The Wisconsin engineer. Volume 60, Number 7 April 1956

Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

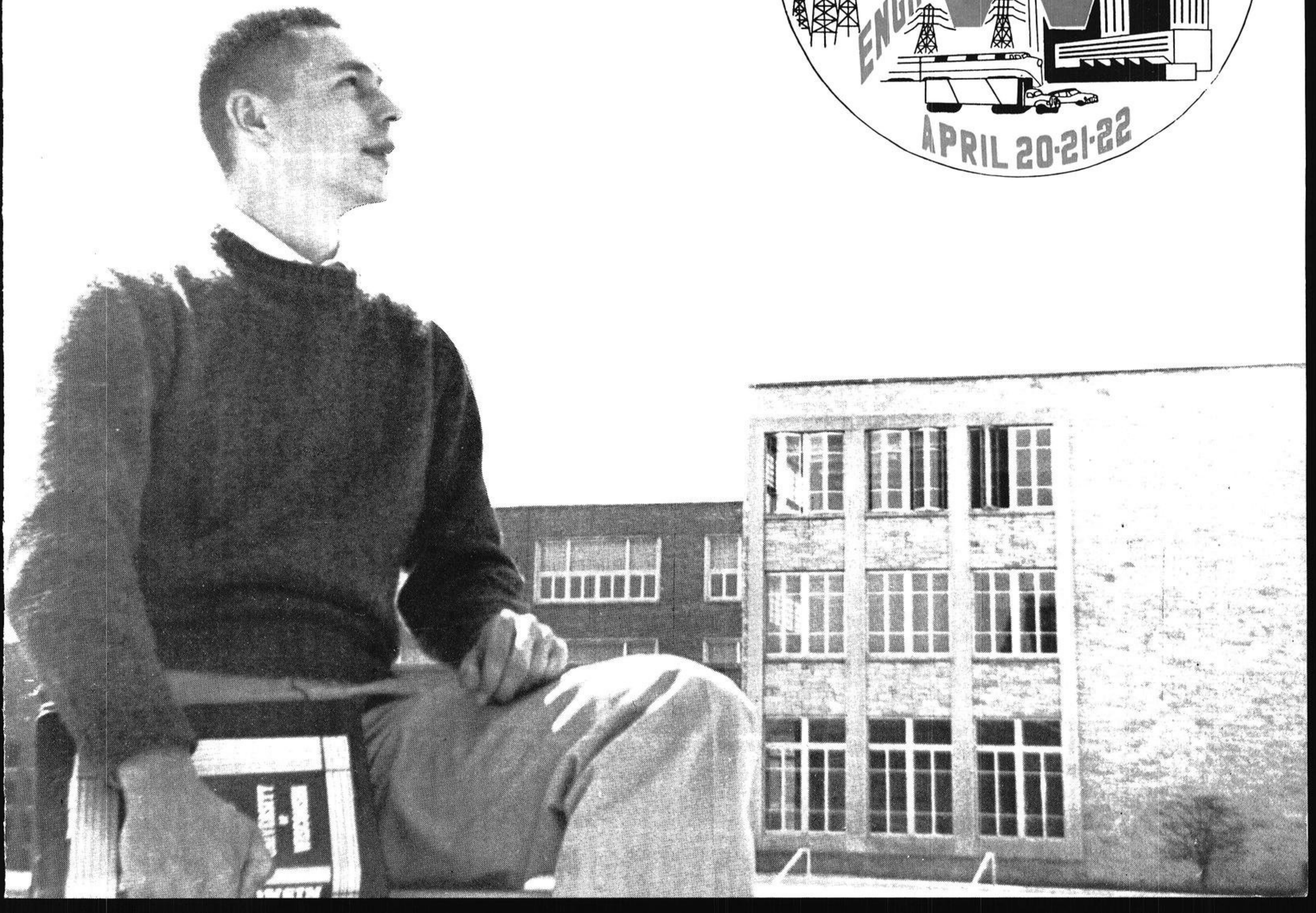
https://digital.library.wisc.edu/1711.dl/7P3DBZ6M5SIJV8I

25¢

The Wisconsin engineer

APRIL, 1956

HIGH SCHOOL ISSUE



Edward J. Stolic, class of '48

speaks from experience when he says . . .

"With U. S. Steel, my future holds interest, challenge and reward."

From his graduation in 1948 with a B.S. degree in Mechanical Engineering, until November of that year, Edward Stolic worked as an operating trainee in the Irvin Works of United States Steel. Following his discharge from the Army in 1950, he returned to work at U.S. Steel. In just 18 months, Mr. Stolic reached a management position as Engineer-Lubrication.

By mid-year 1953, Mr. Stolic was promoted to Foreman-Instrument Repair and Sub-Station. In a recent interview he said: "Opportunities for rapid advancement are almost limitless in U.S. Steel." At 27, Mr. Stolic is supervising a force of 30 men in mechanical and electrical tests as well as instrument repair and maintenance of gas generators, compressors and water purification units. He feels that, "The engineer finds many places to apply the knowledge he garnered in school." The men under Edward Stolic are called on to trouble shoot in any part of the mill. This calls for a wide variety of talents and leads Mr. Stolic to say: "The steel industry has expanded greatly, and with it the need for good men."

If you are interested in a challenging and rewarding career with United States Steel, and feel you are qualified, further information is available from your college placement director. Or, we will gladly send you our informative booklet, "Paths of Opportunity." Just write to United States Steel Corporation, Personnel Division, Room 1622, 525 William Penn Place, Pittsburgh 30, Pa.

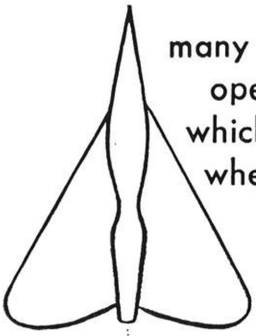
SEE THE UNITED STATES STEEL HOUR. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

USS TRADE MARK

UNITED STATES STEEL

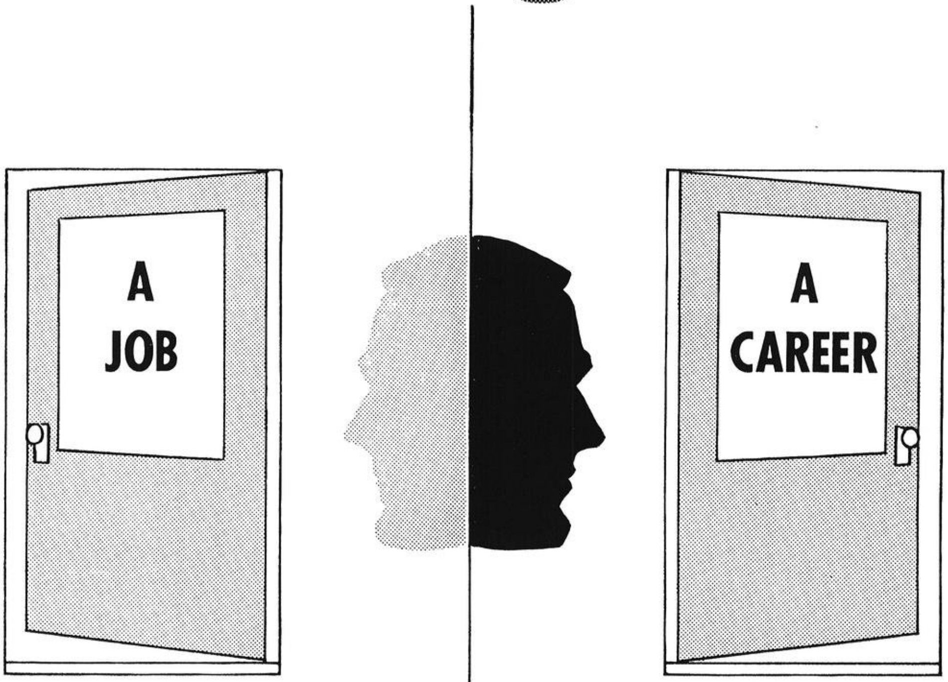
AMERICAN BRIDGE . . AMERICAN STEEL & WIRE and CYCLONE FENCE . . COLUMBIA-GENEVA STEEL . . CONSOLIDATED WESTERN STEEL . . GERRARD STEEL STRAPPING . . NATIONAL TUBE
OIL WELL SUPPLY . . TENNESSEE COAL & IRON . . UNITED STATES STEEL PRODUCTS . . UNITED STATES STEEL SUPPLY . . *Divisions of* UNITED STATES STEEL CORPORATION, PITTSBURGH
UNITED STATES STEEL HOMES, INC. • UNION SUPPLY COMPANY • UNITED STATES STEEL EXPORT COMPANY • UNIVERSAL ATLAS CEMENT COMPANY

6-02



many doors will be opened to you . . . which will you enter when you become an

engineer

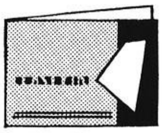


OPPORTUNITY KNOCKS for engineering careers at this magnificent new jet aircraft equipment plant

Make the *right* choice when you begin to invest your hard-won skill and knowledge in engineering. Hamilton Standard offers a plant where initiative and responsibility are encouraged . . . where young men are in top management posts . . . an engineering staff which has been continuously expanding for 35 years . . . a plant which has been judged one of the top 10 in the nation. You don't just fill a position at H-S . . . you commence a career! Some of Hamilton's present projects include jet fuel controls, jet turbine starters, hydraulic pumps, air cycle and vapor refrigeration systems, controls and accessories for nuclear engines, propellers for turbine and piston engines.

GRADUATE PROGRAM . . . while at Hamilton Standard you will be encouraged to take advantage of the company's liberal tuition assistance plan and to pursue postgraduate studies at nearby Hartford Graduate Center of Rensselaer Polytechnic Institute.

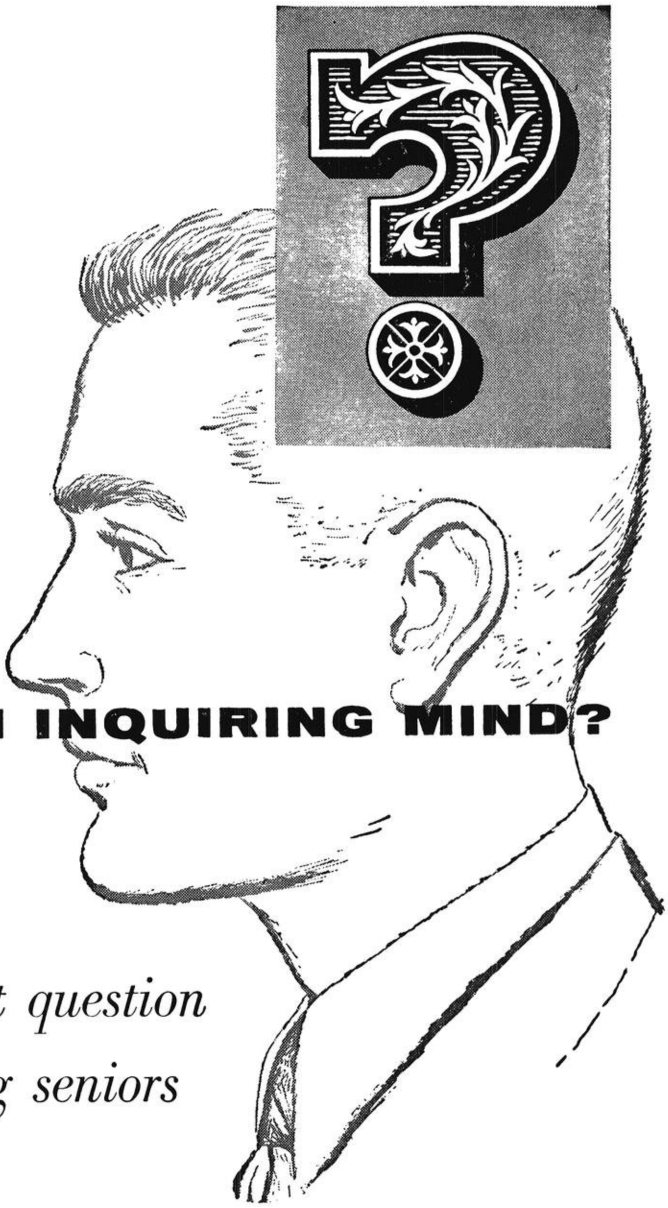
HAMILTON STANDARD



Send for "YOU AND YOUR FUTURE"

. . . a colorful brochure picturing and describing all of the activities and opportunities at H-S . . . plus information on the graduate engineering program. Write Mr. T. K. Bye, (key no.) Bradley Field Road, Windsor Locks, Connecticut.

HAMILTON STANDARD A DIVISION OF UNITED AIRCRAFT CORPORATION



HAVE YOU AN INQUIRING MIND?

An important question for engineering seniors

If your answer is *yes*, you and General Motors may have a great deal to talk over.

Chances are you'd fit in very well here at GM, and we'll tell you why.

No less an authority than General Motors' President, Harlow H. Curtice, has said that GM's basic approach is *the attitude of "the inquiring mind."*

Said Mr. Curtice: "This point of view is never satisfied with things as they are. It assumes that everything and anything can be *improved!*"

Naturally, that kind of industrial philosophy shuts the gate on complacency and opens the door for progress.

It explains why GM leads in so many technical fields.

It also goes far toward telling why so many GM engineers succeed in building rewarding careers.

So—if you have an inquiring mind that neither shrinks at a challenge nor balks at a chance—why not inquire about the opportunities at GM?

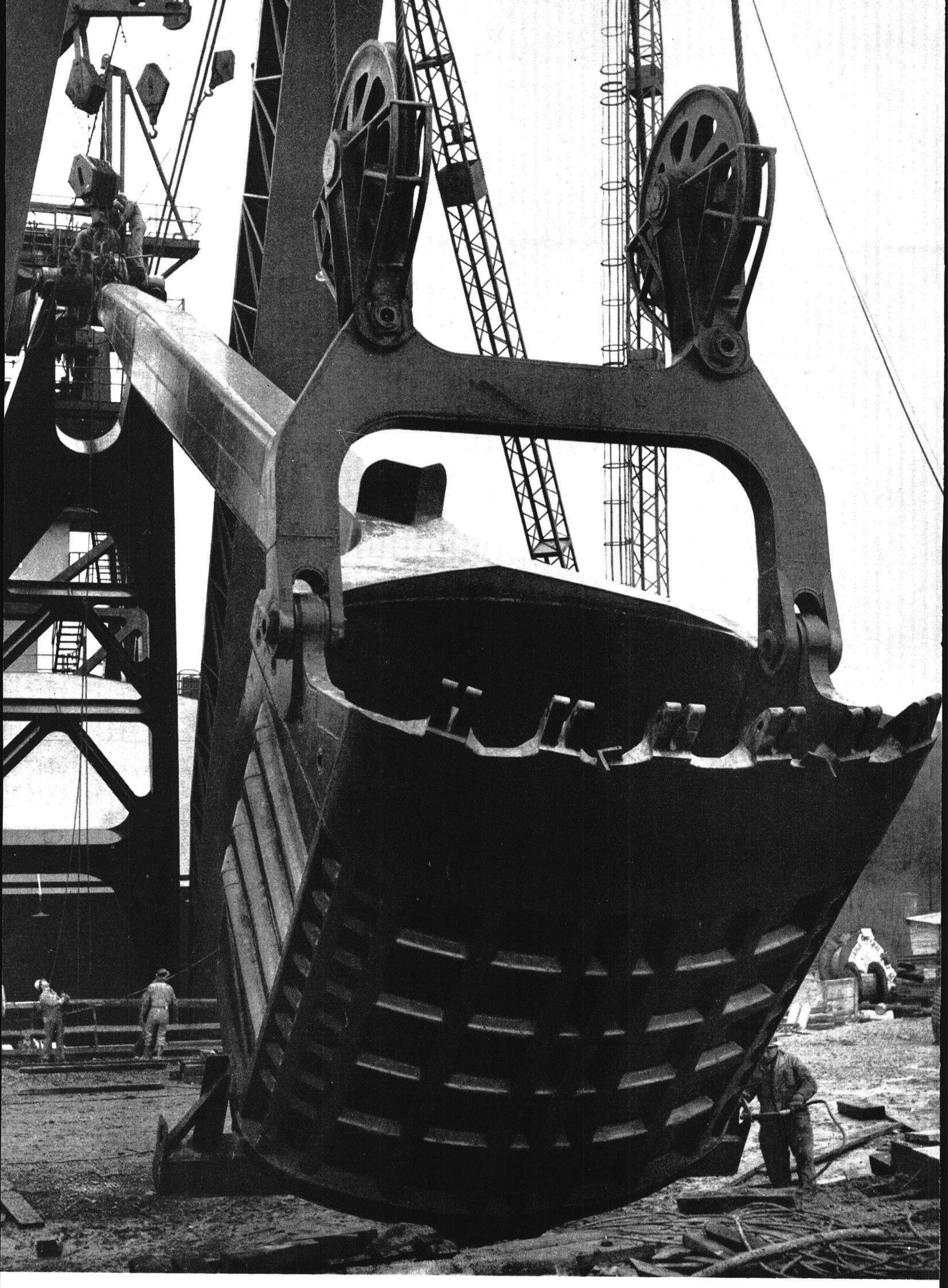
The man to see is your Placement Officer. Or write us directly.

GM Positions Now Available in These Fields:

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING
METALLURGICAL ENGINEERING
CHEMICAL ENGINEERING
AERONAUTICAL ENGINEERING
INDUSTRIAL ENGINEERING

GENERAL MOTORS CORPORATION

Personnel Staff, Detroit 2, Michigan



WISCONSIN ENGINEER

The Student Engineer's Magazine

FOUNDED 1896

Volume 60 — APRIL, 1956 — Number 7

Features

Departments

Cover

Cover subjects are (left to right) Jerry Martin, freshman electrical engineer from Oshkosh, Wis., and the official button design of the 1956 Engineering Exposition.

Frontispiece

The Big Scoop—This Paul Bunyan among excavators rips 90 tons from the earth at a single bite. The machine is 100 times larger than the average power shovel and half again as large as any other. For a new development in power supply, power from a 5000 kva 69,000–6900 portable substation runs through a trailing cable to the shovel. GE motors provide more than 4000 hp.—Courtesy General Electric.

MEMBER OF
ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman:
Professor Merk Hobson
222 Avery Laboratory
University of Nebraska
Lincoln 8, Nebraska

Publishers' Representative:
Littell–Murray–Barnhill, Inc.
101 Park Ave., New York
605 N. Michigan Ave., Chicago

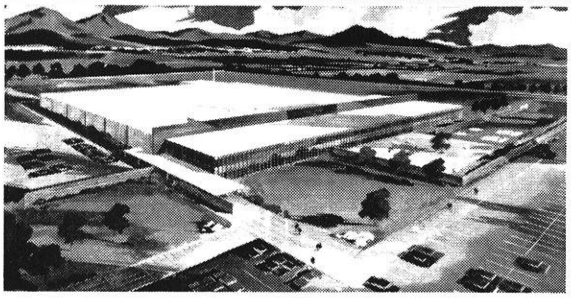
Entered as second class matter September 26, 1910, at the Post Office at Madison, Wisconsin, under the Act of March 3, 1879. Acceptance for mailing at a special rate of postage provided for in Section 1103, Act of Oct. 3, 1917, authorized Oct. 21, 1918.

Published monthly from October to May inclusive by the Wisconsin Engineering Journal Association, 331 Mechanical Engineering Building, Madison 6, Wisconsin.

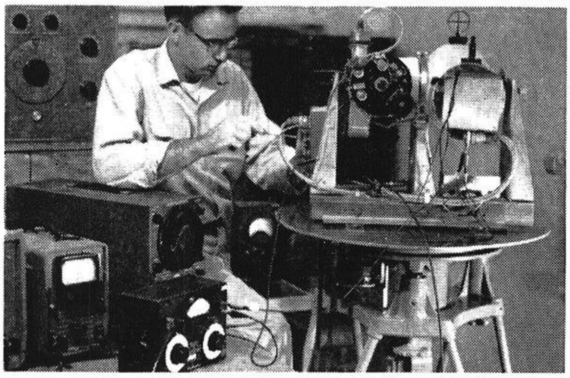
Subscription Price

$1.25 PER YEAR . SINGLE COPY 25¢

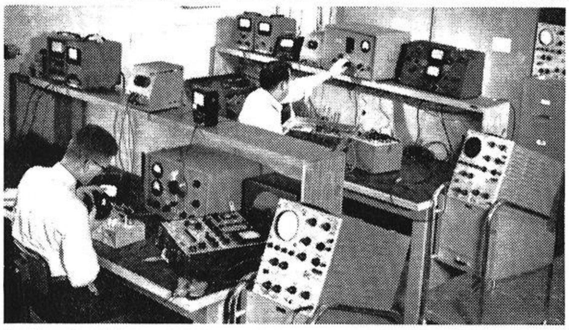
AIRBORNE ELECTRONICS AND WEAPON CONTROL SYSTEMS



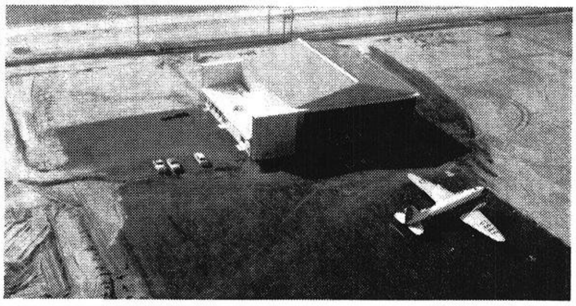
Denver manufacturing plant now under design



Infrared laboratory



Instrumentation laboratory



Initial unit of flight test facility

Communications pilot line production

Simulators in computing center

At Ramo-Wooldridge today there exists a wide range of projects intended to aid aircraft in navigating to the vicinity of targets, finding the targets, destroying them, and returning safely to base. Work is under way in such fields as infrared and microwave detection, information display, communication and navigation, and analog and digital computing. Some projects are in the laboratory development stage, some in the flight test stage, some in pilot production.

Good progress is being made in the establishment of facilities and operational patterns that are well tailored to the unique requirements of advanced electronic systems work.

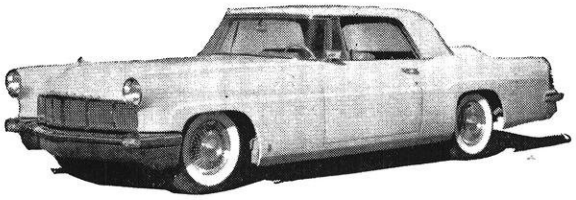
Positions are available for scientists and engineers in these fields of current activity:

Communications Systems
Digital Computers and Control Systems
Airborne Electronic and Control Systems
Electronic Instrumentation and Test Equipment
Guided Missile Research and Development
Automation and Data Processing
Basic Electronic and Aeronautical Research

The Ramo-Wooldridge Corporation

5730 ARBOR VITAE STREET, LOS ANGELES 45, CALIFORNIA

Planned with the finest facilities ...to build the finest of cars



Architects and Consulting Engineers: GIFFELS, VALLET, INC., DETROIT
General Contractor: H. K. FERGUSON CO., CLEVELAND
Mechanical Contractor: STANLEY CARTER CO., DETROIT

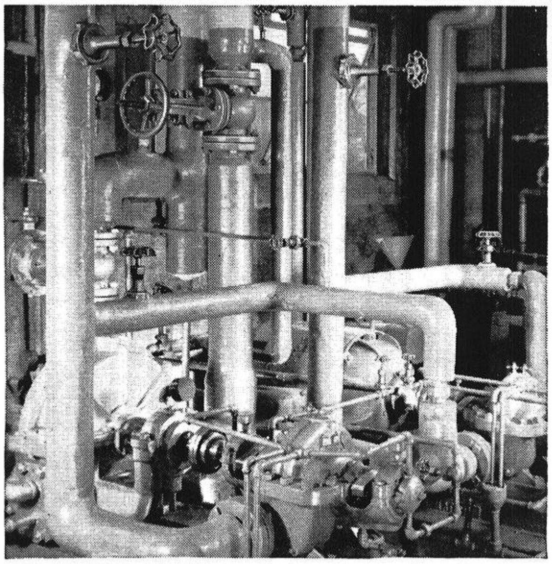
...equipped with JENKINS VALVES

The new Continental Division plant of the Ford Motor Co. has been built with every facility keyed to an avowed purpose . . . producing America's finest motor car.

All components were selected to meet the highest standards of performance. Jenkins Valves control the intricate network of pipelines so essential to modern plant operation.

Confidence in the time-proved efficiency, economy, and safety of Jenkins Valves is the reason why they are chosen for so many of the news-making structures that are pacing the advance in modern plant design.

For all cost-wise builders, the Jenkins Diamond is a reliable guide to lasting valve economy. Jenkins Bros., 100 Park Ave., New York 17.



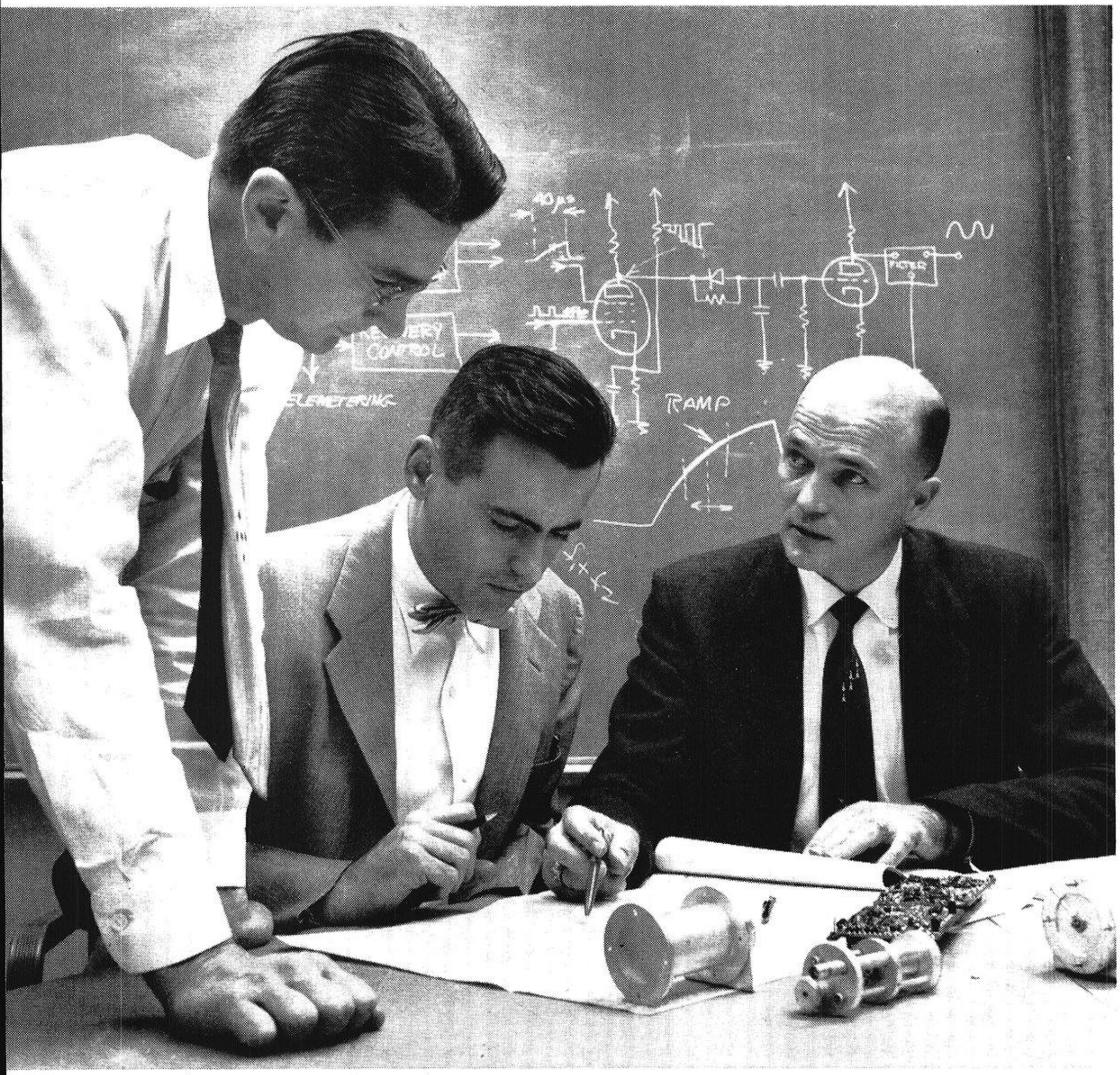
THE JENKINS VALVES installed in the Continental Division plant include many sizes of globe, angle, gate, and check valves. The above illustration shows Jenkins Valves installed on condensate return pump lines.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES SINCE 1864 TRADE JENKINS MARK
Jenkins Bros

SOLD THROUGH PLUMBING-HEATING AND INDUSTRIAL DISTRIBUTORS

SCIENCE AND ENGINEERING

AT LOCKHEED MISSILE SYSTEMS DIVISION



Charles W. Goedecke, Electronic Design Group Engineer, Emerson M. Hoyt, Electronic Research Specialist, and George L. Larse, head of Electronic Systems Development in the Flight Test Electronics Department, discuss important aspects of new electronic command decoding devices for missile guidance systems.

MISSILE ELECTRONICS

DATA TRANSMISSION LINKS SYSTEMS AND COMPONENTS

The advancement of missile systems technology can be measured to a great extent by increasing demands imposed on the ability of electronic systems and components engineers.

Electronic problems encountered in hypersonic flight, particularly at high ambient temperatures, require creative efforts and coordination of a high order from engineers in fields of radar, guidance, telemetry and instrumentation.

New developments at Lockheed Missile Systems Division offer a wide variety of assignments in the following fields:

Command guidance involving the development and application of radio frequency components, video amplifiers, pulse circuitry, decoding and control devices.

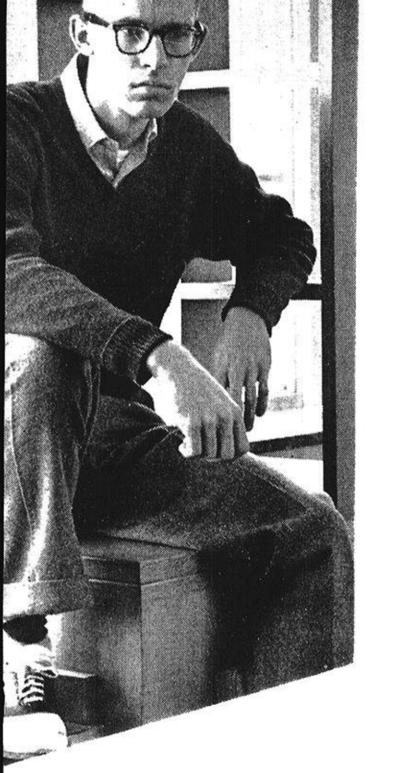
Automatic data processing equipment involving analog-to-digital conversion circuitry; electronic and magnetic storage components; pulse and timing circuitry of all types.

Data transmission and telemetry involving development and application of antennas, transducers, FM oscillators, VHF transmitters and receivers.

Those possessing keen interest in both systems and component development are invited to write.

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

LOCKHEED AIRCRAFT CORPORATION **VAN NUYS · CALIFORNIA**



SPEAKING FOR THE STAFF . . .

