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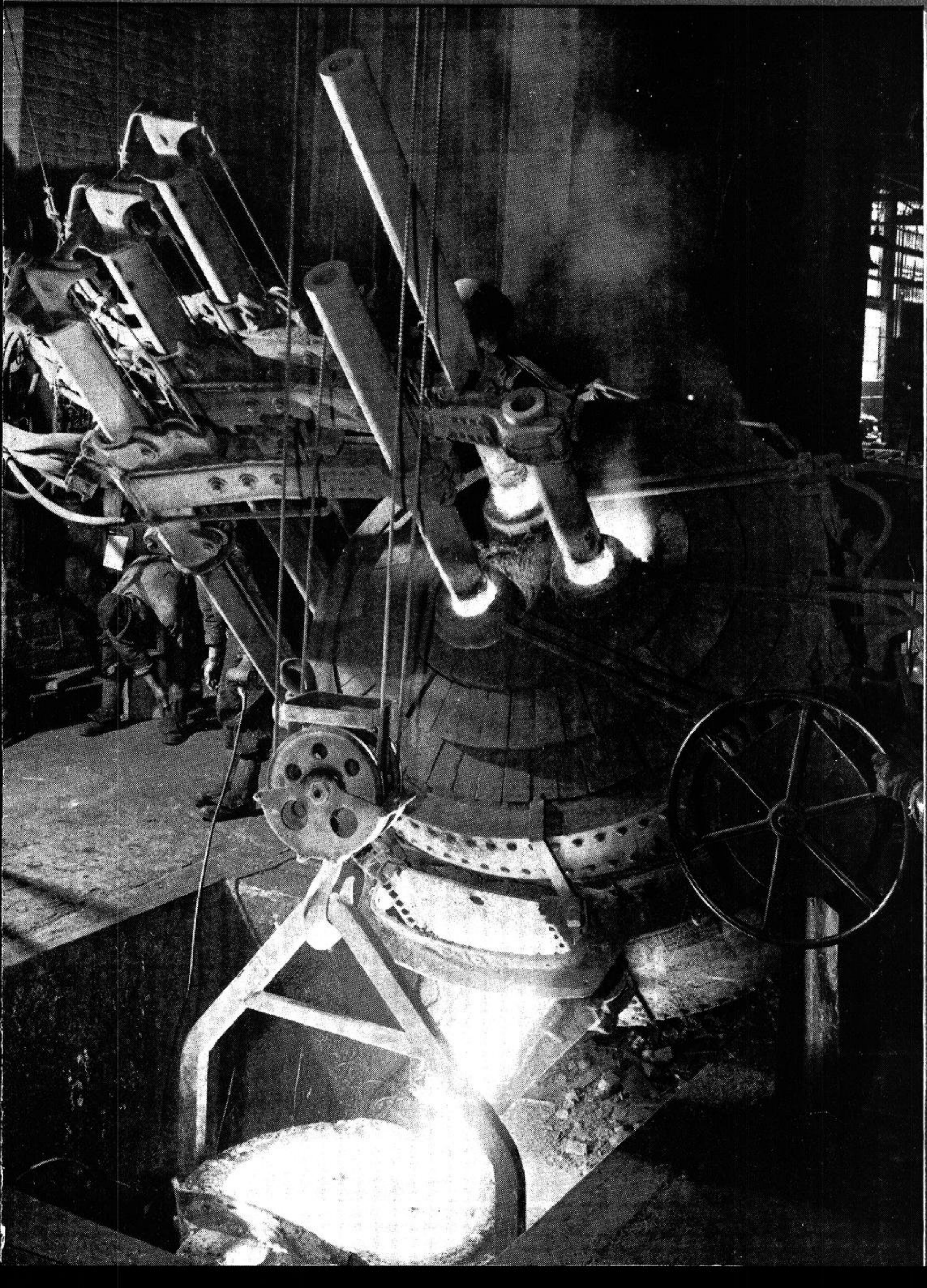
The Wisconsin

engineer



February, 1948

In This Issue:

The Big Inch Pipeline

Television, Please

Foreign Students

On the Campus

High Speed Atoms

Staff Changes

15¢

"The outward forms the inward man reveals"—OLIVER WENDELL HOLMES

Why fabrics get better all the time

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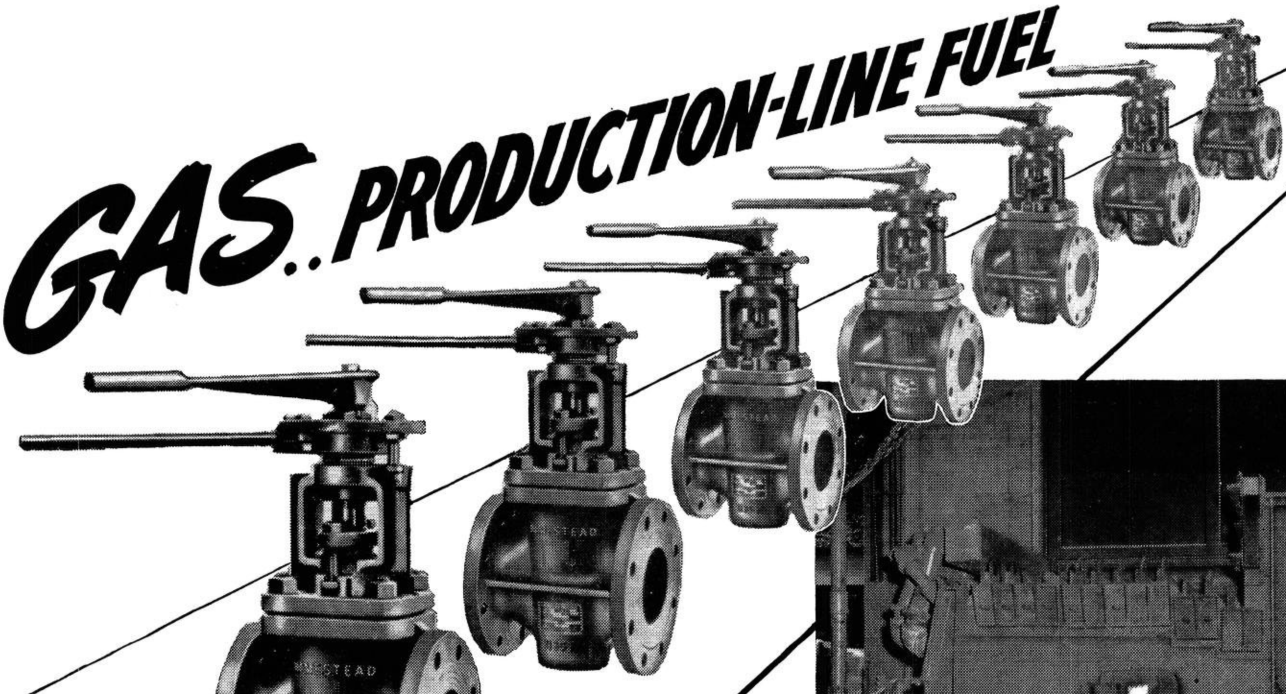
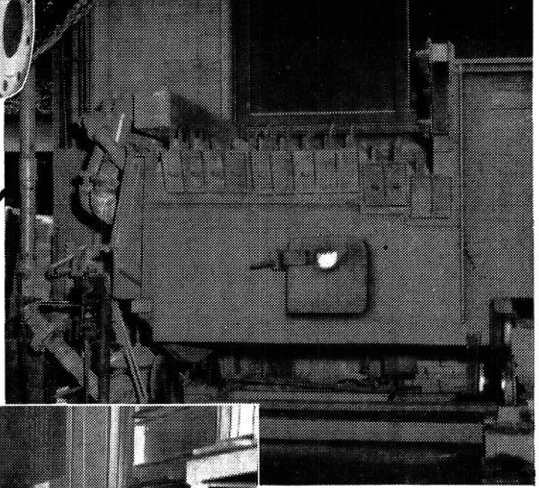
GAS..PRODUCTION-LINE FUEL



Homestead Lever-Seald Valve—for handling fluids at high pressures and temperatures—one of the multitude of Homestead Valves for all types of applications.



Gas-fired "SKLENAR" Furnace for high-speed melting of ferrous metals.

Sectional Gas-fired core-drying oven.

for

FOUNDRY MODERNIZATION

Foundry modernization is a continuing project at Homestead Valve Manufacturing Company, Inc., Coraopolis, Pa., because Homestead engineers have since 1892 kept their sights set on modern productioneering equipment and methods.

And, in their research, these engineers have investigated fuels and combustion techniques as they apply to foundry practice. As a result the productive flames of GAS are increasingly important and more extensively used in Homestead's production lines.

Modern Gas-fired Foundry Equipment, such as the "SKLENAR" furnaces for ferrous metal-melting, utilize the special characteristics of GAS—flexibility, controllability, speed. This saves equipment space, melting time, and lining maintenance. Operating at 2700° F. these furnaces have a capacity of one ton heat per hour, and 160 heats per lining—evidence that modern Gas Equipment is really productioneering equipment.

But this is not the only GAS application in the manufacture of Homestead valves. Core ovens, annealing furnaces, and non-ferrous crucible furnaces are all heated by the productive flames of GAS. In modern foundry practice GAS is the logical fuel for all heating and heat-treating operations.

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DU PONT *Digest*
For Students of Science and Engineering

Weaving of nylon yarn required the development of special sizing material

Problem solved by Du Pont men with many types of training

Each new product that is created in the laboratory seems to bring with it a new set of problems to challenge the ingenuity of the scientist. An outstanding instance of this is nylon. To make practicable the weaving of nylon into textiles, it was necessary to develop an entirely new slasher sizing material—a coating to make the filaments adhere to one another, protect the yarn from abrasion and keep it clean. Sizes used on other fibers proved unsatisfactory on nylon, because of its unique chemical composition.

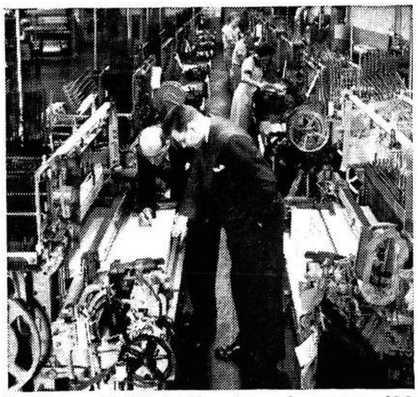
Five candidates were exhaustively tested by Du Pont men. Best by far proved to be polymethacrylic acid (PMA), $[CH_2{=}C(CH_3)COOH]_x$, possibly because its acidic nature is favorable to hydrogen bonding with the polyamide structure of nylon.

Many technical problems involved

(1) After weaving, sizing has to be removed by water. PMA dissolves in water readily up to 10% at room temperatures, but precipitates between 70-80° C. A way had to be found to prevent precipitation at the normal scouring temperature of 100° C.

(2) PMA sets to a brittle, glassy material on fibers, giving a harsh wrap. Suitable plasticizers such as sulfonated vegetable and mineral oils, glycols and other polyhydric alcohols had to be found to correct this condition and permit stretching and flexing of the yarn without film impairment.

(3) Good dispersing agents were necessary so that the powdered PMA would not agglomerate as it dissolved in the sizing bath.



G. W. Fassett, B.S. in Chemistry, Augustana '36, and W. A. Franta, M.S. in Chemical Engineering, North Dakota '34, inspect woven fabric made from PMA sized nylon warp in Du Pont Experimental Weaving Laboratory.

(4) Optimum concentrations of PMA and the various plasticizers had to be determined, and application temperatures worked out for the different types of fabrics (satins, twills, taffetas, etc.) to be sized.

The basic reactions involved in making methacrylic acid monomer are straightforward:

$$\underset{\text{(acetone)}}{(CH_3)_2CO} + HCN \longrightarrow \underset{\text{(acetone cyanohydrin)}}{(CH_3)_2C(OH)CN}$$

$$(CH_3)_2C(OH)CN + H_2O,\ H_2SO_4 \longrightarrow \underset{\text{(methacrylic acid monomer)}}{H_2C{=}C(CH_3)COOH}$$

But several technical difficulties in the manufacture of the polymer had to be overcome:

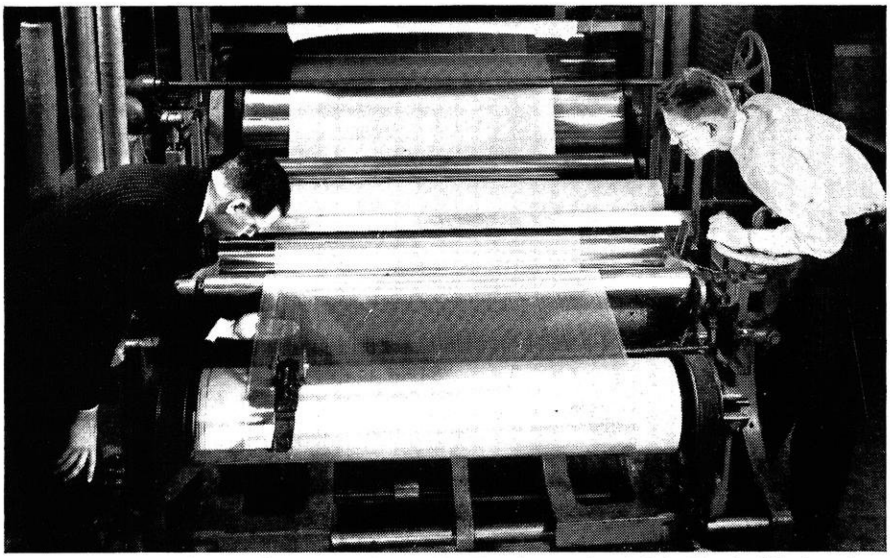
(1) The distillation of the monomer has to be controlled carefully to keep it from polymerizing in the still head.

(2) The monomer must be obtained free of any color-forming impurities that might cause permanent discoloration of the fabric by the final polymer solution.

(3) Polymerization of the monomer must be carefully regulated to get reproducible results and constant molecular weight. This is important because the molecular weight of the PMA determines the viscosity of the size.

(4) Drying the polymer presented unusual difficulties. A special study was made to find an economical drying process that would give a uniform, finely divided product adapted to rapid solution.

Credit for the development of PMA textile sizing, is shared by Du Pont men with many types of training—chemists, physicists, chemical engineers and textile experts, as well as the technical service men who worked in close cooperation with leading textile manufacturers during commercial trials.



J. M. Griffing, Ph.D. (Organic), Columbia '45, and A. Descheemaeker, B.S. in Chemical Engineering, Lehigh '41, inspect PMA size solution and check nylon warp at head end of a slasher. In slasher sizing, entire warp is coated rather than a single thread.

