

Spartan

ENGINEER

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PERIODICALS

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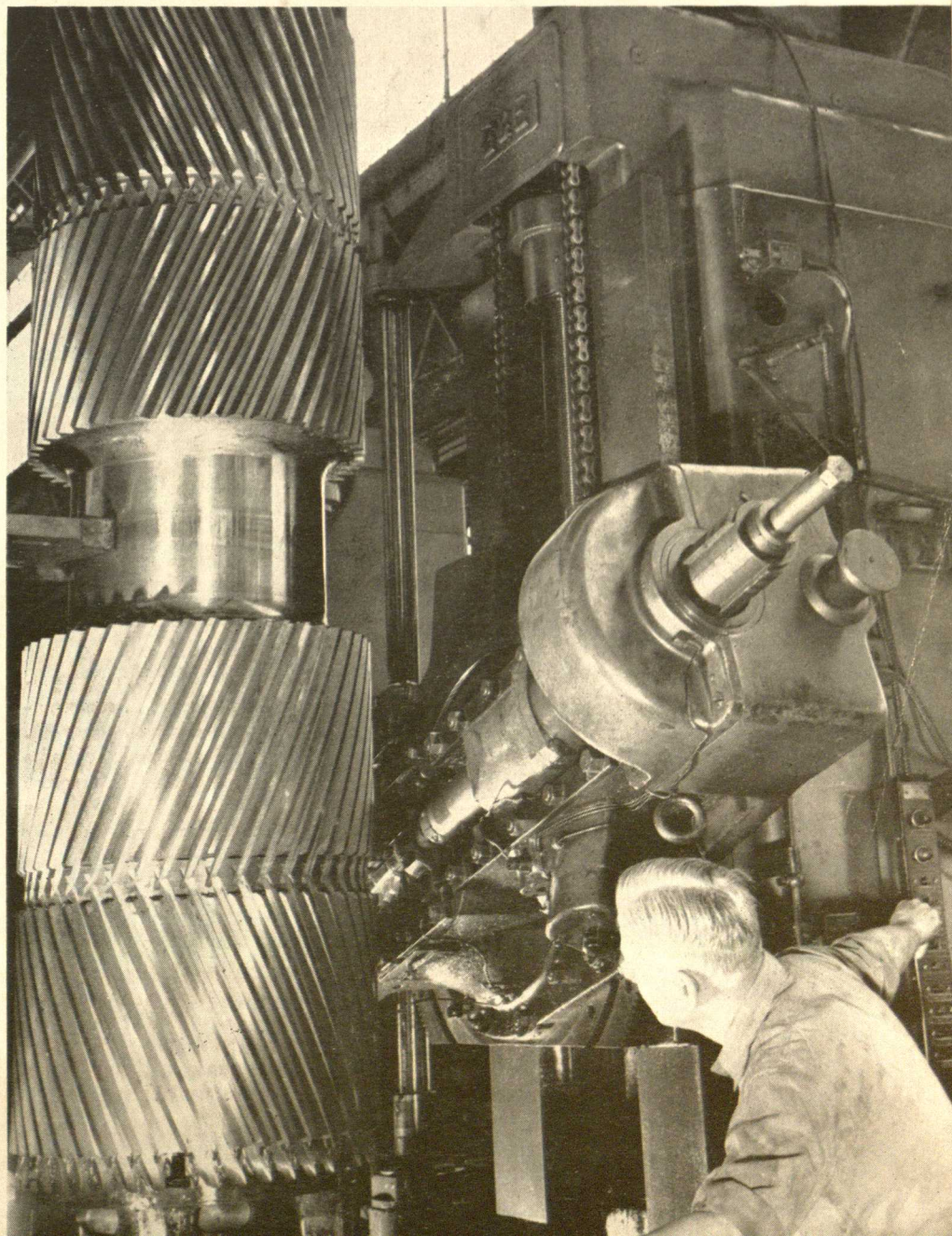
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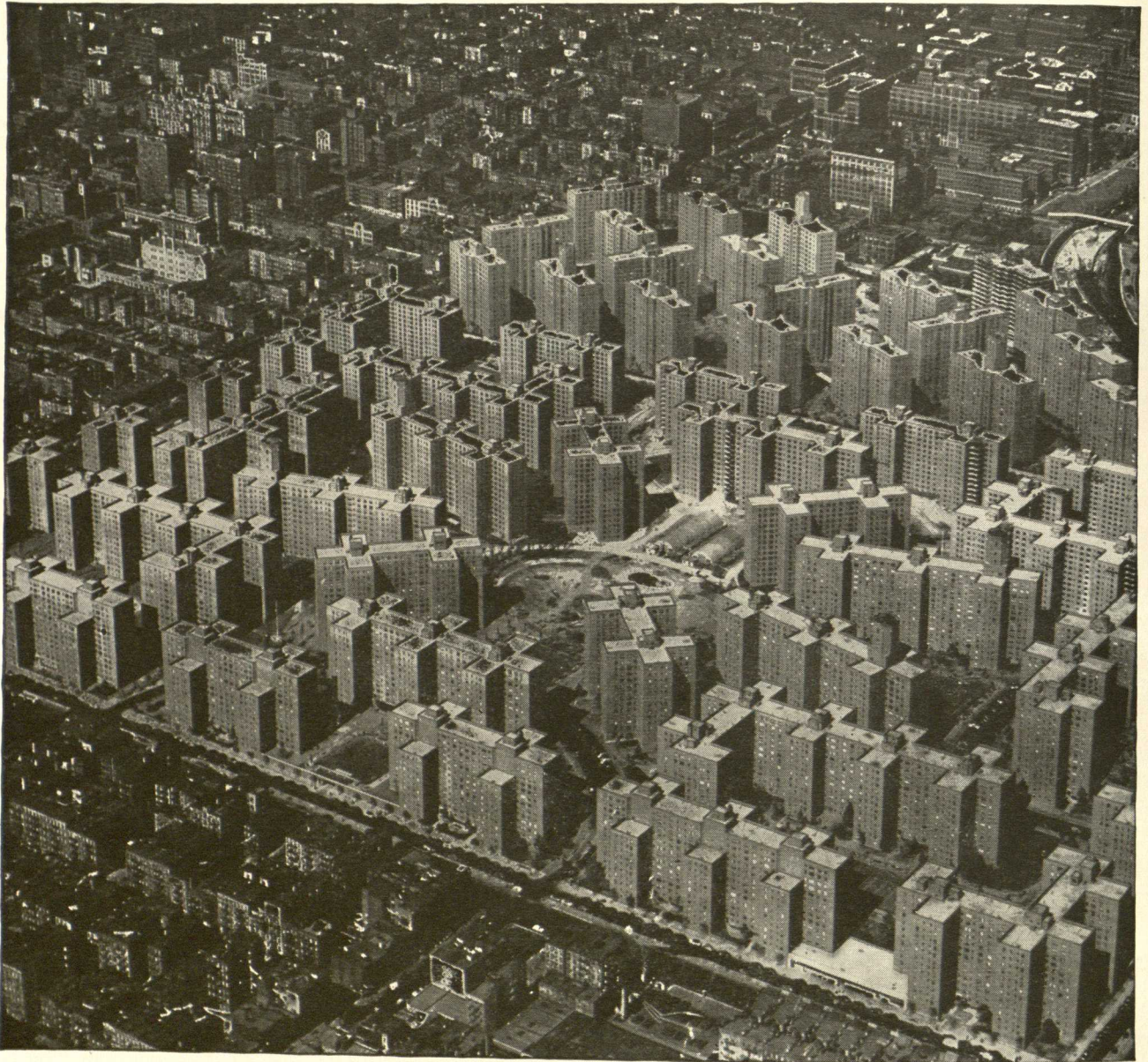
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MARCH, 1950
VOL. 3, NO. 3
TWENTY-FIVE CENTS



How to make 31,000 people happy



ONE of the biggest single housing developments ever undertaken has taken its place in the panorama of New York City's lower East Side. It is the result of cooperation between private enterprise, the State, and the City.

The rise of Peter Cooper Village and adjacent Stuyvesant Town has changed the face of this 80-acre section of Manhattan . . . has transformed a slum area of tenements and factories into modern,

roomy living quarters for 31,000 people.

Many similar projects . . . some perhaps not so large, some even larger . . . must take form before America licks its housing problem. And they'll all require vast quantities of steel, for steel is the backbone of modern construction.

Today the steel industry is looking ahead toward tomorrow's big projects. At United States Steel, a vast training program is going forward continually,

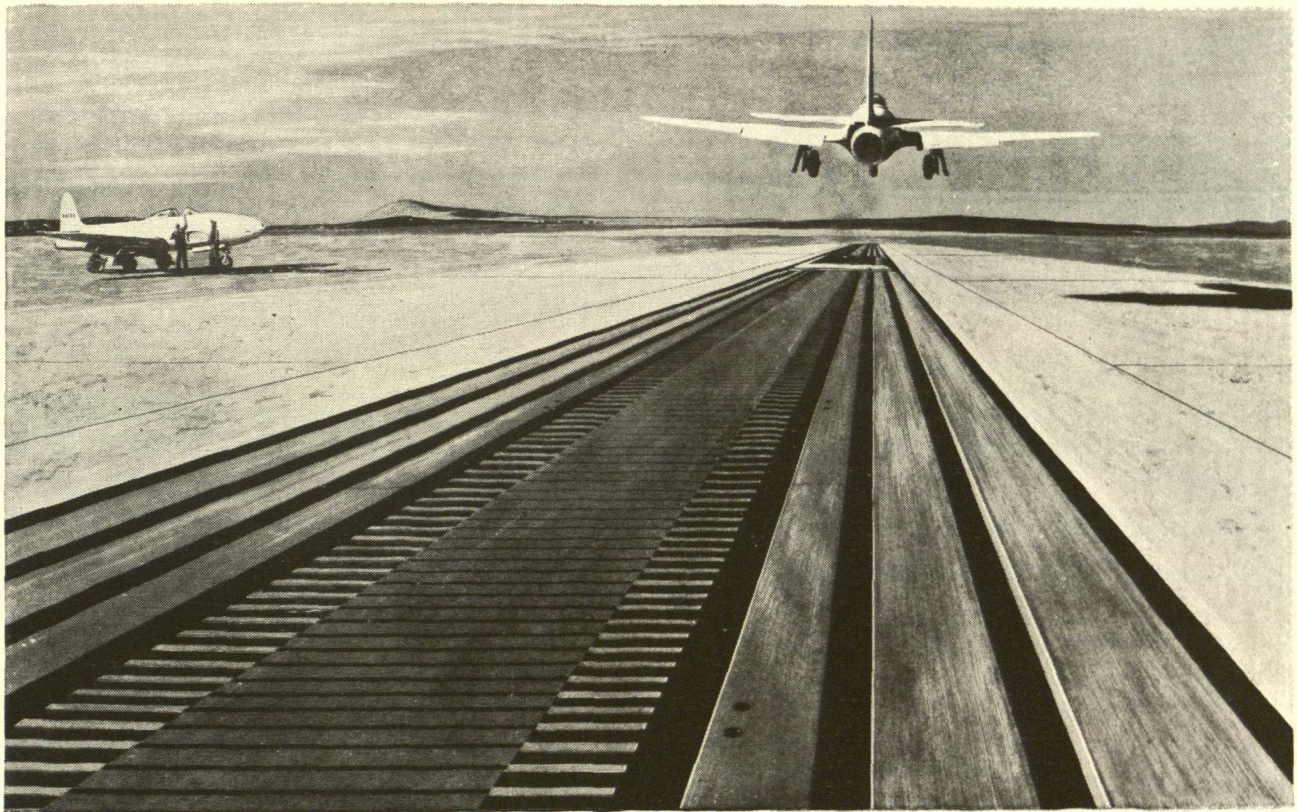
preparing men to handle the many highly-technical jobs that modern steelmaking involves. Many of these jobs are far removed physically from the roaring blast furnaces and glowing open hearths —at the same time, they are absolutely essential to today's precision steelmaking.

Through its training program, United States Steel is laying the foundations for promising futures for young men who meet its qualifications.



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H. C. FRICK COKE AND ASSOCIATED COMPANIES · GENEVA STEEL COMPANY · GERRARD STEEL STRAPPING COMPANY
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UNITED STATES STEEL EXPORT COMPANY · UNITED STATES STEEL PRODUCTS COMPANY · UNITED STATES STEEL SUPPLY COMPANY
UNIVERSAL ATLAS CEMENT COMPANY · VIRGINIA BRIDGE COMPANY

UNITED STATES STEEL



Great Names are built on Solid Foundations

Individual reputations, or futures, like that of a business, are built on solid foundations. So let's examine the basis of a solid foundation.

Suppose you had a problem . . . required some kind of power to help hurl a jet plane into action from a ship. That was a critical problem of the Navy in wartime.

They came to Westinghouse, where they knew they would find a strong foundation in power equipment. And Westinghouse engineers came up with the answer—a motor 1,400 feet long that lies perfectly flat . . . never turns . . . has no shaft

. . . that looks like a railroad. And it works . . . sends a plane into the air at 117 miles per hour.

This same daring spirit developed a 65,000-hp motor to pump rivers of water for a vast irrigation project, 20 percent larger than any motor previously built . . . and a motor so small that you can hold it in your hand, and that runs at the almost unbelievable speed of 65,000 rpm to do another highly important task.

This pioneering spirit prevails throughout Westinghouse, whether it's a need for motors, railway locomotives, gas turbines, steam power,

elevators, radio, electronic devices, x-ray machines, household appliances, plastics, lamps, lighting, atomic power development, or a need in any of the hundreds of other channels in which Westinghouse carves its name with engineering achievements.

Important responsibilities can only be placed on strong foundations. At Westinghouse, programs of training and education strengthen engineering backgrounds so that technical men can assume vital roles in a dynamic organization that stakes its future on the commitment:

YOU CAN BE SURE . . . IF IT'S Westinghouse

SHOCK STRENGTH



Strength factors of Long Life!

No pipe that is provably deficient in any of these strength factors should ever be laid in city streets

Without shock strength—or, for that matter—without all of the strength factors listed opposite—no pipe laid 100 years ago in city streets would be in service today. But, in spite of the evolution of traffic from horse-drawn vehicles to heavy trucks and buses—and today's vast complexity of subway and underground utility services—cast iron gas and water mains, laid over a century ago, are serving in the streets of more than 30 cities in the United States and Canada. Such service records prove that cast iron pipe combines all the strength factors of long life with ample margins of safety. No pipe that is provably deficient in any of these strength factors should ever be laid in city streets. Cast Iron Pipe Research Association, Thos. F. Wolfe, Engineer, 122 So. Michigan Ave., Chicago 3.



SHOCK STRENGTH

The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times on the same spot from progressively increased heights of 6 inches.

CRUSHING STRENGTH

The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

BEAM STRENGTH

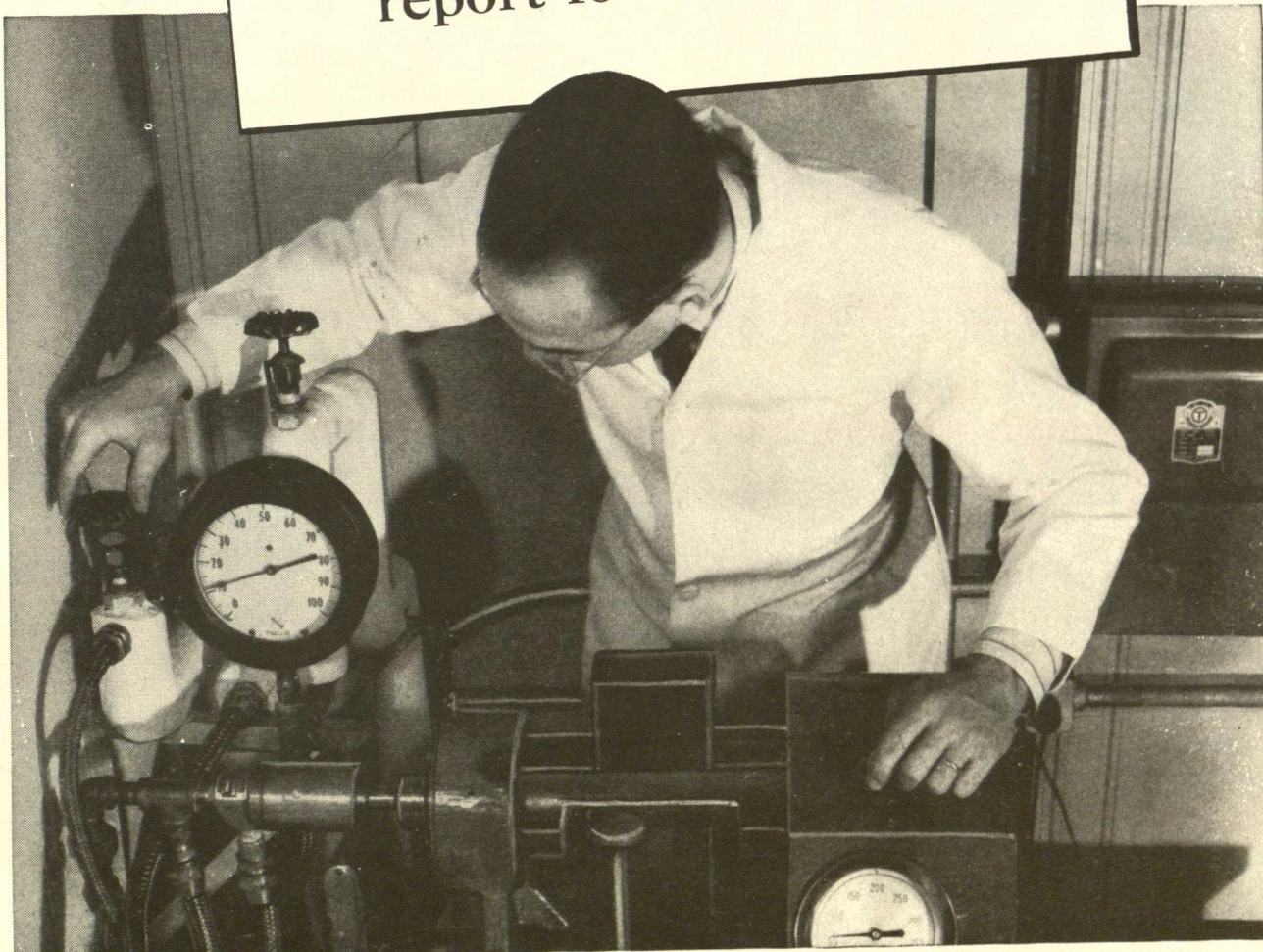
When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

BURSTING STRENGTH

In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

CAST IRON PIPE SERVES FOR CENTURIES

We have good news to
report for the journals



SOME JOURNALS are technical publications. Some journals are the parts of rotating shafts that turn in bearings.

