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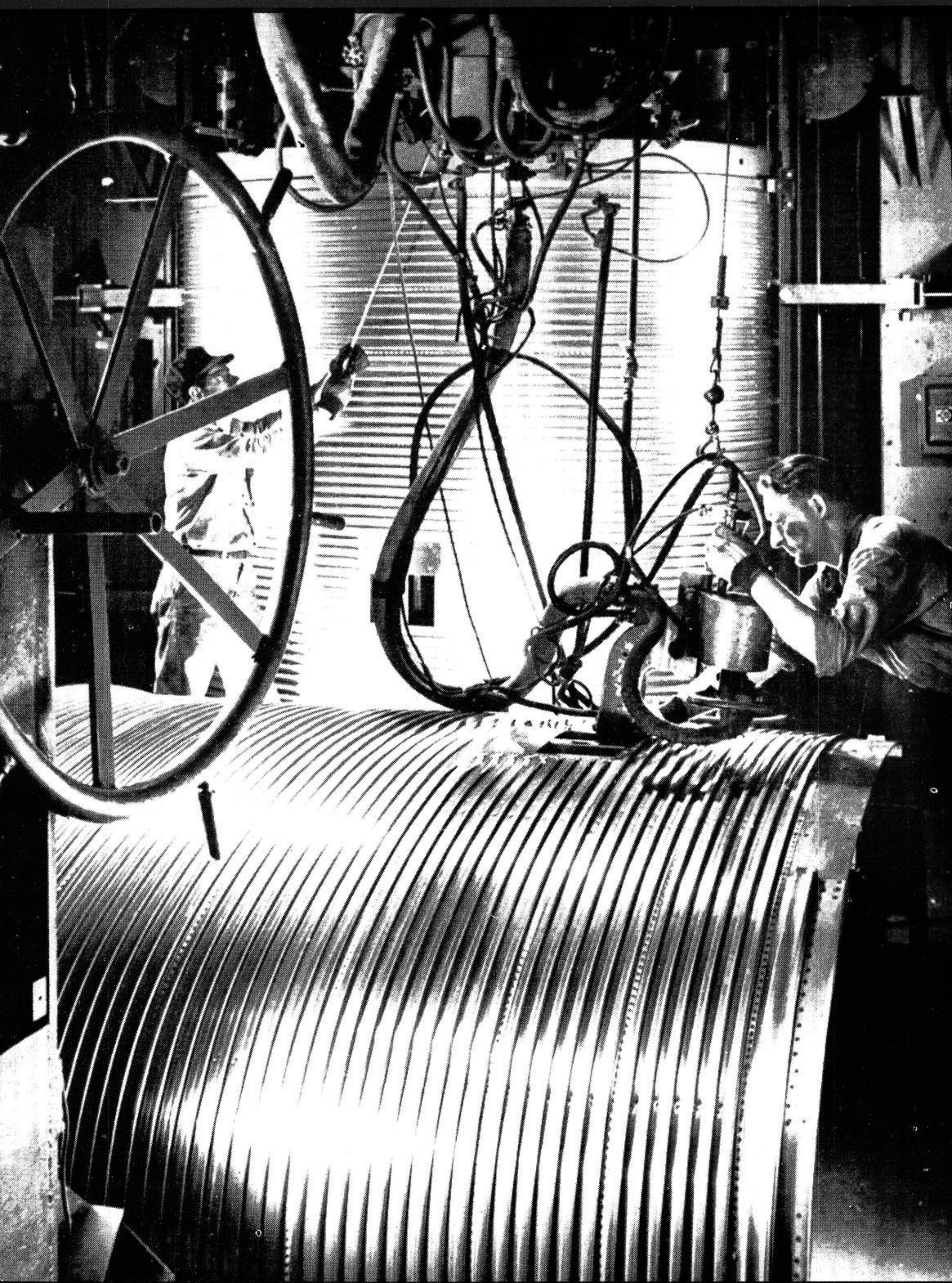
The Wisconsin

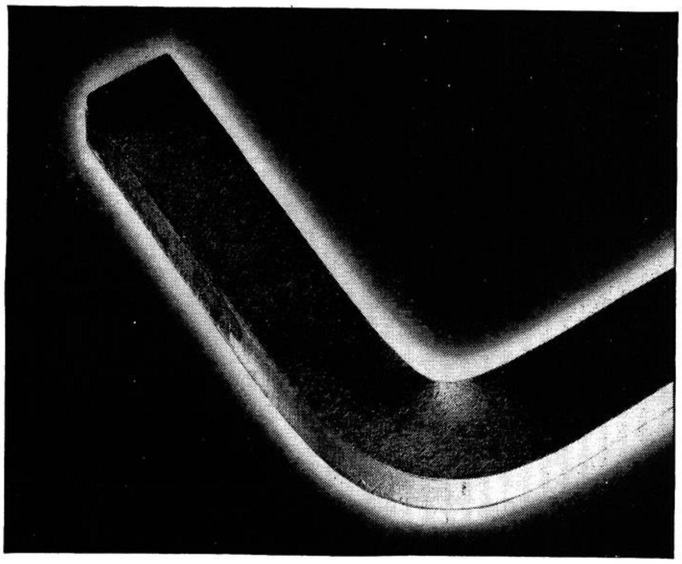
engineer

February, 1953

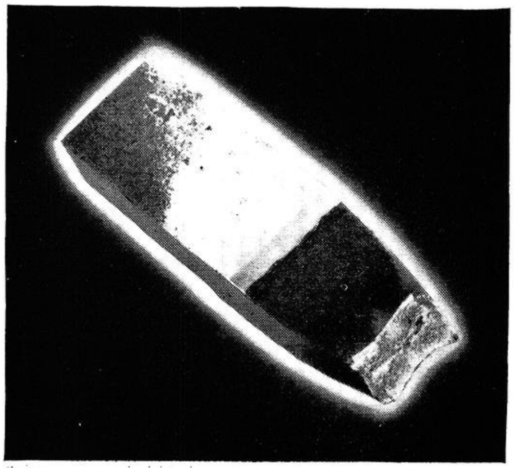


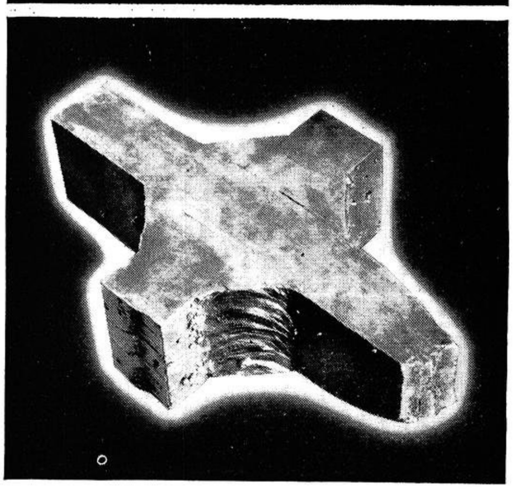
25¢

90° BEND AT 98 BELOW! This sample, flame-cut from 1" CARILLOY T-1 plate, was chilled to –98°F., and then bent to a full 90° angle. Even though the raw, flame-cut edge made up the outer radius of the bend, there was no sign of failure!



New steel has yield strength of over 90,000 psi yet remains ductile at 70°F. below zero even after welding or flame-cutting





100% WELD STRENGTH—Tensile tests on T-Steel specimens like these were made to determine the strength of the welds. These welds develop the full strength of the parent metal. Note that breaks occur outside the heat-affected zone, showing that the heat of welding has not harmed the strength of the material. No special pre-heating or post-heating treatments are required beyond those used with ordinary structural steels.

THIS remarkable steel, U·S·S CARILLOY T-1, offers great promise to those who need a super-strong steel that can be welded, flame-cut or cold-formed.

CARILLOY T-1 is unique. It differs from all other very strong steels in important respects: Its yield strength of over 90,000 psi is *not* lowered by welding or flame-cutting. In these operations, no pre-heating or stress-relieving is required. As a result, CARILLOY T-1 can be readily field welded.

Usually, welded steels of such high strength level suffer a loss of ductility at low temperatures unless elaborate precautions are taken in the welding operation. In striking contrast, notched bend weldability tests show that T-1 steel will remain ductile and tough down to the lowest atmospheric temperatures. As a matter of fact, T-1 steel, after flame-cutting, has been bent to a full 90° angle at temperatures as low as –100°F., without any sign of cracking.

Service tests show that CARILLOY T-1 is well suited for extremely abusive service, and the fact that it can be field welded should greatly lower the difficulties and cost of major repairs. In applications in which tension is the principal stress, thicknesses can often be reduced to one-third of those required with ordinary structural steels.

CARILLOY T-1 steel is another result of United States Steel's active research program which has enabled manufacturers to improve their production methods and make better products, too. All over the country, trained U. S. Steel engineers and metallurgists are constantly at work on problems like this, finding better ways to make and use steel. United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

USS

UNITED STATES STEEL

THIS-n-THAT

School of Industrial Management

The School of Industrial Management at M.I.T. has opened its competition for the fellowships which will be available for graduate students in 1953-1954.

Recent college graduates majoring in science, engiseering or engineering administration are invited to apply. Fellowships include full tuition and cash stipends up to $2,100 for married men.

Applications should be filed by March 1, 1953. Further information may be obtained from Professor Thomas M. Hill, School of Industrial Management, Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

Announcement

A.S.T.E. International Education Awards

The American Society of Tool Engineers has increased the number and value of its Internatoinal Education Awards for engineering students who are interested in pursuing Tool and Production Engineering as a profession These awards will be made to students to aid in their fourth (or in some cases, fifth) year of those curricula in which Tool and Production Engineering subjects are taught. Junior Students may apply for these awards for their Senior Year. Seniors may apply for a year of graduate study.

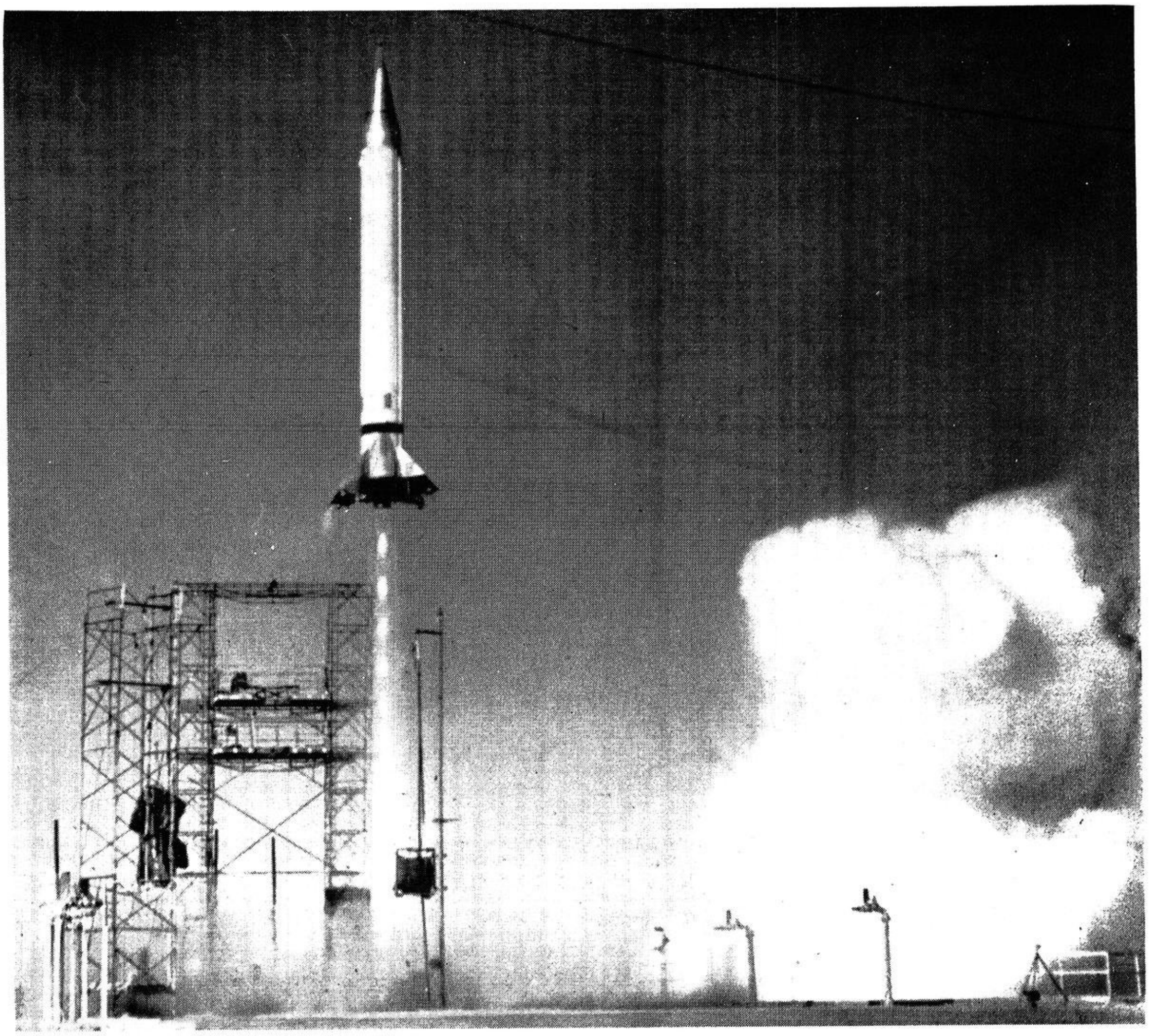
Nine awards will be made to students in institutions in the United States and to one in Canada Geographic distribution will be attempted in selection of students to receive these awards, at those institutions accredited in Engineering by the Engineers' Council for Professional Development.

These grants will be made effective with the school year beginning in the autumn of 1953, and will be paid on a quarter or semester basis to a total of $700.00 a year in accordance with the accounting procedure of the institution at which the student is in residence (this indicates a full-time student a the university or college). Money for these awards has been budgeted in a fund at National Headquarters and all disbursements will be made directly to the school. The student must maintain satisfactory grades to receive the balance of the allotted awards. The Departmental Chaisman, os faculty sponsor, should check the progress reports of the student.

Eligibility

A 3rd-year student in a four-year curriculum; a 3rd or 4th year student in an undergraduate five-year curriculum; or a 4th year student who will continue graduate work in the followisg 5th year; is eligible to compete. His course of studies must include those that prepare him for future work in Tool and Production Engineering.

Rocket Equals Altitude Record



A completely redesigned and reengineered Viking high altitude rocket, one of a series built by The Glenn L. Martin Company for the Naval Research Laboratory, equalled the previous single-stage altitude mark of 135.6 miles when launched December 15 at the White Sands Proving Ground, Las Cruces, N.M.

Shorter by some six feet and of slightly greater diameter, with completely new control, fuel and electronics systems, Viking No. 9's most readily distinguishable external feature was smaller, triangular fins. The power plant, made by Reaction Motors, Inc., was of the same type used on previous Vikings, liquid oxygen and alcohol, with a thrust of 20,000 pounds.

Up to the time of this firing, the altitude record for single-stage rockets was held by Viking No. 7, which was also launched at White Sands on August 7, 1951. A WAC Corporal launched from the nose of a German V-2 in a two-stage operation has reached about 250 miles.

Vikings are being used by NRL scientists to extend knowledge of (1) the physical state of the earth's atmosphere to as great a height as possible, the temperatures, pressures, densities and composition being principle objects of study; (2) the fundamental nature and properties of the ionsphere and those processes which lead to its formation; (3) solar and terrestial radiation and (4) the physics of high-energy particles by high-altitude cosmic ray studies. This information is expected to be of practical benefit in radio communication, meteorology and the guided missile program.

Photo shows a Viking just after takeoff. White cloud at right is steam from water in pit under launching stand, vaporized by tremendous heat from rocket engine.

The Student Engineer's Magazine

WISCONSIN ENGINEER

Founded 1896

Volume 57 FEBRUARY, 1953 *Number 5*

In This Issue . . .

Cover

A front section of a stainless steel highway trailer being assembled by the shot-welding process.
Courtesy the Budd Company

Frontispiece

A quarter-mile manufacturing isle—birthplace of many kinds of power equipment. *Westinghouse*

Articles

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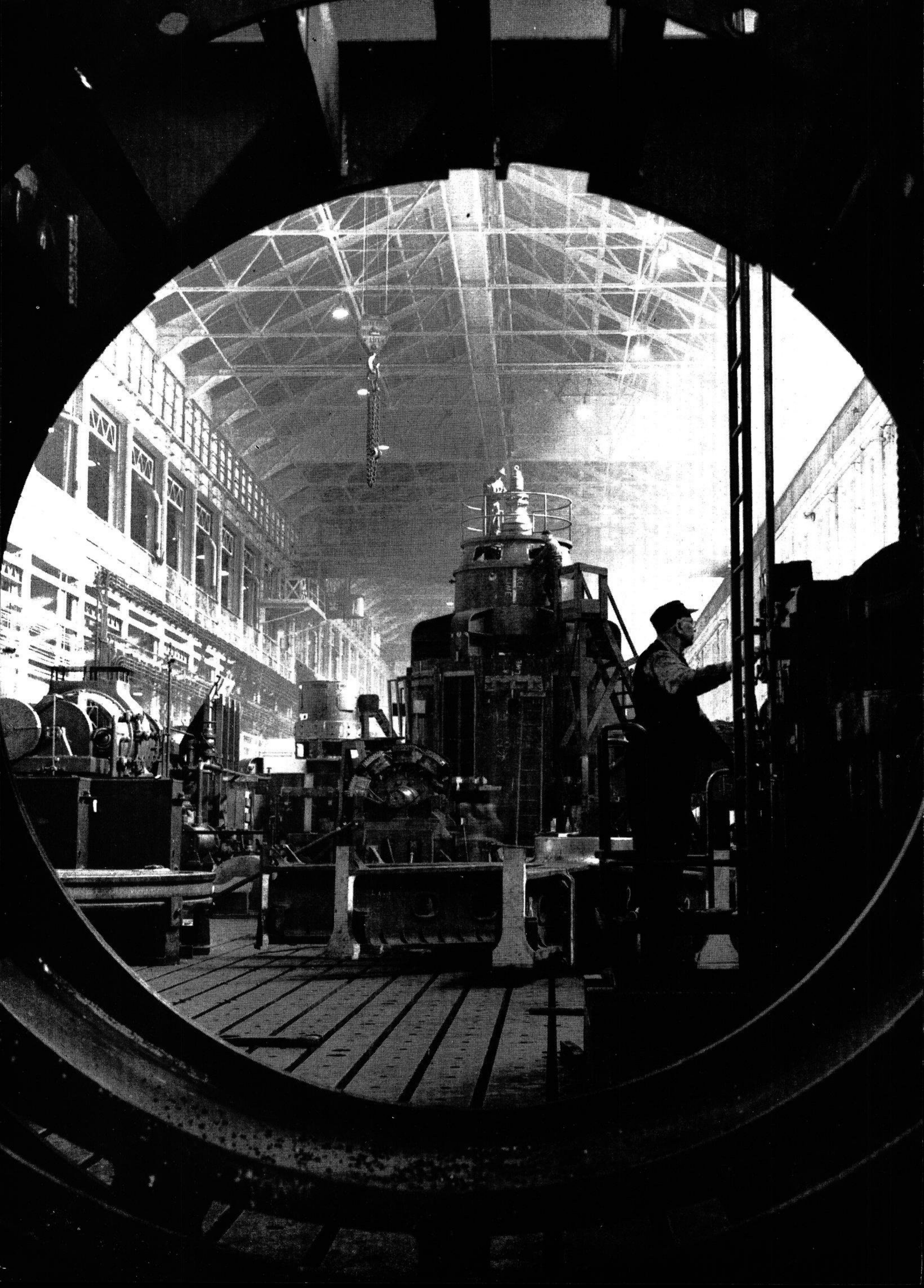


editorial

Are You Worthy of Registration?

The first engineers to establish, legally, their professional status were those who complied with the Wyoming registration law of 1907. In the ensuing forty-three years over half the engineering profession has become registered, according to the National Society of Professional Engineers.

The legal basis for registration is found in a state's inherent power to protect the health and safety of its people. Registration may be required of all engineers who's work entails designs, operations, or processes which have public implications.

Although the purpose is the safety of the public, other advantages are gained by engineers and laymen by registration. A profession is judged by all who use its name. Prohibiting the unfit, the incompetent, and the dishonest from assuming the legal title of engineer enables the trusted members of the profession to maintain high standards and a good name.

Registration is here to stay. A look at the number of applicants for the Engineer-in-Training examination compared to those who qualify shows it is far from automatically passed.

ARE YOU THE PERSON FOR THIS PROFESSION?
ARE YOU WORTHY OF REGISTRATION?

R. A. L.

A FOREIGN STUDENT AT THE UNIVERSITY OF WISCONSIN

by Magne N. Aarnes, m'53

When I studied in Sweden my roommate had a brother, who was going to school in United States, and from his letters we got a broad view of the country and the school system. Often we found ourselves talking about going to America for further studies.

After graduation I went back to Norway my native country, and there I started to investigate how to go about it, but it was more easily thought than done. First I went to the American Consul and got some papers to fill out, and from the Board of Education in Norway, I got a list of recommended universities. I studied them thoroughly, but one name did not make more sense than another.

One day I met a friend who knew a graduate from the University of Wisconsin, who liked it very much, so I sent my application letter to Wisconsin and before long I got a nice letter back saying that I had been accepted.

I went back to the consul, but had to wait my turn. A year or more passed before I got the final word from the Consul, that I was permitted to go to America. I was required to take a language test to prove to the Consul that my English was satisfactory for admittance to an American university. He was rather strict, and I think I flunked, but with nice words and promises he permitted me to go.

After that I had to pass all the doctors examinations and shots for communicable diseases.

It took me, however, still a couple of months before I got my ticket and everything was set.

On an extremely rainy day I left my home town and the rather long voyage lay ahead of me. The following day we arrived in New Castle, England, and after going through the custom office we rattled across the country to Liverpool. Here we had to stay for four days before the ship would embark for Quebec, Canada. On the boat from Norway to England, I met a Norwegian from Canada, who had been home on vacation, and we spent the time by making trips to London and Glasgow.