The *Engineer* Serves an Important Role in Encouraging High School Students to Prepare for Engineering Careers

"We are aware that good engineers must come from soundly educated students from our high schools, and that we will neither provide enough engineers nor those of highest quality unless we encourage and motivate our promising young boys in the high schools to start preparation for engineering and the sciences early in their careers," Dean F. Wendt wrote in the 1954–55 Engineering Experiment Station Annual Report.

In this issue, the *Wisconsin Engineer* once again presents a special section devoted to bringing an awareness of engineering and its opportunities to the high school students of the state. As Dean Wendt pointed out, we must encourage and motivate high school students early in their academic careers so that they may prepare themselves for engineering training in college. Although it was the custom to distribute only the High School issue to the high schools of the state, during the past two years a copy of every issue of the *Wisconsin Engineer* has been sent free to each high school in Wisconsin. In this way, the Engineer plays a part in a large and important program to encourage young people to prepare for engineering careers.

Recognition of the need for developing good potential engineers in the high schools prompted the College of Engineering, in conjunction with the Experiment Station, to establish a program ultimately aimed at finding, developing, and conserving our most important natural and intellectual resource—gifted young men and women of superior intellectual ability. This program was inaugurated in September, 1955 under the directorship of Professor C. M. Brown.

The project has proceeded with the assumption that the shortage of man-power in governmental and industrial fields of strategic importance is a result of a waste in high school of mentally superior students who are the potential leaders for all professional fields.

Prof. Brown explains that waste in high school means the failure to encourage and motivate superior students so that their intellectual gifts are never fully utilized. Such waste is assumed to be less in privileged urban areas than in smaller school systems with more restricted facilities. Thus the basic problem, according to Prof. Brown, is to devise a broad structure within which an individual high school, no matter what its size, can maintain the function of reducing and eliminating the waste of its mentally gifted students.

Preliminary findings in the initial study indicated the feasibility of setting up a plan for the selection of mentally gifted students in the first year of high school. Teaching methods, guidance, and motivation for these selected students are being geared to the findings from a pilot study now in progress. Additional phases of the identification of the selected students will be developed on each year level until aptitudes can be correlated with interests for final motivation and professional guidance.

How the plan will be applied to the individual school will become a local problem to be studied and solved in terms of immediate conditions in the school. The University of Wisconsin College of Engineering is to act as a center of information, advice, cooperation, and assistance for the high schools, but will set up no administrative policies. The college will also establish a center for scholastic data and facts on the superior students identified in the high schools.

Resources will be available, under such an organization, for supplementing and bolstering what a high school is doing for its mentally gifted students or for helping inaugurate what the school may aspire to do.

This long-range program, we think, is a logical plan for reducing the shortage of engineers and scientists. It strikes the problem at its source. Undoubtedly this program is long overdue, but we are glad to see that it has been initiated here in Wisconsin and that the Engineer plays a part in that plan. We of the staff would be happy to think that we had played a part in the solution of such a great state and national problem, and so pledge our continued support by providing the high schools of the state with copies of our magazine.

—R.A.H.

MEMORY MACHINES

by Jim Schilling, e'59

The new revolution that is taking place in technology today is completing the Industrial Revolution that started more than a century ago. First came the mechanization and electrification of brawn and now we have the mechanization and electrification of brains. And at the heart of this 20th century revolution is the electronic computer, a machine that can read and write and perform mathematical manipulations a thousand and even a million times faster than the human mind.

These electronic computers fall into one of two families, either analog or digital. Historically, it was the analog computer that came first, and the famous "mechanical brain" of Vannevar Buch at M.I.T. was of this type. In the analog computer, problems are solved by representing mathematical information as distances, voltages, or currents, and although the analog computer is satisfactory for the less complex control processes, there is a limit to its accuracy and scope. In the digital computer, however, answers are not measured, they are counted, and because of its higher refinements of calculation and versatility, the digital computer is receiving most of the attention of today's computer engineers.

In order to understand the tremendous possibilities that the digital computer seems to offer, let's first examine the way in which such a computer handles information. This is done through the use of a system that is simplicity itself, the binary number system any number can be represented by using the number 2 as a base. Expressed mathematically, we know that any positive number can be obtained from the series:

$$a_1 b^{n-1} + a_2 b^{n-2} + \ldots + a_{n-1} b^2 + a_n b^0$$

where b is the base of the system used

a is any integer such that $0 \leqq a \leqq b-1$

n is the number of terms in the series required to represent a given integer

For example, if b is allowed to equal 10, then (a) would range from 0 to 9 and we have our common decimal system. In the binary number system, then, we let b be equal to 2 and a is restricted to either 0 or 1. Using this notation, with base 2, we would represent the number 21 by using 5 terms as:

$$21 \text{ equals } 1x2^4 + 0x2^3 + 1x2^2 + 0x2^1 + 1x2^0$$

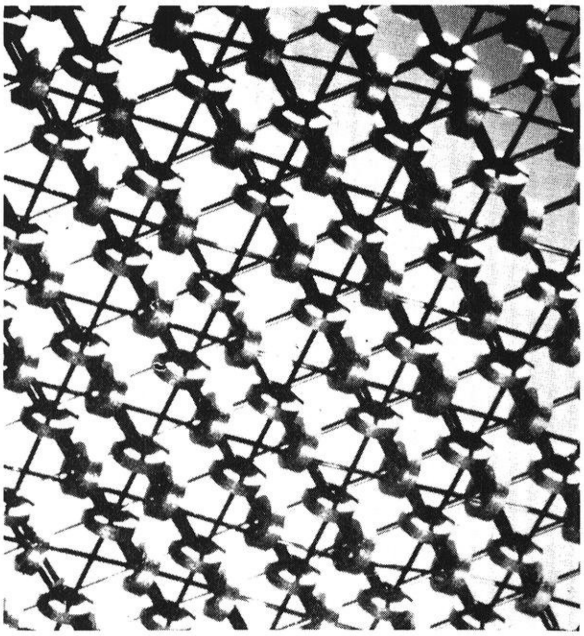
And because of the fixed exponents of our base 2, we can further simplify this notation to 10101 where the coefficient of the most significant term is placed first.

Notice that this binary system is unusually appropriate for the requirements of an electronic computer. The two symbols of 0 and 1 can be represented simply as the on or off of a vacuum tube, a transistor, or the flux density of a magnetic core, to name a few examples. With these 2 states representing the binary symbols, numbers and characters of the English language can be represented in a computer memory. Thus it takes a combination of 5 off and on symbols to represent a letter of the alphabet, and each number can be represented by an appropriate sequence of 1's and 0's.

The binary number system, then, is the method used in the digital computer to handle and process information. And that brings us to the subject of this article, the computer memory and how it utilizes the simplicity of the binary system. The memory or information storage unit is the heart of the computer and the history of computer development is mainly the history of the memory unit. This core of the digital computer serves as a storage place for both data and instructions that are fed into the machine, and it also holds completed computations until they are needed. For convenience,

—Courtesy IBM

This magnetic tape unit is one of the type that is used in the large storage memories of digital computers. A single reel of this tape has a capacity of more than 5 million characters.



—Courtesy IBM

Arrays of magnetic cores such as these are the latest and most promising development in the field of the immediate recall section of an electronic memory. These cores, each about the size of the head of a pin, can recall information in a few millionths of a second.

let's divide the various memories that are needed in a digital computer into three classes.

First of all we have the inner, high-speed memory unit that is used to store information that is in current use. This inner memory must be erasable. However, it is expensive to build a system with almost instant accessibility and therefore the high-speed memory of a computer is usually small, with perhaps a 1,500 to 6,500 English word capacity. Supplementing this system is the second class of memories, the intermediate speed. Such a memory may be a thousand times slower than its high speed partner, but it has a much larger capacity, probably fro 10,000 to 100,000 English words. This intermediate system is also erasable. The third and last class of computer memories supplements the other two with a capacity of perhaps 100 million English words. Such a memory is required for machines that must keep large files, such as the subscription lists of a magazine, but for this tremendous capacity we lose rapid erasability and must be satisfied with very slow access to data.

Of these three memory classes, the high-speed inner memory is receiving the greatest amount of attention from the computer engineer. One of the first forms developed was the vacuum-tube toggle circuit of ENIAC, the Electronic Numerical Integrator and Computer. ENIAC which was built during wartime for the Army Ordance Department, was the first modern computor. Its toggle circuits consisted of pairs of vacuum tubes connected so that when one tube of the pair was carrying current, the other could not. Then when a circuit receives another current pulse, the toggle reverses, and the tube that admitted current is closed, and the other opened. This represents the familiar on-off state that is so convenient for electronic computers. However, the ENAIC took 100 such double circuits to spell out a 10-digit number, and its inner memory was only equivalent to 27 English words. For this and other reasons, nothing exactly like the ENIAC computer will ever be built again.

The limitations of the vacuum-tube toggle circuit forced engineers to find other ways of providing a high-speed memory system for computers. One of the first was the mercury memory, which came out of wartime radar. Here information is stored in a tube of mercury by first converting electrical pulses representing information into sound waves, and then cycling it thru the mercury. A quartz crystal at one end of the mercury tube converts the pulse to slow-moving sound waves and a similar crystal at the receiving end converts the pulse back to electricity. Because of the slowness of sound waves, a mercury delay tank with a 18 inch path allows the storage of about 1,345 information pulses, each spaced ¼ of a micro-second apart. (this is for mercury at a temperature of 65 degrees.) These pulses are recirculated indefinitely through the mercury tube until an electronic gate opens and switches the signal to some other circuit.

Several of the earlier well-known UNIVAC computers used this type of inner memory, and by using 100 mercury tubes, had a capacity of 2,800 English words. However, the mercury-delay system lacks one of the most important inner-memory requirements, instant accessibility. The signals are not available to the computer while they are cycling through the mercury as sound waves, and not until the desired pulse has reached the receiving crystal and is converted to an electrical pulse again, can the calculations continue. The average delay that this restriction causes is about half of the total time that it takes for the pulse to travel through the mercury. In the case mentioned this is about 115 mircoseconds, which is a long time for a computer.

After exploring the possibilities of the mercury-delay tank, computer designers turned to a new type of high-speed memory based on the cathode-ray tube. Here information is stored in the forms of dots of charge on the cathode-ray screen produced by the tube's electron beam. The "dot" information is read off the screen by directing another beam of electrons to the wanted information and noting where the electron emission of the screen produces signal pulses. This pulse represents a charged dot of information, and it takes only about 12 to 20 micro-seconds for the dot to be noted and used in the computer's calculations. One such cathode-ray memory that was built had 40 tubes with a pattern on each screen that was 32 by 32 dots square. This gave a memory of about 1,350 English words and should have been very serviceable. However, the tubes were so delicate that it was almost impossible to keep the memory system in working order.

One of the most promising high-speed devices being studied today uses tiny rings of magnetic material, called magnetic cores. These cores are toroidal and are made of ferrites such as powdered manganese or nickel-zinc ferrite powder. Each is coiled so it can receive a desired current pulse and resultant flux density, B. These cores store information through the direction of their magnetic flux density. Thus when a core is magnetized in one direction, it represents O, and magnetized in the opposite direction, it represents 1. To understand the action of these new ferrite cores, we must first look at the regularity of their hysteresis loop. In such a core, with the loop on a standard B versus H plot, we assume that the core is intially at the H equals O state, which gives a residual —B value that we will call B_r. Then when a plus pulse of current is passed thru the core, the flux density B will rise and H will also rise as the current forces the core to the peak of its hysteresis loop, at a point where H and B have their maximum value. Then when the current is removed, the flux density will fall back to H equals O again, but this time at a residual value of plus B that we will call $+B_r$. In this condition a 1 is said to be stored in the core. Now we can change this state of the core by applying a negative pulse of current through the core winding that will cause H and B to fall, this time to their negative maximum values, instead of their plus maximum values. Again if we remove the pulse of current, H will return to O and B will again be at a negative B_r. This condition represents a O stored in the core, Note that in this state, no amount of negative current can change the coil's message. It is O until a plus current is passed thru the core winding.

In the actual high-speed magnetic memories of this type, there are two windings on each magnetic core. One winding receives the current that stores either a 1 or a O in the core, and this same pulse of current induces a signal voltage in the other core winding. This voltage is induced because of the large rate of change of flux that occurs through the flow of the current pulse. This is:

$$e = -\frac{Nd\phi}{dt}$$

where e is the voltage induced in the coil

N is the number of turns in the coil

ϕ is the flux in each turn in webers

This voltage e then signals the computer circuit that a 1 or a O has been stored.

It can now be seen how useful such a system of cores can be as a memory device. Suppose that a sequence of plus and minus pulses are read into a line of cores to represent a number, such a 10101 which represents 21. These digits will remain stored in the core until the information is needed. Then a negative pulse of current is applied though the core windings and all the 1's will switch to O's but the O's will not be changed. Wherever such a switch took place, a voltage e will be induced in the signal coil of the core. Note that in the coils where a O was already stored, no switch took place and hence no e was induced. Thus a pattern of currents will flow from the memory that is identical to the pattern that was originally stored. This information can now be used by the computer in its calculations.

The magnetic core memory system uses an array of these tiny cores that are arranged in rows and columns to form memory banks. Because of their reliability and strong signal voltages, this type of memory looks very promising for the high-speed systems of digital computers. Remington Rand currently uses this type of inner memory in their new UNIVAC computers. Such a memory has a capacity of 2,000 English words and a total access time of 40 micro seconds.

(Continued on page 66)

—Courtesy IBM

Magnetic drums of this type are receiving the most attention as intermediate speed memories for computers. Data is recorded and stored on the drum surface in the form of magnetized spots, and recall takes place at the rate of 25,000 characters per second. These particular drums each have a capacity of 60,000 characters.

—Courtesy Remington Rand

This Univac computer uses the mercury tube type memory in its immediate recall section. Here information is stored for instantaneous access.

Sound and the Motion Picture

by Richard J. Quentmeyer, m'56

During the late 1880's engineers and scientists set out to find a means of making motion pictures. Up to this time still pictures were the only means of capturing life.

One method of producing motion pictures was to put pictures on movable glass plates which proved to be futile because the high speeds at which the plates would be required to move would break the glass. Another method was that of putting pictures on semi-transparent rolls of paper. This method also proved to be of little value, for not enough light could be projected through the paper to produce a picture on a screen.

In 1898 George Eastman developed the process of photographing pictures on celluloid film. Upon hearing this, Thomas Edison obtained a strip of film and invented the first motion picture projector which he called the Kinetoscope. The machine was nothing more than a box into which one looked through a peep-hole and saw moving pictures by turning a crank. This marked the beginning of motion pictures.

The invention of the Kinetoscope induced Edison to attach his phonograph to the machine so that one could hear music while viewing the moving pictures inside. Since the phonograph required the use of earphones, and only one person could view the Kinetoscope at a time, the machine was abandoned.

In 1898 Edison invented what he called the Cameraphone. This was a motion picture projector that could project the pictures on a screen. To this Edison attached his phonograph by means of a belt in an attempt to synchronize the sound with the picture. The machine was put into commercial use in 1913, but it was so crude that it was soon abandoned by the public.

Although little was heard about sound movies by the public from 1906 to 1926, except for Edison's Cameraphone which was abandoned almost as soon as it was put into commercial use, great progress was made by scientists and engineers in the perfection of sound movies.

Early motion picture cameras and projectors were operated by means of a hand crank which caused the motion picture to be jerky. The hand cranks were replaced by electric motors which made it possible to photograph and project pictures at a constant speed.

Another problem which confronted engineers was that of amplifying sound so that an entire theater audience could hear the sound accompanying a movie. This problem was solved in 1907 by Dr. Lee Forest who invented the vacuum amplifying tube.

In 1921 the Bell Telephone Company, General Electric Company, and the American Telephone and Telegraph Company joined in the development of sound movies using all the principles of the radio, telephone and telegraph.

Another major development came in 1922 when Theodore Case and Earl Sponable developed the AEO tube, which we know as the photo-electric cell, while working on substances extremely sensitive to light. They discovered that sound vibrations could be picked up by the AEO tube and converted to light variations which could be photographed on film.

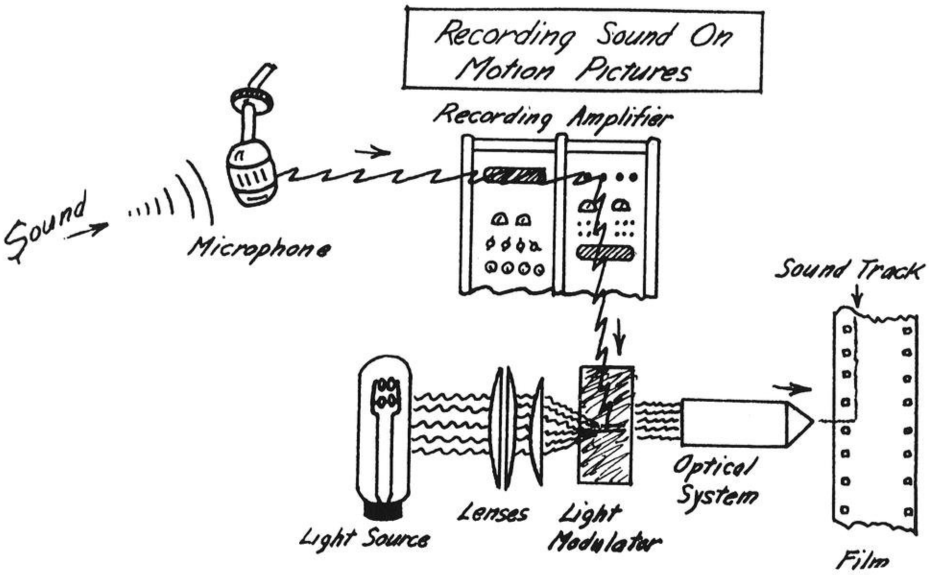


Fig. 1.

The First Successful Sound Movie

In 1926 Warner Brother's Pictures made the first successful sound movie. They had a machine called the Vitaphone, which they were licensed to use by the Western Electric Company. This machine consisted of phonograph records which accompanied the picture. The records were made to synchronize perfectly with the movie projector and were made at a very slow speed so that there was enough sound on one record to accompany one reel of film. The method was eventually done away with because the records required too much handling to be shipped with the film. Also, the records were breakable which made them impractical to use.

After the invention of the AEO tube, a means of recording the sound directly on the film was developed. In January of 1927 the Fox Film Corporation used this method to make their first sound movie. The method proved to be so superior to any other method of combining sound and motion pictures that it is still used today.

The recording of the sound on film was also superior to the disc method in that sounds could be recorded in greater frequency ranges on film. The disc method allowed the recording of frequencies ranging from 100 to 4000 cycles per second, but with the use of sound-on-film recordings, the recording frequencies ranged from 100 to 6000 cycles per second, which made any audible sound recordable.

The Recording of Sound on Film

The recording of sound on film is done as follows: "The voice of an actor or singer before the camera is picked up by a microphone, a highly sensitive development of the telephone receiver. This sets up a delicate, fluctuating current, the waves of which correspond to the vibrations of the diaphragm setting them up. These currents are amplified by tubes, and the resulting amplified, fluttering current carried to the recording machine. Here it passes through a light-valve, composed of two thin metallic ribbons operating in a magnetic field, with a space between them through which a beam of light passes. A moving photographic film passes before this slit, and the tiny strip of light that falls on it is widened or narrowed as the ribbons vibrate to the electrical impulses of the coil, thus opening or closing the slit. Developed, this film now carries a strip of exposed surface, in alternating dark and light spaces, according to the light admitted through the variations of the valve. In the "movietone" process these striations are horizontal, and are called "variable density" striations, because of their different densities or transmissions. In the Photophone process the light modulating device flutters in a horizontal direction, exposing the moving strip from one side, thus giving a series of "hills and valleys" on black and white along the edge of the sound track. This is known as the "variable area" track.

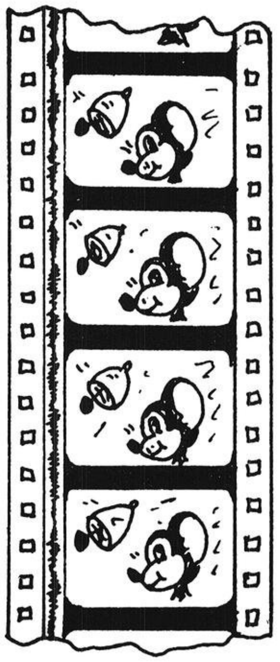


Fig. 2.

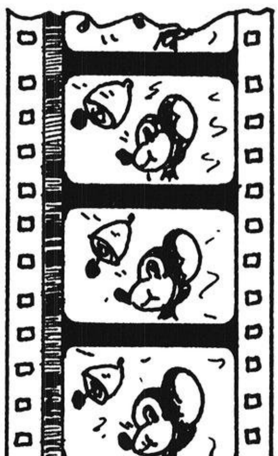


Fig. 3.

Fig. 4.

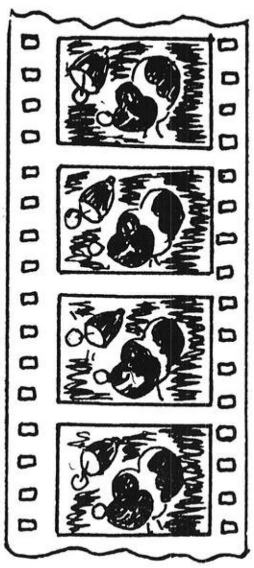


Fig. 5.

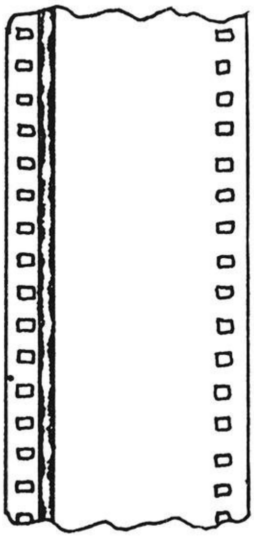


Fig. 6.

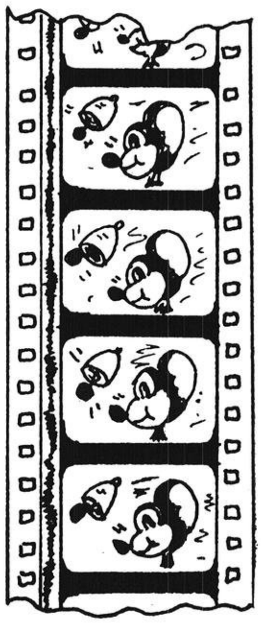


Figure 1 shows how sound is recorded on film. Figures 2 and 3 show the difference between a variable density and variable area sound track.

During the filming of a scene, the camera and sound recorder operate independently of each other. The recorder contains negative film which travels through the machine at a rate of 90 feet per minute. After the film is developed, it is a negative film containing only the sound track along one edge of the film. Likewise, the film in the motion picture is also negative. When this film is developed, only the picture is contained on the film. Figure 4 shows a developed negative film, while figure 5 shows the developed negative sound film.

Different Types of Sound Films

There are three different sound tracks made for each movie. The only sound that is recorded at the same time that the picture is photographed is that of the dialogue. This is done to insure absolute synchronization of the lips of the actors with the sound on the film. A second sound track contains the sound effects. These are such sounds as doors closing, firing of guns, ringing of bells, etc.; they are added after the movie has been photographed. As a rule, realistic sounds can be made by artificial ways just as well as using the real sound. A third sound track contains the musical accompaniment which is also made after the movie has been photographed. This allows the recording engineer to mix the music with the dialogue as he sees fit. Another reason that the musical score is added later is that it would be impractical to have a recording orchestra on the picture set while photographing the action.

Slow motion sound movies were made possible by the use of the independent sound recorder. Slow motion pictures must be photographed at double the normal speed of 90 feet per minute; then when the projector is operated at normal speed, the action appears just half its original speed. For this reason, the sound track must be added to the film after the photography has been completed.

Combining the Sound Tracks and the Picture Films

After the sound effects, dialogue, and music sound tracks are recorded, they must be combined in the cutting room. In the cutting room the sound and picture films are cut, changed around, and rechanged to whatever position the recording engineer desires. The picture and sound films are on negative film up to this point.

In order to synchronize the final sound track with the picture film, a "clapper" boy will have been employed during the photographing of the picture and the recording of the dialogue. The clapper is made of two pieces of wood hinged at one end. When the photographing of a scene starts, the clapper is banged together in front of the camera. By observing when the clapper is closed, on the developed film, and by observing the distinct mark made on the sound film by the clapper, the picture and sound films can be accurately combined in the cutting room. Since the picture head on the projector is above the sound head, the sound track is placed nineteen and one-half frames ahead of the picture to insure the synchronization of the sound and the picture.

After the negative sound and picture films are combined on one film, a final positive print is made. Figure 6 shows a final positive picture film with the sound track along the left side.

Producing the Sound from the Picture Film

The producing of the sound from the sound track is just the reverse of the recording process. An exciter lamp in the sound head of the projector focuses a narrow strip of light on the sound track of the film as it passes through the projector. The variations or densities of light which are caused by the irregularity of the sound track are picked up by a photo-electric cell which converts the light variations into electrical impulses. These impulses are amplified and converted to the original sound. Figure 7 shows the process of producing sound from motion pictures.

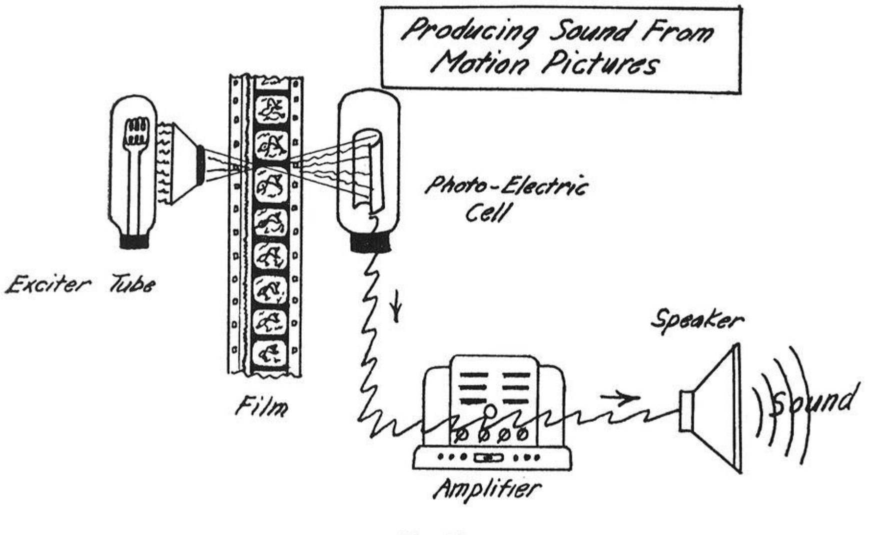
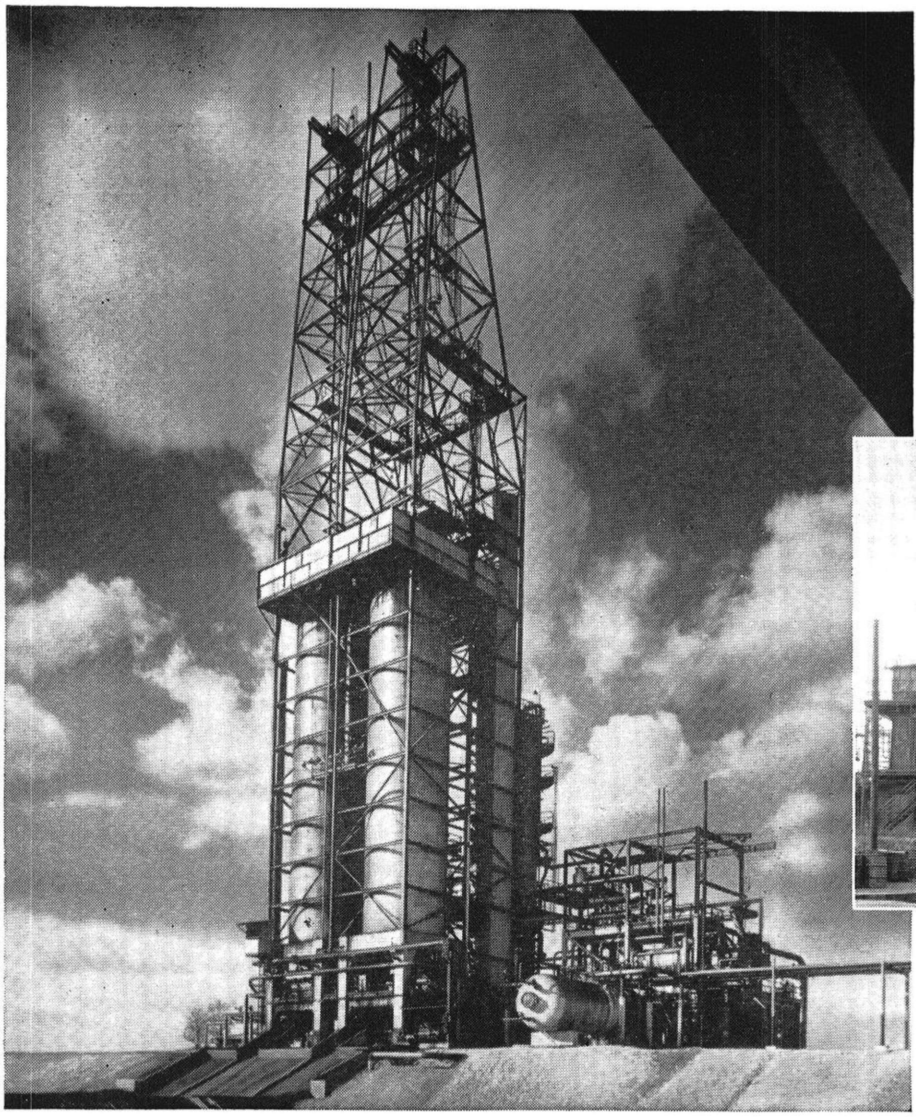


Fig. 7.

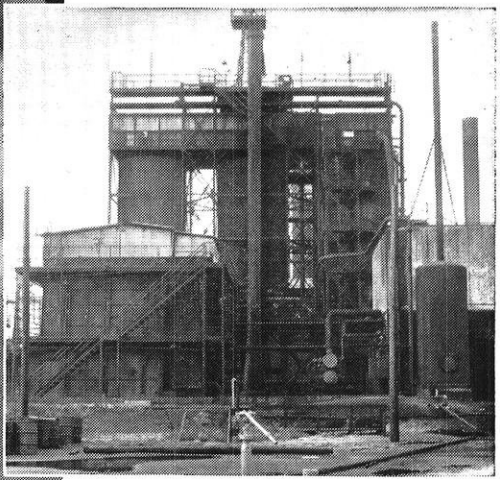
The Coming of Cinemascope

The coming of Cinemascope has brought many changes in sound equipment cameras, lenses, and screens; also the addition of more than one sound track on a film, but the recording of sound on film is essentially the same today as it was back in 1927 when the Fox Film Corporation made its first sound movie by recording the sound directly on the film.

END



This towering modern unit at the El Dorado, Ark., refinery of Pan-Am Southern Corporation, a Standard Oil subsidiary, produces 700 tons of coke daily.



Standard's original delayed coking unit at Whiting recently celebrated its 25th birthday "on stream" and going strong.

How to make an exception prove a rule

TECHNOLOGICAL PROGRESS is rapid in the petroleum industry. Few processes have a chance to "grow old" on the job. Most are killed off through the combined efforts of thousands of scientists working constantly to improve everything we do, make or use in our business.