For both kinds of journals, there's good news in Standard Oil's performance testing program. One result is a new testing device for mill and locomotive driving-journal grease that enables us to tell more accurately than ever before what our greases will do under actual conditions of use. That, in turn, enables us to proceed more directly with the job of making our greases still better.

Standard Oil took the lead in performance testing, and is a leader today. During the war

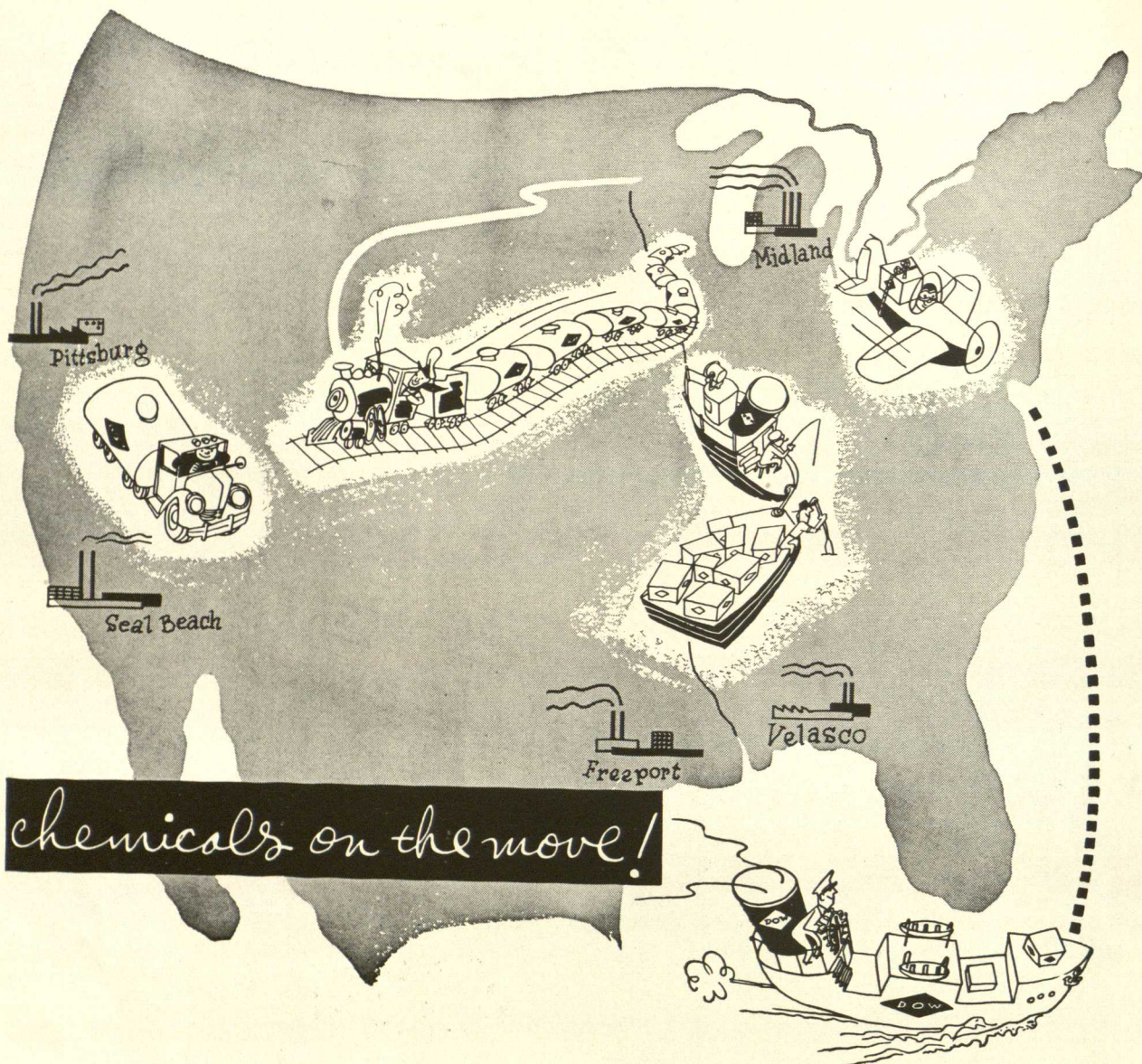
our tests furnished information that enabled the Army to procure certain products with greatly increased reliability of performance. Some of our tests have become a part of government specifications. Many users of our products are benefiting, both from better products and from more accurate information.

As time goes on, we are doing more and more performance testing. In some cases, we have to develop not only the tests but also the testing equipment. But to Standard Oil researchers and engineers, any effort is worth while if it will help make better, more useful petroleum products.

Standard Oil Company

(INDIANA)





By plane, train, truck . . . by boat and barge . . . by nearly every type of transportation, Dow chemicals move across the nation. There are weed killers for the prairies, insecticides for the almond and fruit growers in California, epsom salt for the tanneries in Massachusetts, caustic soda for the paper mills of Washington and soil fumigants for the truck gardens of Florida. These are but a few of more than five hundred Dow chemicals serving American industry and agriculture.

A well-organized sales and distribution system is required to move so varied an output of chemicals into a multitude of major industries from coast to coast. At Dow, this complex distribution problem is solved by strategically locating plants, branch offices, and warehouses near the nation's production centers. In many instances, the much-needed material can be shipped overnight from Dow to processing plants in the vicinity.

This close relationship to industry results from Dow's progress throughout the years in production, sales and distribution of chemicals "indispensable to industry and agriculture".

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

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Although the registration examination cannot be completed until four years after graduation, the portion of the test covering theoretical subjects may be taken at any time. The state board gives the exams twice a year, usually in June and December.

Hendrick contends that most men will find it easier to complete as much of the test as possible while their college work still is fresh in their minds.

According to Hendrick, the National Society of Professional Engineers was organized to give to the engineering profession the same dignity, standing and protection that the Medical Society gives to the physician and the Bar Association assures the attorney. The NSPE boasts 23,000 active members organized into 32 state organizations. Membership is limited to licensed professional engineers.

Regular meetings of the Grand Valley chapter are held in the Union on the second Tuesday of each month. Dinner is served at 6:30 and a business meeting follows. Always included on the program is a technical talk by an outstanding engineer.

Engineering students and faculty members are invited to these meetings, according to Hendrick. Visitors are not required to attend the dinner, but they may do so if they wish. The technical discussions start about 7:30. It is attempted to have notice of the date and place of the meetings published in the State News and announcements are posted on the Union bulletin board.

* * * *

A FLOOD OF NEW SOCIETIES AND HONORARIES has hit the School of Engineering this year, but we are inclined to regard this as a healthy situation in a college the size of MSC.

Among the societies, there are three additions. Last fall, the Society of Automotive Engineers and the American Foundrymen's Society were organized while the American Society of Heating and Ventilating Engineers is in the process of gaining recognition at the present time.

Besides Phi Lambda Tau, local all-engineering honorary which was reactivated last fall, three departmental honoraries are in the process of formation.

In the ME department, plans are well under way for an MSC chapter of Pi Tau Sigma, national honorary mechanical engineering fraternity.

Another group — the EE's — had hoped to instigate a local chapter of Eta Kappa Nu, national EE honorary. However, the plans were not started soon enough for national affilia-

tion, so it now is expected that they will organize on a local scale and go national next year.

The third group is the Chem and Met E's who are planning a local honor group with no present plans for national affiliation.

We are strongly in favor of the formation of these new groups. Most of the large universities in the country already have such organizations and we feel they will prove a valuable addition to State.

* * * *

WE'VE HEARD A FEW COMPLAINTS that some of the fellows are having trouble with their Pickett and Eckel slide rules. Most of the trouble seems to be with the faces of the scales either chipping or wearing away.

According to the Union book store, they will make a replacement or an adjustment on all P & E rules where the difficulty is due to poor material or faulty workmanship. Of course, the book store will do nothing in cases where the damage is the fault of the student.

* * * *

THE ENGINEERING COUNCIL HAS plans well under way for this year's Engineering Exposition scheduled for May 12 and 13. It is expected that the event will prove even bigger and better than last year.

According to Bill Fiscus, council president, arrangements are being made for a number of professional exhibits from industry concerns to supplement the student displays. In addition to the exhibits, there will be speakers and movies, and possibly a dance in the Union.

To make this second annual exposition a real success, the council is going to need the cooperation of every student in the School of Engineering. It is hoped that each student engineering organization will have a display. Most of the societies already have their projects well under way.

DON'T MISS IT . . .

In the May issue, Mel Sandler explains the latest developments in time study without a stop watch.

Photoelectric Cells



Electronic Labor Savers

By Charles E. Paul
Junior, E.E.

DURING THE LAST FEW YEARS, THE photoelectric cell has been rapidly introduced to the general public. Not only has it been used in a variety of industrial applications, but it has become increasingly popular in everyday business.

The recent appearance of the photoelectric cell would lead one to believe that it is relatively new. However, just the opposite is true. The photoelectric effect is comparatively old but its possibilities are just starting to be realized and developed.

This electronic device is taking over many tedious tasks in various occupations. It also is being used where close tolerances of light are employed. Some tasks could not be done at all without the photoelectric cell.

There are three main types of photoelectric cells classified as photoemissive, photoconductive, and photovoltaic. The various characteristics will be described in that order.

* * * *

THE PHOTOEMISSIVE CELL IS BY FAR the most important and most used in industrial application.

In 1887, Heinrich Hertz discovered the photoemissive effect while experimenting with inductive currents. The following year, Wilhelm Hallwachs confirmed this discovery while studying charged zinc plates. Two years later, Elster and Geitel investigated the light-sensitive properties of alkali metals. These metals were found to give stronger currents,

and most important, would respond to ordinary visible light.

The photoemissive cell is composed of a semi-circular metal plate and a straight piece of wire enclosed in a glass envelope. The phototube looks much like the conventional vacuum tube.

The semi-circular metal plate is the cathode and the wire is the anode. The wire is placed at the axial center of the semi-circular plate. The inner surface of the plate is coated with a thin layer of a light-sensitive material.



This recording spectrophotometer can detect and record more than two million different colors. (GE photo)

The tube is either evacuated or filled with an inert gas. The gas filled tubes are more sensitive and have a larger current output due to ionization of the gas.

In the photoemissive cell, light-sensitive materials emit electrons when acted upon by light or other radiant energy. The small current produced by these electrons is increased by use of a vacuum tube amplifier. The larger current from the amplifier is used to close a relay.

To use the photoemissive type of cell, a separate voltage source must be supplied. The voltage, when properly connected, attracts the electrons emitted from the cathode to the anode. In addition, the voltage is used to operate the amplifier.

The main advantage of the photoemissive cell is its instantaneous response.

* * * *

THE PHOTOCONDUCTIVE EFFECT WAS first observed by Willoughby Smith in 1873. At this time, Smith was working as a telegraph electrician in the Azores. One day, while testing his lines with selenium resistors, he found marked differences in resistance from bright areas to those that were shaded. After careful investigation, he found the selenium resistors changed resistance when subjected to different light intensities.

The photoconductive cell is made by close turns of wire on an insulating material. The wire is painted with a conductive substance, annealed and placed in a gas filled tube.

The resistance of the photoconductive cell decreases with an increase in light. This change of resistance produces a current change which is amplified and operates a relay in much the same way as the photoemissive cell.

However, this type cell doesn't have an instantaneous response and the change of resistance is not proportional to the light intensity.

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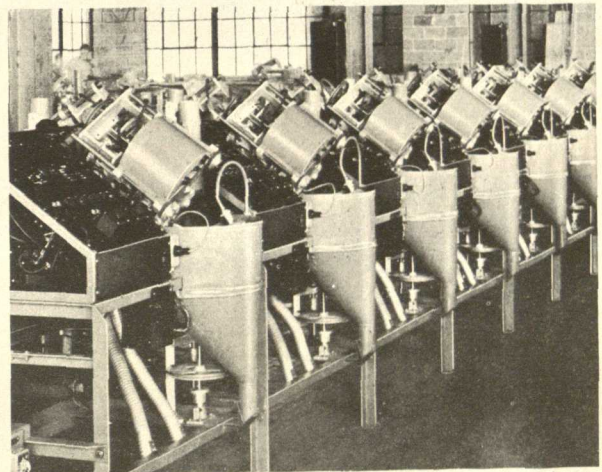
A THIRD TYPE OF PHOTOTUBE IS THE photovoltaic cell. Edmund Becquerel, a French scientist, recorded observation of this effect in 1839. While studying this effect, he discovered that green gave the greatest current output.

The photovoltaic cell is made by oxidizing a copper plate in a flame and chemically changing to cuprous oxide by treatment with dilute sulfuric acid. This plate is known as the cathode. The anode of the cell is a lead plate of the same size. The two electrodes are immersed in an electrolyte and the entire unit is enclosed in a small bakelite case

having a glass window. The window serves to admit light to the cuprous oxide producing an electromotive force (E.M.F.). The photoelectrons liberated by this process come from between the oxide layer and the mother copper.

Another type of photovoltaic cell is the "dry disc". It is made by covering one side of a copper disc with copper oxide, which in turn is covered by a very thin layer of aluminum. In darkness, this cell acts as a rectifier, but produces an E.M.F. when subjected to light.

Photovoltaic cells can be used where a source of voltage is not conveniently available. It can operate a sensitive relay with the internal voltage which it develops. A practical example is the exposure meter used in photography.



Electronic machines in a Michigan plant sort 80,000 beans daily. (Electric Sorting Mach. photo)

The voltaic cell has an output nearly proportional to the light intensity. But because of the time lag, it is not used where an instantaneous response is desired.

Although the voltaic cell requires no external voltage source, it is sometimes desirable to increase the voltage output of the cell. The amplification is performed by use of a vacuum tube amplifier. When amplification is used, a separate voltage source must be present.

* * * *

A MORE RECENT VERSION OF THE photoemissive cell is the "photomultiplier tube". This tube emits photoelectrons in the same way as the photoemissive cell. The difference is in the path of the electrons. The electrons in the photoemissive cell go directly from the cathode to the anode, but in the photomultiplier tube, there are several plates from which the electrons bounce before arriving at the anode. These plates are coated with a material having good secondary emission properties.

(Continued on Page 30)

Color TV



A Brief Comparison Of Two Basic Systems

By Arnold V. Nelson
Soph., E.E.

ALTHOUGH THE NUMBER OF TELEVISION stations in operation today has nearly reached the one hundred mark, at the present time, no noticeable increase beyond this is anticipated. The important reason for this can be told in two words – Color Television.

Color television is still in the demonstration stage. There are 350 station applications pending at the present time and they are all waiting because of color television. The Federal Communications Commission is planning to study these demonstrations before it will begin issuing more licenses. The FCC expects to add 42 new channels, of which many will be set aside for color TV. But before the FCC can give permission to the color television industry, it must decide upon the system to be used. The main feature wanted is a system that will not make black-and-white sets obsolete.

The two main contenders are Radio Corporation of America and Columbia Broadcasting System. These two use different systems for the reproduction of color.

Behind the success of both systems, as with present black and white television, is the basic theory that it is all optical illusion. On the screen of a set at any instant is a rapidly moving bright spot that scans back and forth, covering the screen with 525 lines of light. The slow-reacting human eye sees this as a picture. These pictures are produced at the rate of 30 frames per second, and are blended by the eye to give the illusion of motion. Elements of pictures in the primary colors – red,

green, and blue – will blend in a like manner, giving the illusion of a colored picture.

* * * *

THE RCA SYSTEM, CALLED "DOT Interlacing", is entirely electronic, has high definition, and operates within a six-megacycle band. Being entirely electronic means there are no mechanical devices, such as rotating discs. High definition is accomplished by maintaining 525 lines scanned per frame.



RCA Photo

Color television in operation.

In the transmitting camera are three tubes. In front of them are dichroic mirrors. These mirrors are plates of glass having one surface covered with a thin transparent layer. Certain wavelengths of light are reflected while other wavelengths will pass through. Thus, each tube "sees" only one color. One will provide green; another, blue; and the other, red. Each tube scans the scene continuously, but a sampling device samples each color for a very short time — 3.8 million times per second. The composite output of the sampler consists of a superposition of the green, red, and blue.