Questions College Men ask about working with Du Pont

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WISCONSIN ENGINEER

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In This Issue . . .

COVER:

"Man Made Inferno". This month's cover shows an electric furnace in use at the Lunkenheimer Co.

the BIG inch

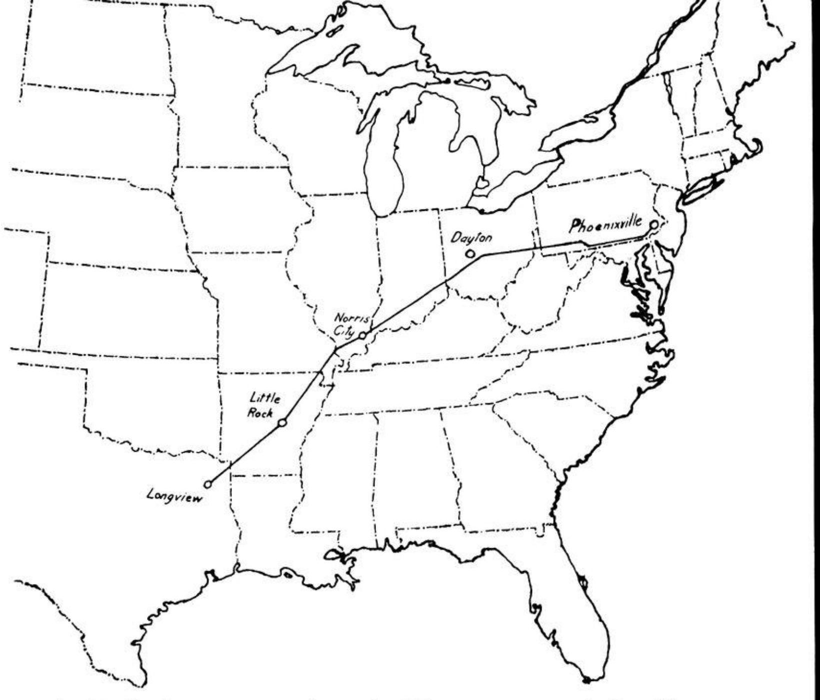
—Photograph courtesy A. O. Smith Co.

Use of specially adapted equipment is the key to rapid construction. Here a crew uses a tractor equipped with side-boom to lay pipe.

...pipeline

by Carl Leyse m'48

EDITOR'S NOTE—This article consists of extracts from a thesis entitled "The History of the Big Inch Pipeline", written by Edward Lotan Smith for his B.S. degree in civil engineering at the University of Wisconsin. Herein, the thesis has been cut to less than half its original length in an attempt to present only the more important items.



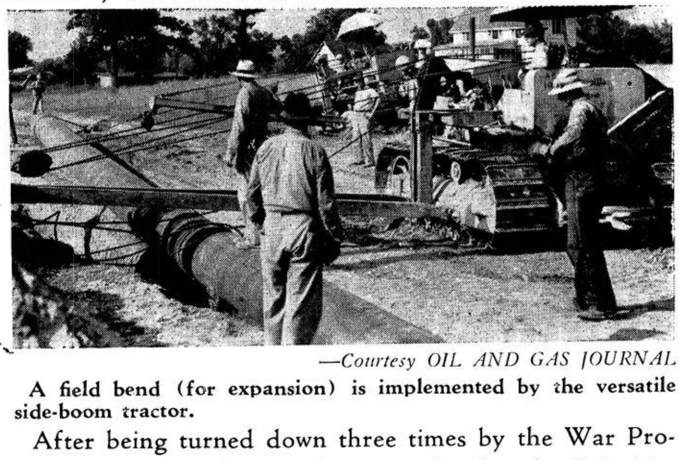
The Big Inch courses up through eight states to reach its ultimate destination at Phoenixville.

THE "Big Inch" pipeline was first suggested in 1941 when the East Coast was faced with a possible oil shortage. After being refused necessary steel several times by government priority boards, the steel was finally allotted and the project was rushed to completion in 1943 in time to aid considerably in the war effort.

PRELIMINARY DEVELOPMENT

Early in 1941 fifty tankers of the United States Merchant Marine were diverted to British service. These tankers were part of a fleet of some 260 which had served the east coast with oil and gasoline from the Texas oil fields. As was expected, this diversion of tankers threatened the East with an oil shortage which would seriously interfere with national defense measures. It therefore became apparent that oil pipelines were needed to replace these tankers.

The biggest of the proposed projects was the 1,500-mile double line from the Texas oil fields to Bayonne, N. J. **This line would consist of a 24-inch pipe to carry crude oil, paralleled by a 20-inch pipe for gasoline.** This project was proposed to Oil Coordinator Ickes in a report submitted by the American Petroleum Institute.



—*Courtesy OIL AND GAS JOURNAL*

A field bend (for expansion) is implemented by the versatile side-boom tractor.

After being turned down three times by the War Production Board and its predecessor, the Supply, Priorities and Allocation Board, the pipeline project finally received WPB approval. By the middle of July 1942 construction started on the first leg of the project, extending from the Texas oil fields to Norris City, Illinois, a distance of 550 miles. This line was to be 24 inches in diameter and to consist of 3/8-inch seamless steel tubing with welded joints. It would require 125,000 tons of steel, although at certain points cast iron pipe would be substituted for steel. Ten pumping stations at 55 mile intervals would be built and the line would have a capacity of 300,000 barrels of crude oil a day. **By the 18th of June 1942 the aerial survey had been completed and ground surveys were under way.**

The design and supervision of the pipeline were carried out by the War Emergency Pipelines, Inc., a corporation capitalized at only $41,000 and owned by the 11 oil companies which market most of the products in the eastern states. The position of the oil companies acting in this enterprise was simply that of supplying the know-how and the experienced personnel for the job. The pipeline owes its name to these experienced oil men. **In the jargon of the oil fields, any pipe over 10 inches in diameter is known as big inch, and from this sprang the official name.**

Extension of the Big Inch pipeline from Norris City, Ill., to the east coast was made possible by an allocation of 224,000 tons of steel by the WPB during November 1942. The 857-mile $60,000,000 extension carried the line across Indiana and Ohio to Phoenixville, Pa., whence branch lines were planned to Philadelphia and New York.

The initial batch of crude oil was moved into the Big Inch during January 1943. Line filling operations were started on New Year's eve, despite washed out river crossings, delay in delivery of materials and other bad breaks that had hampered completion of the line. **Velocity of flow of crude oil through the pipeline was expected to average slightly more than 4 mph. This would supply 12,600,000 gallons a day while the normal eastern seaboard requirements were about 63,000,000 gallons of oil per day. It required about 75,000,000 gallons of oil just to fill the line. The first oil flowed into Norris City February 13, 1943, at the rate of 60,000 barrels daily.**

GENERAL CONSTRUCTION

The size of the Big Inch pipe as well as its length lend distinction to this project. With a wall thickness of 3/8-inch, the pipe sections as delivered averaged 38 to 44 feet in length and weighed 3,800 to 4,200 lbs.

The pipe was shipped from the mill to rail points close to the line. Trailer trucks were then used to "string" it where needed along the right-of-way. Horizontal kinks in the line were purposely inserted to provide for expansion and contraction due to temperature changes.

Pipe sections are strung along the right-of-way by heavy trailer-trucks. —*Photograph courtesy A. O. Smith Co.*

Electric welding to join the pipe lengths was used throughout the project. Two different methods for laying the pipe were used, the stovepipe and the roll weld method. The stovepipe method consisted of laying the pipe directly over the trench on wood timber cribbing so that it rested about two feet above the ground. After the ends of the pipe were brought together with clamps and tack welded, another crew performed a three-pass welding operation to complete the connection. All welds were identified with the welder's mark in order to fix responsibility. The pipe was continuously lowered into the trench several hundred feet behind the welding operations. The roll weld method consisted of welding three or four joints of pipes in a section, after which the entire section was rolled over and added to the line at the edge of the trench. The pipe was lowered into the trench in sections about one quarter mile long.

After completion of the field welds, they were cleaned by hand with a wire brush to remove all particles of flux to minimize pitting and corrosion. Following this operation the pipe was cleaned, primed with coal tar enamel and wrapped to protect it from soil corrosion and electrolysis.

Cleaning and priming were accomplished with a special machine riding on the outside of the pipe and self-propelled by means of a gasoline engine. Equipped with revolving steel brushes that precede the tar enamel applicator swabs, the machine moved at a rate of 40 feet a minute. Several hundred feet behind, another machine followed applying a tar enamel coating and a spiral wound wrapping of asbestos felt. After the pipe was so treated it was lowered into the trench, by means of side boom tractors, and the trench was back-filled. The depth of trench was always sufficient to provide at least two feet of cover.

SURVEY DETAILS

The survey work for the pipeline was done by several firms. One of these firms, Lockwood, Kessler, and Bartlett, of Brooklyn, N. Y., completed 300 miles from Middletown, Ohio, to Uniontown, Pa., at an average of 60 miles per week in the early winter of 1942. To maintain such a pace, seven field crews and a total of 55 men were employed. Some of the equipment and methods used by Lockwood, Kessler, and Bartlett are described in the following paragraphs.

Each crew consisted of six men, including a party chief, transitman, a chainman, a rodman, and two brushmen. Except for the brushmen, who were hired locally, the parties were made up entirely of men experienced in pipeline work.

The station wagons which carried the men as close to their work as possible were equipped with ice chains, heaters, defrosters, radios, and other equipment to insure their arrival and to meet any contingencies that might arise. Rubber hip boots were included to permit men to work in water as were snow boots which were important in mountain operations. Each of the wagons carried a small portable kitchen of sufficient size to permit a hot lunch in addition to providing hot coffee throughout the day.

Working equipment included not only that usually associated with survey work but also much auxiliary equipment. In addition to the transit, rod, and chain, each party had an aneroid barometer, an instrument not usually employed in pipeline operations but which contributed considerably to the speed attained on this job.

Before going into the field, the surveyors were supplied with route and aerial maps. The general route maps showed structures, roads, natural obstacles, bench marks and other pertinent data. As soon as the location surveys were completed, the leveling work was started by new parties, recruited in the main from the location parties. Lockwood, Kessler, and Bartlett used aneroid barometers for this work, a departure from customary procedure. The men who employed the barometers had to be specially trained but the use of these instruments was highly successful. As a result of their use, a saving of 50% in time was reported and in addition greater accuracy was attained than is usual in pipeline leveling.

The data and results of the field work were progressively transmitted to the engineers in the office where they were drafted into the maps on which the actual construction was based. Three sets of maps were prepared in the office: (1) The route map on a scale of 1 inch to the mile which gave the definite route of the line together with pertinent data. (2) The right-of-way map covering

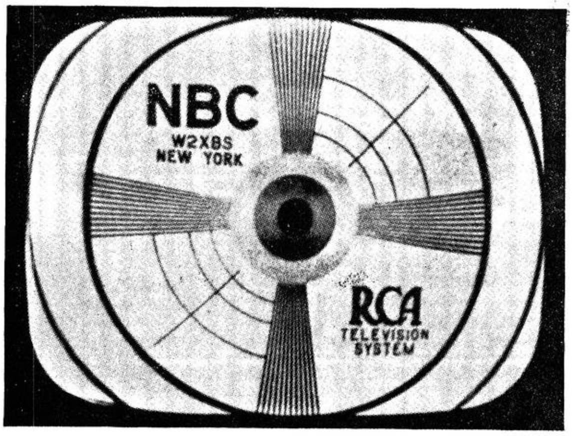
(please turn to page 24)

Television, Please

by James Vasilion e'48

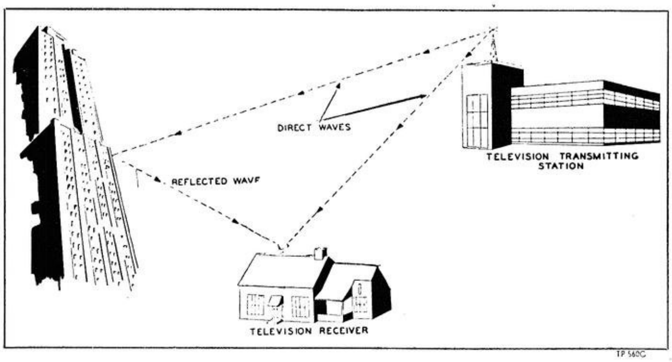
Illustrations courtesy RCA and PHILCO

IN the past few months, television (abbreviated TV) has received a good deal more attention and interest from the public and aspirants than ever before in its history. Among the factors responsible for its sudden rise in popularity is the highly successful televising of sports events, both indoor and outdoor, made possible by the development of the sensitive image Orthicon camera tube. Along with this is the fact that those stations held back by equipment shortages at the end of the war are now on the air with daily schedules of shows.

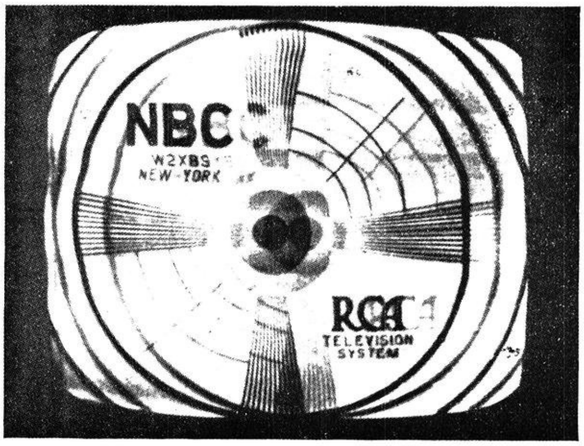


Normal test pattern.

Most television broadcasters are concentrated in the larger cities such as New York, Chicago, Washington, D. C., Milwaukee, etc., where a greater number of people can be reached within the relatively small radius covered by the station. A number of radio manufacturers realizing the potentialities of this market have placed various types of TV receivers on sale. The prices range from $169, for a table model set having a 7 inch picture tube, to $1,700 for large combination sets employing projection type screens of 15 by 20 inches and other refinements.

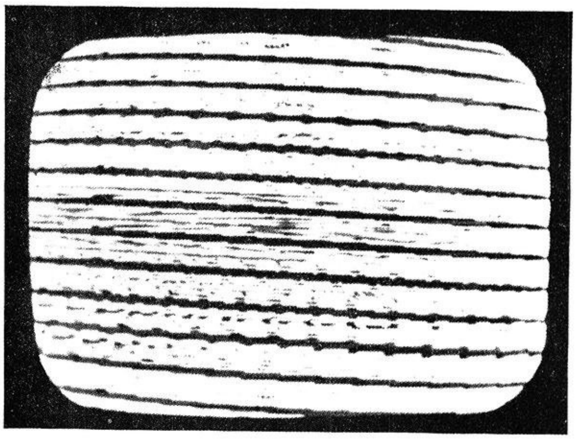


Television waves are easily deflected from their paths.



