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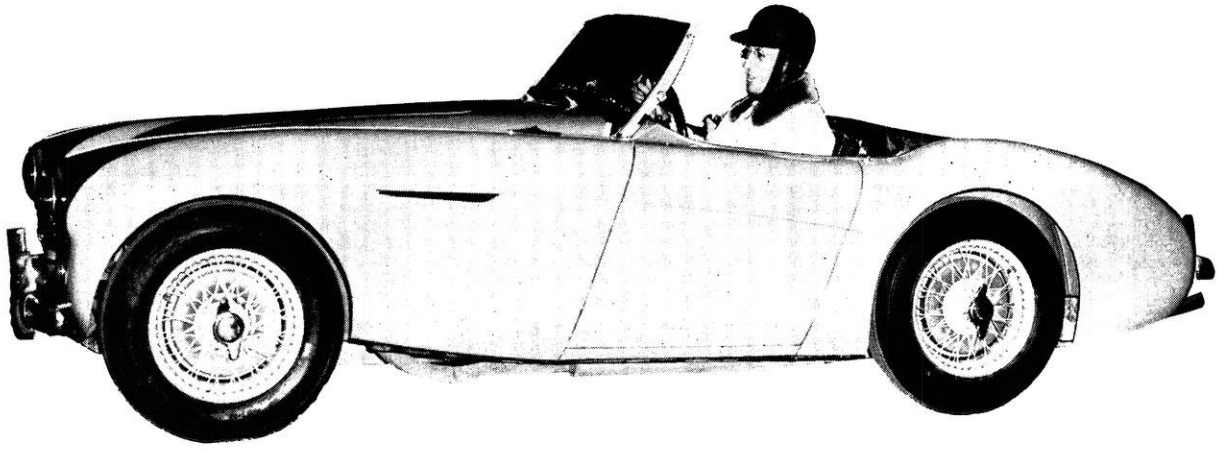
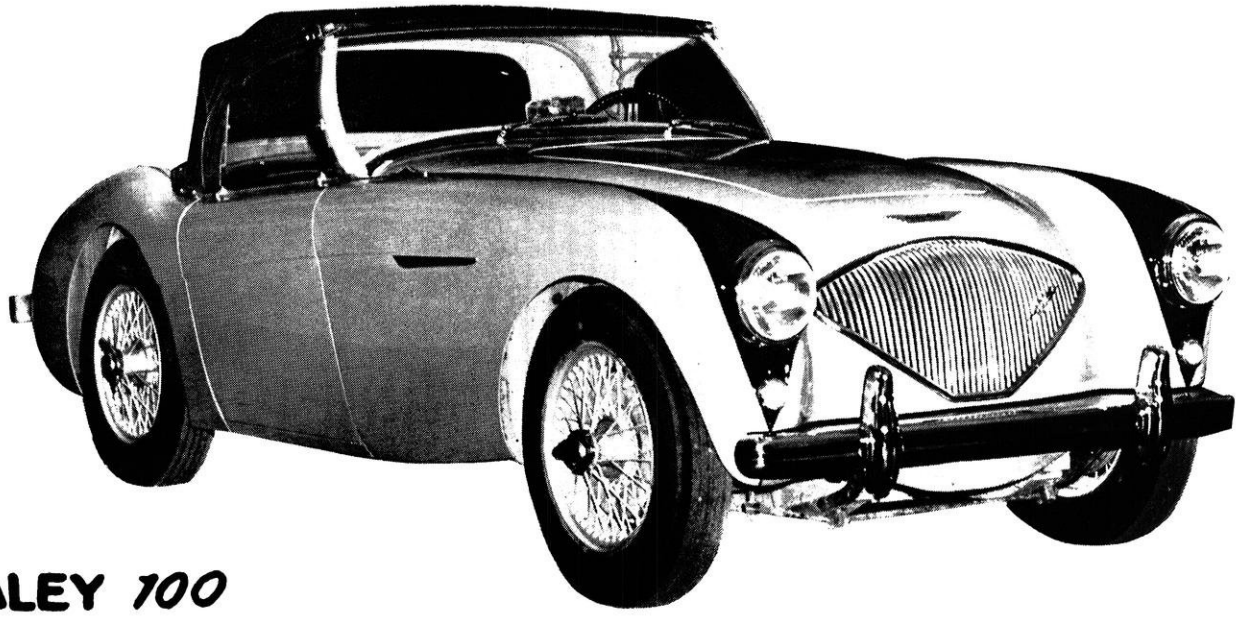
The Wisconsin

engineer

January 1954
25¢





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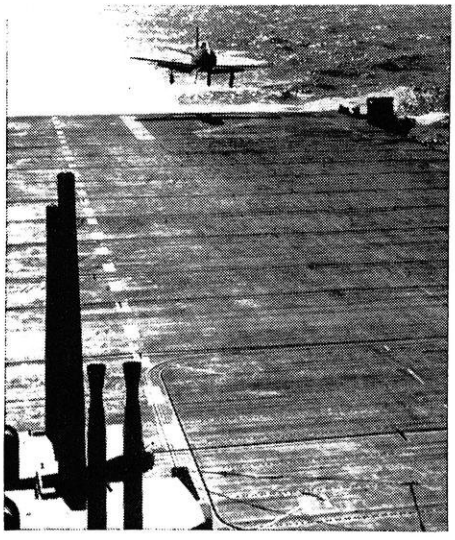

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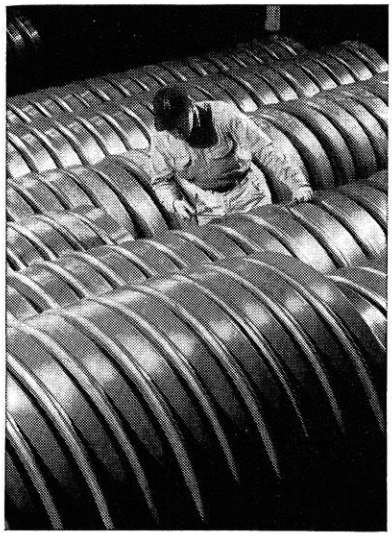

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A MESSAGE TO
COLLEGE ENGINEERING
STUDENTS

from J. M. Wallace, Manager, Meter Div.,
Westinghouse Electric Corporation
University of Pittsburgh, 1935

To the man who wants more than a job

You and I know that getting a job is not a problem these days. Industry needs thousands of young engineers.

But the man who wants more than a job might well pause and consider just how he is going to find his special opportunity. It cannot be found everywhere.

The man I'm talking about wants interesting work with a future, yes—but also something more. He is determined to help make the world a better place in which to live—and wants a job that will enable him to do this. He is co-operative in his work, but demands the dignity of being treated as an individual. This man had high purpose when he elected a career as an engineer.

I know this man. He's many men at Westinghouse. He's an engineer's engineer.

You, who want more than a job, are this man, too. You will be among your own at Westinghouse. G-10273

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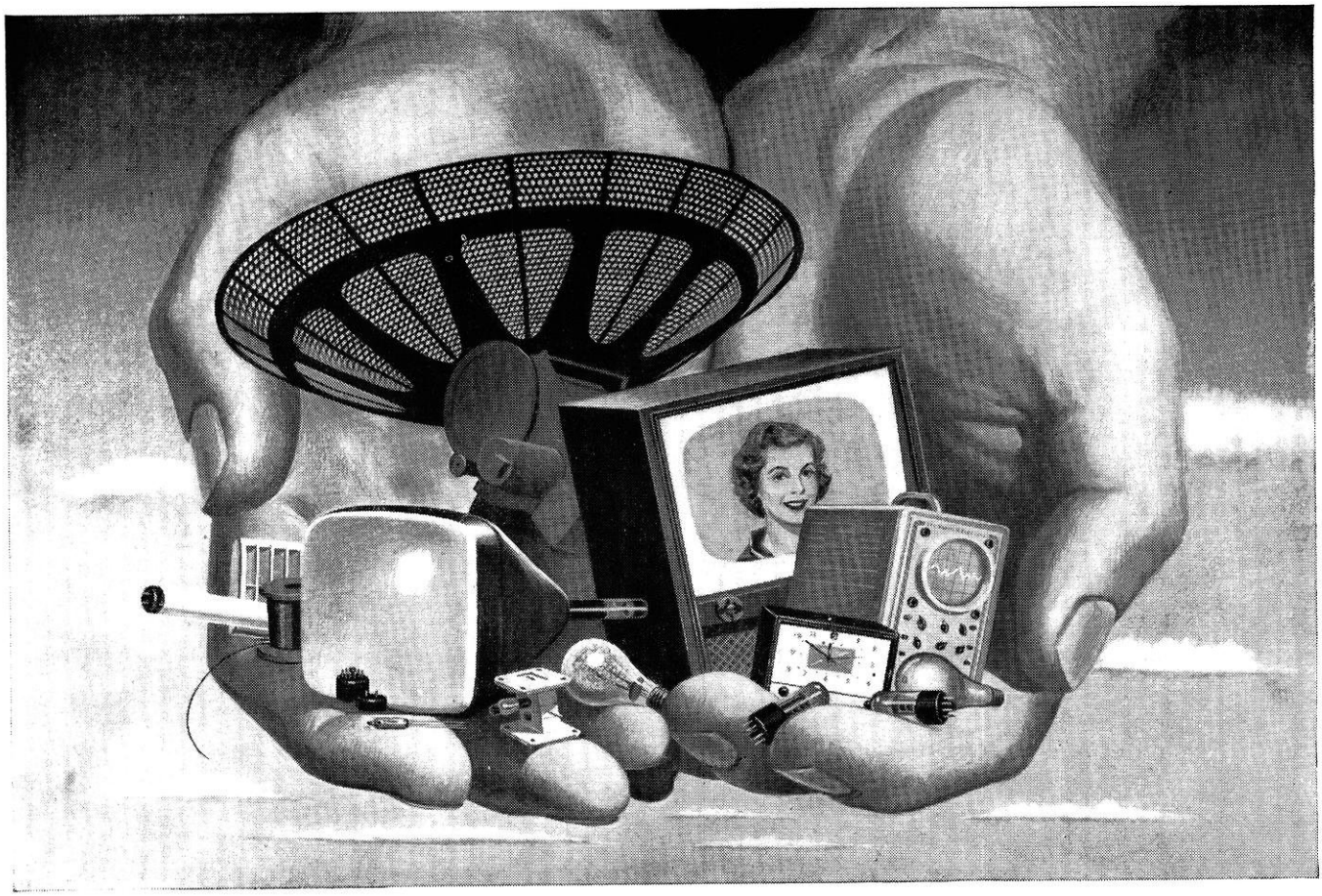
For information on career opportunities with Westinghouse, consult Placement Officer of your University, or send for our 44-page book, *Finding Your Place in Industry.*

Write: Mr. C. W. Mills, Regional Educational Co-ordinator, Westinghouse Electric Corporation, Merchandise Mart Plaza, Chicago 54, Illinois.



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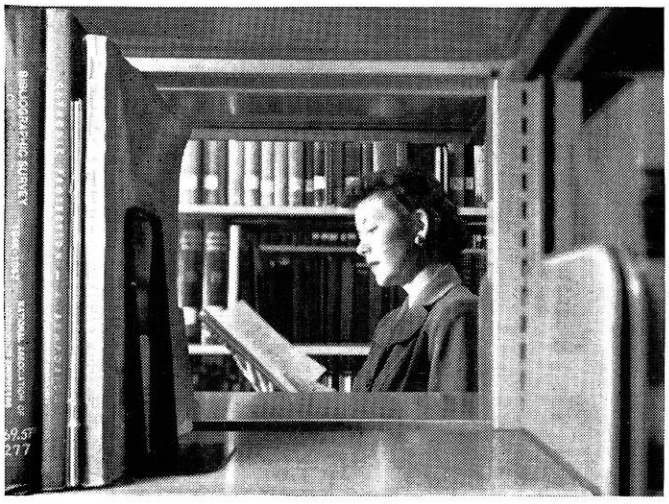

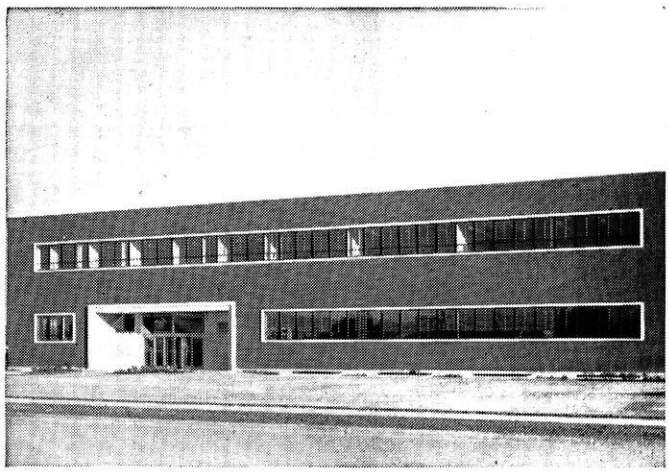

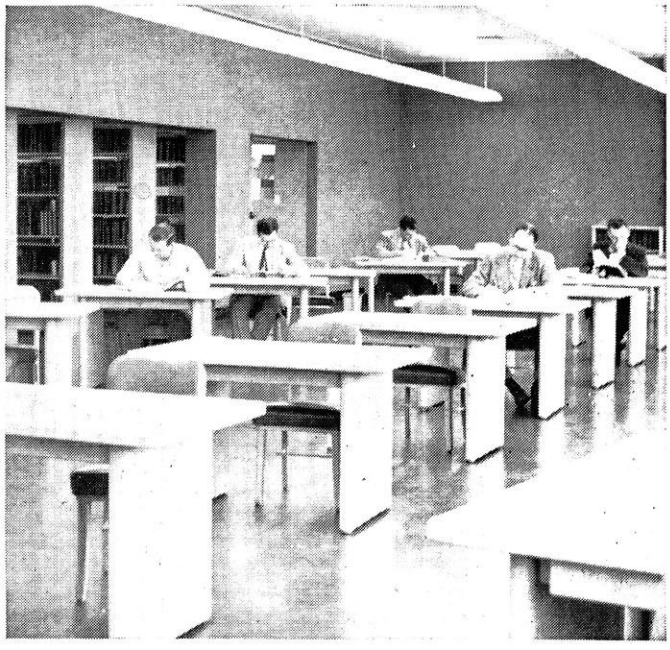

These modern facilities provide an extremely wide range of scientific material including current information on all fields of research

The desire to provide complete technical knowledge for Dow personnel, together with intelligent planning, has produced at Midland, Michigan, one of the most comprehensive of all industrial libraries. This modern, air-conditioned structure contains over 35,000 books and over 600 magazines. New books are added regularly, and both foreign and domestic abstracts are made available.

Most of the material is highly technical. The most extensive coverage is given to material in the fields of chemistry, electrochemistry, biochemistry, agricultural chemistry, chemical engineering, physics and nuclear physics.

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The Student Engineer's Magazine

WISCONSIN ENGINEER

Founded 1896

In This Issue . . .

Cover

The newest sports car to be imported from Europe is the Austin-Healey Hundred. It has a 90 inch wheelbase and weighs but 2150 pounds. The engine is an Austin A-90 4 cylinder overhead valve unit developing 90 horsepower at 4000 rpm. A three-speed syncro-mesh transmission equipped with Laycock de Normanville over-drive provides five forward speeds. In third speed overdrive, the car is capable of speeds around 110 mph. The Healey Hundred will accelerate to 60 mph in about 11 seconds. It sells for about $3000 equipped with heater, overdrive, and knock-off wire wheels.

The car shown is that of Mr. Clarence Graham of Wauwatosa, Wisconsin. It is one of about 20 in the country at present.

(*Photos by Dave Dauterman*)

Frontispiece

This Westinghouse Electric Corporation 50,000-kva mobile transformer is now in service on the American Gas & Electric system. It can be used to interconnect a 132-kv system with either an 88- or a 66-kv system and can step down from 132, 88, or 66 kv to 44, 33, or 22 kv. It is a three-phase unit and is moved from place to place filled with oil and with its coolers and bushings in place. Only the arresters have to be taken down in transit. The transformer weight, with coolers, is 90 tons.

This 50,000-kva unit is contained in the same dimensions and weight that would have been required for 17,000-kva rail-car mounted unit ten years ago. This has been possible by using forced- oil, forced-air cooling with directed flow, and Hypersil steel by simplifying the number of connections as much as possible, by turning the core and coil assembly on its side to save height. and using a vertical terminal board for changing connections.

The two 83,333-kva railroad-car mounted units for Bonneville Power Administration also went into service last year.

Articles

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The Student Engineer's Magazine

WISCONSIN ENGINEER

Founded 1896

Volume 58 JANUARY, 1954 *Number 4*

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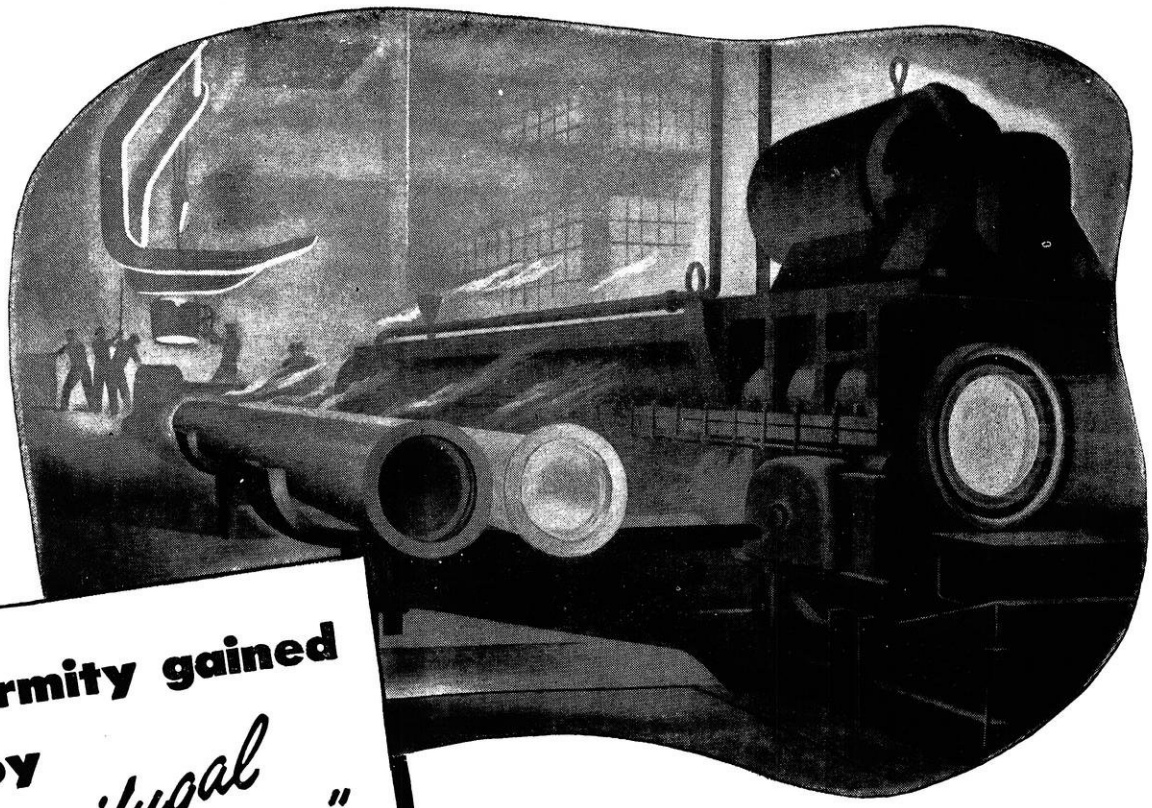


Uniformity gained by "Centrifugal Casting"

The great majority of cast iron pressure pipe produced today is cast centrifugally, in metal or sand-lined molds.

When this mechanized process was introduced 27 years ago, its potentialities for improved production controls were evident. For human fallibility was largely replaced by machine accuracy based on scientific principles.

The improved production controls made possible by the centrifugal casting process have long since been realized. Hundreds of millions of feet of centrifugally-cast-iron pressure pipe are now in service. All of this pipe is more uniform in metal structure, in wall thickness, and in concentricity, than pipe not centrifugally cast.

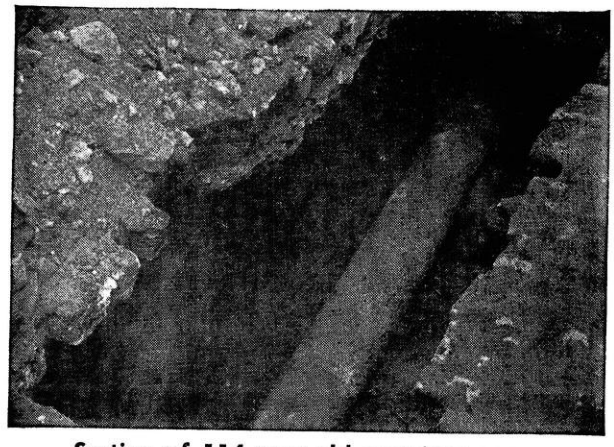
Better production control means better pipe; it results in greater uniformity of quality.

Production controls in cast iron pipe foundries start almost literally from the ground up with inspection, analysis and testing of raw materials; continue with constant control of cupola operation by metal analysis; and end with rigid tests of the finished product.

By metallurgical controls and tests of materials, our members are able to produce cast iron pipe with exact knowledge of the physical characteristics of the iron before it is poured into the mold of a centrifugal casting machine.

Cast iron pipe is the standard material for water and gas mains and is widely used in sewage works construction.

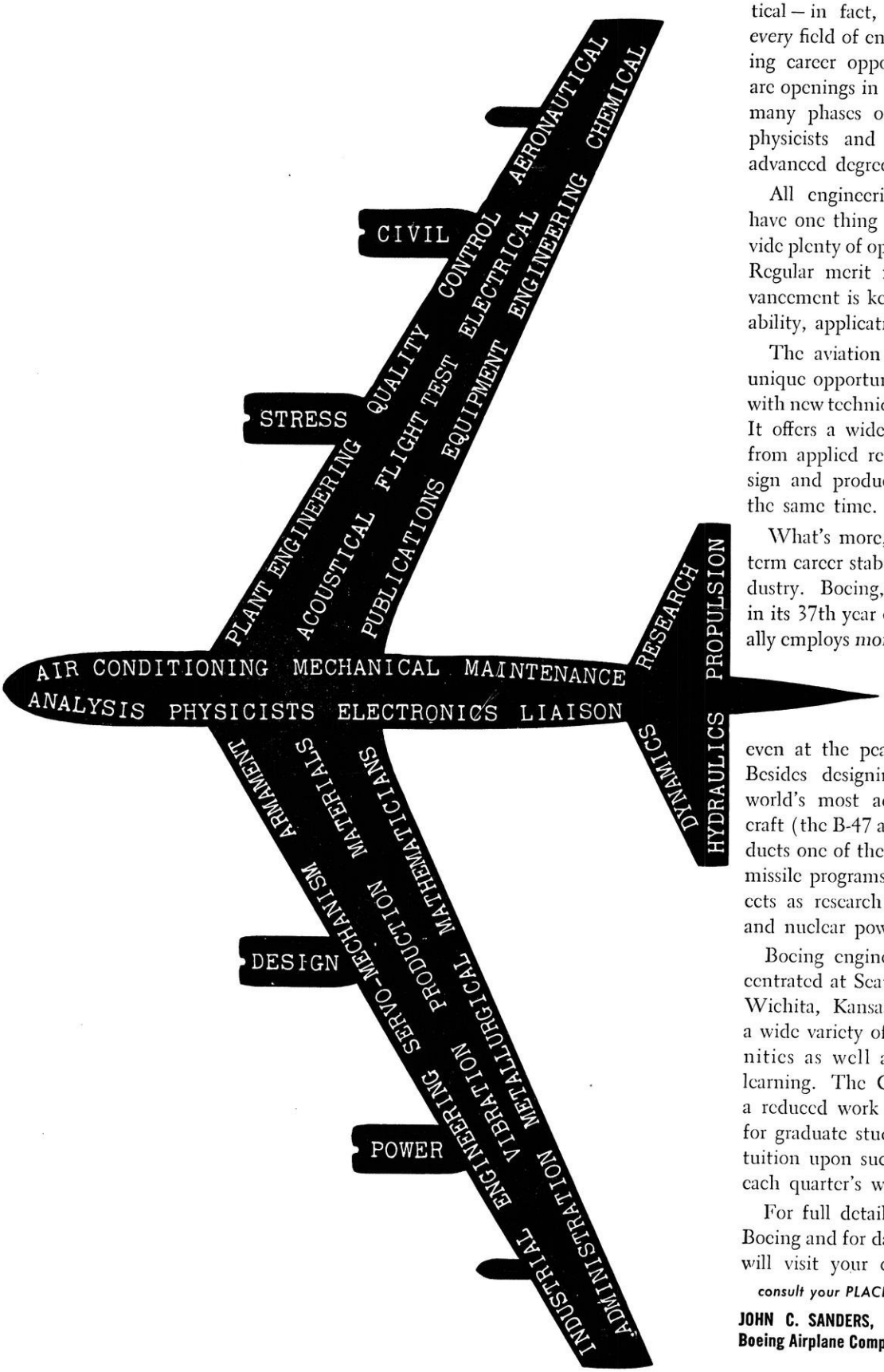
Send for booklet, "Facts About Cast Iron Pipe." Address Dept. C., Cast Iron Pipe Research Association, T. F. Wolfe, Engineer, 122 So. Michigan Avenue, Chicago, 3, Illinois.