Every now and then, though, we experience a happy exception to this rule. That occurs when a new development not only meets the immediate need but also provides the right answer to situations yet unforeseen.

Twenty-five years ago last August a process known as "delayed coking" was invented. The new process made a quicker, cleaner job of converting heavy residual oil into gasoline, gas oil, and coke. It paid off spectacularly when catalytic cracking was invented and these giant new units began calling for feed. It paid off again when the diesel locomotive came along to put the heavy oil burning steam locomotive out of business.

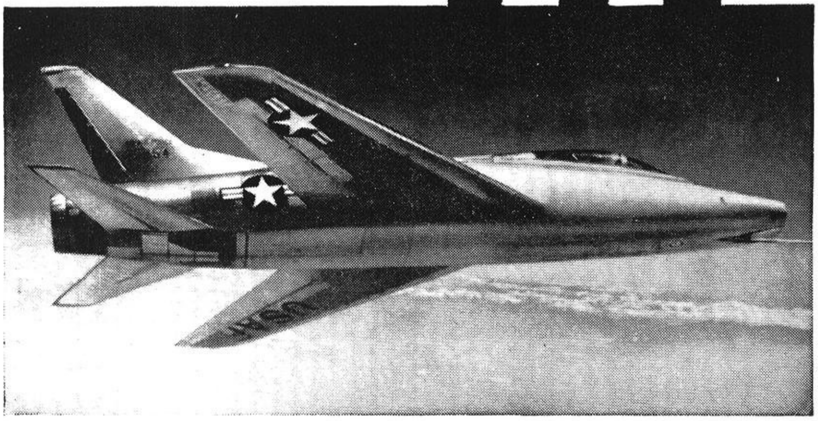
Dr. Robert E. Wilson, chairman of the board of Standard Oil today, was the inventor of delayed coking. Almost all of the young scientists who worked with him in its development are still with Standard too, in responsible positions requiring their special skills.

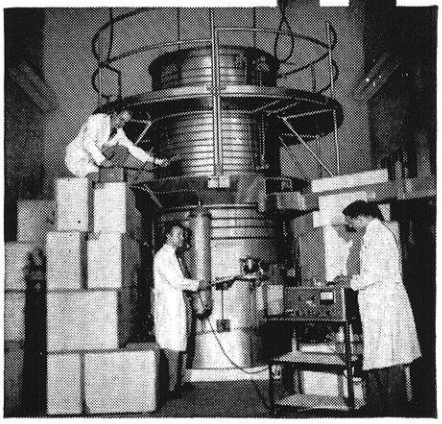
Young scientists in research and engineering at Standard Oil today find it satisfying to see their creative efforts translated into valuable product and process improvements.

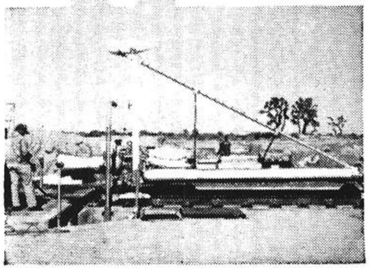
Standard Oil Company

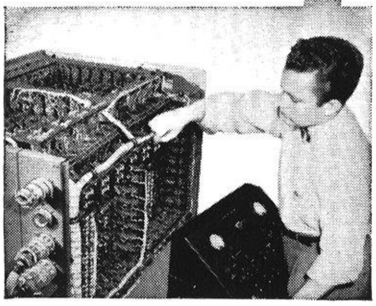
STANDARD

910 South Michigan Avenue, Chicago 80, Illinois









AIRPLANE DE-ICING

by Robert Karlson, m'56

Ever since there have been airplanes flying, the problem of ice formation on the surface of the airplane has been prevalent. In the early days of flying, instead of having devices for ice prevention or control, pilots wouldn't fly during a period when ice would form. The time came, however, when it became necessary for planes to operate in all types of weather. Air transportation could not be stopped for a long period, and the need for constant air defense was acute. For this reason, solution of the ice prevention and control problem was badly needed.

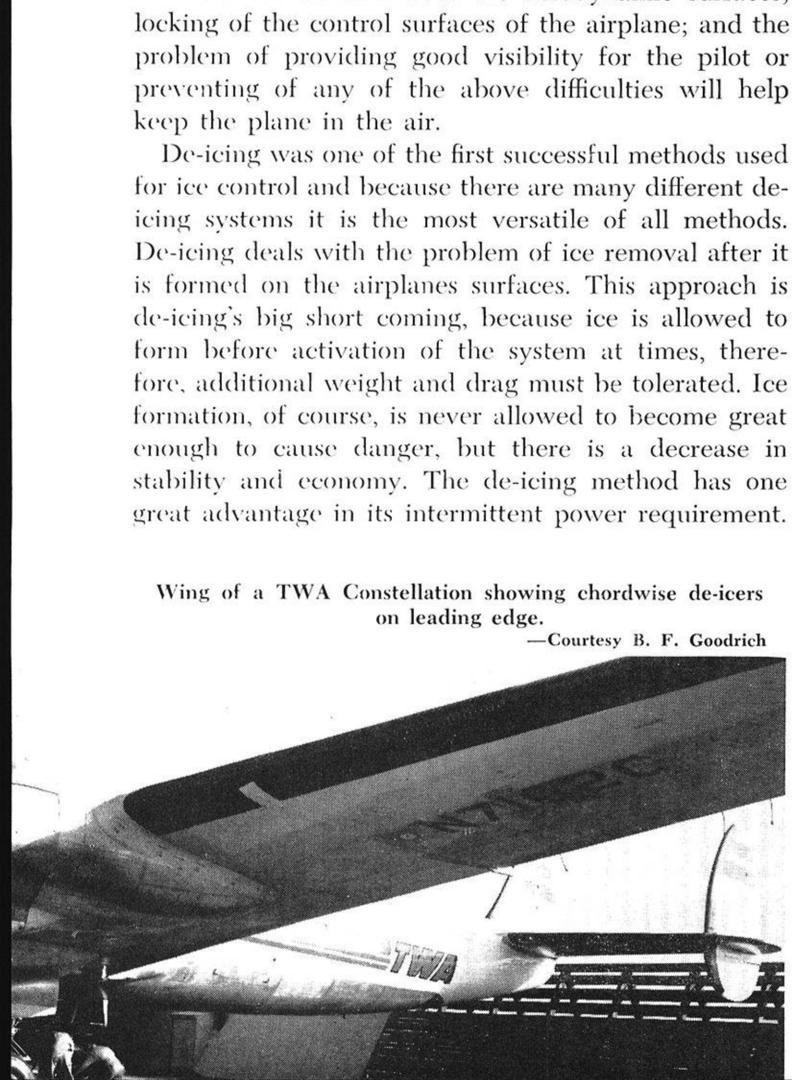
Since the beginning of the development of ice control, there have been many devices used, some that have proved themselves and some that have been discarded.

This article will not attempt to cover all the methods, but only the few that are still used or the ones that show promise for use on airplanes of the future.

The formation of ice on air foils causes many problems in flight, including: greater fuel consumption caused by the additional weight and drag of the ice; distortion of air flow over the aerodynamic surfaces; locking of the control surfaces of the airplane; and the problem of providing good visibility for the pilot or preventing of any of the above difficulties will help keep the plane in the air.

De-icing was one of the first successful methods used for ice control and because there are many different de-icing systems it is the most versatile of all methods. De-icing deals with the problem of ice removal after it is formed on the airplanes surfaces. This approach is de-icing's big short coming, because ice is allowed to form before activation of the system at times, therefore, additional weight and drag must be tolerated. Ice formation, of course, is never allowed to become great enough to cause danger, but there is a decrease in stability and economy. The de-icing method has one great advantage in its intermittent power requirement. The equipment can, therefore, be smaller and less expensive to operate.

Wing of a TWA Constellation showing chordwise de-icers on leading edge.
—Courtesy B. F. Goodrich



Inflatable Rubber Boots

The use of inflatable rubber boots on the leading edges is probably the best of the de-icing systems. These boots when installed on the airplane, closely approximate the aerodynamic shape of the foil. When it is necessary to use them, because of ice formation, the boots are expanded by compressed gases and crack the bond formed by the ice. The ice is then removed by the air stream passing over the surfaces of the airplane. The system is relatively high in maintenance costs because of deterioration of the rubber boots.

Twenty years ago Dr. W. C. Greer, at that time vice-president in charge of research for the B. F. Goodrich Company, invented the inflatable rubber boot and it has been in service ever since. Since that time, of course, alterations and improvements have been made. It is the standard method of de-icing used on many modern military and commercial airplanes. The B. F. Goodrich de-icer is made up of a sheet of stainless steel to which is cemented a two ply rubber layer. The rubber is provided with a series of inflatable cells made up of highly stretchable rubber coated nylon. The inflatable rubber cells are arranged lengthwise in an attempt to insure smooth exterior surfaces. The cells are expanded with cool low pressure air for de-icing. The expansion is controlled by either centrally located distributor valves or selenoid operated valves. In the standard three tube system, air is first admitted to the center tube and as it undergoes deflation, the two outside tubes are expanded. This method gives a pulsating action, that breaks the bond of ice, allowing the air stream to remove it. The cycle is not continuous because time is allowed for the formation of ice.

This de-icing system is installed on the leading edges of the wings and tail and usually has a cyclic operation to keep the compressed air demand to a mimimum. The boots are screwed or riveted to the airplane. Research in the field of de-icer boots is keeping pace with the new design and requirements of high speed airplanes.

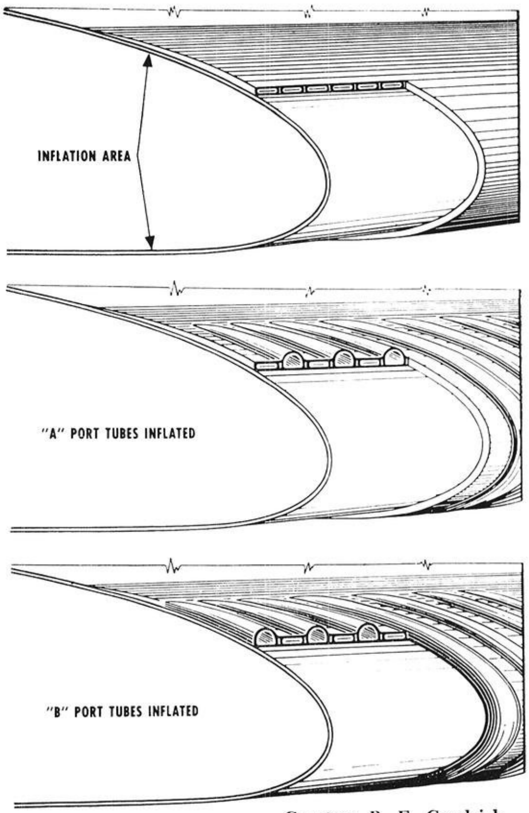
Other De-Icing Systems

One of the other systems for de-icing is by the intermittent application of heat obtained from some external source and brought to the wings by ducts or wires. This method allows build up of an ice coating before it is activated. The total amount of energy used is small in comparison with continuous heating of the air foils used in the anti-icing systems. By dividing the sections to be de-iced evenly, it is not necessary to activate the whole system at one time. The power load needed at any one time is, therefore, minimum.

In this system the ice is heated forming a film of water between the surface of the airplane and the ice, thus, breaking the bond. Extreme care must be taken to be certain there is a great enough bulk of ice for aerodynamic and centrifugal forces to act on for the job of removal. Once the ice is removed rapid cooling must take place to prevent the water from running back on the unheated surface and refreezing.

Propellors, are almost always electrically de-iced. It would be impossible to have heating ducts extending into the propellors and it would be very difficult to have inflatable boots on the propellor blades. The blades usually have electrical heating elements and power is transmitted to these elements by slip rings on the propellor hub. The heating elements are not extended to the ends of the blades because of danger from stone abrasion and corrosion.

A fully automatic de-icing system control is possible with the orifice-type ice detector. This detector will maintain heat in the secton as long as ice is present.



—Courtesy B. F. Goodrich

Chordwise De-Icers

New Systems of De-Icing

The Lockheed Aircraft Corporation has devised a new metal and plastic sheet that is electrically heated for ice removal. It is used on the leading edge of wing and tail assemblies of the Lockheed, F-94 Starfire. Advantages claimed for this de-icer boot are: aerodynamically clean which is necessary for high speeds; very rapid response to heating current; uniform temperature distribution on the surfaces; and it cuts off water run-back preventing refreezing on unheated surfaces.

The Lockheed boot is a silver copper-plastic sandwich bonded to an aluminum alloy base. AC current is used and the boot operates on forty watts. Heating power is applied for two second periods at one and a half minute intervals at the time when icing conditions are present and is capable of an output of seventy-five watts for emergencies. The momentary application of heat breaks the bond of ice that is then removed by the air stream. Lockheed's present design is primarily used on military airplanes, but could easily be adapted for commercial use.

Patterson Products of Detroit, Michigan has a new system for de-icing which employs the use of high pressure jets of air and non-freezing liquids, sprayed against the air foils and windows. This system has the additional possibility of being used for removing rain water by using air in the jets alone.

The jets are spaced along the leading edges of the wing and tail surfaces and along the bottoms of windows, and are spaced closely to insure adequate coverage of these surfaces. They are mounted in revolving heads that rotate at 108 r.p.m. and because there are six jets in each head, this means the solution of air and non-freezing fluid will cover surfaces to be de-iced 648 times a minute.

The unit is relatively lightweight and is reported to be effective on heavy formations of ice. At present, the de-icing fluid jets are being tested by the Air Force.

Anti-Icing

A system used to keep windows clear of ice is tin plating the windshields. This system has been suggested by the British National Physical Laboratory. A film of tin is used for conduction of electric current and has a resistance high enough to cause enough heat to warm the outside of the glass. The impairment of visibility is slight. Application of this system is easily accomplished by methods that are already known by industry.

Anti-icing, the newest approach toward ice control, prevents any ice formation at all. In general, this is accomplished by continuous heating of the air foils with electrically supplied heat or heat from hot air. The anti-icing system has the great advantage of clean aerodynamic surfaces at all times. With this type of system, momentary additions of weight and drag are eliminated. There is no problem of a large accumulation of ice, making this is a truly all-weather system. The big disadvantage is that too much continuous power is necessary to keep surfaces clear of ice. This results in robbing of engine output and reduction of available power for flight.

In most anti-icing systems for propellor driven airplanes, heat is supplied by electric power. This is

(Continued on page 64)

STEAM POWERED AUTOMOBILES

by John Lohrey, m'56

Steam powered vehicles in general have many inherent qualities which make them very desirable for use on the highways. They are silent; a quality that can only be appreciated by those who have been awakened in the wee hours by some large diesel truck roaring down the street. They are economical to operate as they use low cost fuel oil. Since a cross head is used to take up the side thrust of the connecting rod, the cylinders wear slowly. Slower engine speed also contributes to long engine life. Steam power is very smooth—there is no explosion as in the internal combustion engine; this means less wear on the bearings. The engine is geared directly to the rear axle, giving a low center of gravity and more weight on the rear wheels where it belongs; both advantages the gasoline auto cannot claim. Using a non-volatile fuel eliminates vapor lock and greatly reduces the danger of fire and explosion.

The chief limitations are that it takes some time for the boiler to build up pressure, and the car requires more care and attention than the gas engine car.

An understanding of the construction and operation of early steam autos is not only interesting but brings out the problems, the advantages and disadvantages of using steam. Over eighty different makes of steamers were on the American market at one time or another; two or three of these will be considered in some detail.

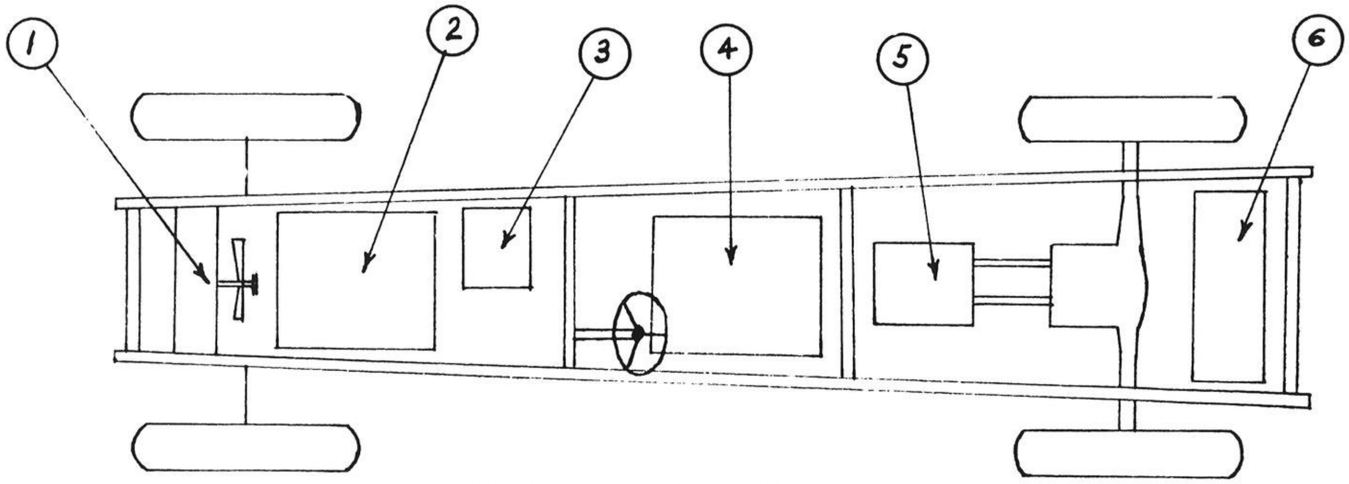
The American Steam Car

The car built by the American Steam Automobile Company used an all welded steel water tube boiler. This was a sturdy affair and even withstood efforts to operate it without water. It had provisions for cleaning out scale which might collect, and was easily blown down (drained to remove dirt and oil that accumulated. The feedwater was automatically regulated. It had a large steam capacity so that extra power was instantly available when needed.

The engine had two cylinders, each with four inch bore and five inch stroke. It was of the single expansion, D-slide valve, double acting type. Although it was throttle governed, the valve cut-off could be changed to give greater economy for normal driving conditions or more power when needed.

Starting the car was complicated, and took several minutes for pressure to build up. First the water level in the boiler had to be checked, and then a drain valve had to be opened in the steam chest for steam which condensed in the cold engine to drain off. Finally the

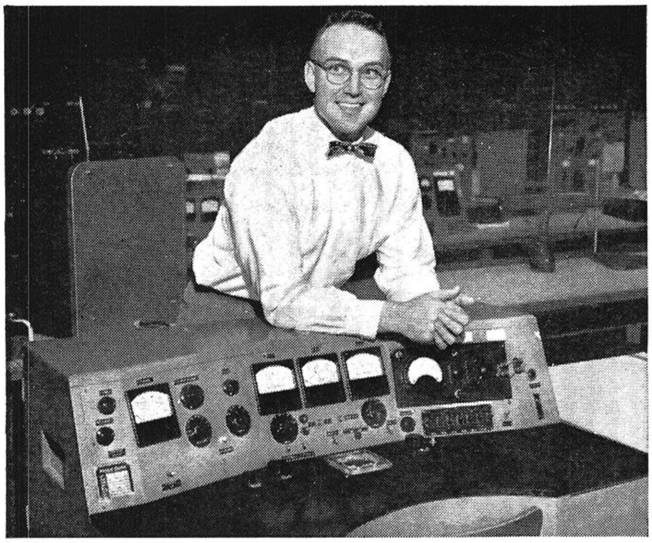
(Continued on page 62)



CHASSIS OF A TYPICAL STEAM CAR

1. Condenser and fan.
2. Boiler.
3. Generator, fuel and water pumps.
4. Water tank.
5. Engine.
6. Fuel tank.

Young engineers making news at Western Electric



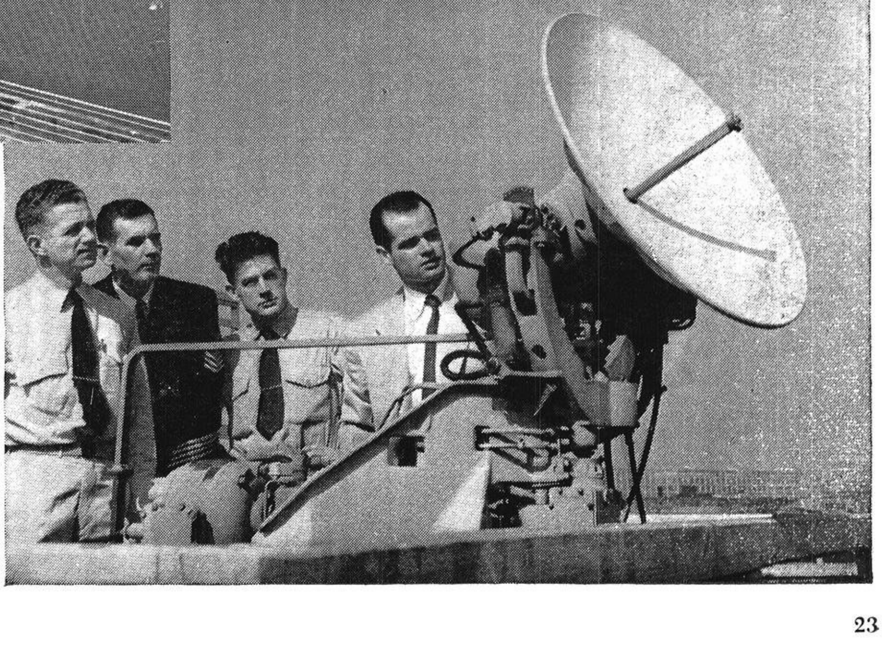
Richard C. Shafer, B.S. in mechanical engineering at Lehigh, was one of 16 engineers assigned to one of Western Electric's toughest post-war projects — developing manufacturing techniques for mass-producing *(with great precision!)* the tiny but amazing transistors which are already causing a revolution in electronics.

Western Electric's primary job — which goes 'way back to 1882 — is to make good telephone equipment that helps Bell telephone companies provide good service. It's a very big job — and a very important one — which calls for the pooling of varied types of engineering skills.

New manufacturing processes and methods are constantly required to produce better telephones, better central office equipment, better wires and cables, new types of electronic equipment to keep pace with the nation's ever-growing need for more and better telephone service at low cost.

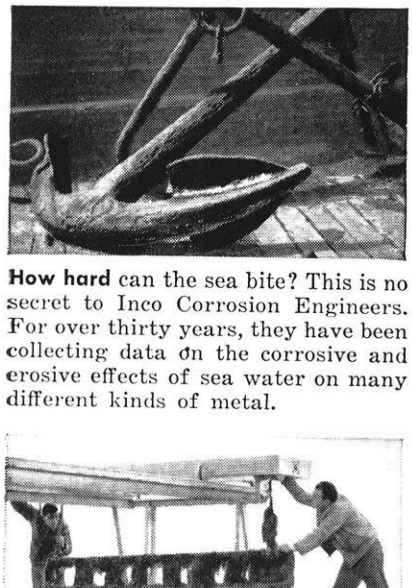
In addition to doing our job as manufacturing unit of the Bell Telephone System, Western Electric is busy producing many types of electronic equipment for the Armed Forces. Here again, young engineers of varied training are doing important work in connection with the manufacture of radar fire control systems, guided missile systems and special military communications systems.

Paul J. Gebhard, B.S. M.E. at the University of Maryland, was one of a team that helped develop Western's new electroforming process for coating steel telephone wire with copper, lead and brass in one continuous operation. His job: to develop conductor resistance-annealing equipment and electrolyte filtration and circulating systems.

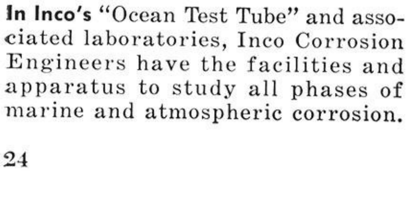


Bobby L. Pettit (at right), an E.E. from Texas A. & M., is one of several hundred members of Western Electric's Field Engineering Force. These F.E.F. men can be found all over the world — working most closely with the Army, Navy and Air Force — advising on the installation, operation and maintenance of complex electronic equipment made by W.E.

Ocean Laboratory—here at its big Kure Beach, N. C., Testing Station, Inco exposes thousands of metal specimens to the corrosive effects of salt spray, salt air, salt water.



How hard can the sea bite? This is no secret to Inco Corrosion Engineers. For over thirty years, they have been collecting data on the corrosive and erosive effects of sea water on many different kinds of metal.



In Inco's "Ocean Test Tube" and associated laboratories, Inco Corrosion Engineers have the facilities and apparatus to study all phases of marine and atmospheric corrosion.

How International Nickel finds out what the wild waves are saying

The sea's a killer of many metals. Some it corrodes or rusts. Some it wears away. Some it destroys by eating up one of the alloying elements. Some it makes so "allergic" to connecting metals that corrosion is speeded up.

To hunt this killer down, International Nickel has made the ocean into a test tube. At Harbor Island and Kure Beach, North Carolina. Here, Inco Corrosion Engineers study the corrosive effects of salt water, salt spray, salt air, water velocity, marine growths, coupling methods.

To help you plan Inco Nickel into your future, International Nickel Company has collected data from almost a quarter of a million individual tests on the behavior of metals and various other materials under all sorts of corrosive conditions.

"Corrosion in Action" is an Inco-prepared film in full color. It shows how corrosion acts and how it can be controlled. Prints loaned to engineering classes and student technical societies. Write, The International Nickel Company, Inc., Dept. 126e, New York 5, N. Y.

INCO TRADE MARK **International Nickel**

Producer of Inco Nickel, Nickel Alloys, Copper, Cobalt, Tellurium, Selenium and Platinum, Palladium and Other Precious Metals

SCIENCE HIGHLIGHTS

edited by Ted Witzel, e'57

GAS TURBINES PUMP GAS

Three hundred million cubic feet of gas will be pumped back into the earth daily by the most powerful concentration of gas turbines in the world. Built by the Westinghouse Electric Corporation, twelve 8000-hp combustion gas turbines with a total maximum rating of 96,000 hp will be installed seven miles out on Lake Maracaibo, Venezuela, on a platform 440-ft long, 131-ft wide, mounted on concrete piling in 80 feet of water. They will drive centrifugal compressors which will inject natural gas, derived from oil operations, under high pressure into the oil field that is under Lake Maracaibo and the surrounding area. The gas conservation plant will recover substantial quantities of additional petroleum and conserve large quantities of gas, in fact, 120 percent more than its earlier counterpart in the same area.

Eight of the units will be direct connected to the centrifugal compressor, four will be geared. The twelve turbines will operate in two strings of six units each.

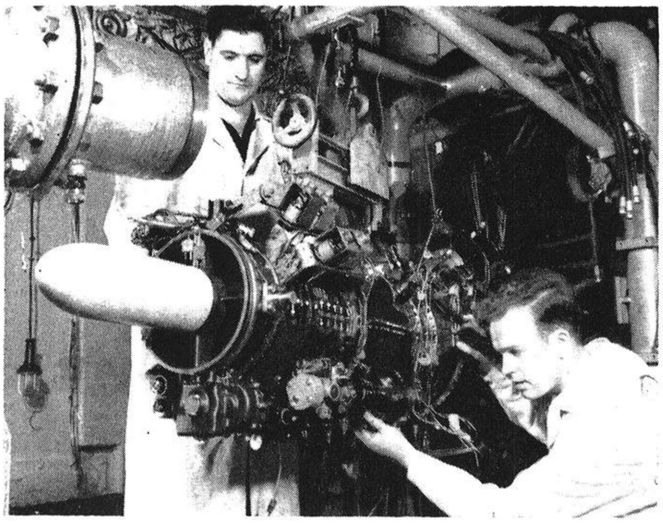
WANDERING TROLLEY TRUCKS

Powered by railroad-type electric traction motors, the unique trucks will receive current from overhead wires through a pair of trolleys—just like a regular trolley coach or street car. The big difference is that the trucks will be equipped with a cable reel so that it can "wander" away from the overhead wire zone and operate as easily as a conventional self-propelled truck.

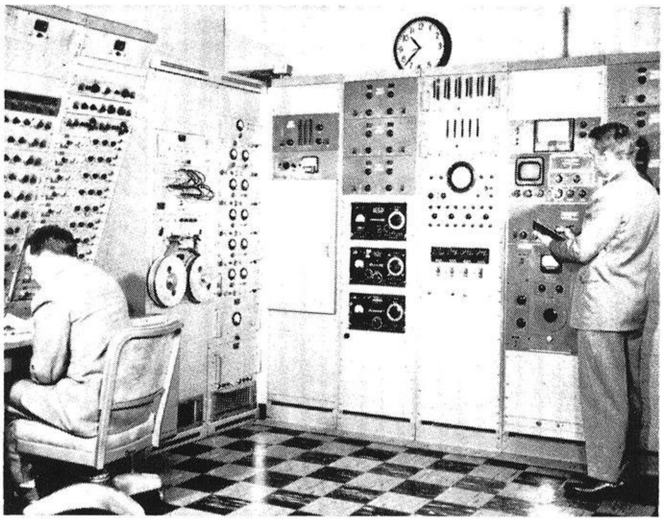
In addition to this flexibility, the big advantage to the electric trucks is cost. It is estimated that the electric vehicles will save approximately $15,000 a year over diesel-powered equipment. This includes amortization and interest charges for the necessary substation and trolley line installations.

The four electric vehicles are being built for the Riverside Cement Company, Riverside, Calif. They will be used to haul limestone from an underground mine to the crusher on the surface.

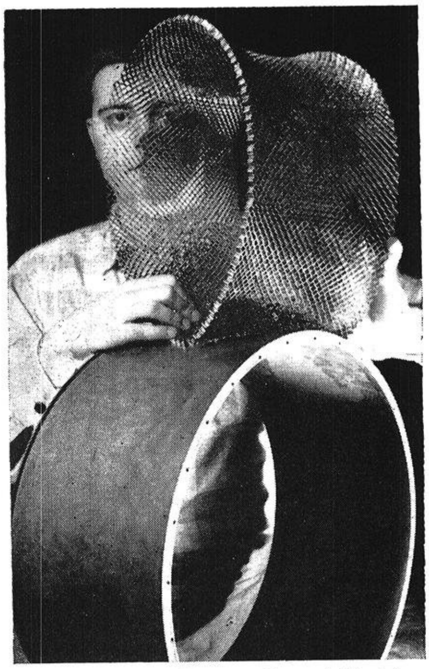
When placed in operation, the 30-ton capacity vehicles will haul the limestone for nearly a mile. Four thousand feet of this distance is underground with a 10 per cent grade to the surface.



Gas turbine for 'copters—In advanced stages of development is General Electric's T58 small gas turbine engine. Developed for the Navy to power helicopters the baby engine, despite its small size and light weight, is rated in the 1000 hp class. Company engineers state it has exceptional torque-speed characteristics and great flexibility in selection of rotor speed because it is designed with a free power turbine. A T58-powered helicopter is expected to stay aloft 50 percent longer than a comparable one with a piston engine, and carry 100 percent more payload.



Data digester—This new magnetic tape recording and data reduction system is being used by General Electric engineers at the Company's Evendale, Ohio jet engine plant to perfect designs of advanced propulsion systems. Total recall of data is done with magnetic tape, and reduction and analysis is effected electronically. Designed and built by GE, the system allows for multiple channels of data such as stress, vibration, pressure, temperature, speed, and flow to be recorded simultaneously at a test site. Reduction is also performed in multiple channels.