Pattern marred by reflected or multi-path signal.

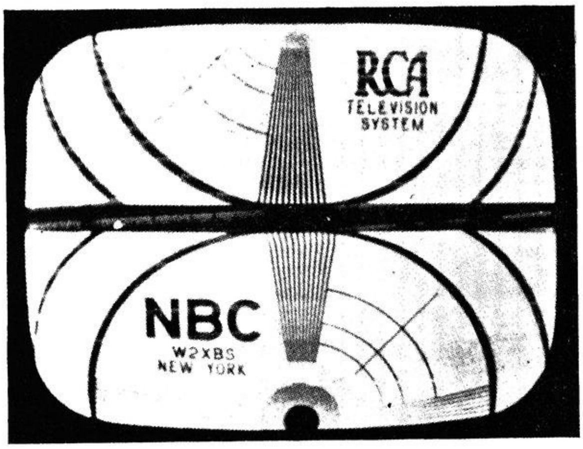
At some time or other, you may have wondered why it is that TV stations are limited to a coverage somewhat under 50 miles. The answer to this question is that television is broadcast on the high frequencies where practically no curvature of the signal around the surface of the earth takes place. The range is therefore just slightly greater than sighting distance from the transmitting antenna to the horizon. The same is true of Frequency Modulation stations since they, too, transmit on the high frequencies.



Horizontal hold control incorrectly set.

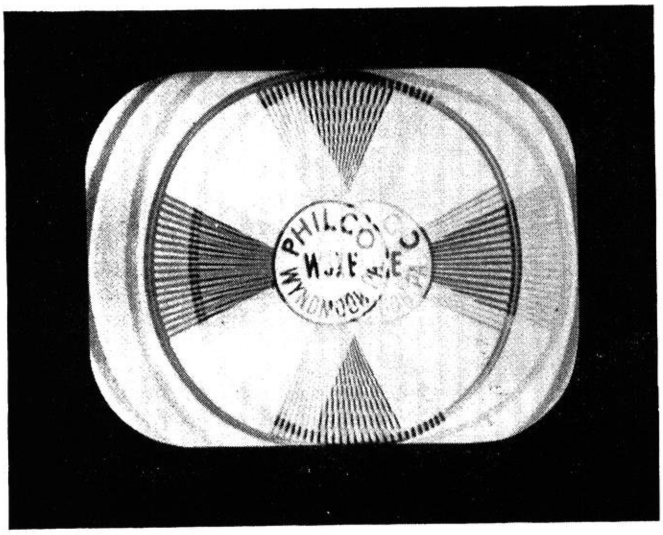
It's true, television signals have been received in this country from England, but this is a "freakish" condition lasting only a few hours and occurring during certain seasons of the year. This condition is formed by ionized gases approximately 200 miles above the surface of the earth reflecting signals down to the earth 1,500 to 2,500 miles from their point of origin.

The problem of installing an antenna for the TV set is an interesting one, especially if you happen to live in an



Vertical hold control incorrectly set.

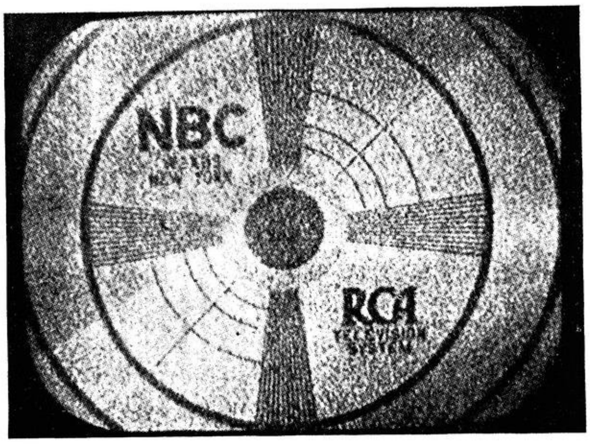
area with several large buildings protruding above the topography of the land. Using just a simple, non-directional antenna, your television screen would probably be filled with "ghost" images caused by signals arriving direct-



Ghosts.

ly from the television station, and signals reflected from buildings in the area. The distance traveled by the signal in each case is different, and so two identical images are seen on the TV screen displaced in time equivalent to the difference in distance. To cope with the problem, directional antennae are widely used and are pointed either directly at the TV station, or at the reflection from a near-by building depending on whichever results in the best reception.

Let's look in on a television studio and see how subject matter is picked up by the camera and transferred into a series of electrical impulses. First of all, the image is focused by means of an optical lens system, onto a small screen located within the camera tube. The screen is made up of thousands of light-sensitive globules placed one layer deep on one side of an insulated sheet, such as mica. Each globule is insulated from the next so that it will assume a charge of electricity in proportion to the intensity of light striking it. A thin stream of electrons is then directed to "scan" the photo-sensitive screen in a manner comparable to the reading of a typewritten page. That is, the electron beam starts from the upper left hand corner and moves horizontally to the right, flies back rapidly to the start of the second line and keeps repeating the process until the entire screen has been scanned. As the electron beam traces across the positively charged globules, they give up their charge in timed sequence generating a voltage wave proportional to the intensity of light falling on each part of the scanned line. In present-day TV broadcasting, the image is subdivided into 31,500 horizontal lines.



Pattern resulting from a weak signal.

The second function of the TV camera is to provide timing markers so that the scanning action within the camera can be duplicated exactly in a television receiver located at some distance from the station. To accomplish this, pulses are transmitted to mark the start and end of each horizontal line and to mark the start of each new picture. The effect produced by the loss of horizontal line markers, as seen on the receiver screen, is for the picture to tear into shreds with parts of the picture scattered throughout the screen. If vertical timing is lost, the effect is for pictures to revolve vertically past your TV screen.

A few points to keep in mind and to use as a guide in judging the performance of television receivers are:

Note the (1) Sharpness of detail.

(2) Linerity of the picture over the entire screen.

(3) Ability to maintain synchronization for weak signals and under heavy static.

(4) Contrast between black and white in the picture for strong and weak signals.

Badger FOREIGN STUDENTS

by Carl Leyse m'48

Turkey's Tavukcuoglu

—Portrait by Hugh Wahlin

Algeria's El Kouby

THE Engineering College of the University of Wisconsin is indeed fortunate to have among its students citizens from many foreign countries. Included in this group of students is Nikola Tavukcuoglu of Turkey, called "Nick" by most of the professors.

"Nick," who is now 27, was born in Istanbul, Turkey. Most of his life has been spent in his native land, but he has also lived for a short time in neighboring Greece. He came to the United States mainly for the purpose of continuing his education here, but also because of a desire to see other parts of the world. Nick has been particularly impressed by, and likes, the individual's independence in social life in the United States. He also appreciates the abundance of materials and merchandise available here. He enjoys the movies and spends much of his leisure time there.

Nikola earned his B.S. degree in Mechanical and Electrical Engineering at Robert College in Istanbul. Robert College is an American institution and the curriculum is very similar to those in the United States. After receiving his B.S. degree, Nick worked for a short time as an engineer for a railroad company in Turkey. He then came to the United States in March, 1947, and entered graduate

(please turn to page 30)

France has a very gifted young man as a representative at the University of Wisconsin in the person of Gilbert El Kouby. Gilbert was born in Algiers, Algeria, on the southern shores of the balmy Mediterranean. He lived in Algeria until 1945, at which time he came to the United States.

Gilbert received military training in the French Air Force. He then served his country as a member of the French Underground. He spent over a year in this organization in his native Algeria. This was at the time the Underground was cooperating with the Americans during their campaign in North Africa.

The Mediterranean and the deserts of North Africa were contributing factors toward making Gilbert's favorite sports swimming and sand skiing. He also likes to play soccer and volleyball, both of which are popular sports in Algeria.

The main reason Gilbert came to the United States was to see "what was on the other side of the Atlantic." Before coming to the United States he spent one year at the University of Algiers, where he had the distinction of being an honor student. He then considered study in the United States and was awarded a scholarship from the French government for continuing his studies here. The

(please turn to page 30)

ON *the Campus*

by John Ashenbrucker e'49
Donald Dowling e'49

DOUBLE DARE YOU

Now that the cares and woes of the fall semester are past, and everyone is digging into the new semester with renewed vigor, there is time to stop and add up the scores for the first half of the 1947-1948 school year. As yet we have no count of those who have forsaken slide rules for adding machines, but from the number of whiskers seen in the lobby of the ME building it follows that there must be a few engineers left who managed to pass thermo. The Schick people blamed Henry Morgan for falling razor blade sales, but we sincerely believe that the approach of March 17 has had a great deal to do with it.

We of the engineering school are in a position to give to the University of Wisconsin the type of publicity that she so richly deserves during this, the one hundredth year of her existence. With the coming of March we will see the celebration of St. Patrick's day, in honor of that worthy gentleman who is patron of engineers and all - time scourge of lawyers.

This traditional event has been observed with varying amounts of enthusiasm for many years, but the days when lawyers and engineers slugged it out bodily are gone forever. There still exists, however, the constructive side of the celebration, and it is up to us, as students, to get behind this one event in the engineering calendar and help to make it a success.

The highlight of the celebration is the St. Pat's dance during which the winners of the beard growing contest are selected.

Representative of the student group selling the most St. Pat buttons is crowned Patrick, Lord and Master of Engineers. Guiding light for these events is Polygon Board. Proceeds from the dance and button sales go to the student engineering societies.

True, these aren't world shaking events, but the friendly spirit displayed during this jubilee does reflect the outlook of the American college student. Let's all pitch in and make this the biggest and best St. Pat's day ever! Show your girl that you're really smooth—grow a beard for St. Pat's day!!

• • •

PRESENT PAPERS

Otto A. Uyehara and O. S. Myers of the Mechanical Engineering Department have been invited to present their joint paper on "Diesel Combustion Temperatures—the Influence of Fuel Composition," January 15 at the annual meeting in Detroit of the Society of Automotive Engineers.

• • •

ALPHA CHI SIGMA

Alpha Chi Sigma, professional chemical fraternity, held its initiation banquet at the Madison Room of the Student Union on December 13, with William Ranz as toastmaster. Dr. J. H. Mathews welcomed the new members into the fraternity. Entertainment was provided by a vocal quartet of Bryant Dunshee, Dick Hellman, Allen Filbey and Bill Tresh. Dr. A. J. Stamm of Forest Products Laboratory delivered the address on "The Latest Methods in Wood Treatment." New initiates were: Allan A. Filbey, John Malenick, Richard A. Myren, Robert G. Parish, Albert F. Preuis, Jr., Roger W. Roeske, and Earle A. Theriault.

• • •

TRIANGLE FRATERNITY

Who says that engineers don't believe in Santa Claus? This past Christmas the boys from Triangle Fraternity had a dozen needy children over to their house for a party and invited old St. Nick to do the honors with the toys and candy. Two of the Triangles got stomach aches.

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AIEE

The student chapter of AIEE met on Tuesday evening, January 13, to hear student papers presented by J. H. Gifford on "Generator Setting Measuring Devices," and E. H. Fritze talking on "Electrical Instrumentation in Structural Testing." Two films, "Electrons in Action" and "Miracle Makers," were shown.

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ASME

Meeting on January 13 for the last time during the fall semester, the ASME saw the colored film, "Building the Golden Gate Bridge." On January 15 and 16 the group made a field trip to the Gisholt Machine Company of Madison to inspect manufacturing methods, particularly those problems involving superfinishing, crankshaft balancing, and production control.

• • •

SSE MAKES STRIDES

Parts of the campus often overlooked are the University of Wisconsin Extensions in the larger cities of the state. Largest of these is the University of Wisconsin in Milwau-

(please turn to page 28)

High Speed Atoms

by H. R. Wahlin m'49

IN THE effort to get a good title for this article we have picked one which is slightly misleading. Actually, the subject to be considered here is the machines which are being used today in atomic research; the purpose of these machines is to produce atoms, or fragments of atoms, which have high kinetic energies for the purpose of bombarding substances to further investigate the secrets of their constitution.

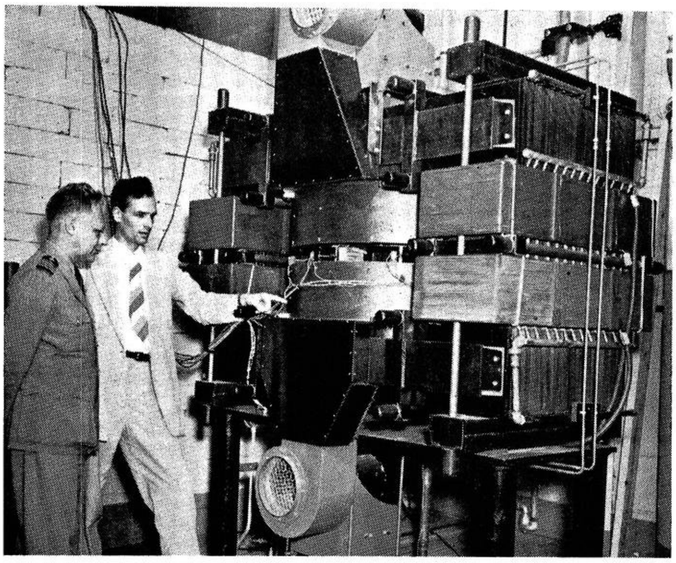
Four machines will be dealt with here: the Van de Graaf generator, the cyclotron, the synchrotron, and the Betatron. Unfortunately, there are a number of other "—trons" in the public eye nowadays, and it might be a good idea to define what we are **not** going to discuss for the purpose of removing confusion.

* * * *

electron: a unit negative charge. Mass 1/1800 that of hydrogen. There is nothing smaller that we can lay our hands on today.

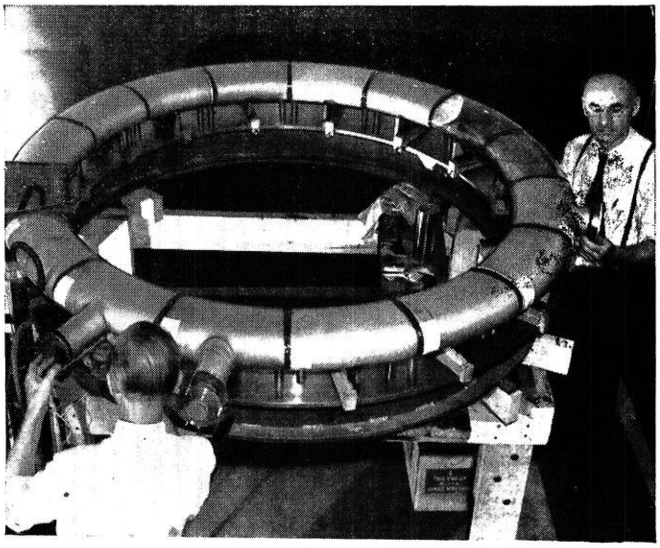
neutron: no charge, and mass that of hydrogen. Since a neutron has no charge, it cannot be controlled or directed; this makes it useful for bombarding highly charged atomic nuclei, but hard to live with.

klystron-rhumbatron: early forms of cavity resonators, developed in 1940, and similar to some present-day radar equipment. (Sources of high frequency, not high energy.)