Section of 114-year-old cast iron gas main still in service in Baltimore, Md.

CAST IRON PIPE SERVES FOR CENTURIES

Engineers of virtually EVERY type are needed on the Boeing team



Mechanical, electrical, civil, aeronautical – in fact, graduates in virtually every field of engineering—find rewarding career opportunities here. There are openings in design, research, in the many phases of production, and for physicists and mathematicians with advanced degrees.

All engineering careers at Boeing have one thing in common: they provide plenty of opportunity to get ahead. Regular merit reviews are held. Advancement is keyed to your individual ability, application and initiative.

The aviation industry offers you a unique opportunity to gain experience with new techniques and new materials. It offers a wide range of application, from applied research, to product design and production, all going on at the same time.

What's more, you can expect long-term career stability in the aviation industry. Boeing, for instance, is now in its 37th year of operation, and actually employs *more* engineers today than even at the peak of World War II. Besides designing and building the world's most advanced multi-jet aircraft (the B-47 and B-52), Boeing conducts one of the nation's major guided missile programs, and such other projects as research on supersonic flight, and nuclear power for aircraft.

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

For full details on opportunities at Boeing and for dates when interviewers will visit your campus,

consult your PLACEMENT OFFICE, or write:

JOHN C. SANDERS, Staff Engineer – Personnel
Boeing Airplane Company, Seattle 14, Washington

BOEING

WISCONSIN ENGINEERS IN THE NEWS

DR. MARTIN A. EDWARDS

Dr. John E. Jacobs has been selected as one of the nation's outstanding young electrical engineers by Eta Kappa Nu, national electrical honor society.

The society has announced that it will present an honorable mention award to Dr. Jacobs, in charge of the advanced development Laboratory of the X-ray department, General Electric Co., Milwaukee, at a dinner on Jan. 18, 1954, during the annual meeting of the American Institute of Electrical Engineers at New York City.

The 33-year old scientist is widely known in industry as the developer of X-ray-sensitive cadmium sulfide crystal detector, which is best known for its application in automatically assuring full and accurate levels of beer and other liquids in cans at unprecedented speeds.

Work on the crystals was begun by Dr. Jacobs during work for his doctorate at Northwestern University, Evanston, Ill.

Dr. Jacobs first became associated with General Electric as a shipping clerk at the company's Kansas City office.

He received GE's highest honor to employees a year ago when he received the Charles A. Coffin award, given for major contributions to science and company welfare.

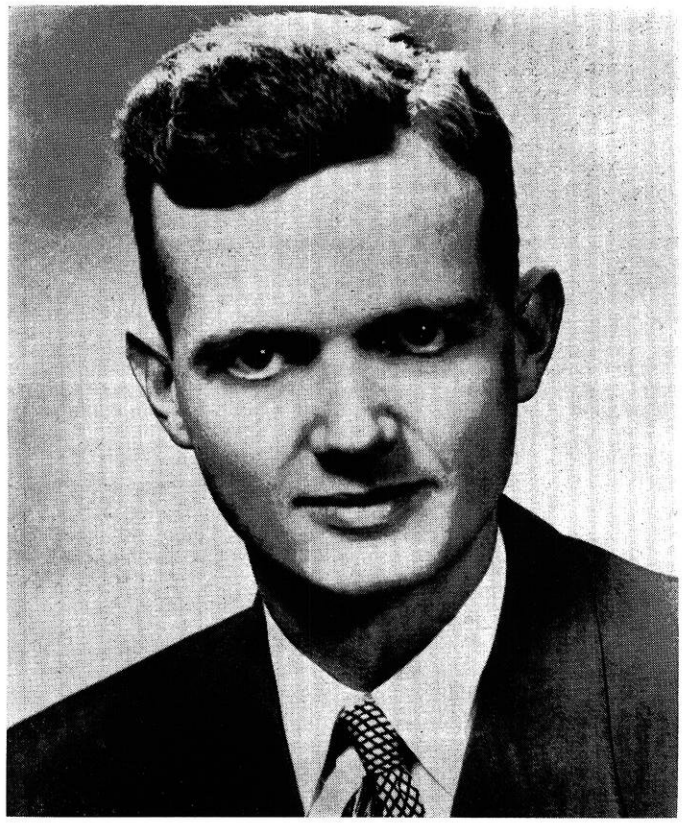
Dr. Martin A. Edwards, manager of engineering for the X-ray department, General Electric Co., Milwaukee, has been elected a Fellow in the Institute of Radio Engineers.

Dr. Edwards is being honored "for his creative contributions to the development of the amplidyne and other control systems," according to the citation to be given to him by the Institute of Radio Engineers.

A nationally recognized authority on power plant controls, Dr. Edwards holds patents on 89 inventions, and is a three-time winner of the famed Charles E. Coffin award, General Electric's highest honor to an employee for outstanding scientific contributions. His most recent invention was given for a fuel regulating apparatus used in aircraft gas turbine power plants, which enables them to operate under a wider range of conditions than before.

Dr. Edwards came to Milwaukee to take his post with the X-ray department in Sept., 1952. He was formerly engineering manager of the General Engineering Laboratory of General Electric at Schenectady, N.Y.

A native of Cautauqua, Kas., Dr. Edwards holds four degrees from Kansas State College, including bachelor degrees in electrical and mechanical engineering awarded in 1928 and 1929 respectively, a masters degree in mechanical engineering in 1934, and an honorary degree awarded in 1946.



DR. JOHN E. JACOBS

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WESTINGHOUSE

editorial

High School Principals

State of Wisconsin

Dear Sirs:

For the first time in the history of the **Wisconsin Engineer,** arrangements have been made to have every issue of this magazine sent to Wisconsin's high schools. In the past, only one special issue was sent to the high schools in the spring of each year; but now you will receive each issue, once a month. We have done this because we feel that the magazine will be of interest to your high school students; but more important, we feel that the magazine will make your students more fully aware of the unlimited opportunities which engineering offers a young man. Never before has the demand for engineers been greater.

Your students ought to know just what engineering is in order that they may consider its possibilities as their future vocation. The **Wisconsin Engineer** is an effective tool which may work toward that end.

Now we ask that you will do your part by putting the **Wisconsin Engineer** in your school library where your students will have ready access to it. Further, how about letting the students know that they are receiving each issue of the magazine? Tell them where to find it in the library. We only ask that you let your students know that they are receiving the **Wisconsin Engineer** and that you give them a chance to read it.

Please accept the subscription to this magazine with our compliments—we are sure you will find its association with your school a happy one.

Respectfully yours,

Jack E. Binning

Jack E. Binning
Editor

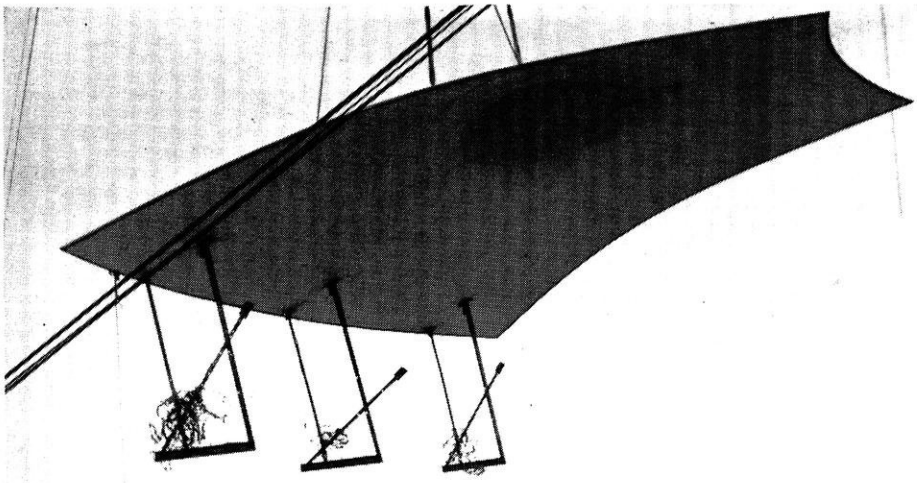
Spherical Home for Atomic Powered Submarine Research

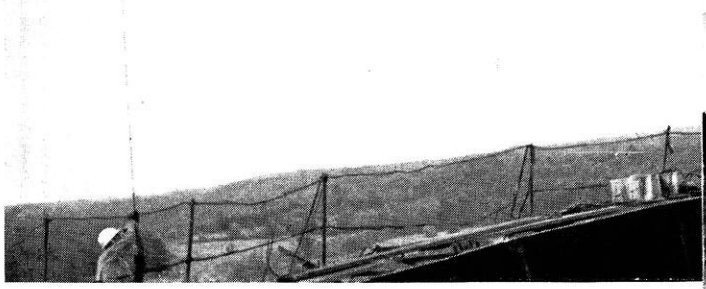
by John R. DuBois, e'56

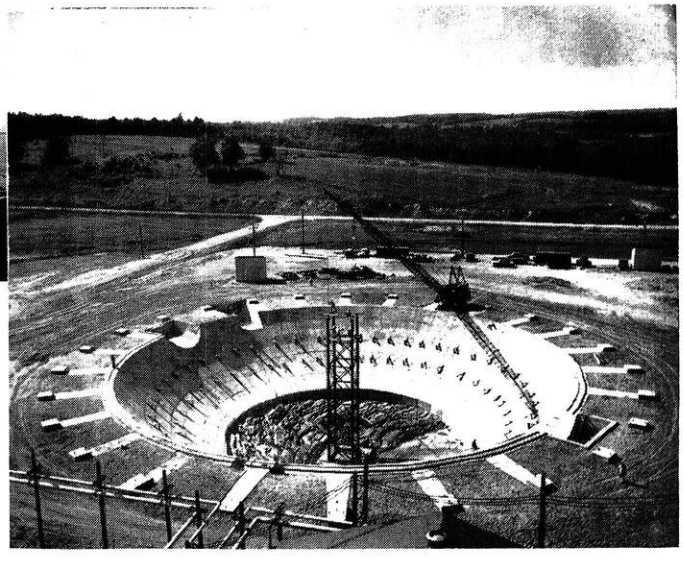
The old pastime of building model boats in bottles has been given a new twist, as the announcement was recently made that a sphere 225 feet in diameter has been completed to house the first submarine nuclear reactor.

This project, known as the Submarine Intermediate Reactor (SIR), is under the direction of the Atomic Energy Commission and their laboratory at Schenectady, New York, the Knolls Atomic Power Laboratory. The General Electric Company, who operate this laboratory for the Atomic Energy Commission, are in charge of the actual construction of the nuclear reactor. This reactor and the sphere that encloses it are located on a 4000 acre site of one time farm land near West Milton, about 20 miles north of Schenectady, in east central New York state.

The foundation of the sphere is a concrete saucer shaped affair—179 feet in diameter and 42 feet deep. Excavation for the foundation was performed by the Elmhurst Contracting Company of Corona, Long Island, New York; they excavated a total of 30,600 cubic yards and did 40,731 cubic yards of embankment work. The foundation design was formulated by the Blaw-Knox Company of Pittsburgh, Pennsylvania, and the actual







Above—A "soaring" section of steel plate being hoisted into position on the mammoth sphere.

Right — Aerial view of reinforced concrete foundation upon which the sphere was supported.

Left — View of the nearly completed 225 foot sphere which will house a prototype submarine for atomic power research.

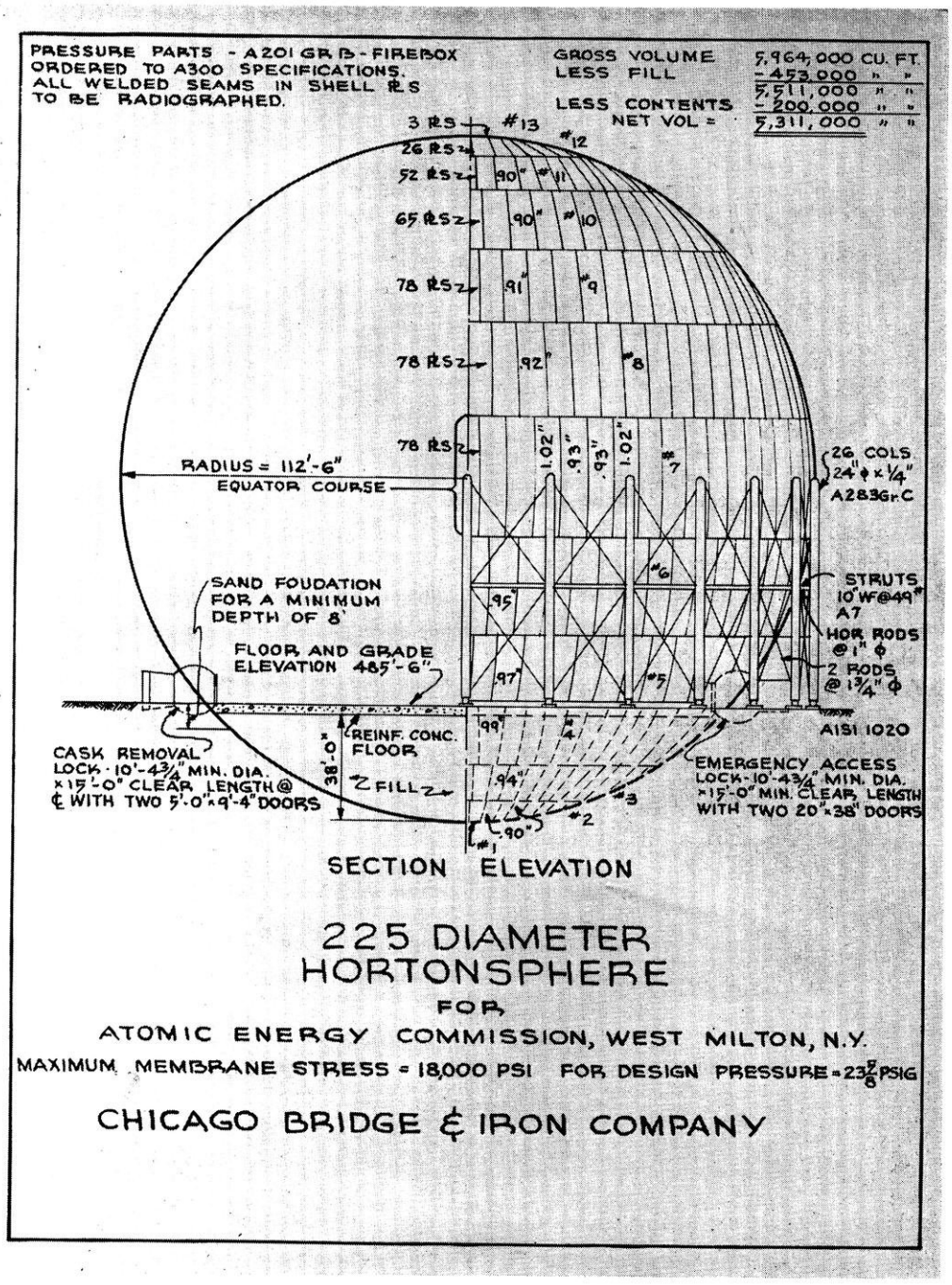


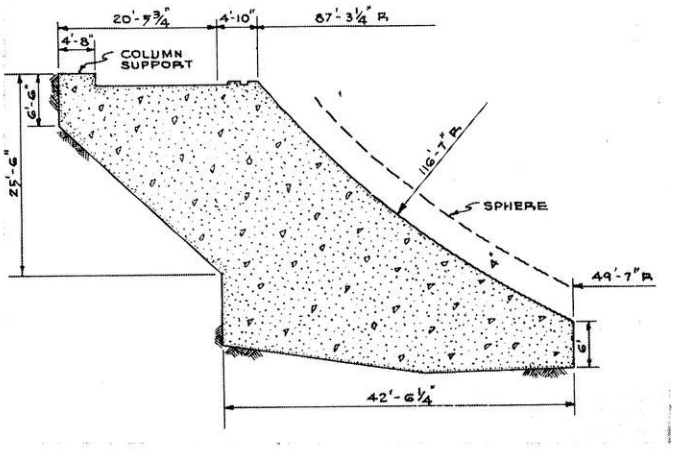
Photo courtesy NAVY TECHNICAL NEWS

foundation construction was handled by Ardini and Pfau, Inc., of Syracuse, New York. It took just 58 days to complete the base that required 1800 cubic yards of reinforced concrete.

The sphere itself was designed and constructed by the Chicago Bridge and Iron Company of Chicago, Illinois, and is the largest spherical structure in the world. The "skin" of the sphere is composed of 682 steel plates, 9 feet by 32 feet and varying in thickness from 0.90 inches to 1.02 inches; the steel of the plates is ASTM A201 Grade B fire-box type. The weight of the entire sphere, 3,850 tons, rests on a ring of 26 structural steel columns, 24 inches in diameter, ¼ inch thick, and 74 feet long, that support the structure at its equator. The construction progressed upward and downward from the equator of the sphere, with sections of four plates assembled on the ground, hoisted into their proper places, and then welded to the neighboring section.

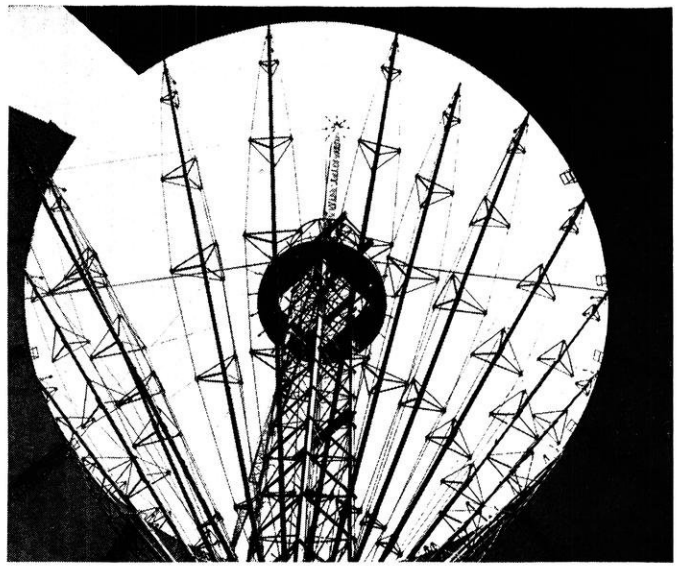
The derrick used in the hoisting operations was an engineering feat in itself. It was mounted atop a 250 foot temporary central steel tower; this elevated 170 foot guyed derrick had a capacity of 100 tons or 28 tons at a radius of 130 feet.

Every inch of weld in the 26,000 feet of welding had to be checked for leaks, so each seam was X-rayed to insure perfection. A four foot space was provided, temporarily, between the base of the sphere and the concrete foundation so X-rays could be made of all seams, both internal and external. After all welds had passed careful scrutiny, the sphere was closed and tested with a pressure of 15,000 pounds per square inch. After all tests were completed, the four foot space was filled with lean con-



Cross-section of sphere foundation.

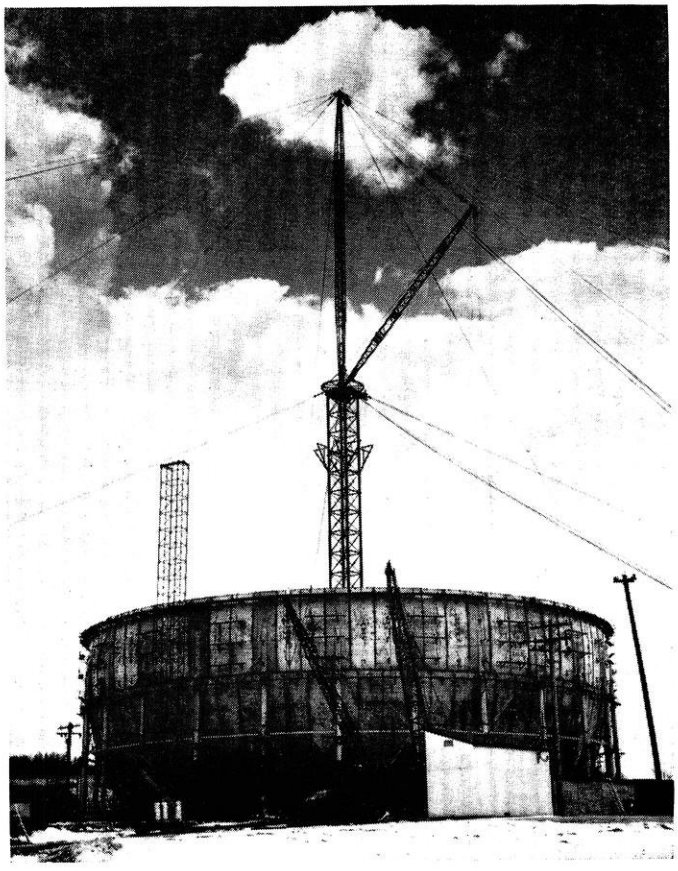
Photo courtesy NAVY TECHNICAL NEWS



Standing inside sphere looking skyward at the elevated hoist tower and at the intricate maze of supporting spars used temporarily during the construction period.

crete to insure that all superimposed loads, such as the 35 feet of compacted aggregate in the interior of the sphere, the three foot concrete floor slab and all the equipment, would rest on the foundation and therefore not place a stress on the shell.

There are two entrances to this air conditioned globe; both spherical shaped locks, 16.5 feet in diameter. The reason for the sphere shaped locks is to attain circular intersections with the main sphere and thereby avoid undo stress. Within the locks, double water tight ship bulkhead type doors are used.



Partially completed sphere. The derrick is perched atop a 250 foot temporary central steel tower and is capable of lifting 28 tons.

Cuts courtesy General Electric

The reason for the huge size of the structure and the many vigorous tests is to provide maximum insurance against the escape of radioactive material in the remote chance that the numerous safety devices should fail. In the event of complete failure of all safety devices, the 5,400,000 cubic feet of space within the carefully tested sphere will contain all the radioactive material. The scientists on the project say that there is no chance of a bomb-type explosion.

To save time, the hull of the prototype submarine, which holds the nuclear reactor, was constructed along side the sphere. Upon the hull's completion, a section of the sphere's shell was removed, the submarine prototype moved inside, and the shell resealed. The Electric Boat Division of the General Dynamics Corporation of Groton, Connecticut, is the constructor of the hull and the steam power plant.

The steam power plant utilizes heat from the reactor core transferred by liquid sodium metal to the boiler. This heat converts water to steam which in turn, drives the turbines which propel the submarine.

This submarine intermediate reactor project is only one of two nuclear science attempts at the problem of using atomic fuel for under-water ship propulsion. The other similar work is the submarine thermal reactor project at the national reactor testing station in Idaho, which is operated by the Westinghouse Electric Company for the Atomic Energy Commission.

Gas Turbines
For
Automotive Use

by Don Wickesburg, m'54

The small, compact gas turbine engine, shown here being carried by two men, is capable of pulling a 32 ton gross load.

Present Status of the Gas Turbine

After 24 years of developing the aircraft piston engine it seemed fantastic to believe that the jet turbine could replace these highly developed reciprocating engines. Today the jet engine has completely revolutionized the aircraft industry.

Gas turbine engines offer many advantages over the reciprocating engines. They are much lighter and require less space; they have about ten per cent as many parts; they are completely free of vibrations and may be adapted to a variety of fuels; they are easy to maintain; they have very good cold starting characteristics and give maximum fuel economy with maximum output; and they have low consumption of lubricating oil and immediate availability of full horsepower. Disadvantages are the higher fuel consumption and the fact that the most expensive parts are most subject to failure.