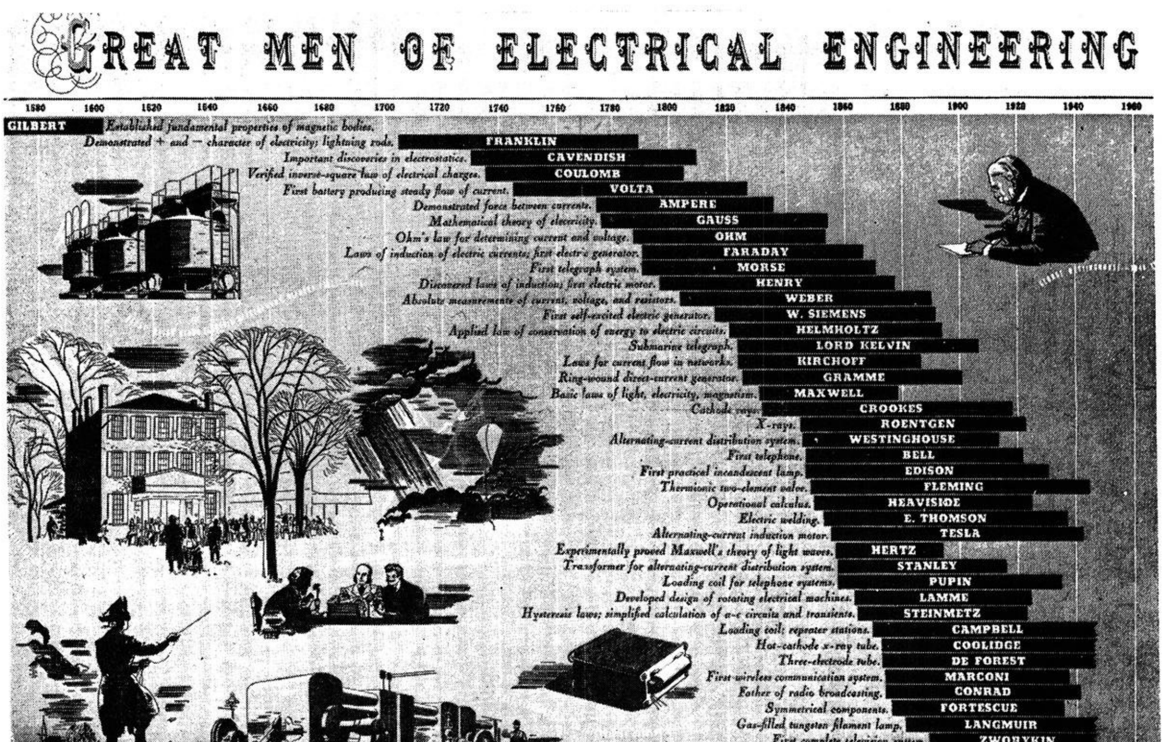
The day of departure from England came, and after swearing before the American Consul in Liverpool that I had not been a communist, fascist, or nazist, I was permitted to go aboard the liner, and shortly after we departed from Liverpool. Some stormy days passed, and

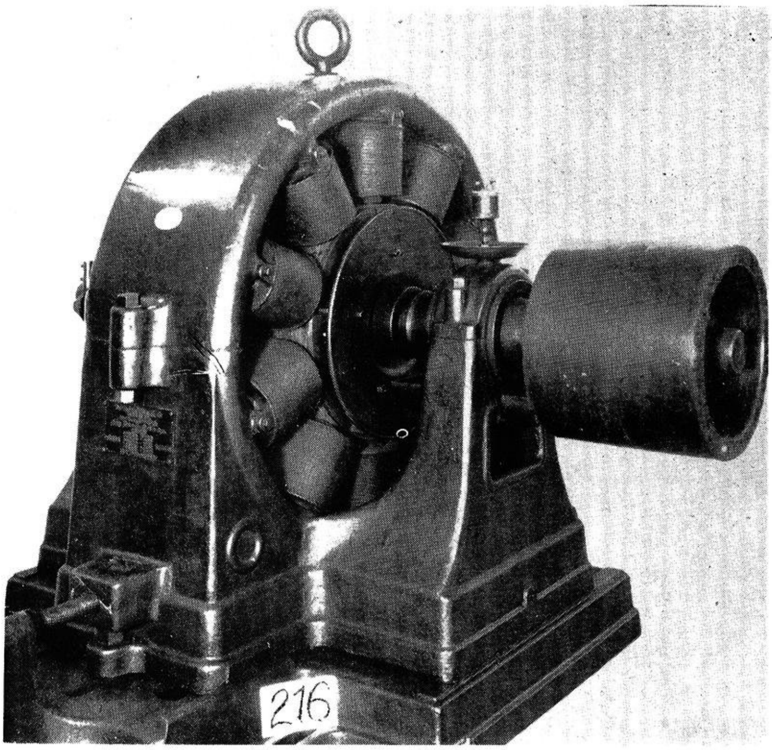
(please turn to page 50)

THE DEVELOPMENT OF ELECTRICITY AS A SOURCE OF POWER

by

Del Desens, e'53





Original AC Generator, 1886-89 — This type had a smooth armature core, covered with a single layer of wire. It produced 133 cycles, 1000 volts, single phase. The bearings required frequent lubrication, being lubricated by drip from the oil reservoirs.

Illustrations Courtesy Westinghouse

Man's discovery and development of electricity as a practical source of labor saving power is a dramatic series of events which awes the electrical engineer, who can by reason of his training appreciate the essential part that each individual contribution played in making the field of electrical power what it is today.

As if guided by an unseen hand, the basic principles of electrical engineering were unfolded in a smooth sequence, resulting in a steady progress that gained momentum in an unbelievably short period of time.

The pageant began with observations of lodestone and amber, and their electrical properties. The magnetic compass was a result of early observations and experiment. It was in a letter of August 12, 1269, that Peter Peregrinas, an Italian, wrote a friend that a lodestone has poles. "Know it as a law, that the north part of one stone attracts the south part of another stone, and the south, the north." This fact is basic in the practical application of magnetism in building electric motors.

Electricity was a novelty, but the accidental discovery of storing the electrical charge in a water filled bottle carried this novelty across the threshold of science and every scientist in the world suddenly became interested.
It was Sir William Watson, an Englishman, who added foil on the inside and outside of the Leyden Jar about 1750. Watson was the first to transmit charge by wire. He supposed that electricity might be led away from a Leyden Jar. He used a wire two miles long insulated from the ground by dry stick supports. Observers on the far end were shocked by the jar; Watson termed the shock an electrical "commotion."

Another example of early power distribution is found in the writings of Dr. Priestley: "The Abbe' Nollet was the first who made experiments upon the phail (Leyden Jar) in France. It seems that in France experiments were first made to try how many persons might feel the shock of the same phail. The Abbe' Nollet, whose name is famous in electricity, gave it to 180 of the guards, in the King's presence; and at the convent of the Carthusians in Paris the whole community formed in a line of over a mile by means of iron wires between every two persns and the whole community, upon the discharge of the phail, gave a sudden spring, at the same instant of time and all felt the shock equally."

The continued progress of the science of electricity is due in part to the men who created the wire which soon proved to be the arteries of the electrical world.

In Nurenberg, during the last half of the 14th century, Rudolf discovered a new method of making wire. It had previously been hammered to shape. Rudolf made a pointed rod and pulled it through a small hole in a metal plate with a pair of pincers, resulting in a circular section. Three hundred years later wire was still drawn in the same way and was used primarily in making "cards" for combing cotton or wool fibers before spinning them.

The wire was stretched out as it was made, and a special factory 200 feet long was constructed for the purpose.

In America, Ichabod Washburn installed in his textile works at Worcester a machine for making wire consisting of a draw-block and a circular drum in which the wire was wound. In 1831 the telegraph was born; and in 1834 he turned the entire factory over to wire production.

Not wire, but a wet string, was the conductor used in a well remembered experiment by Benjamin Franklin. On a June afternoon in 1752 in Philadelphia, he sent his kite into storm threatening skies. A pointed wire extended from the top of the kite to act as a lightning catcher; then came the wet kite string, the key, then a ribbon to Franklin's hand. He was sheltered from the rain and stood on dry ground. As he moved his finger near the key, sparks snapped across the gap and he had identified lightning with the product of the Leyden Jar, and the belief that lightning was an explosion due to sulphur vapors was disproved.

Alessandro Volta, Professor of Physics at Pavia, found that powerful electrical effect could be produced by a series of pairs of different metals. He then made a large pile of alternate silver and zinc discs separated with brine moistened cloth and published the amazing results of his experiments in 1800. The "crown of cups"—jars containing dilute sulphuric acid, copper and silver plates and placed in series—constituted the first real battery and for the first time a steady supply of current was available.

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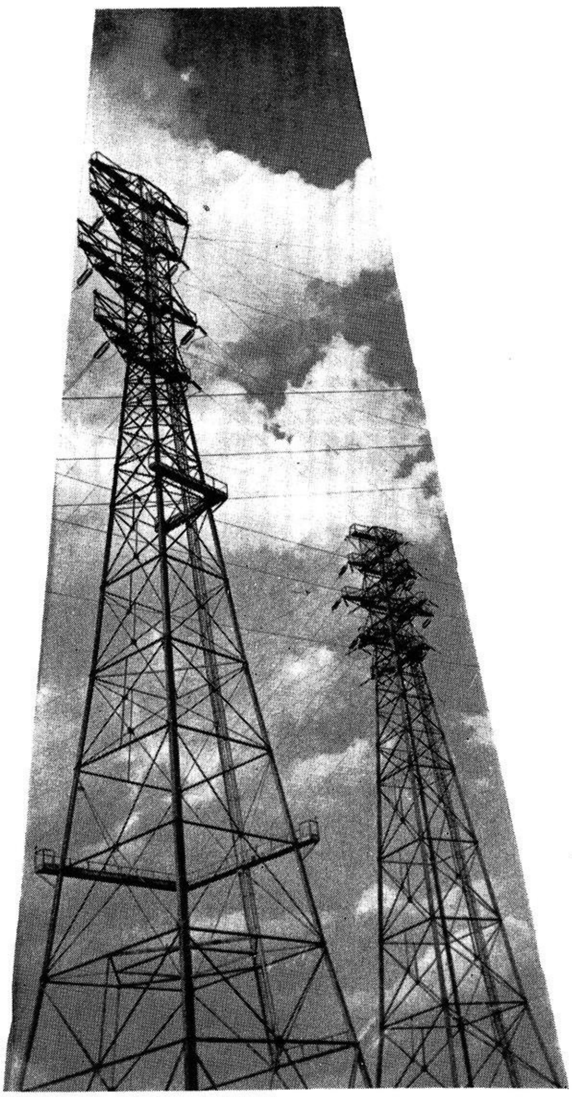


Power Transmission . . . Towers . . . High Voltage — High voltage lines serve to interconnect systems, transmitting enormous blocks of power from hydro-electric plants to industrial load centers. Electrical energy travels along the copper skin of the steel wires at from 6900 to 22,000 volts.

ALUMNI NOTES

by

Eugene Buchholz, m'55

Gonce, John, che '51, is making a study of plant processes for the Ethyl Corporation in Baton Rouge, La. The object of these studies is to test and find more economical methods of plant operation.

Elijah, Leo M., met '51, received his Master of Science degree in June, 1951. Mr. Elijah is now a Metallurgical Engineer with Canadair Limited of Montreal, Canada.

Spencer, C. W., met'52, graduated in August, 1952 with a PhD degree and is now research metallurgist at Sylvania Electric Products of Bayside, Long Island, New York.

Melcher, Norwood, met '40, is a metallurgist in the United States Bureau of Mines, Mineral Division at Washington, D. C.

Fowle, Frederick F., c '93, died at his home in Milwaukee on October 19, 1952. Mr. Fowle also held a Doctor of Medicine degree.

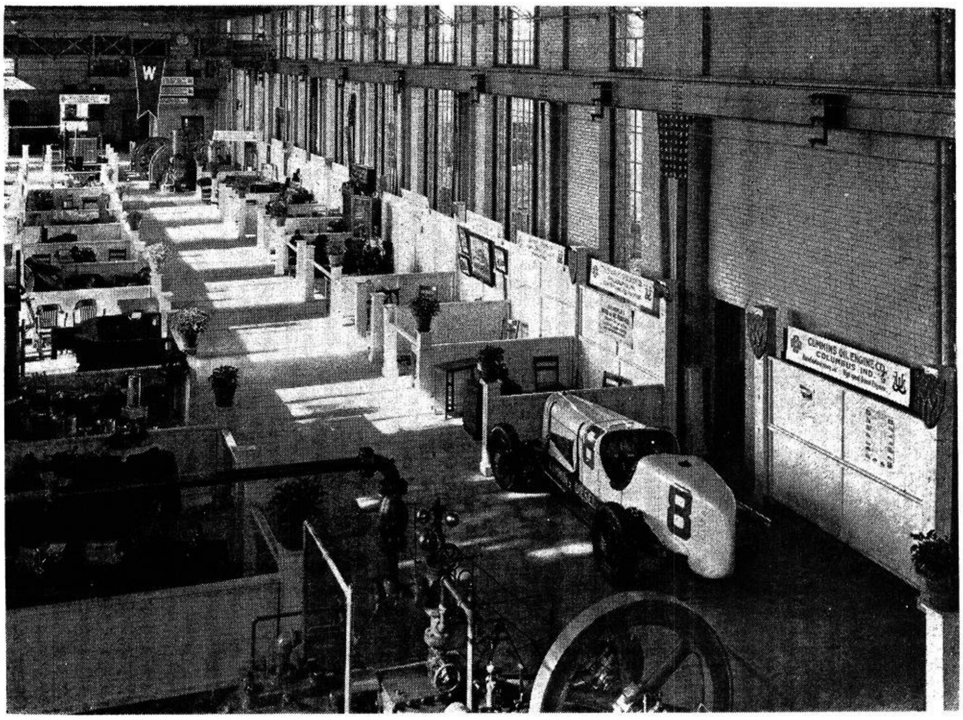
Bardeen, John, e '28, MS '29, was given the Stuart Ballantine Medal of the Franklin Institute on October 15, 1952. Professor Bardeen was given this honor for his contributions to the theory of surface states in semi-conductors and the invention of the point contact transistor.

Wright, J. David, e '09, a veteran of 43 years in engineering electrical system for industry, retired from the General Electric Company on October 31, 1952. A native of Baraboo, Wis., Mr. Wright graduated from the University of Wisconsin in 1909 with a B.S. degree in electrical engineering. He joined General Electric that same year and has been with them until his retirement. In 1950 Mr. Wright assumed the position of assistant manager of the Industry Engineering and Sales Department, the post he held at the time of his retirement.

D. J. WRIGHT

MORE NEWS OF THE 1953 ENGINEERING EXPOSITION

by Richard Groth



The Heat-Power Laboratory during the last Engineering Exposition.

The 1953 Engineering Exposition is on its way! Every Tuesday night since last December the exposition committee, led by Tom Haas and Ken Schneck, co-chairman, has held meetings in the M.E. building. They have discussed plans and ideas, and tried to iron out the snags that crop up in an undertaking of this size. Here are the major results of the committee's work, up to this writing:

Over ninty-five letters have been sent out to industrial firms all over the United States. They explained the exposition offers the opportunity to exhibit or demonstrate any product or apparatus which shows application of engineering. State and local organizations who have already requested space for exhibits include the Johnson Service Company, the Heil Company, the Wisconsin Motor Corporation, all of Milwaukee; Research Products Company, Madison; Waukesha Motors, Waukesha; and West Bend Aluminum, West Bend.

All of the Polygon member organizations are working on ideas for exhibits they will construct. Commitments from individual students and other organizations haven't been called for yet, but here is a reminder on this point: the locations of these student exhibits will be on a first come, first served basis. They will be distributed throughout the College of Engineering buildings, not including the M.E. building. This has been reserved for industrial exhibits, because of its power facilities.

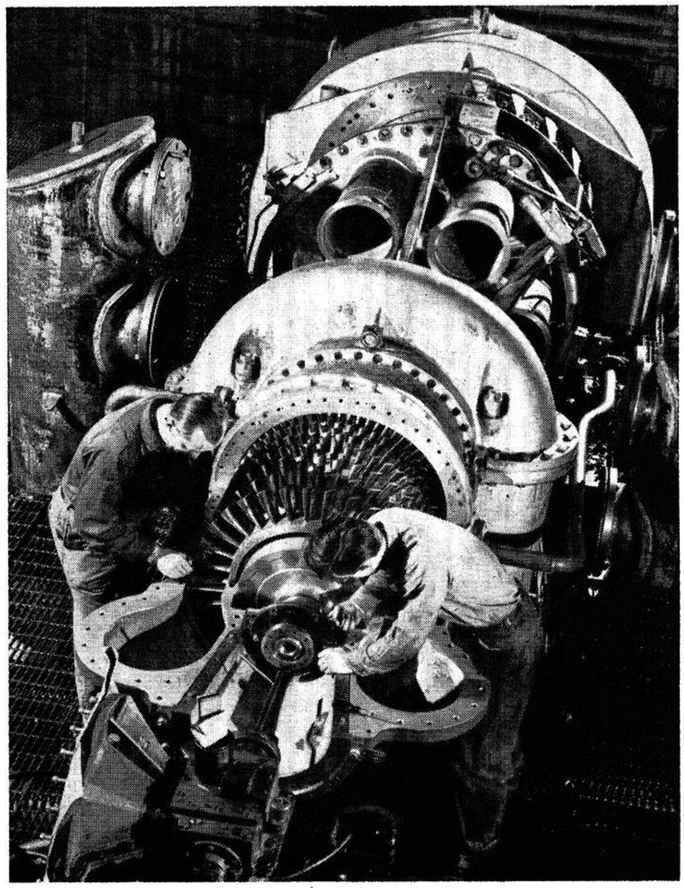
To make the exposition profitable for student exhibitors, $100 in prizes—$50 for both individual and non-Polygon organization exhibits—has been appropriated by the exposition committee. Polygon Board will also award trophies to the individual winners and the groups they represent, but exact details have not yet been worked out.

Part of the scheduled program for the exposition, to be carried out in conjunction with the exhibits, calls for an official opening on Friday, April 10, and a special welcome, on Saturday, for interested high school seniors.

The College of Engineering Exposition is shaping up; it is a wonderful opportunity for every engineer to gain valuable practical experience, to show his abilities and ideas, and to help make it a success.

HIGH SCIENCE

Edited by Gene Worscheck, m'55



New gas turbine.

MORE GAS FOR CONSUMERS

The gas turbine, one of the most versatile new sources of power for industry, is now being used successfully to pump natural gas through pipelines.

The first of twenty-eight 5000-horsepower General Electric gas turbines for the El Paso gas transmission system between West Texas and California has been placed in operation at Cornudas, Texas.

When the remaining units are in operation within the next year, flow of gas through the lines will be increased about 300 million cubic feet per day.

The new gas turbines will operate centrifugal pumps to obtain this increase in capacity. The El Paso system is now using stations with reciprocating pumps at about 100-mile intervals along the line. The use of these units will continue.

LIGHTS

The gas turbine stations are being inserted at about 30-mile intervals between existing reciprocating stations to boost the average pressure and the flow of gas.

The operating cost of the new stations is expected to be less than the cost of present reciprocating stations, principally because the new stations will require less manpower for operation and maintenance.

Sites of the new stations are in the desert where water is a precious commodity. Gas turbines are well-suited to such locations because they require little water and few operating personnel.

The gas turbines are being instaled as part of the expansion program of the El Paso Natural Gas Company.

Nine of the units are already being installed and some are already in operation. All the gas turbines are expected to be in operation before the end of 1953.

•

NEW PERIODIC CHART

A new periodic chart of the chemical elements, listing some of the latest data about them, has been issued by the General Electric Company, according to a recent announcement.

All 98 elements known to date, including berkelium and californium, which were produced at the University of California in 1950, are shown, with the chemical symbols and atomic weights. The latter are taken from the 1952 official list published by the American Chemical Society.

WEATHER PEN

A pen that writes the weather has proved an accurate means of detecting atmospheric changes for General Electric Company scientists here.

The device puts down on paper weather changes ranging from distant summer showers to unrushing thunderstorms.

With the aid of a radioactive point on a slender shaft mounted atop the G-E Research Laboratory, scientists are gauging the electrical activity generated by weather changes as slight as shifting winds.

Electric current, collecting on the radioactive point from high potential developed between earth and atmosphere, is measured by an extremely sensitive photoelectric recorder located in the laboratory's penthouse weather station.

The tiny stylus of the apparatus moves left when negative charges grow on the antenna outside. Positive charges move the pen to the right. Dead center is zero potential on the paper chart moving steadily past the red-writing stylus.

With clear skies overhead, small deflections of the delicate instrument correlate well with the outbreak of showers within a radius of 450 miles.

On clear days the pen stays close to the center line of the chart. But radium-impregnated gold foil on the antenna has made it so sensitive the pen seldom remains at rest.

When thunderstorms move into the area, the pen springs to life. The approach of a storm consistently builds up a negative charge, sending the thin red line far to the left on the ruled paper.

FLY-ASH CONCRETE

Fly-ash is a waste product of steam power stations, collected by the operators in large quantities and at considerable expense, to keep it from being blown over the countryside from stacks of their plants. Since the greatest quantities are collected in the densely populated areas, where the need for highways is greatest, finding a market for fly-ash in highway construction would eliminate the transportation problem that has limited its use in large dams, most of which are situated far from large centers of population.

By preventing the release of free lime, effervescence on the surface of the concrete is reduced materially. Also, fines of the fly-ash fill practically all the voids in the sand; therefore a dense mixture or mass is produced with low permeability, good workability, and with a general reduction in the water-cement ratio. There is a low heat of hydration when fly-ash is used in concrete mixtures, which is an important factor in mass concrete operations.

Test cylinders were made and broken after 7, 28, 60, 90, 180, 270 and 360 days. Plotted results from these tests indicate that the plain concrete had a higher initial strength; the plain and fly-ash concrete had about the same strength at a point some place between 100 and 110 days. After that time the fly-ash concrete had greater average strength—about 600 psi above the plain air entrained concrete.

(please turn to page 46)

MINIMUM CONTINUOUS SAFE FLOW OF CENTRIFUGAL PUMPS

DeLaval Steam Turbine Company
by E. C. Condict, Pump Engineer

Liquids in a centrifugal pump will flash into vapor when the capacity being pumped is too low. Knowing when this will happen and how to prevent it means every operator can avoid this trouble.

Heat is generated whenever work is done. The work used by a pump to increase the pressure of the liquid makes it heat up. When the capacity is large enough to carry off most of this heat, the temperature of the liquid passing through the pump will rise only a few degrees. The heat is not carried away fast enough at small flows, causing the temperature of the liquid to rise and flash into vapor.

The smallest flow at which a centrifugal pump can be safely operated is called the minimum continuous safe flow. If the pump is run continuosly at less than this amount, the liquid in the pump will flash.

The amount the temperature of the fluid can rise before flashing is known as the allowable temperature rise. Suction conditions determine NPSH (Net Positive Suction Head) expressed in feet of the liquid being pumped measured at the centerline of the pump. NPSH is the net head above the vapor pressure corresponding to the temperature of the liquid being handled.

The allowable temperature rise is found by converting the feet of available NPSH into PSI. Then add this PSI to the vapor pressure corresponding to the temperature of the liquid being pumped. This pressure is the vapor pressure corresponding to the temperature to which the liquid may be raised before it will flash.

Once the allowable temperature rise has been established the minimum safe continuous flow can be calculated by the formula:

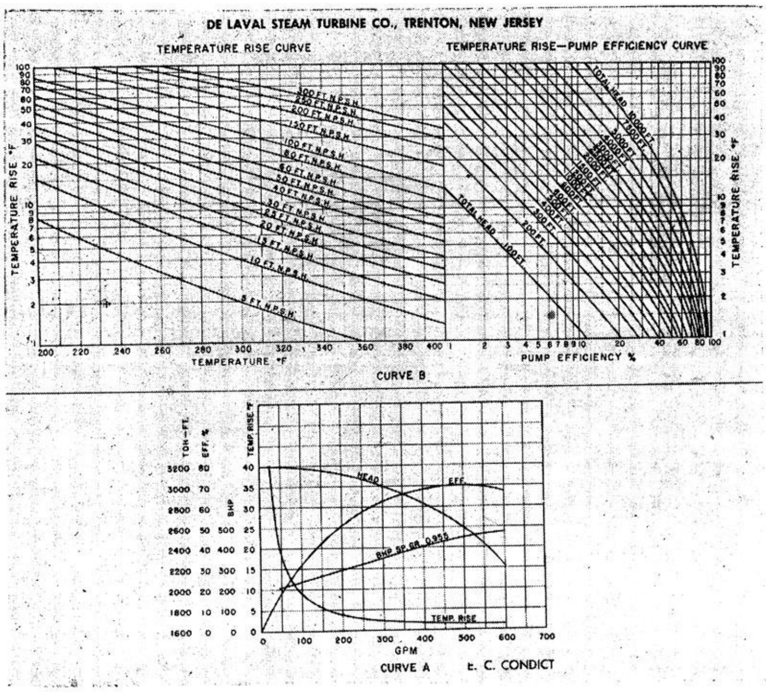
$$\text{(a)}\quad n = \frac{\text{TDH} \times 100}{778\ t + \text{TDH}}$$

n is the pump efficiency expressed as a percentage, TDH the total dynamic head in feet and "t" the allowable temperature rise expressed in °F. The capacity corresponding to this efficiency is found on the pump characteristic curves.