—Courtesy General Electric

JET BEE-HIVE

This honeycomb will be used as the core of future jet engine parts. The result of new alloys and brazing techniques is a "honeycomb sandwich" which is a good insulator, can withstand temperatures of 1800 to 1900 degrees Fahrenheit, and is almost 80 percent lighter than solid structural members. The "sandwich" part, brazed at extremely high temperatures, is composed of a stainless steel skin .010 inch thick with a honeycomb core one-quarter inch thick.

FROZEN FOODS FOR THE ARABIAN DESERT

It is now possible for a person in the middle of the Arabian Desert to open a box of frozen strawberries at 0°F and allow it to thaw in the 125°F ambient heat, timing it so that he has chilled fruit for his eating enjoyment. Transporting frozen foods of all kinds across the hot sands is now accomplished with perfect safety as two prototye railroad refrigerator cars have proved during initial tests. The refrigerator cars were manufactured for use on the Saudi Government Railroad which connects the Port of Damman on the Persian Gulf with the capital city of Riyadh. This railway line, with stations near the Arabian American Oil Company's major oil producing centers, will thus provide increasing quantities of frozen foods to the area.

The railroad cars were manufactured near Brussels, Belgium, and are the first in the world to be equipped with two separate two-stage low temperature refrigeration compressors.

Engineers had determined that two-stage compressors would be required because of the extremely high ambient temperatures (125° F) prevailing throughout Arabia during most of the year and, consequently, excessive compression ratios would have been encountered had the usual domestic practice using single stage units been followed.

ROCK 'N' ROLL

Rock 'n' roll has come to boxcars. A gentle rocking motion is being used for the first time to unload boxcars of grain and other free-flowing bulk materials.

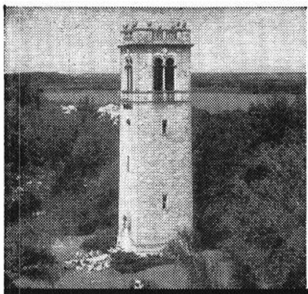
A new one-man operated unloader locks 150,000-pound loaded cars in its grasp on a steeel platform, and by a gentle rocking motion of only three inches at the ends of the cars, empties them at a rate up to four cars per hour.

Unlike the higher capacity grain car unloader which empties a car by tipping it endwise as well as sidewise, the new unloader, known as the Kar-Flo, depends entirely upon a rocking motion and approximately an eight degree side tilt of the car to empty it.

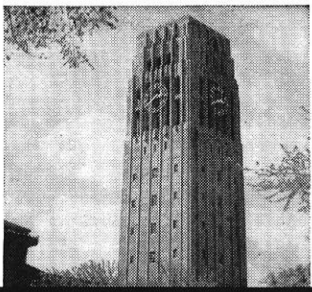
According to Link-Belt, the new unloader eliminates the exposure of workmen to the heavy dust which rises when grain cars are unloaded manually. It also speeds up the unloading process, does not injure the car and is safer than manual unloading.

A method of checking tire wear is said to give data in hours that would otherwise require months. A radioactive phosphor is added to the tread rubber and the test car is trailed by a cart carrying a Geiger counter which measures the amount of the radioactive material left on the pavement. END

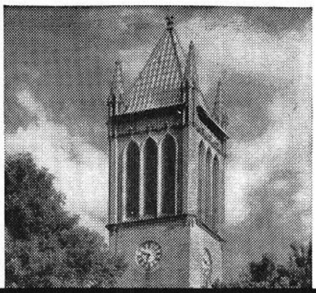
See you at our booth at the Exposition



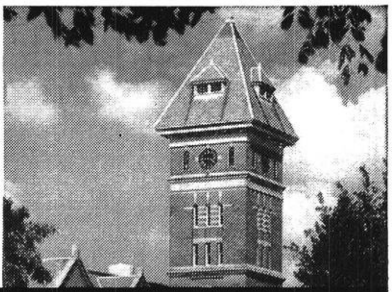
WISCONSIN



MICHIGAN

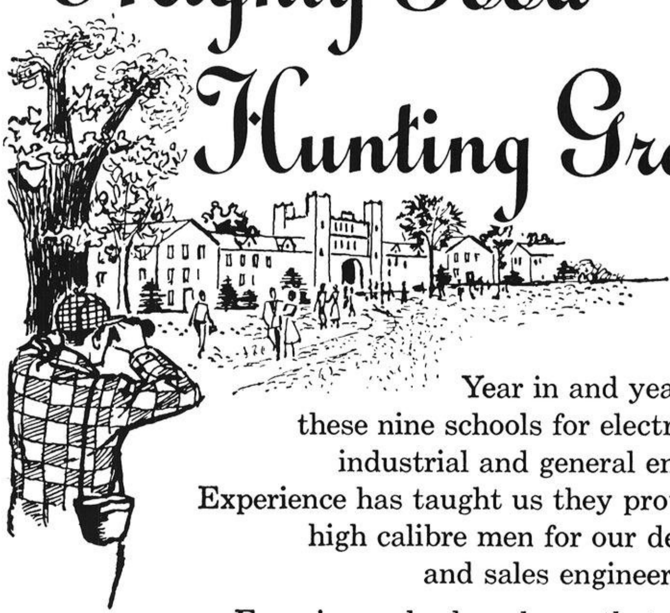


IOWA STATE



PURDUE

these are Mighty Good Hunting Grounds!



Year in and year out, we look to these nine schools for electrical, mechanical, industrial and general engineering talent. Experience has taught us they provide consistently high calibre men for our design, production and sales engineering assignments.

Experience also has shown that those who join us find Square D a mighty good company to be with. Most of these men are still with us, growing and prospering with the constantly expanding electrical industry.

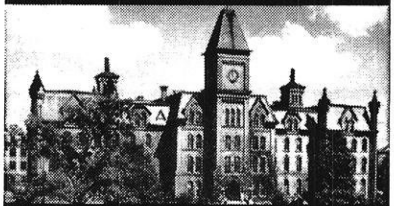
Why not let us tell you more about Square D and what we have to offer?

TEXAS A&M

ILLINOIS

PENN STATE

GEORGIA TECH



OHIO STATE

Mail the Coupon

We'd like to send you a brochure, "Your Engineering Career." It gives the simple rules to follow in selecting an engineering career.

Square D Company, Dept. SA
6060 Rivard Street, Detroit 11, Michigan

I'd like a copy of Square D's brochure, "Your Engineering Career"

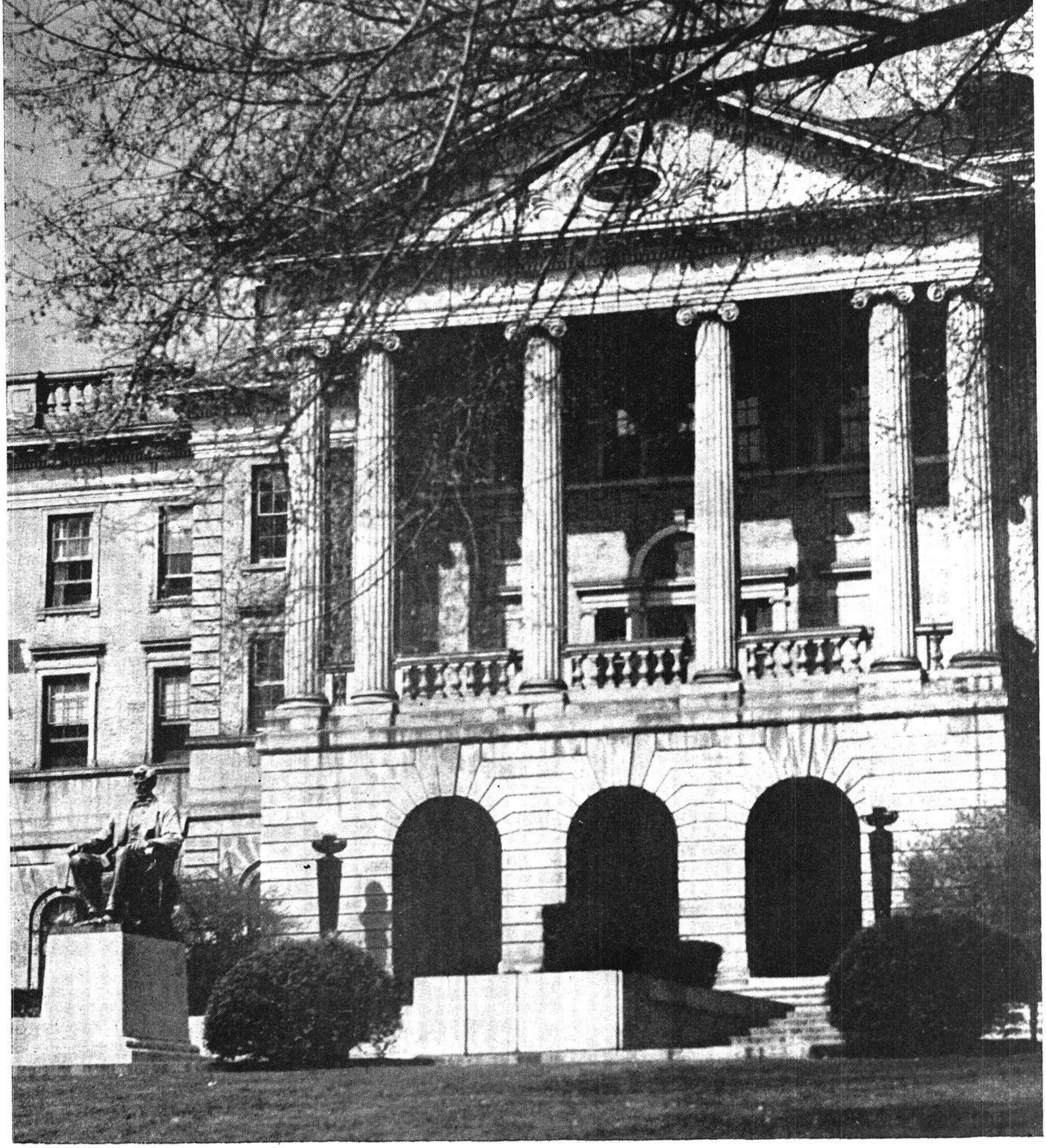
Name____________________

School________________ Class______

Address____________________

City__________ Zone____ State______

SQUARE D COMPANY

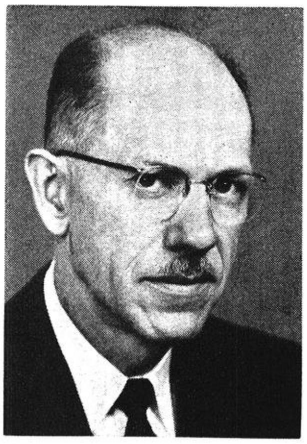


High School Section

When you look through the next fifteen pages of the *Wisconsin Engineer* you'll come across descriptions and explanations of interest to engineering students both present and future. The several articles point out the need for more engineers and also the significance of the engineer's role in our technical society. Each of the five engineering departments is represented by a photo of some representative phase of that branch, and by an article describing that particular branch of engineering. The Section is concluded with a series of questions typical of those asked by high school students thinking of enrolling in engineering school. The *Wisconsin Engineer* hopes that many of you high school seniors who read the magazine will decide to enroll in the college next fall.

The Engineering Profession

by Kurt F. Wendt
Dean, College of Engineering



Kurt F. Wendt.

It is a pleasure, through this High School issue of the *Wisconsin Engineer*, to extend greetings to all students in our Wisconsin high schools. Those of you who are interested in the field of engineering are invited to visit us, to see our laboratories, and to discuss your plans for the future. This year you have a special opportunity. Our students are having another Engineering Exposition on April 20, 21, and 22. You are most welcome to attend to see interesting exhibits of all kinds, and to take the opportunity of inspecting our facilities at the same time.

You are all aware that this is known as a technological age. During the past 100 years engineering has made great strides and its many contributions to our high level of economic well-being are universally recognized. You need only look around to see the products of engineering on every hand. The automobile, the airplane, trains, ships, bridges, buildings, roads, electric light and power, radio, television, water and sewer systems, machine tools, refrigerators, and heating systems, to mention only a few, all are the result of engineering design and production.

Every week we receive many questions and among the most frequent are: What is engineering? What engineering courses are available at Wisconsin? Which courses are most popular? What is the probable opportunity for jobs in engineering in the future?

Engineering is both an art and a science directed toward the adaptation of materials found in nature into useful forms, and the harnessing and conversion of natural forces into useful power by efficient and economical means.

The profession is divided into five major fields: chemical, civil, electrical, mechanical, and mining and metallurgical engineering, each with many subdivisions. Wisconsin has curricula in all of these fields and offers the opportunity for both undergraduate and graduate study in each area.

At the present time electrical and mechanical engineering are about equally popular and together account for about two-thirds of our total enrollment. The demands of industry are high, however, in all areas of engineering and it behooves you to investigate the entire field to determine your special interests before choosing a particular branch.

What of the future? Today we are experiencing an unprecedented demand for more and more highly-trained engineers. It is conservatively estimated that we are graduating each year only two-thirds of the number of engineers needed for simple replacements. Barring a major economic dislocation, supply will not catch up with demand for at least ten years and probably not for fifteen or twenty.

After reviewing briefly some of the engineering developments of the past, you may well wonder whether there is anything left to develop for the future. Actually the discoveries and applications in engineering are increasing at a growing rate and it is the considered opinion of scientists, engineers, and industrialists that we will see many more developments in the future than we have in the past. We have just begun to realize the potential in the fields of nuclear and solar energy, in solid state physics, in communications, in plastics, and in automation. A great challenge and a most interesting future lie ahead for young men and women in all engineering fields.

What are the requisites for success in engineering? As in any profession, success in engineering demands integrity, industry, perseverance, courtesy, and good personality. In addition, interest in and aptitude for mathematics, the sciences, and written and oral expression are of primary importance. If you possess these qualities and aptitudes and find the duties of engineers attractive, you can become a successful engineer. The demand for men and women with sound engineering training will continue and the rewards, materially and in personal satisfaction, are substantial.

Stop and Think

by W. R. Marshall, Jr.
Associate Dean

W. R. Marshall, Jr.

It is a well known fact, which can be verified from anyone's experience, that there are many dissatisfied people in the world today. They change from one job to another in the hopes of finding more happiness and satisfaction as well as more income. Did it ever occur to you boys and girls to stop and to ask yourselves why there are so many people in this group? I will tell you one reason, a very important one, and one which many of them could have avoided. They did not take time in high school to investigate all the vocations available for them, and then, most important of all, to decide into which one of these activities they should enter to find their greatest happiness and success in terms of their abilities and interests.

People have to settle on things for themselves. High school students usually delay this decision until college. College students never find time to arrive at a conclusion. The result is just what we have observed—dissatisfied and "drifting" men and women.

Today, my young friends, in this greatest of ages of rapid development, the first thing you should do is to be sure that you are taking the subjects in high school which will enable you to enter a general or specialized university course. You can do this without omitting any particular subject you may enjoy if you care to work hard enough. Now you may say to me, "I don't know what I want to be." My answer to you is that nobody else was 100% sure that he did, when he was your age. That is just why you should consider my suggestion very seriously.

Your vocation may be in a religious, technical, professional, or business field. At the last minute in high school, you suddenly make a positive and final decision, and then the question, Will you have the required credits in your high school course to enter the college or university which will prepare you best for your chosen vocation? My advice to you, based on the many years of experience of our freshman advisors with thousands of students like you, is: Take invoice NOW; be SURE.

Now let us assume that you make the decision to be an engineer and to come to the College of Engineering at the University of Wisconsin.

On your arrival one of the first things we will check with great care is your preparation in English. Engineers must be masters of English because technical reports must not only be informative, they must be concise and accurate; they must convince others. As an engineer you may have to address groups of people; you must guide the thinking and activities of others in carrying out important engineering projects. Your use of spoken English must, therefore, be of the highest quality, and your thoughts logically expressed. Mathematics is the language of the engineer in his specialized field. You will need at least three years of mathematics and, if you have four, your first year work in college will be easier. Science is important because you should have a knowledge of the laboratory method before entering college. A year of physics or a year of chemistry or both, if possible, are very desirable. Besides these technical prerequisites, an engineer should have as much foreign language, history, and social studies as his high school can provide. By all means have some sport as a hobby. Do you now see what a wide field is left open to you for making your own choice of subjects? Would it surprise you, were I to tell you that if you presented the above program you could fit into almost any vocational field? So you see that it is not difficult to be SURE now, and to be PREPARED to carry out any decision you may make, when you are ready.

To be an engineer requires special interests and abilities. The student must be willing to devote his time eagerly to intensive study and never give up regardless of how hard the work becomes. Not everyone has the determination and perseverance required to do this. Unless you have, you will never be an engineer.

An engineer must also be willing to accept the great responsibility he must assume for the welfare of others. He is devoted to the study of the best-known engineering methods, to the discovery of better ways to protect his fellow man in time of danger, and to develop his sources of supply and leisure for more purposeful, satisfactory, and happy living in times of peace. I am

(Continued on page 66)

Are You Ready for College?

by Prof. K. G. Shiels and Mary R. O'Keefe

Professor Shiels and Miss O'Keefe.

In visiting with a sophomore engineering student recently, I inquired about his progress. He had completed high school in 1950 and he ranked 35 in a class of 186 high school seniors. His American Council test scores, while substantial, indicated that he would be required to apply himself diligently to his studies—this is indeed essential for all college students if they wish to develop their education! In his freshman year he did "A" work in science and mathematics, "C" in one three credit course, and "B" work in his remaining studies. In his reply to my question about his grades for the first semester of his sophomore year, he commented, "The work seems to be getting easier. I had a *four point* record at the close of the semester." This means that he earned a straight "A" record, and his response that the work seemed to be getting easier indicates that he established a good pattern of approaching his college work.

Many students enter the University with a well-established background in high school in the important subjects of English, mathematics, and science. Occasionally there is the temptation on the part of a few to rely upon this background and to neglect the diligent study which is so necessary in college. The immediate acceptance of the fact that a good beginning results in a good ending will lead to setting up a pattern in college which will assure academic success. The early planning of a study schedule will enable a student to weigh values and then to participate in some worthwhile activities at the close of his first semester or first year.

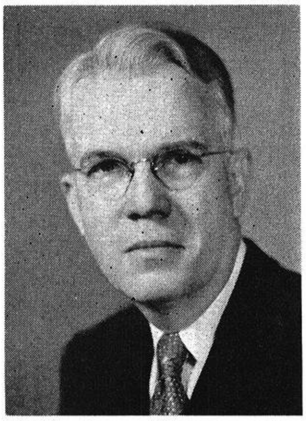
For instance, you have all heard about college traditions. In the years past we have had the friendly feud between lawyers and engineers on the campus. When the engineers conducted their St. Patrick's Day parade —for St. Patrick is the patron saint of engineers, you know—there was much friendly interference on the part of the law students. The parades are no longer held, but there are still the St. Patrick's Day activities, including the beard-growing contest, the basketball game with the lawyers, culminating in the St. Patrick's Day dance—a big event in the life of the engineering student. With the true constructive attitude of the engineer, all these college traditions resulted in the Engineering Exposition which is put on by the students every three or four years. The Exposition is a stupendous showing of the capabilities and the ingeniousness of the engineering students. Any high school student with a real interest in engineering, whether or not he plans to study engineering, should endeavor to visit the College of Engineering at the University of Wisconsin on April 20, 21, or 22 to view first hand the Engineering Exposition.

The students who are working on the exposition are in the main those who started college in their freshman year with a good study pattern for the purpose of developing their educational and professional objective, as well as to have the time for participation in such outstanding events as the Engineering Exposition. These are the students who are on their way! They are the good citizens of the College and of the University. They have found a way of contributing their splendid ability and energy to such worthwhile activities as the Engineering Exposition, the Wisconsin Engineer, Union Board, and innumerable other activities which are so a part of the University. Why not join this group?

K. G. SHIELS
MARY R. O'KEEFE

Why Consult an Oracle?

by Prof. C. M. Brown
Director of College of Engineering High School Research Program



Prof. C. M. Brown.

Since the days of the famous oracle, located at Delphi in Greece, men have always searched for ways to foretell the future. People even pay advertised seers to read their chances in the leaves at the bottom of a tea cup.

Perhaps, you have wished that there were oracles today to which you might go to find out what profession you should follow so that you could be happy and be the kind of a success you want to be. If you assume the personal responsibility of taking the basic subjects in high school and making averages which will enable you to enter any college or university, then when you graduate from high school, you will never need an oracle.

All of the professional careers open to you if they require academic preparation, demand college training. It is very obvious that every person who wishes to prepare for such a profession must go to college. To enter a college means that you must present your high school credits which show that you have completed successfully certain specified courses such as English, mathematics, foreign language, science, etc.

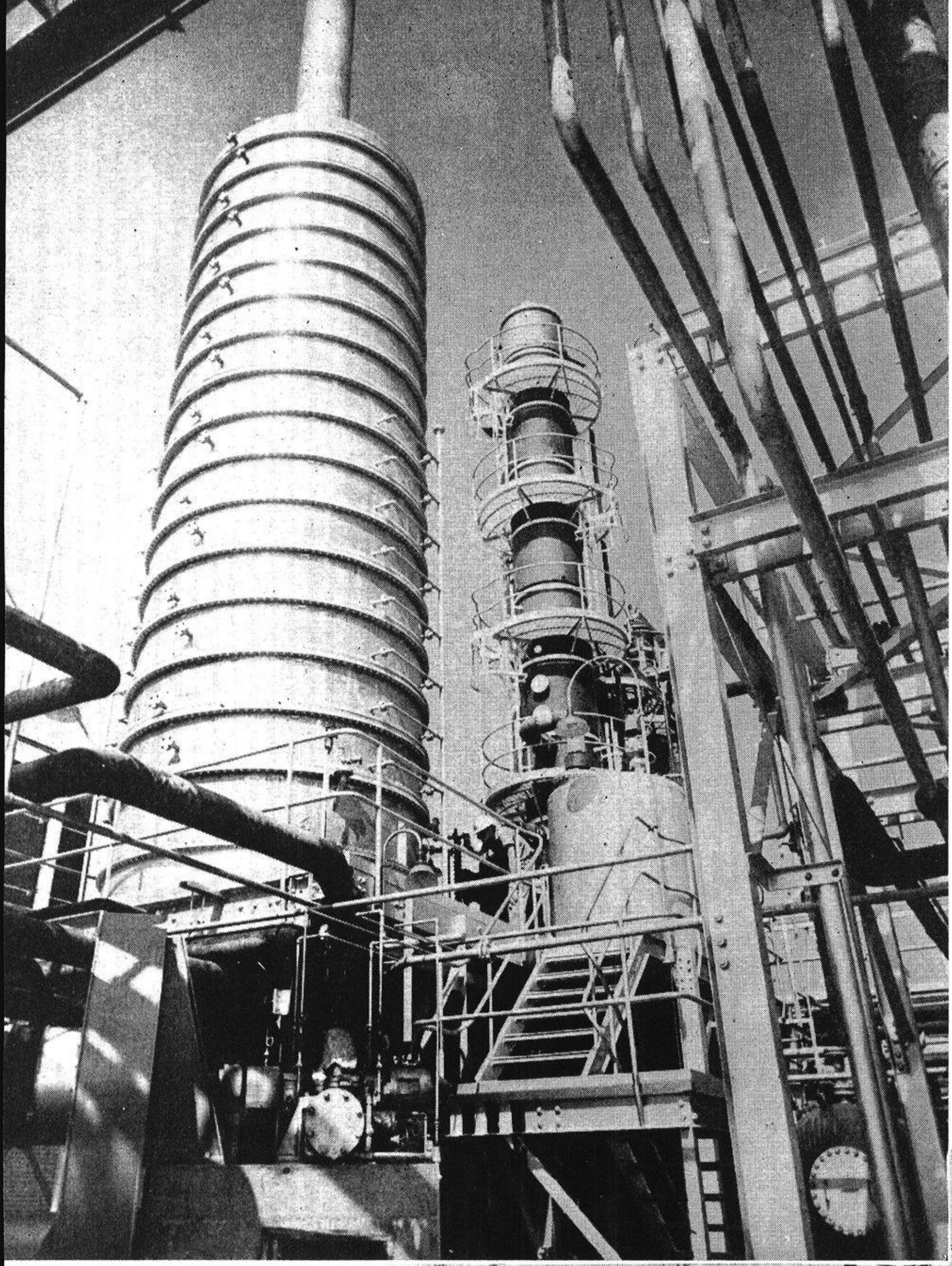
Right now you cannot decide what you want to be. All high school students have that difficulty. High school years are the time to explore your interests under the guidance of those capable of helping you correlate your interests with your aptitudes. To make a decision is a challenge to everyone. That was why even kings who had decisions to make consulted oracles.

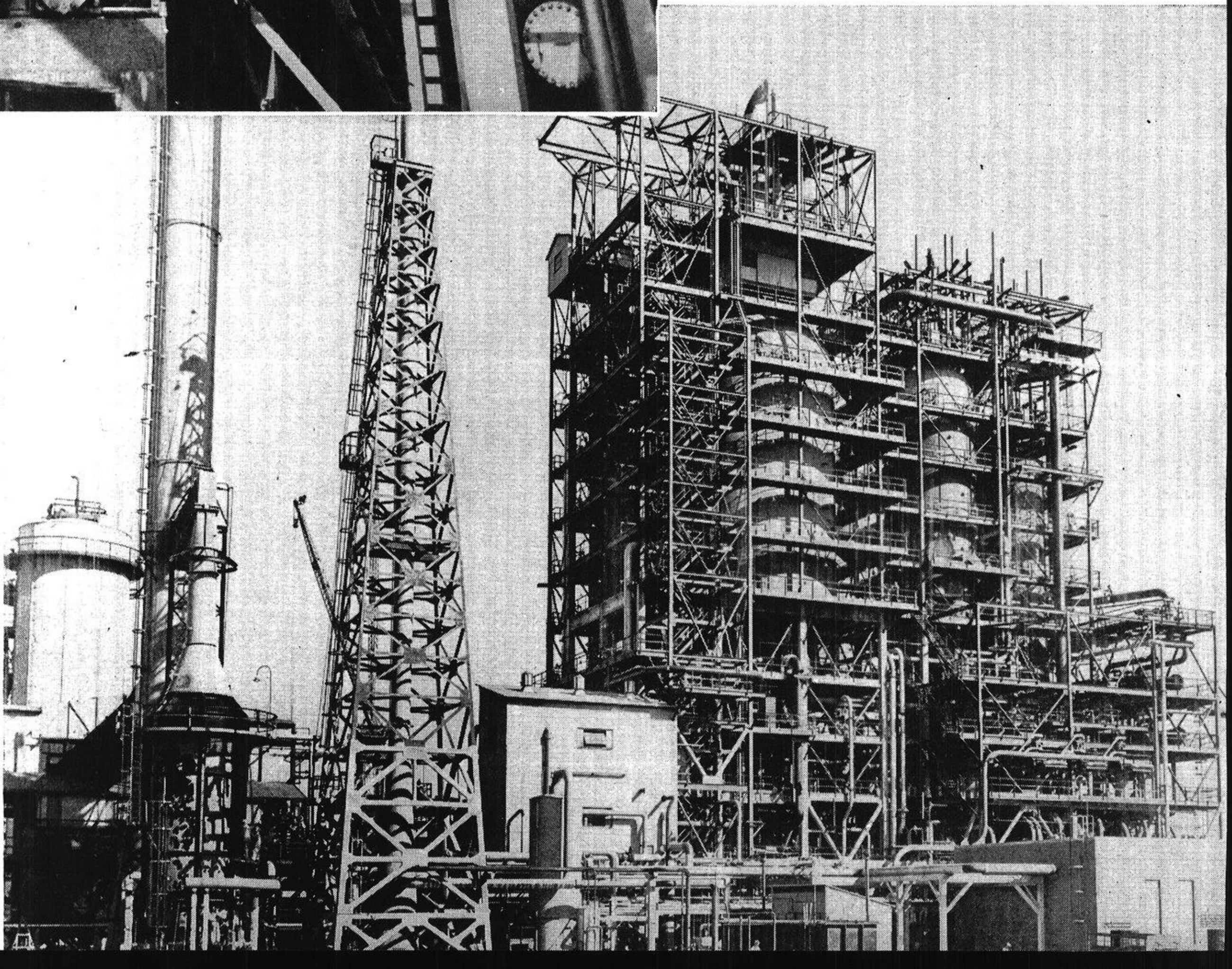
Suppose that you are going to the store to make a purchase. You don't know how much the article you select will cost. You have to buy the article when you go to town. It is the last day of the sale. You must pay cash. If the most complete and expensive model has been advertised for twenty-five dollars, and the others are in lower price ranges according to attachments, how much money will you take with you for this purchase? You don't need any oracle or reader of tea leaves to tell you, "twenty-five dollars." It is just common sense.

Suppose we apply common sense to what we might call taking enough high school credits of superior achievement rating to college to pay for entrance into any professional school. That is precisely what you have to do. Buy your way into college with the quality and quantity of your academic earnings or "high school credits." You will need all the credits in the various subjects that the most rigid entrance requirements for any college or university may demand. Then you will be free to make a last minute decision and pay for it in entrance requirements just as you would have been able to make the purchase of any model of the article we mentioned above—because you took enough cash to pay for the most expensive one.

Here are the basic requirements which will enable you to enter practically any college or any university. Yes, these credits will admit you to the college of engineering. English, 3–4; algebra, 1½; plane geometry 1, solid geometry ½, trigonometry, ½; physics, 1; chemistry, 1; foreign language, 2; history, 1.

You can readily see that there will be plenty of opportunity for you to take other things in which you are interested as you complete the sixteen units required for graduation. Making sure that you have the minimum requirements so that you can choose colleges and careers at will when you graduate from high school does not "cramp your style." On the contrary it will give you the confident feeling which everyone has who knows that he has enough money in the bank to pay bills when due. Just like having accident or hospital insurance. You do not need to go to Delphi to consult the oracle to arrive at this conclusion. It is just common sense. **END**





Chemical Engineering

by Phil Noth, Chem Engineering Junior

Although it is only within the last several decades that it has come to be recognized as a separate and distinct profession, chemical engineering is perhaps the fastest growing of all engineering fields. And this is in harmony with the rapid growth of industrialization that has gone on in the United States also in the past several decades. For it is because of chemical engineers that many of our large process industries have been made possible—industries such as extraction of bromine and magnesium salts from sea water; production of synthetic rubbers, synthetic plastics, and synthetic fibers; manufacture of high octane gasoline, food products, drug and insecticides, industrial chemicals, and explosives.

In general, the work of a chemical engineer is closely related to physical chemistry and is more like mechanical engineering than any other division of engineering, but it is not a combination of these two fields. Chemical engineers work closely with chemists but they do not do the same thing. A chemist usually carries out his experiments on a small laboratory scale. It is the job of the chemical engineer to transform the chemists laboratory discoveries into commercial realities or into large-scale operations. To do this, a chemical engineer must be familiar with the laboratory procedures of the chemist on one hand, and be able to talk in the size and language of the plant operator on the other.