The color signal is sent over the air on one wave band. The TV receiver has three picture tubes which are similar to black and white tubes except that each has a phosphor which produces a different basic color. There is practically a reverse process in the receiver as compared to the transmitter and camera. There is a device here which separates the three colors and sends them to separate video amplifiers and then to three kinescopes.

Each impulse arriving over the radio wave is electronically switched to the properly colored tube. They arrive in such rapid succession that each tube face is covered fifteen times a second with a pattern of tiny dots corresponding to the red, green, and blue in the scene being televised.

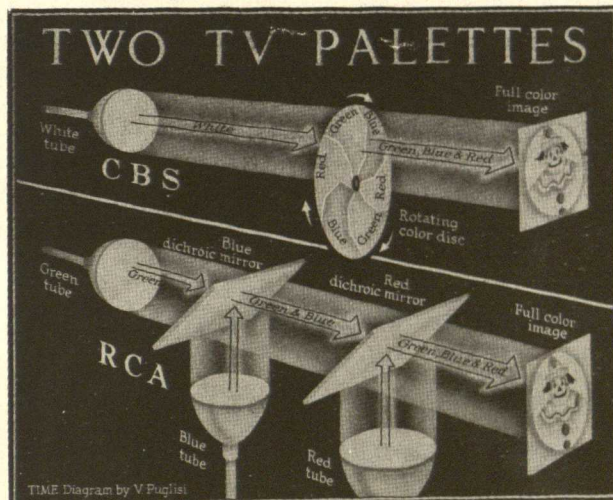
The final step is to combine the three colors into one picture. This is accomplished with two dichroic mirrors arranged so that light from the red and blue tubes is reflected to the eye of the viewer. The green light is not reflected, but reaches the eye direct. The viewer sees the three colors superimposed, forming a full-color picture.

* * * *

THE CBS SYSTEM IS BASED ON ENTIRELY different fundamentals. The transmitting camera consists of a single-image orthicon "seeing" tube. A spinning disc made up of segments of red, blue, and green transparent plastic is placed in front of this tube. When the disc turns, revolving a green segment in front of the tube, the camera sees only the green in the scene. But synchronizing the disc with the scanning speed of the tube, one-color "fields" can be transmitted and appear one after the other on the face of the picture tube.

These pictures on the tube are white. However, in front of the picture tube is another rotating disc synchronized with the one at the transmitter so that a green segment is between the tube and the eye of the observer at the same instant a "grey" field appears on the tube. The other two colors are obtained in the same manner and the three are blended into a colored picture by the eye.

EACH COLOR SYSTEM HAS ITS OWN advantages and disadvantages. A brief comparison follows: The main point of the RCA system is compatibility. When a station is telecasting black and white, the color receiver will show black and white, and when the station telecasts color, color will be shown without any changes being made. Present sets could receive both types in black and white. Owners of current sets could convert or make no changes and still see both types of television in black and white. CBS points out that its system has been tried and proven. To receive the CBS color television, a convertor would be necessary. This convertor would have to be taken away during black and white telecasts and put in front of the picture tube during a color program. In addition, for a set



TIME chart by Robert Chapin. Courtesy of TIME. Copyright Time Inc., 1949.

owner of today to see color telecasts in black and white, an adapter would have to be purchased. This also would have to be switched on and off when a station changed from black and white to color.

Thus, the main difference between CBS and RCA is that the former makes use of a mechanical device which is relatively simple in theory, and the latter uses an all-electronic system which is rather complicated with its three kinescopes.

A third and somewhat smaller contender in the field is Color Television, Inc. They have a "line sequential" system. It makes use of a single picture tube with three layers of differently colored phosphors on its face. The colored pictures are combined by projection lenses on a common screen. As yet, this company has not shown its color pictures officially.

No matter which system is decided upon, color television is definitely on its way. Just as 1948 was "television's year", so will there be a year in the near future which will be labelled "color television's year."

Roads To Travel

The Birth Of A Highway Is A Complicated Process

By Earl Rogers
Senior, C.E.



TODAY IT IS RELATIVELY SIMPLE TO hop into a car and travel several hundred miles to visit a friend. A quarter of a century ago this would have been considered quite a trip even by the seasoned traveler. Have you ever wondered what brought about this change from poor gravel roads to the modern concrete ribbons of today?

The question is answerable in the state road design office of J. C. Myers, a former CE professor at MSC. Although Myers draws the first line on the aerial photographs, he is quick to point out that much investigation is needed before he goes to work on a road. His proposed routes are subject to many modifications and sometimes complete vetoes.

For example, the need for a road must be proven. This need also must be brought to the attention of the proper highway department officials. Sometimes this information is forwarded by a local group, but, generally, the need already is common knowledge in the road design division. An outsider would be impressed with the mental picture the veteran employees in the road design division have of the entire state road system. This awareness, plus the continuous traffic surveys, eliminate the need for formal preliminary investigation of need.

When need of a road is made known by a local group, Commissioner Charles Ziegler, or

one of his deputies, will visit the location and order a formal investigation if the situation appears to merit it. This investigation consists of complete aerial photographic coverage, traffic counts, and a survey of the existing industrial and tourist traffic.

Aerial photography, costing one-sixth as much as a land survey, allows the investigation to be made without the public becoming aware of the possible location of a new highway. The photographs cover the area on a scale of 1:4800 up to 1:20,000 and furnish valuable data to the expert.

Traffic counts may be actual counts or may involve check stations where drivers are questioned. This phase of the investigation attempts to determine when maximum traffic exists, the duration of maximum traffic conditions, why persons are travelling, how far they are going and where they entered the road. This information complements the industrial analysis in evaluating the economic importance of the road.

From his observation of the photographs Myers obtains a surprising amount of information to use in deciding upon a new road route. For instance, he can determine land values by observing the type of crops and the type of soil. He also can judge the terrain and determine the elevations by means of a stereoscope. In addition, he must consider the general

Alumni Notes

By Bob Kitchen
Freshman, C.E.

angles at which the new route will cross property lines — for diagonal crossings will increase rates paid landowners due to separation of buildings and property.

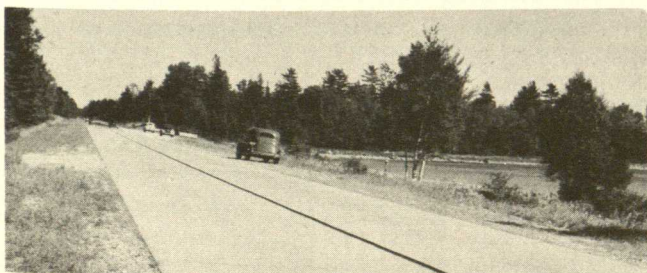
Then, after assuring conformance to highway department standards of alignment, the planning section proposes several routes with strong attention to the costs and expected financial return from the road.

Economically the road is designed on a twenty-year basis with the cost and return expected to balance out at the end of that time. The method of this determination can be reduced to an equation: traffic per day, times mileage saved per car, times 365 days per year, times operational cost per mile of travel, times times 20 years of operation, must equal the cost of construction plus 20 years of maintenance cost.

Naturally, the costs vary with the type of road desired. A two-lane highway runs \$75,000 per mile, while an expressway is three times that amount. However, the heavier traffic load, the increased driving speed, lower fuel costs and reduced accident rate must be included in the final evaluation of the new road's worth.

The conclusions of the planning section are forwarded to the commissioner and other interested officials. Then, if the budget permits and legislation does not prohibit it, the project is released to the various divisions of the highway department.

A preliminary survey crew makes a topographical survey of the general area along the proposed route, listing pertinent data. Working from this information, the road design division decides upon a centerline, which is followed by a second survey crew. This crew determines elevations at the centerline and shoulder



Looking east on U. S. 2 in Mackinac county.

margins every 100 feet or less. This study provides the basis for setting grades and determining the cut and backfill.

At this point earth moving costs and material costs are estimated. These are submitted along with the specifications to the contractors for bids. The highway department follows the job through its entire construction and its baby, the highway, is born.

RICHARD COOK ('33)

Richard W. Cook recently was named acting manager of the Atomic Energy Commission's office at Oak Ridge, Tennessee. As manager, he will administer all contracts for the AEC covering operations of the Uranium 235 production plants; the Oak Ridge National Laboratory; the community of Oak Ridge, and other related activities carried on within the area.

Cook has had more than five years experience with the atomic energy projects. He was assigned to the Manhattan engineering district at Oak Ridge in July, 1944. He held several responsible posts in the Manhattan district organization, for which he was awarded the Legion of Merit.

Born in Muskegon, Mich., in 1907, Cook graduated from MSC as a Civil Engineer in 1933. He spent two years with marine contractors and five years with a firm of consulting engineers in Chicago. He entered the army in October 1940, and served with the quartermaster and engineer corps before going to Oak Ridge.

JOHN KARPOVICH ('42)

In January 1948 John left for Melbourne, Australia to do research work at the University of Melbourne. At present he is studying for his Ph. D. at the Imperial College of Science and Technology at London university in England.

John graduated as an E.E. in 1942. Entering the service immediately, he was released in October 1946. From that time until January 1948, he was engaged in electronic development with General Electric.

BRIEFS

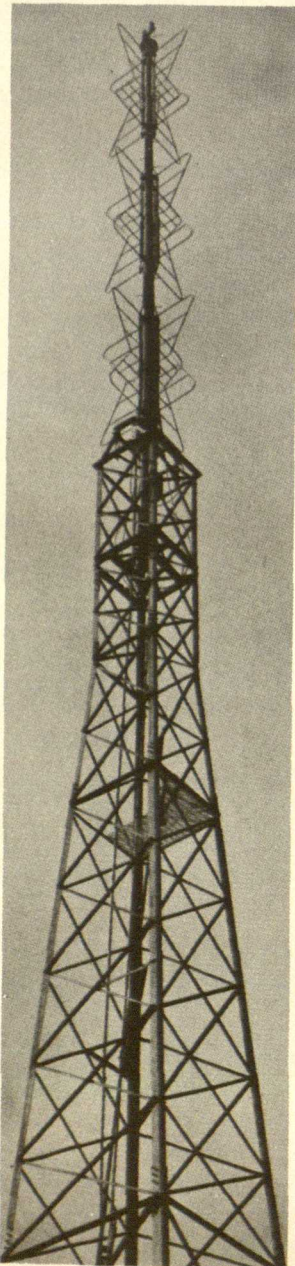
George Dow, '37, is a Plant Design Engineer in charge of plant layout for the Clark Equipment Co.

Robert Bowen, '44, is in business for himself as a partner of Bowen Engineering and Construction Co. He is doing surveying, road construction and general engineering.

Robert Bottoms, '39, is Progress Engineer for the Austin Co., at present working on the Argonne National Laboratory for the University of Chicago.

TELEVISION for LANSING

By **Bob Kuhn**
Junior, E.E.



TELEVISION IS COMING TO Lansing!

WJIM-TV will have its test pattern on Channel Six during the first part of March. Full-time programming will begin as soon as the necessary equipment tests are completed. From its new location on East Saginaw Street, its primary service area is expected to extend 30 to 35 miles.

Both network programs relayed from Detroit and programs originating locally will be broadcast. A relay station near Milford, Michigan will be used to relay the network programs. At Milford the television signals are received with the aid of an 8-foot parabolic reflector and are re-transmitted on 2024 megacycles. These signals are then received at Lansing, monitored, and rebroadcast on WJIM-TV.

The antenna at the new location is an RCA 3-bay "batwing" assembly atop a 300-foot guyed tower. The tower is of the base-insulated type and also will be used for AM when the installation is completed. This antenna has a power gain of 4.3, resulting in an effective radiated power of 18.7 KW on video and of 9.35 KW on sound.

Each of the three bays on the antenna consists of four "bat-wing" shaped radiators mounted at 90

(At left) New "batwing" antenna to be used by WJIM-TV.

degree intervals around the steel pole. The bays are mounted approximately one-half wave-length apart, center to center. The radiators are attached to the grounded pole at top and bottom. This effectively grounds the entire structure for lightning protection.

The horizontal radiation pattern is nearly circular, so that the signal is radiated equally well in all directions.

Enter —

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SPARTAN ENGINEER
PHOTO
CONTEST

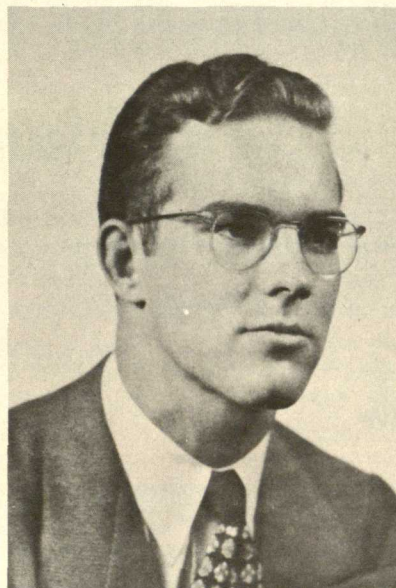
SEE
PAGE 6
FOR DETAILS

WE PRESENT . . .

Herman H. Bickel

TAILOR OF BOILERS

By Harry Horn
Senior, E. E.



DID YOU KNOW THAT VIRTUALLY ALL large boilers are tailor made? Each individual boiler is designed within the usually narrow limitations imposed by the needs and wants of the individual customer. That is why we call Herman H. Bickel a tailor of boilers.

Mr. Bickel is Chief Engineer for the Wickes Boiler Company in Saginaw, Michigan. He was graduated as a Mechanical Engineer from MSC with the class of 1922.

He had always had a strong inclination toward power production and, upon graduation, made a successful bid to enter The Wickes Boiler Company. He began as a draftsman and made steady advancement until he became the company's Chief Engineer in 1932.

The specifications given to a tailor of boilers differ considerably from the specifications given to a tailor of clothes. Mr. Bickel cited a few of the major items to be considered in boiler design. They are: (1) steam requirements (in pounds per hour, pressure, and temperature),

(2) size and shape of the building intended to house the boilers, (3) the type of fuel, (4) the kind of fuel-burning equipment to be used, (5) the degree to which the flue gases are to be cooled and cleaned.

Mr. Bickel pointed out that the boiler-making business is a rapidly advancing one. Its progress has moved at an exhausting pace since he first entered it in 1922. The maximum boiler output in 1922 was approximately 25,000 pounds of steam per hour. Today, outputs range up to forty times that figure. Steam pressures have increased from about 250 lbs./sq. in. to 1,000 lbs./sq. in. In 1922, furnaces were built with refractory walls 18 to 22 inches thick. Today, the walls are only five to eight inches thick mainly due to water cooling of walls.

Mr. Bickel proudly mentioned that all boilers on the Michigan State campus are products of the Wickes Boiler Company.

Born and raised on the farm, Mr. Bickel
(Continued on Page 30)



HERMAN H. BICKEL

Spectator Engineering

Fascinating Field For Flunking Freshmen

By William Throop
Junior, S.E.

LAST WEEK I DECIDED TO HAVE A LITTLE heart to heart chat with my old buddy Dean Miller. I thought that with all of these new professional engineering organizations and fraternities being installed here at MSC, perhaps the Dean would see fit to consider my plan for another new department in the school of engineering. This department would be called Spectator Engineering. Just the thing for a man of my abilities.

After giving my plan for a new Spectator



This view shows the many advantages of MSC's "huge" coal pile as a location for a Spectator Engineering Society meeting.



Engineering Department his enthusiastic approval the Dean got in immediate contact with the University of Ignorant Idiots of Utipedis in lower New York State. Their Spectator Engineering Department, founded in 1803, is reputed to be one of the best in the country. I guess the Dean was really sold on the idea. He has adopted U.I.I.U.'s set-up for a Department of Spectator Engineering to a tee. We will have a department of our own at MSC next spring term.

The basic courses in the department will consist of observations on the women's dorms and a course in blasting and demolition. This course is open only to those students who want to: (1) do nothing but watch blasting and demolition, (2) do nothing but watch blasting, (3) do nothing but watch, and (4) do nothing.

Sp E 201, the only sophomore course, will include inspection and six-hour lab observations of the new Union additions. A prerequisite to this course will be proof by mechanics that the student can support at least half his weight on his right elbow.

The courses in the upper school require a high degree of specialization. The student must decide whether he wishes to specialize in observing two story buildings or larger structures. Observations of buildings to ten stories or more is too specialized for undergraduate work and is reserved for advanced study in grad school.

Lack of competent instructors limits the only senior course to Sp E 400 $\frac{1}{4}$, the inspection trip. This includes side trips through the women's dorms, coffee testing in the Union grill, and jaunts to the Smoke Shop. Text books for the course are obtainable in the Smoke Shop. Texts include such high class literature as "Look", "See", "Glance", and "Peek".

In view of the establishment of the new department at MSC, the Michigan Chapter of the ASSE's (American Society of Spectator Engineers) held a bimonthly meeting on the dwindling coal heap. This location was selected as a great vantage point overlooking the MSC crane. If the coal pile continues to diminish at its present rate, the society probably will have to forego future meetings.

At the meeting, "Clumsy" Clark presided in the capacity of Grand Controller of the Crane. The last man who held this high office regretfully fulfilled his life-long ambition of getting into construction by having his foot caught in the gears on the machinery that he was watching and being tossed into some hardening concrete.