The next problem is to select the correct TDH. At no flow the TDH is called shut-off pressure or SOP. The head of a normal centrifugal pump rises constantly to the SOP. Therefore, if the SOP of a pump is substituted for TDH in formula (a), any error in calculating the efficiency will be on the safe side. Substituting SOP for TDH in formula (a) gives:

$$\text{(b)}\quad n = \frac{\text{SOP} \times 100}{778 \times t + \text{SOP}}$$

Curve "b" was developed to eliminate calculations for centrifugal pumps handling hot water by solving the prob-



lem graphically. Similar curves may be made for any liquid. The temperature rise—pump efficiency curves on the right side may be used for any liquid. Only the temperature rise curves on the left need be changed for other liquids.

Let's for example, take the pump whose characteristics are shown in curve "A". The SOP is 3200 ft. Determine the minimum continuous safe flow when handling 220°F. water with 19′ NPSH. Curve "B" shows that the allowable temperature rise is 20°F. and the efficiency corresponding to the minimum continuous safe flow is 17%. Curve "A" shows the capacity corresponding to 17% to be 47 GPM. Thus the minimum safe continuous flow for the pump whose characteristics are shown on curve "A" is 47 GPM.

How can the pump whose characteristics are shown in Curve "B" be protected from flashing? Install a by-pass line having a suitable orifice from the discharge of the pump back to the suction heater. The size of the orifice is such that it will pass the minimum continuous safe flow. This by-pass line cannot go back to the suction of the pump, as the same fluid would be handled over and over again, causing the temperature to rise until the liquid would flash.

There are two fundamental ways of taking care of the by-pass flow. One way is to keep the by-pass open at all times. In this case the rated capacity of the pump must be the rated capacity of the system plus the minimum continuous safe flow. The second method is to use some flow regulating device. When the pump capacity decreases and approaches the minimum continuous safe flow, a valve in the by-pass line is opened. When the flow is above the minimum the valve is closed. This may be done either manually or automatically.

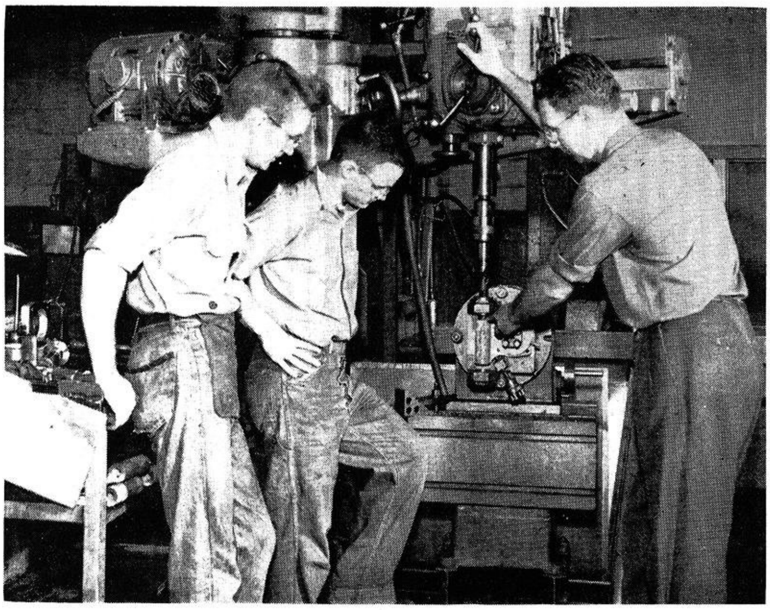
Curve "B" may also be used to determine the NPSH required for a new installation. Assume that a pump is to be installed for handling 275°F water. It is desirable to have a 15°F. allowable temperature rise. This gives a safe margin for possible surges in the suction heater. The temperature rise portion of Curve "B" shows that 30′ NPSH will be required. This means that the heater must be placed high enough above the centerline of the pump so that after friction and entrance losses have been subtracted from the static elevation, there is available 30′ of liquid head over and above the vapor pressure.

When liquids other than water are being handled it would be necessary to draw temperature rise curves based upon the characteristics of the liquid being handled.

Temperature rise curves for a pump may be calculated by means of the temperature rise-pump efficiency curve portion of Curve "B". Take a given pump efficiency and from the characteristic curve select the corresponding head. For example, at 60% efficiency the pump whose characteristics are shown on Curve "A" has a TDH of 3000 feet. The corresponding temperature rise from Curve "B" is 2.3°F.

For mechanical reasons, such as unequal expansion of pump parts, it is desirable to limit the temperature rise. A maximum temperature rise not exceeding 30°F. is a good practice. However, it is advisable to consult the pump manufacturer. Some materials cannot be operated above a certain temperature regardless of the allowable temperature rise.

Knowing when and how to protect a centrifugal pump from overheating is very important. Curve "B" or modifications of it suitable for the liquid being handled lets an operator know how to protect his pump from flashing.



SUMMER TRAINING FOR UNDERGRADUATES

by James Forsyth, m'53

I. INTRODUCTION

Some of the industries which employ graduate engineers have instituted summer training programs for undergraduate engineering students. These training programs differ from regular summer employment in that the work is specifically chosen so that the experience will be useful in postgraduate engineering work. Usually the student is given various job assignments during the period to let him gain broader knowledge than is possible when working at only one job. In some cases the student works at only one job but the work is of a nature that gives better-than-normal opportunity to learn about the activity involved. Probably no two companies have exactly the same system. Some programs involve formal classroom work and a guided schedule while others are strictly on-the-job training with initiative for training left to the immediate supervisor. Some of the work is of an engineering nature, such as design or research, while some work is not of an engineering nature but does involve subjects with which the company feels their engineers should be better acquainted.

The purpose of this article is to better inform undergraduates about summer training programs through a detailed account of one company's training program and to analyze summer training programs in general from the viewpoint of the student.

II. CATERPILLAR TRACTOR PROGRAM

The Caterpillar Tractor Company, located at Peoria, Illinois, recently initiated a summer training program for engineering undergraduates particularly interested in production. Although this program is new, the company has a well established training school whose staff, facilities, and experience are used in conducting the training. As stated by the company in their information for prospective trainees, "The objective of this training program is to provide selected engineering of science students the opportunity of gaining work experience and technical knowledge in the production phase of heavy manufacturing. While participation on the part of any student does not commit him to join Caterpillar Tractor Company after graduation, this experience may lead to a career with the Company. The training program consists of three major work periods—two of which are offered while the student is an undergraduate. To qualify for training, one should be a second semester sophomore enrolled in an accredited college or university. Scholastic achievement and extra-curricular activities are considered, personal characteristics are carefully weighed, as are other factors incluencing likelihood of success in the Company."

The program last summer consisted of both shop work and classroom training. The original plan called for ten weeks of shop work and two weeks of classroom work while the plant was closed for the annual summer vacation. This plan had to be altered due to the steel shortage caused by the steel strike so that about four weeks were spent in the classroom.

Approximately 25 engineering students, representing many midwestern universities, took part in the program. The training schedule was flexible enough that students could choose their own dates for arrival and departure. Those who had to attend ROTC summer camps were excused for the necessary length of time. All training was conducted at the Peoria, Illinois plant which has facilities for most methods of metal processing with the exception of forging. Trainees were paid by the hour, with a bonus for night shift work. Each trainee spent from five to seven weeks on night shift. Lodging was obtained and paid for by the trainees.

Regular education and training department staff members instructed and supervised the trainees, even at production stations. Most of these instructors were graduates of the four year apprenticeship program at the plant. All had had working experience with the subjects they taught; and all had been well trained in the techniques of instruction, in leading group discussions, and in working with people. They encouraged questions and were willing to obtain answers to questions they couldn't answer themselves.

Physical training facilities were excellent. Classes were small, and much use was made of movies, demonstrations, and models. There was very little conflict in subject matter with that studied at the university as most of the material involved practical applications rather than basic theory. The shop work was done on actual production machinery. The plant contains most types of modern production machinery and uses the latest techniques.

The program varried with the individual trainees, but a typical program might have been:

Radial Drill	3 weeks
Welding	2 weeks
Milling Machine	3 weeks
Production Planning	1 week
Hydraulics Applied to Machine Tools	1 week
Foundry Technology	1 week
Machine Shop Classes and Tours	1 week
	12 weeks

As stated above, it was originally planned to have more of the time spent in the shop, but this had to be altered because of the steel shortage. Some of the trainees who would only have one summer of training before graduation were assigned to turret lathes for several weeks. The program represents the first of two summers.

The radial drills and milling machines on which the trainees worked were located in the building where the company's diesel engines are manufactured. The work was all production work, and the training was given on the job. The machines were located throughout the building so that the trainees weren't an isolated group but experienced the same situations as the regular production workers. All machine set-ups were made by the trainees working from the blueprint for the piece. Some machines required frequent set-ups while others did not.

Welding was taught by the training staff in the building where the major portion of the plant's fabrication is done. Most of the time was devoted to electric arc welding since this is the type most used by the company. Limited instruction was also given in oxy-acetylene welding, oxy-acetylene cutting, and brazing. The facilities used were those provided for the two year welding-apprentice trainees. It was not necessary for the trainee to have had previous welding instruction. The course did not conflict much with that taught at the university since most of the time was spent in actual practice and observation rather than in study of theory. Movies and lectures were used to acquaint the student with welding technique and terms. About one week was spent in the training booths practicing welding under the instruction of one of the regular welding apprentice teachers. Another week was spent in observing production welding to acqaint the trainee with tacking techniques, the use of welding fixtures, and production welding problems and methods. Each trainee was assigned to observe a single production welder for a total of perhaps eight hours and then moved to another observation station involving a different welding situation. Usually the production welder permitted the trainee to do a limited amount of welding with guidance.

Both the course in production planning and the course in hydraulics as applied to machine tools were parts of regular courses in the company's four year machinist apprentice program. Therefore, models, movies, and demonstration materials were available. The two courses were studied simultaneously for a period of two weeks by dividing the group into two sections which studied each course for half of the day. Thus classes were limited to about 12 members.

The production planning couse was a study of the organization and function of the company's production plannig department. A few subjects studied were processing, plant layout, and time study. Understanding of the lecture material was aided through the use of typical problems facing some of the sections in the department. The lectures were followed first with the application and then with a discussion. Blueprints of typical parts were distributed and the trainees were asked to choose a sequence of machining operations, specifying the types of machines to be used. The various possibilities were then discussed. Time study training films were shown and the group rated the efforts of people in the movies after having been shown the company's idea of normal effort. Ratings were then compared to illustrate the problem facing time-study men. The trainees were supplied the necessary equipment and then given an opportunity to make a time study of machining operation. Plant layout was studied through a problem which had the group, now divided

(please turn to page 56)

WISCONSIN SOCIETY OF PROFESSIONAL ENGINEERS

W. S. P. E.

Edited by

Stephen Carter, m'55

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BOARD OF DIRECTORS

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- **University Cooperating Committee**
- **Chapter Membership Program**
- **Registration Act Violations**
- **Legislation Committee**

The January meeting of the Board of Directors was held in Milwaukee on January 22, in connection with the annual meeting with brief sessions being held on Jan. 23 and 24. Many of the final details in connection with the meeting were worked out at the Jan. 22 session.

The board reviewed chapter plans for the recognition of Engineers week on February 22 to 28. Most chapters plan active participation in this event.

The sum of $80 was approved for use by the university cooperating committee in making a mail survey of recent engineering school graduates. Graduates would be requested to fill out questionnaires regarding university curriculum.

Details of a proposed intensive membership campaign on a state wide basis outlined by the Fox River Valley chapter was approved by the board. The plan calls for a thorough follow up of prospective members on the new lists of registrants.

A resolution of the Fox River Valley chapter calling the attention of the board to a new interpretation of the registration act was presented. The matter was turned over to a special committee for early action.

The resignation of Mr. R. L. Hungerford, chairman of the legislative committee was accepted with regret. Mr. Hungerford stated that his present work makes it impossible for him to carry on this activity. The board appointed Mr. E. J. Kallevang as chairman to fill out the unexpired term. Mr. Kallevang was instructed by the board to appear at the legislative hearings on the surveyors registration act now in the legislature and to work actively for the passage of this measure.

•

We are pleased to welcome the following into the Society:

MEMBERS

Thomas J. Makal, Sales Engineer, Bark River Culvert and Equipment Company, Milwaukee.

Joseph R. Koenig, Engineer, Dairyland Power Cooperative, La Crosse, Wis.

Durward L. Lindquist, Building Superintendent, Lindquist, Inc., Menasha, Wis.

Dean B. Eckstrom, Owner and Operator, Dean B. Eckstrom Road Construction Firm, Superior, Wis.

Howard R. Turtle, Jr. Asst. Development Engineer, Nash Motors, Kenosha, Wis.

Edgar J. Van Deusen, Industrial Power Engineer, Wisconsin Power and Light Company, Madison.

Ceaser A. Stravinski, Associate Public Health Engineer, Wisconsin State Board of Health, Madison.

John G. Morris, Public Health Engineer, Milwaukee Health Department, Milwaukee.

Fichard A. Schultz, Assistant Chief Engineer, General Telephone Company of Wisconsin, Madison.

AFFILIATE MEMBERS

Albert R. March, Civil Engineer, Fluor Brothers Construction Co., Oshkosh.

Lawrence S. Krueger, Plant engineer, Pelton Steel Casting Company, Milwaukee.

Robert P. Fuller, Engineer, City Water Department, City of Madison.

Mrs. W. Tucker; Mrs. R. N. Hopwood; Mrs. E. P. Hansen; Mrs. H. L. Stark; Mrs. L. T. Rosenberg; Mrs. Harry Gute, chairman; Mrs. H. S. Fullwood.

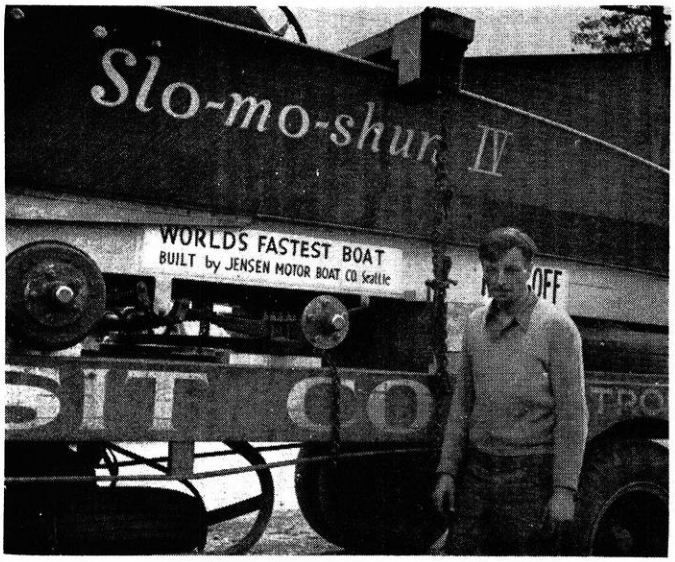
Much of the success of the tenth annual meeting was due to the efforts of the hard working ladies committee pictured above. There is a strong suspicion that the special invitation issued to the wives of the WSPE members brought many of the members to Milwaukee.

On the lighter side of the meeting, mention must be made of the native Bavarian dancers at Thursday night's get-together, the safari in Africa lecture, the excellent banquet on Friday evening when Professor Oakes and his Goofy Gadgets and Larkin, the Magician Extraordinary with his able assistant Mrs. John Blakey.

In addition to the necessary work of the annual meeting the members were privileged to hear an outstanding talk by Frank P. Zeidler, mayor of Milwaukee; obtained a first hand report by George Sievers on the professional and industrial leadership in post war Europe, heard Mr. Robert Garnier, classification examiner for the city of Milwaukee explain the establishment of pay ranges for engineering positions and heard Mr. Carl Taylor, president of the Waukesha State Bank, speak on "America Tomorrow."

(please turn to page 66)

SLO-



MO-

by Marc Momsen

m'53

June 26, 1950, a bright warm day, dawned as a milestone in the history of motor-boat racing. That day, Slo-MO-Shun IV set a new world's record for the measured mile for unlimited class hydroplanes at 160.3235 miles per hour. Everyone except the owner, Stan Sayres, the designer, Ted Jones, and the builder, Anchor Jensen were quite startled by such speed on water.

To the technically minded person, the specifications of the Slo-MO-Shun IV will help explain its performance:

* Length, 28 ft.; Width at sponsons (sort of outriggers), 11 ft. 4 in.

* Stepped up 3 to 1 gear hooked directly to engine. Thus, when engine is turning 3,700 rpm, the propeller is turning 11,100 rpm.

* Weight, complete with gas and oil, 4387 pounds. Ratio is 2.4 pounds per hp. By comparison, a modern car weighs from 31 to 36 pounds per hp.

* Motor is standard Allison aircraft engine rated at 1,800 horsepower.

* At high speed, the boat rides on only four square inches of the inner runner of each sponson, and only half of the two-bladed 14-inch propeller is submerged. The rudder is offset 7 inches to the right of the boat's centerline to keep it out of the terrific force of the propeller blast. If it were on center, force of water would bend it out of shape.

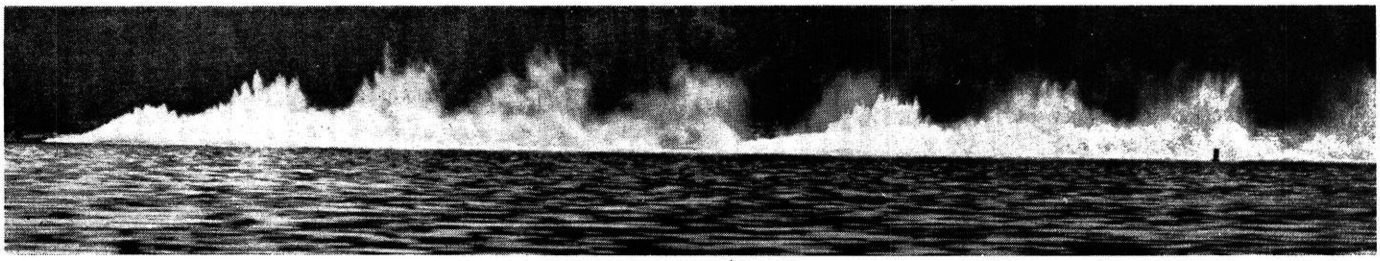
* Acceleration from 45 to 125 miles per hour in 26 seconds. Reaches 160 miles per hour after run of one mile.

Since 1927, Stan Sayres has known the sheer thrill of speed on water, but it was not until 1948, when Ted Jones convinced him that he could build a winning boat, that he entered into the racing picture completely.

Actually, it was back in 1940 that Jones felt he could design a Gold Cup winner. It's been said that he literally eats and sleeps his hobby, because he frequently jots down notes on designing boats in the middle of the night or while eating. All his knowledge came from trial - and - error, as there were no textbooks on the subject. Jones, a Boeing Aircraft engineer, has used his experience and some aircraft principles in designing the Slo-MO-Shun.

The third member of the boat trio is Anchor Jensen, owner of the Jensen Motor Boat Company, Seattle, Washington. This preoccupied Scandinavian has the reputation in boat-building circles of "never asking an employee to do anything that he couldn't do himself—— and probably better and faster at that."

Although Sayres drove the "IV" to the record on June 26, 1950, the real driver of the Slo-MO Shuns is Lou Fageol, considered by Sayres as the "greatest driver



Slo-MO-Shun IV kicking up a rooster-tail spray during a high-speed trial.

SHUN

of them all." Fageol, president of the Twin Coach Company of Toledo, Ohio, drove the "IV" to victory in the 1950 Harmsworth race and the "V" in the 1951 Gold Cup race at Detroit. Also in 1951, the Slo-MO-Shun V won the Seattle Seafair Trophy race with an average speed of 107.050 miles per hour.

The Slo-MO-Shuns are constructed of custom-made mahogany and plywood with strips laid at a unique 45-degree angle on the final panels of plywood. The Elliot Bay Mill Company in Seattle did the custom work and used Monsanto's PF4D Phenolic resin glue for the exterior plywood. A unique point about the boats is the fact that they don't have to be lifted from the water between heats to keep them from filling with water, as most of the expensive speedsters do. Because of their fine craftsmanship, the boats require little more care than the average motor boat, and are expected to last quite some time. Since they have never been run at full throttle, their records ought to stand for quite a while too.

Of course, the Eastern racing people have made strong efforts to buy the boats and take them back East, but Sayres has no intention of parting with his beauties—— "It's too much fun," he says.

Ref: Material for this article was obtained from Monsanto Magazine, June 1952, with pictures and permission from "The Monsanto Chemical Company," St. Louis 4, Missouri.

TED JONES, designer
STAN SAYRES, owner
LOU FAGEOL, driver

RECORDING AND REPRODUCTION OF SOUND

PART II

by James Collins, e'53

The recording and reproduction of sound are limitless subjects. Information and material, received too late for publication in the January 1953 issue of The Wisconsin Engineer makes possible further pursuit of this subject.

The lateral disc recording method is not a "has been" in the recording and reproduction industry because of the new designs and developments in long playing recordings. The Radio Corporation of America has developed the 45 rpm disc and they have produced their own playback unit which utilizes entirely different ideas from the familiar 78 rpm. players and discs.

This long playing disc and record player are interesting from an engineering point of view. The above illustration with cutaway views shows this player. In the top sketch, the mechanism is shown in a position halfway through the record-changing cycle. The selector blades have emerged into position under the record stack, while the support shelves have receded into the spindle. In action, the selector blades and the support shelves operate simultaneously. The selector blades move into the air space between the bottom record and the rest of the record stack, while the support shelves recede, allowing the bottom record to drop to the turntable. The tone arm, as shown in the sketch, has been moved up and away from the turntable to permit passage of the dropping record. In the bottom sketch, the changer is seen in playing position. The support shelves are supporting the record stack, and the selector blades are recessed within the center spindle. The rotation of the shaft attached to the drive gear causes the drive pinions to move the selector blades and support

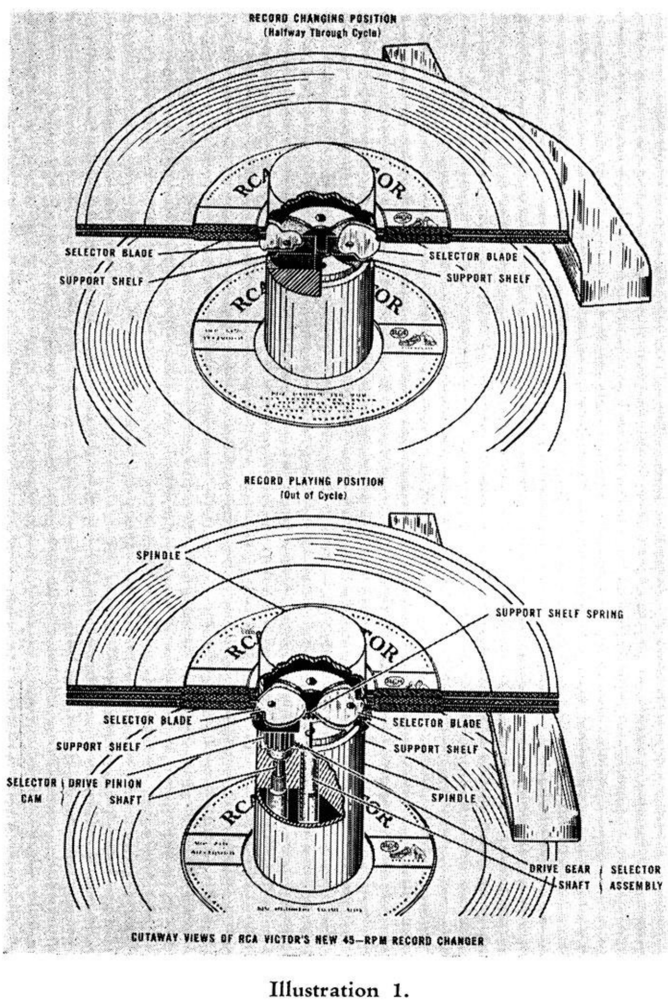
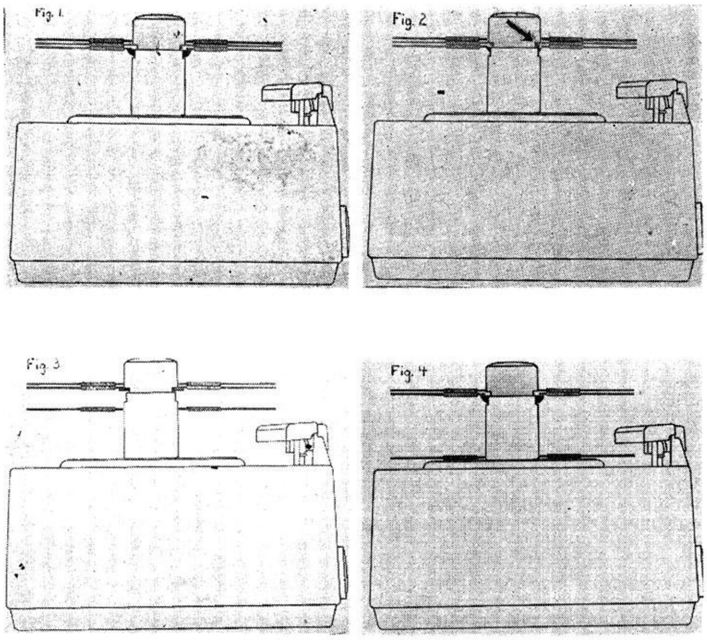


Illustration 1.