Basically a chemical engineer is concerned with the development, design, and operation of manufacturing processes which result in physical and chemical changes of the materials involved. These physical and chemical changes can be broken down into unit operation and unit processes, respectively. Important unit operations include such physical changes as mixing, crushing, grinding, size separation, absorption, and crystallization; examples of unit processes are chemical changes as exodation, reduction, hydrolysis, sulfonation, pyrolysis, and polymerization. Unit operations and unit processes are combined to form a given manufacturing process.

Like other branches of engineering, chemical engineering offers many fields for employment.

A chemical engineer may go into research work with a university, or help an industry solves its problems through research.

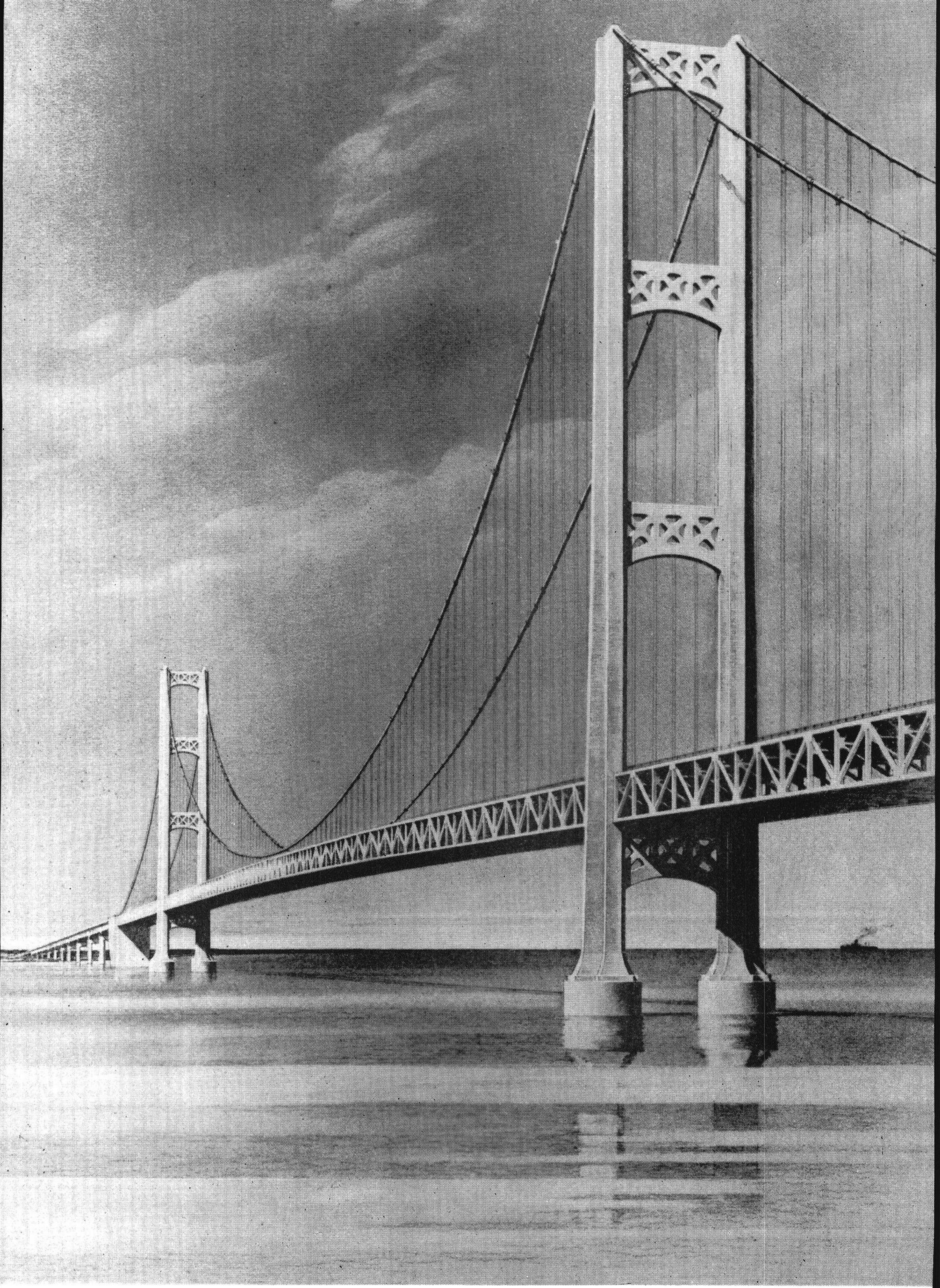
Many chemical engineers are working in development where operations which work out in the laboratory are carried out on a larger scale. Here chemical engineers put their education to work as they solve the problems which arise as the result of handling larger quantities of material.

Operation and production offers a challenge. Once a process has been thoroughly tried and proper large-scale equipment has been provided, a chemical engineer is usually put in charge to supervise the operation and to be prepared to eliminate any unforeseen trouble.

Selling chemical engineering equipment is a field with opportunity for the individual who has, in addition to a sound chemical engineering education, a positive personality and a liking for people.

Because the very nature of a young chemical engineer's work is inclined to develop leadership, he has a good chance of rising to an administrative position.

Teaching chemical engineering courses is certainly open to chemical engineers. Here, a M.S. or a Ph.D. degree will probably help chances for advancement.



Civil Engineering

by John Albrecht, Civil Engineering Senior

The profession of civil engineering offers many employment opportunities for college graduates. Moreover, the number and variety of such opportunities are increasing with the growth of our population and the development of new inventions and processes.

Civil engineers have always been connected with the development of transportation systems. The great advance in the nineteenth century was in the building of our railroads, which still employ many engineers in both operation and maintenance. The mid-twentieth century sees continued expansion of highways, airlines, and pipelines. The growth of highway traffic that has resulted from population growth and establishment of new cities and industries has led to the rapid building of expressways and tollroads. The development of airports and allied facilities, not only in this country but all over the world, has been phenomenal. Pipelines are coming to be a highly favored mode of transportation for petroleum products and natural gas. The civil engineer occupies a prominent place in the planning, surveying, designing, constructing and operating of all these transportation facilities.

Another field that continues to be very attractive to civil engineers is that of structures. There is increasing demand for more housing, shopping centers, office space, public buildings, factories, and other structures of all kinds, both large and small. Civil engineers are associated with architects in the design and construction of large steel and concrete buildings, with contractors in the design and building of homes and apartments, and with public agencies in city planning, redevelopment of slum areas, and laying out of parks and playgrounds. Most spectacular in the field of structural engineering is the construction of great bridges. Many have been built, others are under construction, while still longer and larger ones are being planned for the near future.

With growth in population comes also increased demand for civil engineers to provide safe and adequate public water supplies and to build sewerage systems and treatment plants which will return waste waters to the streams in a form least harmful to fish and other wild life and most satisfactory from the standpoint of use of the lakes and streams by the public. Civil engineers design and build flood control works to prevent or reduce damage from floods, improve river channels for the benefit of navigation, and provide port facilities for both inland and foreign shipping. Water power plants are designed by civil engineers and built under their guidance. Many engineers are engaged in land reclamation, either by the draining of low swampy lands or by bringing irrigation water to dry lands from rivers or reservoirs through miles of canals and aqueducts.

Many civil engineers also find work as surveyors. Surveying is one of the first jobs to be done when an engineering project is undertaken. Surveys must be made to aid in determining the most economical and feasible routes for highways, irrigation canals, and pipelines. Such surveys have been greatly speeded by aerial mapping. There must be surveys of sites for bridges, buildings, dams, and airports. The proper laying out of housing and other municipal developments depends largely on detailed surveys of the proposed sites. Surveyors also locate property lines and determine areas, and thus help to settle disputes between land owners. Much of our country's area still remains to be mapped in detail and many surveyors are engaged in that work.

As with any profession, the future of civil engineering depends on maintaining a continuing supply of young persons who are eager and qualified to enter that profession. The usual road to becoming a civil engineer leads through years of training in a college of engineering. The colleges cannot operate without teachers, and there are many opportunities these days in the engineering teaching profession for young people who have done well in their college work, who have gone ahead to take graduate work, and who also have acquired some practical experience.


Westinghouse

Electrical Engineering

by Jim Schilling, Electrical Engineering Sophomore

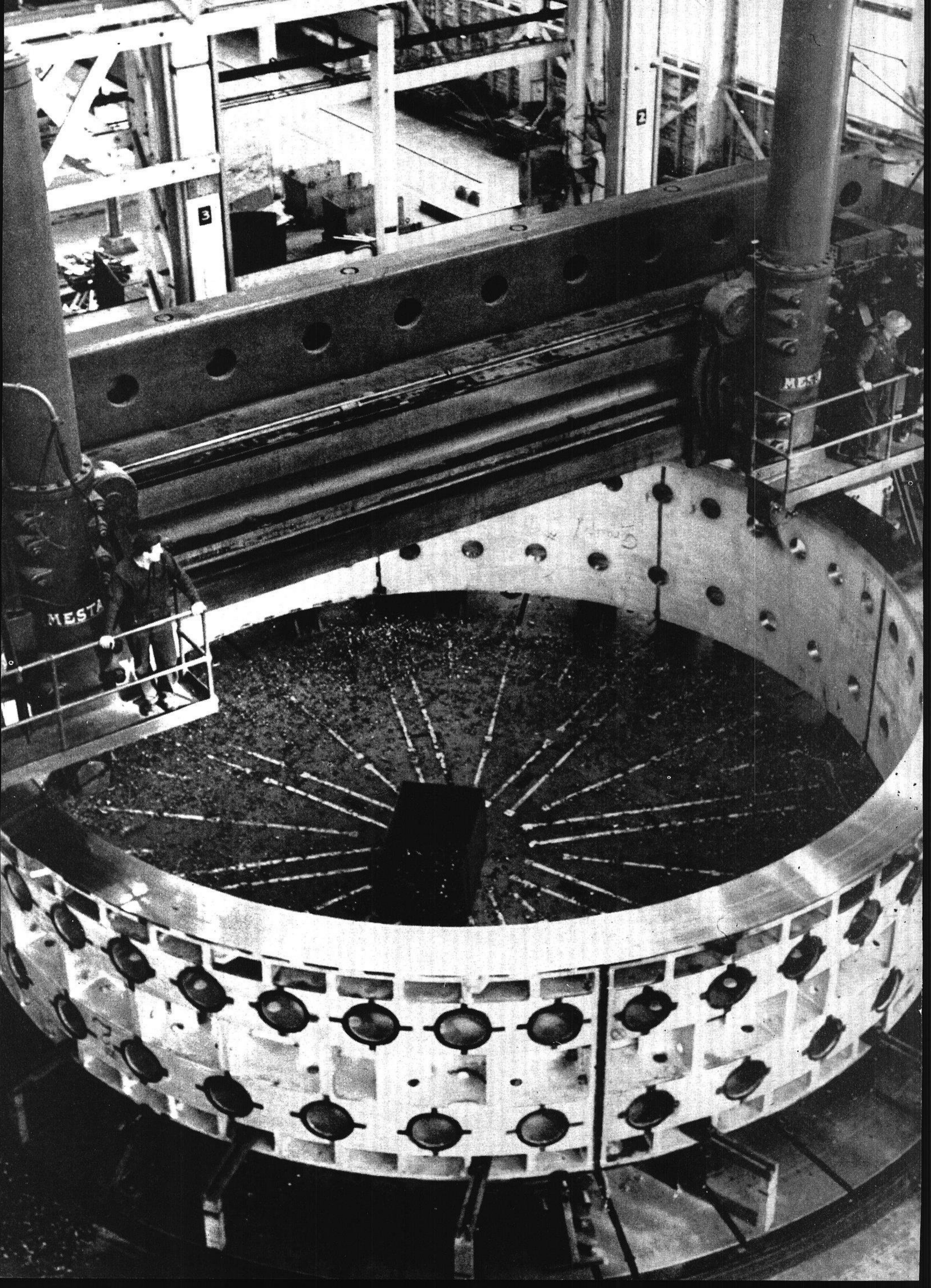
When I entered the University of Wisconsin, I had to make a decision on a college course that would prepare me for a future career. I decided upon Electrical Engineering, and since that time, have become convinced that my decision was the best I could have made. I believe that the electrical engineer is rapidly becoming the key to the future development of our industrial system, and to advances into the unknown that would have seemed fantastic only a few years ago.

Utilization of electrical energy, for purposes of generation and transmission of power, for communication and control, for industry and home use, have become so important in this technological era that electrical engineering is rapidly becoming the focal point of all engineering practices. The tremendous amount of energy that nuclear fission makes available to us is useful only after countless electronic controlling devices convert it to heat or electrical energy. Automation of our industries, which promises to give us a standard of living beyond our fondest dreams, is possible only through electronic controlling brains that are being developed by electrical engineers. These same computer brains are enabling all fields of science to accelerate their progress at unbelieveable rates. Because of them there seems to be no ceiling on the future.

Everywhere I look, in both today and tomorrow, I see the product of the electrical engineer as indispensible to our complex civilization. Electricity in our homes gives us illumination, refrigeration, washing, cooking, and entertainment. And the same servant is providing controls on super-sonic planes, just as it will surely guide the first rocket to the moon.

Because of the role that electricity has in our present and future life, I believe that the electrical engineering student of today is preparing himself for an unparalleled career of both personal satisfaction and social usefulness. This is true in both the technical and the management sense. Industry is becoming more complex each day and management requires a foundation of technical knowledge for intelligent decisions. I believe that the training an engineering student gets is the best preparation for such management responsibilities, just as it is training for a career in design or development.

As a student of the Electrical Engineering Department of the University of Wisconsin I feel that I am receiving an education that is among the best in the country, and I am convinced that this course of study is ideal for the person who wants interest, opportunity, and social usefulness combined in a career. If you are a high school student who wants these same things in his future job, and if you have a real interest in science and math, I can think of no better career choice. Not only does the future offer unlimited opportunity, but today there is a shortage of engineering talent that makes the starting pay of an engineer particularly attractive. Concerns from all over the United States are quick to hire promising engineers for both summer employment during the school years and immediately upon graduation. Thus the student electrical engineer has every right to look forward to a career that is limited only by his attitude and determination, a career that is the key to future progress.


3
2
MESTA
MESTA

Mechanical Engineering

by Lawrence D. Barr, Mechanical Engineering Junior

It has often been said that an engineer is a frustrated person since he deals almost entirely with unsolved problems. Once the problem is solved, the engineer's job is done. This is very applicable to the Mechanical Engineer, as he deals with physical things and conditions, and sometimes people, all of which are, at times, unpredictable.

Mechanical Engineering is customarily divided into three classifications: Design, Power, and Industrial engineering. This division, however, is not made in the college curricula until the senior year, at which time, electives in the chosen branch are taken. A brief description of each branch might be useful for future consideration, although an immediate choice is unnecessary.

A design engineer might be employed anywhere in industry, communications, or power production of any kind. His job is to devise a means or method of doing a given job. For this work he needs a firm foundation in engineering fundamentals plus an up-to-date knowledge of what other people are doing in his field. A design engineer must specify what materials will be used in his device or machine, he often specifies how the materials are to be fabricated, and then says how the device or machine is to be used, allowing for possible misusage at the same time.

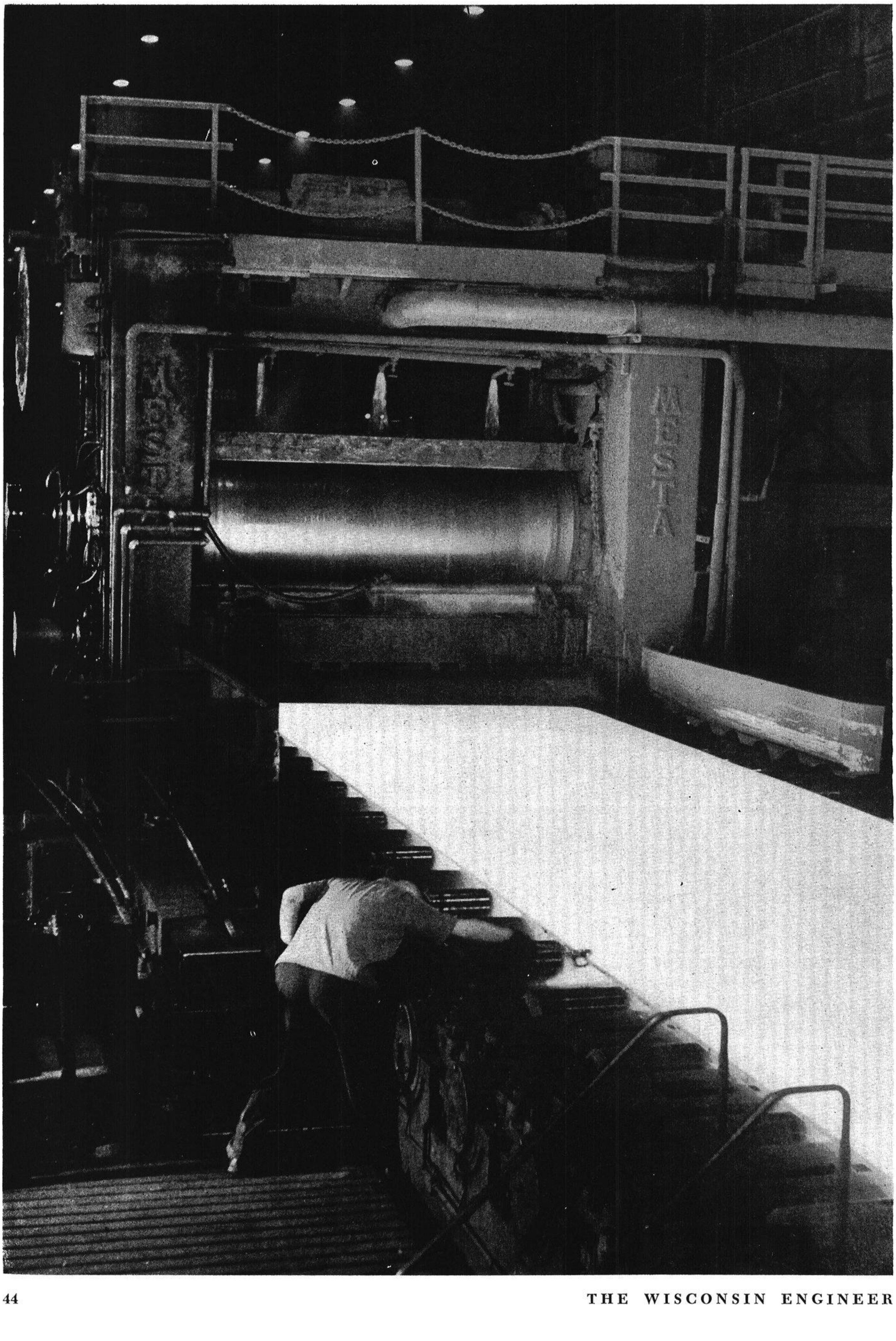
In short, the design engineer must know how to invent, build, and use a practical device that will solve some problems, and at the same time keep its cost down to an economical level.

The Power Engineer is not so likely to be concerned with the building of devices, as much as what can be done with them. It is his job to convert naturally occurring energy into a usable form, such as converting the chemical energy of coal into electrical energy by means of steam boilers and turbine-generators. To do this, the power engineer and design engineer often work closely together on a project. A power engineer must be well-versed on existing power devices, such as electric motors and generators, internal and external combustion engines, and turbines. He must be well-founded in theory, since he often handles energy on a large-scale. And he must have the ingenuity to devise new and better energy handling techniques. Branches of Power engineering are Automotive, Refrigeration, and Heating.

An Industrial Engineer concerns himself with better methods and techniques for doing a given job. How can it be done better? Or faster? Or cheaper? All these are questions ever present to him. To answer them he sometimes becomes a designer, or a power man, or even a personnel man. It is not enough that he find a better method, but he must also convince everyone concerned that it is better. Not an easy job, but often, very rewarding.

These are the main branches of Mechanical Engineering. Attaining any one of them involves a great deal of study and thought for the person involved, but is well worthwhile. Even when an engineering student is "knee-deep" in assignments, he would answer "No!" to a question on whether he would like another field better.

In closing, it might be well to point out that grades are not everything to the engineer. For the mechanical engineer, organizations such as the American Society of Mechanical Engineers, (ASME), and Pi Tau Sigma honorary fraternity for mechanical engineers are worthwhile activities. If you plan to become a mechanical engineer, keep these and similar organizations in mind.


MESTA
MESTA

Mining and Metallurgical Engineering

by Barclay Gilpin, Metallurgical Engineering Junior

Mining and Metallurgical Engineers are concerned with the discovery, extraction and utilization of the world's mineral resources. They work together to produce the metals that are the backbone of our industry.

The mining engineer finds and extracts all classes of minerals from the earth. The field divides itself into three parts; mining engineering, mining geology, and mineral dressing. All students in this curriculum study each field but concentrate on one in the senior year. Their courses include geology, mineral dressing, extractive metallurgy, methods of mining, and mineral evaluation.

The mining geologist finds and explores new ore bodies, solid and liquid fuel deposits and natural gas deposits. With the rapid rate our present known and easily discovered resources are being used up, thorough scientific training is necessary for those who will discover our minerals for future use.

The mining engineer designs, constructs, and operates plants for the recovery of ore from the earth. He selects and applies the mining method best suited to remove the ore from the ground. He must then concentrate it and send the concentrate to the mineral dressing plant.

The mineral dressing engineer separates the valuable constituents of ores from the waste and prepares them for smelting. This is becoming an increasingly important field because of the exhaustion of high grade ore fields and the resulting necessity to treat low grade ores. A familiar example to most people in Wisconsin is the low grade iron ores that are now being treated. The Mosabi range is running out of the high grade ores now used and must depend on these low grade taconite ores.

Metallurgical engineering is a relatively new branch of engineering and yet is one of the most important. It furnishes the tools and materials required in all the other engineering fields. Therefore, the metallurgist must at all times work closely with other engineers in developing and producing products. His job is to understand the nature of metals, make them better, produce them and apply them to the job at hand. Taking these points into consideration the field naturally breaks itself into two parts: extractive metallurgy and physical or applied metallurgy.

Extractive metallurgy is obtaining the metal from the ore. The metallurgical engineer receives the valuable constituents of ores from the mineral dressing plant and treats them to get the pure meal. His work is largely concerned with the chemistry of the process and the heat balances of his furnaces. The engineer must select the chemical reagents, fuels, furnaces, and controls to carry out the process as cheaply as possible and still get a good product. An example of an extractive metallurgical operation is the blast furnace in a steel mill. Here pure iron is obtained from the iron ore by the proper additions of coke, limestone, and air.

The physical metallurgist receives the pure metal from the extractive metallurgist and produces a product that is used for manufacture. He is interested in the physical properties, composition and behavior of these metals. The metallurgist prepares his product by melting, alloying the pure metal, and casting it into an ingot or usable shape.

A physical metallurgist is often an advisor. Another engineer may design a piece of equipment and come to the metallurgist for advice on what to use in its construction. The metallurgist must consider properties, heat treatments, availability, and cost to determine which metal would best suit the conditions under which the equipment will be operating.

Metallurgical engineers at the University do not specialize in either extractive or physical metallurgy. Engineers must be proficient at both in order to do the job well. Their specialized work comes later in industry. All metallurgical engineers must study metallography, metal casting, a lot of chemistry, heat treating, extractive metallurgy, X-ray analysis, surface metallurgy and others. The field of study offers more of a combination of physics, chemistry and mathematics principles than any other type of engineering.

The professions of mining and metallurgical engineering are constantly growing and becoming more important to society. There are many metals that still have no use and many ore deposits that are undeveloped. As long as our society grows, these metals and ore deposits must be made useful. It is just as important that the known metals and mining methods are improved to meet the ever increasing needs of civilization. These are the responsibilities of the mining and metallurgical engineers.

What's Your Question?

by John Albrecht

High school students have many questions concerning requirements and activities of college life. Following are questions and the respective answers pertaining to student life at the University of Wisconsin.

What educational program does the University of Wisconsin offer?

Students have the opportunity to study in almost all major areas of endeavor, including the humanities, arts, sciences, and social studies. In addition, preprofessional and professional opportunities are available in engineering, commerce, teaching, medicine, law, pharmacy, and many allied fields. All told, the University offers over 1,200 courses from which to choose.

What are the admission requirements?

The general method of admission is by presenting a certificate of graduation from an accredited high school with the recommendation of the principal. Sixteen units are the fundamental requirement, which must include one unit of algebra and one unit of geometry.

Does the University have an official grading system?

The University of Wisconsin marks on an alphabetical basis with the grade points per credit as follows:

"A" (Excellent)	4 grade points per credit
"B" (Good)	3 grade points per credit
"C" (Fair)	2 grade points per credit
"D" (Poor)	1 grade point per credit
"F" (Failure)	0 grade point per credit

What are the semester fees?

In all colleges and schools except Law and Medicine the fees are $90 per semester for a resident of the state and $250 for a nonresident.

What housing arrangements are available?

Housing accommodations for single students include: University Residence Halls, Co-operative houses, sororities, fraternities, the University YMCA, International House for graduate men, and rooms in private homes throughout the residential sections of the city. The University Housing Bureau is the clearing center for all student housing information and is located at 434 Sterling Court.

Does the student have any supervision in the planning of his courses and program?

Yes, the University operates on an advisory system whereby each new student is assigned a faculty adviser. The adviser is expected to help the student in the choice of his course and in the selection of a well-balanced program.

Is there additional counseling service available to students?

A trained staff is available to counsel students regarding personal, vocational, or academic problems at the Student Counseling Center.

What provisions do the University provide toward the maintenance of the health of the student body?

The services of the Department of Preventive Medicine and Student Health are available without charge to students who are regularly enrolled in the University of Wisconsin. The Student Clinic and Infirmary are located in the West wing of Wisconsin General Hospital. A portion of each student's fees are used to finance this service.

Are scholarships available for undergraduate students?

There are many scholarships available to deserving students. Scholarship information and application forms may be obtained from the Office of Admissions, 166 Bascom Hall.

Is there an ROTC program?

Freshmen and sophomores are required to take basic Army, Navy, or Air Force ROTC. Eligible Junior students may apply for advanced training.

Are student loans available?

Loans for educational purposes in amounts up to $250.00 are made for periods of less than a year to students in good standing, who have established a satisfactory academic record of at least one semester at the University of Wisconsin.

What are the possibilities of obtaining part-time work?

The Student Employment Bureau is often able to locate some kind of part-time work for those who desire it. Its address is 435 N. Park Street.

Does the University operate any Extension Divisions?

The University of Wisconsin operates Extension centers in Sheboygan, Milwaukee, Racine, Wausau, Green Bay, Kenosha, Manitowoc, Menasha, and Marinette.

How are the library facilities?

There are more than a dozen libraries, the chief among them being the Memorial Library and the Library of the State Historical Society.

Are there sororities and fraternities on campus?

There are sixteen sororities and thirty-four social fraternities on campus, with all but one maintaining resident houses for their members. In addition, there are many professional fraternities.

INVENIEMUS VIAM AUT FACIEMUS: "We shall find a way or we shall make one."
—Memorial Gate, University of Pennsylvania

Investing in young America . . . a progress report

"To HELP deserving young men and women obtain a college education . . . to give financial support to a cross-section of American colleges . . ."

FOUR YEARS AGO, the Union Carbide Scholarship Plan was established with those objectives.

Today, the plan provides the complete cost of tuition and fees for 400 four-year scholarships at colleges and universities throughout the country. As an important part of their education, the scholars are encouraged to gain valuable experience in their chosen fields by obtaining jobs in industry during summer vacation.

50 TECHNICAL SCHOLARSHIPS are also available in specific fields of study. They cover the student's tuition and fees for the senior year. In addition, to assist graduate students and to support academic research, Union Carbide offers 66 fellowships and grants-in-aid to universities.

THE PEOPLE OF UNION CARBIDE regard these scholarships as an important contribution to the future and to two of America's priceless assets—its educational system . . . and its youth.

TO LEARN MORE *about the Union Carbide undergraduate scholarships and the colleges and universities in which they have been established, write for Scholarship Plan booklet X.*

UNION CARBIDE

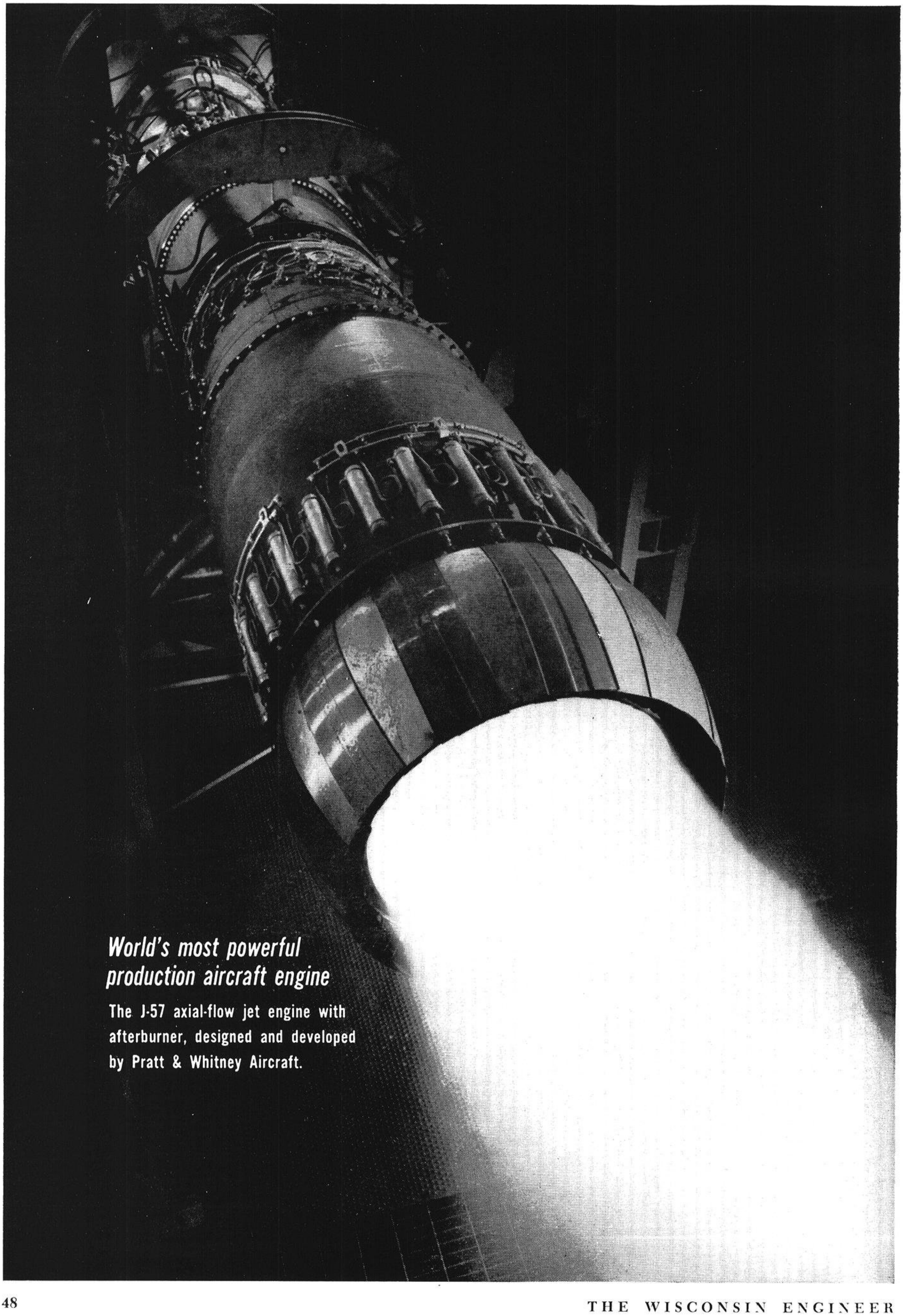
AND CARBON CORPORATION

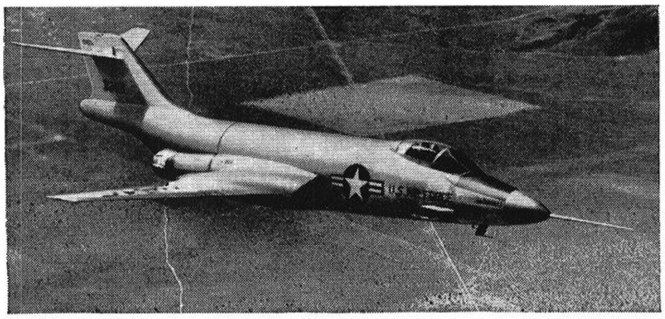
30 EAST 42ND STREET UCC NEW YORK 17, N. Y.