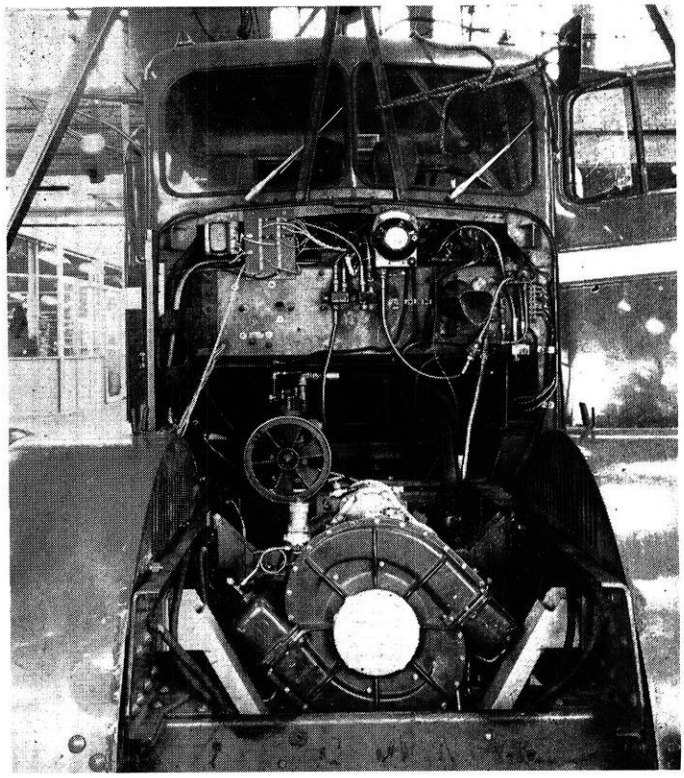
Probably the greatest advantage of the turbine over the present auto engine is in its potential low manufacturing cost. Today most of the parts for the turbine, simple and small in number though they are, require expensive materials and maufacturing processes. This situation might be compared to the beginning of the gasoline engine 50 years ago. Then, engines, though simple mechanically and crudely built by today's standards, were very expensive to produce in terms of man-hours. What was lacking then in piston engine design and is lacking now in turbine engine design is precise knowledge of the design requirements. This knowledge must be obtained by thorough testing. Some of the problems that have to be answered by testing in order to achieve the low cost turbine are:

1. Can turbine blades be welded to their discs with 100 per cent dependability and low rejection rates in quantity production?
2. Can equal or better durability with lower cost be obtained by casting the wheels, or by using mechanical blade joints?
3. Can occasional disc failures be avoided with absolute certainty in quantity production? If not, how much and what kind of armor will be required to prevent injury from a wheel burst? A wheel can be as dangerous as an armor piercing artillery shell.
4. Are the very best and most expensive high temperature alloys really necessary for small turbine wheel rims, or are we at present "over-desiging" the wheels?

There are very good reasons to believe that small turbine wheels will soon be produced for about the same cost as an automobile crankshaft. Low production cost problems for the remaining parts of the turbine engine will be relatively easy, because they do not, in most cases, involve unconventional techniques.

It is not unreasonable to expect small gas turbine engines to be built complete with transmissions for about the same space, volume, weight, and price, as the automatic transmissions in the latest automobiles.

Perhaps the most difficult problem in connection with the use of the gas turbines in the automotive industry will be one of adjustment to a completely different type of machine. It takes considerable time, for instance, to get accustomed to the fact that 10,000 rpm is low idle speed. Actually this is true for a small turbine, and the stresses and temperature at this speed are negligible in the same way as in a piston engine running at 300 rpm.



Front, under-hood view of turbo truck.

Recently the Rover Company of Birmingham, England presented the world's first gas turbine automobile for public test and examination. The unit tested by the Royal Automobile Club was fitted into a standard Rover "75" passenger car, with slight modification to provide for rear instead of front end mounting.

There are two combustion chambers in the Rover's power plant fed with air by a centrifugal compressor with a fully shrouded impeller. Gas from one of the chambers drives the compressor turbine and is then ducted to the second turbine, the power unit, which is independent of the first turbine. Gas from the second chamber is led to the power turbine, the shaft of which carries a single helical reduction gear. Final drive is by a short propellor shaft to an offset differential. There is no mechanical connection between the two turbines.

The present engine has no heat exchanger although it was designed to include one. Difficulties of housing a heat exchanger in a passenger car chassis are mainly re-

sponsible for its absence. In its present condition kerosene consumption is practically twice the quantity of fuel required for a piston engine of equivalent power. The heat exchanger would lower the gas turbine's fuel consumption to within reasonable comparison with that of the conventional engine. It is definitely stated by the Rover engineers that this first automobile is merely a test set-up and that 3 or 4 years are likely to elapse before any production is started.

A reverse gear is provided but there is no gear changing. The driver controls the gas turbine by means of an accelerator pedal, and the only other principal control on the car is the brake pedal. The unit is started by a normal starter motor controlled by a push button on the instrument panel. The turbine idles at 7,000 rpm and runs at 35,000 rpm at a road speed of 85 mph. Combustion air is admitted through ports in the sides of the body and is exhausted through two vertical pipes near the back of the car.

The Royal Automobile Club report states that at the time of the test the road surface was dry, the weather calm, wind speed five mph, temperature 54° F, and barometer reading 30.1 inches of mercury. Kerosene was used as the fuel. It took 13.4 seconds to go from start to idling speed and another 3.4 seconds before the car started moving. The car accelerated to 60 mph in 14 seconds. Although no provision for silencing the exhaust was made, the volume of noise was not excessive or unpleasant but was accented during acceleration.

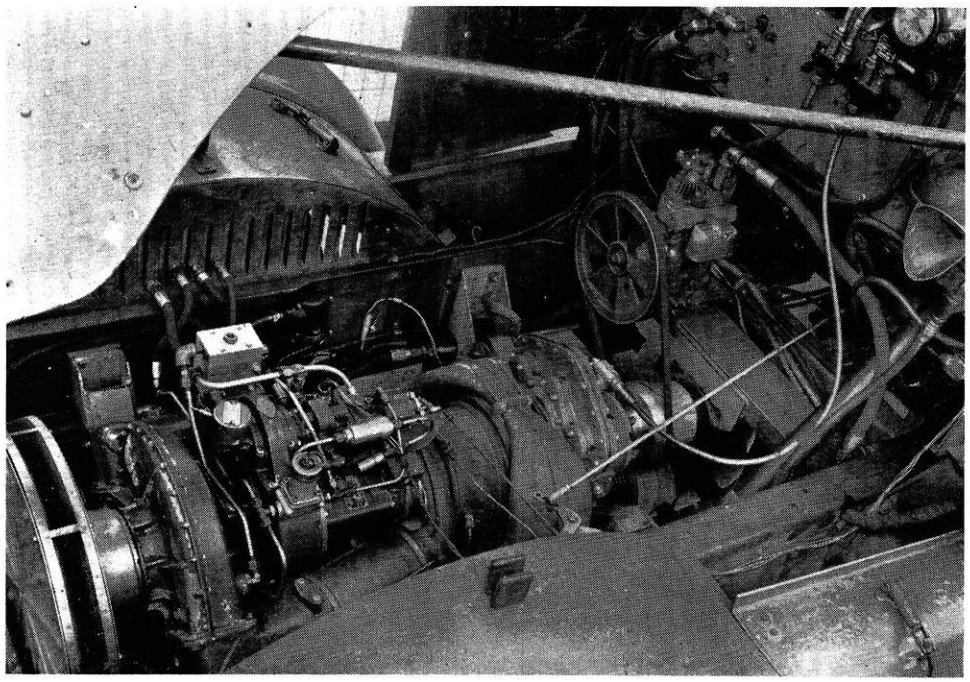
The Boeing Testing Program

The Boeing Airplane Company under the sponsorship of the Navy Department Bureau of Ships has been carrying on a testing program to determine the feasibility of using a gas turbine as a prime mover for heavy duty trucks. The engine being tested is the Boeing model 500. This engine has the unique characteristic that it can be started and brought up to full power output without any warm-up. The motor is started by turning on the fuel and pushing an electric push button which actuates the electric starting motor and spark igniters. When the engine reaches its idling speed of 15,000 rpm the push button is released and the speed is controlled by the foot accelerator to normal operating speeds of 36,000 rpm. The starting period is less than 15 seconds and the acceleration period is five seconds. Therefore, from a cold start, it is possible to take full power out of the engine within twenty seconds. The engine was installed in a conventional truck chassis in March of 1950. During the first test period, which ran through July of 1950, the truck was operated as a solo unit at a gross vehicle weight of 30,000 lbs. It was then converted into a tractor semi-trailer combination, and some tests made at a gross vehicle weight of 67,300 lbs. The loading was then reduced to 54,000 lbs. for the second test period which ran through January of 1951. At this time, the weight was increased to 68,000 lbs. and a third test period begun.

The test mileage for the last four months period was approximately 10% greater than that of the first two test periods which consumed about ten months. The test mileage during the last month of operation was fifty per cent greater than the mileage during the first period of 4½ months and equal to 5½ months of operation during the second period.

Thus it can be seen that the reliability of the engine has measurably improved. However the replacement and repair intervals of certain parts now measured in hundreds of hours of engine use, will have to be measured in thousands of hours of engine use before commercial operators of heavy duty motor vehicles will be satisfied.

THE END



Gas turbine installation in Kenworth Turbo-truck.

—ALUMNI NOTES—

by Richard White, c'55

Harza, Leroy F., c'06, president of the Harza Engineering Co. of Chicago, died Nov. 22 in Chicago at the age of 71. Mr. Harza had an international reputation as a designer and builder of dams.

Fisher, Donald L., ch'50, has recently resigned his position at Standard Oil Company, Louisiana division at Baton Rouge, to work with the S. C. Johnson & Son wax company of Racine, Wisconsin.

McCoy, William D., c'46, recently joined the engineering staff of the city of LaCrosse, Wisconsin.

Trueblood, Wilson D., Jr., ch'23, of the Chicago sales office of Leeds and Northrup Company, has been named manager of the newly opened Milwaukee office of the company. Mr. Trueblood has been with Leeds and Northrup since 1924, serving first as a field engineer, then as sales engineer, specializing in industrial temperature controls and electric furnaces for heat treating. At the present time, he is vice-chairman, Milwaukee chapter of the American Society for Metals.

Wisconsin engineers authored two articles in a recent issue of **Civil Engineering. William E. Schubert,** m'24, vice president and general manager of the Wisconsin-Michigan Power Company, contributed an article on the use of the seismic method for finding depth of rock along the line of a proposed canal.

Prof. **James R. Villemonte** and **Vasudeo N. Gunaja,** former research assistant, discussed the application of the equation for submerged, sharp-crested weirs to a Pashall flume.

The feature article of the magazine describes the tremendous excavation in solid rock for a powerhouse at Kemano for the Alcan aluminum development. One of the two assistant managers on this great project is **Franklin T. Matthias,** c'31.

Gensler, Thomas E., ch'51, recently visited the campus in connection with his personnel work for General Electric Company. Mr. Gensler is now supervisor of the chemical and metallurgical program, technical personnel development services of General Electric Co.

Whitby, Willis R., c'04, who has operated a hardware store in Estevan Saskatchewan for many years, has turned the store over to his son and will spend the winter in Victoria, B.C. He plans to return to Madison for the fiftieth reunion of the class of '04, which includes Professors **Kinne, Owen,** and **Van Hagan.**

DeYoung, John T., c'49, who went to work for the Milwaukee Road immediately upon graduation, is now stationed at LaCrosse. He is one of three Wisconsin grads who recently became members of the American Railway Engineering Association, the other two being **Carl Bachman** of the New York Central and **Ralph G. Michael** of the Chicago and Western Indiana Railroad.

O'Neil, John E., ch'48, and **Hoffman, John P.,** ch'52, both of the Leeds and Northrup sales engineering division, will soon be working out of the newly opened sales office in Milwaukee, Wisconsin.

Persen, Edward A., c'34, was recently appointed engineer for the Veterans Hospital in Madison.

Industrial Use

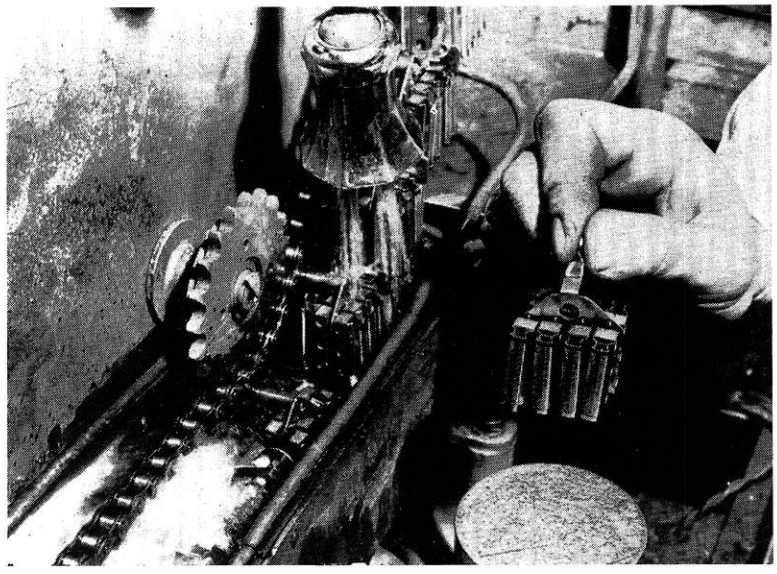
of

ULTRASONICS

by Gene Worscheck, me'55

Photos courtesy General Electric

The ultrasonic wave is identical with the sound wave except that its frequencies are above the audible frequency range of 18,000 cycles per second. Sound can be classified in three ways: the medium through which it passes, its frequency range, and power level. Fig. 1 shows the sound signals plotted with intensity and frequency along the ordinate and abscissa. The audible sound lies near the center of the graph, and surrounding this region are the inaudible sound frequencies. The high-power region lies across the top of the chart and the ultrasonic region along the right side. The area of over-lap in the upper right-hand corner is where new applications of ultrasonic energy are being developed.



Group of eight Schick shaver heads in holder, showing how they come out clean after degreasing in ultrasonic cleaner. Lapping compound, small chips, oil and grease are removed.

In the low-power field the ultrasonic thickness gage and the ultrasonic flaw detector are now being used in industry; these work on the principle that the characteristics of sound vary in solids and gases. Ultrasonic frequencies were used with great success against the German submarine menace in World War II. Ultrasonics is also used to launder clothes; the dirt and grease particles are completely surrounded by the detergent used while the cloth is violently agitated by ultrasonic energy. With sufficient power, the reverse can also be accomplished to precipitate smoke. The ultrasonic precipitator causes the smoke particles to collide and adhere; when these particles become large enough they fall to the bottom of the stack. The most recent development of high-power ultrasonic energy is its application in cleaning small parts. With this method, oil, grease, chips, dirt and other foreign matter are removed from the surfaces of small precision parts at an increased rate, cleaning them more effectively than by older methods.

The high-power field deals with the problem of the transmission of ultrasonic energy into the medium which is to be treated.

For transmitting sound waves into gases and liquids, two different types of transmitters are used. For transmission into air, a low-impedance transmitter is used. Impedance is defined in acoustical engineering as the ratio of the pressure to the velocity of the particles.

For transmitting ultrasonic energy into liquids, a piezo-electric (polarity due to pressure between crystals) transmitter is commonly used. The piezoelectric transmitter consists of quartz crystals which expand and contract when a voltage is placed across the two faces of the crystals. One of the moving surfaces of the crystals is placed in contact with the liquid and radiates ultrasonic energy into the medium, setting the particles of the cleaning solvent in motion. These particles vibrate at a very high rate, and though their displacements are small, have very high accelerations and velocities causing them to collide with great force. Cavitation then occurs when

the forces on the particles are greater than the forces required to keep the particles together. A void exists temporarily in the liquid, and when this void collapses the particles exert great forces which are similar to a water hammer when a faucet is suddenly closed.

The Detrex Corporation* has recently designed a newer and lower cost method, the key feature being a ceramic transmitter which acts as a tuning fork in setting up vi-

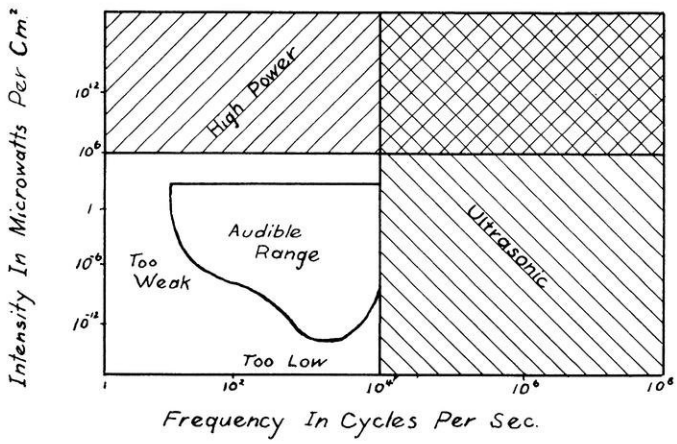
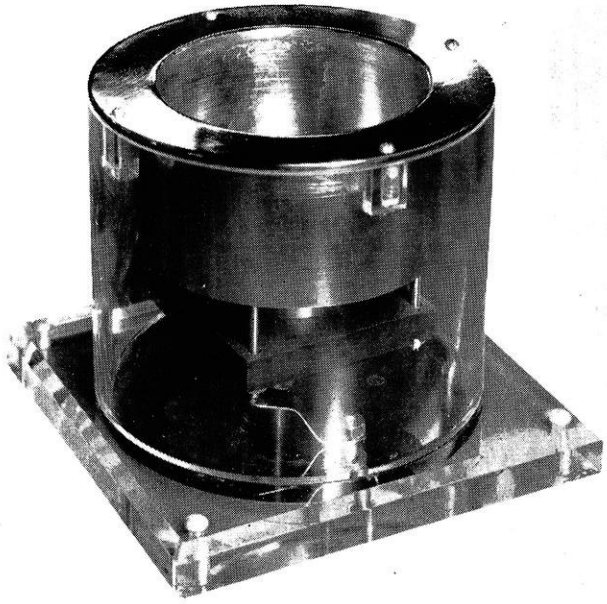


Fig. 1

brations. The new transmitter looks like half of a small ceramic pipe cut lengthwise, about as long as a new pencil, except that the diameter is several times larger. High-frequency sound waves converge from its longitudinal edges. The part to be cleaned is placed in the liquid solvent at a point where the crossing vibrations are most intense.

Using these methods, the area of application is small and limits the process to high-quality work. Transmitters for the cleaning of large sheets of metal are technically feasible but have a high power consumption. The amount of power consumed is directly proportional to the length and width of the strip and the speed of cleaning. For example: a cleaning line five feet wide with a speed of 60 feet per second would require several hundred kilowatts of power, costing several hundred thousand dollars for the ultrasonic transducer and associated equipment.

Fig. 2—Transducer assembly for ultrasonic generator.



A close-up of the transducer is shown in Fig. 2. The liquid treating chamber, about an inch and a half in diameter, can be seen in the center of the housing. The upper face of the quartz crystal forms the floor of the chamber; an insulating and cooling-oil bath occupies most of the space within the plastic shell. The acoustic output of the crystal is in the vicinity of 200 watts, which represents the rate at which sound energy is dissipated in heating the liquid, housing, and surrounding air.

Among the first users of the ultrasonic cleaning method is Schick Incorporated*, manufacturers of electric

(*please turn to page 56*)

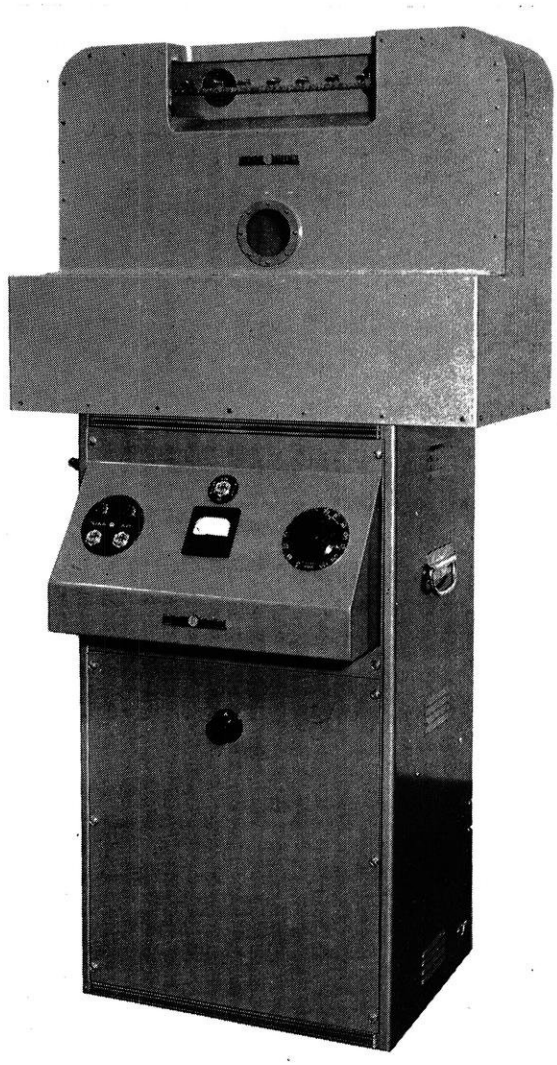


Fig. 3—Ultrasonic degreaser built for Schick, Inc., with conveyer equipment and tank for cleaning solution surmounting the generator.

*Detrex Corporation, Box 501, Detroit, Michigan.

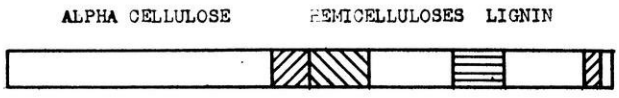
*Schick, Incorporated, Stamford, Connecticut.

SEMI-CHEMICAL WOOD PULPS

by Ron Parkinson, ch'55

Wood pulps were first produced about a century ago by purely mechanical means. This mechanical, or groundwood, process consists of merely breaking down the physical structure of the wood by tearing, or shredding, the fiber bundles apart. The action is very crude and between 1,200 to 1,900 kw.-hr. (67-106 hp-days) per ton of pulp are usually required. Practically no attempt is made to remove wood impurities, and considerably more than pure cellulose fibers are isolated. Hence, pulp recovery is

Removal of hardwood constituents in chemical pulping. Cross hatched portions represent material removed.



Removal of hardwood constituents in semi chemical pulping. Cross hatched portions represent material removed.

quite high and yields are in the neighborhood of 90-95%. Pulp is still produced in large quantities by this process, although its uses are limited by two disadvantages. First, in the shredding of the wood, many of the cellulose fibers are broken or damaged, resulting in low paper strength; and secondly, the high percentage of non-cellulostic material and other impurities color the pulp and decrease its sheet strength.

For high quality paper, a complete separation of fibers is an essential. As stated above, in the groundwood process the fibers are broken or disintegrated; also, many fiber bundles are not separated. Consequently it was not possible to make the present wide variety of strong white papers until the chemical pulping processes were developed. The two major chemical process are the Sulfite, which utilizes a calcium bi-sulfite solution fortified with sulferous acid, and the Kraft process, which utilizes a mixture of sodium hydroxide and sodium sulfide. When chemical processes are utilized, the non-cellolosic materials, which bind the cellulose fibers into a structural whole, are dissolved and absorbed by the chemical liquor, giving almost pure cellulose fibers which can be well separated by relatively small amounts of mechanical energy. A major drawback to all commercial chemical processes is that the liquor utilized is not highly selective in its action. Lignin, which is the principle impurity of wood, may constitute only 17-30% of the total weight, yet in attempting to remove it by chemical action a great deal of desirous material is also removed (see chart). The recovery of wood fiber is not high, about half of the wood being lost during pulping, giving pulp yields of around 45-50%.

It is only natural that the paper industry would like to increase its yield of wood fibers, and yet retain the high strength and brightness characteristics found in chemical pulps. In the semi-chemical field, work has usually been aimed at allowing some non-cellulosic, or hemi-cellulosic material, to remain as non-injurious impurities in the pulp, giving a compromise between high yield groundwood pulps, and low yield chemical pulps essentially free from lignin. Experiments in semi-chemical pulping have shown that pulps possessing good properties can be obtained without destroying as much wood as was previously done, and that, in fact, the hemi-celluloses lost in conventional chemical pulping are often capable of improving the strength development of many pulps. Pulps in which these wood components are retained may be superior for many uses than more highly purified pulps obtained at much lower yields.

Semi-chemical pulping consists of a mild chemical treatment to partially remove the lignocellulose fiber binding material, followed by mechanical refining to separate the ultimate fibers. The yield of pulp, depending on the severity of chemical treatment, may range anywhere between the limits of above 90% for groundwood processes, to yields of 50% or less for chemical pulping.

