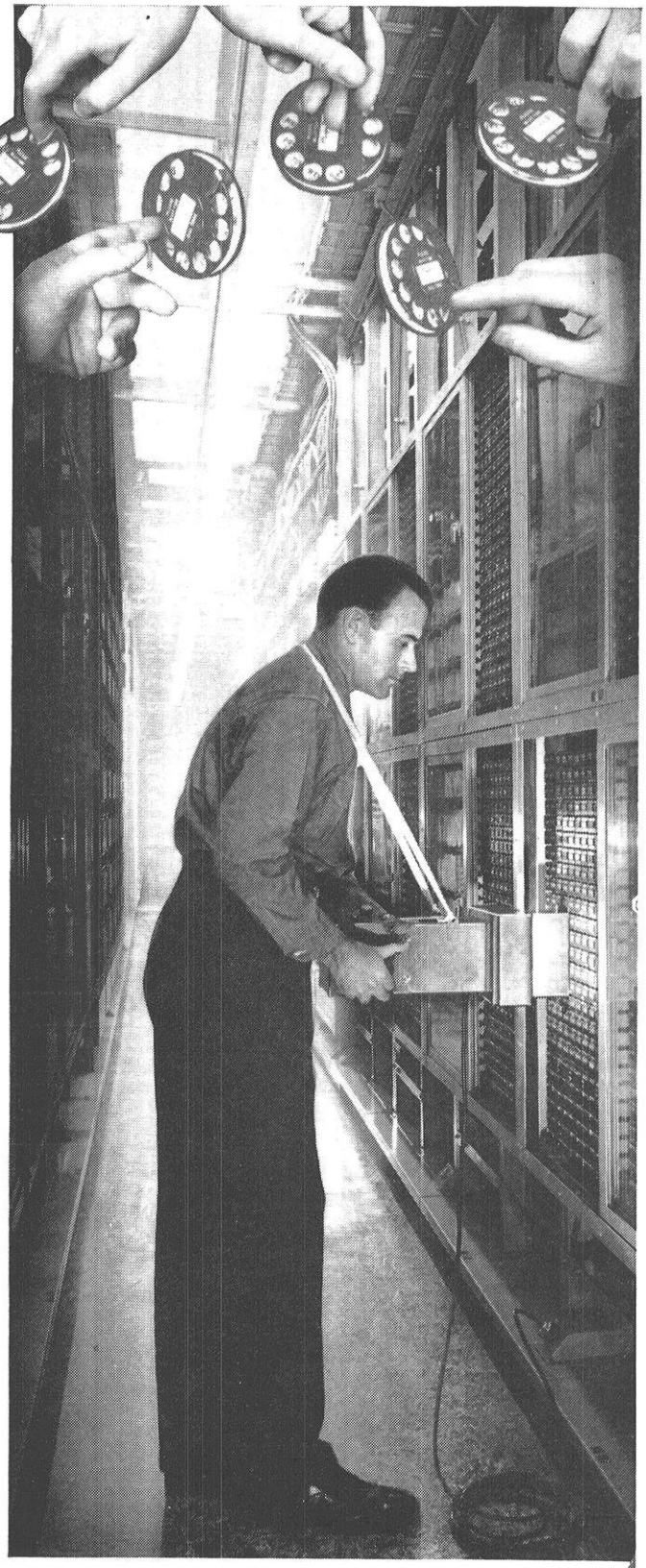

At New York Telephone Company exchanges a unique camera records the dial message register readings—up to 25 at a clip—saving countless man-hours of labor, assuring utmost accuracy and at the same time providing a permanent record.

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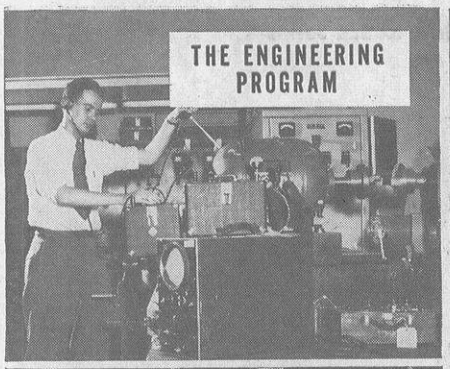

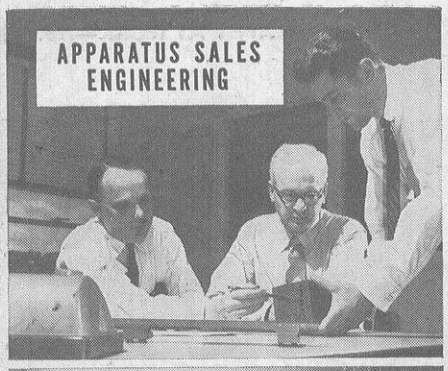

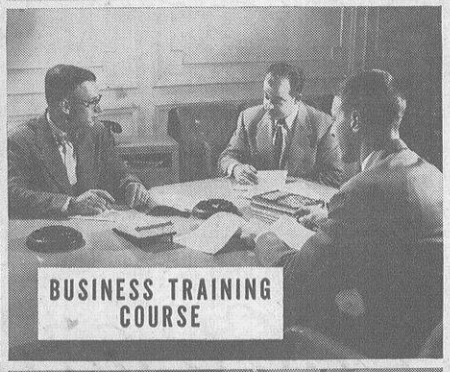

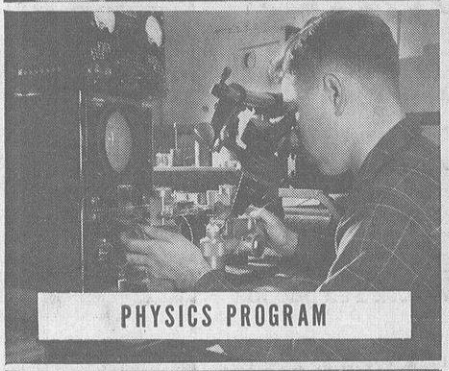

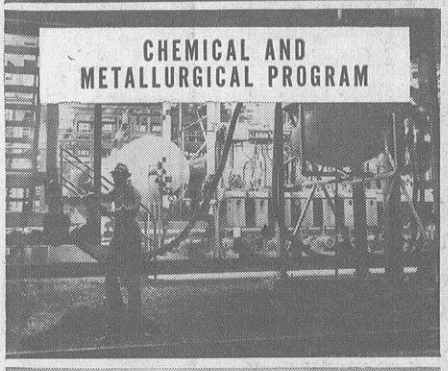

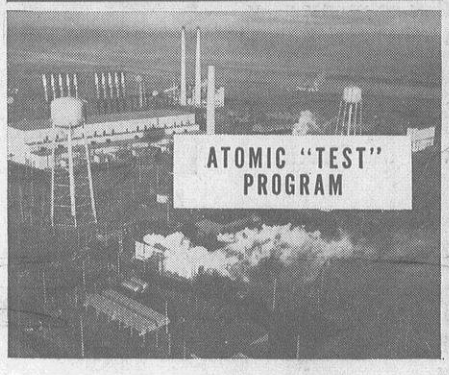

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