Illustrations courtesy
University Loudspeakers, Inc., and
R.C.A.

shelves as described. The rotation of the drive-gear shaft is controlled by the main cam of the mechanism.

Above are a series of photos which illustrate the operation of this RCA Victor 45 rpm changer. As these cutaway views show, the label area is thicker than the playing surface and the center rim. This unique design provides the records with protective air spaces between the playing surfaces and air channels between the label areas for the passage of the changer blades. With this unprecedented safety feature, the selector blades do not touch the records during the record changing cycle.

Figure 1: The records are supported on the spindle by two protruding support shelves. Note that shelves do not extend beyond depressed center rim.

Figure 2: The changing cycle begins. The shelves recede within the spindle, while two selector blades (arrow) emerge into airspace between two bottommost records.

Figure 3: The blades are fully extended. The shelves have disappeared within the spindle. The bottom record, no longer supported, drops gently to the turntable, in playing position. The record stack is held by the selector blades.

Figure 4: The shelves have emerged once more to take over the holding job from the selector blades, which have receded within the spindle. The dropped record is in place on the turntable, ready to play.

The Columbia Broadcasting System uses the 33 1/3 rpm lateral disc recording method which is similar to the 78 rpm standard, except for the use of microgrooves and new disc materials. These two factors combined create superior quality in reproduction. The record players and changers for this system are generally the same as those of the 78 rpm. standard except for the speed change and lighter needle or stylus pressures that are employed.

To determine whether one or the other of these two relatively new types of disc recordings was more desirable than the other would be of no avail, because each has its own desirable characteristics that balance one another. A solution to the problem is the three speed record changer developed to handle all types of discs. The player attachment can be connected to any amplifier or sound system, can also be connected to play through virtually any radio or television receiver. The attachment is housed in a compact cabinet complete with a plug-in phone-jack cable, and measuring only 8 inches in height.

Housed in an attractive luggage-type leatherette carrying case is the new RCA Victor portable all-speed phonograph. Featuring its own built-in eight inch speaker and its own amplifying system, the new phonograph (Model 2ES38) can be carried conveniently and plugs into an A-C power outlet.

Engineered for quick adjustment to 45, 78, or 33 1/3 rpm playing speed, both of these instruments feature a novel slip-on spindle which houses the 45 rpm. record-changing mechanism and merely slips over the instrument's permanent 78 and 33 1/3 rpm. spindle.

Stereophonic Sound

That extra dimensional effect added to the recorded event is known to be produced by the stereophonic sound method. Suppose, for example, we wish to record an orchestral production that is playing in a large auditorium to a full audience. If recorded by the stereophonic method, and if upon playback of this event, you could actually feel that you were sitting in that huge auditorium and enjoying the production or concert with the sense of depth, solidity, and the richness of tone and quality, then true realism has been achieved. In order to illustrate and present a clear picture of this important "third dimensional sound" the above diagram has been prepared.

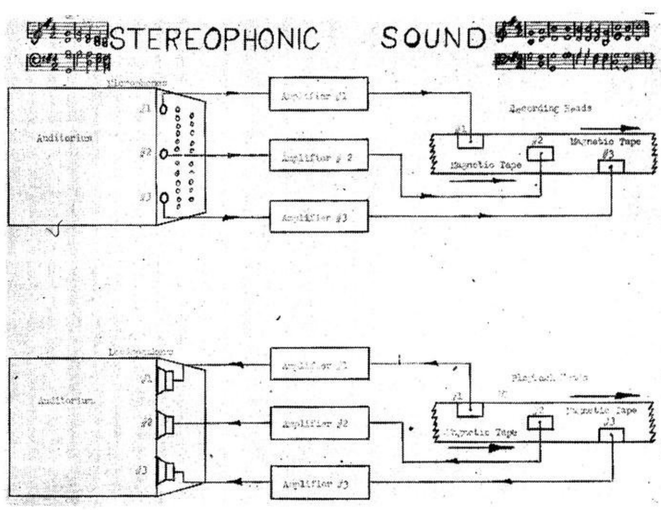


Illustration 2.
(please turn to page 58)

Student Technical Report Section

The Heating Value of Natural Gas

by
Mervin Snodgras

ABOUT THE AUTHOR

Mervin Snodgrass has been kicked out of some of the best engineering schools in the nation. He transferred to U.W. from Carpet Tech where he just completed two years of electives. His major this semester is sewerage engineering which is evident from the material he submits for publication.

THE HEATING VALUE OF NATURAL GAS
School of Fundamental Engineering Finagling
University of Wisconsin
Course: FE 507
Instructor: Professor Shaftus

Object: It appears that the object of this experiment was to thoroughly confuse the student.

Procedure: The apparatus set up for the experiment consisted of several gadgets such as water cans, a gas meter, gas burner, calorimeter, etc. These were all connected by a maze of rubber hoses. The gas burner was connected to the outlet and the gas was turned on. A match was then secured and ignited. This scattered the equipment somewhat. The equipment was again set up and the gas burner was lit and placed under the calorimeter. While the calorimeter was warming up, the humidity and barometer readings were determined. The barometer indicated fair and warmer. The humidity was determined with a sling psychrometer. The thermometers on the instrument were tested and the wet bulb was moistened. The sling psychrometer was then rotated at 250 rpm whereupon it was slung through a closed window. An arbitrary value for humidity was assumed. Meanwhile, a large quantity of steam was blowing from the calorimeter. This was probably because the cooling water had not been turned on. The gas meter (barely visible through the steam) was observed to be running backwards. In the absence of the instructor, there was considerable debate as to whether or not the gas meter should give negative readings. One of the more brilliant experimenters concluded that the hoses were reversed; so, he switched hoses in the middle of the steam. After the run was started, a can of water from the calorimeter was dropped and spilled before it was weighed. This could have loused up the data seriously, but actually it didn't make much difference because no data was being recorded (the recorder had stepped out for a cool one). Near the end of the run, the calculator observed that the calculated heating value was going to be too low. This condition was corrected by lighting a small candle and placing it inside the calorimeter. At this point the instructor returned and made the observation that he had left the experiment in good hands. He struck a match to light a reefer and was deeply hurt when he discovered a gas leak. He was rushed to a local mule, pig, and prof hospital where he may recover by June. In the absence of the instructor and in the presence of the fire department, the police department, the sheriff's office, and the dean's office, the class was dismissed.

Conclusions:

1. Some instructors in the university don't have much patience.
2. Nothing conclusive can be said about the heating qualities of the gas except that it is combusible and, at times, even explosive.
3. A more satisfactory method of finding the heating value of natural gas is to call the gas company.

Data: Only one copy of the data was made and, unfortunately, it was left on the roll.

In computing the heating value of the natural gas, F_f, the finagle factor), should be given a value of 2 because the data was only half as good as it should have been:

Questions:

1. If a gas flows through a ½ inch pipe at the rate of 2.0 cu. ft. per minute, what is the velocity of the gas?

$$Q = AV$$

$$V = \frac{Q}{A}$$

$$= \frac{2.0 \text{ cu. ft/min}}{(.25)^2 \times 3.1416 \text{ in.}^2}$$

$$= 10.17 \frac{\text{cu. ft.}}{\text{min.-in.}^2}$$

$$= 4.47 \times 10^4 \text{ furlongs/fortnight}$$

Note: The gas velocity can be expressed in other units (such as ft/sec.) but values in these units have little practical application.

2. Gas flow is sometimes measured with an orifice meter. What is an orifice?

An orifice is a little room where a prof props his feet up on a desk and looks at his Esquire calendar.

From the SOONER SHAMROCK

How the Petroleum Industry Helped Solve the Nation's Benzene Shortage!

From these giant towers at Standard Oil's Whiting, Indiana refinery comes benzene, a product urgently needed by America's booming industries. The petroleum industry's hydroforming process is helping to solve the critical benzene shortage that threatened the nation.

HIGHLY-SKILLED chemists in well-equipped laboratories may come forth with anything from a new spray for protecting apples against disease and insects to a method for synthesizing benzene from crude oil fractions.

In the latter case, petroleum industry scientists had to run a race with a threatened critical shortage. Production of such things as synthetic rubber, nylon, styrene and phenol plastics, aniline dyes, sulfa drugs, insecticides and certain types of military explosives was endangered.

By use of the hydroforming process, which Standard Oil scientists helped to perfect, our technical men synthesized benzene from petroleum naphthas—and in large quantities.

In fact, at Standard Oil's Whiting, Indiana plant, benzene production capacity has risen in the past year to 16 million gallons. In addition, according to the Petroleum Administration for Defense, other refineries ultimately will produce many times this amount as the petroleum industry's answer to the chemical industry's urgent need for large additional quantities of this vital fluid.

Success in producing benzene commercially is only one of the many benefits derived from the petroleum industry's more than $130 million annual expenditure on research and technical services.

At Standard Oil alone 2,500 persons devote full time to research and engineering. Young college-trained technical men will find the wide variety of subjects under investigation and the keen competition in the petroleum industry stimulating to scientific thought.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois

STANDARD

On The Campus

by

Kneeland Godfrey, c'55

PI TAU SIGMA

Pi Tau Sigma held its fall initiation on January 14 at which time the following men were initiated: Ronald O. Anderson; Robert C. Bowen; James H. Davies; Y. H. Fung; Carl H. Gehrmann; Richard J. Gervtz; John S. Hickman; Bruce A. Howe; Walter D. Hougas; Edwin F. Humpal; Edward F. Jagodzinski; Robert R. Jarasek; Bruce F. Peterson; John C. Richardson; George R. Werth; and John J. Zahn.

After a ceremony at the M. E. building, the members all enjoyed the initiation banquet in the Old Madison room of the Union. Professor Ben Elliott acted as toastmaster for the evening; Mr. G. A. Sievers gave the featured address on "Getting Along With People."

ASME

ASME held its January meeting in Tripp Commons in the Union on Wednesday, the 12th. The gathering was the annual joint meeting of SAE and ASME on the campus. Ken Kulik was elected to Polygon Board to replace Stan Makowski, who is a February graduate. Professor Harker introduced the speaker, Mr. David L. Bogue, senior project engineer on turbo-prop controls at the Allison Division of General Motors. His talk was especially timely, for turboprops are now being used for the first time on commercial aircraft in this country. Mr. Bogue spoke on "Up - to - Date Developments in Gas Turbine Aircraft Engines."

TAU BETA PI

The evening of January 13 saw 34 men, juniors and seniors, initiated to Tau Beta Pi. This is one of the highest honors which can be given to an engineering student, for Tau Beta Pi is to engineering as Phi Beta Kappa is to Letters and Science students. The members and new initiates had dinner in the Roundtable room of the Union and afterwards heard a talk illustrated with slides and films by Dave Kingston, of the geology department of his summer travels in a remote and picturesque part of the Canadian wilds. Other activities of the evening were the welcome to initiates by "Zig" Przedpelski, the initiates' response by Paul Winskell, and the plaque award presentation to Bill Franswick by Professor R. W. Leutwiler. The toastmaster for the event was Professor Ben G. Elliott of the Mechanical Engineering department.

Informal initiation took place on Thursday, December 19, in the Union loft. Harold Brikowski had charge of the program and made arrangements.

The new initiates are: Juniors—Jack Binning, Frederick Culver, Robert Greenkorn, Paul Hardt, Terry Mueller, Bruce Peterson, and Ronald Volkman. Seniors are—Gordon Boettcher, Alvin Borsuk, William Catlin, Daniel Colvin, James Forsyth, Lee Foxwell, William Franswick, Donald Gritzmacher, Charles Hopper, Frederick Hunt, James Hurley, Otto Klieve, Stanley Makowski, Marvin Malik, Donald McCoy, William Miller, Robert Piehl, Frederick Plautz, Richard Potts, Gordon Steiner, David Tess, Elroy Treibel, Douglas Weir, William Wiberg, Paul Winskell, Charles Wittkop, and Richard Zimmerman.

Officers of the fraternity are: "Zig" Przedpelski, President; Marshall Finner, Vice-President; Len Rutz, Corresponding Secretary; Tom Berger, Recording Secretary; Bob Gesteland, Publicity Chairman; and Professor R. W. Leutwiler, Treasurer.

ASCE

ASCE's newly elected officers for the forthcoming semester are Harvey Elmer, president; Howard Anderson, vice president; Fred Culver, secretary; Chuck Fisher, treasurer; and Dave Mynning, Polygon representative. Isaac Senior is in charge of ASCE's exposition exhibit and Chuck Brylls is the group's candidate in the St. Pat's dance beard contest.

The meeting of December 10 featured a talk by Mr. Herried of the State Aeronautics Administration of Airport Construction. January 14 of the new year saw Mr. A. J. Ackerman talk on the Chute-A-Caron coffer dam he designed for a Canadian site several years ago. The dam was designed to derive power from a local and very swift stream so the aluminum company there could use the power. Since the

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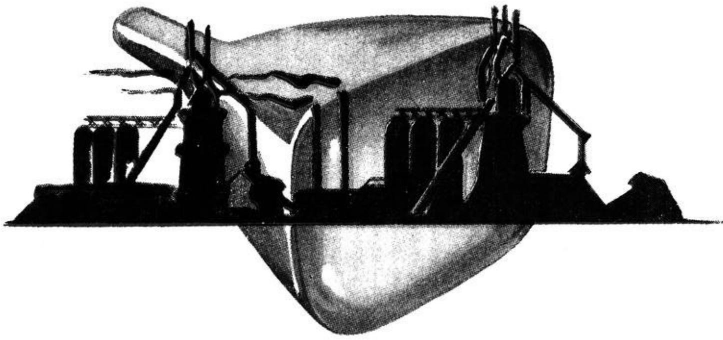
TV GOES TO WORK



Reprinted courtesy
STEELWAYS Magazine

By George Laycock

INDUSTRY is finding that there is more to television than recipes or wrestling or even Kukla, Fran and Ollie. Television is invading mills, factories, research labs and powerhouses across the country. Its job in these places is to inform, not to entertain.

And the industrial jobs it is doing are varied and complex. For instance, there is the program I saw on a hard-working television set in a Canton, Ohio, steel mill.

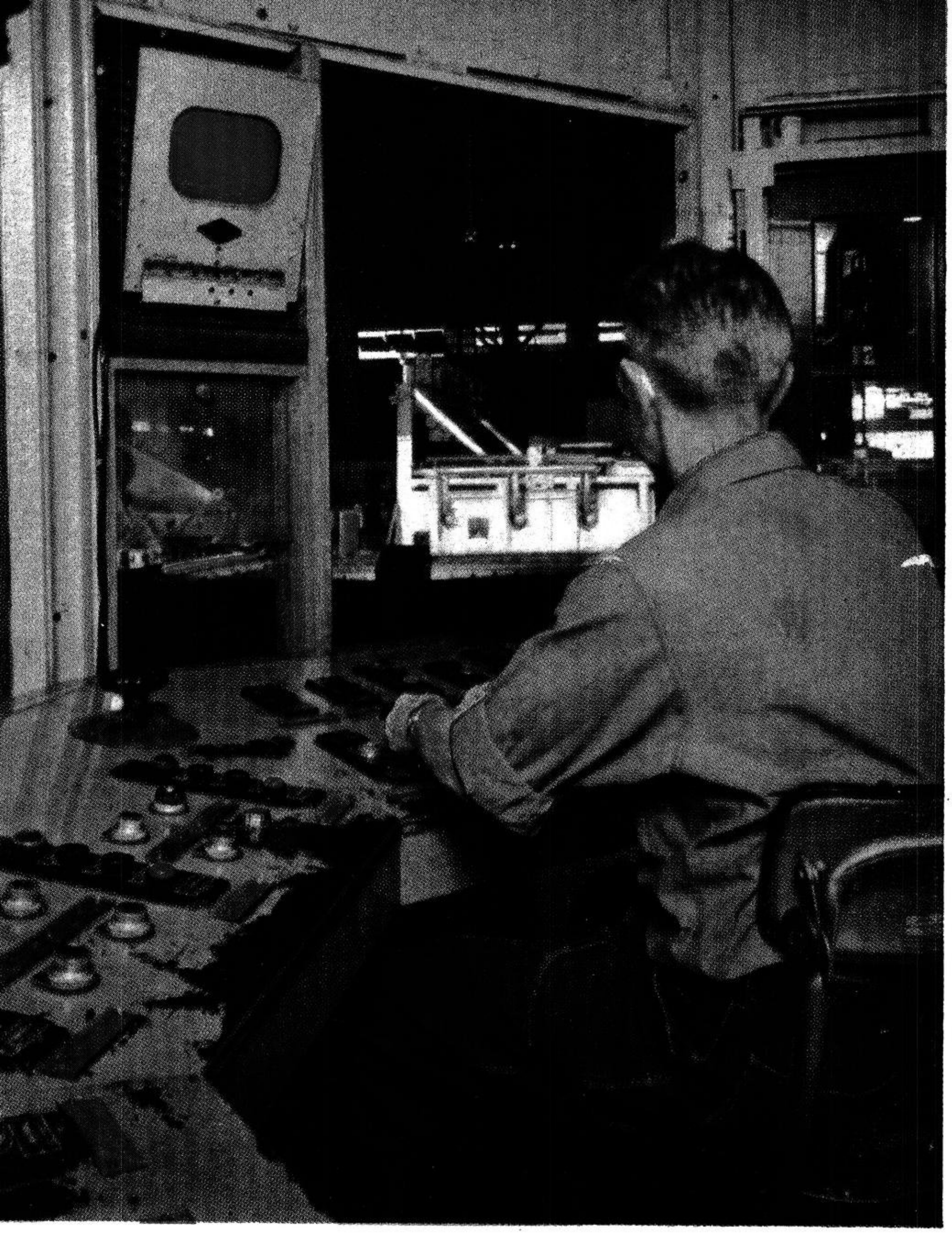
Chief engineer Walter Assel led me back through the busy plant past long conveyors on which rolled a steady line of long, glowing hot steel tubes. Near the center of the plant we climbed a half-dozen metal steps and entered a glass-enclosed control pulpit from which we could look down on the moving tubes. Seated at the panel of buttons controlling the tubes was Marion Spragg. And mounted securely in front of him was a rugged 10-inch television receiver. "I see so darn much television," Spragg said, "that I didn't even watch the fight the other night."

But while that TV set above his control panel may have spoiled Spragg's living room viewing, it has also solved a puzzling problem at the mill. This problem cropped up about a year ago when the company designed and built the new annealing furnace 100 feet down the line from Spragg's pulpit.

Spragg's job calls for manipulating the conveyors so the tubes will stay piled up three and four high in the

is lightweight TV camera, stationed in a yard of the Baltimore
d Ohio Railroad, observes car numbers in a unique demonstration

Sitting comfortably in the B & O yard office, yard clerk Harold DeYoung jots down numbers "grabbed" by a TV eye many feet distant



By flicking a switch, this observer in a steel mill can see what's going on inside the furnace at his right or inside another 200 feet away

furnace to keep it from losing its heat too fast. This called for knowing what was happening inside the furnace. And the fact that the observation door was on the far side of the furnace prompted Spragg to remark that he couldn't see around corners . . . at least not without help.

"We thought of stationing a man at the furnace to signal the pulpit," said Assel, "but he would be idle much of the time. Then we tried a system of mirrors but that didn't work."

It was about that time that the company heard of industrial TV and it wasn't long getting a camera spotted a few inches from the observation door on the new furnace. This long distance eye furnished the help Marion Spragg needed.

When the company recently built a new reheating furnace 100 feet on the other side of the control center, getting the inside information to the pulpit was no problem at all. It told the Diamond Power Specialty Corporation in Lancaster, Ohio, that another TV camera was needed. Now, by operating a selector switch, Spragg will be able to look into either furnace on what amounts to his own network hookup.

Diamond Power, which has sold more industrial television sets than any other company, has installed similar equipment in power companies, scrap metal yards and government arsenals. There is one big difference between this equipment and the television system that brings Howdy Doody to your living room. Every industrial television set has its own coaxial cable sending the picture by wire from camera to receiver. This "closed circuit" television rules out the snow, distortion and lost weekend images that bounce into the home receiver. The electric mixer in a neighbor's kitchen just doesn't matter.

Like all Gaul, an industrial television system has three parts: camera, power unit and receiver. Diamond Power's camera has a $1200 handmade tube with a 9000-hour life expectancy. The tube in the receiver is identical with those in home sets. All three parts weigh less than 150 pounds and can be transported on the back seat of an automobile.

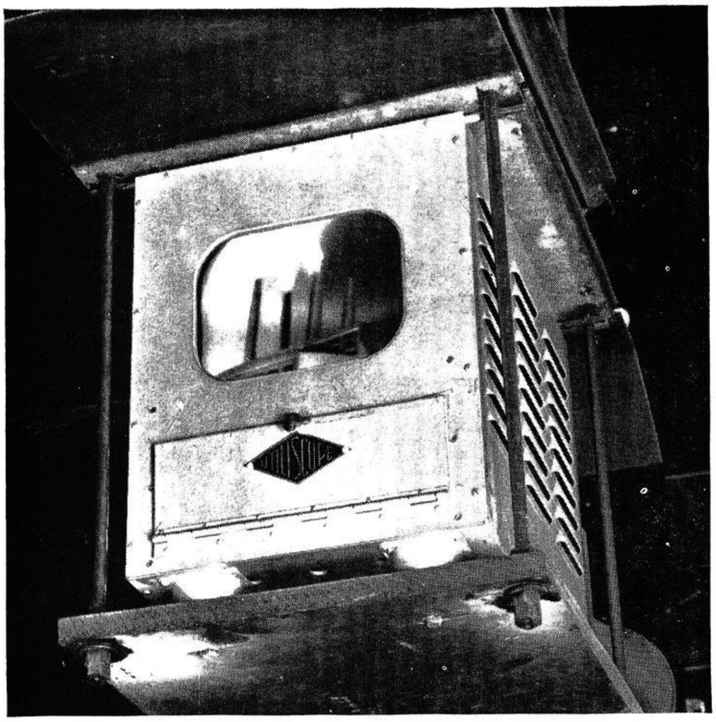
"While these sets work constantly without adjustment and the operator needs no special training," Diamond Power executive G. H. Wilson told me, "we do run into occasional troubles. One day we got a hurry-up call from a power company. They said their picture was getting fuzzier all the time. We sent a service man over. He took one look at the camera, wiped the dust off the lens and they got the best picture they'd had in months."