—Cut courtesy General Electric

Nearly completed, this synchrotron is capable of hurling electrons at forces of at least 70,000,000 volts.



—Cut courtesy General Electric

This doughnut-shaped vacuum tube is for a 100,000,000 volt betatron.

As mentioned above in connection with the neutron, uncharged particles, and whole atoms — on which the charges balance out — are hard to control. Hence the physicist works a great deal with electrons, protons or ions. The first two are charged by nature; ions are atoms from which an electron or two have been removed, destroying their overall zero charge.

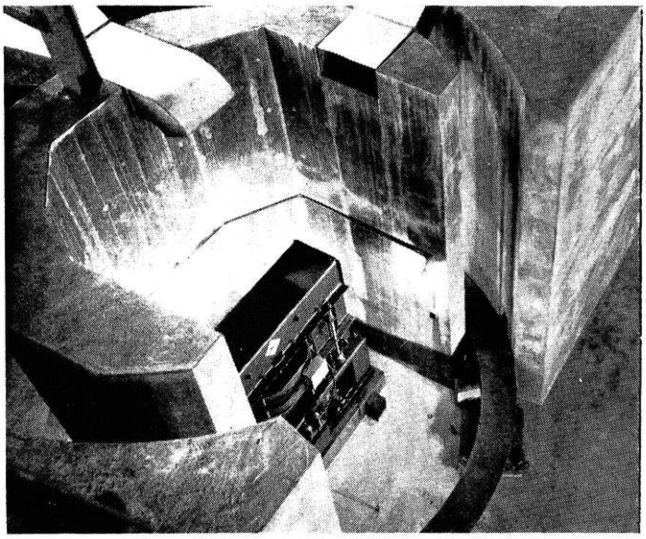
The most direct method of accelerating such particles is to put them between two charged plates, as in a condenser. An electron, say, would be accelerated toward the positive plate and acquire energy in the process. If the condenser plates were at potentials differing by one hundred volts and the electron moved from one all the way to the other, its energy would be one hundred electron-volts when it arrived. This is a ridiculously small figure today when energies of many millions of electron-volts have been attained.

The Van de Graaf machines, such as the one here at Wisconsin, are a refinement of the above technique. In the one here there are no condenser "plates"; instead a series of insulated metal rings down the inner surface of a large tank are charged by a device similar to the laboratory "static machines." The whole is kept under an air pressure of about 100 psi to eliminate leakage of charges. When charged particles are sent down the line of centers of these rings they are accelerated to as high as 4½ million electron-volts at one pass.

THE CYCLOTRON

The cyclotron represents a further refinement of the above idea, by eliminating the need for high voltages. If an electron could be sent through the same potential drop of one hundred volts ten thousand times, receiving a "boost" each time, it would have a final energy of one million electron volts. This scheme was perfected by making the electrons travel in circles, a simple task since any charged particle will travel in a circle about a magnetic field.

The cyclotron consists of a huge magnet which sets up a vertical magnetic field. In this field, and perpendicular to it, are a pair of hollow, D-shaped plates known, strangely enough, as "dee plates." To these a high frequency A. C. is applied. A particle released between these two plates will be accelerated toward one of them by its charge. The magnetic field makes it move in a circle through the dee and come out across the dividing line headed for the other. The A. C. is synchronized to reverse the charges on the two plates at this instant, giving the particle another boost. As the particle gains energy it travels in larger and larger circles within the two dees, finally breaking away at the edge with an energy of many millions of electron-volts.



—Photograph courtesy Allis-Chalmers

Concrete shields protect this 22 million volt betatron, which is used as power for x-ray testing of Army shells.

THE SYNCHROTRON

To understand the synchrotron we shall have to give you one or two equations at this point, showing what goes wrong with the cyclotron. In the cyclotron, the particles travel in circles of such size that centrifugal force and the inward acceleration of the magnetic field just balance. Mathematically this is $\frac{mv^2}{r} = Bev$ or $\frac{mv}{r} = Be$ where the symbols have their usual meanings.

Substituting $v = r\omega$ in the above we have $\omega = \frac{Be}{m}$, i. e: the angular velocity of the particles is constant, so that the same frequency on the dees can be used whether the particle is near the center or just ready to escape, and a steady stream is then available. The joker here is that the mass, and hence the angular velocity of the particle, do not remain constant. The theory of relativity says that the mass of a moving particle is $m = \frac{m_0}{\sqrt{1-\frac{c^2}{v^2}}}$ where m_0 = mass at rest, v = velocity of particle, and c = the speed of light.

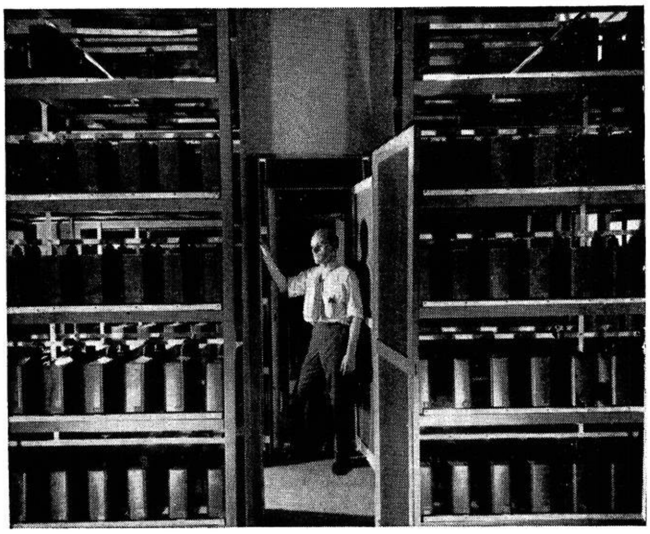
At speeds approaching that of light the particles in a cyclotron actually become heavier and fall out of step with the accelerating forces like rookies on a long march.

The synchrotron corrects this by making the magnetic field, B, around the edges of the dees stronger than at the center to compensate for the increase in mass. It is as simple as that, and the only limits to the energies available are those imposed by construction difficulties.

THE BETATRON

The betatron, the next development in this progression of accelerators, was developed just before the U. S. got into the war and kept under wraps till last year. In the betatron the high frequency A. C. required in cyclotron and synchrotron is done away with altogether.

There is a giant magnet, just as in the two previous machines, but instead of dee plates a doughnut shaped vacuum tube is wrapped around its core. Electrons are fed to this just as a magnetic field is built up in the core by the discharge of a large bank of condensers. The electrons in the tube travel in circles as before, and in addition they are accelerated by the **increase** of the field, similar to the action in a transformer. (In other machines the field is unvarying.)



—Cut courtesy General Electric

From these banks of condensers, electricity at 24,000 volts surges into the coils of the 100,000,000 volt betatron at the G.E. Research Lab.

It takes about 1/250 of a second for the condensers to discharge and in this time the electrons make about 250,000 revolutions through the doughnut, acquiring an energy of 100 million electron-volts. As an indication of the velocity acquired, these electrons end up two hundred times more massive than they were to start with.

As for the next step in the evolution of atomic research tools, who can say? Let's just hope we live long enough afterward to be able to tell each other about it!

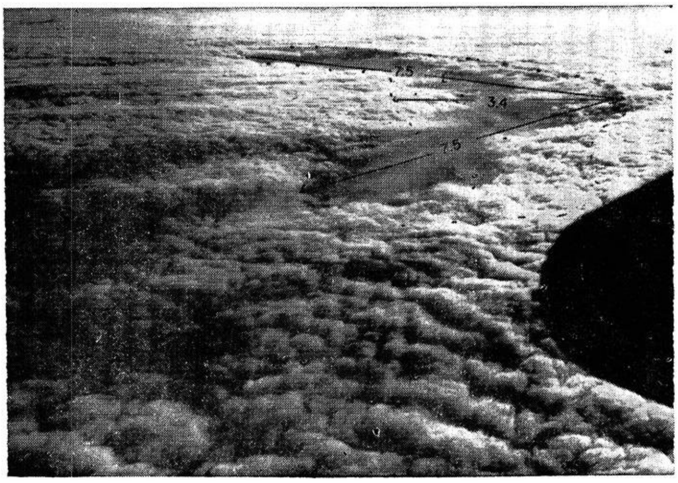
Science Highlights

by E. Robinson m'49 & E. Zimmerman e'49

ANOTHER RAIN-MAKER

Another method for making rain has been disclosed by Dr. Irving Langmuir of the General Electric Company. This latest development involves the scattering of water droplets in actively growing cumulous clouds.

Unlike the dry-ice or silver iodide methods of producing precipitation (which are effective only in supercooled clouds below the freezing level in the sky), the new method can produce rain from cumulous clouds of any temperature above or below the freezing level. In further contrast to previously discovered methods, the new technique is simpler in that it forms rain directly instead of first forming snow which may melt in its journey earthward.



—Cut courtesy General Electric

This "L-shaped" gap in the cloud is caused by precipitating the cloud-moisture through artificial means.

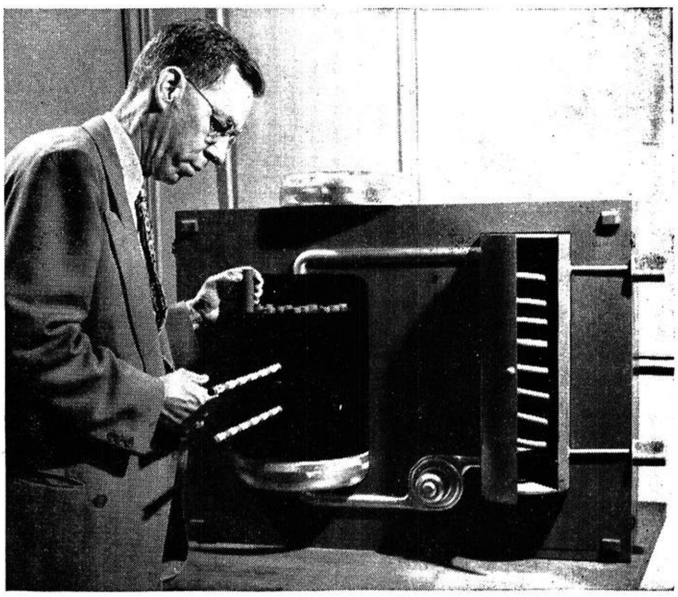
Certain characteristics the cumulous clouds must have, in order for this new technique to be effective, include an updraft of at least five miles per hour, fully grown water droplets, a high cloud water content, and a cloud thickness of several thousand feet.

According to the theory behind the method, a small quantity of water dispensed into a cumulous cloud would begin falling in the form of ordinary water droplets. The drops would be large enough to fall despite the upward wind currents. As these drops fall, they collect the many-times-smaller cloud water droplets in their path. By accretion, the drops grow as they fall.

When the water drops reach a critical size (about three sixteenths of an inch in diameter) they would begin throwing off, or shedding, any further accumulation. These smaller droplets are carried upward by the updraft—gathering all cloud water drops in their path. The critical size is again reached, and the entire cycle is performed again.

ESSENTIALS OF ATOMIC POWER PLANT SHOWN IN MODEL BUILT BY G-E SCIENTISTS

This non-full scale model is schematic of the elements involved in an atomic power plant which was constructed under the supervision of scientists in the G.E. Research Laboratory and seen here with Dr. Kenneth Kingdon.



—Cut courtesy General Electric

"A picture is worth a thousand words," but G.E. scientists believe a model is even better.

At the left is the atomic "pile" where matter is transformed into energy by the splitting of uranium or another fissionable element. In his left hand Dr. Kingdon holds a model rod of this "fuel" material, while the striped rods projecting horizontally represent the control rods which would prevent the process from running away. A heat exchanging fluid would be pumped through the pile, thence to the heat exchanger on the right, where water would be turned to steam. This would then be used to drive turbines in the customary way.

The heat exchanger step is needed because anything entering the pile would become radioactive, and thus steam could not be brought directly from it. The radiations from the pile and the heat exchanger require that both be sealed in a capsule of concrete or similar protective material.

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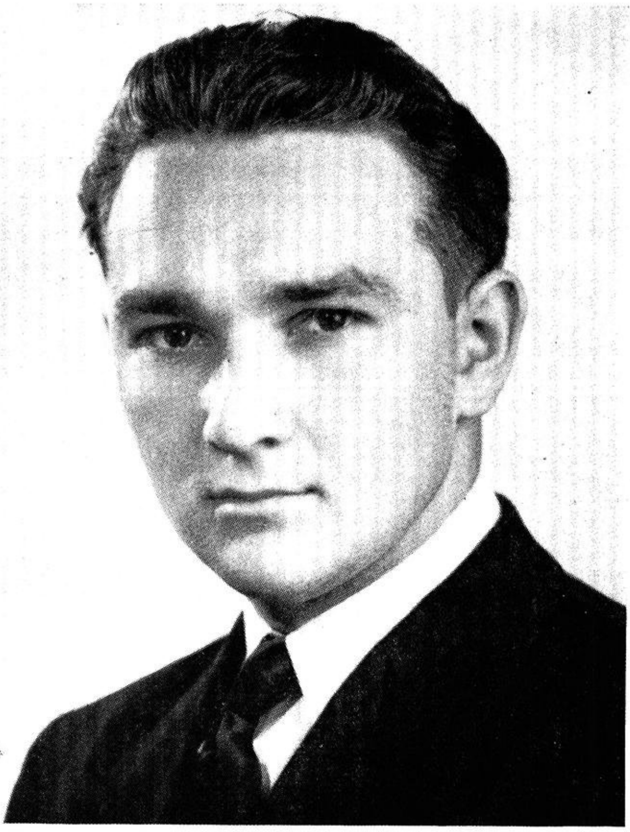
The Wisconsin Engineer STAFF

ROBERT MITCHELL



CHARLES MITASIK

HEADING the editorial staff of the "Wisconsin Engineer" for the next semester in the position of editor will be Robert Mitchell. Bob started life in 1927 in a small town in Arkansas by the name of Smackover. In going through the twelve grades of school, Bob attended no less than sixteen different schools. If he were to pick any one town as his home town during this period, it would be El Dorado, Ark. At sixteen he left home and went to San Francisco where he worked days as a marine electrician in the shipyards of the Bethlehem Steel Co. Nights he spent earning his high school diploma at the Evening High School of Commerce. After this Mitch went into the Navy. Until he entered V-12 he spent his time at Great Lakes. In V-12 he first went to St. Ambrose at Davenport, Iowa. Later he was assigned to Wisconsin. After his discharge he returned here and now expects to graduate in June as a Mechanical Engineer. During his stay here Bob has been quite active in outside activities. He has earned two major letters as a member of the fencing team. Last year he was captain of fencing. He is a member of the Student Board of Athletics, the W-club, and of the activities committee of A.S.M.E. After graduation Bob intends to go into plant engineering and he hopes that it will eventually lead to management.