In Canada: UNION CARBIDE CANADA LIMITED, Toronto

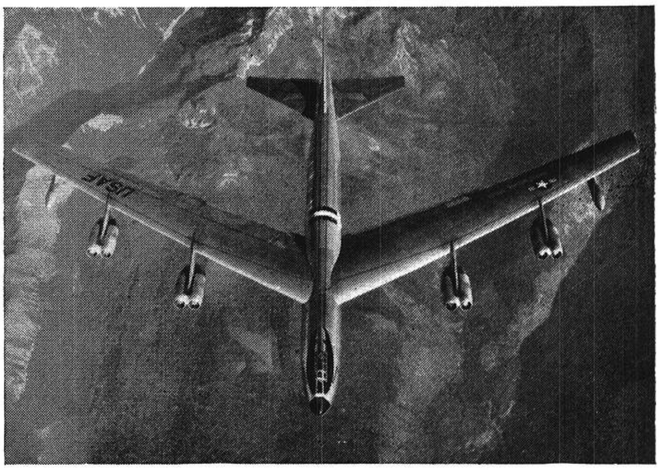
UCC's Trade-marked Products include

LINDE Oxygen EVEREADY Flashlights and Batteries NATIONAL Carbons ACHESON Electrodes UNION CARBIDE Silicones
PYROFAX Gas SYNTHETIC ORGANIC CHEMICALS PRESTONE Anti-Freeze UNION Carbide Dynel Textile Fibers
PREST-O-LITE Acetylene ELECTROMET Alloys and Metals HAYNES STELLITE Alloys BAKELITE, VINYLITE, and KRENE Plastics

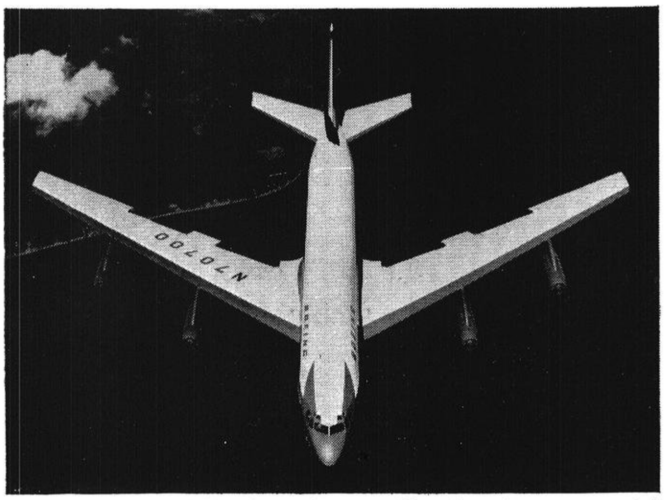

World's most powerful production aircraft engine
The J-57 axial-flow jet engine with afterburner, designed and developed by Pratt & Whitney Aircraft.



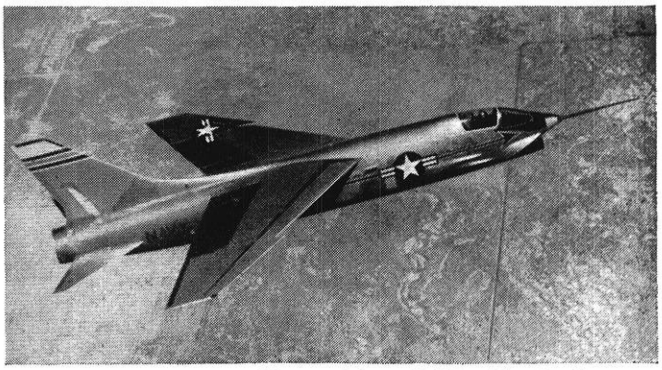
McDONNELL F-101 — The Voodoo, an Air Force supersonic fighter that has two J-57 engines with afterburners, is the most powerful jet fighter yet built.



BOEING B-52 — Eight J-57 engines, mounted in pairs, power this all-jet, heavy Air Force bomber.



BOEING 707 — The Stratoliner will usher in commercial travel in the jet age. It is the counterpart of the KC-135, a military tanker-transport powered by four J-57 engines.



CHANCE VOUGHT F8U — Powered by a J-57 with afterburner, the Crusader is the Navy's fastest carrier-based fighter.

The best airplanes . . . are designed around the best engines

Today's most valuable military aircraft, capable of supersonic or intercontinental flight, include various Air Force and Navy fighters, bombers and transports. Among these are nine types that have a significant feature in common. They all fly on one type of engine — the J-57 turbojet.

Also entrusted to the efficient, dependable operation of Pratt & Whitney Aircraft's jet engines will be the commercial jet transports soon to travel along the air lanes of the world.

The excellence of the J-57 is attributed to the engineering team that has determinedly maintained its leadership in the field of aircraft powerplants. Effort is now being directed toward the improvement of advanced jet and turboprop designs. Still to be anticipated is mastery of current technology's most provocative problem — the successful development of a nuclear aircraft engine.

Many engineering graduates would like to be concerned with the air power of the next generation. One way to fulfill that ambition is to pursue a career alongside the Pratt & Whitney Aircraft engineers who have consistently produced the world's best aircraft engines.

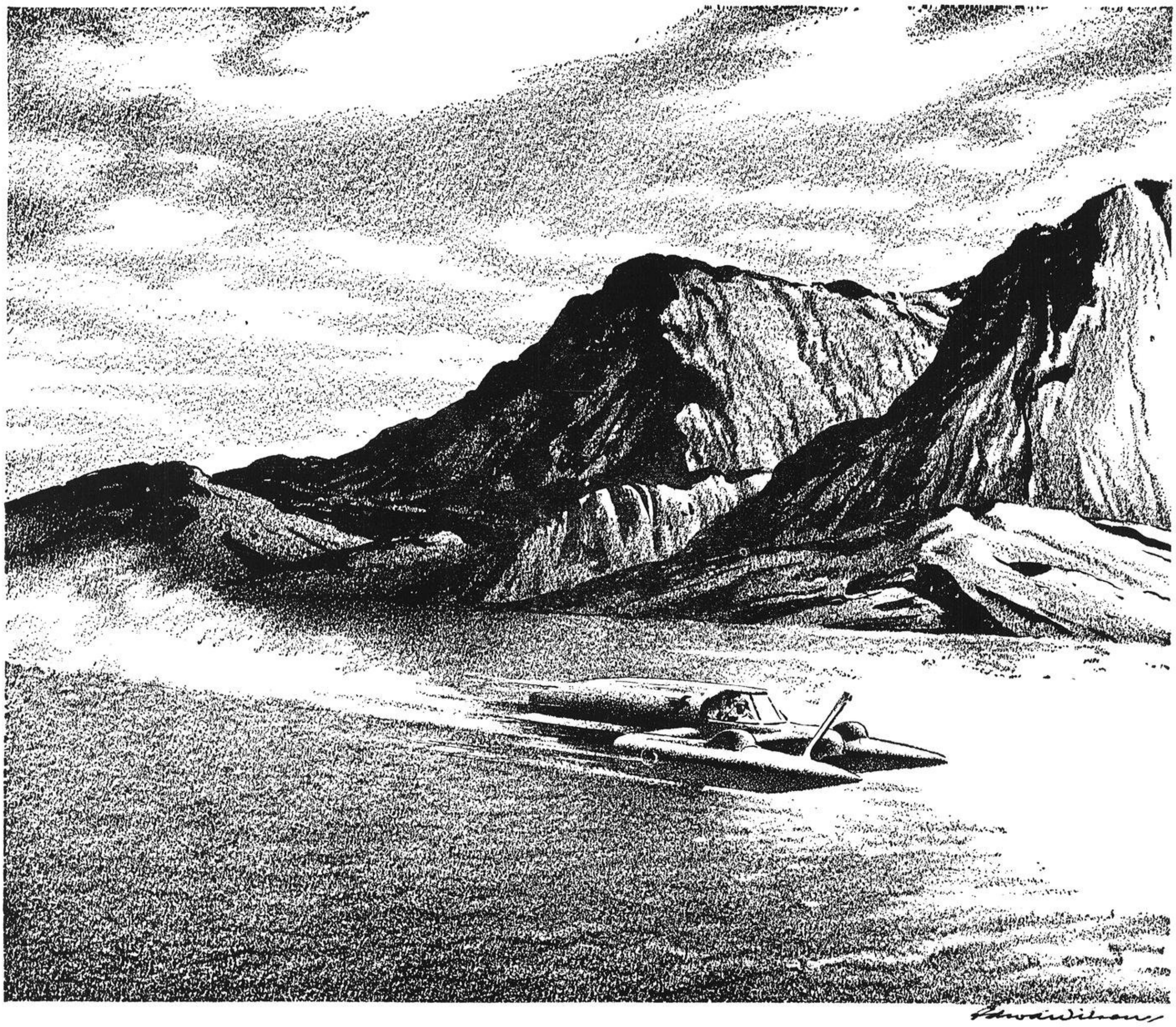
World's foremost designer and builder of aircraft engines

PRATT & WHITNEY AIRCRAFT DEPENDABLE ENGINES

PRATT & WHITNEY AIRCRAFT

DIVISION OF UNITED AIRCRAFT CORPORATION

EAST HARTFORD 8, CONNECTICUT



Behind the Ships that Set the Pace... a Master's Touch in Oil

World's fastest jet boat, Donald Campbell's Bluebird—216 miles an hour . . .

World's fastest propeller-driven boat, Slo-Mo-Shun IV—178 miles an hour . . .

All the Atlantic Blue Ribbon Winners, from the Mauretania to the S. S. United States . . .

Maiden voyage of the world's first atomic-powered submarine . . .

Two-fifths of all the world's freighters . . .

The race horses and work horses of the seas have one thing in common—SOCONY MOBIL'S *master touch* in lubrication.

Good reason! When the chips are down—when records are at stake—when schedules must be met—the men who know marine machinery look to SOCONY MOBIL for its protection.

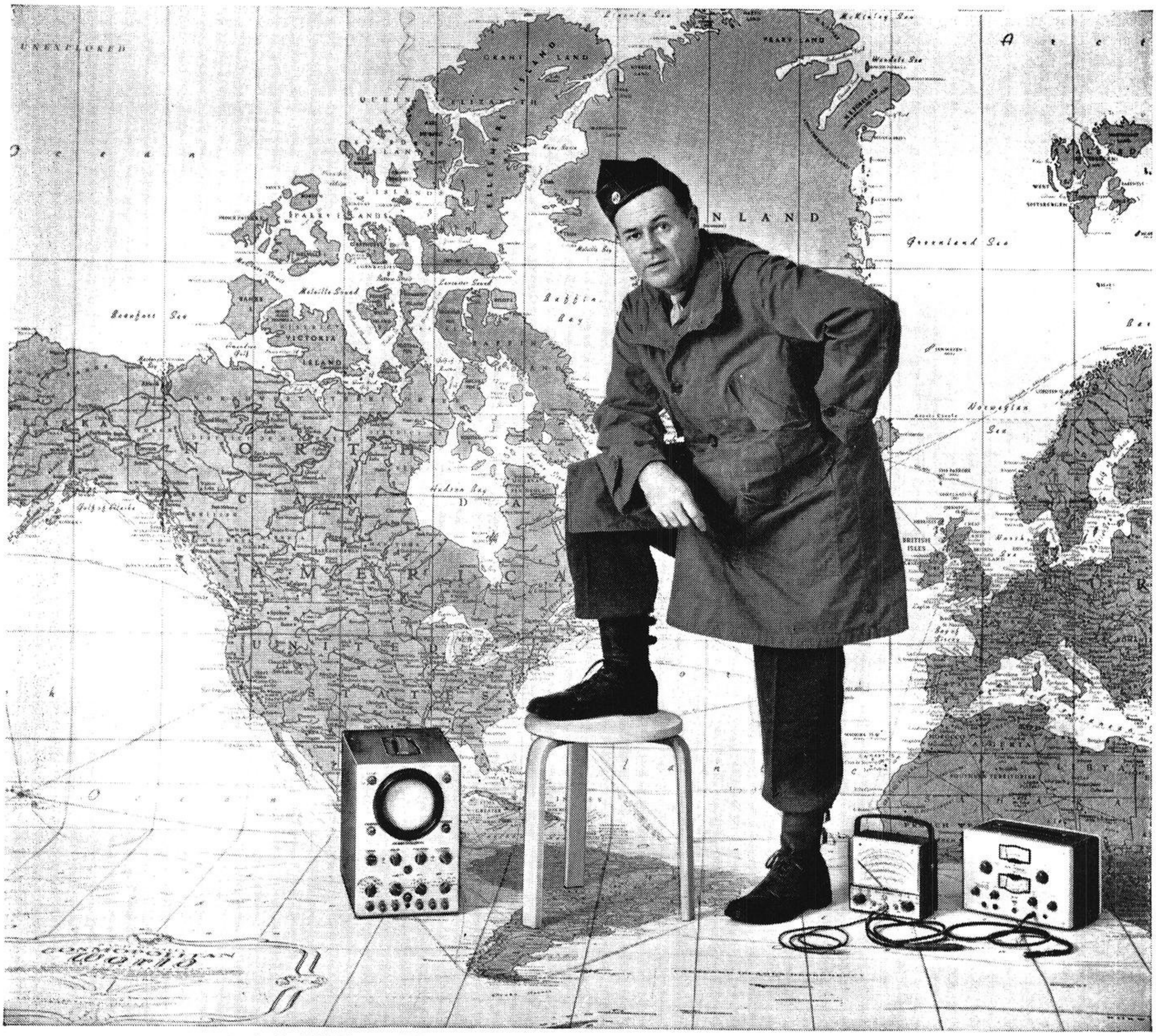
★ ★ ★

Wherever there's progress in motion—in your car, your factory, your farm or your home—*you, too, can look to the leader for lubrication.*

SOCONY MOBIL OIL COMPANY, INC.

LEADER IN LUBRICATION FOR NEARLY A CENTURY

Affiliates: General Petroleum Corporation, Magnolia Petroleum Company Mobil Overseas Oil Company and Mobil Producing Company



All over the world technical "Minute Men" of the RCA Service Company assist the U. S. Army, Navy, Air Force.

How RCA "Minute Men" give added strength to our Armed Forces everywhere

In Northern Japan, in Florida, in Guam—all over the world, the technical "Minute Men" of the RCA Government Service Department are assisting our Armed Forces.

These "Minute Men"—experts in electronic installation, maintenance, and training—are backed by the RCA organization that provides a wide range of complete electronic services and systems to the nation. Behind them stand RCA's 37 years of experience in communications; more than 70,000 RCA employees in manufacturing plants stretching from coast to coast; plus the fullest research facilities devoted to electronics that industry has ever known.

In all these ways, the RCA Government Service Department has proved its ability to give added strength to our Armed Forces.

WHERE TO, MR. ENGINEER?

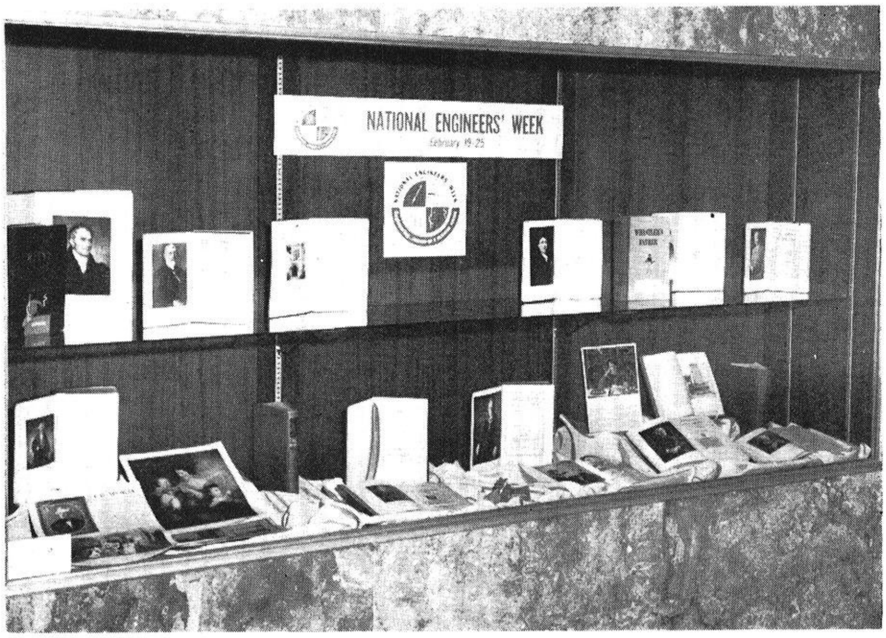
RCA offers careers in research, development, design, and manufacturing for engineers with Bachelor or advanced degrees in E.E., M.E. or Physics. For full information, write to: Mr. Robert Haklisch, Manager, College Relations, Radio Corporation of America, Camden 2, N. J.

RADIO CORPORATION OF AMERICA

ELECTRONICS FOR LIVING

WISCONSIN SOCIETY OF PROFESSIONAL ENGINEERS

W. S. P. E.



Display at University Library "National Engineers Week"—Feb. 19–22, 1956.

SECRETARY'S OFFICE

575 Toepfer Avenue
Madison 5, Wisconsin
HAROLD N. KINGSBURY, *Secretary-Treasurer*

PUBLICATION COMMITTEE

HARLEY L. GIBSON
122 W. Washington Ave.
Madison, Wisconsin
M. L. HOGLUND, La Crosse
J. M. HOLDERBY, Rhinelander
V. A. KNEEVERS, Sheboygan
R. M. LYALL, Milwaukee
C. E. MATHEIS, Wauwatosa
C. M. PERLMAN, Madison
W. A. ROSENKRANZ, Chippewa Falls

W.S.P.E. OFFICERS

ARTHUR G. BEHLING, *President*
A. L. GENISOT, *1st Vice-President*
CLIFFORD NELSON, *2nd Vice-President*
HAROLD N. KINGSBURY, *Secretary-Treasurer*
GEORGE P. STEINMETZ, *Past President*
JAMES BAMBERY, *Director*
WALTER E. DICK, *Director*
JOHN GAMMELL, *Director*
FRANK L. CARLSON, *Director*
E. C. KOERPER, *Director*
THERON BROWN, *Director*
WAYNE G. BRYAN, *Director*

NATIONAL REPRESENTATIVES

RICHARD C. CLARK
HAROLD TRESTER

ENGINEERS' CREED

As a professional engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare.

I PLEDGE

To give the utmost of performance, to participate in none but honest enterprise, to live and work according to the laws of and the highest standards of professional conduct. To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations. In humility and with need for Divine Guidance, I make this pledge.

PUBLIC RELATIONS COMMITTEE

Public Relations activity has been outlined as follows:

1. National Engineers' Week Activities. Engineers' Week activities throughout the State were formulated into a coordinated effort to bring the Engineering Profession before the public. This was accomplished by the Chapters use of the N.S.P.E. Promotional Kit. Speakers' Bureaus were organized to go before the public. Newspaper, radio and television releases from N.S.P.E. attracted considerable attention and favorable comment. Exhibits emphasized local products and new developments. Awards brought forth recognition of local talent. Proclamations were made by local city mayors and the Governor of our state. Engineers' Week Stamps were made available for sale.

2. Publications. All chapters are participating in furnishing news items to the "Wisconsin Engineer". Meet the Presidents' series of articles keynotes the W.S.P.E. section of the magazine. Southwest Chapter made the first contribution in the Jan. issue to a new section set aside for our members' promotions, achievements and retirements.

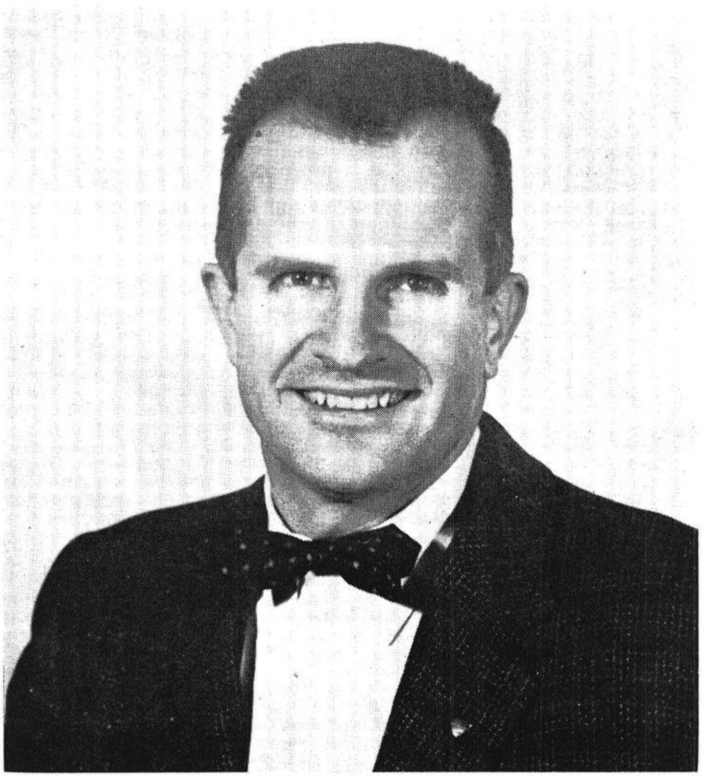
N.S.P.E. publications division supplied more than twenty brochures and articles on the subjects of The Engineers' Week story, professional development, registration, vocational guidance and ethics and practices. All chapters were provided with the N.S.P.E. issues.

3. Vocational Guidance. This activity centers around high school students interested in an engineering profession. Career day speakers and vocational counselors are cooperating with the various high school personnel throughout the State. High school engineering clubs known as Future Engineers of America have N.S.P.E. sanction. An investigation of this project is under way with the parent group sponsored by the Ohio Society of Professional Engineers.

4. Professional Development and Registration Promotion. Due to the limited amount of direct with vari-

(Continued on page 54)

Meet the President



RICHARD B. BRINDLEY
Western Chapter President

Richard B. Brindley, President of the Western Chapter of Wis. Society of Professional Engineers, was born Jan. 26, 1916 in Richland Center, Wis. He graduated from the University of Wisconsin with a B. S. degree in Mech. Engineering in 1938.

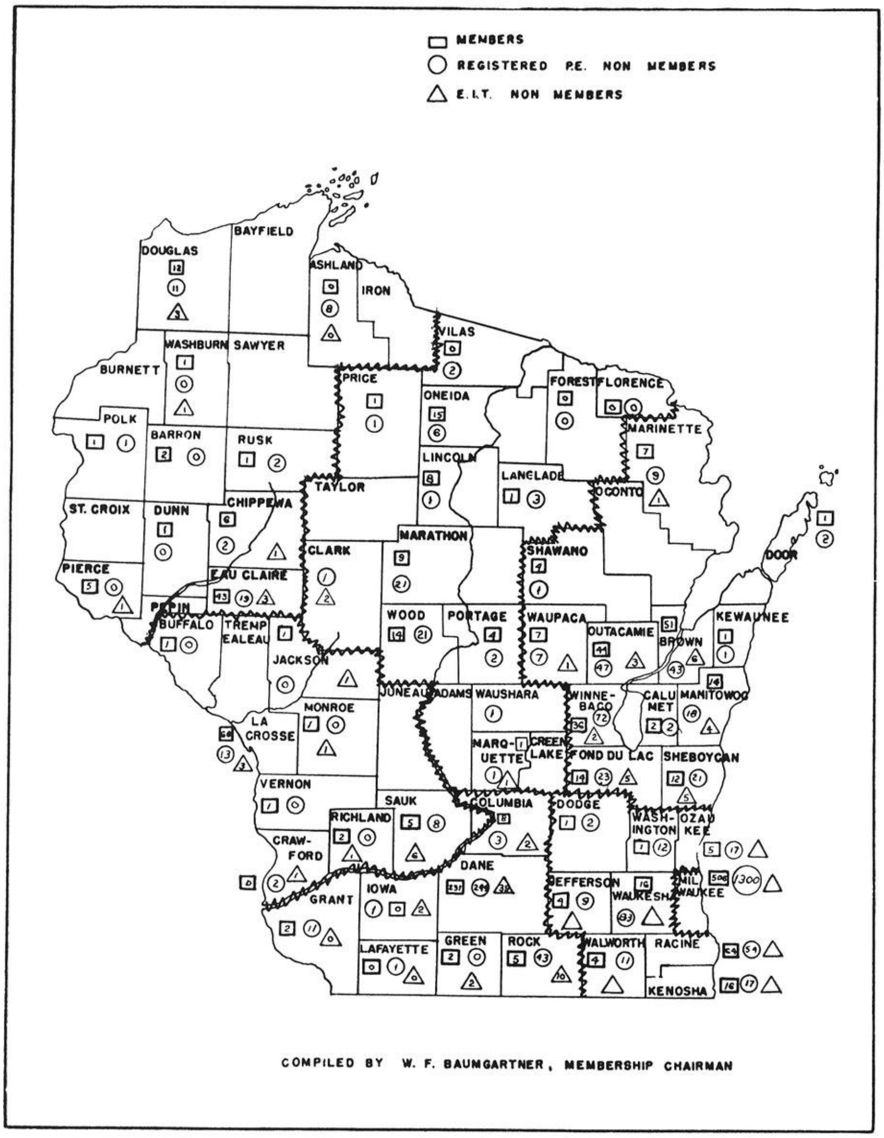
While at the University he was a member of Sigma Phi Social Fraternity, Pi Tau Sigma Mech. Engineering Fraternity, and was a pole vaulter on the University track team. After graduation he gained design and development experience in heating and air conditioning while working for the Trane Co. of La Crosse, Wis. for three years. Original work done at that time in radiant heating by Mr. Brindley was illustrated in an article appearing in the July 1941 issue of "Heating and Ventilating".

During the war Mr. Brindley was an engineer in the Navy Dept. where he assisted in the design of acoustic, magnetic, and contact mine sweeping devices. Since the war he has been design engineer for Northern Engraving & Mfg. Co. of La Crosse, Wis. This plant of some 1500 employees manufactures decorative automotive parts as well as clock dials, name plates, and domestic refrigerator parts. Mr. Brindley designs automatic sequential plating and etching machines for these processes as well as automatic machines for imparting decorative effects to automobile instrument panels.

Mr. Brindley is a member and past president of the La Crosse chapter of the Great Boaks Group, sponsored by the Ford Foundation. He is also a past member, oboist, of the La Crosse Symphony Orchestra, and presently is an Elk and member of the La Crosse Country Club. His hobbies are reading, metal working, golf, and fishing.

Mr. Brindley married the former Jean Heagerty of Oswego, New York in 1949 and they have two children, Barbara Ann 6 years of age; and Richard David 3 months.

END



Chapter	Prospects PEs	Prospects EITs	Membership 7–9–55 PE	Membership 7–9–55 EITs	Quota	Sponsors for New Members 7–9 to 1–28–56 PEs	Sponsors for New Members 7–9 to 1–28–56 EITs	% of Quota
Western	20		63	5	10	2	2	40.0
Northwest	40		62	8	20	5	0	25.0
Wisconsin Valley	60		44	3	15	3	0	20.0
Southwest	300		239	12	60	5	2	11.0
Milwaukee	1300		450	42	175	12	7	10.0
Fox River Valley	225		170	19	50	5	0	10.0
Southeast	255		73	11	30	0	1	4.0
Out of State	800	100	°1133	°110	365	32	12	12.0

(°) Those figures received from State Secretary on August 20, 1955.

COMPARISON BY YEARS

	1953–1954 New Members	1954–1955 New Members	1955–1956 New Members
July	...	...	..
August	...	2	10
September	...	27	15
October	...	38	23
November	...	...	..
December	22	71	28
January	44	123	44
February	92	...	..
March	128	187	..
April	208	...	..
May	...	227	..
June	214	252	..

ous chapters, only two chapters are known to be actively engaged in this subject. Milwaukee Chapter's Thursday noon luncheon meetings have pre-arranged programs emphasizing the subject with gratifying results. Individual participation has created interest among members heretofore resolved to make up the audience.

Southwest Chapter introduced a new program, during Engineers' Week, for Engineering Seniors approaching graduation. Counsel was given them concerning the importance of registration and membership in the society.

MAP SHOWING PROSPECTS IN EACH COUNTY

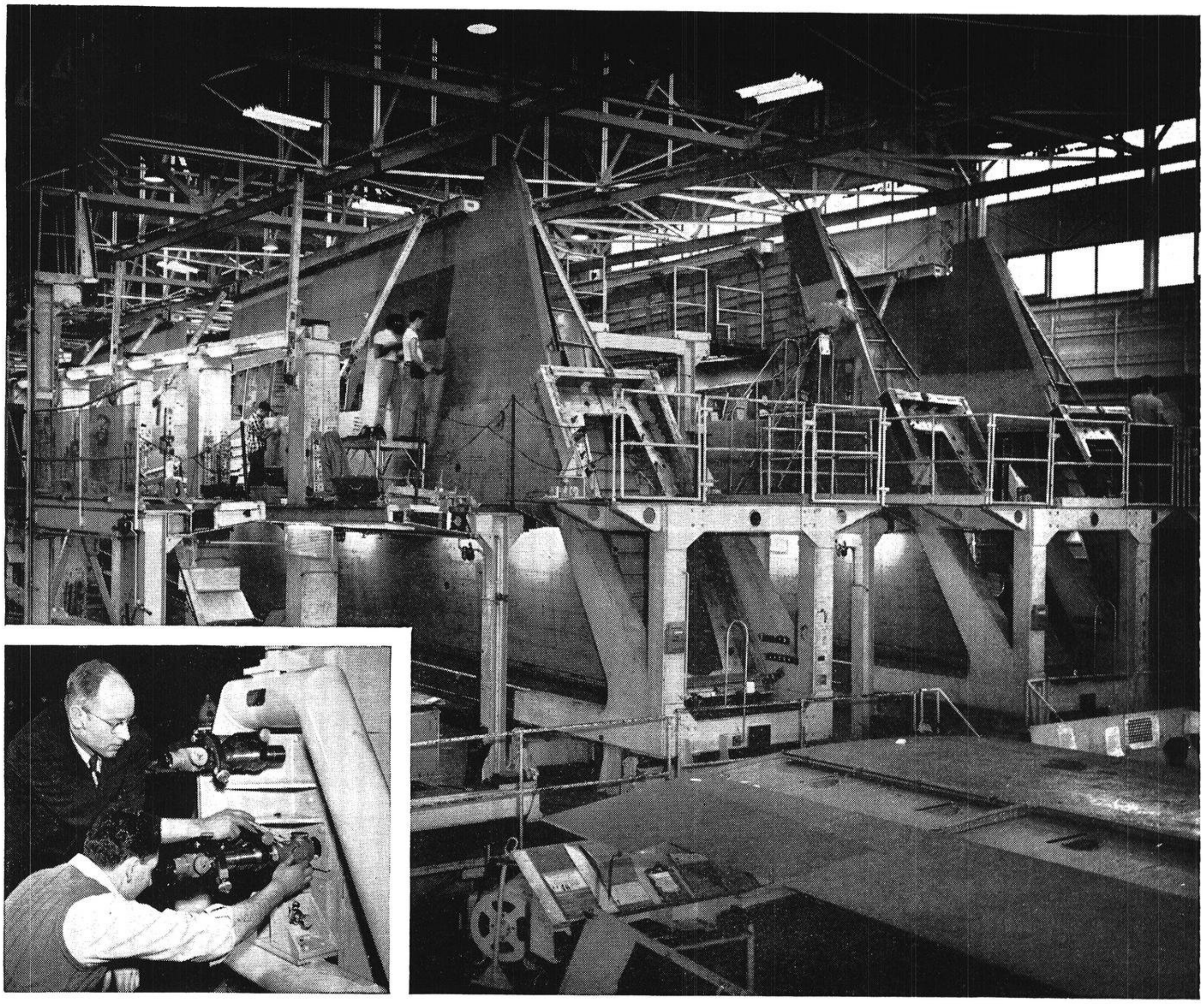
We have prepared a map showing the prospects in each county. The State Board can use this in revising the chapter areas. It is my belief that more interest can be generated by organizing more chapters, thus reducing travel distances. Having more frequent chapter meetings creates more interest in belonging to WSPE. It is my suggestion that Northwest, Wisconsin Valley, Southeast, Fox River Valley and Southwest study the possibilities of dividing up their areas taking into account the number of PEs and prospects in their present area.