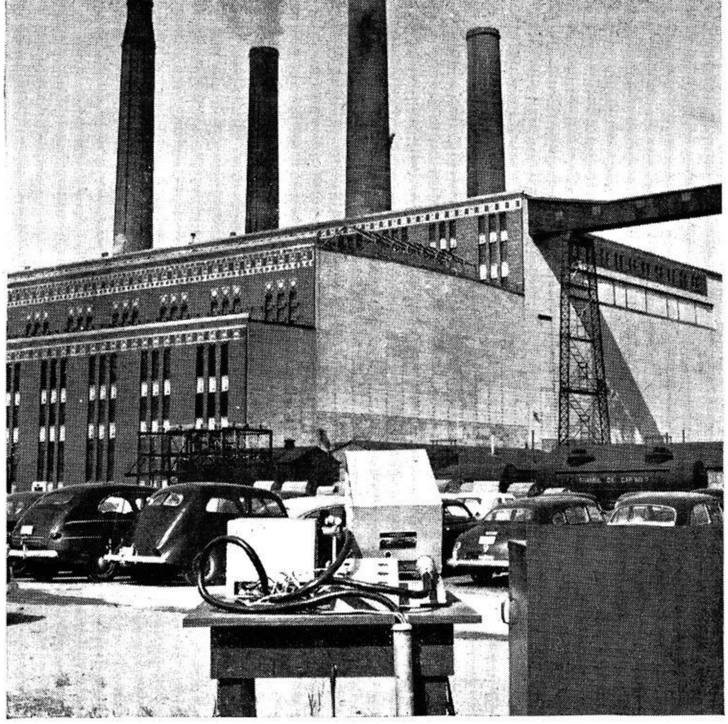
IT is doubtful that this kind of TV equipment will ever be sold across the counter. "We have to sell an application," says Wilson, "not just an instrument."

Diamond Power would not have stepped into industrial TV back in 1946 if the power companies for which it had long made special equipment hadn't been confronted by a special problem. As the power companies increased in size, their boilers grew taller and taller until some were six stories high. The water drums are at the top and so are the gages that show the water level. Operators keep tab on the water in the boiler with remote water level indicators. But these indicators have been known to fib and show water in the boilers when the boilers were dry. That means trouble, for the heat soon collapses the tubing in the boiler. There follows a shutdown for repairs and often a quarter-million-dollar loss.

Actually, that's what happened at a large power company in the South in 1945. A remote water level gage, plus a second one installed to keep tab on the first one, said there was water in the boiler. But by some unhappy co-

Equally proficient in many fields of magazine article editing and writing, author ***George Laycock*** *is intrigued by a new phase of rapid television expansion*

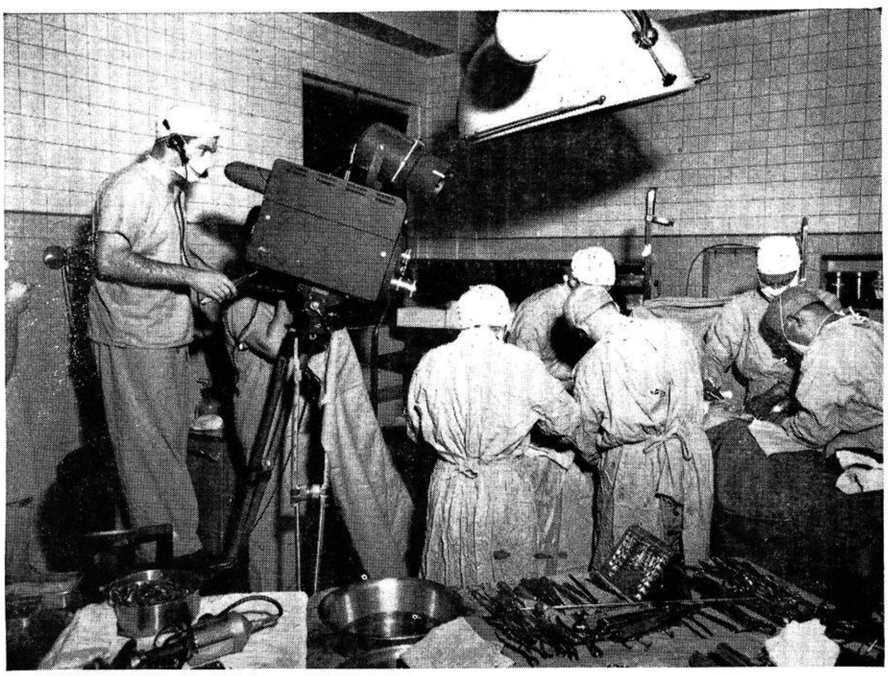




These four Chicago smokestacks are probably the world's most photographed. A TV camera in the power company's yard reports steadily (left) to firing crews in building

At Argonne National Laboratory, "stereo" or three-dimensional television enables men working with radioactive substances to view them safely

Sharply defined true-to-life color TV makes possible the viewing of delicate surgical operations like the one below by large groups of medical students. The operation shown was in a New York hospital



incidence they were fibbing in unison.

Engineers at Diamond Power applied themselves to this problem and decided that here was a job for TV. It would give either the correct picture or none at all. But when they started building an industrial television unit for observation of ignition within the boilers they ran into some new barriers. They soon found that cameras spotted at boiler furnace openings face a combination of heat and dirt that can obscure and even etch the lens. After a lot of experimentation they worked out a special glass window for boilers and equipped it with special air jets to cool the air and blow the dust away. The same windows are used on steel furnaces where cameras are subjected to intense heat.

The use of hard-working TV sets in power plants quickly spread. Today TV is keeping its unblinking eye on the tops of smokestacks to check firing efficiency and air pollution. For example, four smokestacks standing above the Chicago District Electric Generating Corporation are probably the most

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Development of Electricity - -

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Close on the heels of this came the first electric light, discovered by Humphry Davy in 1802. He used 150 powerful voltaic cells and two charcoal electrodes. An electric flame of dazzling brilliance arched over from one to the other.

But this new development did not prevent further experimentation of the general properties of electricity, and soon Hans Christian Oerstad, of the University of Copenhagen, ran a current of electricity through a wire and induced a movement in a near by magnetic "compass" needle, and the fact that electric current creates magnetism became known. The electromagnet soon appeared due to the efforts of William Sturgeon, who, in 1825, wound a single layer of thick copper wire around an iron core. Joseph Henry, professor of Princeton, independently devised, in 1828, an electromagnet with several layers of wire and invented insulation of wire as a preliminary step. One of his magnets was capable of lifting two tons.

On October 17, 1831, it was Michael Faraday who pulled together the loose ends of fact by winding two hundred feet of copper wire into a hollow cylinder and attached a galvanometer to detect any current. Then he plunged a bar magnet into the hollow coil and the needle moved. Removing the bar caused the needle to move again. On the basis of this, he invented the disc dynamo—the first dynamo-electric machine ever built.

In 1831-32, Hippolyte Pixii, a Frenchman, came out with a dynamo in which a permanent magnet was rotated in front of spools of wire generating alternating current.

Tom Davenport patented a simple electrical motor in 1837. It was a wheel with two magnetic spokes and two magnets arranged outside the wheel. By reversing the current from a batterly regularly, the alternate attraction and repulsion caused rotation.

Inventors made great efforts to overcome the alternation of the current so that it would be comparable to current from a battery. The split commutator was first applied to the dynamo by an Italian, Antonio Pacinotti. The motion of his dynamo was jerky, however. Z. T. Gramme came up with a solution when he devised the ring armature in 1870 by multiplying the number of spokes or coils, thus gaining him the reputation as the father of the continous direct current dynamo. The motor came by accident, when at an industrial exhibition in Vienna in 1873, a workman carelessly connected the leads from a running generator across the binding posts of another generator, and its armatures began to revolve.

By this time Sir Charles Wheatstone, English physicist, had patented the use of electromagnets to replace permanent magnets in dynamos and electricity was ready for commercial application. The first commercial installation of an electric light was the Serrin type of arc installed in the Dungeness light-house in England in 1862. Ten years later, Von Hefner Alteneck, an engineer with Siemens in Germany, invented the "drum-wound" armature, and commercial dynamos for use in arc lighting became available in Europe.

The first practical dynamo was built in this country in 1876 by William Wallace. As a commercial value for electrical items became apparent, experiment became more widespread and America assumed a good sized share in electrical development.

In 1880, American Charles Brush made great improvements on the storage battery. Next he improved the arc-light by automatically providing a constant arc length by feeding in carbon rods. He organized the Brush Electric Company which was later merged to form General Electric. He sold many arc-light units to factories and stores in 1878.

Electric lights were first permanently installed on public streets in Public Square, Cleveland, in 1879. The lights were twelve 2000 candle power Brush arc lamps. Niagara Falls got a small preview of what the future had in store when in 1879 a small dynamo at the Falls supplied 15 arc lamps in a park at the edge of the Falls. By 1895 the Falls became known as the laboratory of American water-power.

Then came an eye-opening event which created a new impetus to the electrical field. On New Years Eve, 1879-80, Edison displayed an electric lamp and a system of lighting at Menlo Park which was far superior to the old arc lamps. Then things really began to happen. The first commercial electric generating plant in the world to be put into service in London by the English Edison Company started operating in January, 1882, slightly ahead of Edison's New York Station.

The first New York Edison power station was installed in a dilapidated building at 255-257 Pearl Street, New York City. Underground conductors were laid in 1881 and three Edison "Jumbo" dynamos were installed to serve an area of about one square mile. Factories were started for lamps, underground cables, sockets, meters, switches, etc. July 5, 1882, the first of the dynamos was operated by steam. A month of tests followed, using the bank of 1000 lamps in the station as the load. At 3:00 p.m. on September 4, 1882, the first service was supplied to 400 lamps and commercial power was a new born industry in America with Thomas Alva Edison as its king.

Edison had, by "99 percent perspiration and 1 percent inspiration" come through with the electric light and a way of making it practical. Edison was essentially a mechanic and proceeded by rule of thumb. Alternating current involved much mathematics; and Edison could not understand it, so he would have none of it.

But elsewhere A.C. was in the spotlight. Lucien Gaulard, a French inventor financed by John D. Gibbs, patented an A.C. system of distribution about 1882. They

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Development of Electricity - -

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used "Transformers" in their system and this mechanism made its first public appearance at an electrical show in the Westminster Aquarium. When he first tried to patent the "transformer," he was refused because the court ruled that, "More current can not be taken from it than is put in!"

About that time George Westinghouse of air brake fame had established himself in the field of electricity and he bought up the transformer patents and put William Stanley to work improving them. Soon Stanley was busy constructing about a dozen transformers designed to reduce a 500 volt main line to 100 volts on the secondary, and in the spring of 1886 he placed them in successful operation to light several stores. Thus Westinghouse established the first commercial alternating current plant in the world at Buffalo, New York.

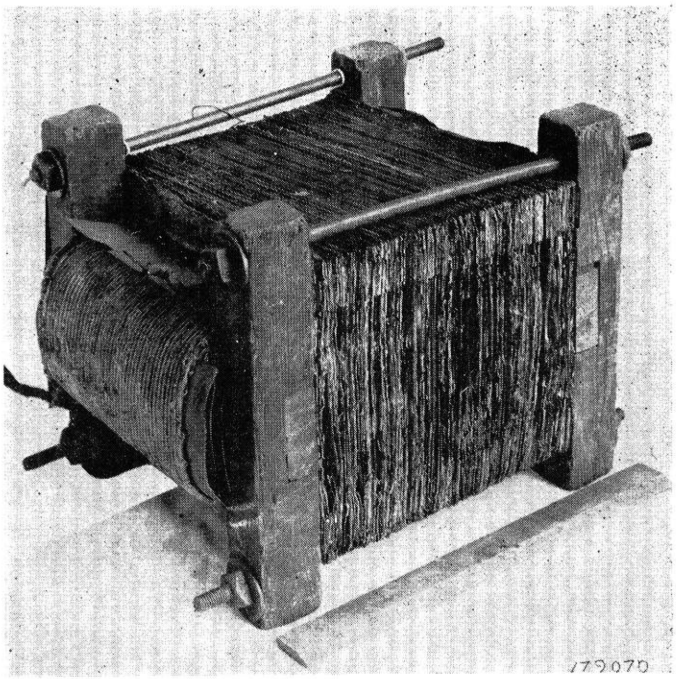
The full importance of these transformers and the idea of voltage transformation became realized May 16, 1888, when in a lecture before the American Institute of Electrical Engineers, foreign-born Nikola Tesla brought the men of electricity to their feet by describing a three phase alternating current system complete in every detail. By employing high voltages for transmission, electrical powerhouses could reach far beyond their one mile direct current range to serve customers hundreds of miles away.

Within a month George Westinghouse snapped up the discoveries and put them to work. He paid $1,000,000 plus royalties for the 40 basic patents which Tesla had obtained in November and December of the previous year.

Dr. Henry Prout summed up the activities of Westinghouse at this time as follows:

> "The alternating current transformer is the essential key to transmission of power at low cost. The polyphase motor is the essential key to the reproduction in mechanical form of power transmitted by electricity. In the hands of Westinghouse and his engineers, the crude transformer of Gaulard and Gibbs capable of supplying at low efficiency a few incandescent lamps became in a few years a transformer which could deliver thousands of horsepower at an efficiency exceeding 98 per cent, and the primitive motor brought to America by Tesla in 1888, and loaded to its practical limit when driving a ten-inch ventilating fan, became a motor capable of delivering hundreds and even thousands of horsepower."

With this, electrical power became big business and reorganization began. The Thomson-Houston Company and the Edison General Electric Sompany merged to form the present General Electric Company. Westinghouse absorbed the U. S. Electric Company and the Consolidated Electric Light Company.



Transformer with Westinghouse H plates and lathe-wound coils.

Thus sides were chosen for a bitter battle between the interests of direct current and alternating current. The ensuing battle was splashed all over the front pages of the New York papers. Whenever a workman was killed by A. C., a score was chalked up on the front pages for the D.C. system. Governor Hill of New York appointed Gerry, in 1886, to find a more humane method of execution than hanging. Gerry promptly recommended the use of A.C. electricity and Westinghouse screamed foul. Rumor has it that Edison was then paying 25 cents for each neighborhood cat brought in by thieving boys for experimental A.C. victims.

The first execution using the electric chair took place on August 7, 1890, with the execution of Kemmler. The New York **Times** related the event as, "Far Worse Than Hanging. Kemmler's death proves an awful spectacle. The electric current had to be turned on twice before the deed was fully accomplished." Now Edison yelled foul.

But Edison had not been smug about A.C., and had in his employ a genius who was better able to cope with the problems of alternating current than any other person in the world. Charles Steinmetz came into the organization with the Thomson-Houston Company and had actually been included in the contract. It was this dwarfish, crippled, four and one-half foot immigrant who presented the complete Law of Hysteresis with all its mathematical complexity to the A.I.E.E. on January 19, 1892. Soon a flood of electrical theory came from his pen in the form of the long and complex "symbolic method," which soon resolved into volumes entitled: **Steinmetz on Alternating Current.**

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Development of Electricity - -

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The path was technically cleared for the advance of alternating current, and Tesla struck the D.C. interests a heavy blow, when, in 1893 at the Chicago World's Fair, he let 1,000,000 volts of high frequency current pass through his body, lighting lamps and melting wires. It was also at this Fair that the first electrical household appliance appeared in the form of a flat-iron.

Alternating current finally surpassed D.C. when in 1893 contracts were signed calling for a Tesla polyphase system to be constructed at Niagara Falls. Power was brought from Niagara Falls into the city of Buffalo in November, 1896, and was accompanied by the firing of a cannon.

The first recorded user of hydro-electric power was Lester Pelton, who sent power from a dynamo at a water wheel at Chollar Mine, Nevada, to a stamp mill about one mile away.

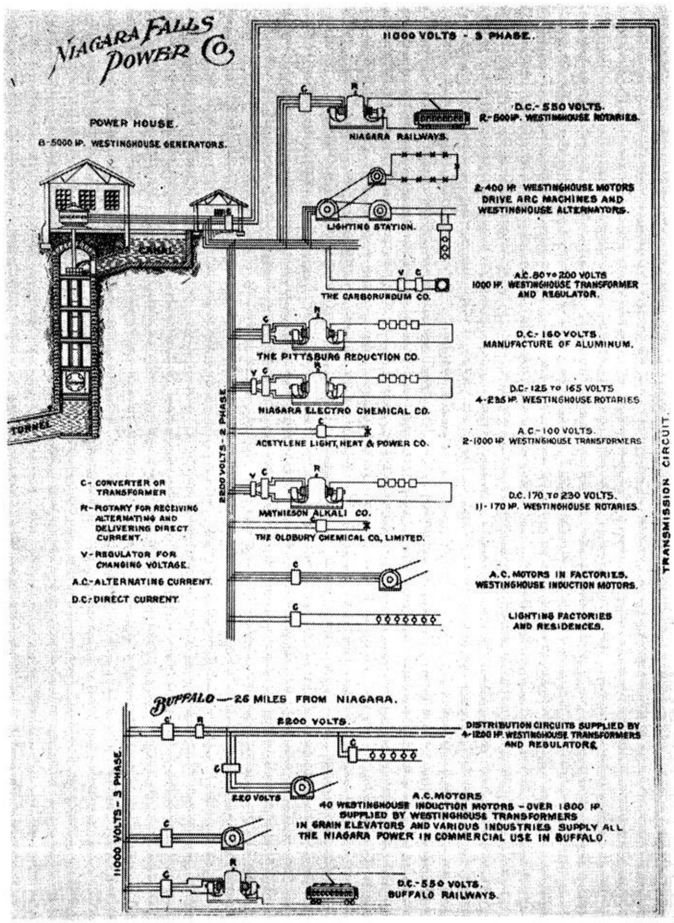
The alternating current was standardized at 60 cycles per second, although at first Westinghouse engineers had favored 133 cycles. Tesla fought bitterly for 60 cycles and quit the Westinghouse organization because of the conflict. Soon Steinmetz added mathematical derivations to the arguments in favor of 60 c.p.s. and it became standard.

The emphasis is those days was on power generation and transmission, with little emphasis on power distribution to the ultimate consumer. In ENGINES OF DEMOCRACY, Burlingame describes the situation as follows:

"The planning of transmission and distribution was complicated to say the least and it must be admitted that it was extremely haphazard in the revolutionary years. 'The engineers,' says engineer Samuels, 'were so wrapped up in generating and transmission that many of them considered distribution as too low-brow to merit their attention. Distribution was frequently left to the linesman, purchasing agent, and storekeeper, and many distribution systems grew up to give the impression of crazy quilts, without any apparent logic either in circuit sizes, voltages, or locations, and sizes of transformers'."

The impact of electrical power upon society was tremendous, and the rapid growth of the electrical power industry has not yet stopped. Burlingame says in his book, BACKGROUNDS OF POWER, in fitting tribute to this era:

"The use of electric power caused revolutionary changes in the structure of industry . . . All the genius of Edison, Steinmetz, Tesla, and hundreds of other pioneering dynamic minds was necessary to the fulfillment of the dream."



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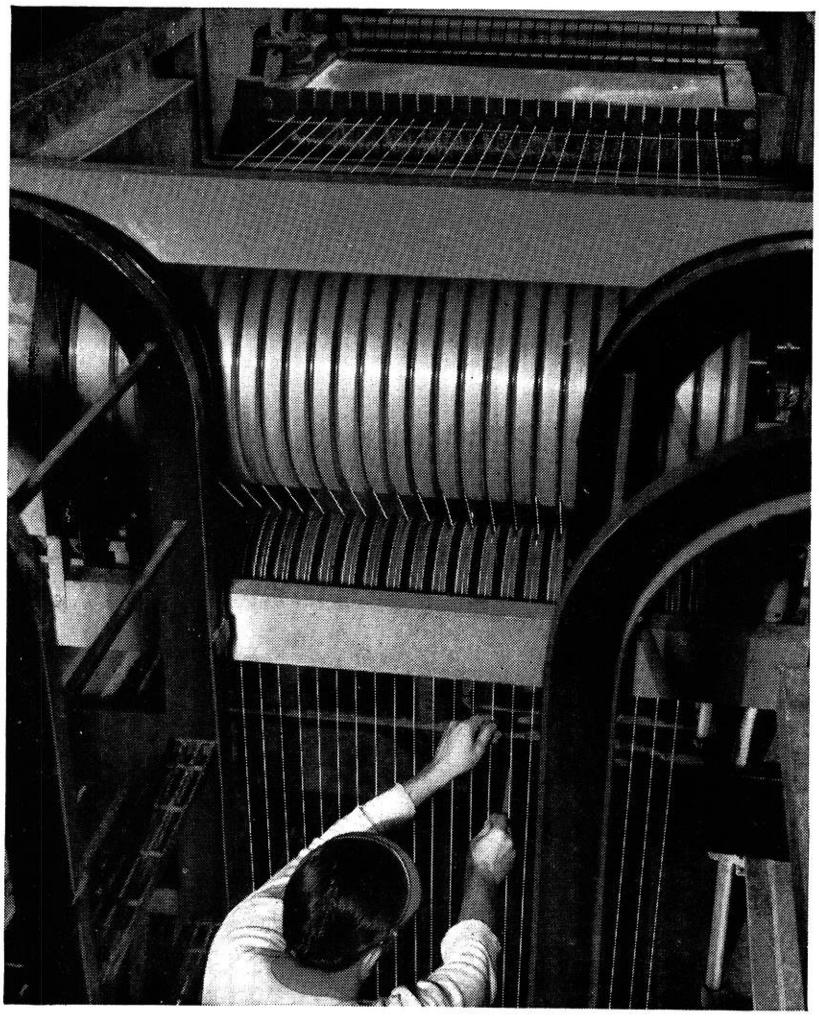
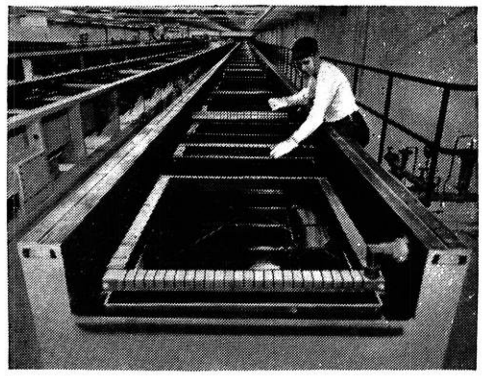
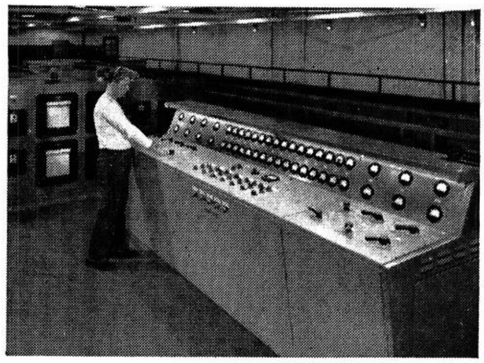


25 strands of steel wire start on their way to be electrolytically coated with copper, lead and brass.



Part of the 600 foot long electroforming machines where wires go through successive baths of plating solutions.



Console of controls for entire process is readily operated when necessary, even though seldom used in the almost fully automatic operation.

ENGINEERING . . . with a pioneering twist

There's a real incentive in working out ways to do things that have never been done before. And problems in pioneering are constantly cropping up at Western Electric—manufacturing unit of the Bell Telephone System.

For example: the revolutionary electroforming process dreamed up and made a reality by Western Electric engineers for making copper coated steel wire.

The big idea was this: Could a process be developed in which successive coats of copper, lead and brass would be deposited on steel wire electrolytically in one continuous operation?

Engineers of varied skills—electrical, mechanical, chemical, metallurgical, civil—went to work as a team. After solving many problems, they came up with a process that makes better, stronger wire at lower cost—does it at the rate of 1¾ billion feet per year.

Recent developments such as microwave radio relay networks for telephone calls and television programs—operator and customer dialing of long distance calls—secret electronic equipment for the Armed Forces—promise an ever-widening field for young engineers of varied training at Western Electric.

Western Electric

BELL SYSTEM

A UNIT OF THE BELL SYSTEM SINCE 1882

AWARDS for WRITERS

First and Second Prizes for Good Articles

- - - THE WISCONSIN ENGINEER - - -

Your publication—*The Wisconsin Engineer* solicits written articles by students in the College of Engineering.