Semichemical pulps have been produced using acidic, alkaline, or neutral liquors. While alkaline liquors give a pulp possessing good strength characteristics, there is a severe deterioration in the color, giving a dark pulp which can never be bleached economically for use in white papers. Acidic liquors also give pulps of low bright-

ness, and are usually of doubtful commercial interest due to the large initial investment of acid resisting equipment required. Optimum results in both pulp strength and brightness are obtained when using a neutral sulphite liquor.

The neutral sulphite semi-chemical process utilizes as a solvent a mixture of sodium sulphite and sodium carbonate. The actual pulping agent is the sulphite; the carbonate is added as a buffer against the volatile organic acids formed at high temperatures, which would darken the wood by acid hydrolysis.

The wood chips are introduced into convential stationary digestors, or spherical rotary digestors. (See ill.) The chips are usually steamed to evacuate trapped air, and then the liquor is added at pressures up to 200 psi to increase its penetration. The liquor contains enough sodium sulphite necessary to remove the desired amount of wood substance, and the carbonate buffer in a ratio of 4 to 6 parts sodium sulphite to one part sodium carbonate. Enough carbonate must be added to maintain a pH nuetral enough to prevent execessive corrosion and possible pulp degradation. The chips and liquor are heated to temperatures up to 170° C for three to eight hours. The original liquor will have a pH of approximately 10, while the pH at the end of the cook should preferably be above 7, but may fall below. The treatment removes about half the lignin and some of the hemi-cellulose material. (See chart). After cooking, the chips must be mechanically defiibered since the bond between fibers is still quite strong.

It was only after modern attrition mills, usually disk refiners (see ill.), were developed, which could separate the chips into ultimate fibers without breakage or fracture, that semi-chemical pulps actually became important. The partially cooked chips are introduced between active grinding surfaces in a suspension of 85-90% water. The mechanical power requirements are around 570 kw hr compared to 1,500 kw hr in the groundwood process. After passing through the refiners, the fiber appears as particles of a slurry thinned out to a consistency of ½-1%. The fibers are then screened for mechanical impurities, thickened, washed, and brought into suitable form for use as a board or paper pulp. As mentioned above, the yield depends upon the severity of the chemical treatment; however, it is in the yield range of 70-80% that the desirable combination of high yield and comparably high strength is found. Under suitable conditions, these semi-chemical pulps will have strengths comparable to those developed in fully cooked, delignified chemical pulps, and a color only slightly darker.

Contrary to the chemical pulping processes, which utilize the conifers as their wood supply, the majority of the work done in the semi-chemical field has been with the hardwoods such as birch and aspen. The strengths of the hardwood semi-chemical pulps are considerably higher than those of chemical pulps produced from the same wood and are within 75-80% of the corresponding values for conifer pulps.

With the scarcity of spruce and other conifers rapidly becoming more and more acute, and with the annual growth of aspen in the northern states greater than the annual drain, it is expected that more and more mills will obtain a substantial portion of their pulp supply from hardwood semi-chemical pulp sources. In addition to the obvious advantage of utilizing wood species which are

(please turn to page 38)

Construction of spherical rotary digestors for new semi-chemical plant at Rhinelander Paper Co., Rhinelander, Wis.

W.S.P.E.

Edited by Jon Baumgartner, ch'56

SECRETARY'S OFFICE
2318 Rowley Avenue
Madison 5, Wisconsin
E. C. Wagner, Secretary

ANNUAL MEETING

Don't forget the dates of the WSPE eleventh annual meeting, January 28, 29, 30, at the Schroeder Hotel, Milwaukee, Wisconsin.

If you haven't already made hotel reservations, do so at once. The Schroeder Hotel is holding a block of rooms, so mention the WSPE meeting to be assured of space.

A feature of the professional engineers annual banquet will be the designation of Frederick T. Agthe as recipient of the annual citation for meritorious service.

The schedule of traditional social events such as the get-together, the special ladies program, the annual professional engineers banquet, and the noon luncheons, will be enhanced by three nationally known speakers—Dr. J. O. Christianson of the University of Minnesota, Anthony von Wening of the A. O. Smith Corporation and Froedtert Enterprises, Inc., and Charlie Grimm of the Milwaukee Braves.

The program committee has also been fortunate in obtaining several well known engineers for the Saturday morning general session. J. J. Weiler, president, Wisconsin Architects Association, will discuss the very provocative subject "Building Design — Architect or Engineer?" M. O. Withey, emeritus dean, College of Engineering, U. of W., will present "How We Can Improve the Status of the Engineer."

"Administration of the Registration Law," will be handled by W. E. Crawford, chairman, engineering division, Wisconsin Registration Board of Architects and Professional Engineers. K. F. Wendt, dean, College of Engineering, U. of W., will discuss "The Significance of Registration to the Engineering Graduate."

The respective programs of functional group chairmen R. W. Smeaton, John Gammell, E. W. Odbert, and C. E. Mohs will be found in the January News-Letter.

HIGHLIGHTS OF ACCOMPLISHMENTS AND ACTIVITIES, 1944 - 1953

Forward

In the short span of 10 years WSPE has grown from a small group of less than 400 charter members into an effective, statewide group of over 900 members and seven chapters. Each chapter has its own officers and organization and acts on state and national policies at a local level.

Member Service

Issues annually or biannually a directory of members.

Lists positions open in state and municipal service.

Holds two statewide meetings per year and numerous chapter meetings for the purpose of presenting speakers on professional issues of the day, discussing important questions concerning the profession, and broadening acquaintance among professional engineers.

Issues news about the activities and members of the society monthly in "Wisconsin Engineer and periodically at other times through WSPE "News Letters."

Public Relations

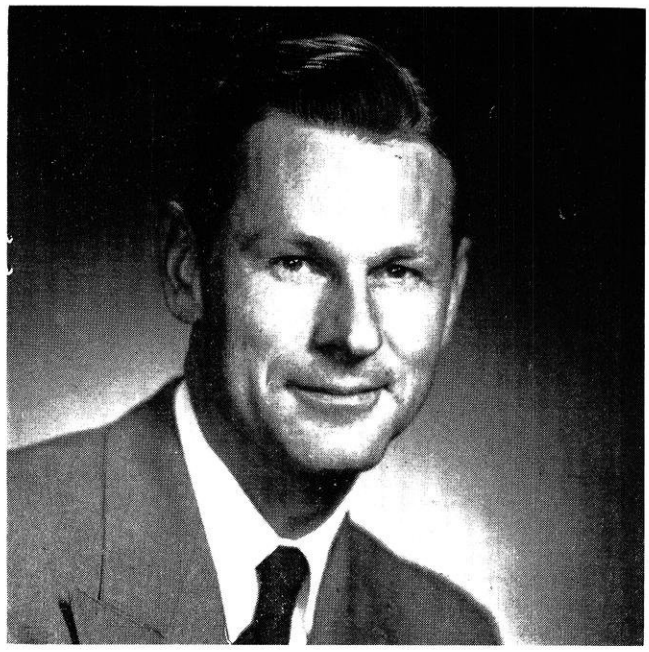
Launches annually a statewide program of information and service to the community during engineers' week, to publicize the profession.

Renders public service to communities, through the chapters, as the occasion may warrant.

Promotes the candidacy of qualified registered engineer members to various state, county, or municipal quasi-public appointments, such as commissions, etc.

(*please turn to page* 26)

Meet the Presidents



LESTER O. HOGANSON

Southeast Chapter

Lester O. Hoganson, president of the Southeast chapter of the Wisconsin Society of Professional Engineers, was born at Rochester, Wisconsin, March 22, 1915. Within a year his parents moved to Burlington, Wisconsin, where he attended public school. While attending Burlington high school, he was a member of the football and basketball teams that won the conference championships in 1932-1933.

In 1937, Lester Hoganson was graduated from the University of Wisconsin with a Bachelor of Science Degree in Civil Engineering. He worked with his father, a general contractor, and then for Mr. Joseph Biagi, consulting engineer, until 1938 when he became city engineer at Burlington.

He was ordered to active duty with the Army as a 2nd Lt. in the Signal Corps in January, 1941. After serving in this country, Alaska and the Aleutians, Mr. Hoganson was released from active duty as a Lt. Col. in March, 1946. Since then he has been, and presently is, city engineer for Burlington and village engineer for the villages of Union Grove and Waterford, Wisconsin.

He is interested and active in the development of engineering as a profession, being a charter member of the Southeast chapter of the Wisconsin society, and at present a member of the board of directors of that society. Memberships in the American Waterwork Association, Central States Sewage Work Association, Society of American Military Engineers and American Public Works Association are also held by Mr. Hoganson.

Civic activities have included the presidency of the Burlington Kiwanis Club, the Burlington Community Chest and the Wisconsin Alumni Club of Burlington and vicinity and membership in the Ross-Wilcox Post of the American Legion. Last year, he was secretary of the Engineering and Public Works Section of the League of Wisconsin Municipalities and this year is serving as vice-chairman of this group.

Mr. Hoganson was married to Jane Wagner in 1946. They both list photography and square dancing among their interests and hobbies.

(*continued from page 24*)

Annually awards special citations to deserving members in recognition of outstanding service to state, to WSPE, and to the engineering profession.

Cooperates with city governments in civil defense work.

Fees and Classifications

Formulates and periodically revises a schedule of fees for consulting work and classifications for employed professional engineers and registered engineers - in - training. More than 3,000 copies of such schedules have been distributed.

Participated in studies by a committee for governmental taxing units in the Milwaukee area leading to a report, "Survey of Positions in Government." Recommendations on salaries and classification of professional engineering positions were made by WSPE.

Appeared before state civil service and other similar groups in behalf of salaries and classification of professional engineers.

Ethics and Practice

Have adopted the standard code of ethics and practice for guidance in Wisconsin and publicized the code of ethics and practice for guidance in Wisconsin and publicized the code on appropriate occasions.

Handled over 200 cases of reported registration law violations and unethical conduct, almost all of which have been closed favorably to our membership where violations or misconduct existed. Since all cases but one were the result of ignorance of the law or unintentional unethical conduct, little or no publicity has been given these corrective measures, nor was punitive action taken. One flagrant case was turned over to the registration board, which forced compliance with the law.

Registration Promotion

Have issued about 5,000 circulars to engineers of professional caliber throughout the state, providing information on the benefits of, and procedure for, registration.

Largely responsible for establishment of PE examination refresher courses in Appleton, Eau Claire, Green Bay, Madison, and Milwaukee.

Instrumental in effort to secure a full time secretary for registration board and in legislating an increase in registration renewal fee to support the full time secretarial position and enlarged staff.

Aids in publicizing announced dates of forthcoming PE and EIT examinations.

Education

Instrumental in establishment of evening post graduate engineering curriculum at University of Wisconsin in Milwaukee leading to an MS degree.

Collaborating in development of a program for testing engineering aptitude of students.

N.S.P.E. DECLINES TO JOIN JOINT COUNCIL

An invitation to join the Engineers Joint Council has been declined by a vote of 69 to 12 by the board of directors of the National Society of Professional Engineers. The vote was taken during the board's recent fall meeting in Indianapolis, Indiana.

Rejection of the invitation came after many months of deliberation that followed its issuance by EJC last spring.

Following the discussions, the board expressed the belief that effective professional action could be accomplished only through an integrated, three-level organization composed of individual members. Since EJC does not now operate within such a framework, the board voted to decline the invitation at this time.

Concurrently, however, the board urged the officers of NSPE, as well as the society's various committees and the state and local organizations, to extend the fullest degree of cooperation to EJC and other engineering associations in programs for the betterment of the profession in which a mutual interest exists.

At the Indianapolis meeting the board also authorized the construction of a headquarters building in Washington, D.C. to house the society's staff and operations. The great increase in NSPE membership during the last ten years and the correspondingly expanded programs make such a move desirable.

Plans for the celebration of National Engineers' Week, February 21-27, 1954, and for the continued expansion of the public relations program were also given final approval during the conference.

●

By T. CARR FORREST, JR.
N.S.P.E. President

It is contemplated that the income of the national Society for 1954 will be very close to $300,000. This is based upon the best estimates which can be gleaned from past history of the society, the expanded activities which the society is already embarked upon, and a number of other miscellaneous considerations which were presented to the budget committee.

It is contemplated to spend more money on some of the existing programs of the society in order that a better job can be done. One of these is the governmental liaison work. both in our office and in reporting of items to the profession. A minimum of $10,000 will be spent in this direction.

The public relations program so auspiciously launched by the voluntary contributions of the NSPE

(*please turn to page 34*)

McCormick's

Engine-Ears

by Larry McCormick, ch'55

" 'Tis truth that the alcoholic vapours which float about the brain on the Eve of the New Year are not dispersed readily; forsooth, they persist even until the last final exam is written."—old saying attributed to a prehistoric Hastytastian.

* * *

Saturday, January 9, saw the men of Triangle promenading their girls in the Pompeian Ballroom of the Loraine Hotel. The formal was slated to be held in the lion house at the zoo but the punch was sent to the wrong address and naturally the party followed the punch. The fraternity will be taking in a new class of pledges in February. An all-time high I.Q. average of 80 is expected.

* * *

At Engineering Freshman Lecture class on Friday, December 4, 1953, the two highest ranking freshman engineers of 1952 - 53, with grade point average of 2.97 for the year, were given special recognition. Jon H. Baumgartner, Ch.E.2, was awarded a slide rule by Fred H. Culver, Ci.E.4, president of Tau Beta Pi. Arthur L. Morsell, M.E.2, was awarded a slide rule by John C. Richardson, M.E.4, president of Pi Tau Sigma, who presented the award in memory of the late Professor G. L. Larson, who was a guiding light of Pi Tau Sigma through his many years at the University.

* * *

While smoking that last cigarette before Mechanics class, a commotion on the south side of the E.E. building drew me to the window. An Air Force portable crane was unloading a large crate which aroused considerable speculation among the members of the class. The box contained a radio teletype field unit which the ROTC Signal Corps has acquired. The unit cost $30,000 and was built by Hallicrafters. Communication will be carried on with other Big Ten schools and it is claimed (unofficially) to have a range that would permit transmission to Oregon State.

* * *

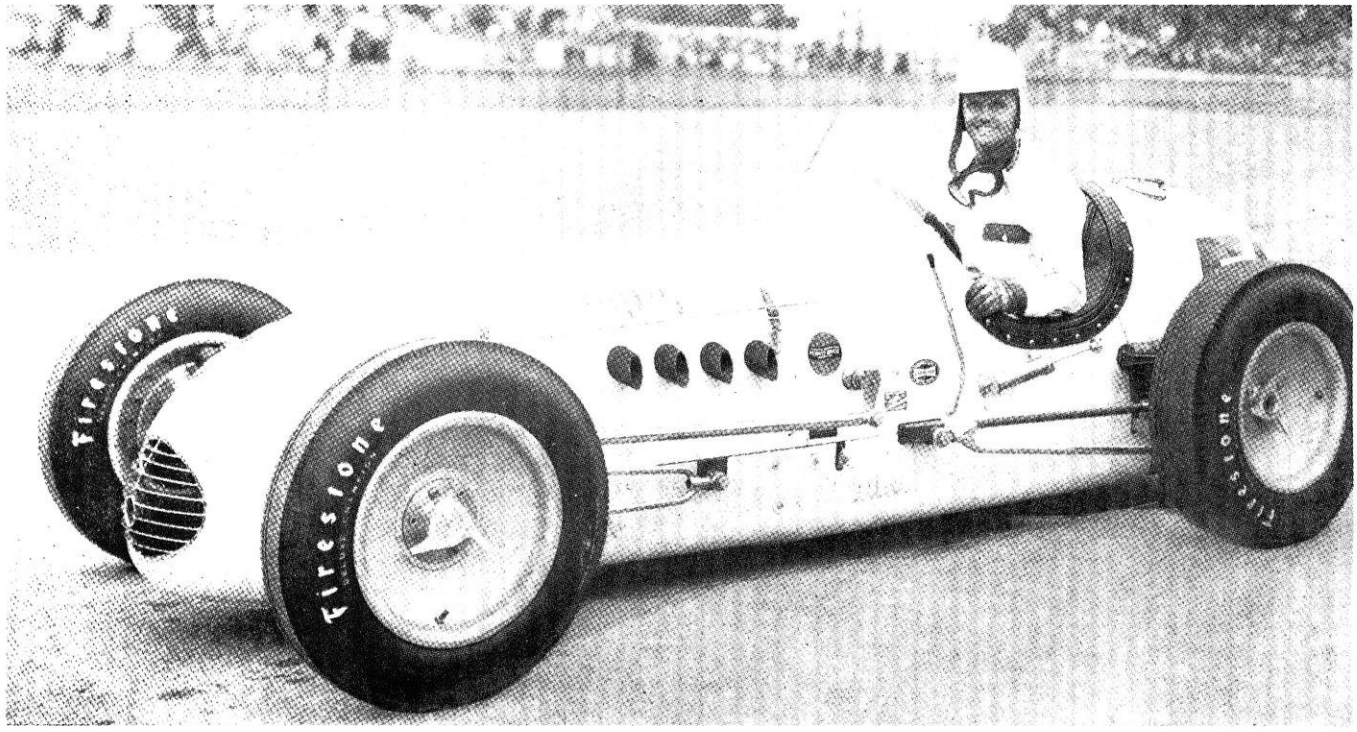
At the December 16 meeting of ASCE, elections were held. The new officers are: William Zeeb, president; Joe Johanning, vice-president; Gene Weir, secretary; and Don Harrman, treasurer. The society, realizing that the men on the engineering campus know very little about the functions of ASCE, has appointed a publicity committee. The members of the committee are: Gerald Wichman, Carl Burnard, and Dale Owen. Entertainment had been planned for this meeting but the movie projector broke down; as there are no ME's in ASCE, the film was not shown. A jovial fellow, Mr. William Huegel, has been nominated as ASCE's candidate in the St. Pat contest. Oh, when will we get an Irish St. Pat?

* * *

ASME held a gigantic rally in Tripp Commons, January 12. "Be my guest," said Bill Boyes, ASME president, to Paul Padrutt, the top guy in SAE. As a result, the entire SAE mob sat around and ate the refreshments so generously provided by ASME. A speaker, Mr. Dave Pearl of Hamilton Standards Co., extolled the complications of engineering aircraft machinery. In February ASME is sponsoring a trip through the Gisholt Machine Co., and for the February meeting the organization is trying to obtain a speaker from DuPont.

Jon Baumgartner (left), and Arthur Morsell, top '52-'53 freshmen, accept awards from (l.-r.) John Richardson and Fred Culver.

OFFY 270



Courtesy SPEED AGE Magazine

Bob Swiekert and his car at Indianapolis.

by Kneeland Godfrey, c'55

The most well known engine in American track racing today is the 270 cubic inch Offenhauser, Meyer and Drake. Because of its comparative simplicity and great reliability, it has, since its inception in 1933, become practically the only engine seen at the Indianapolis 500 and the major dirt track events around the country. The motor has only four clyinders, a design which keeps the number of components to a minimum and thus reduces the number of parts which might fail in a race. Equally important, this simplicity gives the powerplant the great torque needed for fast acceleration out of the many turns in a track-type race. This high torque makes it unnecessary to shift gears at the truns, thus simplifying the driver's job, and reducing lap times due to the elimination of the time lost in gear shifting.

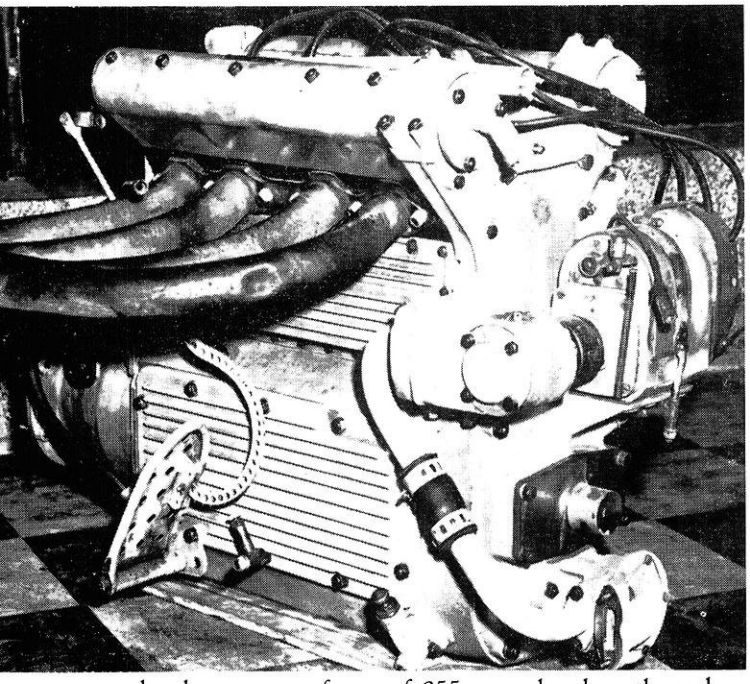
As a complete unit, the engine weighs 522 pounds and costs about $6,000. The high cost comes from the fact that virtually every part must be specially made at the Meyer and Drake plant. The engine may be purchased with a bore diameter of either 4 5/16 or 4⅜ inches. Stroke lengths available are 4⅜, 4½, and 4⅝ inches. The International Class C engine displacement limit is 4½ liters (274.60 cubic inches). This limits the largest stroke-bore combinations to 4⅝ x 4 5/16 (270.02 $in.^3$) or 4½ x 4⅜ (270.60). Other sizes of the Offenhauser engine today being built are the 97 cubic inch midget powerplant and a 220 cubic inch model. The engine is generally designed with a 13.2 : 1 compression ratio.

The firm is headed by Dale Drake, a racing engine expert, and Louis Meyer, three times Indianapolis winner. They bought the company from Fred Offenhauser in 1946, and are today building the same engines, greatly improved, which Offenhauser built in the 30's. Actually the motor got its start as a 255 cubic inch engine designed

by Harry Miller in 1931 to race against souped up Ford fours. He designed the famous and very successful Millers of the 1920's.

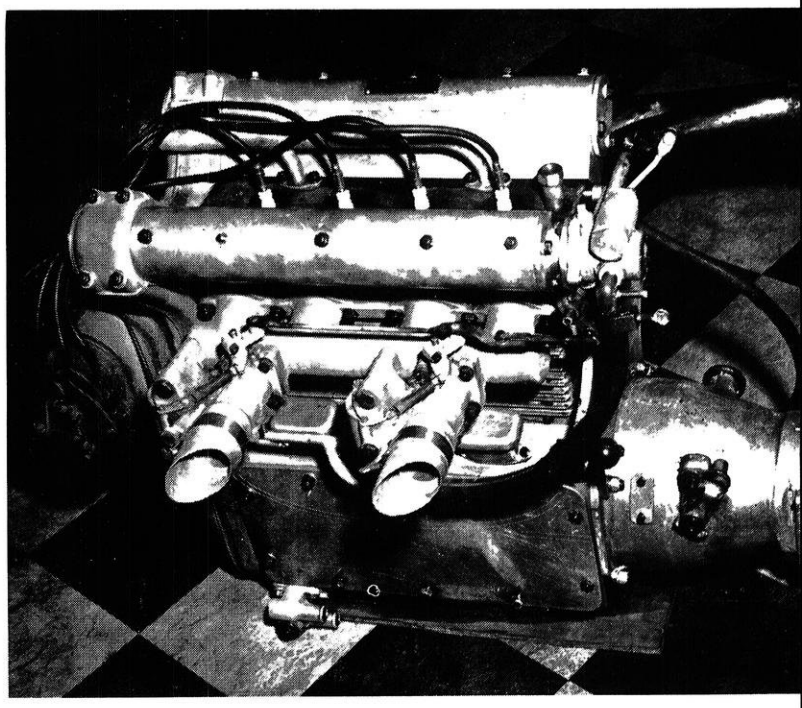
The Offenhauser 270 has two overhead camshafts—one to actuate the intake; and one, the exhaust valves. This feature, as opposed to placing the camshaft in the block, eliminates the reciprocating weight caused by the pushrods of the valve train. Thus the motor can turn over at higher speeds and develop greater power. Each of the four cylinders has two intake and two exhaust valves mounted above the head in the one piece block-head assembly. This unit construction provides a sturdier engine and eliminates the possibility of a blown head gasket. With multiple valves, the large opening area necessary in an engine with such large cylinders is obtained, but the undesirable weight of a very large single valve is eliminated. The cylinder heads have a dome shape, with the valves beneath each cam inclined at 45° to the vertical. Dual counter-wound valve springs keep the valves well

The Offenhauser 270, workhorse of the racing world.



seated—they exert a force of 255 pounds when the valves are open. The valves themselves are all 1 23/32 inches in diameter. They open into large, highly polished intake or exhaust ports. The spark plugs are set at the top of each dome between the four valves. Specified for warm-ups before racing are R 1 plugs, while R 11's are used for the race itself. An aircraft type Scintilla vertex magneto, reworked for racing, is used. The firing order of the cylinders is 1-3-4-2. The magneto which supplies the spark is driven by gears from the gear train. It replaces the usual battery-type condenser-coil combination. Its advantage lies in the fact that the magneto builds up a hotter spark with increasing rpm's, instead of a spark having less voltage, as in the case where an ignition coil is used. The hemispherical head, now incorporated in some production engines, affords the least head area for a given volume. Thus less heat is lost to the coolant and more is available as power. This shape has been found to give more power than any other yet known. The camshafts are driven by a train of gears from the crankshaft and are mounted in an aluminum case at the front of the engine.