MEMBERSHIP

We have reached the half way mark of the present administration year. Our record so far is only 12% of our quota. Not good you say. Well, what can we do about it? We have the prospects so it is up to all of us to get busy from now on in to the last board meeting in June. Since Progress Report No. 4 there were 11 PE's and 5 EIT's taken in to our society which makes a total of 32 PE's and 12 EIT's since last August. All *chapter officers and membership should take an inventory immediately and decide to take drastic action to improve the situation.*

Southwest Chapter started a campaign to get new members in Rock County by inviting all registered engineers in Beloit to a dinner at Beloit on January 31. The purpose

(Continued on page 56)



Boeing production engineering—precision on a big scale

This Boeing B-52 wing jig is one of a battery of four. Each one is 90 feet long and weighs more than 1,000 tons. Yet many of its tolerances are within 1/1000 of an inch — as close as a fine watch! Almost-absolute accuracy on a tremendous scale like this means that Boeing production engineers face some of the most stimulating challenges in engineering today.

These production engineers are of many types. And, because of steady expansion, Boeing needs more of them: industrial, civil, mechanical, electrical and aeronautical engineers.

There is "growing room" for topnotch production engineers at Boeing's Wichita and Seattle plants. Big programs are now under way on the airplanes and guided missiles of a few years hence. And Boeing production engineers are responsible for the high quality and continuous development of such industry-leading airplanes as the B-52 — famous "Long Rifle" of Strategic Air Command — and the 707 — the world's first jet tanker-transport.

At Boeing, production engineers find individual recognition in tightly integrated teams in design-analysis, test, and liaison-service. They find that Boeing is an "engineers' company," with a long-standing policy of promotions from within the organization.

Career stability and growth are exceptional at Boeing, which now employs more than twice as many engineers as at the peak of World War II. Boeing engineers enjoy a most liberal retirement plan. And life for them is pleasant in the progressive, "just right" size communities of Seattle and Wichita.

There are opportunities at Boeing in design and research, as well as in production. If you want job security, satisfaction and growth, it will pay you to investigate a Boeing career *today*.

For further Boeing career information consult your Placement Office or write to either:

JOHN C. SANDERS, Staff Engineer — Personnel
Boeing Airplane Company, Seattle 14, Wash.

RAYMOND J. B. HOFFMAN, Admin. Engineer
Boeing Airplane Company, Wichita, Kansas

BOEING

Aviation leadership since 1916

SEATTLE, WASHINGTON WICHITA, KANSAS

W.S.P.E.

(Continued from page 54)

and aims of WSPE were explained in detail by Paul Grogan and other WSPE members present. I know that Southwest will secure many new members from that area. May I suggest that similar meetings be held in other parts of the state. I have in mind Green Bay and Menasha in Fox River Valley, Racine and Kenosha in Southeast, Milwaukee, Superior in Northwest and in other cities where we have a large list of registered engineers. It takes time to organize such a meeting and it requires special invitations from some key man in the area. Southwest did it with success. President Ayres and your chairman are anxious to help you at such meetings. Why don't you write Page Johnson at Madison for details today? It will pay off. In the meantime make a list of your prospects in the areas with their address so that you will be ready when you decide to set a date for the meeting. It takes time to organize so don't put off the preliminaries. We will be glad to hear from you soon regarding this suggestion.

In our contest the January 20th Membership Memo shows the following:

	Net Gain	Net Gain per M	Prospective Members
Michigan	186	62.8	2962
Indiana	43	16.1	2674
Wisconsin	35	15.6	2247
Minnesota	35	22.0	1588

Next month tabulations undoubtedly will reflect substantial changes in the standings of the states. For as all may recall the rules upon which this contest is based: viz. *current and arrear members only are included in the tabulation.* We should see that we do not have a long list of such members as this will affect us very much.

REPORT OF ETHICS AND PRACTICE COMMITTEE

January 28, 1956

The Ethics and Practice Committee has concentrated its main efforts toward the elimination of non-registered engineers from the Wisconsin Telephone Directory. Probably the best way to illustrate the results is with figures.

In the present Milwaukee Telephone Directory there are 215 listings of engineers. Of that 215 there were 85 listings which were either questionable or definite violations of the Registration Act. The reason we use the term questionable is that in many instances the company name is used and it is difficult to check whether a registered professional engineer is in responsible charge. The results of this date are as follows. Out of the 85 listings, which were investigated, we have 12 which as yet have not complied with the Registration Act. In the next few days we reduced that number to 5 or 6 listings. This indicates what can be done at a statewide level if the engineers work together as a team.

The Ethics and Practice Committee has also been active in investigating members' complaints and during the year several reports were written and followed up by your Board of Directors. We cannot claim 100% results for we do not obtain 100% cooperation from our membership. The Ethics and Practice Committee is only a tool that can be used by each and every member to keep our profession at a high level. It is every members' duty to his society and to his profession to report all violations of Ethics or Practices to the chairman of his Chapter concerned. By doing that he allows the Ethics and Practice Committee both at the Chapter and State level to fully perform their duties in keeping the profession at a high level.

I would like to thank the Board of Directors and all the hard working committee chairmen and members on the excellent job that they are doing in keeping the Engineering Profession in Wisconsin in such high esteem.

BOARD OF REGISTRATION
LAND SURVEYORS

As of March 2, 1956 a total of 486 have filed applications for Land Surveyor.

On Feb. 1, 1956, the number of Land Surveyors registered in Wisconsin totalled 271.

REGISTERED ENGINEER & ARCHITECTS

The number of Engineers registered in Wisconsin as of Aug. 1, 1955, numbered 4194, Engineers in Training 1196 and Architects 667.

THE CONSULTING ENGINEER AND HIS OBLIGATIONS IN PROFESSIONAL ENGINEERING AFFAIRS

BY HERBERT MOORE
Milwaukee, Wisconsin

Thirteenth Annual Meeting Wisconsin Society of Professional Engineers, January 27, 1956, Milwaukee, Wis.

In considering obligations of consulting engineers in professional engineering affairs, I think we should be aware that membership in our state engineering society is divided into four functional groups, namely, educational, public employment, industrial and consulting. Our society constitution provides that nominating committees shall comprise equal representation from these groups, with the view that these result a balance of interests on the governing board of the society.

In this respect, our Wisconsin Society of Professional Engineers is unique in comparison with other state engineering societies. Our pattern has been copied elsewhere. It seems to me our Society framework has survived long enough to say that it is strong.

With reference to the division of our membership into functional groups, members choose the group in which they are most interested. There are no requirements for membership in a functional group other than membership in the Society.

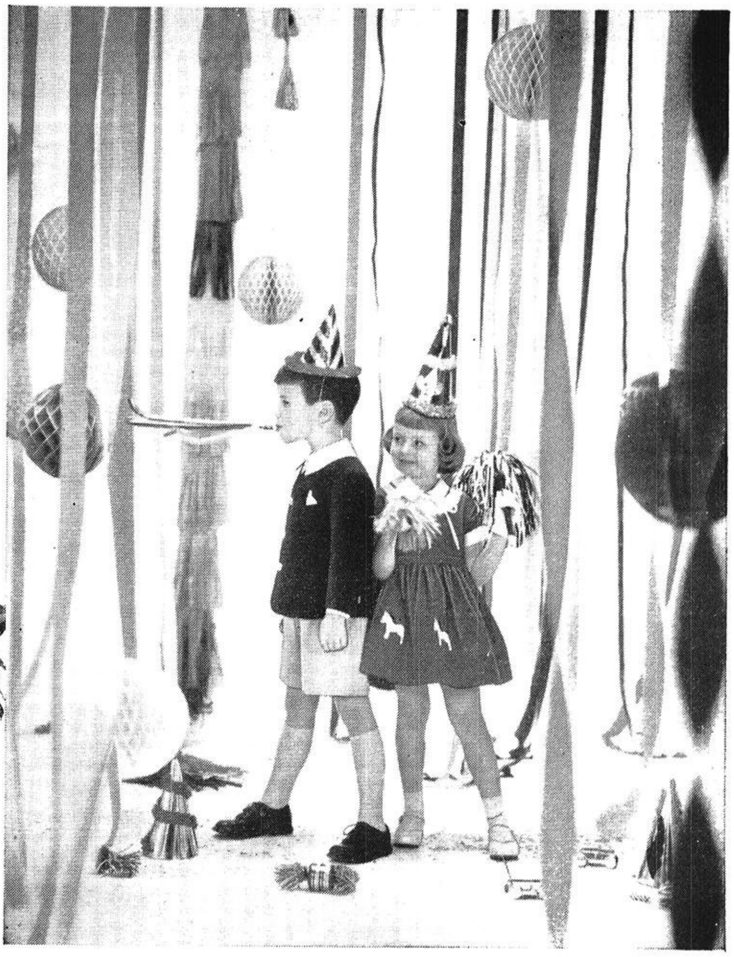
Thus within the framework of our state society, problems of concern to anyone of the groups can be discussed and acted upon. If official society action is desired, the matter can be referred to the Board of Directors.

This functional group is a forum for action.

Perhaps every engineer should look upon his work as "consulting engineering." The employed engineer renders "advice" for only one client—yet he participates in de-

(Continued on page 58)

partytime **PAPER**
and
lifetime **CHROME**



Maybe you can't see the connection between paper and handsome chrome plating—but it's there. Like so many things, both products begin with chemistry—and alkalies are indispensable to both.

Allied Chemical's Solvay Process Division is a leading producer of alkalies—like caustic soda and soda ash used in papermaking. Another Allied Division, Mutual Chemical, uses soda ash in the making of chromium chemicals, such as chromic acid for plating.

Because Allied's seven divisions are foremost producers of chemicals, there are scores of cases where two or more divisions team up to contribute to a finished product or to serve a particular industry.

Allied Chemical altogether turns out more than 3,000 products. Seen or unseen, they're helping everyone who makes, grows or uses things—that is, *you.*

HERE'S HOW THEY'RE
ALLIED

DIVISIONS:
Barrett General Chemical
Mutual Chemical National Aniline
Nitrogen Semet-Solvay
Solvay Process • International

***Allied* to serve you better**

Allied Chemical

61 BROADWAY, NEW YORK 6, N. Y.

CHEMICAL PROGRESS WEEK-APRIL 23-28

"A Better America Through Chemical Progress"

W.S.P.E.

(Continued from page 56)

veloping a detail of a plan involving the executive of good judgment which is the essence of engineering endeavor.

As he gains in experience, the work he does becomes more important. He may render advice and counsel to numerous clients and become established as an independent consulting engineer.

At that time, an engineer may advise not only as to good design and quality of workmanship, but also wherein a certain design or plan may relate to or fit into the scheme of things in our social order.

Obligations in professional engineering affairs that devolve upon consulting engineers are shared with others. It seems to me important to recognize that fact. In this sense, I am not suggesting sidestepping responsibility, but rather an approach to a fundamental problem.

Consulting engineers were practicing their profession far in advance of state registration laws. However, in the present category in which we fall, with engineering registration laws in every state in the Union, I think consulting engineers quite generally recognize a legal basis of the engineering profession.

During the past several years there have been formed in other states separate organizations of consulting engineers. It appears to me to indicate a weakness in the structure of state engineering societies in those states in question. In Wisconsin, consulting engineers have a home within the framework of our existing state engineering society.

Apparently, an organization of a society limited to consulting engineers would be just another pressure group of limited influence.

As a part of W.S.P.E. and indeed of the profession, we grow and become important by virtue of these associations. We can assume our just share of obligations.

Chapter News

FOX RIVER VALLEY CHAPTER

The annual Engineers' Week meeting of the Fox River Valley Chapter, Wisconsin Society of Professional Engineers, was held Thursday, February 23.

Master of Ceremonies F. J. Euclide, Engineering Superintendent of Green Bay, presented a program of special interest. Remarks of recognition of Engineers' Week and early Engineer George Washington was given by Gordon Mercer (Algoma), Engineers' Week Chairman, followed by two special engineering reports of major public interest.

Featured guest speaker Robert K. Chapel (Green Bay) narrated a progress report in color slides, on "Green Bay's New Water Supply", and "The Deep Inch", a colorfilm history of the dramatic twin-pipe crossing of turbulent Mackinac Straits.

Honored at this meeting was the Green Bay Engineers' Club, whose program of educational meetings contributes to civic betterment.

MILWAUKEE CHAPTER

National Engineers' Week was celebrated by the Joint Engineering Societies of Milwaukee including W.S.P.E. A banquet was held on Feb. 22nd in the Sky Room at Plankinton House. This was followed by a meeting at the Public Service Auditorium. Dr. Parkinson was presented an award as "The Engineer of the Year". Cdr. George W. Hoover, USN, delivered an interesting, dramatic and timely address on "Why An Earth Satellite". Cdr. Hoover pointed out that the day of the pioneer is not over. The scientists, physicists and engineers are the Modern-day pioneers, and the frontiers they are setting out to conquer are the limitless expanses of outer space.

SOUTHEAST CHAPTER

Southeast Chapter Secretary-Treasurer Walter E. and Helen

(Continued on page 68)

Chance Vought F7U Cutlass

Here's a simple equation:

NO HIGH ALLOY STEEL = NO PLANE

Without stainless steel, super-high-temperature steels and special electrical alloys, it just wouldn't be possible to build, power and control a plane in the over-600-miles-per-hour class. That is our job: to develop and produce such metals, and it may be the niche in industry that will interest you in the future. In any case, remember that whenever you have problems that involve resisting corrosion, heat, wear and great stress, or require special magnetic properties, we're the people to see. *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.*

PIONEERING on the Horizons of Steel

Allegheny Ludlum

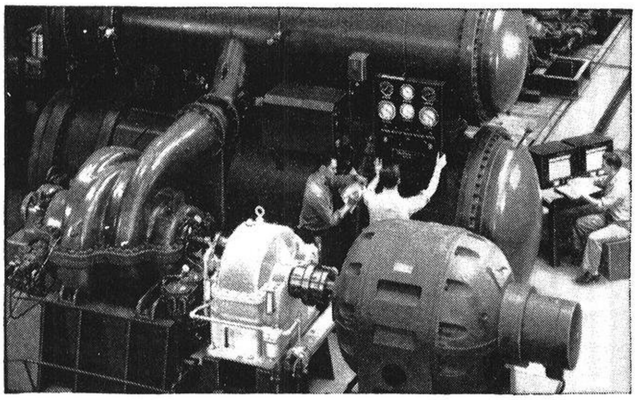
AL
LEADING PRODUCER HIGH-ALLOY STEELS

Warehouse stocks of A-L Stainless carried by all Ryerson plants

WSW 6004

"POWER OFF!" Test operations are directed from this central control room, where special measuring instruments greatly speed up the collection of pump performance data. That's one way Worthington products are made more reliable by using . . .

. . . the world's most versatile hydraulic proving ground



COMPREHENSIVE TESTS are run on a Worthington centrifugal refrigeration unit (lower left) now in service as one of the Arabian American Oil Company's central air conditioning units in Dhahran, Saudi Arabia.

When you make pumping equipment that has to stand up and deliver year after year anywhere in the world, you've got to be sure it will perform as specified.

That's why we built one of the world's largest hydraulic test stands at our plant in Harrison, New Jersey. Here, over a half-acre "lake," we can check the performance of anything from a fractional horsepower unit to pumps handling over 100,000 gallons a minute. When you realize there are thousands of sizes and types of centrifugal pumps alone, you get an idea of the versatility we had to build into our proving-ground.

Naturally, our new test equipment is a big help to our research engineers, as well as our customers. Now they get performance data on products quickly and accurately. Using it, we can save months, even years, in developing new Worthington fluid and air-handling devices—equipment for which this company has been famous for over a century. For the complete story of how you can fit into the Worthington picture, write F. F. Thompson, Mgr., Personnel & Training, Worthington Corporation, Harrison, N. J.

4.25A

See the Worthington representative when he visits your campus

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

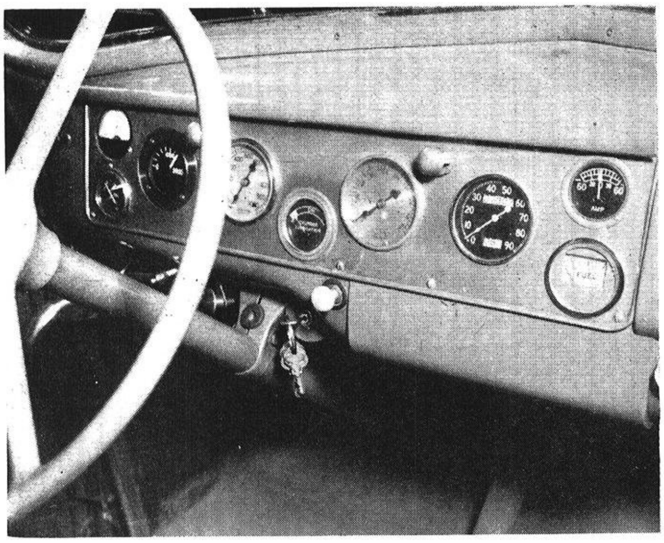
WORTHINGTON

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

AIR CONDITIONING AND REFRIGERATION • COMPRESSORS • CONSTRUCTION EQUIPMENT • ENGINES • DEAERATORS • INDUSTRIAL MIXERS
LIQUID METERS • MECHANICAL POWER TRANSMISSION • PUMPS • STEAM CONDENSERS • STEAM-JET EJECTORS • STEAM TURBINES • WELDING POSITIONERS

SOFT-PEDAL FOR A SUPERSONIC STORM

this AiResearch pneumatic control weighs only 3 ounces, yet regulates the flow of hot air to critical airplane parts with unfailing dependability. It reacts 100 times faster than equipment previously used.



Dash of Keen Steamliner.

Steam Autos

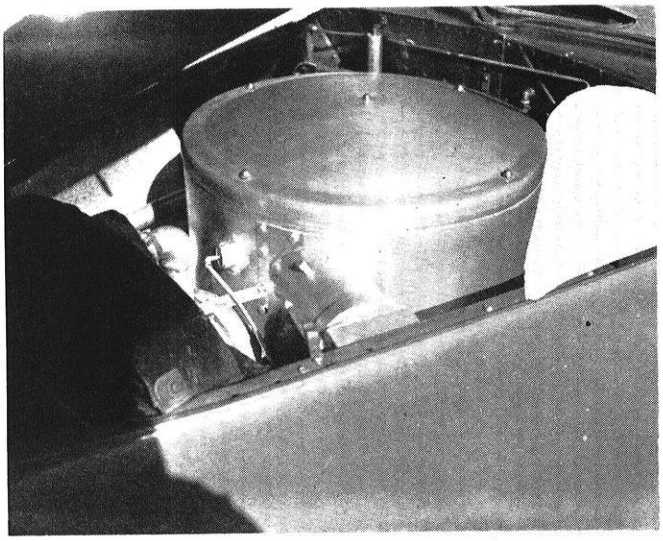
(Continued from page 22)

switch was closed to start the burner. The dashboard had many instruments which were confusing to anyone not familiar with them.

The Doble Steam Car

The Doble steam auto used a flash type boiler, which I believe to be the most suitable type or steam cars. The water tube boiler held a large amount of water, all of which had to be heated to build up pressure. With a flash boiler, there was no water in the tubes when the burner was lighted. Consequently, the tubes quickly became hot; then water was pumped into them, and it instantly "flashed" into steam. It built up full pressure in only thirty to forty-five seconds and thus cut down to a minimum the long waiting period connected with the starting of most steam vehicles.

The burner operated automatically; starting whenever steam pressure fell below 750 pounds per square inch. Water was pumped into the boiler under control of the boiler temperature and pressure. There was no worry about insufficient water in the boiler, and the number of instruments was reduced. The boiler responded very quickly to load changes so boiler pressure remained quite constant.



Under the hood of the Keen Steamliner.

The Doble used a four cylinder, double acting, compound engine with two high pressure cylinders (two and five-eighths inch bore, five inch stroke) and two low pressure cylinders (four and one-half inch bore, five inch stroke). By means of a foot pedal, the steam cut-off in the cylinders could be varied to meet various road conditions and give greater economy. Piston type valves which wear less than the common D-slide valve were used in the engine. Main crank shaft and connecting rod bearings were roller bearings, and gave long, trouble free service.

The British Sentinel Waggon

Prior to World War II, the Sentinel Waggon Works of Shrewsbury, England, built a steam powered truck. It was claimed that the initial cost was less than that of a gasoline powered truck, and operation was more economical. Fuel costs were only 44.7% of that for an equivalent gas engine truck, while fuel costs for a diesel were 56.5% of that for the gas engines. The truck enjoyed some popularity, but has practically disappeared due to certain serious limitations. The truck used a water tube boiler fired with coal or coke. Although an automatic stoker fed the furnace, it required considerable attention; and two men were necessary to operate the truck. Little effort was made to keep down the weight of the truck and since the total weight that can be carried over public highways is limited by law, the payload was lower that it could have been. Exhaust steam was used to produce draft as in a steam locomotive. The result was a high consumption of water, and the truck had to stop often to renew its supply.

About this same time, the Germans were experimenting with steam powered cars, trucks and busses which overcame the shortcomings of the shortcomings of the Sentinel truck.

German Steam Vehicles

The Henschel Locomotive Works of Kassel, Germany, did extensive experimenting with autos, trucks and busses using the Doble power unit. They were in actual production of trucks and busses just prior to the second World War. Evidently the war put an end to production, and nothing has been done to renew it since. This is both unfortunate and surprising because of the success of the units built. They were built more cheaply and operated more economically than their gasoline engine powered rivals. One of the reasons the Germans were interested in them was they burned coal oil, thus saving gasoline for the war effort. Perhaps they were not revived after the war because there was no longer the need to conserve gasoline.

Although they were never in production of the auto, models were thoroughly road tested and gave excellent performance.

(Continued on page 64)

Futures · With CHALLENGE!

ENGINEERS Who Know Their Business Will Want to Make It Their Business to Hear The Full Story of Chemstrand . . . where the future has just begun! . . .

WRITE TODAY if you think you can qualify for a position on Chemstrand's team.

TECHNICAL PERSONNEL MANAGER, Dept. UW-2
The Chemstrand Corporation
Decatur, Alabama

Gentlemen:
It is my understanding that you need for immediate employment graduate engineers in various fields, particularly chemical, mechanical, industrial, textile and instrument engineering.

I am a graduate______________engineer.
Please send me information concerning the ground floor opportunities at Chemstrand.

NAME____________________________

STREET__________________________

CITY______________ZONE____STATE________

CHEMSTRAND

THE CHEMSTRAND CORPORATION, DECATUR, ALABAMA

TOMORROW'S BIG DECISIONS WILL BE MADE **by the men who act today...**

Steam Autos

(Continued from page 62)

Present Day Activity

If any of the larger automotive manufacturers of today are working on steam cars, they are keeping it secret. The only experimental work on new power plants seems to be on gas turbines and free piston type engines. Although the companies seemingly pay little attention, many individuals are operating steam autos and are convinced of their superiority to the gasoline auto. Most of these people operate the old steam cars built years ago, but a few actually built modern cars which are great improvements over the old model steamers.

The Keen "Steamliner"

Mr. Charles F. Keen of Madison, Wisconsin, is one of the enthusiasts who built his own car. His "Steamliner" in a handsome looking coupe (see fig.) which uses a Doble type flash boiler. It has a single cylinder, double acting D-slide valve engine with a three inch bore and five inch stroke. This seems like a small engine compared to those previously mentioned, but the car uses very high pressure steam (1500 pounds per square inch), and Mr. Keen states that it is entirely adequate. The car gets twelve to fourteen miles to the gallon of furnace oil, which is the usual fuel used. Acceleration is equal or superior to that of any stock model car on the road today. Mr. Keen has minimized the number of instruments on the dashboard to make operation of the car simpler. He is now working on a uniflow type engine to replace the present engine in hopes of getting still greater economy of operation.

The Future of Steam Vehicles

The future of steam power does not look bright. Large auto manufacturers have spent millions to bring the gasoline engine to its present high state of development. The public is used to internal combustion engines, and it would be difficult to develop a market for a mass produced steam car. It would take much time and money to develop a steamer that is as simple to operate and requires as little care as the gasoline auto does, and this would be essential to make it popular.

One place where I believe the steam engine could be an immediate success is in powering the heavy duty trucks and equipment such as are used in open pit ore mining, road building and general earth moving. These vehicles need great torque at low speed; no other engine can match the steam engine for this quality. The long life of the steam engine would cut maintenance costs to a minimum. Such disadvantages of the steamer as more instruments and the delay necessary to heat the boiler would be of one consequence as experienced men operate the equipment and once started, it runs all day. Also, in this field, one would not have the trouble of overcoming the natural public reluctance to accept something new. **END**

De-Icing

(Continued from page 21)

because there is no available source of hot air, and the only practical way remaining is to anti-ice a propellor through the use of slip rings and electric resistance heaters on the blades.

Jet airplanes, on the other hand, do not have the propellor problem. Generally the jet airplanes produced today have a hot air anti-icing system. Jets have a tremendous source of hot air from the engine compressors. This hot air is sent through the airplane by means of ducts that are in the leading edges of the wing and tail surfaces or any other surface that would be subjected to ice accumulation. It would, of course, be possible for jet airplanes to use an electrical anti-icing system using their alternators for a source of power, but this would not be as economical or as mechanically simple as the hot air duct system.

The engineering division of the Northrup Aircraft Company has developed what they call "highly effective" thermal anti-icing system that is primarily designed for the F–89D Scorpion. Their system takes care of wings, empennage, wingtip rocket pods, windshields, leading edges of the engine intake ducts and forward frame components.

To keep the leading edges of the airframe and engine components clear of ice formation, high temperature air is bled from the compressor of the Scorpion's two J35A35 jet engines. Ducts are used to take the air from the compressors to places of ice formation.

The engines have additional ice protection from screens that retract automatically when the plane is airborne or if icing conditions prevail when the plane is on the ground. These screens have a dual purpose. When they are extended and the plane is idling on the ground these screens will help to keep birds and small animals from being sucked into the engine.

The windshield of the Scorpion is protected by electric resistance heating. This is much the same principle as the tin-plating of the windshields mentioned earlier. The Scorpion's windshields have a coating of conductive material on both the inside and the outside of the glass. The outside unit for ice protection and the inside unit for anti-fogging. In normal flight both units are heated continuously and the output can be raised for emergency conditions.

There is a new technique for applying electric heater elements on the surface of air foils. The heater elements are sprayed by flame spray guns. This process is very adaptable because of the ease with which it can be applied to complicated profiles, and requires only standard commercial equipment. In designing this equipment the manufacture kept in mind the important requirements of the heater. They are: heat losses to structure must be at a minimum; resistance of conductor element should be adjustable to varying loads; physical and mechanical properties of equipment

(Continued on page 72)


Capital VISCOUNT
Capital Airlines
Capital AIRLINES
an enthusiastic OK
for Collins New Integrated Flight System
Capital Airlines wires: "Enthusiastic in approval of Collins Integrated Flight System—basic flight instrumentation for our entire Viscount aircraft fleet."
There's good reason for this enthusiasm. The Collins Integrated Flight System is the greatest advancement in all-weather flying aids. It presents to the pilot a continuous picture of his aircraft's attitude and position, on two easy-to-read instruments. It takes the strain out of instrument landings, assuring the most precise descent possible. It makes cross country navigation easier and more accurate.
The Integrated Flight System —another leading achievement by Collins in aviation electronic development.
COLLINS RADIO COMPANY
CEDAR RAPIDS, IOWA • 1930 Hi-Line Drive, DALLAS 2, TEXAS
2700 W. Olive Avenue, BURBANK, CALIFORNIA
COLLINS

Memory Machines

(Continued from page 13)

Another type of inner memory is now being developed in the laboratories that is analogous to the magnetic-core system. It uses a new ferro-electirc material that retains an electric history just as the ferrite cores retain a magnetic history. However, the ferro-electric memory may prove to be more practical because of the small amount of electric power that it requires. Bell Telephone has built such a ferro-electric crystal memory that is composed of two sets of parallel electrodes at right angles to each other in a crystal only 1/4 inch square. Such a tiny crystal can store 256 binary digits. Again, the future of this type of high-speed memory in digital computers looks promising.

The supplement to the inner-memory, the intermediate-speed memory, uses the magnetic drum as a information storage place. This drum has a ferro-magnetic material on its outer surface that is comparable to the magnetic tape recorder. Then the drum is rotated at high speed, magnetized tracks are put on its surface that represent stored information. These digits or words are written on and read off by electro-magnet heads that are directly over the magnetized tracks. IBM has developed such a magnetic drum that lays down tracks one-tenth of an inch apart that stores about 80 binary digits to the inch. With this storage capacity a drum only 4 inches in diameter and 12 inches long could store about 4,000 English words.

Although drums with a capacity of up to 100,000 English words have been put into use, the magnetic-drum memory has serious limitations. Like the mercury-delay tube of inner memories, information on the drum is not immediately available, and the desired portion of the drum must come under the electromagnetic head before the computer can receive information. This means a delay of 10,000 to 20,000 miscro-seconds on even the fastest drum, which is a long time by computer standards. The magnetic-core memories may solve this problem, however, just as they seem to be the answer for the high-speed inner memory. Once a way is found to cut down on their cost, the magnetic-core may be even used in the largest intermediate memory sizes, up to 200,000 English words.