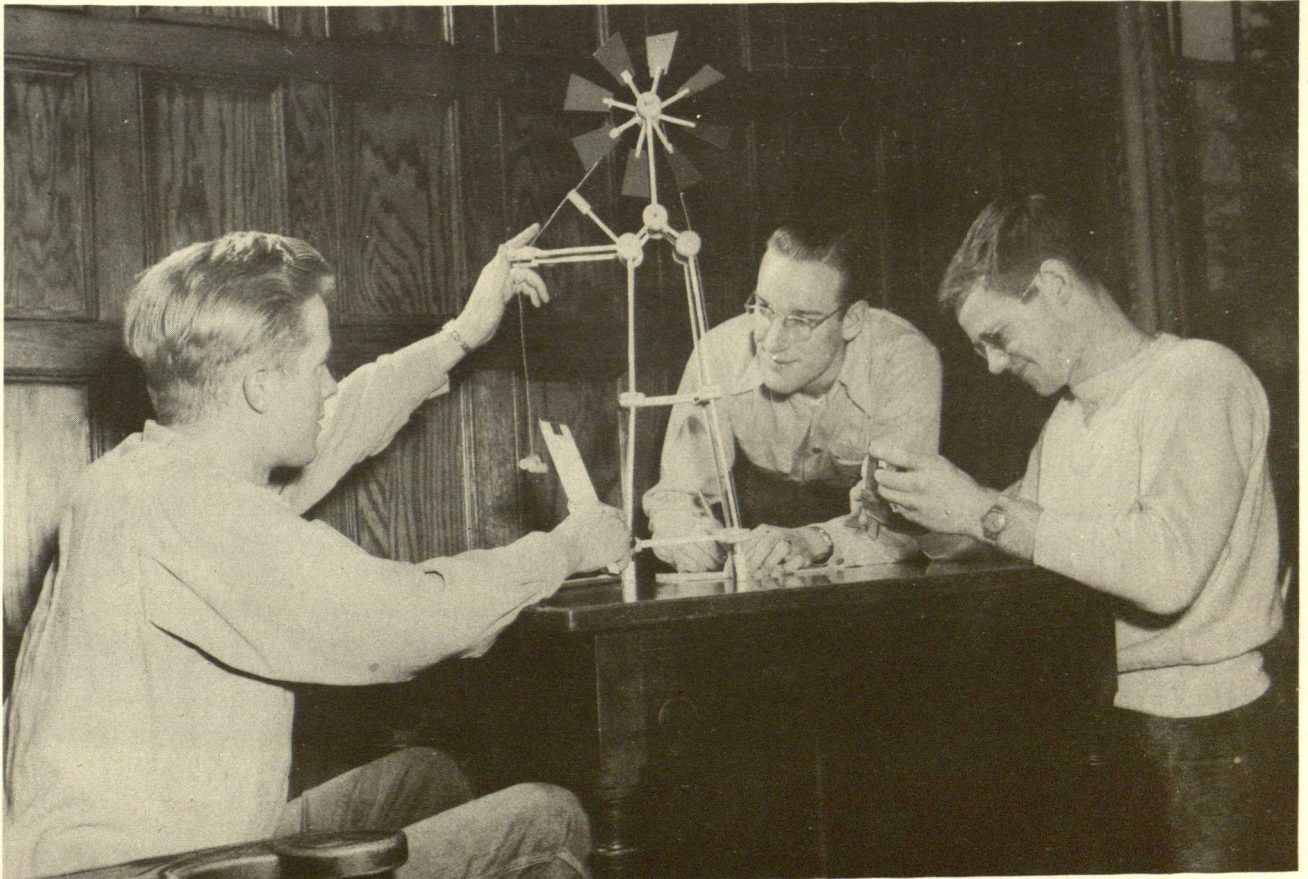
It was decided at the meeting that a quality scale would be applied in the future to the subject of observation. The following scale was chosen: Master Operator, Big-time Operator, Pick Wielder Extraordinary, Shovel Leaner First and Second Class, and Carriers of the Hod. With this classification, mental and physical effort on the part of the members will be reduced to a minimum — a most desirable condition. It is of the utmost importance that the trained spectator engineer should watch the job with a complete minimum of activity

and should perfect the method of talking out of the corner of his mouth to fellow observers without moving his cigar or his eyes.

The membership decided to enter a float in the coming Water Carnival. The ASSE's float committee decided to accept the idea of a board fence with several select members leaning on it. Since it is against the society's principle to do any of the actual construction work, it was voted to sublet the building contract for the float, with eight members appointed to watch the actual construction work.

To join the ASSE, a student in the department of Spectator Engineering is required to rip the top off an old abandoned steam shovel cab and get the names of all active members of the society on it with a 12-inch cold chisel. They will also have to develop the proper poise and balance for Spectator Engineering by wearing a 25-pound anvil around their necks for the brief period of 6 terms. With this small bit of business completed, the group adjourned the meeting to look at some motion pictures of people looking at a construction job.

If Hydraulics is just so much water over the dam to you, Thermo leaves you cold, and Sand, Cement, and Concrete weigh you down — do as I plan to do spring term and become a Spectator Engineer for a new lease on life.



Here is a typical observation problem confronted by students in the Spectator Engineering field.

ENGINE MILESTONE

Reo's New Truck Engine Now In Production

By Emil Raulin
Junior, M.E.



LAST JULY, REO MOTORS INTRODUCED its all-new Gold Comet heavy duty gasoline truck engine. This engine is a "lifetime" overhead-valve power plant that Reo describes as the "most powerful truck engine of its size ever built."

Specially designed, precision production machines were needed to produce this new engine. It is the product of a 3-year, \$1,500,000 engineering and research program. Test headquarters for the engine development were established at San Bernadino, California. Field tests there were conducted under a wide variety of conditions.

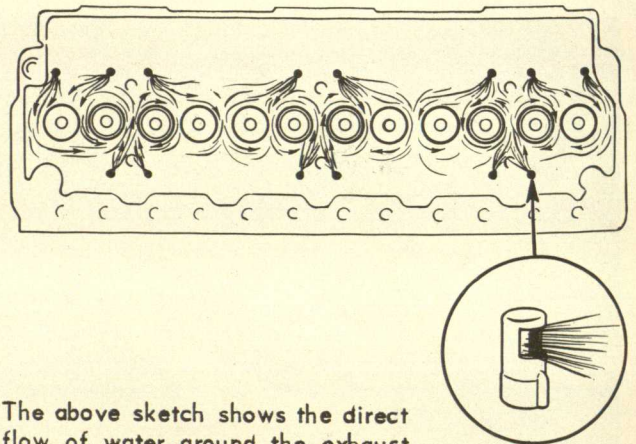
The Gold Comet engine is completely new, according to Reo engineers. They describe it as another milestone in truck engine design.

The new 6-cylinder engine, with overhead valves and wet cylinder liners, develops 140 H.P. at 3200 RPM. Other features are the one piece casting of manifold and cylinder head, sodium cooled exhaust valves, seven-bearing crankshaft, and Houde viscous damper using silicone fluid to reduce vibration.

Although the engine has many new features, it is free from radical design. It includes all the design advancements that have been proven within the past 15 years.

As an aid to visualizing the details of this engine, let us examine it by sub-assemblies.

First, the cylinder assembly. Here the out-



The above sketch shows the direct flow of water around the exhaust valve seats.

standing development is the "wet sleeve" principle, unique in gasoline truck engines. The cylinders are in the form of sleeves and come in direct contact with the water in the block. They are kept permanently watertight by an overlapping block gasket on the top and two neoprene seals at the bottom.

The sleeve cylinders are made of a high-carbon alloy which retains the perfect round for an indefinite period. The sleeves are of uniform thickness throughout, and are completely surrounded by water. This insures longer wear, better heat control, and reduced oil consumption.

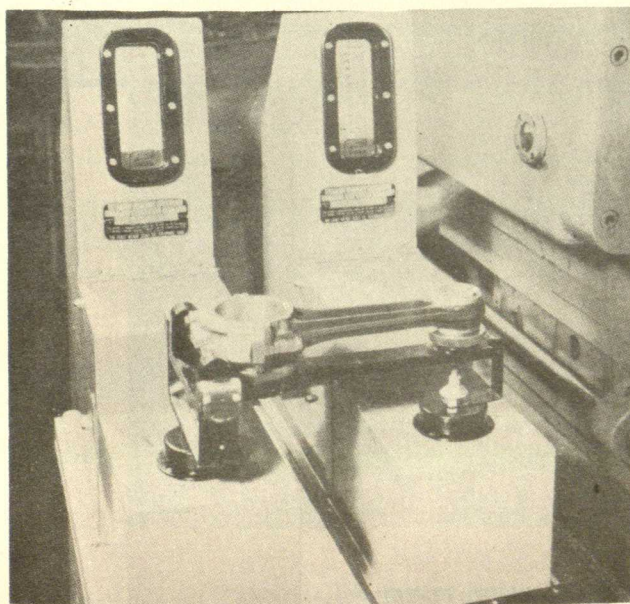
With this method of using sleeves, an engine

overhaul is a simple and economical process. It is only necessary to install an inexpensive sleeve, piston, and ring assembly to obtain a nearly new engine.

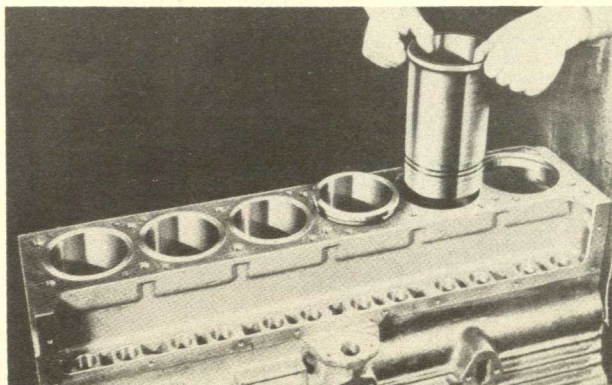
The pistons for the Gold Comet are made of an aluminum alloy and are bronze plated to eliminate cylinder wall scuffing during the break-in period. A four piston-ring combination has been engineered to require a minimum of maintenance and to reduce oil consumption. The pistons are fitted with two compression rings and an oil control ring above the floating piston pin. There also is an additional oil control ring below the pin. Design of the piston is such that it combines light weight, rapid heat conduction, and low expansion.

Next comes the crankshaft assembly. The crankshaft is supported by seven interchangeable bearings with a steel back and copper-lead bearing surface. The crankshaft is dynamically and statically balanced to a tolerance of one-quarter ounce-inches. The outstanding feature of the crankshaft assembly is the use of a torsional viscous vibration damper mounted on the front of the shaft. This damper, a new development in vibration control, improves operating smoothness and prolongs engine life by absorbing impulses that tend to twist the crankshaft.

Let us now look at the intake and exhaust system. The exhaust gases are quickly expelled into a large manifold passage which gets larger in area, allowing the hot gases to expand. On expanding, the gases cool, decreasing their velocity, which decreases back pressures to a minimum. This, plus the volumetric efficiency of the intake manifold, means added horsepower and a cleaner engine.



The wet sleeve principle is one of the outstanding features of the Gold Comet engine.



Each finished connecting rod is checked and balanced to close tolerances for smooth operation.

Exhaust valves are of the airplane type. They are sodium cooled, with stellite facing for long life. Exhaust valve seats contain stellite inserts. The intake valves are made of silchrome, seating directly in a machined seat in the cylinder head. Intake and exhaust valves are actuated from the camshaft by means of pushrods.

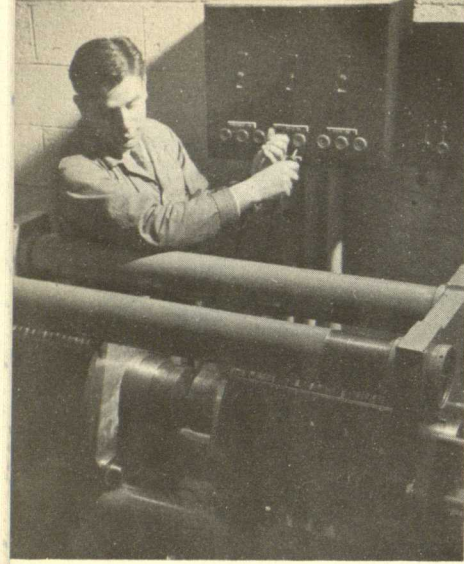
Reo is justly proud of the cooling system designed for the engine. The water from the pump is carried through a water gallery to the center of the block, rather than to the front, as in conventional engines. Generous water passages are provided around the wet sleeve, allowing even cooling the entire length of the block.

The water is then forced to the cylinder head. Here fourteen nozzle jets direct the flow of water around the exhaust seats. The object of this arrangement is to force jets of water in the sides of the valve ports, thus tending to develop rotary flow, and provide maximum contact with the hot surfaces. The water is removed by three equally spaced outlets.

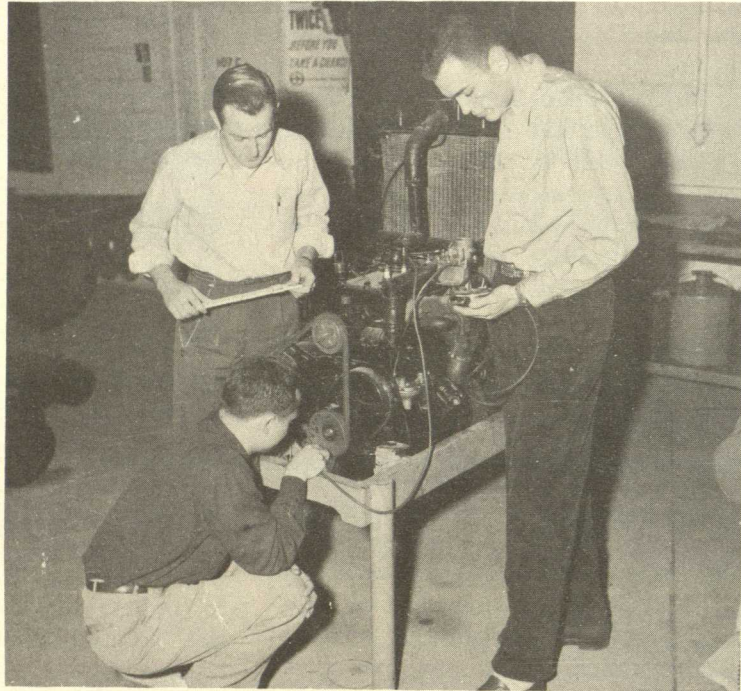
Many improvements have been made in the casting of engine parts. A good example is the casting of the intake manifold as a part of the head casting. The cylinder block also is a complete casting. Of alloy iron, it is compact and rigid in construction with the crankcase parting line on the main bearing line. This facilitates maintenance, but imposes greater duty on the cylinder block structure. These are rows of horizontal ribs on each side for added rigidity.

The powerplant suspension system is of the three point type with two brackets on the fly-wheel housing at the rear and two closely spaced feet under the front.

Few real advancements have been made in truck engine design in recent years. However, Reo engineers feel that their new Gold Comet should prove a tremendous step forward in the trucking industry.



The Physics department is proud of its new electromagnet.

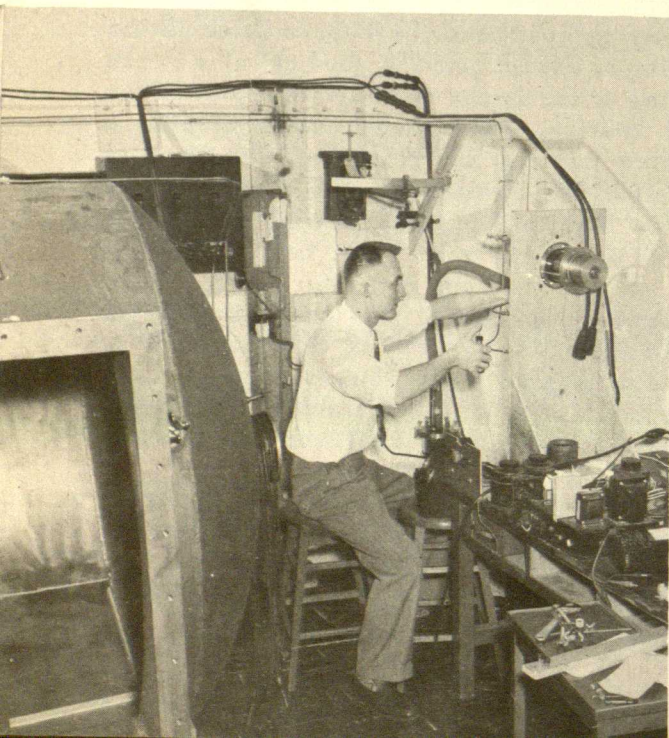


Farm motors and engines are thoroughly investigated by Ag. Engineers.

A few jokes and goofy antics kept things lively between dances at the Engineer's Ball.



Crowds and music



Part of the Physics department's new equipment for measuring the size of an electron.



Two dollars well spent for admission to the Engineer's Ball.



Hard at work on the Orsat test in the ME power lab.