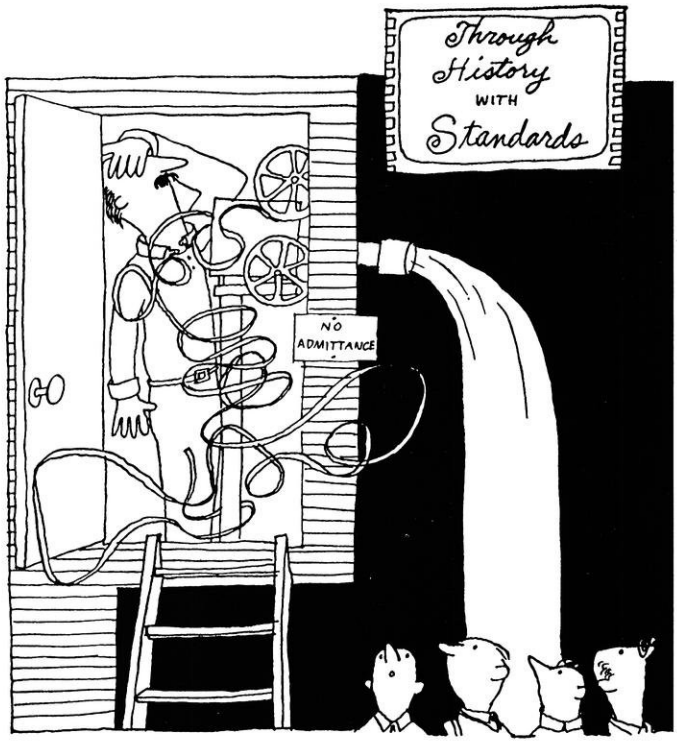
The fuel system desired by most purchasers is a set of fuel injectors made by the Hilborn Company. Of the constant flow type, they consist simply of a venturi for each cylinder and a small orifice in the venturi. An engine driven fuel pump pushes the fuel through the orifice at 35 psi. Here it forms a mist and soon vaporizes. Horsepower increases of 10% are not uncommon with these units due to the elimination of most of the obstructions to flow of the fuel mixture found in carburetors.



Heat treated solid skirt aluminum alloy pistons are used. The piston head raises above the top of the block when the crankshaft is at top dead center. Much of the piston top must be cut away, however, to allow for adequate valve clearance. Three rings are used: a plain compression, a scraper, and an oil ring. The engine's connecting rods are heat-treated forgings of SAE 4340 cromium-molybdenum-nickel steel. They are machined from the forgings to give a tubular shank and precise tolerances. The small ends have bronze bushings in which the piston wrist pins fit. The big ends have steel-backed insert type bearings. The connecting rods, each eight inches long and weighing 52 ounces, are sorted by weight into matching sets to eliminate later balancing. As a final safety measure, the connecting rods are shot-peened to eliminate fatigue failures.

The 270's cylinder block is made of cast iron alloyed with nickel. It is normalized before machining to relieve internal stresses caused by casting. The crankcase is a sturdy aluminum casting and has an integral bell housing. The crankshaft, composed of SAE 4340 crome-moly steel, has five mainbearings, each mounted in a mangan-

(*please turn to page* 52)



A weak and niggardly projection. —Shakespeare, Henry V.

THROUGH

STAN

Courtesy
AMERICAN STANDARDS ASSOCIATION

HOW A KING'S ARM BECAME AN EARLY STANDARD OF MEASUREMENT

One of the first known attempts to set up a standard in the Western world took place in the year 1120, at the time of the first Crusades.

The sponsor was King Henry I of England, whom the Encyclopaedia Britannica describes as a well-educated monarch. Henry ordered that the ell, the ancient yard, should be the exact length of his arm, and commanded that distance henceforth to be the standard unit of comparison of lengths throughout his kingdom.

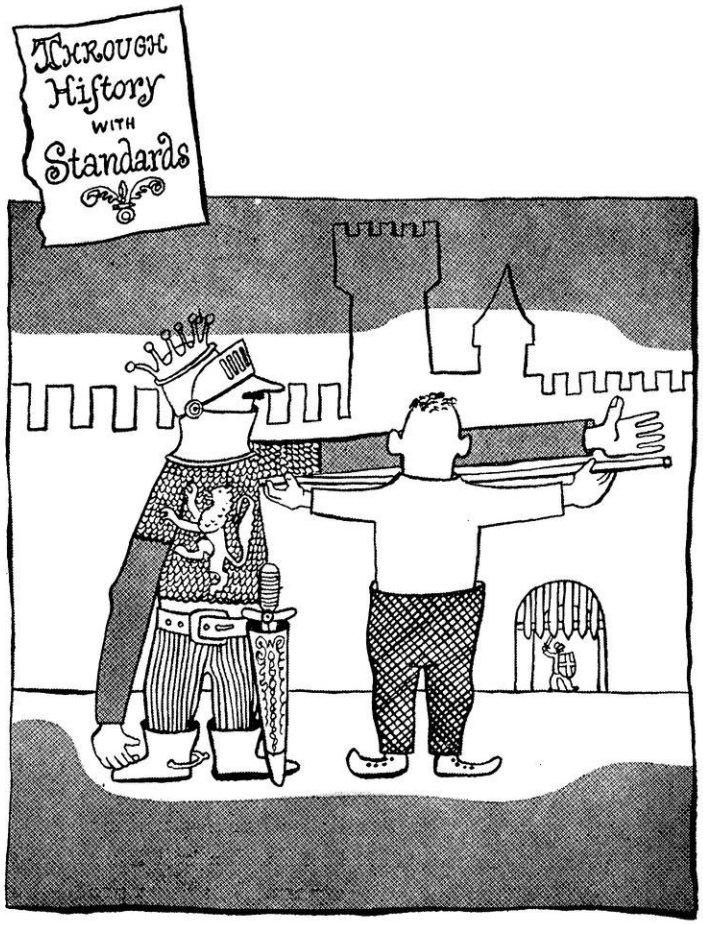
The ell, 45 inches in length, is still used in a few areas for measuring cloth.

HOW THE MOVIES BUILT AN INTERNATIONAL MARKET FOR THEIR FILMS

In the early years of the motion picture industry, stoppages and imperfections in films were common. They were caused by irregular perforations and perforation spacings in the film, by non-standard motion picture machinery, and by non-standardized methods of handling film and equipment. In 1916 the Society of Motion Picture Engineers cited such stoppages as a main cause for the lack of popularity of motion pictures among large numbers of people.

Standards have completely eliminated these difficulties. The industry is now highly standardized in processes, product and procedures, not only in this country but internationally. After the American Standard for the location of the sound track on 16-mm film was adopted internationally in the 1930's, many other motion picture standards were internationalized. The ASA Sectional Committee on Standards for Motion Pictures, PH22, made up of 32 organizations, has developed more than 60 American Standards, and many of these have found world-wide acceptance.

Today, motion picture film from one country can be projected in the standard equipment of any other country in the world.



What are thou? Have not I an arm as big as thine?
—Shakespeare, Cymbeline

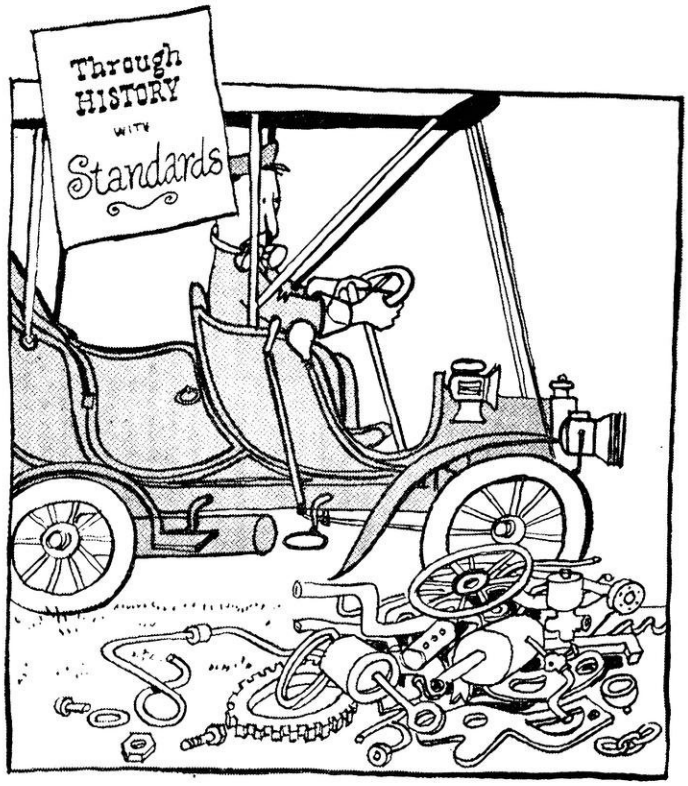
HISTORY
H
ARDS

HOW A YOUNG INDUSTRY PROVED ITS PARTS WERE INTERCHANGEABLE

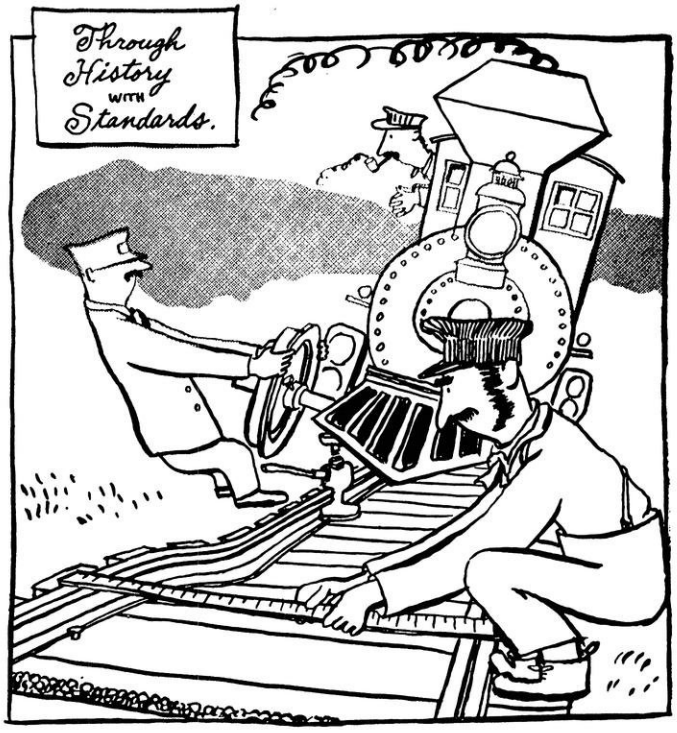
A dramatic and convincing demonstration was given in London in 1908 of the rapid progress toward standardization that the United States had even then achieved in the manufacture of its automobiles.

In February and March of that year, Henry M. Leland chose three one-cylinder Cadillac cars at random from the warehouse of the agency in London. The cars were taken to the Brooklands Race Track and there were completely dismantled. A control commission of the Royal Automobile Club of England scrambled the parts into three piles of 724 each and then replaced 89 of the parts with new parts from stock.

Three new cars were reassembled from the piles of standardized parts without hand fitting. The only tools allowed were wrenches and screwdrivers; files and emery cloth were forbidden. The cars were driven 500 miles over th Brookland Track with only one minor adjustment.



All are but parts of one stupendous whole. —Pope, Essay on Man



Around the ancient track march, rank on rank, the army of unalterable law. —Meredith, Lucifer in Starlight

HOW THE RAILROADS STANDARDIZED THEIR TRACK GAGES

Standards engineers agree that probably the most important group standard ever developed in the U. S. was the railroad's standard track gage and system of interchangeable brakes and couplings. These standards make possible the interchangeability of rolling stock among virtually all roads throughout the nation.

Most of the early American railroads had their own gages, the changeover to the present standard gage being made about the time of the Civil War. At one time President Lincoln issued an order that the gage should be five feet. This never became effective, and after many consultations between the roads the present gage of 4 feet 8½ inches became universal.

This standard gage is used in Britain, the U. S., Canada, and most of Continental Europe. India and most of the important railroads in South America use 5 feet 6 inches. South Africa uses 3 feet 6 inches. Australia has never adopted a standard gage, and when cargoes are transferred they have either to be reloaded or special undertrucks have to be used.

LITERARY ENGINEERING

THE ENGINEER AND THE HUMANITIES

by Wayne R. Crone, e'53

EDITOR'S NOTE: This paper won first place in the local Tau Beta Pi pledge essay contest. It has been forwarded to the national chapter to compete with papers from other Tau Beta Pi chapters.

Albert Einstein, a great scientist and avid patron of the humanities, once remarked that a person trained **only** in a technical field could be likened to a well trained dog. A remark such as this provides wholesome food for thought. Serious examination of our past and future educational experiences seems necessary.

Because of the intense pressure placed on the engineering students during their college career, few realize that they may be neglecting a very important facet of their education. Little in the realm of humanities is offered in the average, present day engineering curriculum. Yet humanities are those studies which truly add flavor to an education. Such studies are exceptionally lucrative in a sense differing from the returns obtained from the regular engineering subjects.

Engineers are regarded by non-engineers as somewhat cramped in their learning. Are they correct in their appraisal? Th engineering curricula have become so crowded with technic, scientific, and mathematical subjects that few electives are provided. For those electives which are allowed, many engineering students are sorely tempted to elect more of such subjects, being under the impression that greater benefit will be derived by pursuing their specialty further. On the other hand, being tired of the pressure, the overworked student may tend to search out the "snap" courses regardless of their content. The net result is that people offering criticism of engineering educations are all too often correct.

With a good engineering background, the student will always have excellent opportunities to expand his engineering knowledge, especially in a field so dynamic as engineering. However, he will never have an equal opportunity to broaden his education with a perusal of the humanities as he does while engaged in obtaining his formal education.

All students have several widely dispersed directions of interest. Some may foster a natural inclination toward language study, others a weakness for music, or history, or innumerable other subjects. The magic of following up these interests is that not only is a basic intellectual curiosity satisfied and a feeling of self-satisfaction obtained, but new vistas are opened. There is always action and reaction. Learning always leads to more learning, a very healthful situation in all cases, whether it be in one's own field or in another object of interest. Thus, when one decides to elect a course he has always thought he would like, he is not only following his immediate desires, but is also developing these interests into more formidable proportions.

The long term benefit of such studies may not be apparent at once. Only bits of knowledge may seem to be gleaned from here and there. The fact is, however, that the gleaning continues after the subject is ended. The new knowledge serves as an impetus toward finding out further about the subject. With this motivation, the person always is on the alert for new facts and thoughts. His reading and observation are stimulated, and his interests start branching. What was originally a poorly defined penchant has crystallized into active participation.

The meat of the matter is that there is a definite need for the student of engineering to broaden his education with the humanities. The time is now, while the student is in college. The benefits of taking such subjects far exceed the immediate effect of learning some additional facts.

THEY STARTED OUT EVEN AT GRADUATION:

Why is one doing better now?

You may not see it in their outward appearances – but there's a big difference between these young men. One has held three jobs in the five years since graduation. He's still looking for a job that offers him a lifetime career. The other has been with a Bell Telephone Company during that time. He's on his way up!

Seventy-five per cent of college men hired by the Bell Telephone Companies since World War II are still with these telephone companies after *five years!* Here's why:

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There Are Places to Go—Each year the number of college people hired is related to estimates of the number of future management positions expected to be available. We are looking to the future—yours and ours.

You Grow with a Growing Business—The Bell System is one of the fastest growing businesses in the world. Since the end of World War II, it has spent about nine billion dollars for new construction. The past five years have seen the introduction of network TV transmission, dialing of Long Distance calls and the development of the remarkable transistor.

You'll Be Happy—Not only because of the interesting and rewarding work, but for many other reasons. For instance, Bell Telephone Companies are located in all parts of the country. So you may be able to start where you want to live. And what about salaries? It is the basic policy of the telephone companies to pay salaries that compare favorably with those positions of similar responsibility in other fields.

No matter what your military status, it's worth inquiring about Bell System employment opportunities. Your Placement Officer has the details. And be sure to talk to our employment representatives when they visit the campus. The time to plan your future is now!

BELL TELEPHONE SYSTEM

(continued from page 26)

membership over the past three years will not only be continued but expanded. It is expected that in excess of $20,000 will be spent on this activity.

The engineering profession may well be at the crossroads of whether we continue to advance toward even greater professional status, or whether we reverse our trend and revert to a trade. I am referring to the extensive interest in the profession regarding the growth of collective bargaining organizations. NSPE proposes an aggressive program to determine the real causes behind interest in this development —activities in which the professional society can engage to assure continued professional progress; programs toward the better development of engineers in industry, government, and the teaching profession; and an endeavor to develop as much information as possible for the enlightenment of engineers on this important subject. It is contemplated that at least $15,000 may be spent on this program.

It is sincerely hoped that all members will make it a point to avail themselves of the services of their professional society, to offer their cooperation, and to be active in whatever capacity they may find their services most needed. It is only through the cooperation of all of the members of NSPE that our continued aggressive programs can be maintained.

MILWAUKEE CHAPTER

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CLYDE R. ETHIER
Reporter

At the December meeting of the Milwaukee chapter, Ed Kallevang and Art Behling reported to the Milwaukee membership on the fall meeting of the NSPE board of directors in Indianapolis. They pretty thoroughly covered the discussions and actions of the board, and explained the present situation with regard to unity, and the reasons for declining affiliation at this time with EJC.

There will be no local meeting scheduled for the month of January, as all activity is directed toward providing a successful 11th annual meeting of the WSPE, which is to be held in Milwaukee at the Hotel Schroeder on January 28th, 29th, and 30th.

In addition to the usual excellent group meetings, a few highlights of the program include the address by Anthony von Wening, chairman of the finance committee of the A. O. Smith Corp., to the Friday luncheon; the talk by Dr. J. O. Christianson, superintendent of the University of Minnesota College of Agriculture, on "Americanism" to the Friday dinner meeting (sponsored by General Motors Corp.); and the Saturday luncheon will be enlivened by the irrepressible Charley Grimm.

Don't miss it!

SOUTHEAST CHAPTER

•

H. J. CARLIN
Reporter

The Southeast chapter of the Wisconsin Society of Professional Engineers held its regular quarterly dinner meeting in the Holiday Room of the Avalon Hotel in Waukesha, Wisconsin, on December 2, 1953.

After a refreshing tour and visit at Jack Waite's cement tile company plant on Highway 164, the stage was set for the Avalon's famous prime rib roast dinner.

Presiding over this dinner meeting were President Lester O. Hoganson and Program Chairman Howard J. Wurst.

The following men were nominated for chapter officers from July 1, 1954 to July 1, 1955:

President, Charles E. Pflug, Kenosha; vice-president, Donald C. Bengs, Waukesha; secretary-treasurer, Walter E. Dick, Waukesha; director, James L. Trebilcock, Cedarburg.

Mr. M. E. Nevins, president of the Wisconsin Centrifugal Foundry in Waukesha, gave a most interesting talk and presentation on methods of centrifugal casting. Mr. Nevins discussed high temperature alloys and showed an excellent display of high type precision fittings. He explained their many uses in the component parts of the armed services.

NORTHWEST CHAPTER

•

R. N. MORRIS
Reporter

The November meeting of the chapter was a dinner gathering held at the Eau Claire Hotel; twenty-five members and guests attended.

Guests included W. L. Hinderman, state president of the Minnesota Society of Professional Engineers and district engineer of the Asphalt Institute; R. B. Johnson, assistant district engineer of Minneapolis; and Ed Howard, Institute representative of Champaign, Illinois; S. E. Hicks and J. R. Schultz, members of the Southwest chapter, Madison, Wisconsin.

W. F. Baumgartner, our local state director, gave a report on the October meeting of the board of directors that was held in Milwaukee.

The following committees were appointed by President Gohn:

Committee on Engineers' Week to be held in February: chairman, Roderick Bott, Chippewa Falls; Stuart Willison, A. O. Ayres, Paul McKinnon, and Aldon Lokken, of Eau Claire.

Nominating committee to submit a slate of officers for election at the January meeting: Virgil Dufeck, chairman; A. W. Piltz, of Eau

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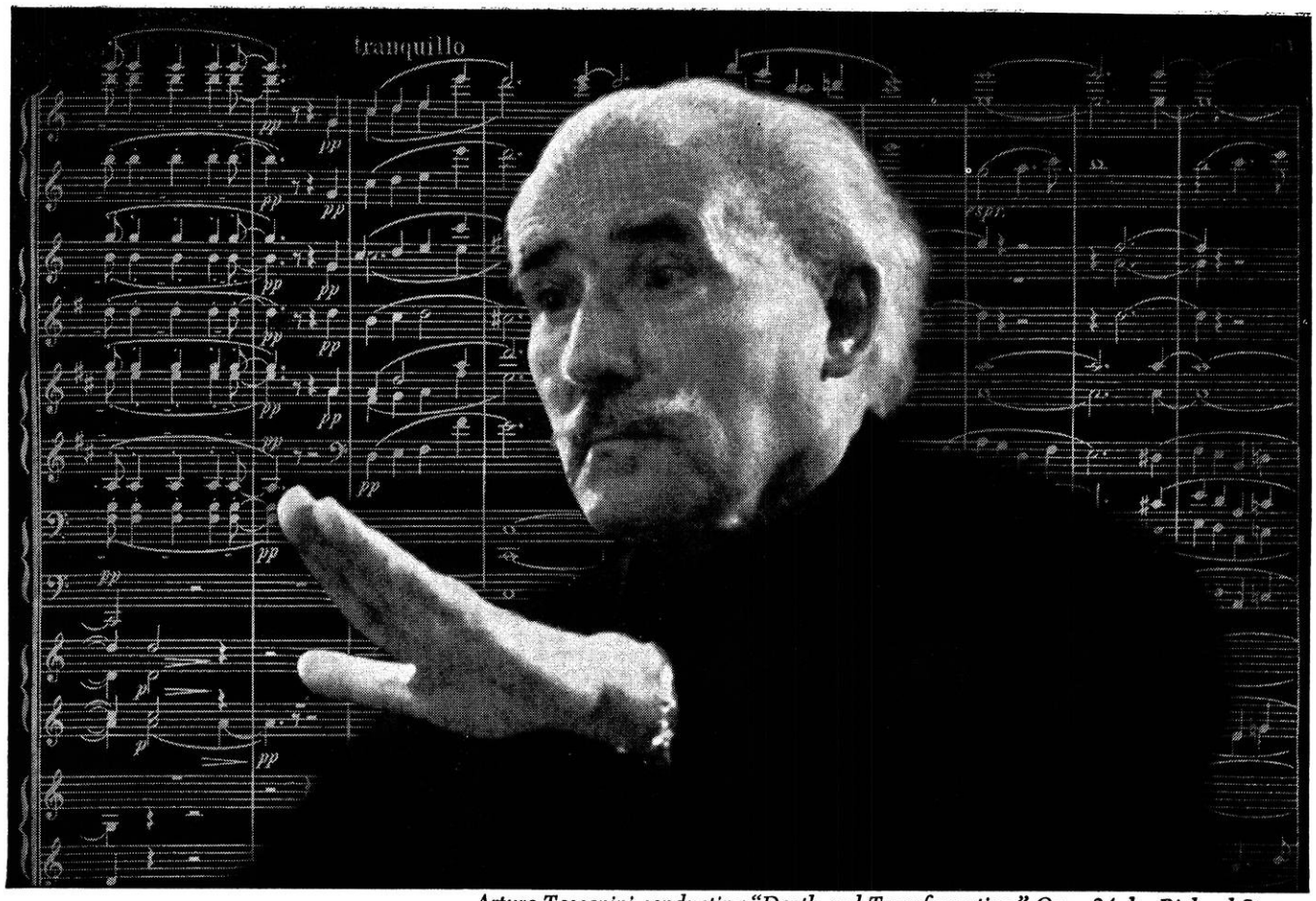

Arturo Toscanini conducting "Death and Transfiguration," Opus 24, by Richard Strauss

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RCA Victor High Fidelity is the result of 50 years of leadership in recorded music, phonograph research and development of radio and motion picture sound. It is a new dimension in sound created by the perfect union of recorded music and the phonograph.