As Business Manager for the next semester, Charles Mitasik will head the Business Staff of the "Wisconsin Engineer." Chuck started on the staff in 1946, working up from staff member to Advertising Manager.

Born in Czechoslovakia, Chuck (and family) came to America to settle in Wisconsin. He is a graduate of West Division High School in Milwaukee and of the Machine Shop course of the Junior College Division of the Milwaukee Vocational School. He also attended Extension Division. During this same period Chuck served at a trade as an electric welder for the Harnischfeger Corporation, and he stayed with the company until he entered the Navy in May, 1944. Before going to sea he went to electricians' school at Iowa State College at Ames, Iowa. After his discharge he returned to work at Harnischfeger's until he entered school here in September, 1946. Chuck will graduate with an M.E. degree in June, and he intends to enter the production management field.

Mitasik is also a member of the S.A.E. and A.S.M.E. societies.

CHANGES

by R. W. Hacker e'49

ROBERT ST. CLAIR

EMIL KASUM

Retiring as editor for the past semester is Emil Kasum. He has accepted employment at the Westinghouse Co. in Pittsburgh, Pennsylvania. Among Emil's other activities on the campus are active membership in A.I.E.E. and vice-president in charge of pledging at K.H.K., the Electrical Engineering fraternity.

ACTING as Advertising Manager for the next semester will be Robert St. Clair. He was born and reared in Wauwatosa where he graduated from high school in 1941. Until the inevitable sojourn with the Armed Forces, Bob worked in the Secretary-Treasurer's Office of the Wisconsin Telephone Co. He spent close to four years in the Air Corps as a bombardier. However, all this time wasn't wasted; because while with the Army in Florida he met the girl who is now Mrs. St. Clair. Upon his discharge he came here to the University. He will graduate in 1949 with a Mining and Metallurgy degree, and he intends to enter the Sales Engineering field. Bob's other outside activities include membership in the Mining Club, Theta Tau, and the American Institute of Mining and Metallurgical Engineers.

St. Clair is an old hand at the publishing business (particularly circulation) since he claims to have personally delivered every newspaper printed in Milwaukee between 1936 and 1942.

Succeeding Bob as Circulation Manager is Hank Sieth, who expects to graduate in E.E. in 1950.

WILLIAM GOTTSCHALK

William Gottschalk is retiring as Business Manager. Graduating with a degree in Mechanical Engineering, Bill is leaving shortly for California to look for employment. Besides his work on the Engineer, he was publicity chairman for M.E.S.W. and an active member of the A.S.M.E.

Alumni Notes

by J. J. Kunes e'48

L. Hunholz e'49

—E.E.—

Earle S. Henningsen ('12) has been named Manager of Engineering, Schenectady Motor and Generator Division, by General Electric Company. A native of Oconto, Wis., he joined G.E. as a student engineer on the Test Course upon graduation, and was transferred to the A-C Engineering Department in 1915. He left the company in 1917

—Cut courtesy of General Electric
E. S. Henningsen

to serve as a lieutenant in the Navy, aboard the USS Georgia. Returning to G.E. after the war, he became assistant engineer in the A-C Engineering Department, and in 1930 engineer of the department.

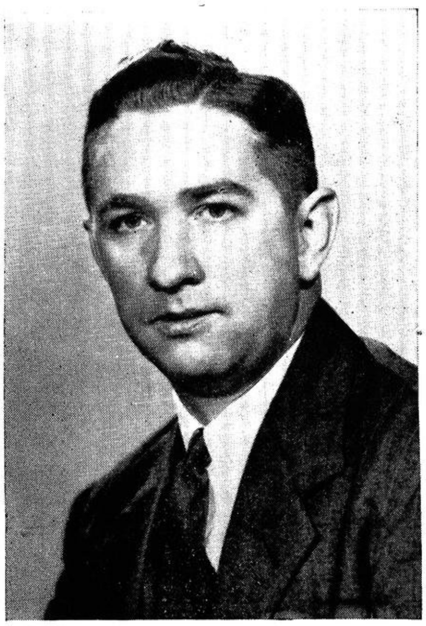
Charles W. Green ('07), assistant to the executive vice-president and military relations personnel office, has retired after twenty-eight years of service with Bell Telephone Laboratories, Inc. Before World War I he was an instructor and assistant professor at the Massachusetts Institute of Technology, and after the war became associated with Bell.

Ray S. Hoyt ('05) has retired after 40 years of service with Bell Telephone Laboratories, Inc. After a year at MIT as a grad student and assistant instructor, he worked for American Telephone and Telegraph Company. He became affiliated with the Western Electric Company in 1907, taking time out to obtain his MS degree from Princeton in 1910.

William M. Knight ('39) has had an interesting and varied career since his graduation. He started with G.E. on their Test Course, then transferred to their Industrial Control Engineering Department. In 1940 he worked on the Panama Canal as Junior Electrical Engineer; in 1941 became an Electrical Materials Engineer for the U. S. Public Works Department, working with the Navy at Newport, R. I. In 1942 he returned to G.E. as an Electrical Engineer in their Aeronautical Equipment Section. Here he worked as a specialist in aircraft electronic equipment. Enlisting in the Navy in 1946, he served as an instructor in electronics and is now temporarily stationed in Washington, D. C., servicing mobile FM radio equipment for the Shore Patrol, while awaiting a sea duty assignment with the Atlantic Fleet.

William N. Schink ('42) of Crystal Lake, Ill., is making selector switches, potential controls, and allied radio equipment for the Oak Manufacturing Company. All his spare time is taken up in building a new home. He was Business Manager of the "Engineer" in 1941.

Harry V. Somerville ('29) recently was promoted to the position of Manager of the East Central Region by RCA Victor Corporation. He



—Cut courtesy of WISCONSIN ALUMNUS
H. V. Somerville

had been sales manager in Cleveland since 1944. While on the campus he had his own ham station, W9AEU. He is a member of the Institute of Radio Engineers.

R. L. Oetting ('36), Illuminating Engineer with the General Electric Company, spoke before a meeting of the Illuminating Engineering Society on January 8th, on the subject: "Office Lighting." He is a member of that IES committee which published a report, "Recommended Practice of Office Lighting."

Gerald Keppert ('46) is a transmission engineer, working at present on a mobile radio-telephone for the Milwaukee Laboratories of the Bell System.

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The Way We See It . . .

Enough Is Enough

Well, it looks as though we aren't going to have to keep a pocket full of nickels handy in order to have dance music on the night of the Prom. For a while it seemed that it was going to be that or have "Joe Paduke and his 'We're hot tonight' sextet". It has finally been announced that a band has been signed for the Prom. I hope that after the trials and tribulations that were gone through to secure a band are reviewed, something will be done to remedy the situation. The Prom King is elected too late in the fall to be able to engage a band when the tours are laid out. His only chance to get a first class band is if there is an open date or if a cancellation comes up.

It is my opinion that the signing of the band should be taken out of the hands of the Prom King and placed in the hands of some organization that is in session as soon as school opens in the fall. An ideal group to do this would be the Student Board. Here is a group elected by the students and always ready to do its best for them. One of their first duties on the opening of the fall term should be to get in touch with the booking agencies in Chicago and let them know the date of the Prom and the type of band desired. This will let them know that the University of Wisconsin is in the market for a good band on a certain date. Then when the tours of the various bands are arranged, an engagement can be made. Lessons learned in signing the bands from year to year can easily be passed down within a single organization. As the situation exists now, each Prom King starts from scratch. It was a close call this year. The band was signed less than two weeks before the date of the Prom. Let us hope that the lesson learned will be well taken, and that the set-up as it exists now for engaging the Prom band will be changed.

R. W. H.

Taking Stock

Along about this time of the semester, with a rough one behind us and a similar one ahead, it is only natural for one to stop and "take stock" of what he has accomplished and what he has yet to do. The trouble with most of us is that we attempt to fool ourselves, as well as others. It is an old game. The trouble with that, in turn, is that we are often better at fooling ourselves than we are at fooling others. This makes us feel that justice has died an emphatic death — in our own case.

Well, before we get all excited about this thing, suppose we stop and figure out just what the purpose of all this mathematical and theoretical treadmill is. Correct me if I am wrong.

Primarily, we are attempting to increase our value to others. Specifically, those "others" are our future employers and the ones who will be dependent upon us for the niceties and necessities of life. Ultimately, of course, we are attempting to increase our value to ourselves—but that primary step **must** come first. In the field of work which most of you readers have chosen, it is essential that basic theory be **understood,** not memorized. That is the difference between the mechanic and the engineer. Further, it is essential that mathematics be understood if these basic theories are to be of any real value. Therein lies the difference between the good engineer and the engineer.

Unfortunately, it is easier to memorize than to learn. Most examinations are based upon how good the memory is, not how good the understanding is. This is natural, for measuring one's understanding is more involved than measuring one's memory. As long as teachers are overloaded as they are now, this will probably endure.

In looking both back and ahead, we should observe weaknesses in our basic understanding of theory. We owe it to ourselves, ultimately, to get that theory. That is the best way to retain engineering as a profession.

R. J. M.

S-T-A-T-I-C

by Chuck Strasse e'49

A little girl was showing her playmate her new home.

"This is my daddy's den," she said. "Does your daddy have a den?"

"No," was the answer, "he just growls all over the house."

* * *

St. Pat grew a beard and saved money on razor blades.

* * *

A blushing young woman handed the telegraph clerk a telegram containing only a name, address and one word "yes."

Wishing to be helpful, the clerk said, "You know you can send ten words for the same price."

"I know I can," she replied, "but don't you think I'd seem too eager if I said it ten times?"

* * *

"Does Marian ever go out on a party?"

"Yes, every one she's at."

* * *

"I'm a self made man."

"You're lucky. I'm the work of a wife and three daughters."

* * *

"Hell, yes," said the devil, as he picked up the phone.

A few of the boys comparing notes in the Rathskeller. (Editor shown, upper right).

Frosh: "May I kiss you good night?"

Dorm Girl: (Silence.)

Frosh: "May I kiss you good night?"

Dorm Girl: (More silence.)

Frosh: "Say, are you deaf?"

Dorm Girl: "No, are you paralyzed?"

* * *

"How high did you get in school?"

"I'll have you know that I never touched the stuff."

* * *

"This letter says my dachshund died."

"What happened?"

"He met his end going around a tree."

* * *

"I've drunk to your health when I'm near you
I've drunk to your health when I'm alone
I've drunk to your health so doggone much,
I've darn near ruined my own."

* * *

As the Eskimo said when he finished his story and got up off the cake of ice, "My tale is told."

* * *

"Why is it in Madison that two ambulances always go to the scene of a wreck?"

"The first is to pick up the people who are hurt, and the second is to pick up the senior law students who didn't make it."

* * *

St. Pat says:
When the weather's full of ice and storm,
A heavy beard will keep you warm.

* * *

Lawyers are like some girls; they climb the ladder of success—wrong by wrong.

* * *

"Where can I get hold of you next week?"

"I don't know, I'm kind of ticklish!"

* * *

Definitions

A cannibal is one who likes his fellow man—with gravy.

A lawyer is one who likes his fellow man—with money.

* * *

"I'm just burning up with love for that girl."

"Well, don't be a fuel and make an ash of yourself."

(please turn to page 27)

Science Highlights . . .

(continued from page 15)

A MILLION WORDS A MINUTE

Ultrafax, a combination of television, radio relay and photography, represents another revolutionary advance in communications. Developed in R.C.A. Laboratories, Ultrafax can handle documents, letters, printed pages and messages at the rate of a million words a minute, and can transmit photographs, maps and other illustrations at the rate of 30 pages a second.

STOP THAT BLAST

It is easier to avoid an explosion of Uranium-235 than to plan and use the very special mechanism to cause it to explode. Since the rate of reaction of U-235 is on an exponential curve which is extremely steep, as the masses of U-235 approached each other in the short distances just before meeting the rate of reaction would increase a millionfold in a millionth of a second. The enormous energy production in each of the masses would raise the temperature enough to volatize the uranium long before the explosive stage was reached. Thus the masses would be dispensed and scattered into maximum possible volume at minimum possible concentration, which would stop the reaction.

This means that in an unmoderated pile where subcritical masses are brought near each other by means of machinery, the uranium itself would prevent a blast if the machinery could not be brought to a stop.

ELECTRON MICROSCOPE

Recently before the Electron Microscope Society of America pictures were shown with magnifications of 200,000 to 300,000 times actual life size, thus in effect extending human vision down into the sub-world of life on its smallest scale. Some of the pictures shown were of objects one four-millionth of an inch in diameter.

ULTRA MICROTOME

Also demonstrated was a new knife with a special steel alloy blade one inch long that travels in a slot on the rim of a disk spun by an electric motor with a speed of 60,000 r.p.m. The knife can cut thin sections as small as four-millionths of an inch thick. It goes so fast that the actual cutting may be done by a supersonic s h o c k wave traveling ahead of the blade.

The knife is an ultra microtome for cutting extremely thin sections of many kinds of materials for examination of their structure under the powerful eye of the electron microscope.

The material whether metal, bone, tooth, or fiber is first frozen in liquid nitrogen to prevent the frictional heat from destroying the material while it is being cut. The thin sections are blown into a collecting tunnel at the rate of 1,000 a second.

NEW GLASS TYPES

A glass has been developed that conducts electricity. It is a fully transparent piece of glass, which will transmit solar heat during the day and at night, by connecting to an electric circuit, can be heated to any desired temperature. It will have many industrial applications with a possible use in electronic tubes.

Another glass, designed to protect certain types of seedlings, absorbs more than half the solar heat, but which transmits more than half the solar light. Then there is the cellular glass product which is "permanently vermin-proof, rat-proof, and rot-proof, and it is also impervious to light and has excellent insulation properties, making it useful in cold storage spaces." A tempered-glass has been developed that is "especially invulnerable to the impact of hail stones."