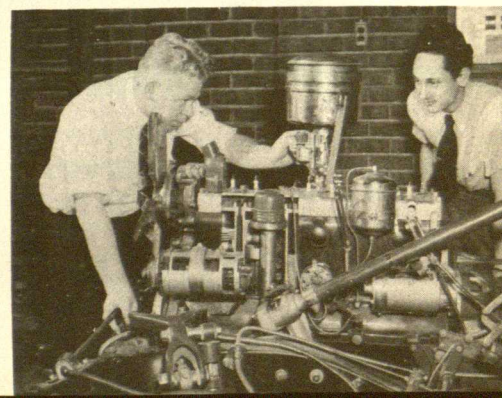


Engineer's Ball.



Patterns are given the final touching-up before going to the foundry.

One of the latest cut-away models in the automotive lab.





By Dick Travers
Senior, Ch.E.

SILICONES

Miracle Of Modern Chemistry

SILICONES ARE SEMI-ORGANIC COMPOUNDS containing silicon, hydrogen, carbon, and often oxygen. It has long been known that over 87% of the outer crust of the earth is composed of silicon compounds. A vast extent of our present chemical industries would be virtually impossible if there were no such element. Now, there is a completely new field for the use of silicon — the "Silicone industry."

The silicon compounds have tremendous possibilities as to compare with our present number of carbon compounds. Silicon lies in the same periodic group and is the only element which behaves almost identically to carbon. Many of the reactions which are now considered purely "organic", will occur by substituting silicon for carbon. Is it any wonder that the future for silicones is so bright.

The silicones, isolated and now synthesized, present such unique properties as resilience, non-volatility, toughness, lubricity, flexibility and chemical stability over a wide range of temperatures. These compounds have so impressed our organic industries that countless new silicones are being developed.

Every day, silicones, the chemical "centaurs", midway between conventional organics and typical inorganics, perform jobs better than old materials and make new processes possible. Such companies as General Electric and Dow Corning are devoting large portions of their facilities to research in this field.



One of the largest fields for the use of silicones is the petroleum industry. Silicone oils possess a viscosity index high above that of our now commonly used commercial lubricants. Their applications in the field of heavy diesel engines is of prime importance.

Now, engine vibration at critical speeds, crankshaft whip, and other torsional vibrations, may be virtually eliminated, giving smoother rides to future motorists. Silicone oils are non-corrosive and remarkably resistant to moisture and even live steam. These oils may be used to reduce both rolling and sliding friction at far higher temperatures than are now feasible.

Hydraulic systems in aircraft now are utilizing these oils to prevent frozen landing gears and wing flaps when the mercury drops as low as -70 degrees Fahrenheit. When severe climatic conditions are to be encountered, silicone oils are nearly always the answer.

Since silicone compounds are resistant to heat and oxidation, silicone resin coatings pigmented with aluminum are being used to protect hot metal surfaces such as motorcycle cylinders, exhaust mufflers and boilers. Porcelain has found a real competitor since silicone coatings are more chip resistant, can be used with lighter sheet metal, resist most food-stuffs, and do not yellow or chalk.

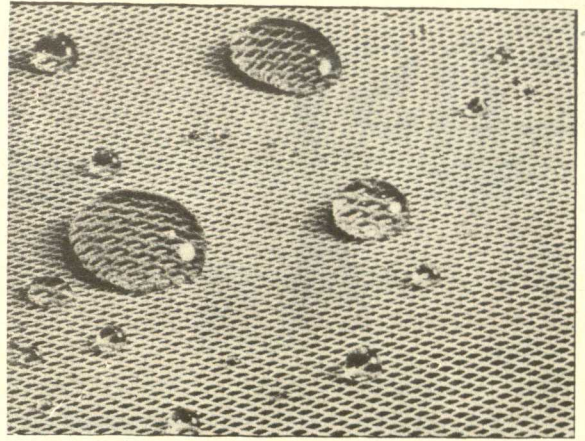
In the food industry, Dow Corning's "Pan Glaze" has revolutionized baking by eliminating the need for greasing pans before each baking. One coating is good for 100 to 200 bakings, but the big economy is in better bread, no spoilage due to rancid grease, and reduced labor costs. A similar product for the retail trade, "Pantastic", offers greaseless frying and ease of cleaning pans.

Silicone electrical insulating materials have been responsible for up to 50% reduction in size and weight of all types of electrical equipment. Similar thermal characteristics are exhibited by silicone synthetic rubbers which retain complete flexibility far beyond the temperature limits for organic rubber.

In airplanes, other silicone products withstand almost unbelievable operating temperatures. In Jet engines they are not only capable of temperature resistivity, but stand up under pressures ten to fifteen times as great as that of the atmosphere. This same all-around resistance makes them excellent as seals and gaskets for all sorts of chemical equipment.

Another widely sold product utilizing natural polishing qualities exhibited by silicones is marketed under the trade name of "Sight Savers". This item is a small pad of silicone impregnated tissues for wiping and cleaning eye glasses.

There are so many processes using silicones that it is impossible to enumerate them. Silicones are employed in the production of new and better adhesives, paints, varnishes, lacquers, soaps, detergents, waxes, plastics,



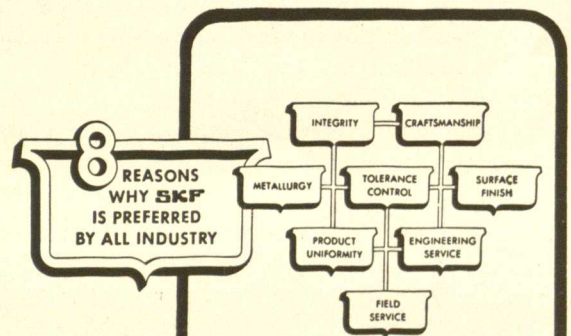
Screen coated with silicone compound shows very good water repellent quality.

anti-foam agents, and flake caustic soda.

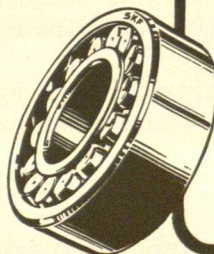
Like a new father's offspring, the accomplishments of silicones seem to be unending. However, such babies as these are not born every day, even in the chemical industry, famed for its pro-creative powers. The capabilities of this new child are virtually limitless in extent, infinite in variety, and many years will be required to utilize them to their fullest extent.



DC4 compound, developed during the war for sealing ignition systems of aircraft engines, finds many peacetime uses.

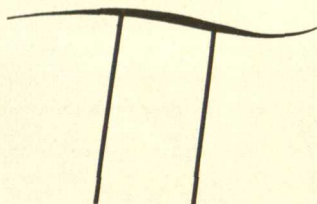


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By Ed Seligman, Senior, Math Major

NE OF THE FIRST NUMBERS THAT A student of mathematics runs into is " π ":

This number possesses many interesting properties besides its familiar application to the area and circumference of a circle.

Pi is an irrational number — that is, it cannot be expressed as the quotient of two integers. Because of its irrationality, it is an infinite, non-repeating decimal. Prior to the discovery of Pi's irrationality, mathematicians tried to reproduce this quantity to many decimal places in the hope that the decimals would repeat themselves.

The world's record for these computations seems to be held by the English mathematician William Shanks, who carried the calculation to 707 places. This large decimal would be somewhat impractical since the entire volume of the universe could be computed to the nearest 1/100,000 of an inch by using a value of Pi having only 50 decimal places.

The value of Pi may be approximated by inscribing a regular polygon in a circle having a diameter of one. As the number of sides of the polygon becomes greater, the perimeter approaches the value Pi.

A very unusual method of computing Pi can be accomplished by ruling a series of parallel lines one inch apart on a flat piece of wood. If a stick one-half inch long is dropped on the

piece of wood, the probability of its touching or crossing one of the parallel lines is $1/\pi$. Don't try this method, though, unless you have plenty of spare time. It was considered a good result when a value of Pi equal to 3.1553 was obtained after 3024 trials. (At this point, no doubt, the tired experimenter chopped his apparatus into toothpicks, took two aspirins, and went home).

Plenty of patience also is required for grinding out Pi by using the fact that if two numbers are selected at random, the probability that they will be relatively prime is $6/\pi$. Two numbers are said to be relatively prime if they have no common divisor, excluding 1 — for example, 7 and 11 are relatively prime, while 6 and 9 are not. Using this method, Pi equal to 3.12 resulted after 250 trials in one test.

Pi has many applications in mathematics. The formula for the probability that a certain number of people in a group will be alive after a given period of time involves Pi. Pi also appears in Stirling's formula for the approximation of factorials.

The next time you see Pi in a formula or expression, don't dismiss it with "Here's that circumference-radius ratio again." Rather say "I'd better watch this baby. It can do things for me."

The Societies



The high light of this past term for the ASCE was a Kodachrome film on "Rail Steel in the World of Today" narrated by Lowell Thomas. Mr. O. W. Irwin, President of the Rail Steel Bar Association, was the principal speaker of the evening.

Two other movies were shown during the term. One, an Abbot and Costello short, the other on the MSC - Arizona football game narrated by Al Dorow, popular MSC quarterback and star passer.

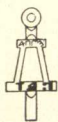


At the first meeting of Winter Term, Bob Kuhn was elected president of the Amateur Radio Club for the remainder of the school year.

The new transmitter has proven very satisfactory on the ten meter band, and plans have

been made for the construction of a rotary beam antenna on this band. The RF section in the old transmitter is being revamped for use on both 3.9 and 14 megacycles and is expected to be in operation soon.

Work on the code practice table has been completed and code classes are in session daily. Interested persons should check the bulletin board on the 6th floor of the EE. bldg. for schedules.



The initiation of new members of Tau Beta Pi was held during February with the local chapter entertaining the National Executive Council.

President of this council is Professor Merton M. Cory. Professor Cory is well known on

(Continued on Page 32)



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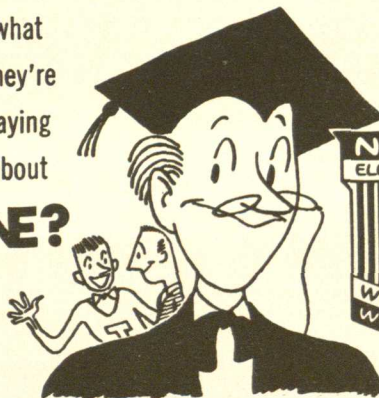
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... CAMPUS NEWS

NORMAN F. PEDERSEN, '49, WAS AWARDED a graduate assistantship in the C. E. department. Pedersen will work on a committee with David O. Van Strien under the chairmanship of Professor Cade with the purpose of reorganizing the hydraulics lab.

A series of tests have shown that the weir tank can be reduced to one-half its length without noticeably effecting experimental results. Also contemplated is a transparent plastic weir tank and a compressed air tank to insure constant water pressure.

LAST FALL TERM, DR. JEFFRIES, OF the E.E. department, suggested the development of some type of practical engineering experience for the E.E. students. The proposed plan was for students to get practical experience to supplement classroom theory.

An organized plan was set up with the faculty acting as consultants. Several projects were worked out during Christmas vacation.

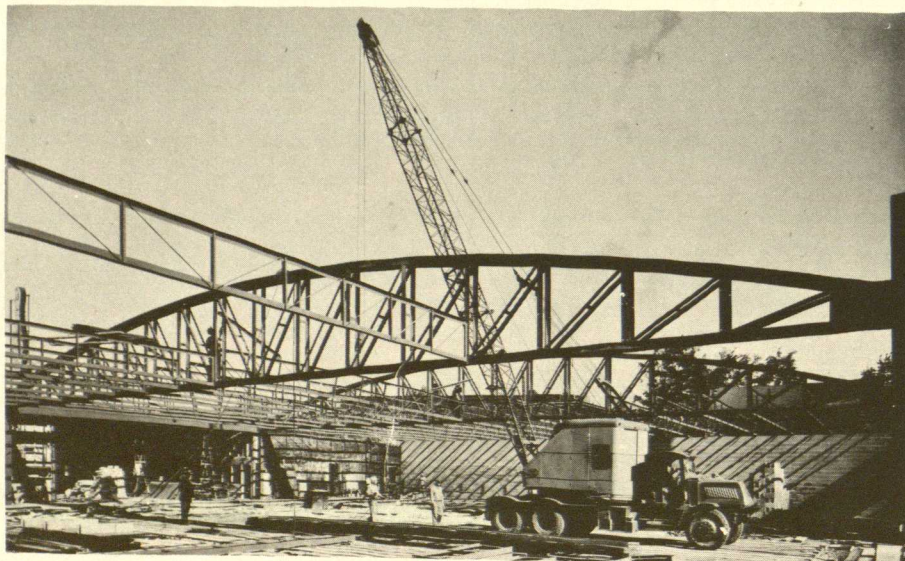
It is hoped that these projects may become accepted as the required lab work for some of the E.E. courses.

Results of the plan and work on individual projects will be compiled and reported at a meeting of the AIEE this month. Anyone interested in this work may contact Dr. Jeffries for further information.

FACULTY MEMBERS OF THE M. E. DEPARTMENT and their wives held a ball at the Forester's Cabin at the beginning of the term. Michael Delich emceed the affair, with Professor Galak as social chairman and Professor Sigerfoos in charge of arrangements.

During the party, the widely unknown, but
(Continued on Page 28)

Jarvis Engineering Works



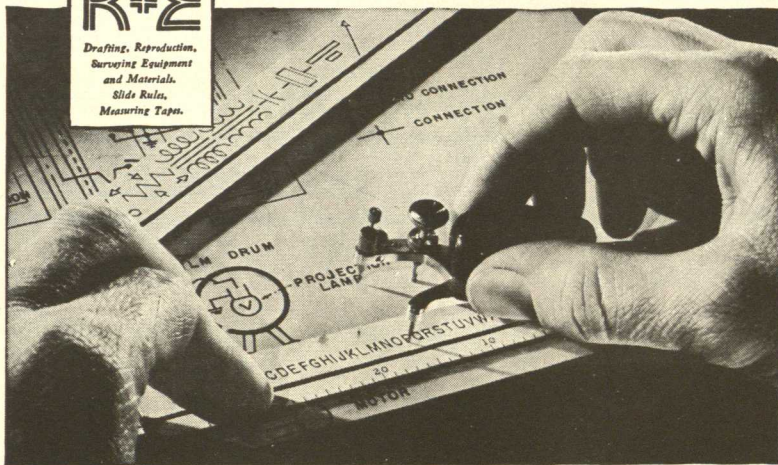
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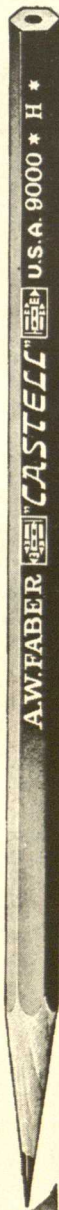
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Ask for CASTELL at your book store. Don't allow yourself to be talked into using a substitute. CASTELL is a life-time habit for up-and-coming Engineers.

AW FABER-CASTELL
PENCIL COMPANY INC. NEWARK, N. J.



Campus News

(Continued from Page 26)

talented group of musicians known as the BTU-ers made their debut. The group includes Donald Renwick on the trumpet; James Apple and Paul Kyburz, trombones and Leonard Price, french horn. With a few strings to supply the missing overtones, we may hear more of the BTU-ers.

The air compressor that was mentioned in these pages a while back is now nearly installed. It is adjusted for experimental purposes having variable clearance provisions and connections for taking indicator cards at both ends of the cylinder. The air delivery to the machine may be measured also.

Paul DeKoning plans to experiment with indicator card diagrams of the compressor using electric strain gages and an oscillograph. A new piece of equipment will enable students to measure deformations on the various machine parts. A small sensitive receiver is attached to any desired spot and stresses and strains occurring there will be picked up and recorded on an oscillograph.

The proposed experimental stress analysis course will become a reality spring term. The

course will be known as ME 485, and will be taught by Prof. Stanley Gralak. Spring term it will be an elective, but next winter term all design optioners will be required to take it.

Power option majors will have a new refrigeration and air conditioning laboratory soon. The lab will be located in the basement of Olds Hall.

Instructors Robert Morley and Robert Wallkes are planning a series of evening courses for the general public on steel and home heating. The courses are sponsored by the department of continuing education and will run for eight weeks with two-hour classes once a week.

Remember the Date

MAY 12 & 13

Second Annual

Engineer's Exposition

QUICK QUIZ

ON INSULATED CABLES

Q. What process for coating copper conductors is superior to "tinning"?

A. Okoloy coating on conductors in rubber insulated cables outlasts "tinning" 2 to 1. Okoloy -- an exclusive alloy developed by Okonite -- is more resistant to corrosion than tin and prevents reaction between copper and rubber. Years of use prove that it has twice the life of "tinning." It's one more reason why Okonite wires and cables are so reliable, so truly economical to use.

THE OKONITE COMPANY, PASSAIC, NEW JERSEY



External Gaging shown. Equipment also available for internal gaging.

NEW! *Electronic* MEASURING EQUIPMENT

The new Brown & Sharpe Electronic Measuring Equipment enables accurate gaging to .00001" as fast as test-pieces can be handled. It features a separate amplifier unit which isolates heat-producing elements and prevents temperature drift in gaging units.

Another unique feature is the true linear response of gaging units which permits accurate setting for entire scale with only one gage block or master.