A genuine high fidelity instrument re-creates the full range of tones and overtones of the original composition—exactly as the composer intended. The precise balance of sounds from the highest to the lowest must be maintained if perfection is to be achieved.

"Victrola"® phonographs, Victor records, and "intermatched" high fidelity equipments for those who want to assemble their own units—all are designed to work together to bring the brilliance of the original performance into the home. Now, with RCA High Fidelity instruments, you can hear the full gamut of the orchestra—from the shimmer of the cymbals to the beat of the tom-tom. Your favorite music sounds just as if you were in the presence of the recording orchestra and artists.

True Hi-Fi—as in RCA Victor instruments and components—embraces the entire scale of tones from the rich lows to the colorful highs. Nothing is missing . . . the sounds reach the ear in their proper proportion and relation.

The nation-wide interest in high fidelity reflects a growing taste for the highest quality music. Developments by RCA scientists and engineers now let you enjoy this new musical experience. Visit your RCA Victor dealer and hear the new Hi-Fi models of "Victrola" phonographs, Victor records and "intermatched" components.

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- Design of receiving, power, cathode ray, gas and photo tubes.

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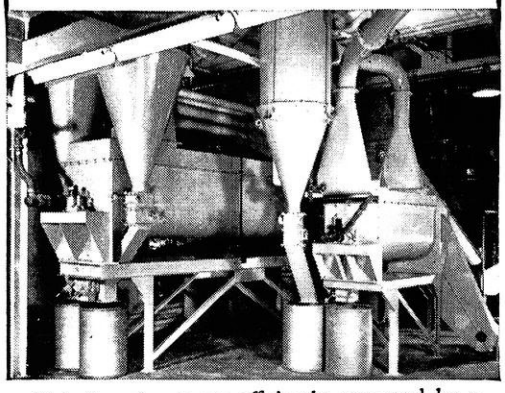
Also many opportunities for Mechanical and Chemical Engineers and Physicists.

Another example of opportunities for engineers at LINK-BELT

Baby cream or volatile solvents--LINK-BELT helps make chemical processing more efficient

On this Link-Belt universal crescent flat top conveyor chain, jars of baby cream take this irregular path, each always riding separately on its own chain top plate.



Volatile solvents are efficiently recovered by a Monotube Dryer, one of many Link-Belt products widely used in chemical processing industry.

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IN almost every phase of the huge chemical industry, you'll find Link-Belt conveying, processing and power transmission machinery at work. Likewise at quarries, mines and farms . . . in refineries, mills and factories—Link-Belt equipment handles materials every step of the way. This efficient equipment provides the high-capacity, trouble-free operation that brings more goods to more people at a lower price.

Hundreds of Link-Belt products serve all industry. And many engineers are needed to staff the laboratories, plants, engineering and sales offices of this nationwide organization. For facts on how you can become one of them, write for fully illustrated booklet, "An Introduction to Link-Belt." Or, if you're in the vicinity, stop in at one of the plants listed below. 13.377

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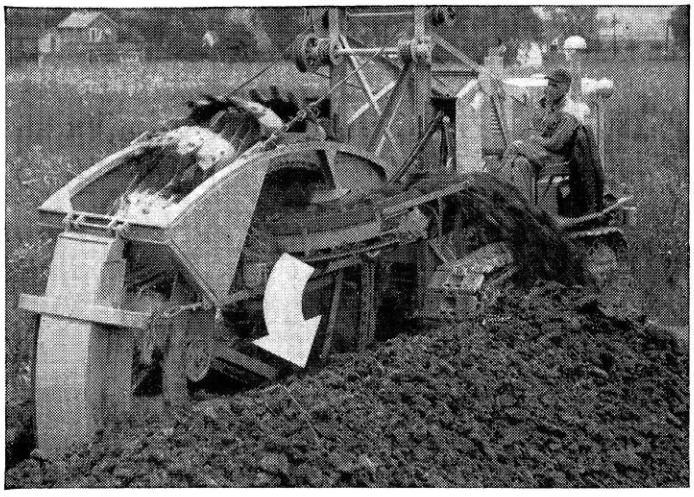
Indianapolis 6.....220 S. Belmont Ave.
Indianapolis 6.....519 N. Holmes Ave.
Los Angeles 33.....361 S. Anderson Ave.
Minneapolis 5.....200 Lyndale Ave., N.
Philadelphia 40.....
.....2045 W. Hunting Park Ave.
San Francisco 24.....400 Paul Ave.
Seattle 4.....3405 Sixth Ave., S.

Another page for **YOUR BEARING NOTEBOOK**

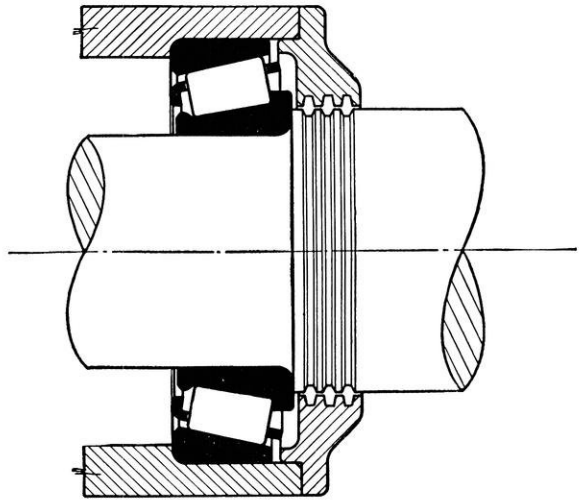


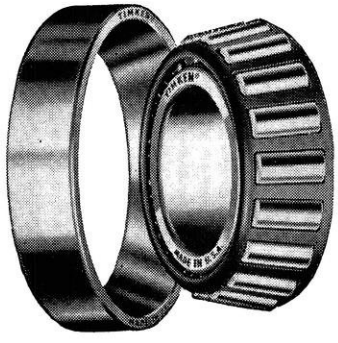
How to keep buried wheels turning smoothly

Hidden under the pile of dirt (see arrow) is a 4-wheel truck that backs up this ditch digger's whirling buckets. To prevent breakdowns, the wheel bearings had to be able to absorb the shocks of boulders and the digging action itself. And they had to be protected from the dirt. The engineers who designed this application licked both problems by mounting the truck's wheels on Timken® tapered roller bearings. Timken bearings absorb the shocks because they have tough, shock-resistant cores under hard, wear-resistant surfaces. And Timken bearings make closures more effective.

How TIMKEN® bearings help keep dirt out—lubricant in

Timken bearings make closures more effective because they hold the housings and shafts concentric. As a result, dirt can't get in—lubricant can't get out. Maintenance is minimized. Continuous, trouble-free operation is assured.

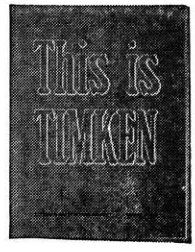




TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

Want to learn more about bearings or job opportunities?

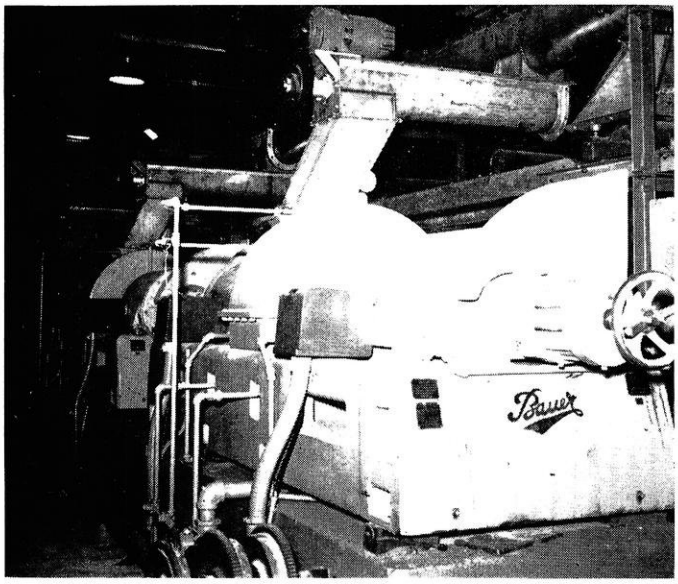
Many of the engineering problems you'll face after graduation will involve bearing applications. For help in learning more about bearings, write for the 270-page General Information Manual on Timken bearings. And for information about the excellent job opportunities at the Timken Company, write for a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



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⓪ AND THRUST →⓪← LOADS OR ANY COMBINATION ✳

Semi-Chemical Pulp - -

(*continued from page 23*)



Disk grinders for refining of semi-chemical pulp. Each revolving disk is powered by a 500 hp motor.

cheaper and more readily available than the conifers, there are several other favorable factors:

(1.) An expenditure of approximately 60 per cent of the total power required for the manufacture of spruce pulp; (2.) Production rate for aspen 20% greater than for spruce pulp; (3.) Reduced cost of strength development; (4.) Economics of larger unit production; (5.) Better paper formation.

The high yield of pulp obtained by semi - chemical processes, and the adaptability of these processes to the many wood species that are available, but not used extensively today, should serve as incentive toward additional uses and further applications with a wide variety of woods.

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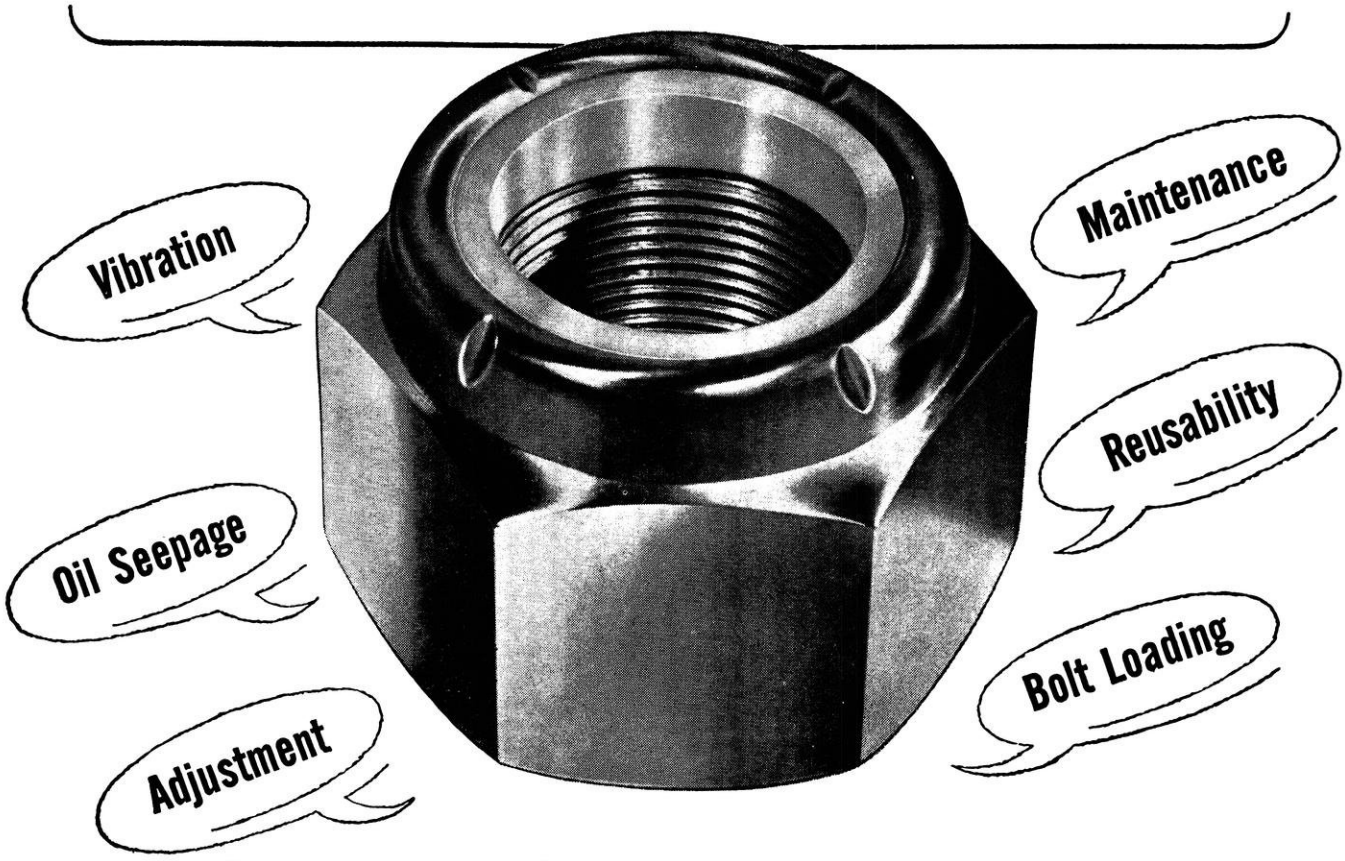
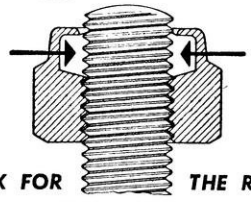
THE END

Whenever fastening problems arise...





Consider ELASTIC STOP NUTS

LOOK FOR THE RED LOCKING COLLAR

It is threadless and resilient. Every bolt impresses (but does not cut) its full thread contact in the Red Elastic Collar to fully grip the bolt threads. In addition, this threading action properly seats the metal threads—and eliminates axial play between bolt and nut threads. All Elastic Stop Nuts—regardless of type or size—lock in position anywhere on a bolt or stud, maintain accurate adjustments and seal against liquid seepage. Vibration, impact or stress reversal does not disturb prestressed or positioned settings.

Whenever fastening presents a problem—ESNA is ready with a quick answer. More than 3000 types and sizes of self-locking vibration-proof fasteners—plus the "know-how" of ESNA engineers—are available here at ESNA.

ESNA has long been known as "design headquarters" for self-locking fasteners. Accepted by Army, Navy and Air Force, virtually every aircraft built in the past decade has been Elastic Stop Nut-equipped. On the railroads, in the oil fields, on automobiles and construction equipment, Elastic Stop Nuts manufactured to exacting quality control standards, are doing specialized jobs every day.

Be familiar with the design help ESNA offers. Write us for details on Elastic Stop Nuts. Elastic Stop Nut Corporation of America, 2330 Vauxhall Road, Union, N. J.

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DESIGN HEADQUARTERS FOR SELF-LOCKING FASTENERS

ENGINEERING INSTITUTES

Welding Applications — **January 13, 14, and 15, 1954**

This conference will be of value to the welding engineer, design engineer, and welding supervisor. Typical topics to be discussed include: inspection of welded joints, design procedure in welding, welding of pressure vessels, codes and regulations which apply to welding, welding of light gauge metals, and heavy weldments.
Fee: $20

GEORGE R. SELL
Institute Coordinator

* * *

Electric Meters — **January 20, 21, and 22, 1954**

New types of meters and more economical metering techniques are to be discussed in this institute. It is being arranged for persons responsible for the testing, calibration, and maintenance of electric meters of various types. They will learn of recent improvements and advancements in meters and metering techiques.
Fee: $20

HENRY J. KUBIAK
Institute Coordinator

* * *

Industrial Heat Transfer — **January 25, 26, and 27, 1954**

A review of the fundamentals of industrial heat transfer will be presented in this institute. Also, current practices in the design and operation of heat transfer equipment will be included. Specific applications of heat transfer apparatus will be discussed. Engineers who desire to expand or refresh their knowledge of heat transfer applications will find this course valuable.
Fee: $20

CLAY R. JACKSON
Institute Coordinator

* * *

Industrial Waste Problems — **January 28 and 29, 1954**

Special problems in the disposal of industrial wastes to prevent pollution of the state's water resources will be considered. It is intended that both organic and inorganic wastes will be considered in special sessions.
Fee: $15

LEONARD F. HILLIS
Institute Coordinator

* * *

Industrial Instrumentation — **February 2 and 3, 1954**

The new technical field of industrial instrumentation is attracting the attention of alert industrial administrators. We have planned this program to show recent accomplishments in measurement, testing, and control through instrumentation, and to indicate how these new techniques may be applied to your industrial operations.
Fee: $15

RAY C. TEGTMEYER
Institute Coordinator

* * *

Television — **February 10, 11, and 12, 1954**

The purpose of this institute is to give television servicemen and others the opportunity to learn the latest methods and techniques in the servicing of television receivers. Also, a summary of late developments taking place in television design.

The special character of the application of an electronic digital computer for airborne automatic controls is reflected principally in the input-output units.

MORE THAN 100 TIMES FASTER THAN THE HUMAN BRAIN

The physical quantities defining the state of the system—such as altitude, rate of climb, heading, and other vital information—are measured by instruments whose outputs are usually in the form of mechanical displacements or voltages. These analog quantities are converted into digital numbers that are processed by the computer; it performs in "real" time the computations corresponding to the mathematical representation of the control problem. The results of these calculations are numbers representing the signals used to control the system. These output numbers are converted into the analog-type signals used in the control operations.

At Hughes Research and Development Laboratories, where the subminiature airborne digital computer was pioneered, analog-digital input-output systems have been developed for several applications.

For example, in the conversion of direct-current voltages to binary numbers, the many input voltages are digitalized in sequence by a comparison with a precisely linear saw-tooth waveform, gated once per revolution of the drum to successive inputs. Time intervals are produced which are used to control a gated binary counter. Resulting binary numbers are stored in the memory for subsequent use by the computer. Output binary numbers each control the symmetry of a square wave recorded on a drum channel during the output sampling periods. Reading heads continuously present the waveforms to the respective output channels where they are standardized by regulated-current switch tubes and are filtered to establish the direct-current components. Several such waveforms may be time-shared on a single drum channel by encoding.

A major effort at Hughes is also devoted to adapting electronic digital computer techniques to business data processing and related applications—uses destined for far-reaching peacetime application.

ENGINEERS AND PHYSICISTS

Activities at Hughes in the computer field are creating positions in the Laboratories. Experience in the design and application of electronic digital computers is desirable, but not essential. Engineers and physicists with backgrounds of component development or system engineering are invited to apply.

Address:
SCIENTIFIC
AND
ENGINEERING
STAFF

HUGHES
RESEARCH
AND DEVELOPMENT
LABORATORIES
Culver City, Los Angeles County
California

Input-output units (above) of the Hughes airborne electronic digital computer. (Left) Operation of the pilot's direction indicator is discussed by W. S. Shockency (left), Radar Laboratory, and M. L. MacKnight of the Advanced Electronics Laboratory.

So You're Smart

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

ANSWERS NEXT MONTH

THE FLYING FLY

If two locomotives start from two cities 132 miles apart headed toward each other on the same track, and if a fly flies back-and-forth between the headlights of the two trains as they speed to their own (and the fly's) destruction, how many miles will the fly fly before he is crushed to death by the two headlights? One locomotive travels at a constant speed of 83 miles per hour; the other at 37 miles per hour. The fly does 7 miles per hour.

PLASTIC DUNCE CAP

Let us assume that a professor has undertaken to modernize his classroom by the addition of a bright red plastic dunce cap. Recent budget cuts, however, have forced him to construct the cap himself. His friendly neighborhood plastic dealer sells bright red plastic sheets at 50c per square foot. However, he offers the prof a bargain of 30c per square foot on a triangular sheet of green plastic 2 feet on one side, 3 feet on the other leg, and 5 feet on the hypoteneuse. A quick slide-rule calculation by the prof reveals that only 75% of the green plastic will be used in the dunce cap. He further concludes that green will be only 90% as effective in his color scheme. Should the professor buy this green plastic?

Answers to the Brain-Crackers Which Appeared in the December Issue

EGYPTIAN ALGEBRA

The plane of the face of the pyramid makes an angle of 51.7° with the base.

* * *

EQUUS NON EST EQUUS

Equal spherical triangles can not be made to coincide. Simple, huh? Incidently, the title is a simple Latin play on words which with one translation state that "equals are not equals" or that "horses are not horses." A more sensible translation is that "horses are not equal."

* * *

TRAVELING IN CIRCLES

There is nothing wrong with the mathematical manipulations used in proving that the sum of the sixteen semicircumferences is equal to the large semicircumference. This is true. The fallacy lies in the fact that an improper limit was taken. The limit as n approaches infinity of $(\frac{1}{2}\pi\frac{d}{n})n$ is equal to $\frac{1}{2}\pi d$ and not d. The infinite process of subdivision will make the semicircles smaller, but even these infinitesimal semicircles will have a semicircumference of $\frac{1}{2}\pi d$.

* * *

MATHEMATICAL PARADOX

Don't feel bad if you didn't get this one. There was a typographical omission which rather fouled up the logic. The problem should be corrected to read, ". . . subtracting b^3 from both sides gives $ab^2 - b^3 = a^3 - b^3$ . . .". We now see that $1 = 3$ only because we divided by zero ($a - b = 0$ when $a = 1$, $b = 1$).

* * *

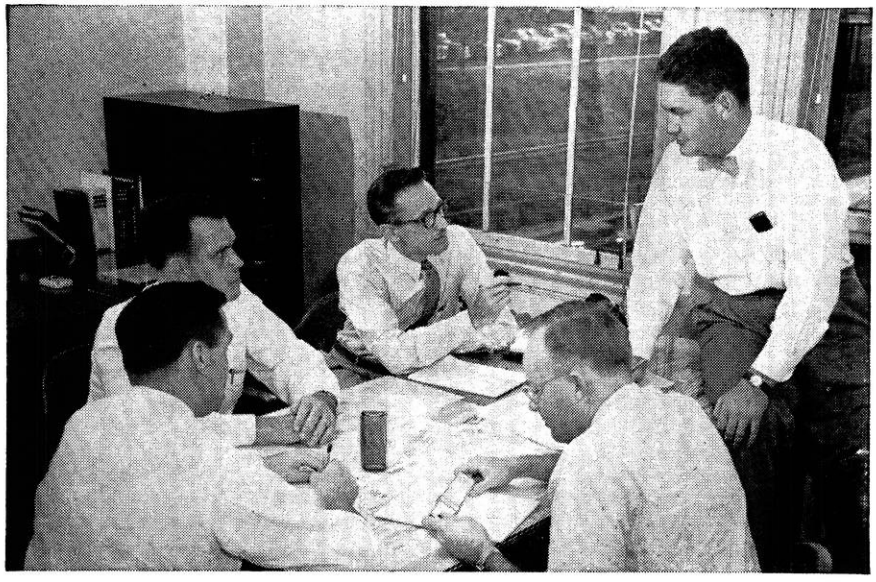
AND ANOTHER PARADOX

Here the answer is simply that no value of x will satisfy the equation. Thus in dividing both sides by $4x - 20$, you have divided by unequals.

THE DU PONT DIGEST

Plant Development

Offers Training and Opportunity



John Purdom, M.S. in Ch.E., Ohio State '48 (*right*), confers with other engineers on the progress of a new plant.

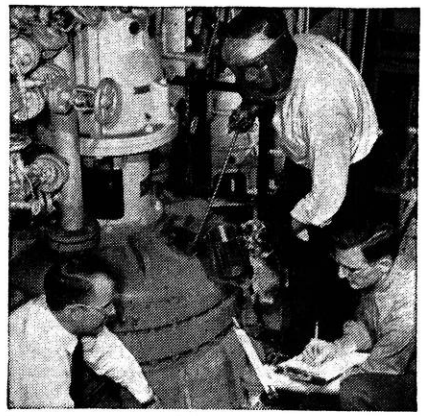
A young chemical engineer recently had his first assignment in a *Plant Development* group at Du Pont. He was part of a team assigned to improve recovery of adipic acid, a nylon intermediate, from plant-waste streams.

First, he made a literature survey for possible leads. Three recovery methods came under consideration: *solvent extraction*, *crystallization*, and a combination *distillation-crystallization* process. He helped to set up a laboratory program to compare and evaluate them.

Preliminary results were somewhat inconclusive. It was decided to go ahead with semi-works tests, while an organic chemist completed the laboratory work.

Next, the young chemical engineer joined forces with a mechanical engineer to design a semi-works plant to evaluate each method. In this plant, all vital points were checked and rechecked: materials of construction, steam and water requirements, heat-transfer coefficients, yields, product quality, and pollution problems.

The semi-works data revealed that the *distillation-crystallization* process was the most economical, and also gave the best product quality. Usually, the next step would be construction and operation of a pilot plant. But this time, engineers from the *Production Division* arranged for a limited-scale plant test, using a spare batch still and a crystallizer on a part-time basis. Two months of testing confirmed the previous data—the new *distillation-crystallization* process recovered adipic acid efficiently, and would reduce costs considerably. The plant is now using this process successfully.