To meet conditions that the normal glass cannot, a sandless glass family using phosphorus pentoxide as its base has been developed. This new family of glasses was developed at the request of atom bomb psysicists, because uranium hexofluoride, used in experiments, bit so savagely into the reaction chamber observation windows. The physicists wanted, besides the instruments recording the process, to be able to see what was happening. Ordinary glass does not offer much major resistance to hydrofluoric acid, but this one does.

Another of this family permits 80 per cent of ultraviolet rays to pass through while ordinary glass lets only one per cent through. The use of this glass in homes will enable every home to have an enclosed sun bathing room which can be used regardless of outside temperatures.

Then there is the glass which absorbs 90 per cent of the infra-red rays in light at only a small loss in visible light transmission. This glass will be of great use in film projectors where it can replace all other screens designed to prevent the heat from the bulb from burning up the film.

Despite the entirely different basic ingredient, it has many similar characteristics of ordinary glass. It has similar appearance, and it is durable and elastic. However, its strength is greater than that of ordinary glass, and it is easier to work with because it can be blown at relatively low temperatures (this last property may be of somewhat a disadvantage in some applications).

The main disadvantage to a greater use of these glasses is the fact that phosphorus pentoxide costs seven cents a pound as compared with the almost negligible cost of sand.

There is now being used a phosphate glass which slowly dissolves in water to prevent scale and to control corrosion caused by industrial, process and domestic waters. It is also effective in stabilizing water containing iron or manganese.

(please turn to page 34)

It's a good thing he doesn't dress for every industry he serves

He's a Square D Field Engineer. There are others like him in Square D branches in more than 50 principal cities of the United States, Canada and Mexico. These men are liaison between Square D and industrial America. Their full-time job is contacting industries of every type and size. It is through them that we are able to do our job effectively. That job is three-fold: To design and build electrical distribution and control equipment in pace with present needs—to provide sound counsel in the selection of the right equipment for any given application—to anticipate trends and new methods and speed their development.

If you have a problem in electrical distribution or control, call in the nearby Square D Field Engineer. He makes a lot of sense in finding **"a better way to do it."**

For many years, ADVERTISEMENTS SUCH AS THIS ONE have appeared regularly in leading business magazines. Their primary purpose is to build acceptance for Square D Field Engineers, practically all of whom come to us from leading engineering schools such as yours.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D CANADA, LTD., TORONTO, ONTARIO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

the BIG inch . . .

(continued from page 8)

—*Photograph courtesy A. O. Smith Co.*
Welds in cribbed-up pipe are carefully inspected. Each weld has the individual welder's identification mark for responsibility fixing.

the right-of-way area which varied from 50 to 75 feet in width, on a scale of 1 inch to 1,000 feet, providing information on property ownership, distances, types of soil, types of vegetation, and similar data. (3) The profile map which presented the data obtained from the barometric leveling.

PUMPING STATIONS, PUMPS, MOTORS, AND VALVES

Oil was moved through the Big Inch pipeline by electric centrifugal single-stage pumps operating in series, with three 1,500 hp. units totaling 4,500 hp. at each station. Stations were spaced at average intervals of about 50 miles throughout the length of the line. Operating pressures were between 725 and 740 lbs. per sq. in. At the time the line was designed it was believed that the pressure drop would be about 12.9 lbs. per sq. in. per mile.

The rotors of the single-stage centrifugal pumps were 16 by 12 inches in size. They ran at a speed of about 1,800 rpm., which was low for pipeline service. The pumps operated with a minimum positive suction pressure of 20 to 30 lbs. per sq. in. Each pump was rated at 8,750 gallons per minute against a 630-ft. head.

The entire pipeline required the use of 29 booster pumping stations. All but two of these were equipped with three main pumps, each driven by a 1,500-hp. 1,800-rpm., 2,300-volt, squirrel-cage induction motor. Each motor had an 18-inch shaft extending through a fire wall located in each station between pumps and motors, and connected to the pump shaft by a flexible coupling. A seal was used around the shaft at the fire wall to exclude from the motor room gases which might emanate from the pump room.

Dispatching of oil shipments through the line was directed from a central office. Orders and other messages were transmitted to the stations by teletype. After a year of operation "full voice" systems were installed in all the stations.

The main motors were designed for starting at full voltage with a starting current not to exceed five times full-load current. Each motor weighed 5½ tons, and was approximately 4½ feet high, 4½ feet wide, and had an overall length, including extended shaft of a little over 7 feet. The motors were of the open type and were self-ventilated by fans built integrally with the motor.

Valves for the Big Inch pipeline weighed 7½ tons and were 12 feet high. The distance from face to face of the end of the 52½ inch diameter flanges was over 4 feet. The thickness of the high-nickel content metal was 4 inches. The body bonnet stud bolts (2 in. by 13½ in.) were of a 125,000-lb. tensile strength special alloy. The valves were of outside screw and yoke type, operated by bevel gear and had a totally enclosed gear case. The valve stems were about five inches in diameter and the hand wheels about 3 feet in diameter. The stem protector on top of this outside screw and yoke design had an indicator to show the position of the gates. With the ball-bearing operation, the operator found it relatively easy to open and close this valve even when the differential pressure was the maximum line pressure.

OPERATING PLAN

The Big Inch pipeline was operated by the government as an emergency war facility. It was not a common carrier, and did not file tariffs, and was not available for general use of shippers. The pipeline was run exclusively for the purpose of increasing production and distribution of petroleum war products.

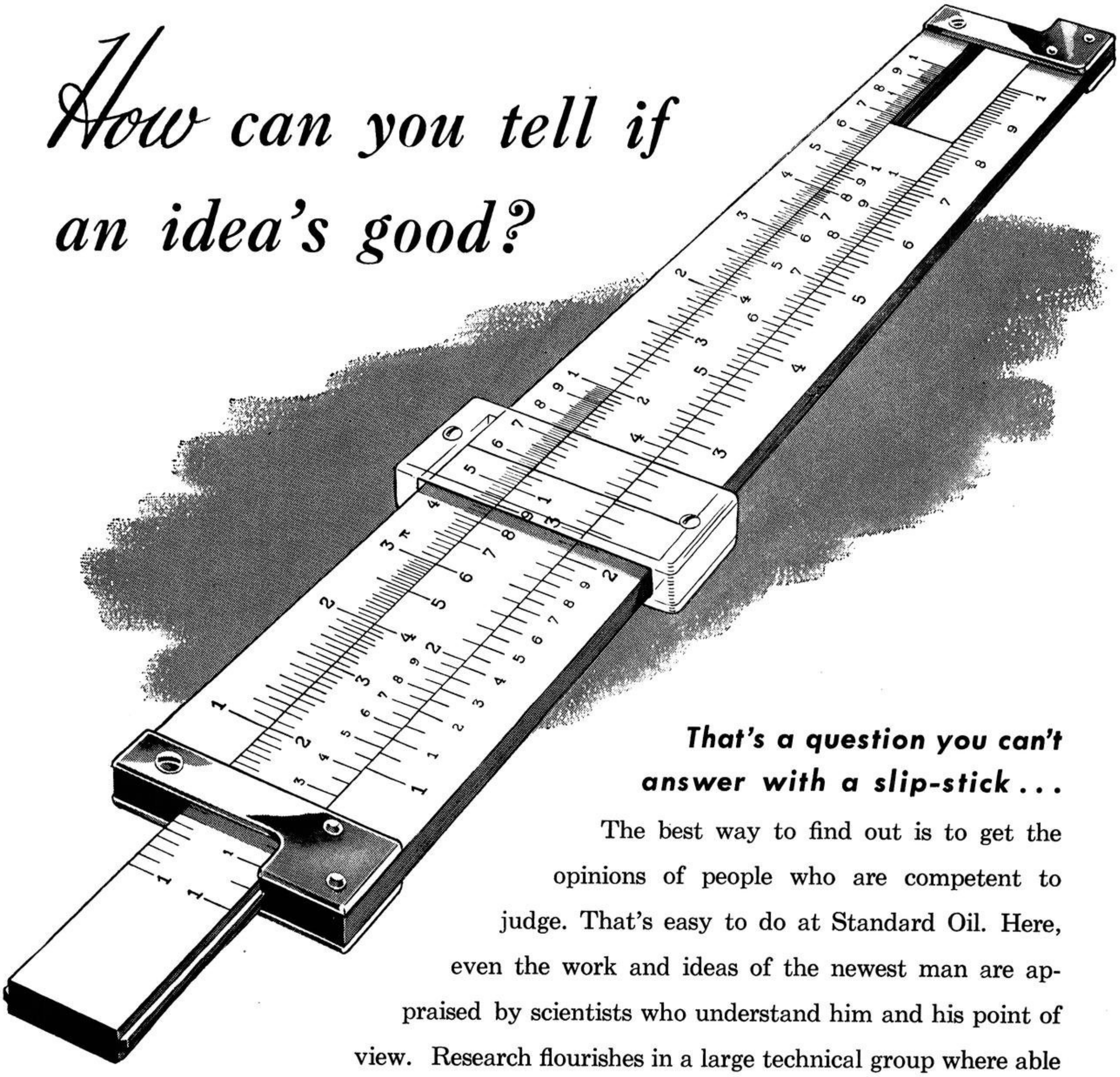
The line was owned by the Defense Plant Corporation, a subsidiary of the Reconstruction Finance Corporation. All the oil it carried was owned outright by the Defense Supplies Corporation, another RFC agency.

Oil was put into the pipe in batches of between 600,000 and 900,000 barrels each, alternating crude and heating oil, so that each end of the line was operating 2 or 3 days at a time on each product. Defense Supplies Corp. bought both crude and heating oil at Longview at the posted price plus transportation to Longview. The oil was then sold at Norris City, f.o.b. tank cars, at cost plus a markup of 30 cents a barrel from Longview to Norris City. When the line was completed the markup price was roughly the same as the tanker rate from Gulf Coast ports to New York.

Once crude or heating oil had been sold to DSC the seller lost all control over it and had no claim on its disposition. Thus there were sellers who did not buy at the eastern end and buyers that had no production in Texas.

(please turn to page 26)

How can you tell if an idea's good?



That's a question you can't answer with a slip-stick . . .

The best way to find out is to get the opinions of people who are competent to judge. That's easy to do at Standard Oil. Here, even the work and ideas of the newest man are appraised by scientists who understand him and his point of view. Research flourishes in a large technical group where able chemists and engineers, in the light of their broad experience, evaluate the ideas of the younger men. Under such favorable conditions, capable technologists combine their efforts and convert good ideas into practical achievements. The vast, progressive petroleum industry is jam packed with possibilities for men with ideas.

Standard Oil Company

(INDIANA)

STANDARD

STANDARD SERVICE

the BIG inch . . .

(continued from page 24)

RIVER CROSSINGS

The most spectacular feature of the construction of the 24-inch pipeline was that of laying pipe across rivers. One contractor was used for the major crossings because in all cases special equipment and know-how were needed.

The pipelines crossed the Mississippi River at a point near Cape Girardeau, Mo., where the river is 1,500 feet wide at normal stages. To conform to regulations of U. S. Engineers in effect in recent years, it was necessary to have the lines buried with 3 feet of cover in the river bed in order to avoid an obstruction to the current which might give rise to the formation of a sand bar.

Because of the depth of water, it was necessary to plan a new method for drilling shot holes. A novel procedure was devised which was a product of early experience in drilling shallow oil wells. This consisted of having the drilling done by oil-well spudders, or drills, mounted on barges.

Shot holes 6 feet apart were drilled on each side of the trench in staggered positions with the two rows 4 feet apart. Drilling was done through an 8-inch casing, set in the river bed. Six-inch pipe was then set at the bottom of the hole and the 8-inch pipe was pulled out. The 6-inch pipe protruded several feet above the water level.

A blasting charge of from 50 to 100 pounds of dynamite was placed in each hole. Both rows for the entire length of the trench were shot at the same time by electric current.

—Photograph courtesy A. O. Smith Co.

This shot gives an idea of some of the rugged terrain crossed by the Big Inch.

In dredging out the trench after blasting, most of the debris was removed by a centrifugal pump, with fan type impeller, and 18-inch suction, mounted on a barge. Most of the large rocks and submerged logs were removed by clam shell and orange peel dredging equipment. Rocks too big for removal in that way were picked up by a gravel hook, made like ice tongs, with six long fingers of 3-inch by 1-inch steel bars, between which water could flow.

Preparations for the actual laying of the pipe were made on the river bank where 40-ft. lengths were welded with four beads per weld into two-piece sections. These two-piece sections were then barged to a point where one section at a time was lifted by a floating derrick to a laying barge. This barge was equipped with a steel ramp inclined at an angle of 6 degrees. Welding of the pipe was done on this ramp and then the barge would move out from under the pipe as additional sections were added. Because the empty pipe would float, heavy clamps were fastened to it just before it was lowered into the trench. These clamps weighed 5,000 pounds each and were spaced every 25 feet. As the line extended across the river, sometimes as many as four lowering-in barges were required.

In crossing the many smaller rivers similar methods were used as those described for the Mississippi River. Usually, however, after the trench was ready the pipe was assembled on one bank and then pulled into position by tractors and trucks on the opposite bank. This method was used to cross the Delaware River.

FACTORS IN ECONOMIC SELECTION OF PIPE SIZE, CAPACITY, AND STATIONS

The 24-in. diameter of the "Big Inch" pipeline was determined by several factors. Some factors favored the big pipe and other factors limited the size.

First, as to relative size of the line, it must be remembered that our country was at war and maximum efficiency in the use of critical materials was a prerequisite. It was important to transport the maximum quantity of oil per ton of steel used and per horsepower of motive power required.

PIPE SIZE COMPARISON FOR ECONOMIC SELECTION

Size of Line Outside Dameter—Inches	8	12	16	20	24
Capacity per day, bbl.	20,000	56,000	98,000	190,000	300,000
Investment cost per barrel per day moved 1,000 miles—dollars	650	366	256	205	158
Operation cost per barrel moved 1,000 miles—cents	23.6	15.3	11.3	8.6	7
Pump efficiency per cent	78	80	82	84	86
Bbl. per day per ton of steel per mile	339	635	889	1095	1200
Bbl. per day per hp. per station	45.9	52.3	64.2	65.9	67.4

(Source: **Mining and Metallurgy:** 24: 186. October 1943.)

(please turn to page 38)

S-T-A-T-I-C

continued from page 26

"Is this ice cream pure?"
"As pure as the girl of your dreams."
"Give me a pack of cigarettes."

* * *

Perplexed Oriental: "Our children velly white. Is velly strange."
"Well, Occidents will happen."

* * *

Soft the new love tells her lies,
And ah, she tells them well;
Demurely I avert my eyes—
Alone, I laugh like hell.

* * *

"Waiter, there is a fly in my soup."
"That will be ten cents extra, please."

* * *

"Waiter, there is a fly in my soup."
"Okay, here's a fly swatter."