The best and most appropriate articles on hand at press time each month will be published.

To facilitate editing and setting articles in type by the printer, he following form for material submitted is suggested:

1. Typewritten—57 stroke line.
2. Double space.
3. Carefully proof read—by author.

Articles submitted in above form will receive favorable consideration by the magazine staff for the Edward M. Kurtz Award of 35 dollars, and Jesse B. Kommers Award of 20 dollars, as a first and second prize for the two best papers worthy of publication in

- - - THE WISCONSIN ENGINEER - - -

Science H.L. - -

(continued from page 21)

All in all, it appears that use of fly-ash in a portland-cement concrete mix is good, provided it produces the desirable result for the particular project. Also, because of the price differential between a bag of portland cement and a bag of fly-ash, a considerable saving can be realized on a large project.

Applying fly-ash concrete.

NEW LAMINATE

In request by the U. S. Navy's Bureau of Ships, a new lower-cost glass mat melamine laminate is now being produced by Synthane Corporation, Oaks, Penna.

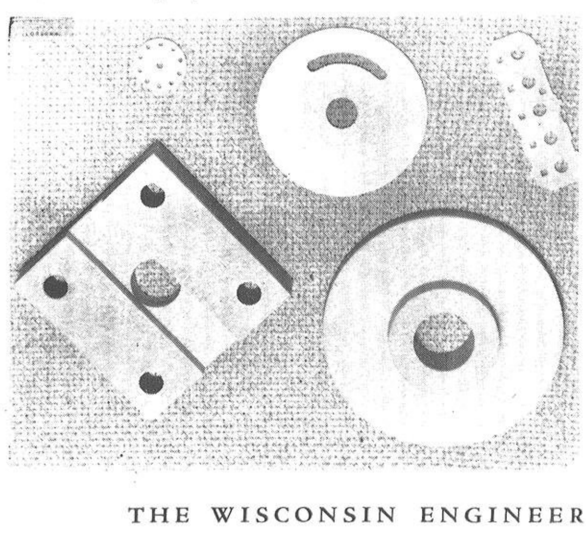
The new grade, which combines high fire and arc resistance with good mechanical and chemical properties, will soon become standard for all Navy electrical power and lighting applications. Designated by Synthane, the new laminate is available to suppliers of electrical and power equipment at a considerable saving under the cost of the continuous filament glass-base material whose electrical properties it matches.

The new material, laminated in thicknesses from 1/16" upward, uses a glass fibre mat impregnated with melamine resins. Thus its mechanical properties are less directional than those of a woven base laminate.

Lower production costs of the new laminate is due to the elimination of weaving operations. Also, no lubricant need be applied and removed later as in the case of woven fibers.

In addition to electrical applications, the new laminate is expected to be particularly useful where chemical resistance is required, such as in the plating and photographic industries.

Below: Soon to become standard for all U. S. Navy power and lighting applications, a new gloss-mat melamine laminate is being produced by Synthane Corporation. Designated as Grade G-8, the new material combines high fire and arc resistance with good mechanical and electrical properties.



to the

ELECTRICAL ENGINEER

or

PHYSICIST

with an interest in

RADAR

or

ELECTRONICS

Hughes Research and Development Laboratories, one of the nation's leading electronics organizations, are now creating a number of new openings in an important phase of their operation.

Here is what one of these positions offers you:

THE COMPANY

Hughes Research and Development Laboratories, located in Southern California, are presently engaged in the development and production of advanced radar systems, electronic computers and guided missiles.

THE NEW OPENINGS

The positions are for men who will serve as technical advisors to government agencies and companies purchasing Hughes equipment—also as technical consultants with engineers of other companies working on associated equipment. Your specific job would be essentially to help insure successful operation of Hughes equipment in the field.

THE TRAINING

On joining our organization, you will work in the Laboratories for several months to become thoroughly familiar with the equipment which you will later help users to understand and properly employ. If you have already had radar or electronics experience, you will find this knowledge helpful in your new work with us.

WHERE YOU WORK

After your period of training—at full pay—you may (1) remain with the Laboratories in Southern California in an instructive or administrative capacity, (2) become the Hughes representative at a company where our equipment is being installed, or (3) be the Hughes representative at a military base in this country—or overseas (single men only). Compensation is made for traveling and moving household effects, and married men keep their families with them at all times.

YOUR FUTURE

In one of these positions you will gain all-around experience that will increase your value to our organization as it further expands in the field of electronics. The next few years are certain to see large-scale commercial employment of electronic systems. Your training in and familiarity with the most advanced electronic techniques now will qualify you for even more important future positions.

How to apply:

HUGHES

RESEARCH AND DEVELOPMENT LABORATORIES

Engineering Personnel Department
Culver City, Los Angeles County, California

See your Placement Office for appointment with members of our Engineering Staff who will visit your campus. Or address your resumé to the Laboratories.

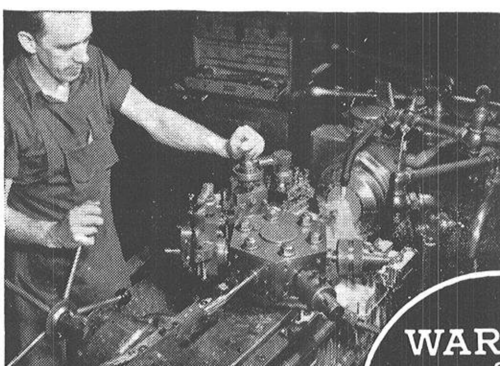
Somebody ought to speak sharply to Nature

THERE'S a lot of loose talk these days about profits, attacking them as though they were evil.

The very existence of the world depends on profits; the *improvement* of the world depends on *big* profits. A farmer plants one potato and usually gets back 15. Even allowing for all his costs, that's more than 1000% profit! He plants one pound of corn and gets back 336 pounds—that's 33,600% profit. These are big profits. Is that bad?

Should the farmer be scorned as anti-social? Should his "excess" profit (whatever that is) be taken away from him? Should he be told that from now on he must limit his "profit" to, say, 6%?

To legislate against profits is as silly as to legislate against things growing.



Warner & Swasey is always interested in talking future opportunities to young men of ability and character. Write Charles Ufford.

WARNER & SWASEY
Cleveland
Machine Tools
Textile Machinery

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY TURRET LATHES, AUTOMATICS AND TAPPING MACHINES

A Foreign Student - -

(continued from page 14)

the passengers had an excellent opportunity to clean out their stomachs and look at the nicely served food in the dining room. After eight days we caught sight of the light beams from the light house on Bell Isle at the entrance of the St. Laurence River. That was my first glimpse of this continent.

Quebec is an interesting city, and I spent a day or so looking around. From there on I travelled by bus and was satisfied when I reached Chicago, and was able to dismount from that shaking buggy. I stayed for some days in Chicago visiting some relatives in Evanston. My relatives did not understand Norwegian too well, so I got to use the little English I knew. The same thing surprised me here as during the voyage, that people understood very well what I said, and I understood them. I thought that I would have little language trouble, but later on, I found that English was not so easy.

It was in the beginning of October and being still warm, it was pleasant to roam around in Chicago and Evanston. It was especially interesting to watch the heavy traffic during the rush hours, and the handling of the traffic on Michigan Avenue.

I intended to start at the University in February, and in the meantime I decided to visit some close relatives in Saskatchewan, Canada, and in Seattle, Washington. Although the most part of the harvest was done, I got a pretty good impression of farming during my stay in Canada. The prairie impressed me tremendously, but I did not like the dust storms too well.

On my may to Seattle, I passed through Montana, and it was interesting to watch the small oil wells scattered over the country side.

Washington State greeted me with mountains, valleys, fjords, and fishing vessels, and it seemed that I had dropped back to west coast of Norway where I came from. Right away I felt at home. During my visit in Seattle, I lived with American families and found them very pleasant.

The time passed quickly, and before I really knew it, Christmas was here, but my impression of Christmas in America, was that it was only business all the way through. On New Year's Eve I got a big surprise in seeing poeple hugging and kissing like mad when the clock struck twelve. Well I guess that some did not watch the clock too well either.

The food here is different from that at home, but I soon got accustomed to most of it. One thing was the beans; I always felt ready to burst after eating them. Another thing was the turkey; I had a hard time to find it delicious, but it seems to me that if you are sticking around it for a while, you get used to that too.

My visiting time being over, I got on the train and arrived in Madison on the Milwaukee Road at the West Washington Avenue Station. It was awfully cold, and still worse, I could not catch sight of the town. I went to the clerk in the station and asked him for the first train to Madison. He looked at me with an extremely queer expression on his face, but when he said you are in Madison, Sir, I asked him in what direction I could find the town. He got me a cab, and I bet he was quite sure that I was dead drunk. The cab took me to a hotel, and it being late, I went to bed.

The next day I was roaming around to get a room, and was lucky to meet a Norwegian who had a room to offer me. I have lived with him ever since.

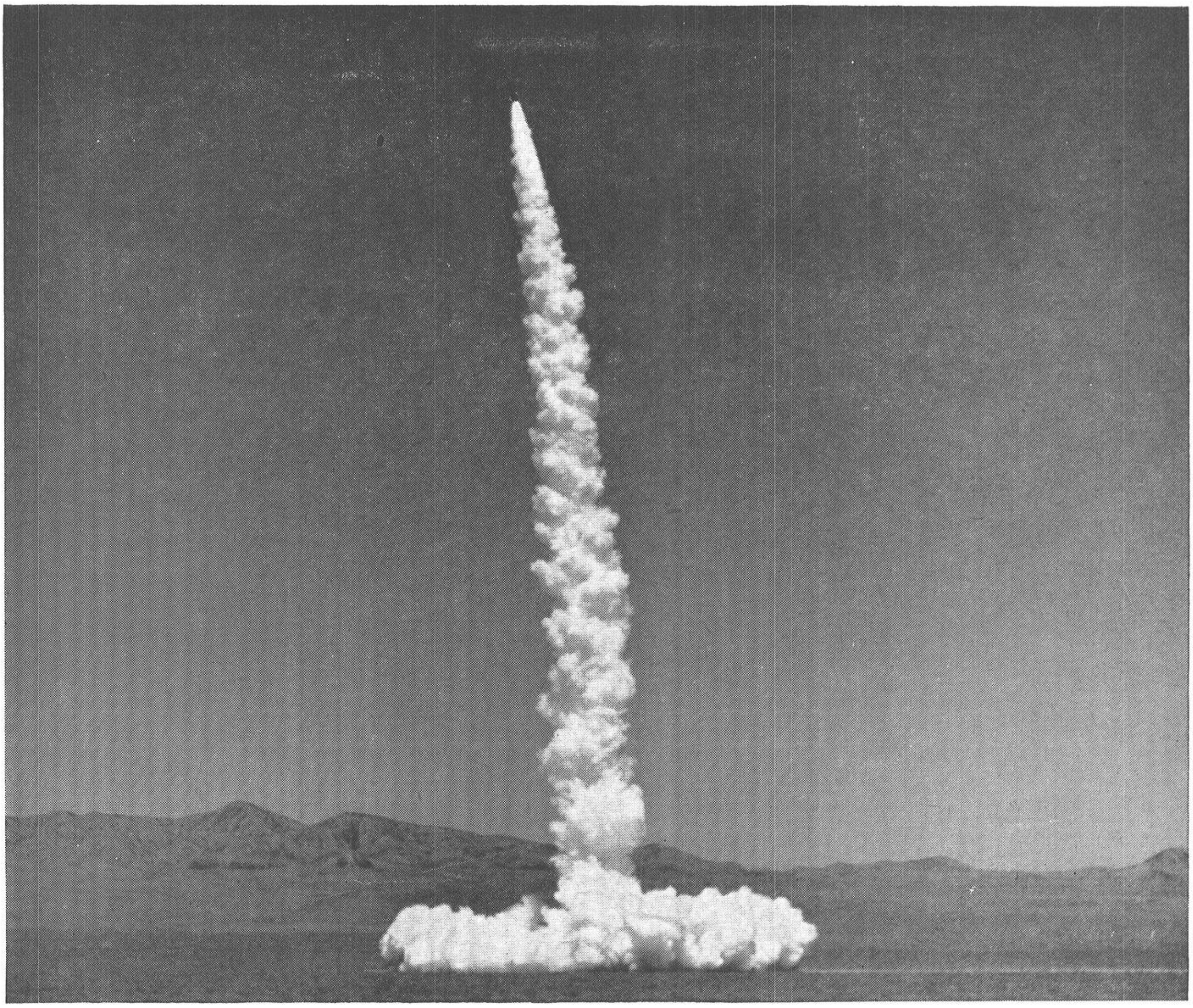
Because the school system here and in the Scandinavian countries is so completely different, I had to go to the various professors to get credit for the different courses I already had taken at home and in Sweden. The professors were very kindly, and it was a pleasure to talk to them. When I got lined up, I got an advisor. I never knew that advisors existed in schools before, but he helped me and told me what courses to take, and was great help to me.

The registration was another thing that was new to me, and I found that the student did not follow a four year strict course outline, but was able to choose the subjects for each semester. I got through all right, but the night before my first day of school I did not sleep too well. I was too anxious to see how I would understand the lectures and the way of teaching.

What surprised me was that the professors appeared to be so friendly. You could go and ask them for help when you got stuck. That we had to turn in homework was also new to me. I was used to having professors who were men between 50 and 60 years of age, who hardly cared if there was a student in class or not. Everything was left up to the student, and to ask question of the professors took such a brave man, that no one dared to do it. We went one year at a time, and only the six hours finals in each subject counted. If you failed in one subject, you had to take the whole year's work over again.

The first semester here I had a subject that required written reports. I remember the first report that took me more than two days to finish, and I was still afraid that the professor would not understand what I had written. The big surprise was, however, when I got it back with a grade of B. I still think that this is the biggest surprise of my life. The professor corrected the misspelled words, and in this way I was able to learn spelling at the same time.

Now at the end of my last semester, when I look back at my work in the College of Mechanical Engineering, I am very thankful to this country and the University for having given me the opportunity of studying here. The time at the school has been interesting and informative. Besides this I have had the opportunity to visit with American families and to take trips to various factories arranged by the University. For a foreign student this is just as important as the study at school. Besides this there are students here from almost every country in the world, and we learn to know that each of us is just as good as the other. One's nationality does not make any difference, and if anyone will be able to build the world peace, it will only be done when we all realize that one nation is just as good as the other.



On the Campus - -

(continued from page 35)

current was so swift and solid rock cliffs followed the river on both sides, it was found impossible to divert the stream while construction was under way. Also, since the stream was so rapid, it was not feasible to build the dam with water still in the stream. The problem was solved by building the 22 million pound dam out the water—up on end. It was made of reinforced concrete with the bottom contoured to the river bed. When finished, the supports were blasted away and the obelisk fell softly into place, for the water absorbed 90% of the shock.

AIEE and IRE

The December meeting of the combined groups was highlighted by a talk on microwave relays and their use in long-range television transmission given by Mr. Zwarra, a representative of the Wisconsin Bell Telephone Company. The AIEE-IRE committee for the Wisconsin Engineering Exposition got its start at the meeting when Rudy Santo was put in charge of the group. He will direct the group's designing of their exhibit.

Other notes . . . Election of officers for the second semester was held during the opening week of the term. The annual AIEE paper contest will be held during March, with the winners to be announced at that meeting. The local winner will be awarded with an expense-free trip to the body's district convention. AIEE and IRE wish to point out the following reasons for joining the group: 1) seniors will save $10 on their AIEE fees if they belong to the student branch, 2) informative and valuable activities are put on each semester, 3) members will receive the society magazine.

SAM

The members of the Society for the Advancement of Management took a field trip to Milwaukee on Friday, January 9 for the purpose of visiting several large industrial firms there. During the morning the group visited the Nash body plant and next had lunch at the Allen Bradley Company. After the meal the members were conducted on a tour of that plant. The day was ended with a rewarding visit to the Pabst brewery.

At a previous meeting SAM elected the following officers for the second term: Rudy Sirnz, president; Ron Schuchardt, vice-president; Dick Muller, treasurer; and Art Arntsen, secretary. The organization's membership is open to students in any field, but the programs and policies of the group are of greatest interest to those in the engineering field.

POLYGON BOARD

New officers of the board: president, Allen T. Schmidley; secretary, David S. Hanke; and treasurer, John P. Frenck. At present the projects of the board are the St. Pat's dance on March 14 and the Engineering Exposition in April. The dance is to take place in Great Hall in the Memorial Union from 9:30 till 12:00 P. M. Richard Kent's orchestra will be on hand to provide music. The committee for the dance is: general chairmen, David Vinton and David Hanke; program, Bill E. Boyes; publicity, Al E. Rabe; finance, John P. Frenck; and decorations, Don L. Dietrmeyer.

Arrangements for the exposition are progressing. It is expected that about 40 industrial firms will have displays and that about 100 student exhibits will be prepared. Trophies and cash prizes will be awarded for the best student displays. The engineering groups readying exhibits for the exposition include the societies on campus and the several departments of the school.

ASAE

A regular meeting of the Wisconsin student branch of the ASAE (American Society of Agricultural Engineers) was held on January 13 in the Ag. Engineering building. Highlights of the business meeting was the making of plans for a field trip to the Dubuque plant of the John Deere Company. About thirty members plan to make the trip.

The speaker for the evening was Frank S. Moulton, an AgE faculty member and one of the popular instructors with his students. He was architect of both the Wisconsin Memorial Union and the main portion of Wisconsin General Hospital. Mr. Maulton gave a talk called "Hobbies" which he clearly illustrated with many of his ink drawings depicting in detail scenic and historical spots throughout the state.

TV in Industry - -

(continued from page 38)

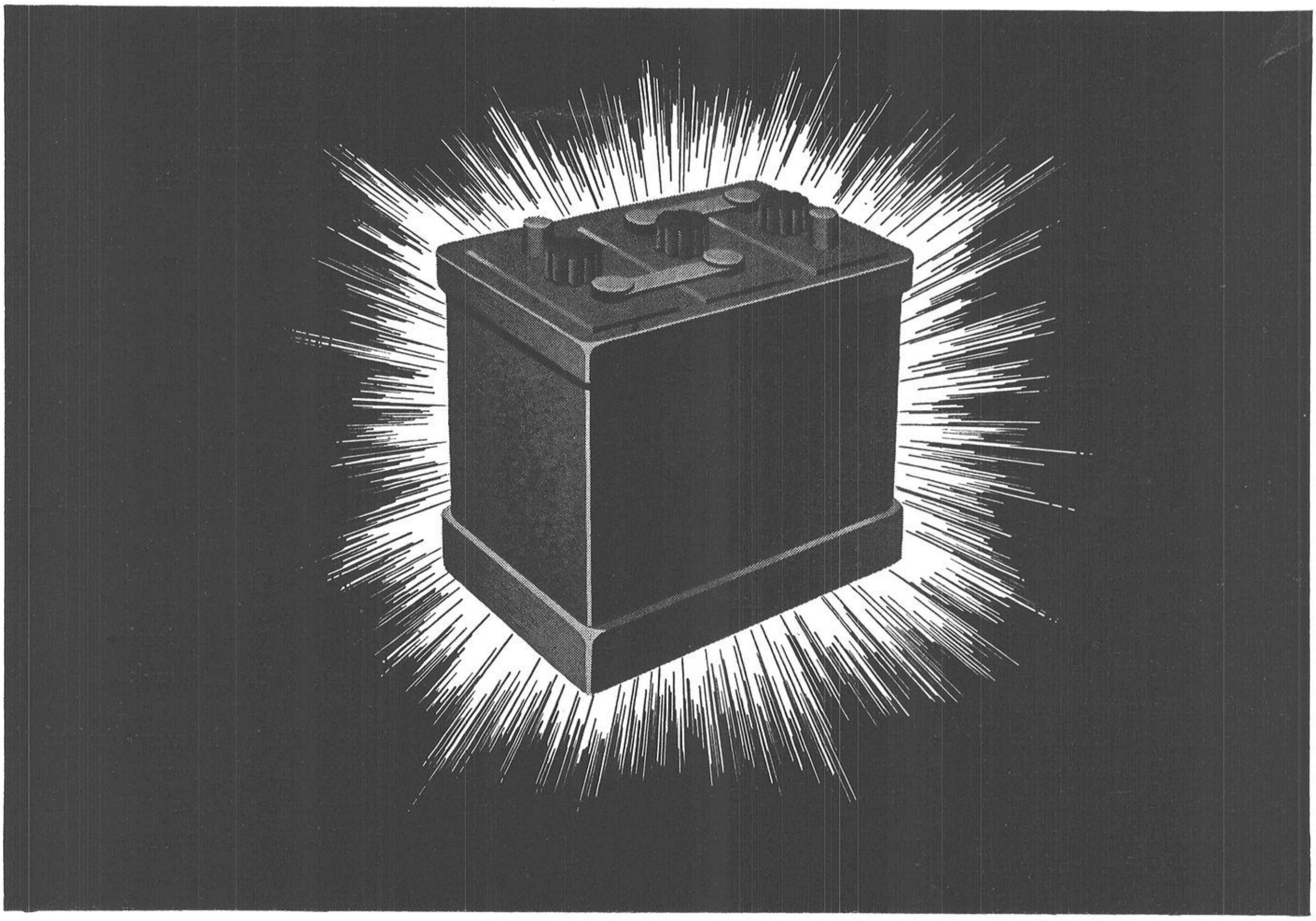
photographed stacks in the world. From the yard a TV camera sends its smoke pictures to the firing crews inside, who can tell with a glance how well they're doing their job.

When Diamond Power engineers installed this outdoor camera they knew that rain hitting the glassed front of the camera housing would mask out the picture. The firing crew now switches on a remote control windshield wiper when it rains.

Another use of TV may come in the oil industry. Diamond Power engineers think it is only a matter of time until TV will be used for locating broken oil well bits and examining well casings.

Furthermore, industrial TV has many possibilities for non-industrial applications. Medical schools are used closed circuit color television equipment, manufactured primarily by RCA and Remington Rand, to pipe close-up pictures of surgical operations to large groups of students. Aerojet Engineering has a TV camera in a rocket firing pit. Du Mont, active in both color and black-and-white industrial TV, has developed, among other things, three-dimensional TV with Argonne National Laboratory to enable scientists to work with radio-active materials at a safe distance.

At least one department store uses closed circuit TV to pipe its style shows about the building. There is already talk of replacing submarine periscopes with tiny, sensitive TV cameras that will let several crew members scan the waves at once. At the present time perhaps the biggest closed circuit industrial installation in the country is in the steel industry. A battery of four cameras and receivers in a steel mill in Geneva, Utah, helps feed four-ton steel slabs into three reheating furnaces, where they are heated to 2300 degrees for rolling into plate and hot rolled strip.



Summer Training - -

(continued from page 25)

into sections of three men each, making a layout of a production line to produce a given quantity of certain parts. The various layouts were then analyzed and criticized by whole group.

The hydraulics class consisted of a series of lectures and laboratory periods. The subject matter was restricted to a study of the various types of valves and pumps used in machine tools, their functioning, and the use of hydraulic circuits to control machining operations. Lectures were supplemented by the use of cut-open models of the actual valves and pumps being discussed. Also, the study of hydraulic circuits was aided by an elaborate laboratory arrangement which made it possible to quicly and easily assemble various types of pumps and valves into many different circuits for analysis and observation. Trainees were also asked to design circuits which would result in certain sequences of movements typical in automatic machining operations.