Write for illustrated Bulletin. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

BROWN & SHARPE 

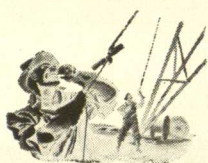
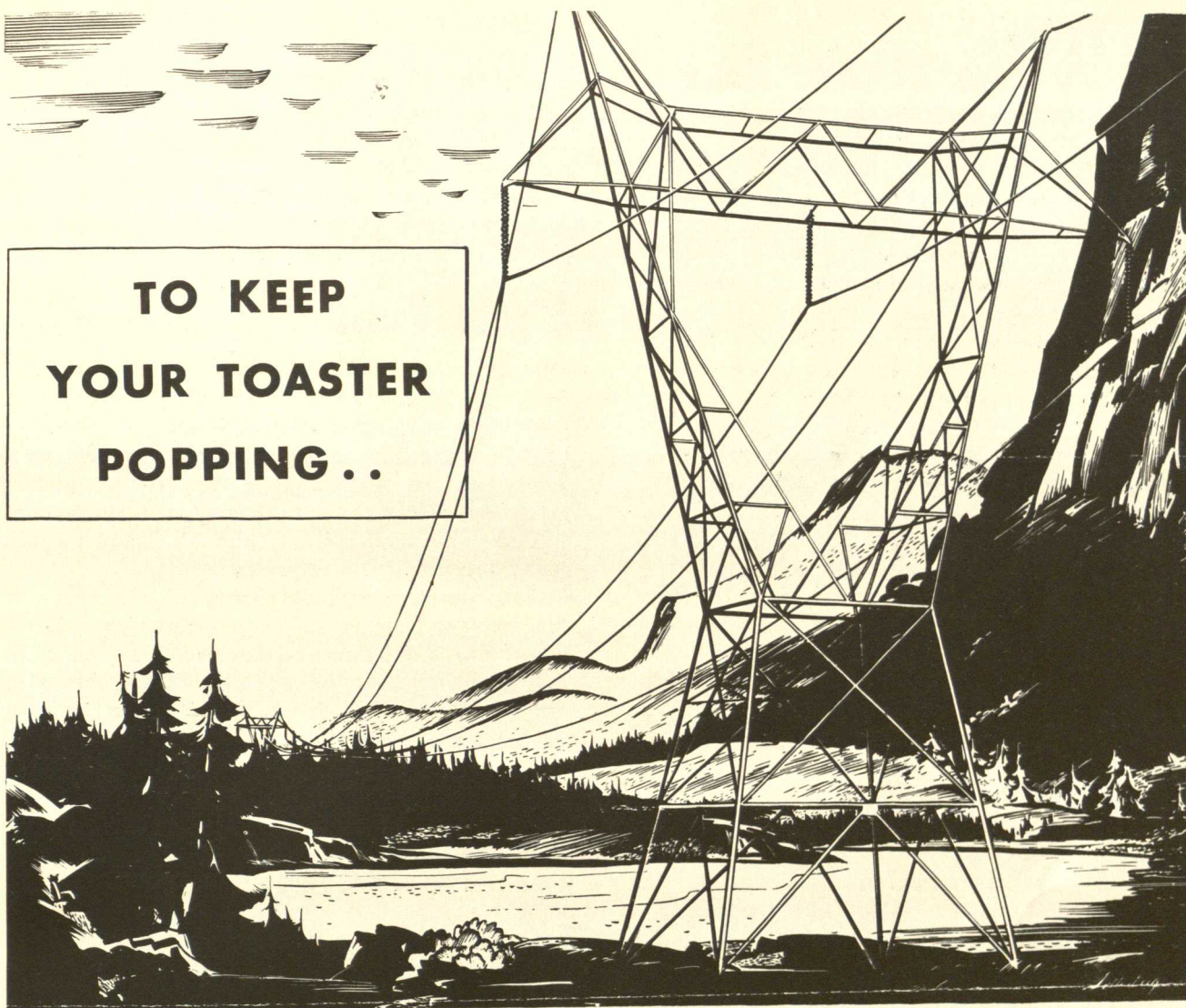


THE BEST CABLE IS YOUR BEST POLICY

OKONITE  insulated wires and cables

8032

**TO KEEP
YOUR TOASTER
POPPING..**



Six million electric ranges. 37 million radios. 29 million electric clocks. 27 million electric refrigerators. 17 million electric coffee makers. 23 million toasters... *Thirty years ago, they were just a sparkle in someone's eye.*

Facts like that should hearten you, when you wonder about your future in American industry. The opportunity's there—as it was there for Alcoa in the early days of electrical transmission.

Today, nearly half the high-tension lines that feed those appliances are made of Alcoa Aluminum. Nearly two million miles of ACSR (aluminum cable steel reinforced). Although it was light, and corrosion resistant, and con-

ductive, nobody wanted to make aluminum into cable, at the beginning. All right, we said—we'd do it. We launched a long research project to produce purer metal, and made the basic changes in our reduction processes that the research finally indicated. We built a cable-testing laboratory long enough to mount whole spans of cable, and vibrate them as the wind does, to check fatigue strength. This was hard, discouraging work, and it took most of the lifetimes of a good many Alcoa people.

But today aluminum high-lines cross the Great Bear in Canada, and funnel Grand Coulee's power into millions of homes and factories. We think they stand as a pretty good monument to this country's way of doing things, through research perseverance, stockholders' courage, and employees' hard work. ALUMINUM COMPANY OF AMERICA, 742C Gulf Building, Pittsburgh 19, Penna.

ALCOA **FIRST IN**
ALUMINUM



INGOT • SHEET & PLATE • SHAPES, ROLLED & EXTRUDED • WIRE • ROD • BAR • TUBING • PIPE • SAND, DIE & PERMANENT MOLD CASTINGS • FORGINGS • IMPACT EXTRUSIONS
ELECTRICAL CONDUCTORS • SCREW MACHINE PRODUCTS • FABRICATED PRODUCTS • FASTENERS • FOIL • ALUMINUM PIGMENTS • MAGNESIUM PRODUCTS

We Present (Continued from Page 15)

had his early education in country schools. His father died when he was only ten years old, and he was forced to assume the usual farm responsibilities while still in grade school. Farm work never appealed to him and he decided to be a banker. He went to Ferris Institute where he took a course in bookkeeping and banking.

He discovered a strong liking for mathematics and this led him into a course in Mechanical Engineering. When Uncle Sam beckoned him into his S.A.T.C. program at MSC in 1918 and subsequently dismissed him, he decided to stay here and take an M.E. course.

After talking with Mr. Bickel, we reached the conclusion that his early banking interests were not entirely forgotten. Let us illustrate this by citing a few of his more recent financial adventures.

Mr. Bickel is Vice-President of the Hospital Board of St. Luke's Hospital in Saginaw and a member of its building committee. The board recently successfully solicited money for construction of a new two million dollar hospital.

Mr. Bickel is a charter member of the Peace Lutheran Church of Saginaw. He was on the

original Finance Board that solicited \$35,000 in 1941 for the construction of the parish's first unit. Eventually Mr. Bickel became finance board chairman for the Parish. Since that time they have been able to finance a new \$200,000 parish hall.

Ferris Institute lost a fine bookkeeping and banking prospect when Mr. Bickel decided on Mechanical Engineering.

Photo Cells (Continued from Page 9)

Each electron striking this material liberates other electrons, and in turn these electrons, plus the original, are reflected to another coated plate where the process is repeated. There is an amplification due to secondary emission before the electrons reach the anode.

The photomultiplier tube is used where great sensitivity is required.

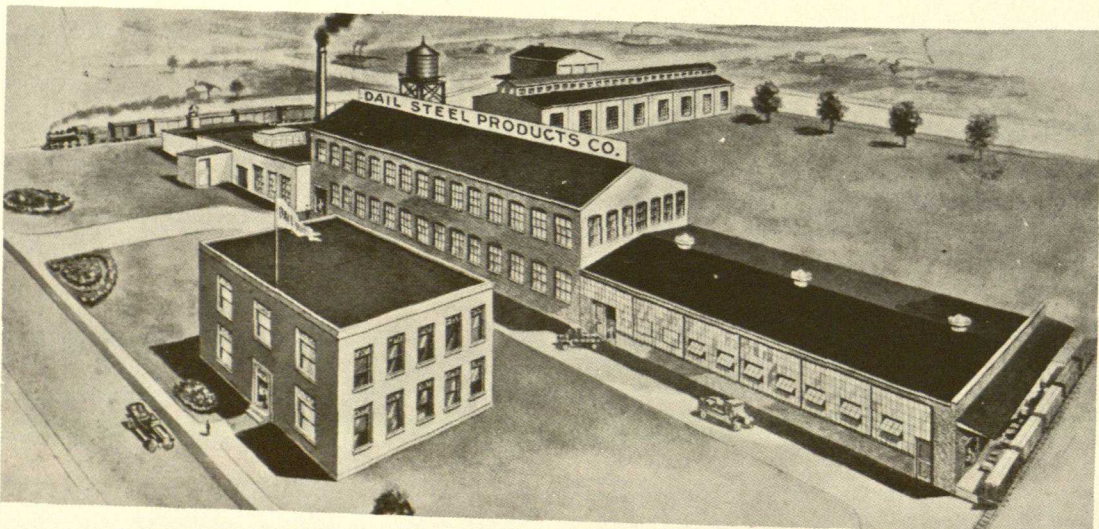
The greatest use of photoelectric cells at the present time is in mass production industries. The more common applications are sorting, counting and inspection. Photocells also are used in scientific work to detect minute quantities of light.

Electronic devices constantly are being developed and adapted to specific purposes. The photoelectric cell goes hand in hand with this increase and is expected to play an even more important role in the future.

DAIL STEEL PRODUCTS CO.

INCORPORATED 1913

*Manufacturers of METAL STAMPINGS
AND ASSEMBLY WORK*
LANSING 1, MICHIGAN

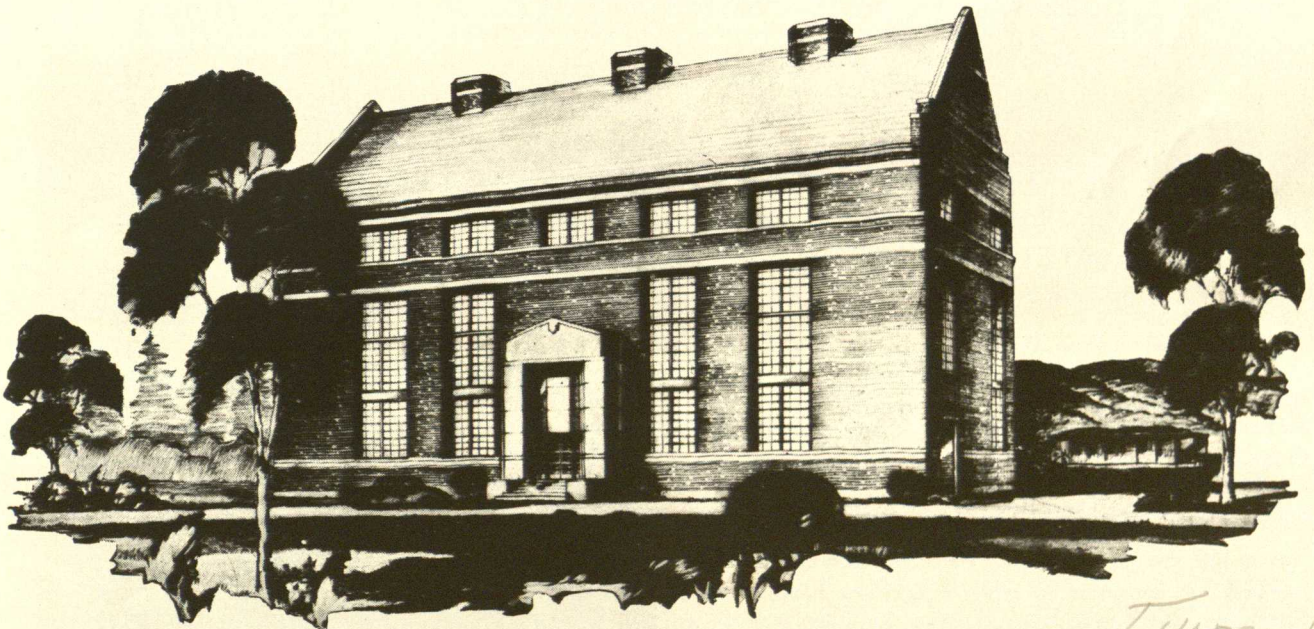


MODERN DESIGN AND EFFICIENCY
GO HAND IN HAND WITH WICKES QUALITY
AT *Michigan State College*
EAST LANSING, MICHIGAN

This modern steam generation plant pictured below houses the *eleventh* Wickes Boiler installed at Michigan State College with space provided for the 12th unit.

Working to the specifications of Claud R. Erickson, consulting engineer of Lansing, Michigan, Wickes designed a 3-drum boiler that makes this installation the *most modern, efficient generation plant* to be found at any educational institution in the country. Boiler specifications: capacity, 125,000 lb. per hr.; design pressure, 350 psi; total steam temperature, 550°F

Wickes has the engineers, the manufacturing facilities, and the skilled workmen to fill your requirements for *boilers of any type up to 250,000 lb. steam per hour and 850 psi*. Your inquiries will receive prompt attention.



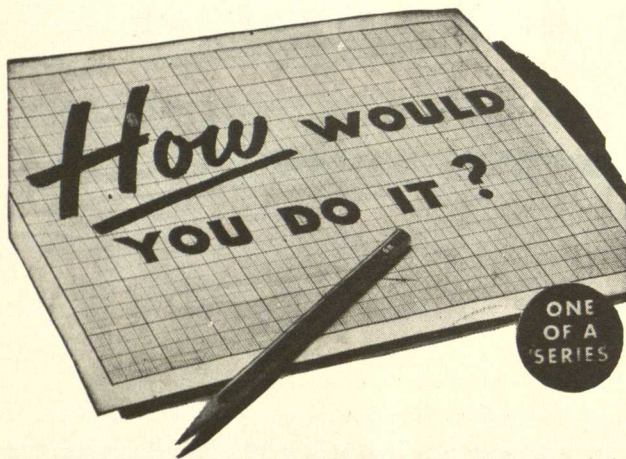
WICKES **BOILER**
COMPANY

THORSON
ADV & SALES
MGR

DIVISION OF THE WICKES CORPORATION

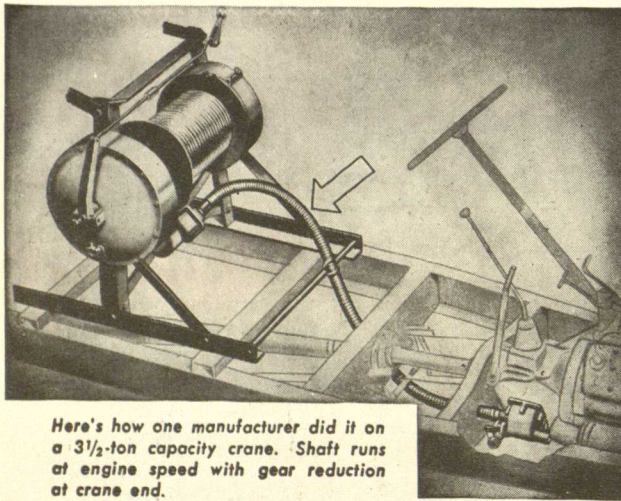
SAGINAW, MICHIGAN

RECOGNIZED QUALITY SINCE 1854



PROBLEM — You are designing an automobile service car with a crane on the back end. You are going to take power from the transmission to drive the crane drum. How would you do it?

THE SIMPLE SOLUTION — Use an S.S.White power drive flexible shaft. Connect one end to a take-off on the transmission and the other end to the clutch which operates the crane drum—simple, easy to install, good for positive, dependable operation.



Here's how one manufacturer did it on a 3 1/2-ton capacity crane. Shaft runs at engine speed with gear reduction at crane end.

This is just one of hundreds of remote control and power drive problems to which S.S.White flexible shafts provide a simple answer. Engineers will find it helpful to be familiar with the range and scope of these useful "Metal Muscles" for mechanical bodies.

*Trademark Reg. U. S. Pat. Off. and elsewhere

WRITE FOR BULLETIN 4501

It gives essential facts and engineering data about flexible shafts and their application. A copy is yours for the asking. Write today.



S.S. WHITE INDUSTRIAL DIVISION
 THE S.S. WHITE DENTAL MFG. CO. DEPT. C, 10 EAST 40th ST., NEW YORK 16, N. Y.



FLEXIBLE SHAFTS • FLEXIBLE SHAFT TOOLS • AIRCRAFT ACCESSORIES
 SMALL CUTTING AND GRINDING TOOLS • SPECIAL FORMULA RUBBERS
 MOLDED RESISTORS • PLASTIC SPECIALTIES • CONTRACT PLASTICS MOLDING

One of America's AAA Industrial Enterprises

The Societies

(Continued from Page 25)

the campus. Prior to last June, he was an instructor in the Electrical Engineering Department.



The Society of Automotive Engineers is the newest of State's engineering societies. Their constitution was approved late fall term. Roy Elicker is chairman of the group; George Dolengowski vice chairman; Don Endres secretary; and Richard Keinath treasurer.

At the first meeting in January, a movie, "Traveling with the Rocket" was shown, depicting the development of Oldsmobile's rocket engine. An Olds employee supplemented the movie with a short talk.

A future meeting of the Detroit chapter will feature a short skit by students from branches throughout southeastern Michigan. John Fiebelkorn will represent MSC in the play which will illustrate humorous incidents in engineering in industry.