The third complement of the complete computer memory, that of a vast storage analogous to a large filing system, is in the comparatively early stages of development. Most digital computers still rely on punched cards which can be read no faster than 20,000 words per minute. When this is compared to the intermediate memory which can be read at 400,000 words per minute, or faster, and the inner memory, which can be read at 6,000,000 words per minute, it can be seen how the large memory bank severely limits the speed of the entire digital computer. However, the newer computers have partially gotten away from this limitation by changing from the standard punched card to rolls of magnetic tape. To date, this is the best improvement that has been made in the large storage class and by using great lengths of tape with several parallel tracks on each tape, almost inlimited information capacity can be realized. Again, however, the magnetic tape has several undesirable properties. Access time to the tape is very slow, and it is almost impossible to make corrections or additions on the tape without great expense. Either blank spots are left between information areas or else a new tape is made each time a correction or addition is needed. Both alternatives are wasteful and very expensive.

Perhaps an answer to this dilemma of the need for large storage capacity has been found by Gilbert W. King. He is working on a photo-scopic disk memory that is based on the great density of information that can be stored on a disk using high-resolution photographic emulsions. With this photoscopic technique it may soon be possible to employ densities 100 times as great as those on magnetic tape. This means it may be possible to store 500,000 words on a 12 inch phonograph record, and this small storage space would also mean almost instantaneous read-off time.

The development and application of this photoscopic technique is still in its early stages, but it promises to eventually give us a computer that has the storage capacity of a library of books. And when this vast capacity is used with the magnetic-core and ferro-electric memories, there may be no limit to the speed and usefulness of the digital computer. **END**

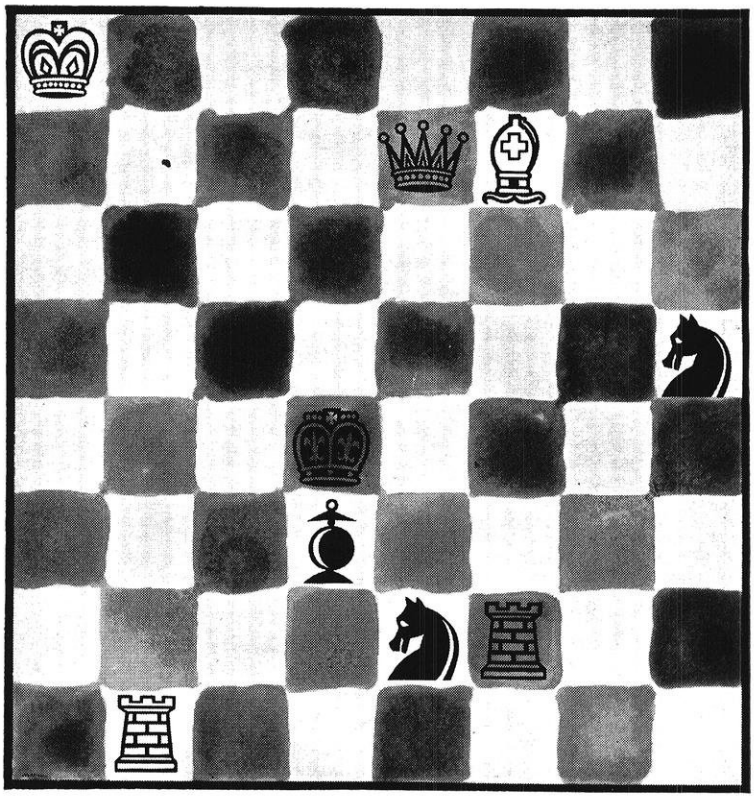
Stop and Think

(Continued from page 33)

sure you can readily see that to do this an engineer needs the most rigorous type of specialized training. Without a good high school foundation, no one can start such a program in college.

Besides thet specialized training which is required of an engineer, it is essential that he have a broad general education. People do not always reason out that if the engineer is going to use his specialized training to the highest degree of efficiency in serving his fellow man, that he should also know something of history, politics, psychology, economics, and all the other fields which affect the potential needs of the engineer's neighbor. To say that an engineer has a very narrow restricted education is not true; exactly the opposite is the case.

In summary, get ready for ANY vocation or profession by taking *basic* requirements NOW. Next, inform yourself about what a future in all vocations that seem to interest you will provide in service to others and in success and happineses for yourself. Lastly, make a wise decision in terms of your abilities and interests under the direction and guidance of someone equipped to give you counsel. And, finally, I hope you decide to be an engineer and come to the College of Engineering at the University of Wisconsin. **END**



W.S.P.E.

(Continued from page 58)

Dick of Waukesha vacationed at the Mardi Gras in New Orleans and then visited the Evangeline Country of Louisiana during the latter part of February.

Resolved, that the Southeast Chapter members living in Waukesha County be granted permission to form a new chapter and affiliate with the Wisconsin Society of Professional Engineer, and

Be it further resolved, that the Southeast Chapter members residing in Jefferson, Dodge, Washington, and Ozaukee counties be allowed to join the Chapter of their choice, and

Be it further resolved, that any member of the WSPE may belong to more than one chapter by paying additional Chapter membership fees.

SOUTHWEST CHAPTER

CHAS. M. PERLMAN

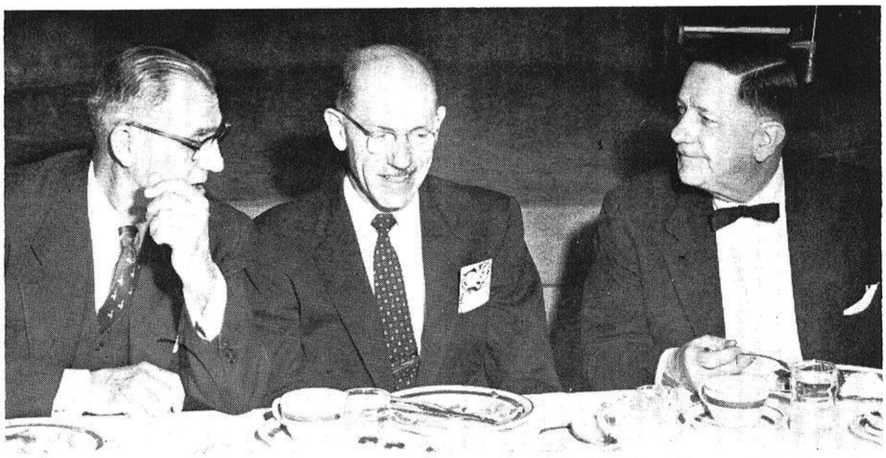
Under the chairmanship of Prof. Thomas J. Higgins of the University Electrical Engineering Department, together with a hard working committee composed of Warren Turner, John Frederick, Page Johnson, Chas. Perlman and Fay Morgan, a program of "National Engineers' Week" activities was carried out with great success. The program embraced a variety of activities for every day in the week of February 19 through 25 which included radio and television panel discussions, talks at service clubs in madison and neighboring cities, talks before high school students and displays of engineering works and accomplishments.

Highlighting the week of events was the dinner meeting at Great Hall, Memorial Union on Wednesday, Washington's Birthday, February 22, at which more than 300 persons were present. The Chapter was host to graduating senior engineering students, 150 from the University of Wisconsin and 32 out of 33 from the Wisconsin Institute of Technology at Platteville.

Special recognition and appreciation on a state-wide basis must be given to Leo Kosak, Chairman of Registration Promotion who promoted this idea of providing the Chapter members with the opportunity of counseling the engineers approaching graduations on the merits of "Registration" and "Professional Engineering". The Chapter also wishes to extend its appreciation to Professor Paul J. Grogan for his excellent job in providing the facilities and program arrangements in conjunction with T. K. Jordan, Program Chairman for the Chapter.

Other guests were C. W. Ottensman, Dean of the Institute; Frederick W. Schuler, West High School physics teacher, who was recently awarded citation by W.S.P.E. as one of the three State's

(Continued on page 70)



At the head table—from left, E. J. Kallevang, retired Vice President of Engineering from the Wisconsin Power & Light Company, who was recently named the "outstanding engineer" of the State Society; Kurt Wendt, Dean of the College of Engineering, University of Wisconsin; and Harold L. Plummer, Chairman of Wisconsin State Highway Commission, the guest speaker.

W.S.P.E.

(Continued from page 68)

outstanding science and mathematics teachers; and E. J. Kellevang, Retired Vice President of Engineering of the Wisconsin Power & Light Co., who was recently named "outstanding engineer" of the State Society.

WESTERN CHAPTER

Karl O. Werwath pointed out to the Western Chapter of the Wisconsin Society of Professional Engineers at their dinner meeting at La Crosse Tuesday evening Feb. 21, matters of serious and proper concern in maintaining a strong and healthy nation.

"The growing need for technical manpower is in two directions: Number and depth of technical know-how. We are acutely aware of the demand for professional engineering personnel. Actually, much of the problem is the alarmingly small number of sufficiently qualified engineering technicians.

The 'engineering team' is engaged in taking the load from human and animal muscles and using our natural forms of energy and machines so that this work is now done 95 per cent by machines, whereas in the Civil War days, probably 15 per cent of the work was accomplished that way. New machinery is taking people out of the labor force and substituting mechanized power and control. This requires a new high degree of technical skill by our workers if we are to maintain our productive leadership. Such become a part of the 'engineering team'. To maintain our productive leadership of 5 per cent of the people producing 50 per cent of the world's goods, which we must do to maintain our economic and political leadership, requires that each individual understand clearly his part in this production and distribution effort; and especially if he is engaged in technical work, that he understand the broad implication and specialized know-how of not only his technical job, but the economic and human factors as well."

"An engineering technician is one who can carry out in a responsible manner either proven techniques which are common knowledge among those who are technically expert in his branch of engineering, or those specially prescribed by professional engineers. Under general professional engineering direction, or following established engineering techniques he shall be capable of carrying out many duties.

In carrying out many of these duties, the competent supervision of the work of skilled craftsmen will be necessary.

An engineering technician, therefore, requires a background sufficient to enable him to understand the reasons and purposes of the operations for which he is responsible." END

De-Icing

(Continued from page 64)

should be unaffected by extreme ambient temperatures; external surfaces should be aerodynamically smooth; thickness of coating should be minimum for weight saving, and it should have good adhesion to metallic surfaces; with easy maintenance for economy and repair on the field.

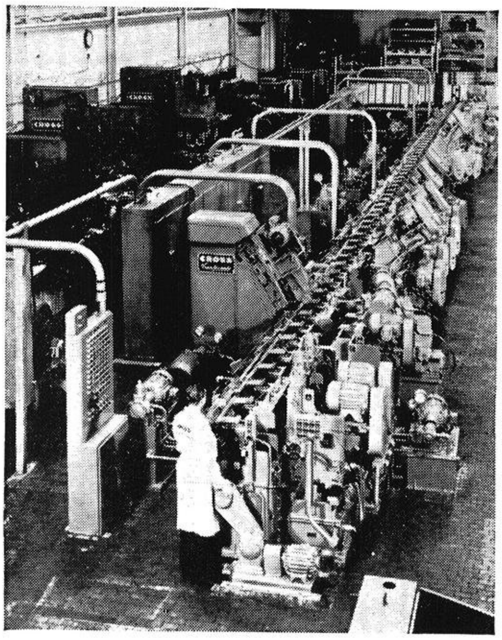
The manufacturer claims his heater will fulfill the above requirements and extensive tests have been completed on the equipment. These tests have shown that this de-icing equipment can be adapted to transonic and supersonic air foils and will give satisfactory service.

The electric power necessary to operate this system comes from the airplane alternator and can be used for continuous heating, anti-icing or intermittent heating de-icing. The weight of the installation on a four engine transport type airplane would be about 1000 pounds and the maximum power input would be 130.6 kw. In relation to the total weight of the airplane it is very light.

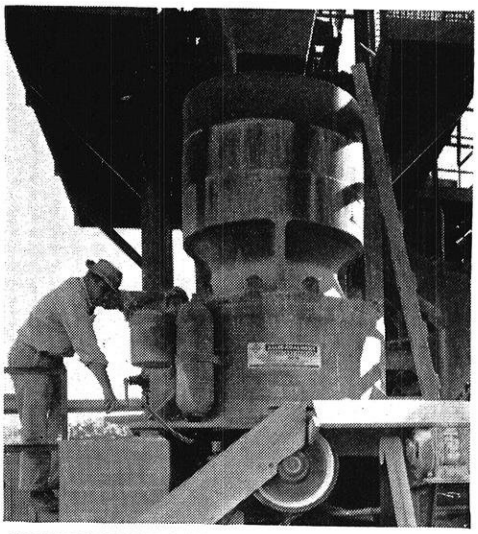
In the field of transonic and supersonic airplanes the problem of ice control must be considered differently. The designs of the sonic air foils and ambient conditions of flight at these speeds must be taken into consideration. These factors indicate the de-icing system would be best.

Transonic and supersonic air foils are designed very thin for undistorted air flow. With this thin design it would be practically impossible to install hot air ducts to carry hot air into the wing and tail surfaces. At supersonic speeds anti-icing is not necessary because of heat generated by air friction. At a speed of Mach 3 the skin temperature of the airplane would be approximately 2000° and would constitute a cooling problem instead of ice control. Ice control systems will be necessary only when the plane is traveling on the ground and before high speeds are attained. **END**

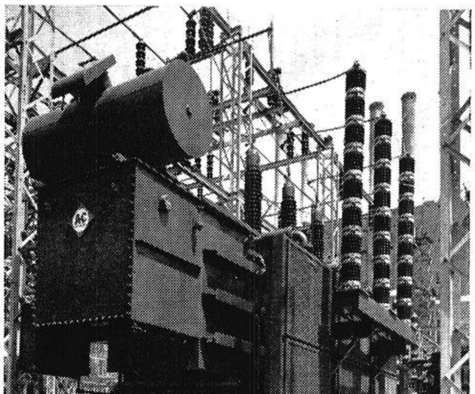
Build your future on these 3 Growth Industries . . .



MANUFACTURING — There are 51 Allis-Chalmers motors in this lineup of machine tools designed for high automobile production.



CONSTRUCTION—Crushers like these from Allis-Chalmers process the enormous quantities of aggregate for the booming construction industry.



POWER GENERATION—Allis-Chalmers is helping meet growing power demand with equipment such as this 150,000 kva transformer.

THERE IS much talk today about growth companies. Allis-Chalmers is one of them, supplying machinery for three basic industries—manufacturing, construction and power.

Therein lies an opportunity for you, since Allis-Chalmers builds many types of equipment.

. . . for a manufacturing industry that must increase output $3.5 billions by this time next year.

. . . for the construction industry that is destined to spend many billions of dollars on highways in the next ten years.

. . . for the electric power industry that will double its capacity by 1956.

Here's what Allis-Chalmers offers to Young Engineers:

A graduate training course that has been a model for industry since 1904. You have access to many fields of engineering: Electric power, hydraulics, atomic energy, ore processing.

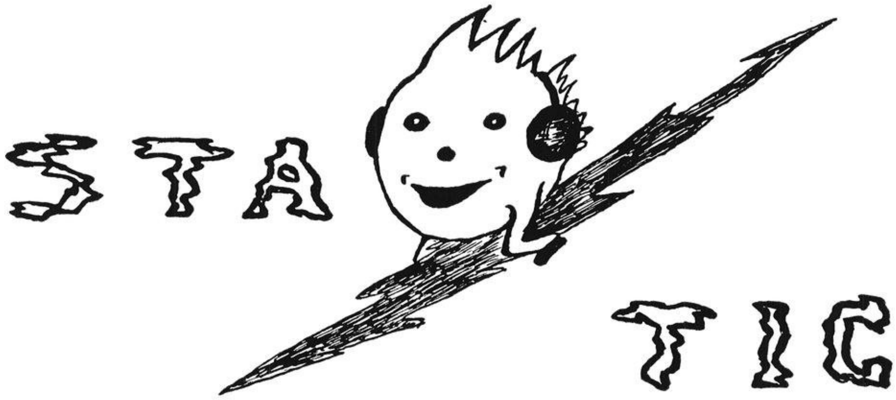
There are many *kinds* of work to try: Design engineering, application, research, manufacturing, sales. Over 90 training stations are available with expert guidance when you want it. Your future is as big as your ability can make it.

Or, if you have decided your field of interest and are well qualified, opportunities exist for direct assignments on our engineering staff.

In any case—learn more about Allis-Chalmers. Ask the A-C manager in your territory, or write direct to Allis-Chalmers, Graduate Training Section, Milwaukee 1, Wisconsin.

A-4684 **ALLIS-CHALMERS** A-C ALLIS-CHALMERS

Plants and Sales Offices all over the World



I. R. Drops, II

We hear that a fool and his money are soon parted, but please tell us how they got together in the first place.

° ° °

As a good neighbor she agreed to take the youngsters of her block to the pool for the afternoon. In her anxiety for their safety she failed to notice a red light and was whistled to a halt.

As the policeman came along he asked, "Lady, don't you know when to stop?"

"See here," she protested, "these are not all my children."

° ° °

I'd like to get something for my wife, but nobody will make me an offer.

° ° °

It takes years of experience for a girl to kiss like a beginner.

° ° °

The main trouble with lipstick is, it doesn't.

° ° °

Then there was the meteorologist who could look into a girl's eyes and tell weather.

° ° °

Some people have no respect for age, unless it's bottled.

° ° °

Coed to EE: "I don't care if you are a volunteer fireman, keep your hands off my hose."

° ° °

"You know," said the high school graduate, "I have half a mind to go to college."

"Well," his teacher decided, "that's as good as most."

° ° °

C.E.: "Did Fifi blush when the strap on her bathing suit broke?"

Chem.E.: "I didn't notice."

When I was a little lad
Upon my mother's knee,
She used to ask me, "Son of mine—
What will you one day be—?"

And I, with slide rule in my hand—
The toy I loved so dear—
Would answer, "Mama you well know
I'll be an engineer."

While other boys my age
We're reading fairy tales
I'd bug my little eyes out
Over books of logs and scales.

The formulae they stuffed me
Was not sweet milk and meal—
I'd eat equations X times Y
How good they made me feel.

And so it was that pi to me
Was nothing that I ate.
I knew it equaled three one four
So I'd leave it on my plate

The calculus and algebra
Became my bone and joint
What difference did it really make
If my head came to a point?

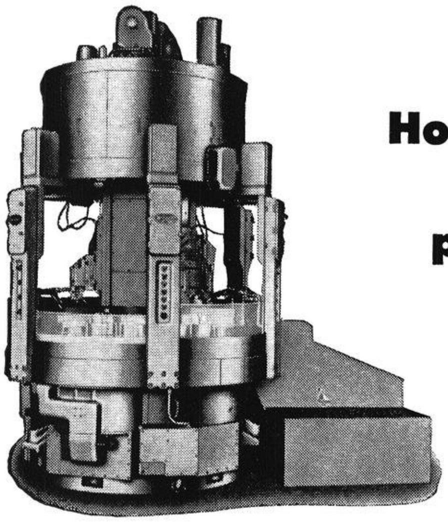
Then as it is in every life
A kindred soul I spied
I wooed her with exponents
And with fractions she replied

Her eyes were complex variables,
Her figure hyperbolic
Her lips were hysteresis loops
Her smile was quite symbolic.

Our wedding was a joining
Of two mathematical wizards
We knew all calculations
From alpha to the izzards

Yet with all this wealth of knowledge
No matter how we try,
The operations we do best
Is just to multiply.

Another page for **YOUR BEARING NOTEBOOK**

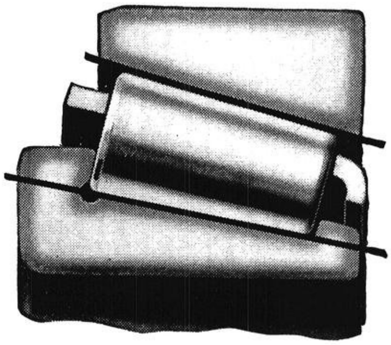


How to locate shafts accurately on high-speed precision chucking machine

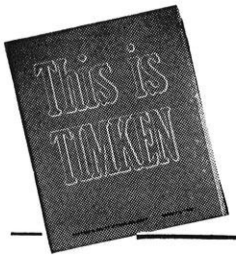
Engineers designing the new Bullard Mult-Au-Matic Type "L" vertical chucking machine were faced with the problem of achieving high precision despite heavy work loads and high speeds. To do this, they used Timken® tapered roller bearings to furnish the precision and load-carrying capacity required at the locating position.

Full line contact gives Timken® bearings extra load capacity

Because the load is carried along a full line of contact between rollers and races, Timken bearings have extra load-carrying capacity. And their tapered construction permits them to take radial and thrust loads in any combination. Result: shafts are held in rigid alignment, shaft deflection and end play are minimized, gears mesh smoothly, spindle precision is assured at high speeds.



Want to learn more about bearings or job opportunities?

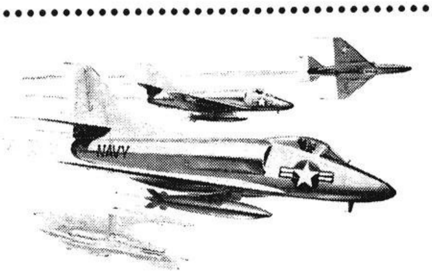


Some of the engineering problems you'll face after graduation will involve bearing applications. For help in learning more about bearings, write for the 270-page General Information Manual on Timken bearings. And for information about the excellent job opportunities at the Timken Company, write for a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

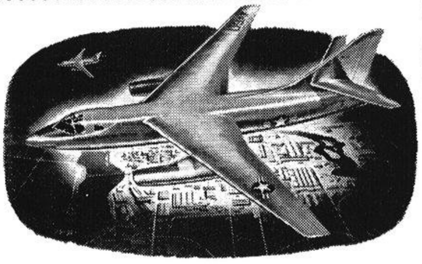
TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

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

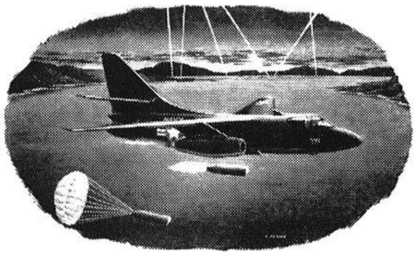
F4D, "SKYRAY"— only carrier plane to hold official world's speed record



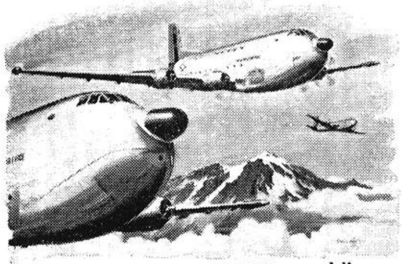
A4D, "SKYHAWK"— smallest, lightest atom-bomb carrier



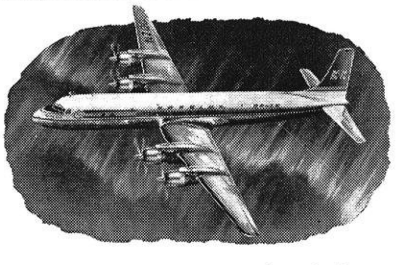
RB-66 — speedy, versatile jet bomber



A3D, "SKYWARRIOR"— largest carrier-based bomber

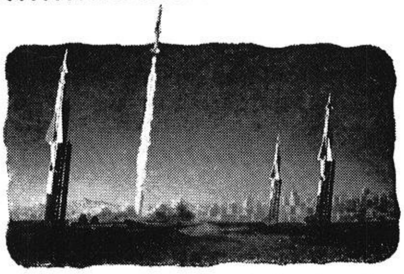


C-124, "GLOBEMASTER"— world's largest production transport

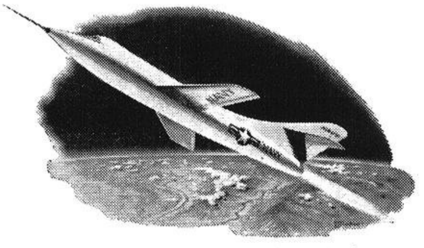


DC-7 "SEVEN SEAS"— America's finest, fastest airliner

Engineers: join this winning team!



"NIKE"— supersonic missile selected to protect our cities



D558-2, "SKYROCKET"— first airplane to fly twice the speed of sound

At DOUGLAS you'll be joining a company in which the three top executive officers are engineers . . . you'll be associated with men who have designed the key airplanes and missiles on the American scene today! Nothing increases an engineer's ability faster than working with other engineers of top calibre.

Not only is Douglas the largest manufacturer of commercial aircraft in the world, but it also produces outstanding aircraft and missiles for *every* branch of the armed services! This diversity, besides giving you job security, provides unequalled opportunity for the engineer with an eye to the future.

Challenging opportunities now exist in the following fields:

Mechanical design
Structural design
Power plant installation design
Weapons delivery
Aerodynamics
Thermodynamics
Electronic computers
Systems analysis
Aircraft air conditioning
Hydraulics
Stress analysis
Servo mechanisms
Acoustics
Electronics
Mechanical test
Structural test
Flight test
Process engineering
Missiles

DOUGLAS
First in Aviation

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

For further information relative to employment opportunities at the Santa Monica, El Segundo and Long Beach, California divisions and the Tulsa, Oklahoma division, write today to:

DOUGLAS AIRCRAFT COMPANY, INC.

C. C. LaVene, Employment Manager . . . Engineering General Office
3000 Ocean Park Blvd. . . . Santa Monica, California

To create in steel the flowing lines of today's cars, calls for metal of particular forming qualities.

Sleek styling starts with special steel:

Photography turns chemist—helps produce it.

Fenders, hoods, roofs and side panels call for best quality steel—and the watchful eye of photography guards specifications and controls that quality.

Car designers' dreams come true only if steel forms well under the pressure of deep drawing operations. That takes a particularly high quality steel.

Great Lakes Steel Corporation, Detroit, Mich., unit of National Steel Corporation, makes this steel for the automobile industry. And to make sure of its high quality they use photography. For example, during production, spectrograms show chemical make-up—insure the proper minute quantities of alloying elements, and photomicrographs reveal crystalline structure.

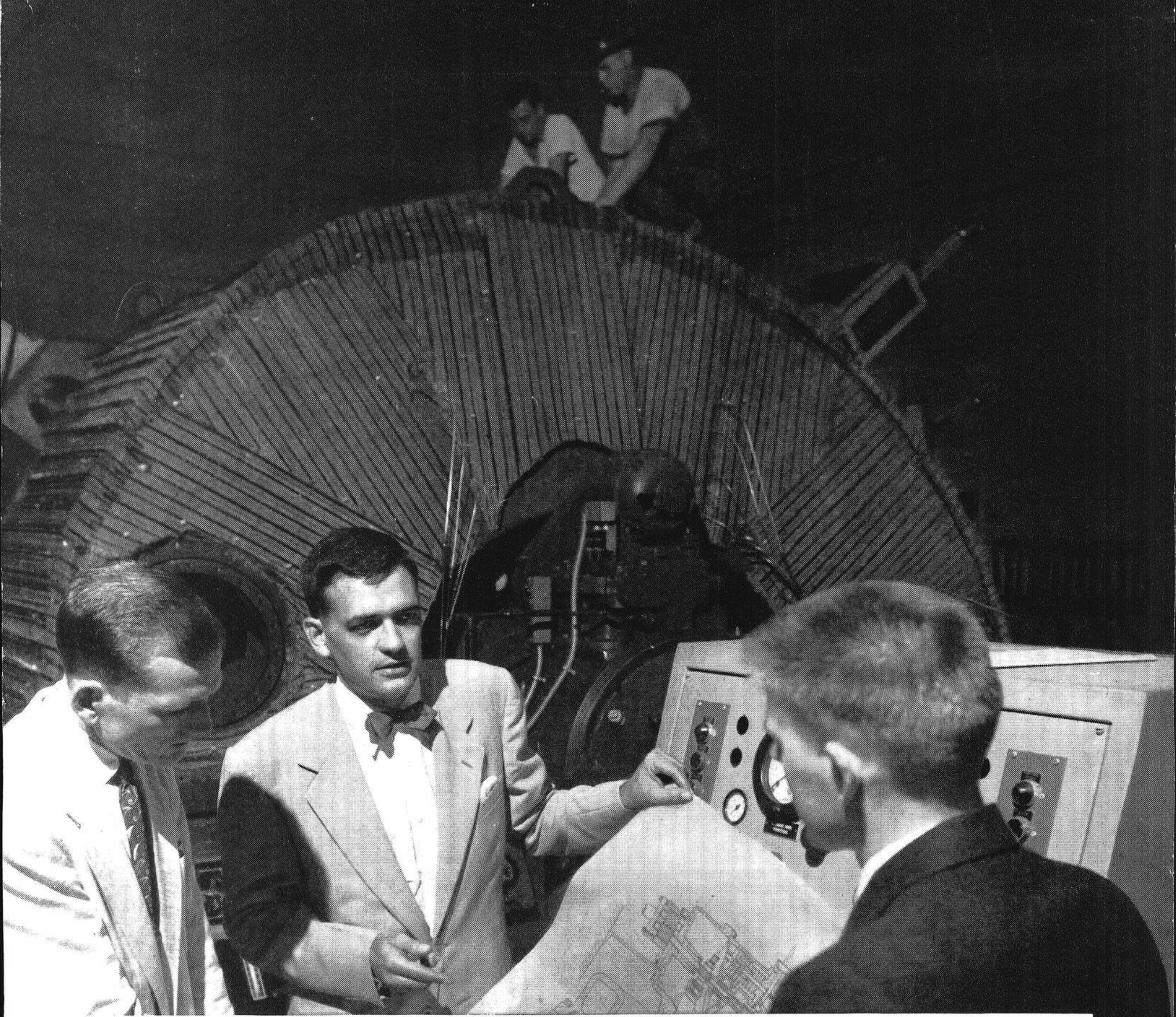
Controlling quality is but one of the many ways photography works for modern industry. In small businesses and large it is aiding product design, simplifying production, creating sales and expediting office routine.

At Great Lakes Steel a spectrogram is readied for reading in the densitometer—one of the tests that assure quality steel.

Behind the many photographic products becoming increasingly valuable today and those being planned for tomorrow lie intriguing and challenging opportunities at Kodak in research, design and production.

If you are interested in these opportunities in science and engineering—whether you are a recent graduate or a qualified returning serviceman, write to the Business and Technical Personnel Dept.

Eastman Kodak Company, Rochester 4, N. Y.



G-E Development Engineering offers you careers with unlimited professional growth

In G.E.'s new Turbine Product Development Lab in Schenectady, Ed Freiburghouse, RPI '44, describes development engineering to students Bob Parker, Mississippi State '56, and Don Williams, Yale '55. Ed explains the extensive development of new bucket designs for steam turbines which lead the way to increased efficiency and operating economy.

Similar product development is being done in G.E.'s 132 plants in 101 cities and 24 states, offering you opportunity for professional development in many engineering channels, working with the more than 200,000 products G.E. makes for industry, the home, and defense.

The G-E Engineering and Science Programs train you in the field of engineering most suited to your interests and aptitudes, such as development, design, or the laboratory.

956-1A

Progress Is Our Most Important Product

GENERAL ELECTRIC

MAIL COUPON FOR CAREER INFORMATION

MR. W. S. HILL
ENGINEERING PERSONNEL
GENERAL ELECTRIC COMPANY
SCHENECTADY 5, N. Y.

Please send me your descriptive bulletin, ENS-P-5, on the G-E Engineering and Science Program.

NAME..

COLLEGE.................................... DEGREE & YEAR..............................

ADDRESS..