Robert Thomson (*left*), B.S. in Ch.E., Univ. of Va. '50, **David S. Rumsey** (*center*), M.S. in Ch., Univ. of Mich. '48, and **Rene M. LeClair** (*right*), M.S. in Ch. E., M.I.T. '51, test samples on an experimental batch unit.

That's how one young chemical engineer started his career in a typical Du Pont *Plant Development* group. The job of such groups is to make processes and equipment more efficient, to adapt products to new uses, and to improve product quality.

Plant Development work not only offers opportunity in itself but valuable training for other fields.

SCIENCE HIGHLIGHTS

Edited by John DuBois, e'56

MISERY MOUNTAIN

Cuts courtesy General Electric Co.

In a small test hangar literally chained to the blizzard-swept peak of 6,240 foot-high Mt. Washington near Gorham, N. H., prototype jet engines for Air Force and Navy fighters and bombers are given intensive icing tests long before the jet power plants propel aircraft on their first test flights.

Mt. Washington, whose summit is stormier than the polar icecap, provides a laboratory above the clouds. The mountain summit is very suitable for work on icing problems. What with its high moisture content and low temperatures "Misery Mountain", as it is commonly called, has the right altitude for checking the "let down" performance of a jet engine, when critical icing conditions occur as the plane comes in on approach to land.

Most icing affects jet engines when the plane is dropping from 6,000 feet to sea level at reduced throttle for a landing approach; running the jet engine on Mt. Washington very closely simulates this actual condition.

Most of the development work on General Electric's first "hot nose" engine, the J-47, was done in this small test hangar chained to the top of Mt. Washington.

VEST-POCKET PAGE BOY

Business men with jobs that keep them on the move should be interested in a new device of engineering called the Page-ette. It's a vest-pocket radio receiver which can pick up messages and instructions within a 25- to 35-mile radius of a paging service headquarters.

Anyone wishing to reach a subscriber to the radio-page system telephones the service headquarters. Within two minutes the transmitter is sending out the message and repeating it frequently for the next hour. The subscriber lifts the six-ounce receiver to his ear once every hour and pushes a button to listen. Upon hearing his name, he telephones the person paging him or follows the specific instructions included in the broadcast.

To permit fast insertion of new messages, each station headquarters uses two magnetic drum recorders. The entire list of messages is transcribed on one drum, which is played back continuously over the radio station. While this drum is on the air, the operator is able to record a new list on the second drum with any additions or deletions. The second drum can then be switched into the playback circuit and the process repeated.

The new system is already in operation in Cincinnati, Cleveland, St. Louis, Philadelphia and Minneapolis with installation underway in other cities.

DIAPHRAGM MEETS ALL CONDITIONS

Material engineers at the Westinghouse Electric Corporation have developed a new diaphragm in response to a challenging need. A diaphragm sensitive to minute changes in air pressure was required. Further the flexing of only a few thousands of an inch had to be essentially the same at –30 degrees C. and at 110 degrees C. as at room temperature. It was also required that the diaphragm be air tight, not absorb moisture, and be able to withstand vibration and shock common to airborne apparatus.

Measured against these and other practical production requirements, the common diaphragm materials such as thin metals, natural and butyl rubber fail.

The new diaphragm is of one of the silicone rubbers and succeeds in providing a solution to the problem. Methods have been worked out for molding membranes of silicone rubber as thin as 0.005 inch to aluminum discs repetitively and meet all the requirements. The process is a precision one, requiring extremely accurate control of process temperatures and times, curing cycle rates, and a high order of cleanliness.

These diaphragms have numerous potential applications. They have already been applied to airborne equipment and to power switchgear.

NEW AIRCRAFT FLOWMETER

Jet pilots soon will have a means for keeping a continuous, more precise check on how much fuel their aircraft consumes in flight as a result of a new device developed by engineers of the General Electric Company.

The equipment, called a mass flowmeter, measures the actual fuel being gulped down by thirsty jet engines in terms of pounds per

(*please turn to page* 48)

Cleveland's Louise Baker achieves costume jewelry for earrings and necklace which will flash rather than merely sparkle. The bulb is the world's smallest photoflash lamp, developed by General Electric. *Cut courtesy General Electric*

SMALLEST FLASHBULB

A tiny flashbulb which is expected to revolutionize the picture making habits of the nation was introduced by the General Electric Company.

Described as "the world's smallest, least expensive, most convenient, and most reliable flashbulb yet," the new photographic light source is known as the "M-2."

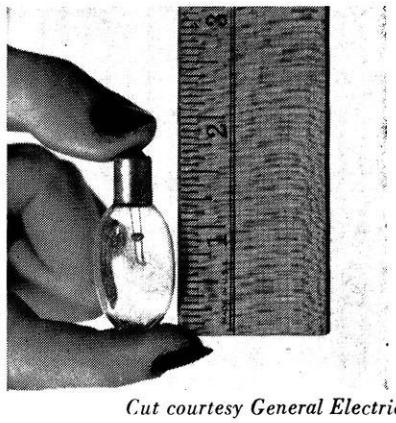
The M-2 produces sufficient light for the great majority of amateur flash needs. Rated at approximately 4000 lumen-seconds, it provides sufficient light for good black-and-white picture results at distances up to 15 feet when used with existing reflectors, fast film, and box-type cameras. Owners of better cameras will obtain good results of considerably greater distances.

The new lamp is equivalent in light output to the SM, or Speed Midget; compared with the No. 5, by far the most popular flashbulb today, it has the same effectiveness at half the distance.

Besides being the smallest flashbulb yet introduced, the M-2 differs in appearance from all previous types in that it has a smaller base. Similar in size to that of the smallest Christmas tree bulb, the base is of the miniature type, smooth, and without either pins or screw threads. It is pushed straight into the socket, and needs no positioning or turning.

The bulb itself is so small that a dozen of them, enough for shooting a complete roll of film with flash, can be carried easily in a shirt pocket or purse.

Retail price of the M-2 is 10 cents per bulb. This price means that a picture taker, using the new bulb instead of the No. 5 or its equivalent, effects a saving of 36 cents in shooting one roll of film.



Cut courtesy General Electric

(continued from page 34)

Claire, and E. H. Nelson, Amery.

Mr. Hinderman, in a brief talk, issued a challenge to the Wisconsin society. At present Wisconsin has 920 members, and Minnesota approximately 900 members. Hinderman expects to have the greater membership count in the Minnesota society by July 1, 1954. Let's hope that Wisconsin can do better than to tie this one.

WISCONSIN VALLEY CHAPTER

●

J. M. ABERNATHY
Reporter

The Wisconsin River Valley chapter operates on a calendar year basis. The new officers elected take over in January and the Meet the Presidents series will introduce the incumbents during the coming year. Mr. Waldemar Nielson, plant engineer for the National Container Corp. of Wisconsin, presently holds this position. Mr. Nielson was born in Brooklyn, N.Y., June 13, 1890. He attended public school and high school in Brooklyn. He furthered his education by attending night classes for ten years at the Polytechnic Institute of Brooklyn and Columbia University, studying engineering courses.

He received his practical engineering experience with many firms before coming to the Tomahawk company in 1933. Among his numerous activities, he serves as American Legion Boy Scout committee chairman and takes an active interest in psychology and gardening.

FOX RIVER VALLEY CHAPTER

●

R. E. LEE
Reporter

No chapter news submitted.

SOUTHWEST CHAPTER

●

C. H. GAUSEWITZ
Reporter

At the December 2 meeting of the Southwest chapter of the WSPE held at the Capital Hotel, Mr. W. Williams, surveyor and professional engineer of the firm of Williams and Wertz of Grand Rapids, Michigan, spoke on "Professional Relations Between Engineers and Surveyors." Mr. Williams, a graduate of Michigan State College, class of '21, opened his talk with an expression of gratitude the Spartans feel for the Badgers for helping to put them in the Rose Bowl. When the Illinois-Wisconsin score was announced at the end of the Spartan-Wolverine game in East Lansing, the Spartan band marched off the field playing "On Wisconsin."

Mr. Williams compared the relations between surveying, the many branches of engineering, and architecture with that of travel on a multilane highway—each traveling in the lane of his particular specialty. There is no harm, he felt in crossing from lane to lane providing the transition is made gradually and with caution.

He asked all the professions to abide by the golden rule. He hoped for good integration between surveyors, engineers, and architects. Integrated, they could be powerful influence on favorable legislation for all of the professions.

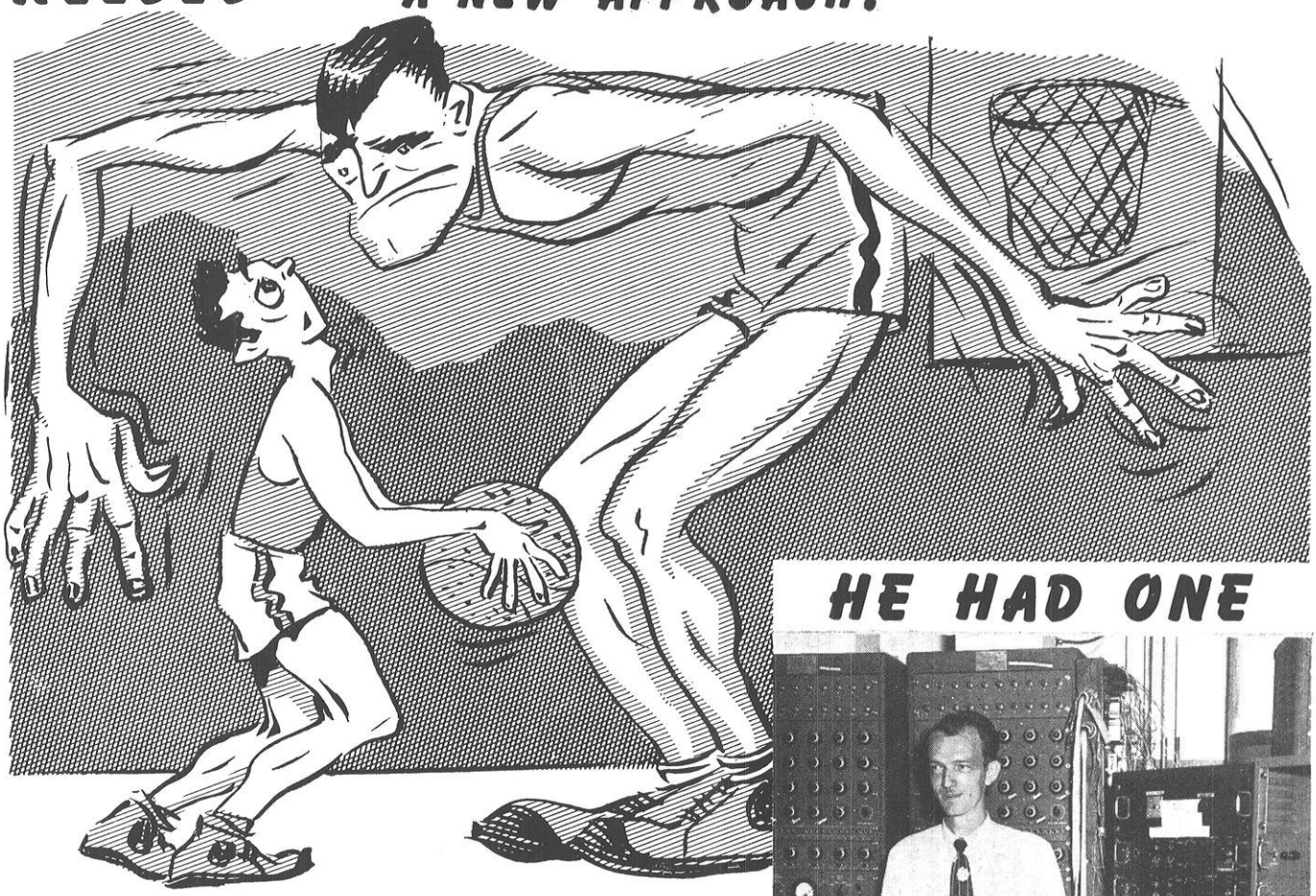
WESTERN CHAPTER

●

D. W. GRUNDITZ
Reporter

The Western chapter of WSPE met December 15, 1953 at the Linker Hotel in La Crosse. Mr. Robert Luxford was the principal speaker. A film on tool and die making was also shown.

NEEDED--- A NEW APPROACH!



HE HAD ONE

Prime contractors to our Armed Forces—M. A. C. is engaged in the design, development and production of airplanes, helicopters and guided missiles. One of the newer products of McDonnell ingenuity, the F101 Voodoo, will soon join the arsenal of the U. S. Air Force.

McDonnell engineering planners are constantly alert to new materials, new equipment and new techniques. A Flight Test Hanger, Propulsion Laboratory, Altitude Test Chamber and Wind Tunnel are recent additions to our engineering facilities. We are also interested in new engineering talent—men who can contribute original thinking—*engineers with a new approach.*

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

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

BOBBIE S. SHARRAH
Assistant Chief Dynamics Engineer — Missile Engineering Division
B.S.A.E. Iowa State College '45
M.S. Applied Mechanics Washington University '52

Pictured in front of our REAC installation, Bob Sharrah exemplifies the type of pioneering spirit essential in missile engineering. He developed a new and useful approach to the problems of stability of guided missile control systems as influenced by aeroelastic effects. At twenty-eight, Bob also points up the youthfulness of M.A.C.'s engineering management.

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

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

McDONNELL *Aircraft Corporation*

Science Highlights - -

(*continued from page* 45)

hour and indicates it on the aircraft's instrument panel.

The flowmeter will aid pilots or flight engineers by making it simpler for them to compute remaining flying time. It also will give them a quick method of evaluating engine operating efficiency through comparison with data gathered from past experience.

The heat content of jet fuel is based on its weight rather than its volume. This means that the specific gravity of the fuel becomes a prime factor in the amount of "push" it will give to the engine.

Since specific gravity varies with the type of fuel and its temperature, measurement of the mass of the fuel at the time of its use is essential in determining the efficiency of fuel consumption.

●

STIRRING WITHOUT A ROD

Westinghouse has developed a new way of stirring the melt in an electric arc furnace. This melt, like soup, has to be stirred to speed up the "cooking" and provide more uniformity of the bath. But just how does one stir a "soup" of tons of liquid steel? Men have done it by hand (rabbling—which has obvious drawbacks) and cranes sometimes tow an ingot of steel around in the melt — but that's not too good either.

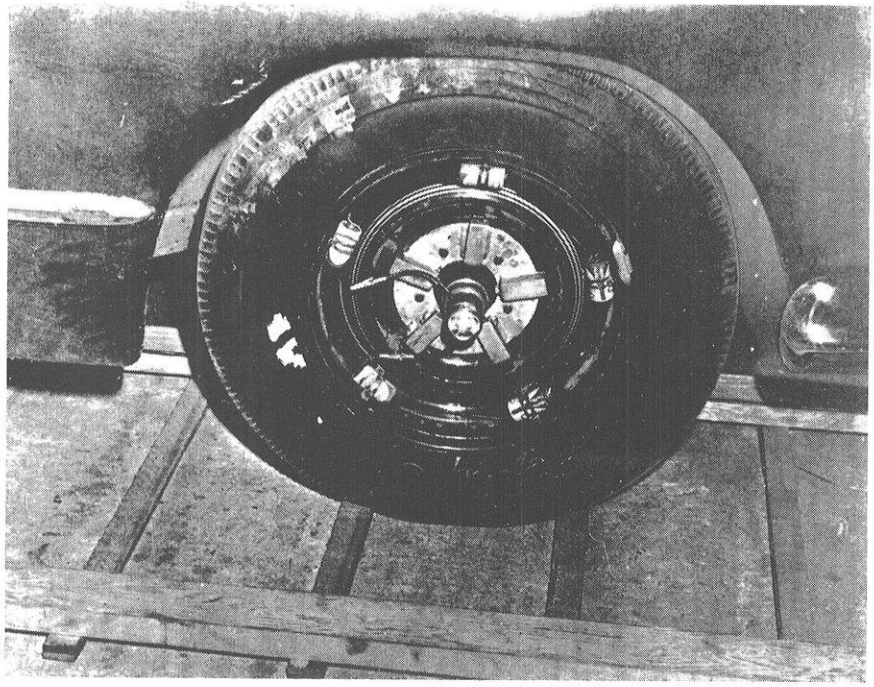
With a d-c excited electro-magnet, stirring is done by remote control; the magnet is rotated below the arc furnace and the strong flux field enters the furnace from one pole, passes through the melt, and so out to the other pole of the magnet. In so doing, it creates currents in the steel that establish a circular flow within the melt. The system requires about 165 kw for the rotating magnet, which is driven by a 50-hp motor.

Smoother Rides

with a

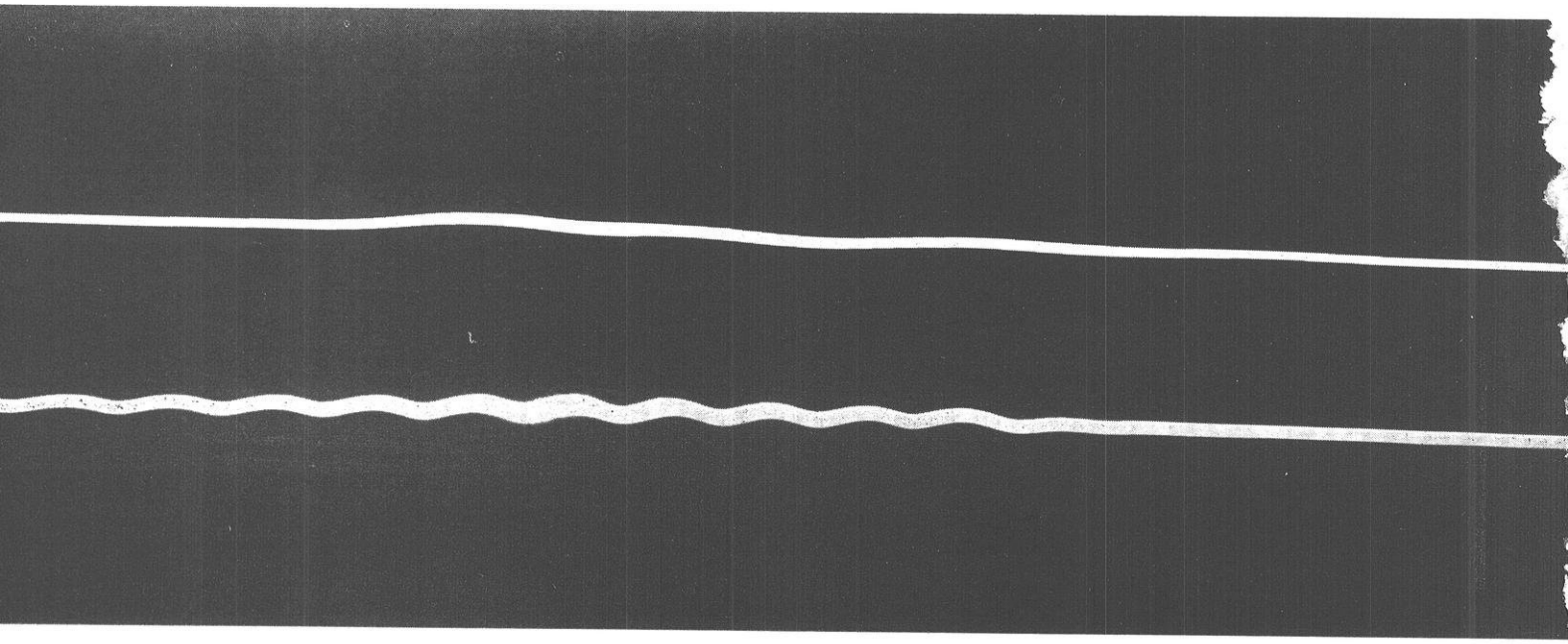
Auto Wheel Balancer

Edited by John DuBois, e'56



Picture at left shows the mercury disc mounted inside wheel rim. A flashlight is attached to the hub to produce a light streak in night road test. Batteries have been carefully balanced around the rim to light the flashlight. The car was then driven over the rungs of a long ladder to simulate the effect of a rough washboard road.

The two light streaks below were produced by two separate time exposures on the same film. The bumpy lower streak was recorded by the flashlight on the hub when the car was driven over the ladder rungs without the mercury discs, proving that every jolt is transmitted to the axle and the rest of the car. The upper streak shows the same ladder test after the mercury-filled discs were attached to the wheels. Note that all bumps and shocks have been cancelled.



A new mercury-reactor attachment for automobile wheels will combine several advantages to give motorists smoother riding comfort. This is accomplished by a set of four discs which can be attached to the wheels of any car. Each disc has a number of radially positioned cylinders containing mercury, and is mounted inside the wheel rim around the axle. The discs are attached to the same lugs which hold the wheels and are covered by the hub caps.

The mercury-loaded discs eliminate the need for balancing weights on car wheels. Weights have never been fully satisfactory because the balance is lost every time a tir is changed or a wheel transposed. Furthermore, uneven wear on tires soon offsets the balance. With the new discs, however, the wheels are constantly dynamically balanced regardless of other factors. This not only produces a smoother ride, but also has proved in tests to extend greatly the life of the tires, because they are made to wear evenly.

The tremendous centrifugal force built up in a rotating car wheel magnifies any unbalance and develops a hammering action. The mercury disc builds up an equal counter force to this and completely cancels the unbalance.

Another important function of the mercury weighted discs is their vertical shock-absorbing action. The mercury reacts instantly against chatter and shocks due to road roughness before they reach the axles and thereby save considerable wear on chassis points. All other cushioning devices on the car pick up the shock after it has passed the wheel.

The mercury stabilizers also control lateral action. Since the mercury is free to move from side to side, as well as up and down in the chambers, any tendency of the wheels to wobble or shimmy is countered, saving wear on wheel bearings and king pins.

The gyroscopic force built up by the mercury also stabilizes the car's forward line of motion. This helps to straighten wheels out after turns, eliminate drifting, and prevent side-hopping on rough roads.

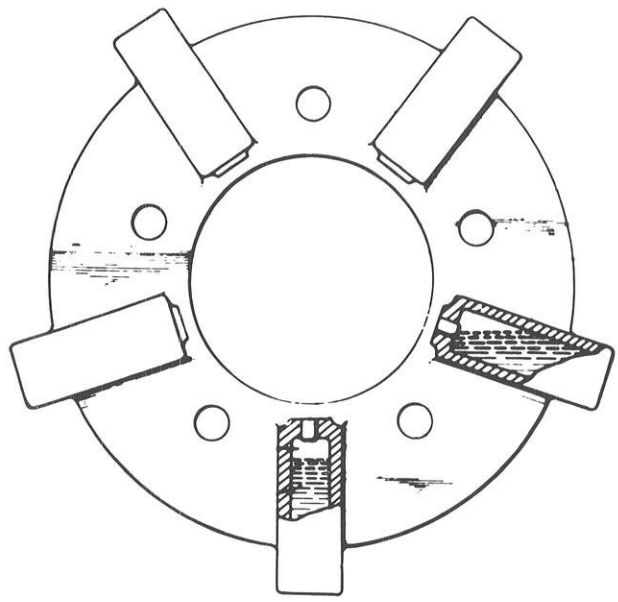


Diagram shows wheel stabilizer with mercury filled chambers and holes which fit over lugs.

Oswego Products Corporation, Oswego, N. Y., has received clearance on a patent application after two years of product research. Test models are made of aluminum, but possibly they can be produced in plastic to retail for about fifty dollars per set of four. The discs will be adaptable to any make of car.

THE END

Offy 270 - -

(continued from page 29)

ese-bronze web. Additional weight in the form of bronze plates is added to the crankshaft after machining is completed in order to balance it. The crankshaft is then Magnaflux inspected for flaws and dynamically balanced after machining is finished. Main bearing journals on the latest engines are 2½ inches in diameter. Connecting rod journals are 2⅛ in diameter. Lubrication for the 270 is of the dry sump type—a separate oil tank serves as a reservoir instead of having a pan beneath the crankcase. An advantage of this system is that the oil is filtered before it returns to the engine. Pressure to the various bearing surfaces as well as scavenging of return oil is provided by a double gear pump mounted at the front of the engine beneath the gear train.