"Waiter, there is a fly in my soup."
"Yeah, we ran out of turtles."

* * *

"Waiter, there is a fly in my soup."
"All right! I'll bring you a fork."

* * *

"Your mother-in-law died. Shall we bury her?"
"Don't take any chances. Cremate."

* * *

"Are you the boy who took my order?"
"Yes sir."
"Well, I'll be damned. You don't look a day older."

* * *

Voice on phone: "John Smith is sick and can't come to class today. He asked me to notify you."
Professor: "All right. Who is this speaking?"
Voice: "This is my roommate."

* * *

"Do you love me, Joan?"
"My name is Helen."
"Isn't this Wednesday?"

Campus . . .

(continued from page 12)

kee. The Society of Student Engineers of the University of Wisconsin in Milwaukee, more readily referred to as the S.S.E., has made rapid strides since its conception last year. It can boast of being the largest organized group on the Milwaukee campus, and of being correspondingly the most active.

Dedicated primarily to the promotion of interest and professional development among its student members, the S.S.E. has successfully fulfilled these obligations by providing well planned programs and interest-provoking tours for its membership. Some of the highlights of this program have been a talk by A. C. Brahm, Milwaukee City Planner, who gave a survey of the Milwaukee master plan and its significance to the engineer; and a most enjoyable address by D. J. Mack, professor of metallurgy at Madison, whose theme was "What Does Industry Look For in the Graduating Engineer?"

The non-technical phase of an engineering career has been given special emphasis by the S.S.E. under the guidance of Professor H. R. Puckett, faculty advisor to the body, particularly because this aspect is so often forgotten. Along these lines was the program of January 9, which featured Dr. Person, head of the Sociology Department at Milwaukee Extension. Dr. Person expanded the engineer's obligation to society.

Because of the nature of its purpose, the S.S.E. holds social activity at a minimum. It is not entirely forgotten, however, for the semester's functions were terminated by a very successful dance.

Next semester's officers have already been elected and introduced to the membership. Carl Duwe, president during the fall semester, has been retired with a vote of thanks, and new president, Robert Lea, is assuming his duties. This semester promises to be a good one for the S.S.E., U.W.M.

(please turn to page 37)

"Our American concept of radio is that it is of the people and for the people."

Freedom to LISTEN – Freedom to LOOK

As the world grows smaller, the question of international communications and world understanding grows larger. The most important phase of this problem is *Freedom to Listen* and *Freedom to Look*—for all peoples of the world.

Radio, by its very nature, is a medium of mass communication; it is a carrier of intelligence. It delivers ideas with an impact that is powerful . . . Its essence is freedom—liberty of thought and of speech.

Radio should make a prisoner of no man and it should make no man its slave. No one should be forced to listen and no one compelled to refrain from listening. Always and everywhere, it should be the prerogative of every listener to turn his receiver on or off, of his own free will.

The principle of *Freedom to Listen* should be established for all peoples without restriction or fear. This is as important as *Freedom of Speech* and *Freedom of the Press.*

Television is on the way and moving steadily forward. Television fires the imagination, and the day is foreseen when we shall look around the earth from city to city, and nation to nation, as easily as we now listen to global broadcasts. Therefore, *Freedom to Look* is as important as *Freedom to Listen,* for the combination of these will be the radio of the future.

The "Voice of Peace" must speak around this planet and be heard by all people everywhere, no matter what their race, or creed, or political philosophies.*

David Sarnoff

President and Chairman of the Board,
Radio Corporation of America.

**Excerpts from an address before the United States National Commission for UNESCO.*

RCA RADIO CORPORATION of AMERICA

*FREEDOM IS **EVERYBODY'S** BUSINESS*

FOREIGN STUDENTS . . .

(continued from page 11)

Gilbert El Kouby

choice of the University of Wisconsin was prompted by the Institute of International Education in New York, which recommended it for a good engineering education. Gilbert entered the University as a Mechanical Engineering student in November, 1945, and received his Bachelor of Science degree in May, 1947. At the present time he is enrolled in Graduate School and will receive his Master of Science degree in June of this year. Gilbert's special field of interest is heating and air conditioning. First among the courses he has enjoyed most is the course in Heat Transfer. Besides tending to his engineering studies Gilbert has also been a French instructor for the French Department of the University.

Gilbert has grown fond of the United States and plans to remain here for a few years after he graduates. During this time he intends to gain much experience in heating and air conditioning while working for some of the large concerns in this business. After this phase of his intended program, Gilbert will leave the United States for other parts of the world. He does not intend to return to Algeria immediately and at the present does not know exactly where he will go on leaving the States. We are sure that wherever he goes, he will be a first class engineer.

Nikola Tavukcuoglu

school at Wisconsin the following summer. Nikola decided to do his graduate work at Wisconsin because of the fine reputation this school has in Turkey.

Nick is majoring in heating and ventilating, and will receive his Master of Science degree in June, 1948. After graduating, Nick plans to spend a few years in the United States doing heating and ventilating work, so as to become acquainted with American methods. Then, on returning to Turkey, he will apply the experience gained in the United States and intends to start his own business some time later.

Arriving on the campus in May, 1947, at a time of the year when the trees were freshly leaved and the grass just green, Nikola was impressed by the beauty of the campus and the surrounding lakes. They reminded him very much of the area around his native city of Istanbul. He found Picnic Point on Lake Mendota almost identical to a spot on the Sea of Marmora where he had spent much of his spare time. The Sea of Marmora, situated between the Dardanelles and the Bosporus, is where Nick engaged in his favorite sports which are swimming, sailing, and water polo. Nick says that his studies have kept him from enjoying the facilities available here for these sports, as much as he would like to.

Many foreign students in the United States are sent by their government, but Nick is financing his education from his own savings and certainly deserves much credit for this. Nick also has a brother who came to the United States shortly after he did and at present is studying Electrical Engineering at Cornell.

Nikola appears to be enjoying his stay at the University of Wisconsin. Besides taking care of his studies, he is an active member of the International Club. The courses in heating and ventilating that Nick has taken here have been much to his liking and he believes that they are exceptionally good. Nick says he will always be a strong supporter of the University of Wisconsin, especially on returning to Turkey.

CHANGE OF ADDRESS:

If you are a graduating senior or are moving to another local address, please fill out the following form and return it to 356 M.E. Bldg. Please print or type.

NAME: ....

OLD ADDRESS: ....

....

NEW ADDRESS: ....

....

Alumni Notes . . .

(continued from page 18)

—M & M—

Arthur J. Yahn ('31) is with the St. Louis Smelting and Refining Co. at Fredericktown, Mo. He is general superintendent of operation of mines and mills; works with lead and copper ores.

Henry P. Ehrlinger ('31) is president of the "Golden Monarch" Mining Company of Silverton, Colorado.

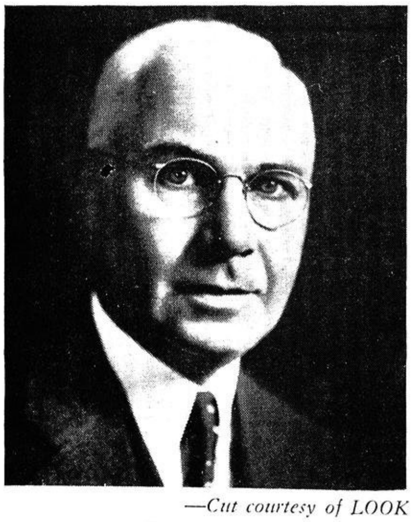
Richard E. Mieritz ('39) is superintendent of mining and milling operations for the American Smelting & Refining Co., Duroy, Colorado.

Karl J. Klapka ('39) is an engineer in the diamond drilling division of the Wheel Truing Tool Co. of Detroit, Michigan.

Edward L. Koltun ('39) has a wife and 5-year-old son. He is employed by the U. S. Geological Survey as a Topographical Engineer.

John R. Kildsig ('39) is an experimental metallurgist with the Allison Division, General Motors Corp., at Indianapolis, Ind.

— CE —



—Cut courtesy of LOOK

Dr. Savage

Dr. John Lucian Savage ('03), recipient in 1944 of the John Fritz Medal and an honorary D.S. degree from the University of Denver in 1946, was honored in the "Look Applauds" section in a recent issue of LOOK magazine:

"More people are indebted to him, and will be for generations to come, than to any other engineer. Grand Coulee Dam, the world's biggest man-made structure, and some 60 other hydroelectric and irrigation projects have been built to his specifications. These projects have opened up millions of acres for farms, industries, and homes.

"Savage is chief design engineer of the U. S. Reclamation Service. But the demand for his talents has been world-wide. Recently, he's been working on projects in Europe, Asia, and Latin America. Yet never has he sought a fortune. His main interest is only to take part 'in enterprises that have as their objective the development of human relations'."

Robert F. Ewald ('05) resigned recently after 35 years' service with the Aluminum Company of America. He did preliminary work on the Fontana Dam for TVA.

Louis R. Howson ('08), member of the engineering firm of Alvord, Burdick, & Howson of Chicago, was recipient of the 1947 award of the John M. Goodell prize of the American Water Works Assn. for "the most notable contribution to the science or practice of waterworks development."

G. H. Zeisler ('08) is vice-president and chief engineer, doing heavy construction with the H. W. Horst Company of Philadelphia. He has two children—both married.

Archibald W. Nance ('10) died at Pittsburgh, Pa., on Nov. 7. He was a veteran of World War I. He specialized in structural design with the Farris Engineering Company of which he became secretary-treasurer.

Chris A. Weipking ('21) has been made chief engineer of the Delta Manufacturing Division of the Rockwell Manufacturing Co., at Milwaukee. He had been research engineer for the same company.

W. C. Lefevre ('34), Waterbury, Conn., is working for Stone and Webster Engineering Corporation.

E. J. Jandacek ('36) is a construction engineer for Stone and Webster. He lives with his wife and children (Jean, 10; Ronald, 4) in Houston, Texas, where he is Construction Supervisor on the construction of the 17-story Shamrock Hotel, part of a "community center" which will include a 5-story garage, food-market, theater, department store, etc. "Dutch" was president of the Knoxville Wisconsin Alumni chapter while he worked at Oak Ridge during the war.

John O. Neighbours ('38) is a designing draftsman for the Pennsylvania Water & Power Company, at White Hall, Maryland.

Ray E. Lutz ('40) is an industrial engineer for the Rome Cable Corporation of Rome, N. Y.

Paul C. Sodemann ('43) announces the birth of a son last Feb. 4th. He is an hydraulic engineer with TVA.

Joseph G. Osterman ('47) is with the United Engineers and Constructors of Philadelphia.

Four of the Civils who graduated in 1947 took railway jobs. **Birkett** and **Knoer** went with the Illinois Central R. R.; **Dittloff** with the Milwaukee Road; **Kriegel** with the Southern Railway.

—ChE—

Fred C. Kraatz ('39) is living in Downey, California, where he is in the technical department of the Pittsburgh Plate Glass Company of Los Angeles.

Glenn W. Leupold ('40) is a welding engineer for the A. O. Smith Corporation of Milwaukee.

Robert Charles Morbeck ('43) is in Cranford, N. J., where he is a chemical engineer for the Standard Oil Development Company.

New Wisconsin Alumni will soon appear in the offices of various companies throughout the land. Some of the February ChE grads who have accepted positions and their prospective employers are listed below:

Fred Garber ('47;M'48): Procter and Gamble Co., Cincinnati.

Robert Bringman: Nekoosa-Edwards Paper Co., Port Edwards, Wis.

Science Highlights . . .

(continued from page 22)

IMPROVED LIQUID-LEVEL GAGE

Use of two General Electric sintered alnico permanent magnets separated by an aluminum diaphragm now provide a leak-proof magnetic coupling for an improved liquid level gage made by the Boston Auto Gage Co. here. The magnets are made of G-E alnico 2.

Designed to indicate accurately the level of the insulating liquid in the transformer, the gage utilizes a float inside the transformer tank to transmit the motion of the liquid to one of the alnico magnets. This magnet in turn transfers its motion by a powerful magnetic flux to a similar magnet placed on the other side of an aluminum diaphragm and attached to a dial indicator needle.

The aluminum diaphragm is pressure tight to a minimum of 30 pounds per sq. inch effecting a permanent seal between the liquid and the gage proper. To effect a seal in the opening where the gage is installed, the gage flange is mounted with four studs to the side of the tank, usually below the maximum oil level and is then sealed by a hy-car gasket. This method may also be able to be applied to other problems of a similar nature.

NON-METALLIC MAGNETIC MATERIAL FOR HIGH FREQUENCIES

Philips Technical Review relates how entirely new methods have become possible as the result of research work with ferrites, substances of the type of MFe_2O_4, with M denoting a bivalent metal. Some of these ferrites have a cubic structure and are capable of forming mixed crystals in any proportions. With a few exceptions these non-metallic substances are ferromagnetic. Their specific resistivity is 10^7-10^{12} times as high as that of iron, so that the problem of eddy currents is relegated entirely to the background, even in the range of radiofrequencies and without laminations. By suitable composition and heat treatment it is also possible to keep the hysteresis and residual losses relatively low, while the initial permeability may be of the order of 1000. By means of a pressure or spraying process this material, called "Ferroxcube," can be molded into various shapes, and coils of improved quality or smaller volume have been made with it for different purposes. Thanks to its being homogeneous, it makes a good magnetic screen.

"INSIDE-OUT" MOTORS

Three tiny electric motors, unique in that they are "inside out," have been built by General Electric for use in testing the aerodynamics of spinning missiles at Army Ordnance's Proving Ground, Aberdeen, Md.

Only one and three-quarters inches in diameter and six inches long, the motors are rated at one-tenth horsepower, and have an extreme speed of 80,000 revolutions per minute. They are mounted in projectiles being tested at supersonic speed in a wind tunnel.

The positions of the rotor and stator are reversed in these motors. The stator, which is normally the stationary outside case, in these motors is on the stationary shaft. The outside case forms the rotor and rotates around the shaft.

When mounted inside a missile, the external frame of the motor is fastened to the projectile's case, spinning it at high speeds so that its aerodynamic characteristics at supersonic speeds may be observed and measured.

To obtain up to 80,000 revolutions per minute, a special generator had to be built to power the midget motors.

CONTEST NOTICE

SUBJECT: Statistics as Part of Engineering Courses.

SPONSORS: Engineering College Magazines Associated, in cooperation with the American Society for Quality Control.

PURPOSE: To acquaint students and faculty of engineering colleges with the advantages of the study of statistical methods as a part of the standard college courses in engineering.

AWARDS: National recognition will be given to the magazine, college, and author sponsoring the first, second, and third place articles.

RULES:

1. Papers on the contest and subject shall be limited to 2,500 words or less, and must be published in an engineering college magazine prior to June 30, 1948.