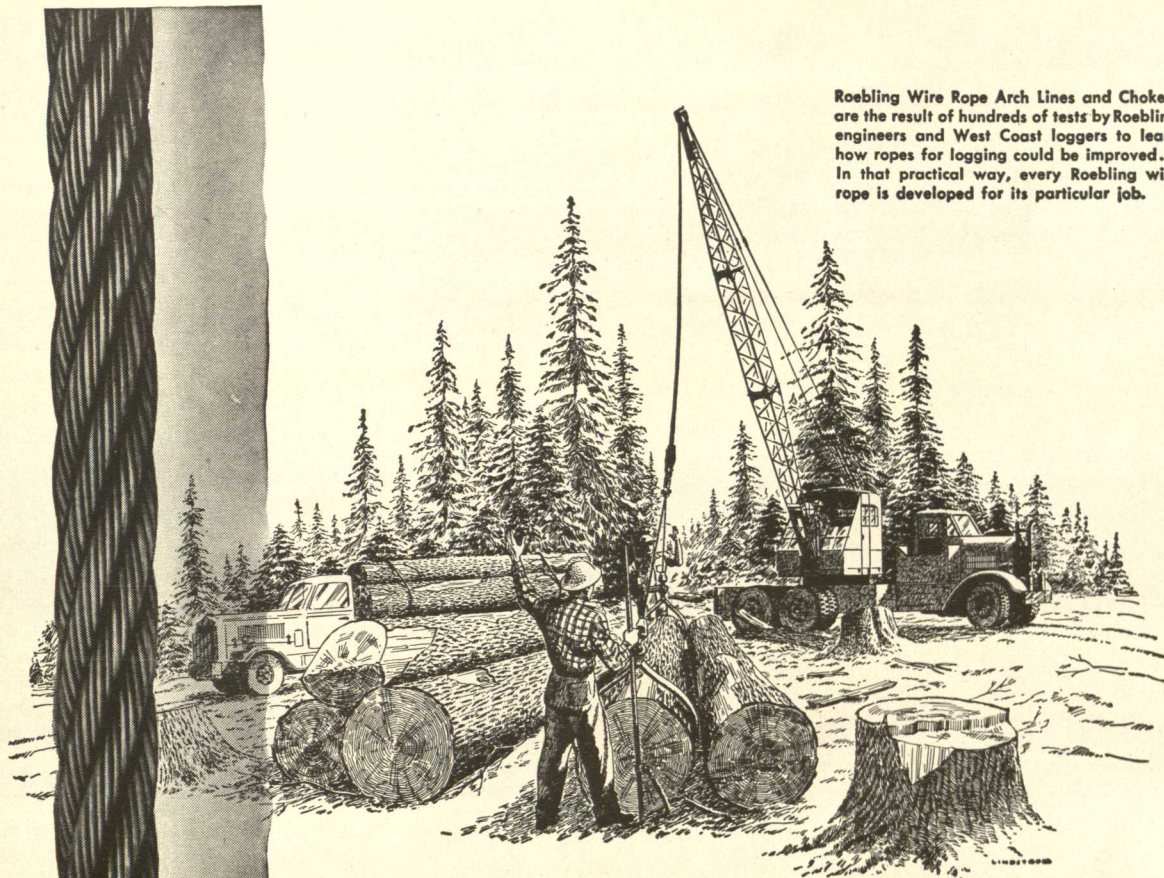
Pictured above are four of the five officers of AIEE-IRE for this year. From left to right, Blaine Cadwell, IRE secretary; Dean Morgan, treasurer; Paul Fair, vice-chairman; and John Foulkes, chairman. Not in picture Vernon Kidd, secretary.



The ASME underwent an operation last term that divided it into three parts. The split created separate divisions of industrial, design and power. All groups will continue to function under the same officers, but each will have it's own vice-chair-

(Continued on Page 34)

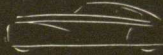
Roebing Wire Rope Arch Lines and Chokers are the result of hundreds of tests by Roebing engineers and West Coast loggers to learn how ropes for logging could be improved... In that practical way, every Roebing wire rope is developed for its particular job.



Why men who watch costs specify Roebing



Roebing Aircord contributes importantly to safe, sure "control in the air"



Roebing Oil-Tempered Spring Wire leads for automotive springs.



Roever Magnet Wire insulation is 10 to 40 times tougher than other types.

WIRE ROPE made of "Blue Center" steel has extraordinary ability to withstand abrasion, shock and fatigue—a roundabout way of saying that it lasts longer and costs less! And "Blue Center" steel is an exclusive Roebing development—made only by Roebing. It is a matter of record that Roebing "Blue Center" Steel makes today's unbeatable wire rope for performance and economy.

Similarly, Roebing's full range of electrical wires and cables, high carbon specialty wires, aggregate screens and woven wire cloth are the standard of quality. Research, engineering and the most modern, precision manufacturing facilities give the whole wide line of Roebing wires and wire products an unsurpassed *plus* value throughout industry. **THAT'S WHY...**

Today it's Roebing!

JOHN A. ROEBLING'S SONS COMPANY, TRENTON 2, NEW JERSEY

Atlanta, 934 Avon Ave. * Boston, 51 Sleeper St. * Chicago, 5525 W. Roosevelt Road * Cincinnati, 5253 Tredonia Ave. * Cleveland, 701 St. Clair Ave., N. E. * Denver, 4801 Jackson St. * Houston, 6216 Navigation Blvd. * Los Angeles, 216 S. Alameda St. * New York, 19 Rector St. * Philadelphia, 12 S. Twelfth St. * Portland, 1032 N. W. 14th Ave. * San Francisco, 1740 Seventeenth St. * Seattle, 900 First Ave. S.

A CENTURY OF CONFIDENCE



The Societies

(Continued from Page 32)

man and program director. Prof. Jesse Campbell is the honorary chairman and it is proposed to have three more faculty advisors, one for each division.

Individual meetings of the new divisions are planned in addition to regular combined business meetings of the entire society. Any ASME member is privileged to attend any or all of the meetings regardless of his option.

It is hoped this move will create better attendance at meetings, as well as more centralized interest in the programs planned.

The Industrial Engineers have organized a special division of the A.S.M.E. They have formulated plans for several interesting programs.

Oldsmobile and two smaller plants are cooperating in the project of making motion pictures for IE courses. These pictures also will be available to interested groups. The first of these will depict the Industrial Engineer's role in industry.

Professor Limbocker is conducting a class in "Principles of Motion Study" at Eastern high school for the benefit of manufacturers in this vicinity.



Pi Mu Epsilon, math honorary, is continuing its speaker series. This program is designed to describe the relation of mathematics to other scientific fields.

Highlight talks during the past term were given by Dr. Leonard, head of the Philosophy department, and Dr. Rogers of the Chemistry department.

The first issue of Pi Mu Epsilon's National Journal was published in Syracuse recently. Dr. Frame, head of the math department, is an assistant editor of the bi-annual magazine. The publication is now available at MSC.



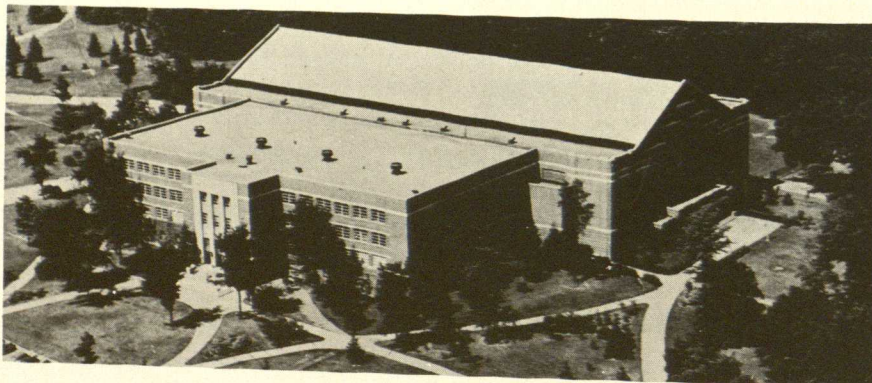
Sigma Phi Sigma, Physics honorary society, had Dr. Kikuchi of the Physics department as guest speaker at their regular meeting last term. Dr. Kikuchi spoke on "Micro Wave Absorption".

The group held a banquet on February 8, at which time twenty new members were initiated.

the history of
COPPER

In the May Issue of the
SPARTAN ENGINEER

DISTEL HEATING COMPANY



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REFRIGERATION

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LANSING

MICHIGAN

SPRINGBOARD TO A CAREER IN ENGINEERING

by J. F. ROBERTS

Manager, Hydraulic Department
General Machinery Division

ALLIS-CHALMERS MANUFACTURING COMPANY
(Graduate Training Course 1919)

YOU HAVE to start somewhere—and as far as I know, flagpole painting is the only job where you start at the top. Next best thing is to get in where there are many opportunities, and many interesting, worthwhile paths to follow—particularly if you are not entirely sure just what type of work you want to do. You then have a chance to try more than one field, and eventually find the work that will give you the most in satisfaction and success.

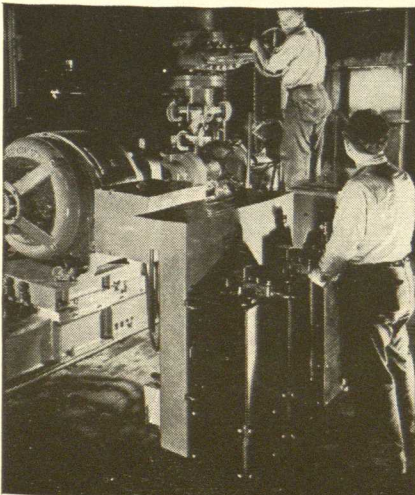


J. F. ROBERTS

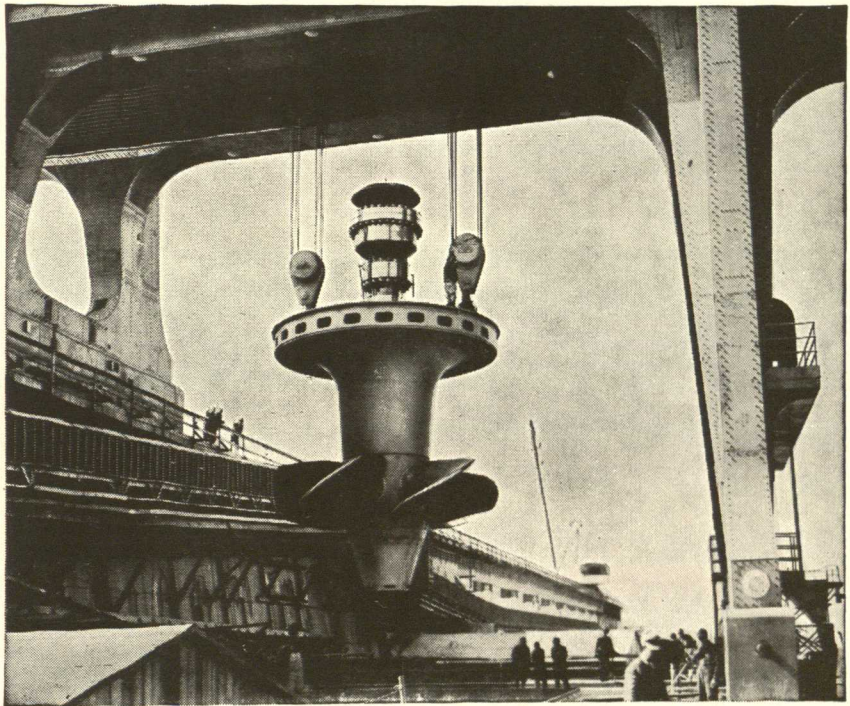
Growth of Hydraulics

The field I'm best qualified to discuss is hydraulic engineering. Crude waterwheels were man's first mechanical source of power. Today, in highly perfected modern form, they're still a major source of abundant, low-cost electric power. The field is constantly expanding and holds a world of opportunity. Hydraulic power becomes increasingly important to the nation as the need for low-cost power steadily increases. Moreover, a hydraulic plant once installed produces energy with a minimum of manpower. There's no fuel to mine, prepare, ship, unload and burn—small operating personnel is required.

Right now at Allis-Chalmers we're designing and building turbines for vast new hydro-power projects, not only for the U.S.A. and Canada, but also for Mexico, South America, Norway, New Zealand



Graduate students conduct performance tests of centrifugal pump units.



Kentucky Dam TVA Field erection view of 250-ton gantry crane lowering hydraulic turbine assembly. One of five 44,000 hp, 48-ft. head, Kaplan type turbines.

and the Philippine Islands. We're also restoring many veteran turbines to better-than-original efficiency and capacity after long years of faithful performance.

Hydraulics was a field that I hadn't seriously considered as an undergraduate at the University of Wisconsin. I graduated as a Mechanical Engineer in 1918, and entered the Allis-Chalmers Graduate Training Course in January 1919. It was there that I got interested in the big waterwheels.

My first assignment was in steam turbine erection. Then I moved over on the hydraulic turbine test floor. In May 1919 I was sent to North Carolina on the acceptance tests of a big hydro-electric power installation. I continued with hydraulic field work such as tests and trouble shooting until 1925, when I went into the sales end of the work. Two years later I left the manufacturing side and became Hydraulic Engineer for the Power Corporation of Canada, supervising the design and installation of some 15 plants.

In 1936 I became Hydraulic Engineer for the U. S. Government TVA, involving 12 projects and 30 large units. I returned to Allis-Chalmers in 1942 as Manager of

the Hydraulic Department—and had the unique experience of building some of the same turbines that I had purchased for TVA.

Vantage Point for All Industries

These personal notes serve to illustrate two interesting facts about the Allis-Chalmers Graduate Training Course. First, it's tailor-made for each student. Since 1904, graduate students here have been helping plan their own courses—making changes as they went along and new interests developed. They've had an opportunity to divide their time between shop and office—follow important projects through from drafting board to installation.

Second, the organization is in close contact with virtually all phases of industry: hydraulic or steam electric power plants and utilities; mining, smelting and rock products; public works; steel and metal working; textiles; food processing; flour milling. Allis-Chalmers builds basic machinery for ALL these industries and many more. Its engineers, executives, salesmen and production experts have a ringside seat for industry in action.

ALLIS-CHALMERS



Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin

NEW

Developments

Pneumatic Strip Tester

A device known as the "pneumatic strip tester", is now being used to test the strengths of metals.

This device uses compressed air to vibrate strips of metal at their natural frequency, until they fail. During the test a light beam is intercepted by the specimen during each vibration. The light beam is focused on a photoelectric cell so that the vibrations are counted electronically and the exact frequency can be found.

When a test strip begins to crack, it ceases to vibrate as fast, and the testing device automatically stops. The frequency used then is multiplied by the time needed to cause failure to find the number of vibrations the metal can stand before it fails.

Because of the high frequencies which can be produced on the tester, metal strips can be

vibrated enough times in 24 hours to equal two or three weeks testing on mechanically-operated devices.

Surgical Radio Receiver

A tiny radio receiver which can be placed beneath the skin surgically has been developed for use by medical scientists in nerve stimulation experiments.

The radio applications are said to make it possible to study the nerve reactions to stimuli without the use of anesthetic.

All surgery involved is performed while the subject is anesthetized, and the experiments are painless. The incision soon leaving the subject normal in every respect except for the fact that there is a radio receiver under the skin.

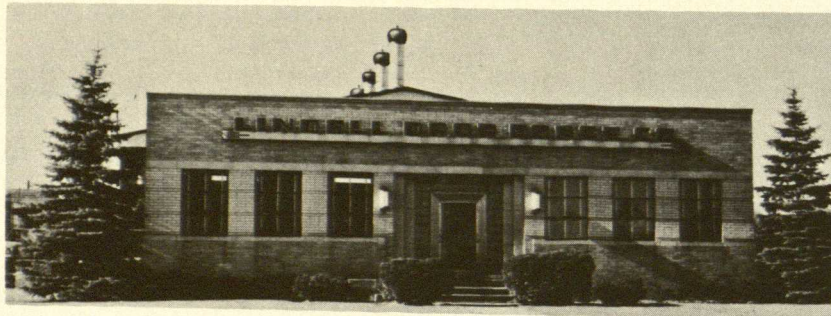
The receiver is spherically shaped and
(Continued on Page 38)

LINDELL

Established 1910

DROP FORGE COMPANY

Incorporated 1923



Manufacturers of
HIGH GRADE DROP FORGINGS

2830 South Logan

Lansing 3, Michigan

Telephone 4-5403



He uses $\frac{7}{8}$ of the earth's elements in his cooking

If you've always thought of glass simply as a substance made of sand, soda, and lime, we believe this will surprise you:

Corning scientists, such as the one you see here cooking up a batch of experimental glass, have actually made glass using 84 of the earth's presently known 96 elements.

Nearly 3000 of these experimental glass compositions are turned out every year, as Corning scientists search for new and useful ways to combine nature's elements.

Already Corning has developed more than 50,000 formulas for glass. Just as alloys make metals more useful, these 50,000

formulas make glass more useful—enlarging its applications in untold and sometimes surprising ways.

Corning makes glass so strong that it can be used as piping in a steel mill. Corning makes glass so soft that it can be melted with a match—and glass so resistant to thermal shock that it can be heated to a cherry red, then plunged into ice water without its breaking.

Today, throughout industry, *Corning means research in glass*—research which, along with a multitude of other developments, has made glass one of today's most

versatile engineering materials.