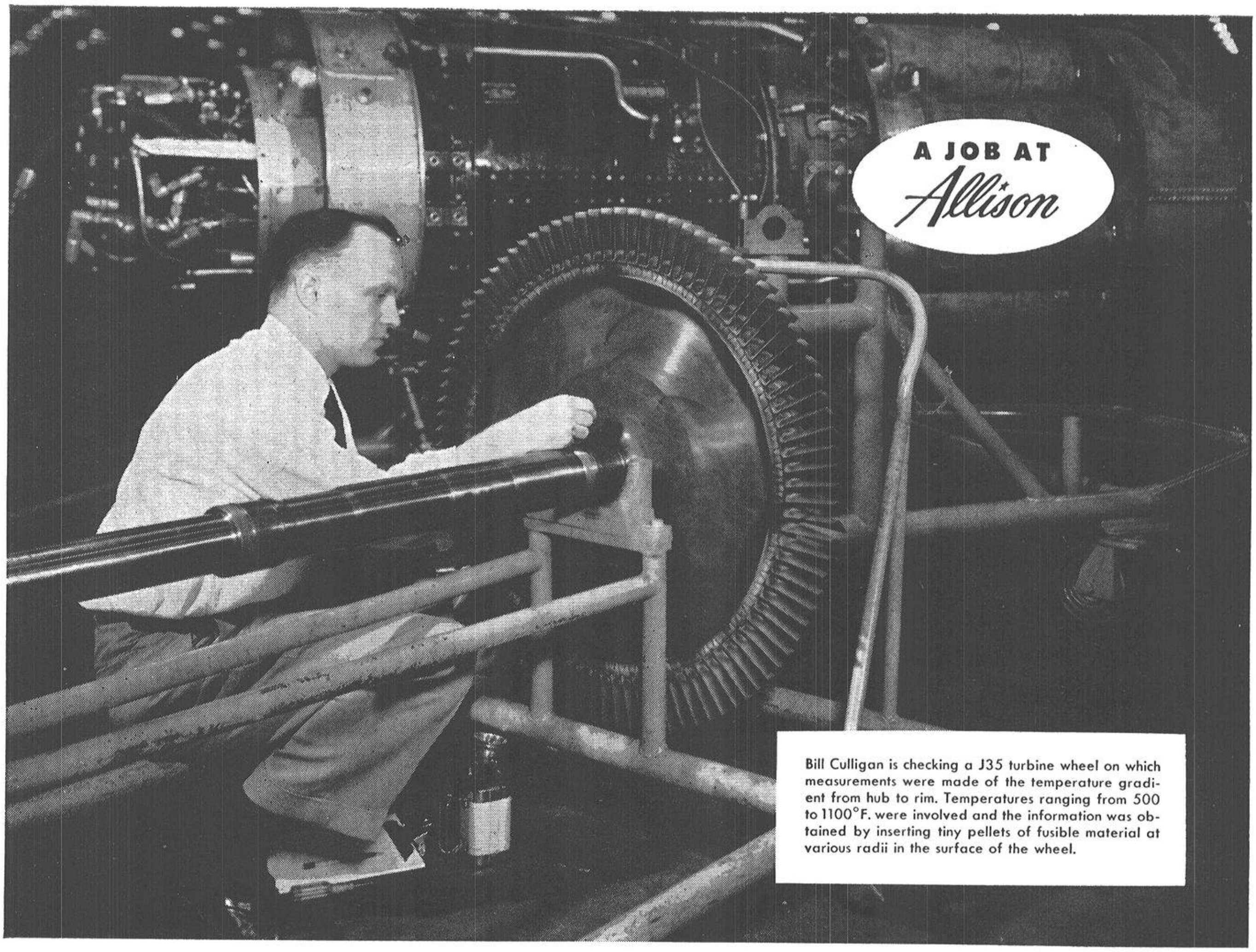
The foundry course, one week in length, was conducted with the staff and facilities of the foundrymen's and patternmakers' apprentice training programs. Half of the time was devoted to lectures and discussions of casting and patternmaking in relation to the company's 500 ton-per-day gray iron foundry. The other portion of the time was spent in tours of the various departments of the foundry and pattern shop. The tours were made in small groups guided by foundry and patternmaking apprentices who tried to correlate the tours with the lecture material. No actual production work was done in the foundry by the trainees since graduate engineers usually spend several weeks working in the foundry during their training.

About a week was spent by some of the trainees in machine shop training other than actual production work. This period consisted of a series of lectures and discussions of shop techniques, tours of the production facilities, and practice sessions in making set-ups on mills and drills. The practice set-ups were made in the training shop with the trainees making a set-up until the machine was producing parts that were within the specified tolerances as indicated on the blueprint.

During the summer, the group also was given a series of lectures on industrial economics during which free discussion of the subject was encouraged. Various officials of the company visited the group and gave talks on subjects related to their position in the organization.

The program was not an attempt to make machinists, welders, or time study men of the group. This would have been obviously impossible in the very limited time devoted to any one subject. An effort was made however to have the trainees gain in one summer as much knowledge as possible of practical production procedures and problems.

(please turn to page 60)



Bill Culligan is checking a J35 turbine wheel on which measurements were made of the temperature gradient from hub to rim. Temperatures ranging from 500 to 1100°F. were involved and the information was obtained by inserting tiny pellets of fusible material at various radii in the surface of the wheel.

● William L. Culligan, Jr. received his B.S. and M.S. degrees in Aeronautical Engineering from the University of Michigan in 1945 and 1947. His first two years with Allison as a junior engineer were devoted to gaining direct experience in the operation of jet engines in the Experimental Test Department. In December, 1949, Bill was promoted to Experimental Engineer and has been specializing in applying improved instrumentation to jet engines as a means of obtaining better data for analyzing and predicting their performance. This has included some special "jet rakes" to obtain pressure and temperature data in the hot jet exhaust of engines on the test stand and in flight. There also were such things as quartz windows and periscopes to permit viewing the combustion inside the engine.

On one occasion he spent six weeks assisting in Air Force tests of an Allison engine at Eglin Field, Florida, where the inlet air temperature to the engine was varied from minus 65°F up to a "hot day" temperature of 110°F.

Today Bill is considered one of our experts on analyzing engine performance. He is only one of several hundred engineers who have interesting and important jobs in Allison's growing program of development and improvement for turbo-jet and turbo-prop aircraft engines. We think you, too, would like to work for the only manufacturer whose jet engines have accumulated more than 2,000,000 hours in the air.

Allison is looking for young men with degrees in

MECHANICAL ENGINEERING ELECTRICAL ENGINEERING AERONAUTICAL ENGINEERING

A lesser number of openings exist for majors in Metallurgy, Electronics, Mathematics and Physics

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

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Recording and Reproduction - -

(continued from page 31)

Three separate microphones, three individual amplifiers, and a three channel tape recorder will be used to demonstrate this system. The three microphones, placed at particularly good pickup positions in front of the orchestra on the stage, will send three separate lines of information from their electrical ears to their respective amplifiers. The amplifiers, in turn, are connected to their own individual recording heads, spaced equally on the three channel tape recorder. Such recorders as made by The Ampex Electric Corporation may be used; shown here is one of their special purpose tape recorders.

The tape now has three sources of information upon it, each representing what one "electrical ear" heard in its position before this orchestra.

When played back, this recorded event is fed from the three separate recording heads (now pickup heads), through their amplifiers and to the three individual speakers of these emplifiers. Thus the sound or audio eminates from three sound sources, as shown in the diagram.

Many types of speakers exist for various purposes. Our choice of speaker for the stereophonic sound system would depend upon such factors as the size of the room, its acoustical qualities, and the quality desired. Equal quality consideration should be given to all components of the system, especially the termination loudspeakers.

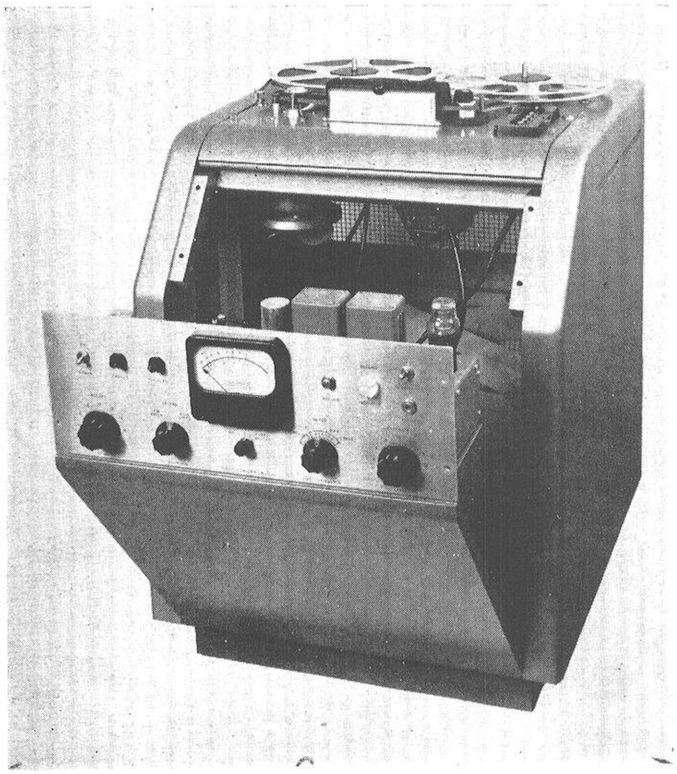
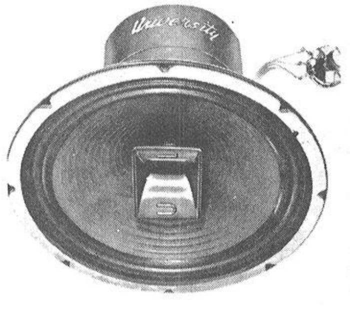
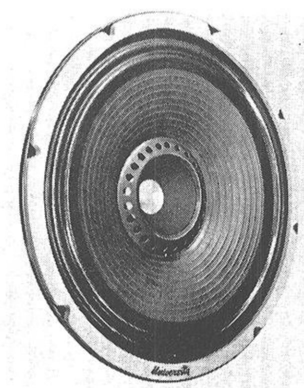


Illustration 4.—Special purpose tape recorder.

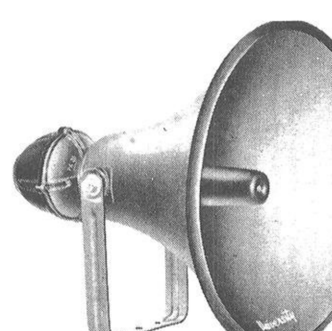


Dual range coaxial speaker.

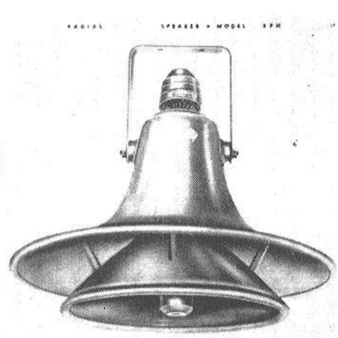


Diffusicone high fidelity.

Illustration 3.



Model PH reflex trumpet.



Radial reflex speaker.

If, in our system of stereophonic sound, at any place along the line the separate information channels had been mixed, the entire process would have become utterly defeated. The basis of stereophonic sound is found in the fact that hearing, as well as seeing, is done through two body organs: ears or eyes. The use of two "inputs" for each of these senses gives us the perception of depth. True, we listen to a radio using our two ears, but still we feel no depth or realism because the sound eminates from only one source. Even if we had used two radios, tuned to the same station frequency, thereby using two speakers, the stereophonic effect would still not be present. Why? The several inputs at the radio station have been mixed, and this has been transmitted as one signal over the airways.

Any number of channels upto the limit of the tape recorder can be used for the stereophonic sound effect. Three channels serve to illustrate the dependency of the final result upon each individual component. True reproduction of sound is determined by the elements of the entire amplification system. Stereophonic sound attempts to provide such a system along with the creation of "presence" and high fidelity with depth, solidity, and full realism . . . . . the goal of the recording and reproduction of sound.

"Allis-Chalmers Graduate Training Course Helped me Continue my Studies,"

says ROBERT D. BAIRD, Ph. D.

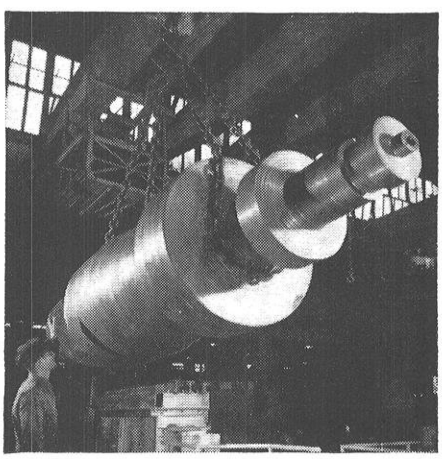
University of Illinois, B. S.—1942 • University of Wisconsin, M. S.—1949
University of Wisconsin, Ph. D.—1951
and now a member of Engineering Calculations Group

"I'VE ALWAYS been interested in the *basic* problems of engineering. But when I got out of school, I needed additional courses to do the things that interested me. More mathematics—more mechanics were required. Since joining Allis-Chalmers, these gaps have been filled."

Variety of Experience

"I became interested in the Allis-Chalmers Graduate Training Course during a plant tour in my Senior year. As I watched men building steam turbines, electric motors, transformers, pumps, rotary kilns, crushers, and many other products, I was impressed by the variety of experiences to be obtained at A-C. It looked to me like a cross-section of heavy industry. When I found that GTC students choose the departments they work in, as well as the type of work, I decided to join Allis-Chalmers.

"As a GTC student, I was given every opportunity to work in many departments. However, the basic problems involving aerodynamics, mechanics and elasticity appealed to me and I chose to work primarily on blowers and steam turbines."



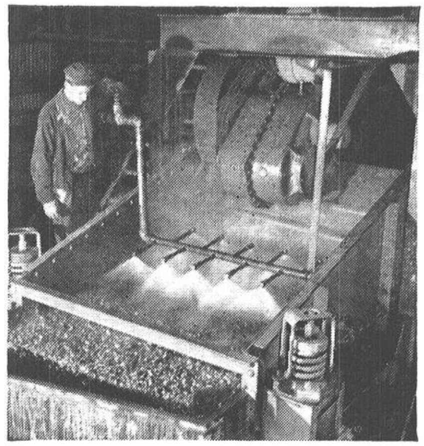
Rough-machined turbine spindle for 120,000-kw steam turbine. Calculating torsional stress and critical speed on shafts like these is part of Baird's job.

Aided by Experts

"Since joining A-C, I have had the opportunity to work with the company's leading consultants, and was encouraged to attend evening courses at the University of Wisconsin, in Milwaukee, which led to a Master's degree.

"In 1949 the company awarded me a graduate fellowship for 12 months' residence study at the University of Wisconsin and I got my Doctor's degree in Mechanics.

"So you see, whether you want to do basic engineering or be a sales engineer, designer, production or research engineer, Allis-Chalmers Graduate Training Course offers a wonderful opportunity."



Vibrating screens by Allis-Chalmers are found throughout the world, wherever coal and ore are mined and rock is quarried.

Facts Graduates Should Know About Allis-Chalmers Graduate Training Course

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

2. The course offers a maximum of 24 months' training.

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

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

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

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

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

ALLIS-CHALMERS

Summer Training - -

(continued from page 56)

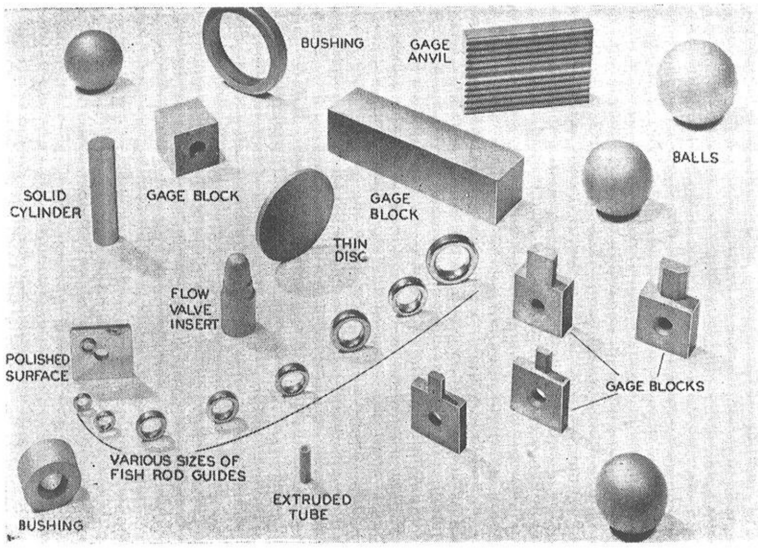
III. SUMMER TRAINING IN GENERAL

It is best for students to decide during the winter months whether they are interested in one of these summer training programs since company representatives often interview prospective trainees early in the spring. Waiting until a few weeks before summer vacation means that the interested student will have less chance of finding what he wants and less chance of being accepted since most companies limit the number of trainees. Information about when company representatives will visit the campus may be obtained by watching the white cards on the placement bulletin boards located in the Mechanical Engineering Building and the new Engineering Building; or by inquiring at the Engineering Placement Office, Room 261, Mechanical Engineering Building. The placement office sometimes receives information concerning summer training for undergraduates from companies which do not send representatives to the campus. This information is posted on blue cards. Written inquiries and applications must be made in these cases.

In considering whether to take part in one of these programs, the student might consider the advantages of participation. These programs present an opportunity to gain much in the way of technical knowledge that may be of value in understanding university subjects and in future employment. They allow the student to establish some contact with industry and a prospective employer. They are an aid in helping the student decide before graduation in what type of work and industry he would like to find permanent employment. They give participants a good knowledge of the company, its policies, and the area in which the company is located which might aid in decisions at graduation time. Participation is an indication to future prospective employers of a real interest in engineering.

At the same time, it is good to consider those factors which might influence a decision not to participate. The pay in some of the training programs is not as high as some students can obtain in other work. This varies with training programs and individual students so that no general conclusion can be drawn. In those cases where the pay is lower, the gain from participation must be weighed against immediate financial needs. In most cases, the student will have to spend the summer away from home and friends. Costs of room and board are likely to be greater.

Summer training programs do not present opportunities enough for all students to participate. Those who wish to take part must find out what is available, must take interviews and write letters, and must sell themselves to the company. A sincere interest in the type of work offered in the program and likelihood of permanent employment with the company are two factors given much weight by the company. Those who do find it possible and advantageous to participate are likely to be well repaid in the knowledge gained and associations formed.



Cut courtesy Carboloy

A variety of parts made of carboloy Grade 608 Chrome Carbide.

The unusual combination of properties exhibited by Grade 608 Chrome Carbide, first of the new Series 600 Cemented Chrome Carbides to be made available by Carboloy Department of General Electric Company, is expected to lead to wide application of the new man-created metal. Many preliminary successful applications, Fig. 1, have already been made. These broad applications demonstrate the extent to which chrome carbides can be used by industry.

Grade 608 Chrome Carbide has extremely high resistance to both corrosion and erosion, and has good abrasion resistance too. Made by the powder metallurgy process, this metal is lightweight, has a coefficient of thermal expansion approximately the same as steel, is completely nonmagnetic and has extreme resistance to high temperature oxidation.

General Physical Properties

The new metal is composed of 83% chrome carbide, 2% tungsten carbide and 15% nickel. Among its outstanding physical properties are its density, which is about half that of tungsten carbide, and its coefficient of thermal expansion, which approximates that of steel. Actually tungsten carbide has a thermal expansion coefficient about half that of steel.

Grade 608 Chrome Carbide is a hard, strong metal and resists abrasion much better than hardened steel.

High Resistance to Corrosion

Salt spray tests conducted at Battelle Memorial Institute reveal that Series 600 Chrome Carbides retain their metallic lustre after being subjected to a 30% salt spray for 750 hours.

When subjected to sulphuric acid corrosion tests, Series 600 Chrome Carbides show 30 times the resistance of 18-8 stainless steels and 3 times the resistance of conventional carbides. Resistance of chrome carbides to nitric acid is 8 times that of other carbides and twice that of 18-8 stainless steel. Chrome carbides are inert when exposed to citric and lactic acids.

Resists Oxidation and Erosion

The Series 600 Chrome Carbides resists oxidation at all temperatures up to 1832F. When subjected to a temperature of 1850 F for 24 hr. samples of chrome carbide are

PROPERTIES, FABRICATION METHODS, and APPLICATIONS for GRADE 608 CHROME CARBIDE

by J. D. Kennedy

Wear Part Sales

Carboloy Department, General Electric Company

only slightly discolored, while simultaneously exposed samples of stainless steel and tungsten carbide have completely disintegrated.

Steam erosion tests show a resistance from chrome carbides about 50 times that of conventional carbides. Samples 1½ inches in dia. and 0.250 in thick were placed ½ in. in front of a 350 psi jet of saturated steam passing through a 1/16 in. dia. nozzle for 25 hr. periods.

Four tests of 25 hr. each made with different but identical nozzle assemblies show no measurable erosion penetration on the chrome carbide samples after the first three tests. Maximum average penetration after the first 100 hours is 0.0004 in. These tests show that Series 600 Chrome Carbides are equivalent to other metals with maximum resistance to steam erosion.

Available Sizes and Shapes

Grade 608 Chrome Carbide is already available in limited quantities in a variety of shapes for engineering and metallurgical test applications. Production facilities are being expanded to permit delivery of production lots soon.

When production facilities are completed, the new carbide will be available in approximately the same size and shape range in which tungsten carbide is now being offered.

Because costly and critical tungsten and cobalt are not constituents of Grade 608 Chrome carbide, it is expected that complete parts can be economically made of solid chrome carbide in contrast to attaching individual pieces as has been done with tungsten carbide in the past. The light weight of chrome carbide is another factor in favor of this design concept.

Methods of Fabricating, Finishing, and Attaching

Generally the same methods used in fabricating tungsten carbide are used for Grade 608 Chrome Carbide. Components can be molded to shape for standard or quantity parts. They can also be economically machined to required shapes in the presintered condition for small lot production. Grinding, lapping and polishing of chrome carbide is performed with conventional silicon carbide grinding wheels, diamond grinding wheels and diamond lapping compounds. Polished surfaces of chrome carbide have a more brilliant lustre than those of tungsten carbide

Grade 608 Chrome Carbide can be attached by brazing, by mechanical means or by thermosetting resin cements. It is necessary to flash plate chrome carbide parts with nickel for brazing with conventional materials.

The results of recent tests with ethoxyline resins as a bonding agent for attaching chrome carbide to non-porous materials like metals have been very encouraging. Bond strengths of the ethoxyline resin cemented joints at room temperature are much lower than brazed joints but approximately equal to those of soft soldered joints. In general, resin-cemented joints can be used in place of brazed joints where high strengths are not required and when the application operates at room or slightly elevated temperatures.

Use of ethoxyline resin cemented joints precludes that the surfaces of the carbide and metal be clean. They should be grit-blasted and rinsed clean with a solvent. Although ground or smooth surfaces do not bond well, as-sintered or sand blasted surfaces on carbides produce satisfactory bonds.

Bond shear strengths of from 5000 to 8000 psi at room temperature have been obtained with ethoxyline cements of several manufacturers using various curing methods. At 200F bond strengths decrease to ½ the above values. Prolonged immersion in water weakens the bond about 15%.

Carbide parts that have been attached by ethoxyline resin cements can be removed by heating the joint to 600F at which temperature the cements decompose and the parts can be easily pried loose. The charred cement can be removed by sanding or scraping.

Typical Applications

The excellent corrosion and erosion resistance of Grade 608 Chrome Carbide, combined with good abrasion resistance, point to successful applications in broad fields in industry.

In the chemical field, its resistance to acids and sodium hydroxide indicates that nozzle and control valve components are ideal applications.

In the pharmaceutical and food processing fields, Grade 608 Chrome Carbide will also find applications in valves and nozzles because of its resistance to citric and lactic acids. Scraper blades for centrifuges and seal rings for homogenizing equipment are other excellent chrome carbide applications.

Because chrome carbide has about the same thermal expansion rate as steel it is finding wide application in the gage manufacturing field where wear resistance of gaging surfaces and temperature effects of expansion are important considerations. The corrosion resistance of the chrome carbide gaging surfaces is also a factor in prolonging gage surface life.

The completely non-magnetic properties of Grade 608 Chrome Carbide mean that it is possible to make instrument components that are non-magnetic and yet highly resistant to wear and corrosion.