2. The paper to be presented shall cover any phase of the statistical field as an argument for the acceptance of statistical courses. Papers must be written as an aid in engineering rather than the specialized field of quality control, since statistical training for quality control engineers is recognized as a necessary prerequisite. It must, however, cover one or more of the following points:

   a) The effect of statistical training on the undergraduate with relation to other engineering subjects under study.

   b) The value of the statistical course to engineers through its use or understanding in their professional field.

   c) Discussion of statistical sampling and techniques or other applications of statistics in the field of engineering.

   d) A summary of the statistical techniques being offered engineering students at the institution involved, and a possible practical solution to the problem of expansion of these offerings.

3. Papers shall be written by undergraduate or graduate students of the institution involved. Illustrations or charts may be (and should be) used, provided that such illustrative material shall not be reproduced from any published material without the written permission of the publisher.

4. These papers shall be submitted to the Wisconsin Engineer, 356 Mechanical Engineering Building, by the 5th of April.

5. The Board of Directors of the Wisconsin Engineer will select the paper to be published, and this paper will be forwarded to the national contest.

JUDGING: Papers will be judged on the following points:

1. The argument advanced for the inclusion of statistics in engineering courses.

2. The approach to the problem, its appeal, and logical nature.

3. Literary effort, phraseology, composition, preparation, and narration.

POSSIBLE REFERENCES:

Quality Through Statistics, A. S. Warton.

Statistical Quality Control, E. L. Grant.

Control Charts, An Introduction to Statistical Quality Control, E. S. Smith.

Economic Control of Quality of Manufactured Products, W. A. Shewhart.

Statistical Method from the Viewpoint of Quality Control, W. A. Shewhart, Department of Agriculture, 1939.

The Mathematical Theories of Probability, Arne Fisher.

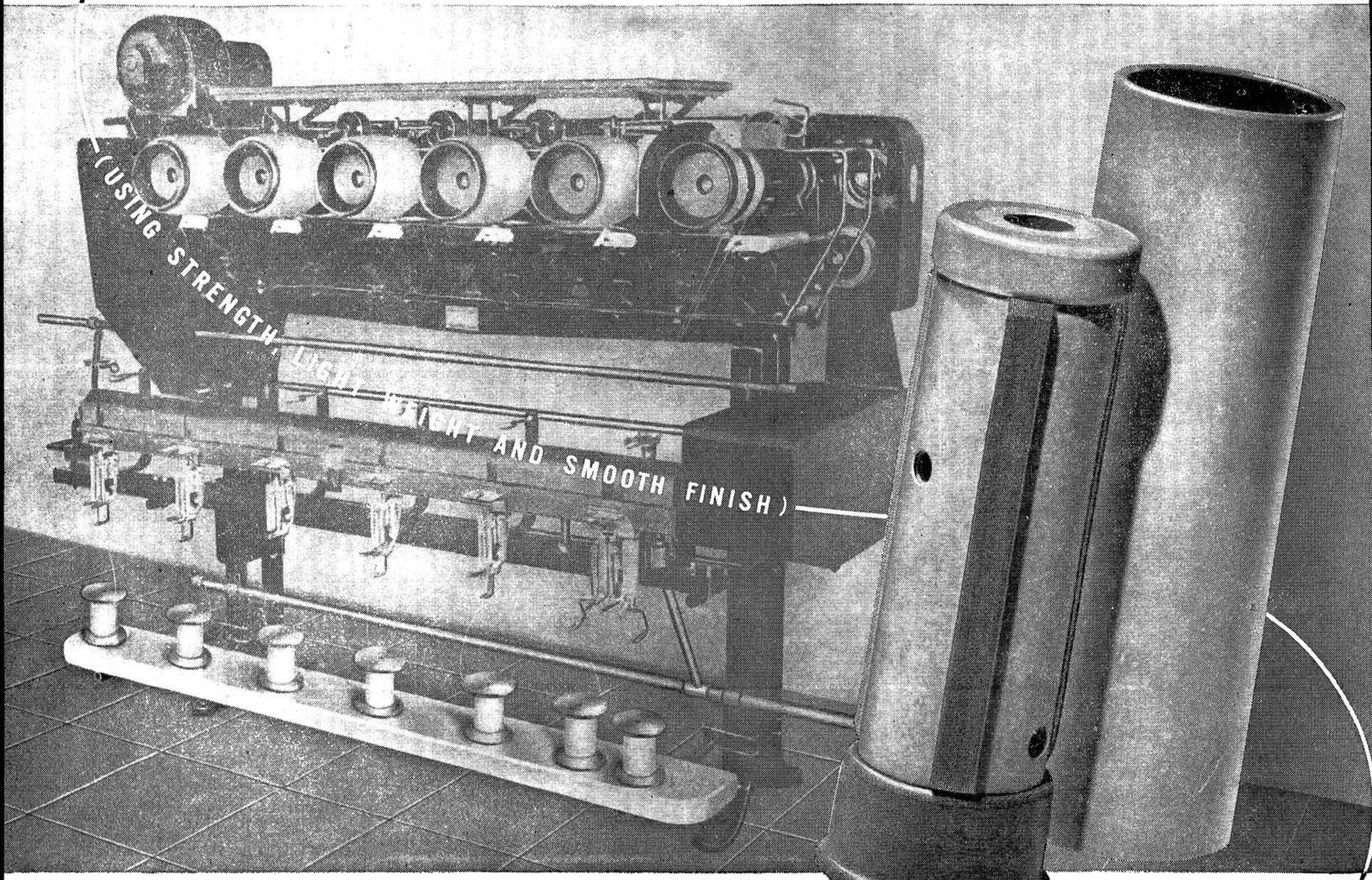
Probability and Its Engineering Uses, Udny Yule.

Journal of Engineering Education: May 1947, October 1946, May 1946, and March 1946.

Plastics where plastics belong

Because of a unique combination of chemical, electrical, and mechanical qualities, Synthane laminated plastics can be applied to an endless number of practical purposes Moisture and corrosion resistant, light-weight and structurally strong, Synthane has many collective advantages not readily found in any other material. One of the best electrical insulators known, Synthane is hard, dense, durable . . . quickly and easily machined.

Among the interesting occupations of our type of technical plastics are the redraw bobbin and chuck (below) used in winding fine denier nylon for women's hosiery.



Fine nylon filaments can be wound without pulling and sticking because of the smoothness of the bobbin. Light weight of bobbin and chuck allows the spindle to be started and stopped faster and with less effort. Greater crushing strength of tube permits larger amounts of nylon to be wound. This is an appropriate job for Synthane, an interesting example of using plastics where plastics belong.

Synthane Corporation, 1 River Road, Oaks, Pa.

SYNTHANE **where Synthane belongs**

DESIGN • MATERIALS • FABRICATION • SHEETS • RODS • TUBES
FABRICATED PARTS • MOLDED-MACERATED • MOLDED-LAMINATED

Campus . . . *(continued from page 28)*

THETA TAU INITIATION

The highlight of the Theta Tau initiation was the dinner at the Loraine Hotel. Feature speaker of the evening was City Manager Howell. Speaking from experience, Mr. Howell told of a past flood control problem on the Ohio River. Although he emphasized the administrative side of the project, Mr. Howell was not refuting the fact that it was engineering skill that made this project possible. "The engineering involved was difficult, but the greatest job was selling to the layman the idea that the solution would work."

Other speakers of the evening included Dean Withey, Dr. G. A. Rohlich, of the C.E. department, and Mr. Hopkins, of Chicago.

Mr. Hopkins spoke of the advantages that could be gained through the engineering fraternity by the exchange of ideas and personal contact with men of the same profession.

PROF. WENDT GETS POST

The appointment of Kurt F. Wendt, professor of mechanics, to the post of associate director of the Wisconsin Engineering Experiment Station was approved January 31 by the university board of regents.

Forced to restrict its activities during the depression and war, it is now able to resume operations because of the inclusion of the annual sum of $40,000 in the university's biennial budget. The director of the station is Morton O. Withey, Dean of the College of Engineering.

The functions of the experiment station are to promote engineering education by fostering scientific investigation and industrial research and to render public service by cooperating with industry, manufacturers, and professional engineers in the solution of fundamental problems of broad interest.

The electrical standards laboratory, the ordnance precision gage laboratory, and the general research under way in the college will be drawn into the scope of the station. The station will provide a ready means to Wisconsin citizens for obtaining information concerning the results of research.

Prof. Wendt graduated from the university in 1927, and he has taught in the College of Engineering since that time. He is in charge of the materials testing laboratory, consulting engineer for the Forest Products laboratory, and is a member of the three-man board directing research at the university under a grant from the Four-Wheel Drive Co.

the BIG inch . . . .

(continued from page 26)

From these figures it is clearly apparent that the highest efficiency in transportation could be obtained through a single large-diameter line. The size of the line was not made larger because of a number of limited factors.

(1) The War Production Board stipulated that the pipe used in this project must be made from steel billets. This automatically required the use of seamless pipe, as electric-weld pipe is made from plate, supplies of which were critically short. Only one mill in this country was equipped to make seamless pipe as large as 24-in. outside diameter. This fact by itself limited the line to a maximum size of 24 inches.

(2) The question of supply also limited the line to a 24-in. size. Careful investigation of the production in East Texas, with further deliveries via pipe line from other fields, disclosed a maximum possible supply of approximately 300,000 barrels per day. This could be efficiently handled by a 24-in. line.

(3) No suitable construction equipment was available for laying larger pipe. Much of the available equipment even had to be remodeled and revised for handling 24-in. pipe.

PRESENT SITUATION

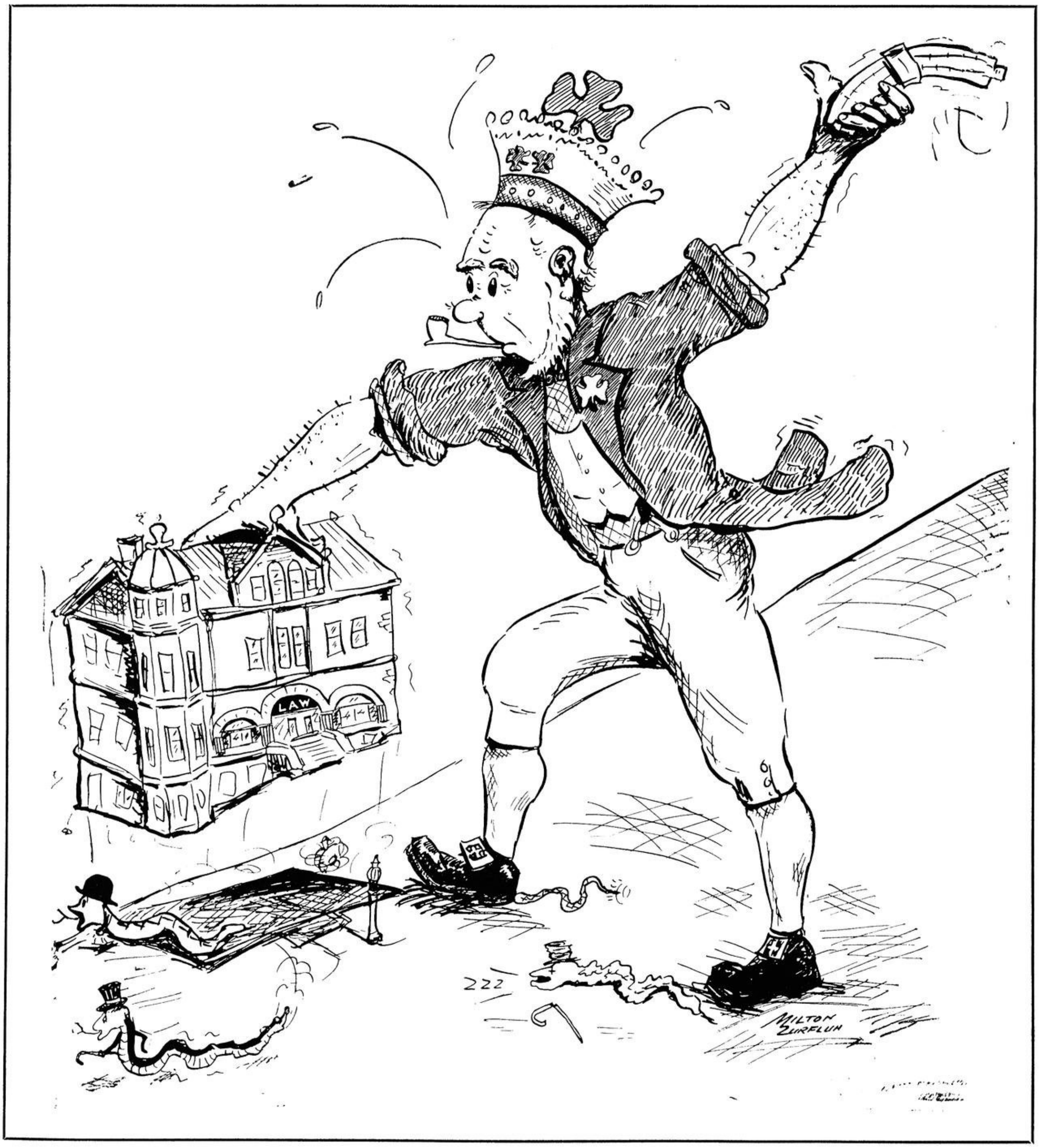
The disposition of the Big Inch pipeline was a function of the War Assets Administration. The future use of the pipeline is of much concern to powerful business groups in the United States. Oil companies, because of their investment in tankers, do not want the line used for transporting oil and by their failure to bid for the line assured the pipelines to transportation of natural gas. Railroad companies argue that if the line is used to carry oil it will interfere with their business and best interests.

During the summer of 1946 it was announced that bids would be received for both the Big and Little Inch pipelines.* The bids submitted at that time were all turned down because they were not high enough, although some conditional offers ran as high as $135,000,000.

Bids were submitted for a second time early in 1947. A bid for $143,127,000, nearly equal to the original cost, was submitted by the Texas Eastern Transmission Company. This offer, proposing to use the lines for natural gas, topped six other "valid" bids.

This bid was accepted by the War Assets Administration and now (July, 1947) the Texas Eastern Transmission Company is seeking Federal Power Commission authority to operate the pipelines as natural gas carriers and to build additional facilities.

* The "Little Inch" pipeline was the name given to the 20-in. diameter line that was built after the "Big Inch" and on almost entirely the same right-of-way. The "Little Inch" transported gasoline and other petroleum products. It carried a total of 105,960,000 barrels of wartime products, and the "Big Inch" carried 261,862,000 barrels of oil.



St. Patrick, as recently seen ridding Bascom Hill of the serpents.