Corning is constantly turning up new kinds of glass, new uses for existing ones. So when you're out of college, and concerned with product or process improvement, it will pay you to call on Corning before your planning reaches the blueprint stage. *Corning Glass Works, Corning, New York.*

CORNING
means research in glass

L
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**Beginning Its
36th Year
of Successful
Stamping
Service**

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*Serving
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**AUTOMOBILES
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EQUIPMENT
INDUSTRIAL
EQUIPMENT
DOMESTIC
EQUIPMENT
LAWNMOWERS**
1159 Pennsylvania
Avenue
Lansing, Michigan

New Developments

(Continued from Page 36)

enclosed in a plastic case. The wire running to the nerve also is enclosed in plastic, and is connected to the nerve by a small silver foil electrode which fits sleeve-fashion around the section of the nerve. Medical observers say there appears to be no harm to the nerve tissue.

For the experiment the subject is placed in a large coil, ten feet in diameter, connected to a transmitter. When a nerve is to be stimulated, a signal is sent from the cage to the receiver. The subject may wander about the cage at will, and still receive stimuli.

Gas Turbine Locomotive

Knowledge gained from experience in the aircraft gas turbine field has been utilized in designing the nation's first gas-turbine electric locomotive. The unit made its first public appearance before assembled rail executives at Erie, Penn.

The announcement was made that the 4,500 horsepower locomotive had satisfactorily passed preliminary tests and would be turned over to the Union Pacific for additional tests on freight runs.

In appearance it resembles the diesel-electric unit but is actually powered by a gas-turbine, similar in principle to those used in jet aircraft.

The compressor, combustion chamber and turbine are of in-line construction. Air is drawn through a compressor into several combustion chambers. Fuel is injected and the mixture burns, raising the temperature of the compressed air. Resulting gases expand and move at great velocity against the turbine blades, turning the shaft. The shaft drives both the power plant compressor and the generator. Power from the generator is supplied to eight traction motors, each of which drives one of the eight axles.

The experimental unit exerts about twice as much horsepower, at the rails, as a diesel-electric locomotive of comparable size. It burns low grade bunker oil, but a spokesman expressed the hope that research may lead to a successful means of burning coal.

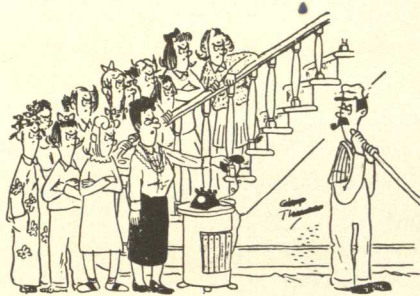
Rapid Tempering

A tempering process which heats a metal surface from room temperature to 1600° F and cools it down to room temperature, all within five seconds, has recently been developed.

SIDE TRACKED

A fellow seated at a bar watched a nice-looking girl come in and drink four Manhattan cocktails with no apparent effect. His curiosity getting the better of him, he leaned over and asked, "Would five make you dizzy?"

To which she replied, "The price is right, but the name is Daisy."



"IT'S FOR YOU."

Blonde: "Do you notice anything different about me this evening?"

E. E.: "You've got on a new pair of nylons."

Blonde: "No - that's not it."

E. E.: "That a new skirt?"

Blonde: "No - try again."

E. E.: "Must be the sweater."

Blonde: "No, you silly, I dyed my hair black and I'm wearing glasses."

* * * *

A few short years ago
When shady jokes were told,
A co-ed blushed a fiery red
And thought the man most bold.

And now upon the campus
There are so few who frown,
When she dashes for a pencil
To copy the joke down.

* * * *

A blessed event recently gladdened the life of an O.S.U. couple. The father, a bit pre-occupied by the problems of how to stretch the allotment check, walked right into the room marked "Delivery." The nurse was horrified.

"Don't you know better than to come into this room?" she asked. "You're not sterile."

"You're telling me?"

* * * *

A long skirt is like prohibition - the joints are still there, but they're harder to find.

Looking coldly at the man who had just given him a nickle for carrying his bags twelve blocks, the little boy said: "I know something about you."

"What?" asked the man.

"You're a bachelor."

"That's right. Know anything else about me?"

"Sure. So was your father."

* * * *

First C.E.: "How far are you from the correct answer?"

Second C.E.: "Two seats."

* * * *

"What did you make in Calculus last term?"

"I flunked. Prof thaid I didn't know math from a hole in the ground."

* * * *

"Me slept with daddy last night," said the small child to the kindergarten lady who believed in correct diction, even by the very young.

With emphasis the teacher said, "I slept with daddy last night."

"Well, then," said the child, "you must have come in after I went to sleep."

*I asked my girl if me she'd wed,
She lifted up her lovely head,
And in her sweetest manner said,
"Go ask Father."*

*She knew I knew her father was dead.
She knew I knew the life he'd led.
She knew I knew what she meant when
she said,
"Go ask Father."*

* * * *

"What lovely antique furniture. . . . I wonder where Mrs. Jones got that huge chest?"

"She probably inherited it, I understand her mother had one too."

* * * *

"No!" said the centipede crossing her legs. "A thousand times no."

* * * *

Scene: A classroom just after the teacher has tripped over the wastebasket and fallen on the floor.

Teacher: "Well, why do you all look so dumbfounded?"

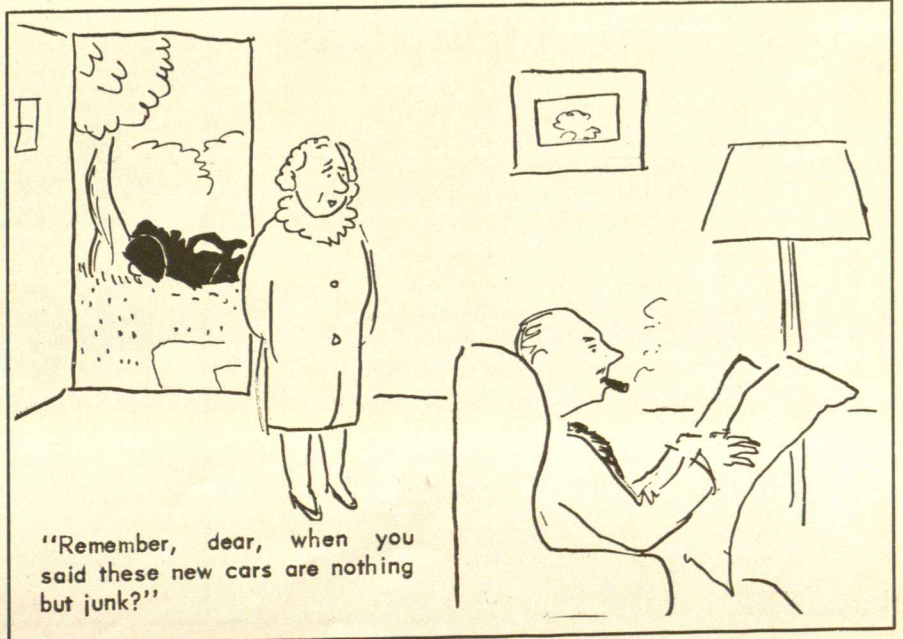
Billy: "Oh, teacher, I saw your knee."

Teacher: "Go stand in the corner, Billy."

Tommy: "I saw your garter."

Teacher: "Go the the washroom and don't come out till I call you. Johnny! Where are you going?"

Johnny: "I'm expelled, teacher."



"Remember, dear, when you said these new cars are nothing but junk?"

SIDE TRACKED

The girl was through with her bath and was just stepping onto the scales to weigh herself. Her husband happened to return home at this time and entered through the back door. Seeing what his wife was doing as he passed the bath room door, he exclaimed. "Well, dear, how many pounds today?"

Without turning her head she replied, "I'll take 50 pounds today, and don't you dare pinch me with those tongs."

* * * *

It was not a slow lecture, nor a fast lecture, but a half-fast lecture.

* * * *

Limey, to girl in saloon: "Are you 'aving one, Mary?"

Mary: "No, it's just the cut o' me coat."

* * * *

The U. of M. Graduate had just given his wife a beautiful skunk coat for Christmas.

"I don't see," she mused, "how such a nice coat can come from such a foul-smelling beast."

"Well," replied the lawyer, "I don't ask for thanks, dear, but I do demand a little respect."

He was an American. She was French. He was in New York to buy furniture for his store in San Marino. He met her on an elevator. She looked good to him. He looked good to her. He took out a pad and pencil and drew a picture of a hansom with a question mark after it. She nodded yes. They went for a ride in the park. He drew a picture of a restaurant. She nodded yes. They ate. He drew a picture of some dancers. She nodded yes. They danced. Then she took the pencil and pad. She drew a picture of a four-poster bed. Now, what he is trying to figure out is how she knew he was in the furniture business.

* * * *

Funeral Director (to aged mourner): "How old are you?"

"I'll be ninety-eight next month."
"Hardly worth going home, is it?"

* * * *

Stage Hand: "I hear you and the leading lady are on the outs."

Electrician: "Yeah, it was one of those quick change scenes with the stage all dark. She asked for her tights, and I thought she said lights."

* * * *

Hear about the sculptor who put his model to bed and then chisled on his wife?

We couldn't resist telling about the fellow who offered his new girl friend a Scotch and sofa. She reclined.

* * * *

She reached below her dimpled knee,
Into her rolled-down stocking,
And there she found a roll of bills...
Ah me, 'twas sweetly shocking.

"Why don't you keep them in a bank?"
Inquired a nosey prier.

"The principle is the same," she said,

"But the interest here is higher."

* * * *

C.E.: "Is the boss in?"

Office girl: "I'm sorry, he isn't."

C. E.: "Will he be back after a little?"

Office girl: "No, I think that's what he went after."

* * * *

A castaway on a desert island, following another shipwreck, pulled ashore a girl clinging to a barrel.

"How long have you been here?"
asked the girl.

"Thirteen years," replied the castaway.

"Then you're going to have something you haven't had for thirteen years," said the girl.

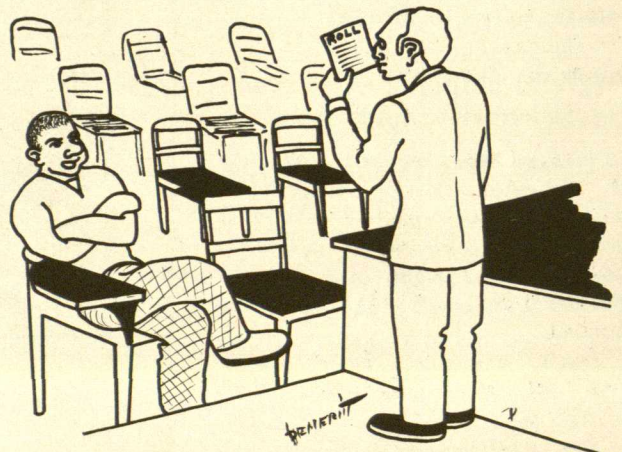
"You don't mean to tell me there's beer in that barrel."

* * * *

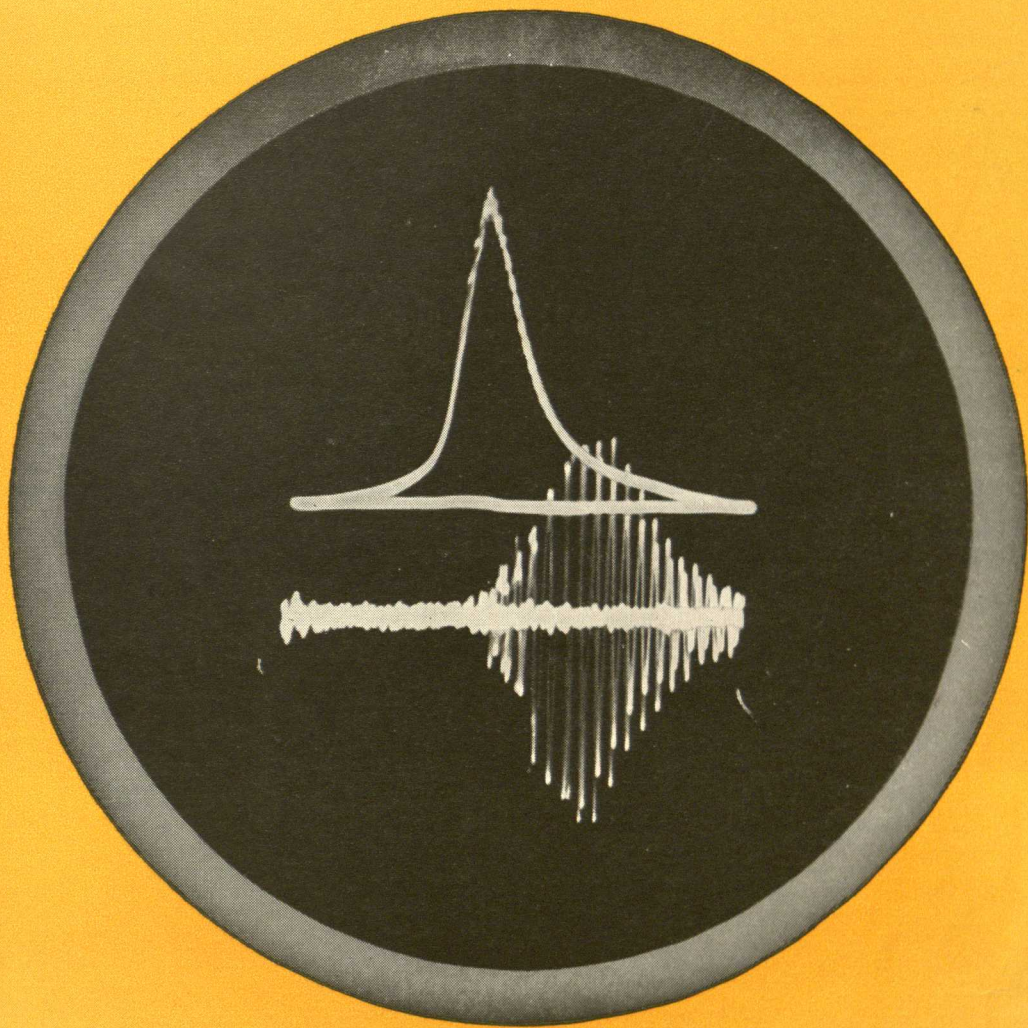
Have you heard about the girl who refused to go through with the marriage to an old man because she didn't want to feel old age creeping up on her?"

Success Complete

The designer leaned across his board,
And wonderful things in his head were stored.
He said, as he rubbed his throbbing bean,
"How can I make this thing hard to machine?
If this part here were only straight,
I'm sure the thing would work first rate.
But it would be easy to turn and bore,
It would never make the machinists sore.
I'd better put in a right angle there,
Then watch those babies tear their hair.
Now, I'll put the holes that hold the cap,
Way down in here where they're hard to tap.
Now this piece won't work, I'll bet a buck,
For it can't be held with a plate or chuck.
It can't be chilled, or it can't be ground—
In fact, the design is exceedingly sound."
He looked again and cried, "At last,
Success is mine! It can't even be cast"



Clark? Here. Paul? Here. Easter? Here. Throop?
Here. Bowers? Here.



This is a picture of "PING"

It's a picture that gives automotive engineers clear-cut facts on performance—a picture that suggests how photography with its ability to record, its accuracy and its speed, can play important roles in all modern business and industry.

No, this is not the "doodling" of a man on the telephone. Far from it. It's the photographic record of an oscilloscope trace that shows, and times, detonation in a "knocking" engine. It all happens in a few hundred-thousandths of a second—yet photography gets it clearly and accurately as nothing else can.

Oscillograph recording is but one of countless functional uses of photography in bettering prod-

ucts and improving manufacturing methods. High speed "stills" can freeze fast action at just the crucial moment—and the design or operation of a part can be adjusted to best advantage.

And high speed movies can expand a second of action into several minutes so that fast motion can be slowed down for observation—and products be made more dependable, more durable.

Such uses of photography—and many more—can help you improve your product, your tools, your production methods. For every day, functional photography is proving a valuable and important adjunct in more and more modern enterprises.

Eastman Kodak Company, Rochester 4, N. Y.

Functional Photography

... is advancing business and industrial technics

Kodak

*"Nothing is stronger than
public opinion. Given the
facts, nothing is wiser."*

On Competition

Hatch a good idea and you hatch competitors.

It works this way—to take General Electric as an example:

In 1934, the automatic blanket was initially developed by General Electric. Today there are twelve other companies making electric blankets in competition with G. E.

In 1935, General Electric first demonstrated fluorescent lamps to a group of Navy officers. In 1938, the first fluorescent lamps were offered for sale. Today they are being manufactured by a number of companies.

The first turbine-electric drive for ships was proposed and designed by G-E engineers. Today four companies in this country build this type of ship-propulsion equipment.

After several years of laboratory development, General Electric began production and sale of the Disposall kitchen-waste unit in 1935. Today fourteen other companies are in this field.

The first practical x-ray tube, developed at General Electric years ago, is now a highly competitive business for seven manufacturers.

In 1926, a practical household refrigerator with a hermetically sealed unit was put on the market by General Electric. Today 34 companies are manufacturing household refrigerators with hermetically sealed mechanisms.

* * *

Research and engineering snowplow the way, not only for new public conveniences, but also for new companies, new jobs.

There are 20% more businesses today than there were immediately after the war.

Industry furnishes over 10,000,000 more jobs than ten years ago.

The average family owns more and better products of industry than ten years ago.

Any American company that plows back money into research and engineering development makes new business not only for itself, but for others.

The economy that does most to foster competition is the one that makes easiest the establishment and growth of business.

You can put your confidence in—

GENERAL  **ELECTRIC**