There are many other divergent applications for Grade 608 Chrome Carbide such as: Shear blades for molten glass, core pins for baking ceramic parts, fishing rod guides that resist salt water atmospheres, textile machinery guides, mold components for die casting processes, punches for movie film and a host of other applications where stainless steel is not sufficiently abrasion-resistant.

Mechanical parts for all types of machinery that must resist wear, corrosion, high temperatures or erosion are of course 'naturals' for the new carbide. Some applications for Grade 608 Chrome Carbide may overlap those for tungsten carbide, but the properties of this new carbide exceed tungsten carbide in so many specific factors that this will undoubtedly prove to be the exception rather than the rule.

What Are They?

- ☐ *Thrust bearings*
- ☐ *Clutch disks*
- ☐ *Grinding wheels*
- ☐ *Ceramic insulators*

The correct answer is grinding wheels, shown as they emerge from the electric kiln.

Not ordinary grinding wheels, however. They are Norton *New-Process* Wheels — made by modern, streamlined, precision methods developed by Norton engineers.

A Big Step Forward

This new process involves advanced equipment, new manufacturing techniques, and close quality control during every step of grinding wheel production. As a result, Norton *New-Process* Wheels are produced to a degree of structural uniformity never before possible.

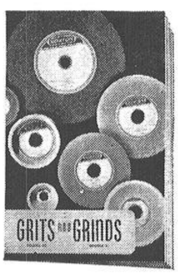
This increased uniformity means extra assurance of consistent grinding action throughout each wheel and from wheel to wheel. Which, in turn, means more evenly wearing, longer lasting wheels — together with more cutting action per wheel and per dollar.

In addition, the built-in balance of Norton *New-Process* Wheels cuts down vibration and enables them to hug the work more closely, assuring smoother, better grinding performance.

A wide range of wheels employing both ALUNDUM* (aluminum oxide) and CRYSTOLON* (silicon carbide) abrasives are made by the new process.

Looking Ahead With Norton

Geared to industry's constantly expanding needs, Norton Company serves *every* manufacturing field by "making better products to make other products better." Young men planning technical careers are invited to consider the established leadership and far-ranging scope of the Norton world-wide organization.



Send For Additional New-Process Facts

Recent Norton literature gives further details on this important advancement in grinding wheel manufacture and performance. Write for your free copy.

John J. Amero, M. S., Cer. Eng., North Carolina State '38, checks duplication of grinding wheel grade with the aid of an oscillograph. John has been working on the development of Norton "New Process" wheels.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON

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

Making better products to make other products better

ABRASIVES · GRINDING WHEELS · OILSTONES · ABRASIVE PAPER & CLOTH · REFRACTORIES, POROUS MEDIUMS & LABORATORY WARE · NON-SLIP FLOORING · GRINDING & LAPPING MACHINES · BORON CARBIDE PRODUCTS

NORTON COMPANY, WORCESTER 6, MASSACHUSETTS

BEHR-MANNING, TROY, N. Y. IS A DIVISION OF NORTON COMPANY

W.S.P.E. - -

(continued from page 27)

Editor's Note:
This material reached us too late for the January issue.

- Program Notes
- Awards Committee
- NSPE Membership Campaign
- Education Committee

* * *

The final board meeting of 1952 was held in Milwaukee on December 13 with nearly all members in attendance.

Last minute details of the annual meeting in January were approved as planned by the program committee. Pierce Ellis reported on an investigation of the probable cost of holding the next WSPE meeting at one of Wisconsin's resort hotels. Rates appear to be comparable with those at hotels. Means of learning the wishes of the membership on this matter were discussed but no decision reached.

At the request of Chairman Ben G. Elliott the board approved the addition of Fred Agthe and Dean M. O. Withey to the awards committee.

It was reported that six new members had been added as a result of the NSPE mail campaign reported in the last issue. The personal follow up in which all members can lend a hand should result in a large number of new members.

John Gammell, chairman of the education committee reported on intensive plans being made by that committee. Mr. Gammel stated that progress in engineering and related scientific fields was being hampered by the lack of trained personnel. He stated that workers in the scientific fields must start their training in high school. Surveys have shown that one third of all high school pupils are capable of being successful in scientific fields. Plans are being made for the guidance of high school students fields through close cooperation between WSPE and high school guidance and science teachers.

We are pleased to welcome the following into the Society:

MEMBERS

Joseph Lovercio, Engineer, Airport Division, Milwaukee County of Public Works

Earl S. Godard, Manager Production Engineering, The Trane Company, La Crosse, Wisconsin

Thomas K. Jordan, Director of Aeronautics, Wisconsin State Aeronautics Commission, Madison

Franklin D. Ditch, Chief Engineer, The Electric Sprayit Company, Sheboygan

Ben Shetney, Engineer, State Highway Commission of Wisconsin, Madison, Wisconsin

Alfred J. Wojta, Agricultural Engineer, University of Wisconsin, Madison

Donald R. Franzmann, District Engineer, Northern States Power Company, Chippewa Falls, Wisconsin

AFFILIATE MEMBERS

Stanley J. Jachim, Engineer, State Highway Commission of Wisconsin, Eau Claire

Dale E. Gordon, Engineer, State Highway Commission of Wisconsin, Eau Claire.

ENGINEER SHORTAGE DISCUSSED BY NORTHWEST CHAPTER

Many qualified engineers are now doing work which could be done by laymen, resulting in a waste of trained manpower, W. F. Baumgartner, chapter president, declared. He said the State Highway Commission, of which he is division engineer here, is adopting the policy of using untrained men for work which does not require professional training wherever possible, and is attempting to use engineers only for work requiring their professional skill.

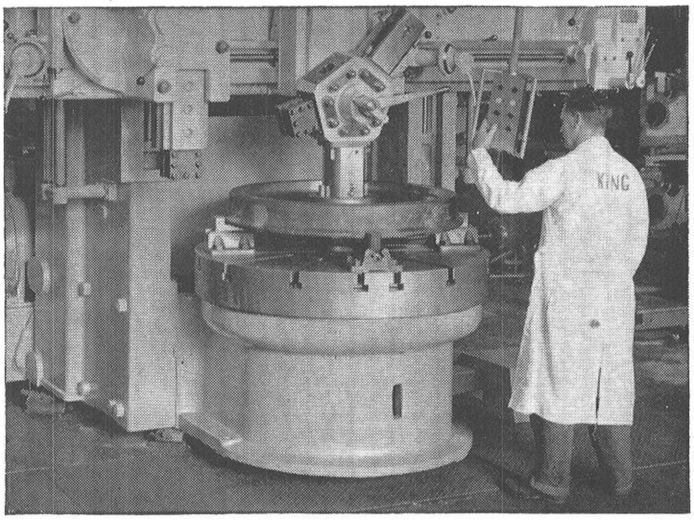
Pierce Ellis, Milwaukee, first vice president of the state society, also advocated better utilization of engineer manpower, and reported that the state organization is promoting courses in vocational schools in an effort to increase the supply of semi-trained workers in the engineering field.

Increased promotion of the profession among high school and college students was proposed by T. E. Thoreson, River Falls, chairman of the education committee. Mr. Thoreson suggested that the society provide speakers to schools to explain advantages of engineering as a career, and provide libraries of colleges in this area with books and material on engineering.

Mr. Thoreson also proposed that students interested in engineering be invited to a meeting of society, where they could discuss the subject with professionals. He also suggested that the society provide speakers for civic club meetings during Engineers' Week, Feb. 22 to 26.

W. T. Gohn, present secretary-treasurer, was proposed for president by the nominating committee in its report. Others nominated were M. R. Charlson for vice president, W. E. Hestekin for secretary-treasurer, and E. R. Holm as director for three years. Holdover directors are R. F. Bott and R. P. Boyd.

Another page for **YOUR BEARING NOTEBOOK**

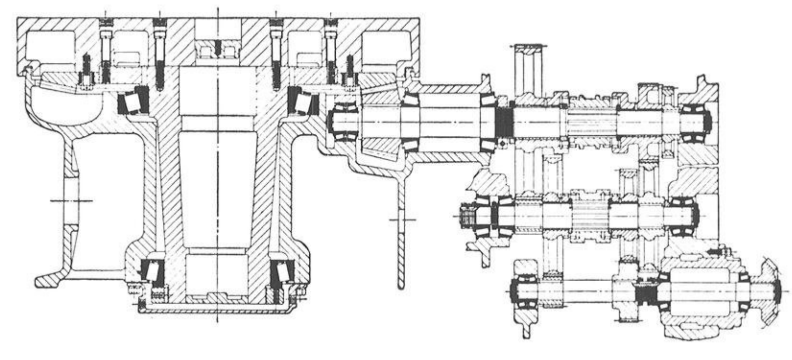


How to keep a high speed boring mill accurate

To insure table accuracy in high speed boring mills, spindle vibration must be eliminated. That's why designers mount the table spindles on Timken® precision tapered roller bearings. They hold spindles in positive alignment, eliminate vibration. Line contact between rollers and races of Timken bearings provides extra load-carrying capacity. The true rolling motion and incredibly smooth surface finish of Timken bearings practically eliminate friction and wear within the bearing itself.

How spindle and drive shafts are mounted on TIMKEN® bearings

The drive of a high speed boring mill is mounted on single row type TS, and two row type TNA bearings. Input, intermediate and bevel pinion shafts are mounted on two type TS bearings on one end, and a two row type TNA bearing free to float on the opposite end. Single row type TS bearings are indirectly mounted on the main table vertical spindle.



TIMKEN

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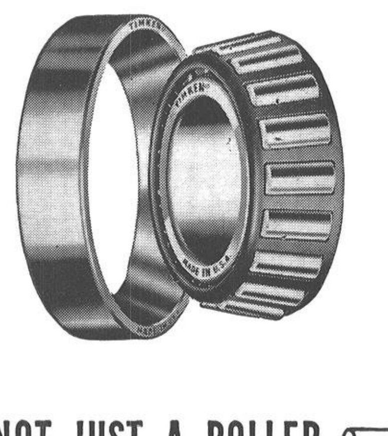
TAPERED ROLLER BEARINGS



Want to learn more about bearings?

Some of the engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'll be glad to help. Clip this page for future reference, and for a copy of the 270-page General Information Manual on Timken bearings, write today to The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

NOT JUST A BALL ○ NOT JUST A ROLLER ⊂⊃ THE TIMKEN TAPERED ROLLER ⊂⊃ BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION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STATIC

BY I. R. DROPS

Situation: Two infants in the nursery of the maternity ward of the hospital.

First Infant: "Are you a little boy or a little dirl?"

Second Infant: "I don't know."

First Infant: "I'm a little boy."

Second Infant: "How do you tell?"

First Infant: "Wait till the nurse leaves and I'll show you."

The nurse leaves and the First Infant pulls the cover down and says: "See, blue booties."

* * *

College man (finishing a letter to a friend): "I'd send you that five I owe you, but I've already sealed the envelope."

* * *

The little dog walked by the tree. The tree said, "Have one on me." The doggie blinked, like Mickey Mouse, and said, "No thanks, just had one on the house."

* * *

A man wandered into a tennis tournament the other day and sat down on the bench.

"Whose game?" he asked.

A shy young thing sitting next to him looked up hopefully.

"I am," she replied.

* * *

Guide: "We are passing the largest brewery in the state."

Engineer: "Why?"

Shortly before the invasion started, a general and his staff were watching a troop-carrying glider go by. From it came a carrier pigeon. Powerful field glasses followed the bird to a nearby coop. A colonel raced over, got the message attached to the bird's leg, bounded back breathlessly, and handed it to the general. He opened it with trembling hands, read it, cursed, and threw it on the ground. Then he walked away, his face bright purple. The colonel waited a moment, then picked up the message. It read: "I have been sent down for being naughty in my cage."

* * *

Engineers wonder why girls with streamlined figures offer the most resistance.

* * *

"Beg your pardon, but aren't you an engineering student?"

"No—it's just that I couldn't find my suspenders this morning, my razor blades were used up, and a bus ran over my hat."

* * *

Joe: "That college turns out some great men."

Bill: "When did you graduate?"

Joe: "I didn't graduate—I was turned out."

* * *

Bureaucrat: "If we are unable to figure out a way to spend that two hundred and twenty million dollars, we lose our job."

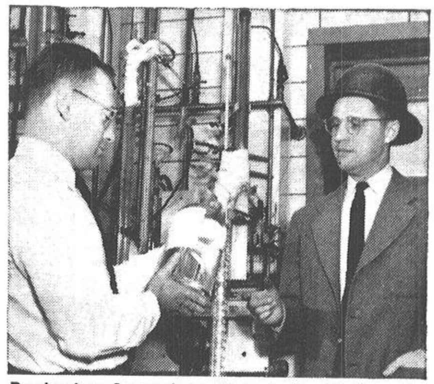
Secretary: "How about a bridge over the Mississippi River lengthwise?"

* * *

He: "Will you marry me?"

She: "No, but I'll always admire your good taste."

THE DU PONT DIGEST



Production Supervisor *Robert B. McCue (at right), B.S. in Ch. E., West Virginia '38, and plant laboratory shift-leader J. P. Quarles, B.S. in Ch. E., Lehigh '38, discuss analysis of a product sample.*

JOB WITH A FUTURE—

Supervising Production

Varied experiences in a Du Pont chemical plant fit young engineers for higher responsibility

As was pointed out in the last issue of the *Digest*, Du Pont's many product lines afford men interested in production supervision experience in a wide variety of operations.

For a better idea of what the work involves, let's consider a specific case—the production of "Mycoban" sodium and calcium propionates, inhibitors used by bakeries to extend the mold-free life of bread and other baked goods.

Many of the problems encountered in the manufacture of "Mycoban" are similar to those arising in the manufacture of any Du Pont chemical. There is the same continuing effort to improve quality, while cutting costs through the better use of equipment, instrument controls and raw materials.

The supervisor works hand in hand with the plant technical section toward these goals. He also keeps himself informed on technological and economic trends affecting production and sales, finds explanations for out-of-line costs, and prepares plans and estimates for increasing production.

Such work obviously calls for a sound technical background. In addition, however, considerable administrative ability is needed. A supervisor must be able to *supervise*. His duties include keeping people under him informed about long-range changes in company policy and assuming responsibility for their safety and morale.

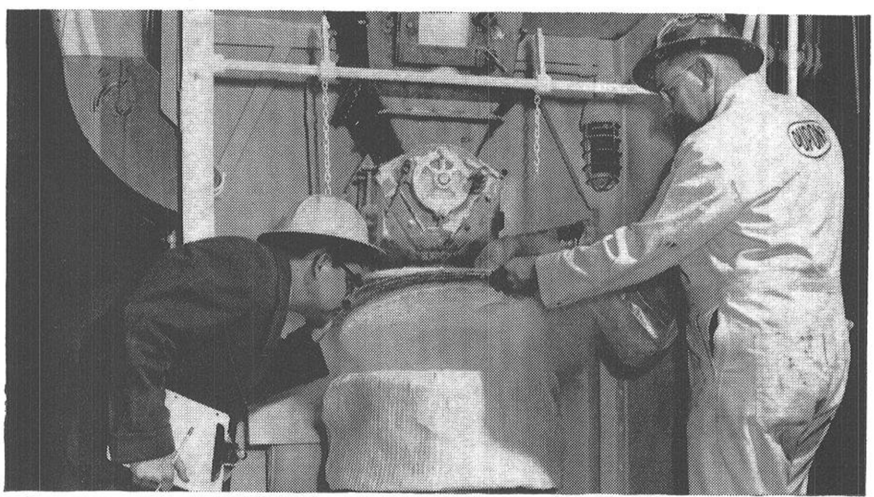
The unusual problems encountered in "Mycoban" production are largely due to the seasonal nature of its sales. Its greatest use is in the hot, humid months, or from late spring to early fall. For this reason:

1. Production and warehouse inventories of "Mycoban" must be carefully balanced against sales forecasts. The supervisor gathers necessary background information for this operation.

2. Production needs, including manpower, equipment and materials, must likewise be planned to meet sales forecasts.

3. Maintenance, including a yearly hydrostatic test of the plant, must be scheduled with the plant maintenance supervisor for the minimum interference with peak-season production. Emergency maintenance must be kept down by carefully planned preventive maintenance.

As you can see, production supervisors have a broad field of activity at Du Pont. The experience gained in this job will prepare an ambitious man for advancement to positions of still higher responsibility.



Process Control Engineer *W. L. Morgan (at left), B.S. in Ch., West Virginia Wesleyan '37, observes packing characteristics of "Mycoban" powder as it comes from the loading hopper.*

YOU'LL WANT to read "Chemical Engineers at Du Pont." Explains opportunities in research, development, production, sales, administration and management. For copy, write: 2521 Nemours Building, Wilmington, Del.

DU PONT
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BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Listen to "Cavalcade of America," Tuesday Nights on NBC—See It Every Other Wednesday on NBC TV

All kinds of engineering jobs call for photography

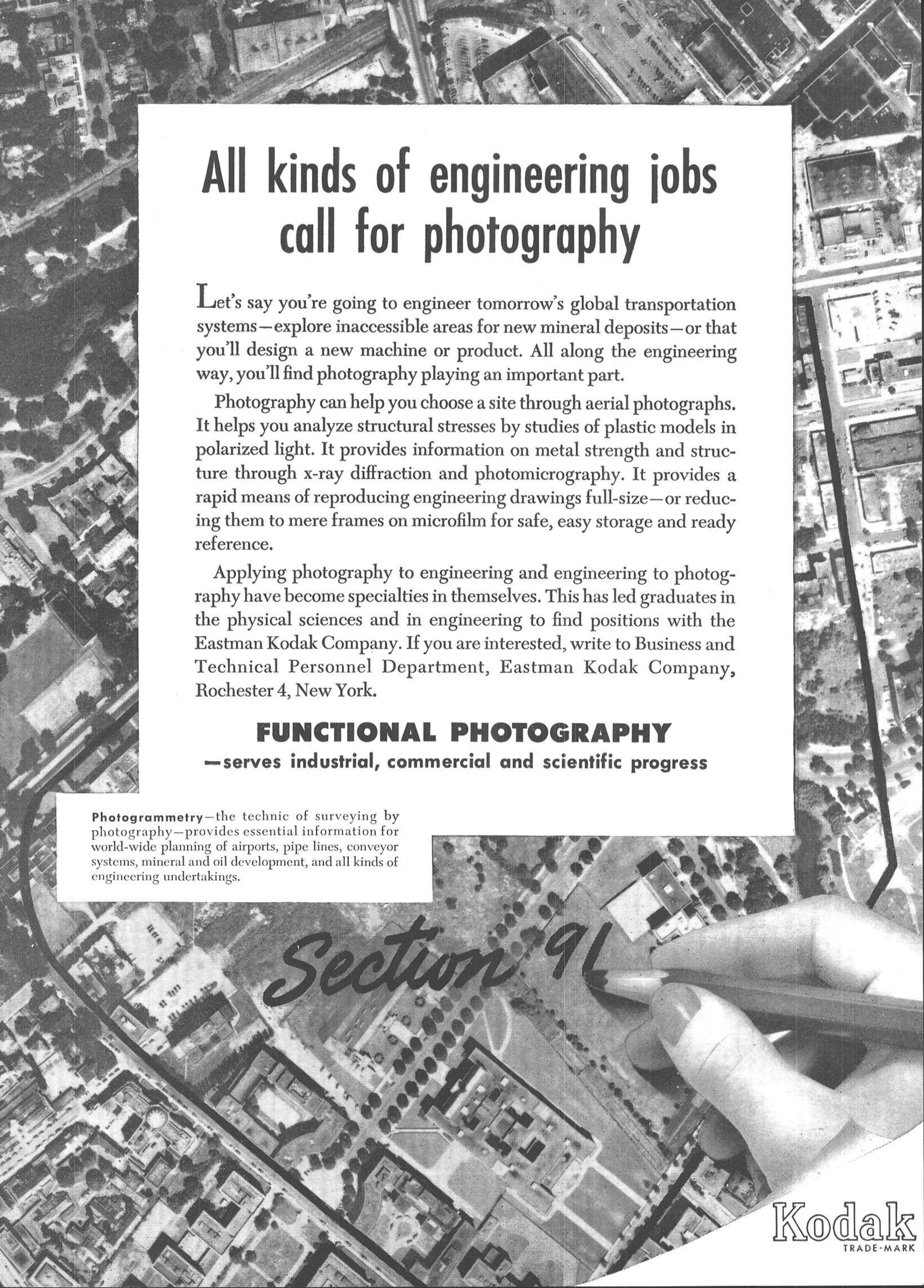
Let's say you're going to engineer tomorrow's global transportation systems—explore inaccessible areas for new mineral deposits—or that you'll design a new machine or product. All along the engineering way, you'll find photography playing an important part.

Photography can help you choose a site through aerial photographs. It helps you analyze structural stresses by studies of plastic models in polarized light. It provides information on metal strength and structure through x-ray diffraction and photomicrography. It provides a rapid means of reproducing engineering drawings full-size—or reducing them to mere frames on microfilm for safe, easy storage and ready reference.

Applying photography to engineering and engineering to photography have become specialties in themselves. This has led graduates in the physical sciences and in engineering to find positions with the Eastman Kodak Company. If you are interested, write to Business and Technical Personnel Department, Eastman Kodak Company, Rochester 4, New York.

FUNCTIONAL PHOTOGRAPHY

—serves industrial, commercial and scientific progress



Photogrammetry—the technic of surveying by photography—provides essential information for world-wide planning of airports, pipe lines, conveyor systems, mineral and oil development, and all kinds of engineering undertakings.

MY QUESTION TO THE G-E STUDENT INFORMATION PANEL:

"What educational training opportunities are available to engineers in General Electric?"

. . . JAMES H. ROBBINS, University of Florida, 1953

The answer to Mr. Robbins' question, presented at a student information meeting held in July, 1952 between G-E personnel and representative college students, is printed below. If you have a question you would like answered, or seek further information about General Electric, mail your request to College Editor, Dept. 221–6, General Electric Co., Schenectady, N. Y.

M. M. BORING, *Engineering Services Division* . . . In General Electric the engineer has his choice of engaging in either Company education programs or in graduate study in nearby colleges and universities.

The Company programs are based on material directed toward better fitting the engineer for a career with the Company. He will gain first-hand knowledge of industry, come in contact with many different products and types of work, and associate with top-flight engineers.

General Electric actively encourages college graduate study, and when this study applies to the individual's work, on approval by his departmental manager, provisions are made for refunds of one-half tuition costs upon satisfactory completion of courses.

The technical education programs in G.E. may be divided into two main categories: the advanced technical programs, where carefully selected students (any engineer may apply) are given intensive training; and the general and specialized technical courses, available to all Company engineers.

The objective of the advanced technical programs—Creative Engineering, Advanced Engineering, and Process Technology—is to impart an understanding of fundamental scientific principles and their application to particular problems, as well as to encourage a basic approach to these problems and promote confidence in the engineer's own ability.

The Creative Engineering Program is directed toward developing creative and inventive abilities, and a logical approach to design problems by definition, search, selection, and evaluation.

Organized to develop top-flight engineers, the Advanced Engineering Program provides an opportunity to study fundamental physical principles and advanced mathematical methods in the areas of electrical and mechanical engineering.

The Process Technology Program, concerned with chemical, chemical engineering, and metallurgical fields, acquaints the engineer with laboratory and engineering groups, with activities in many locations, and with various product businesses of the Company.

The category that includes the general courses is designed to acquaint engineers with the engineering aspects of marketing, manufacturing, and application engineering as well as providing less intensive courses on fundamental principles. The specialized technical courses provide intensive study for engineers permanently assigned to operating departments in such fields as servomechanics, heat transfer, and magnetic design.

In addition, educational opportunities are offered engineers by our Manufacturing, Marketing, Employee and Plant Community Relations, and other divisions.

Besides having the opportunity for educational development, the engineer in General Electric is given a good job with plenty of responsibility, sound training for a lifetime career, opportunities for careers in widely varied phases of science and engineering, a good place in which to work, and a place in which to lead a well-rounded life.

You can put your confidence in—

GENERAL ELECTRIC