SAE 50 oil flows from the pump as follows: through a tube to the main bearings, and through a passage in the crankcase to the connecting rod journals. Some of the oil is thrown from these bearings and splashes against the cylinder walls and piston pins, after which it all drains to a sump at the bottom of the crankcase. From this point the oil is pumped back to the supply tank. Before its return to the tank, however, some of the oil is channeled up to the camshaft bearings. Holes through the cams from the hollow camshaft allow some oil to reach the hardened steel cups which transmit the thrust exerted by the cam lobes down to the valves. The cups serve to eliminate all but axial loads on the valve stems. Thus both valve stems and the cup bearing surfaces are lubricated. Some oil drains to the front of the powerplant and falls on the gears in the gear tower. Thus, with the return off all the oil to the reservoir, the lubrication cycle is completed.

Engine cooling water is circulated by a centrifugal pump driven by gears from the crankshaft. Water from the radiator is pumped through a distributing passage to a full length jacket around the cylinders. Then it is forced up to the head to cool the exhaust valve seats. Insufficient cooling of the exhaust valves is a common difficulty in engines—the valves frequently burn out as a result. This is brought about by the fact that the exhaust valves can only become cooler when they can transmit heat away from themselves. And only through the valve stems and guides or though the valve seats can heat be transmitted. So the better the heat absorbing capabilities of the valve seats, the better the functioning of the valves and the longer will be their life. Another complication caused by very hot exhauste valves is "hot spots." They are caused by rough surfaces or edges and holes in the combustion chambers. When much heat is present, it congests, so to speak, at these edges and often causes preignition, which robs power from the engine by causing combustion at other times than the power stroke. All of these difficulties are eliminated by carefully designed valve cooling. After circulating past the valves, the water leaves

(please turn to page 56)

million watt spark plug . . .

Calling this jet engine ignitor a million watt spark plug is an understatement. Actually this picture shows a 1,500 kw discharge that occurred in 25 microseconds.

One of a series of photographs taken as we vary voltages and ignition system design, it helps us study the arc size and the penetration of the discharge into the combustion chamber. These and other studies provide the knowledge necessary for the design of dependable ignition systems — systems that will start combustion at 45,000 foot altitude and −65° temperature.

Good ignition is important. Yet ignition research is only one small phase of our development program.

But this work does suggest how completely we explore technical areas to produce dependable aircraft engines. And it illustrates the wide variety of tools and techniques we use to solve difficult problems.

Here, emphasis is put on "getting the facts" — *all the facts.* This makes good sense to recent graduates who want to do real engineering — explains why so many are attracted to a career at Pratt & Whitney Aircraft.

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation

East Hartford 8, Connecticut

"I chose Worthington for opportunities in international trade"

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

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

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

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

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

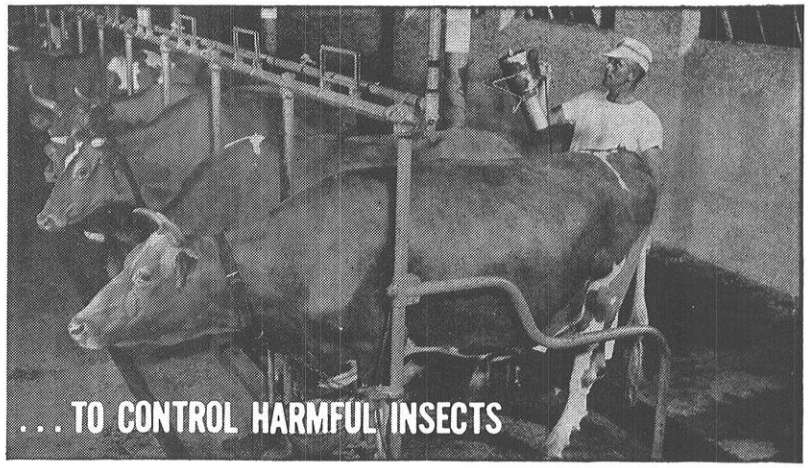
8.26

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

WORTHINGTON

THE SIGN OF VALUE AROUND THE WORLD

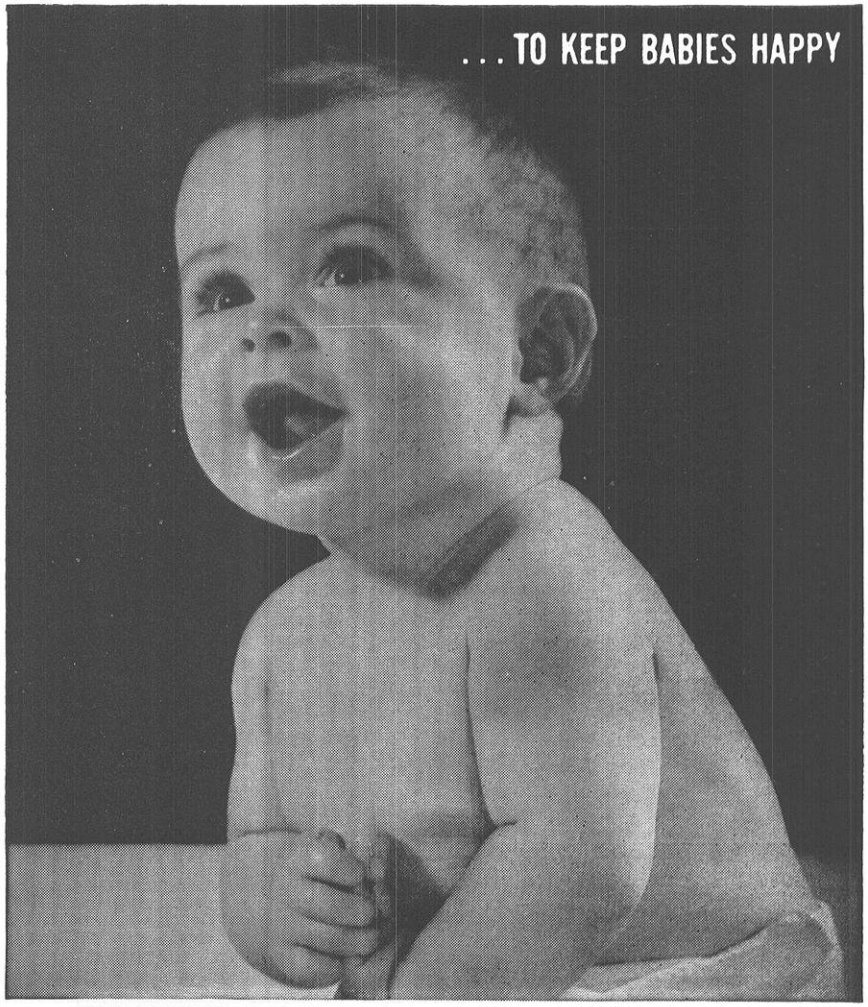
Hercules® explosives are used by geophysical crews to locate potential oil deposits. Hercules also makes cellulose and rosin derivatives that serve the petroleum industry in several ways—as in oil well drilling muds, corrosion inhibitors, and as additives in secondary recovery operations.



Livestock sprays made with Hercules Thanite® offer quick knockdown and high kill of houseflies, horn flies, stable flies. Thanite also fortifies household and aerosol formulations. Another Hercules toxicant—toxaphene—is widely used in agricultural insecticides.

HOW HERCULES HELPS...

Lotions for tender baby skins benefit from Hercules research in cellulose. Hercules cellulose gum—a water-soluble colloid—serves as an emollient, thickener, and suspending agent in lotions of many types. It's also found in toothpastes, face creams, and pharmaceuticals.



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

HERCULES

HERCULES POWDER COMPANY INCORPORATED *Wilmington 99, Delaware*
Sales Offices in Principal Cities

EC54-1

Offy 270 - -

(continued from page 52)

through a manfold atop the head and returns to the radiator.

Most Offenhausers have transmissions with two forward speeds and a reverse. A reverse gear is required by the AAA for cars competing in championship events. The lower of the two gears has a 1.9:1 ratio, while the other is direct drive (1:1).

With number four cams, 13.2:1 compression ratio, straight methanol fuel, and fuel injectors, the Offy 270 can be expected to develop 330 horsepower at 5000 rpm. This amounts to 1.22 hp per cubic inch, about twice the output of a typical production engine. Although even more horsepower can be had if additives such as nitromethane are put in the fuel, they can reduce the mileage per gallon to such an extent that their use isn't warranted. This is due to the more frequent pit stops required for refueling.

The Offenhauser, Meyer and Drake 270 engine, since its conception 20 years ago, has been developed to such an extent that today it is virtually the only type of engine seen at big car championship races. There is admittedly a need for new designs to stimulate the improvement of the racing engine, but until a really good one comes along the Offenhauser 270 will remain unbeatable in American track racing.

THE END

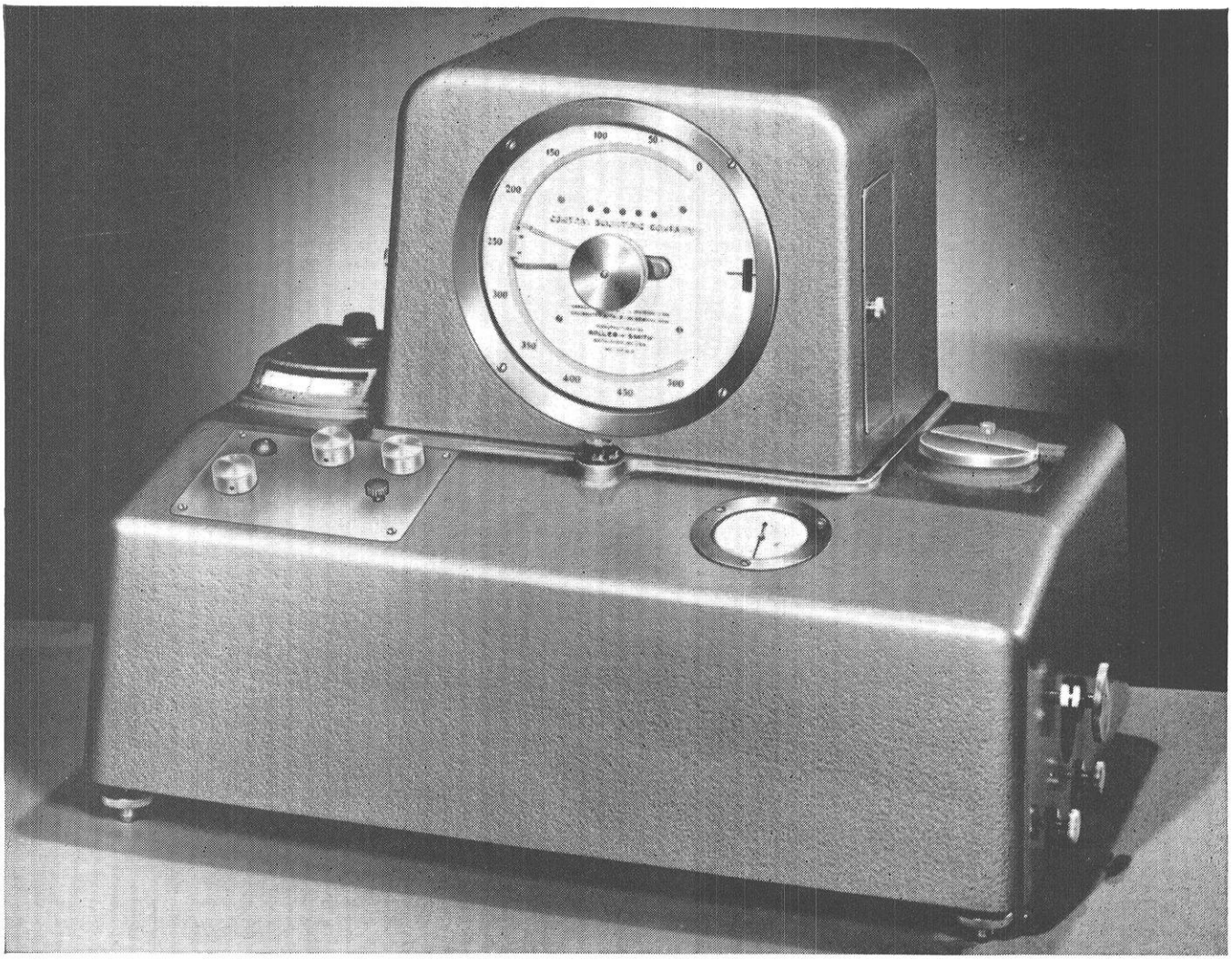
Ultrasonics - -

(continued from page 21)

shavers; the equipment is shown in Fig. 3. The lower cabinet contains a 750 kilocycles[4] per second generator. The cleaning process takes place within the upper cabinet which houses a conveyor chain and drive motor, the treating tank, and the electroacoustic transmitter. A cylindrical stainless-steel housing for the crystal is used in preference to the plastics housing of the usual ultrasonic generator because of the harmful effects of chlorinated hydrocarbon solvents on plastics. The upper surface of the crystal is covered by water or a weak salt solution, providing the ground side electrode which acts as one plate of a capacitator, the dielectric being the crystal. The motion of the crystal sets up a wave which passes to the treat tank where the cleaning takes place. The conveyor chain moves at the rate of one foot per minute. This device serves a specialized purpose, being used solely for cleaning shaver heads.

Before the cleaning process, a series of grinding and lapping operations leads to the plating process after which a finish lap is applied. It is following the finish lap that a careful cleaning operation is required. Results have shown a 50 per cent reduction in cleaning costs[3], more than two-thirds reduction in floor space, and the cleaning process is more effective. Two operators can load and unload more than 2800 heads per hour.[3]

THE END



THE PERCENTAGE of hydrogen in liquid hydrocarbons can be determined by making two simultaneous measurements on the sample to give (1) density and (2) the absorption rate for beta rays. The weight percentage of hydrogen in the sample is computed from these measurements and a calibration curve. The new instrument shown here, a Standard Oil development, measures the beta ray absorption rate.

BETA RAY

used to speed hydrogen measurement

The problem: How to measure the percentage of hydrogen in organic compounds in a short time.

The established process was combustion. It took about four hours, and so discouraged the use of hydrogen determinations. But such analyses are increasingly important. Processes in the petroleum and chemical industries often involve hydrogenation or dehydrogenation. In addition, the percentage of hydrogen is an index to the performance of critical fuels such as those used in jet planes.

A rapid method for measuring hydrogen content would therefore be a great help in both research work and plant control. Standard Oil's Engineering Research Department, specialists in solving technical problems, took on this challenging assignment.

A new machine—a beta ray hydrogen analyzer—was invented and constructed. It gives results in five minutes, and is twice as accurate as the old combustion method. It is so easy to operate that a laboratory technician can use it.

Problems such as this are met continually in Standard Oil laboratories. They offer an opportunity for young men with training in chemistry and engineering to test their knowledge, skill and ingenuity.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois

STATIC

BY I. R. DROPS

Since we call our professors profs, it's easy to see what we should call the assistants.

•

"Damn," said the ram, as he hurtled over the cliff. "I didn't see the U-turn."

•

Girl: "Am I the first girl you ever kissed?"

Feller: "Now that you mention it, you do look familiar."

•

A young man whose father had been hanged was filling out a college application. After the usual hereditary questions there was one asking the cause of the death of his parents. He thought a while and finally put down this answer: "Mother died of pneumonia. Father was taking part in a public ceremony when the platform gave way."

•

Now I lay me down to sleep
The lecture's dry, the subject deep;
If he should quit before I wake,
Someone kick me for goodness sake!

•

Little Girl: "Mother, are there skyscrapers in heaven?"

Mother: "No dear, it takes engineers to build skyscrapers."

He: "There's a certain reason why I love you."

She: "Oh, my goodness!"

He: "Don't be absurd."

•

Englishman No. 1—Terribly sorry you buried your wife yesterday.

Englishman No. 2 — Had to — dead, you know.

•

Jones: "The report says the man was shot at close range."

James: "Then they must have been powder marks on him."

Jones: "Yes, that's why she shot him."

•

Early to bed and early to rise,
Your gal goes out with other guys.
In the parlor there were three . . .
She, the table-lamp, and he;
Two is company, there is no doubt
So, the little lamp went out!

•

"Who ya bringin' to the dance?"

Well, I like Helen's figure, Alice's lips, Betty's legs, Peg's arms, Virginia's dancing, Kay's . . . Kay's . . . I guess I'll bring Kay."

Awards that foretell your gain

Chemicals from coal hydrogenation...

...acclaimed the 1953 Chemical Engineering Achievement!

IN 1933 Carbide received the first Chemical Engineering Achievement Award. This recognized the beginning of commercial production of much-needed chemicals from petroleum and natural gas—which proved to be the beginning of the American petrochemical industry.

HISTORY REPEATS—Now, just twenty years later, Carbide has received the 1953 Chemical Engineering Achievement Award for "the first successful production of chemicals from coal by a high pressure hydrogenation process."

In minutes, coal becomes gases and liquids rich in needed chemicals—"one of the major contributions in this century to the well-being of us all."

Some of these chemicals are used in making plastics, synthetic rubber, pharmaceuticals, vitamins, and many other things. Others are completely new and hold great promise.

FOURTH RECOGNITION—Carbide is the first two-time individual recipient of this award. It also is the fourth time the people of Carbide have been recognized, for they shared in two previous group awards—in 1943 for synthetic rubber, and in 1946 for atomic energy.

TRUE SIGNIFICANCE—As in all Chemical Engineering Achievement Awards, coal hydrogenation was recognized not as the accomplishment of any one individual but as the result of the cooperative efforts of many.

The people of Union Carbide appreciate the recognition of their achievement by the distinguished Committee of Award, composed of senior chemical engineering educators.

UNION CARBIDE
AND CARBON CORPORATION

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

UCC's Trade-marked Products include

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

● Wallace L. Carr was graduated from the University of Illinois with a B.S. degree in Electrical Engineering in 1951. After a short time with a large electric utility—where he was Junior Engineer in substation design—he came to Allison where he is presently Electrical Engineer in the plant engineering department, Aircraft Engine Operations.

Wally's job in this department varies from designing plant, lighting, and power layouts, and machinery electrical diagrams to electrical and instrumentation layouts of turbo-jet and prop-jet test cells. With a multimeter, he is shown above checking the thermocouple circuits on the control panel in one of the Allison test cells.

In jet cells, it is necessary to simulate all engine controls that appear in a jet plane, plus other controls which are necessary to check and evaluate engine performance . . . operating temperature . . . acceleration . . . speed . . . fuel consumption . . . oil flow, etc.

Electronic control of important functions of jet engine operation has made the electrical portion of test cell operation a complex and fascinating problem for the Electrical Engineer.

Allison, a leader in the field of turbine engines, offers unlimited opportunities to young graduates with degrees in Mechanical Engineering, Electrical Engineering, Aeronautical Engineering and Industrial Engineering. Why not plan early for *your* engineering career at Allison.

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

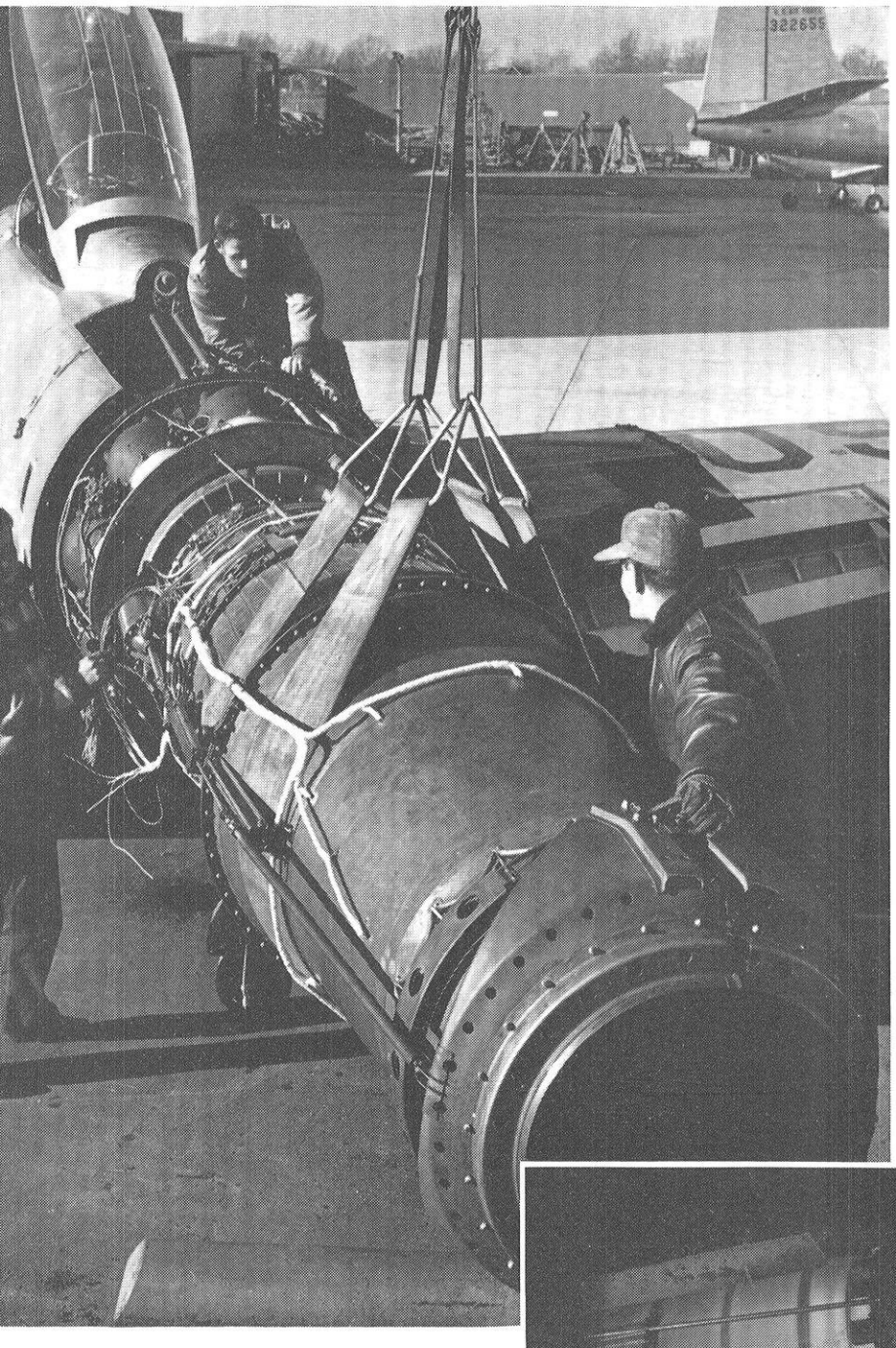
Allison **DIVISION GENERAL MOTORS CORPORATION • Indianapolis, Ind.**

Design, development and production—high power TURBINE ENGINES for modern aircraft . . . heavy duty TRANSMISSIONS for Ordnance and Commercial vehicles . . . DIESEL LOCOMOTIVE PARTS . . . PRECISION BEARINGS for aircraft, Diesel locomotives and special application.

PHOTOGRAPHY AT WORK No. 6 in a Kodak Series

Photography teams with research to slash industry's corrosion bill

Camera and Film work as research tools as International Nickel Company develops new alloys which prove tougher and defy corrosion.



Each year industry saves more and more millions on its corrosion bill by using Monel*, Inconel* and other corrosion-resisting alloys of the International Nickel Company.

To develop such alloys, "Inco" maintains extensive research—research that keeps photography on the job day-in and day-out.

This is because photography provides information which can be obtained and studied in no other way. Photomicrographs show metal structure. X-ray diffraction patterns reveal the arrangement of molecules. High-speed and time-lapse movies display the workings of corrosion.

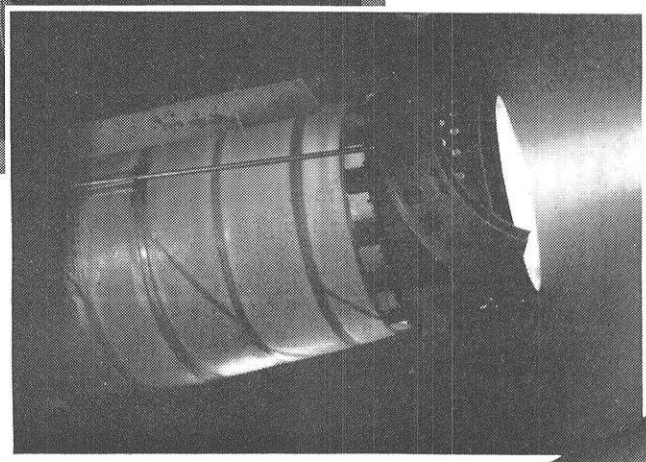
Industries, large and small, find photography an important factor in their research—just as they know it improves manufacturing, cuts costs, and speeds many business operations.

"Today so many new applications of photography exist that graduates in the physical sciences and in engineering find them valuable tools in their new occupations. Other graduates—together with returning servicemen—have been led to find positions with the Eastman Kodak Company."

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

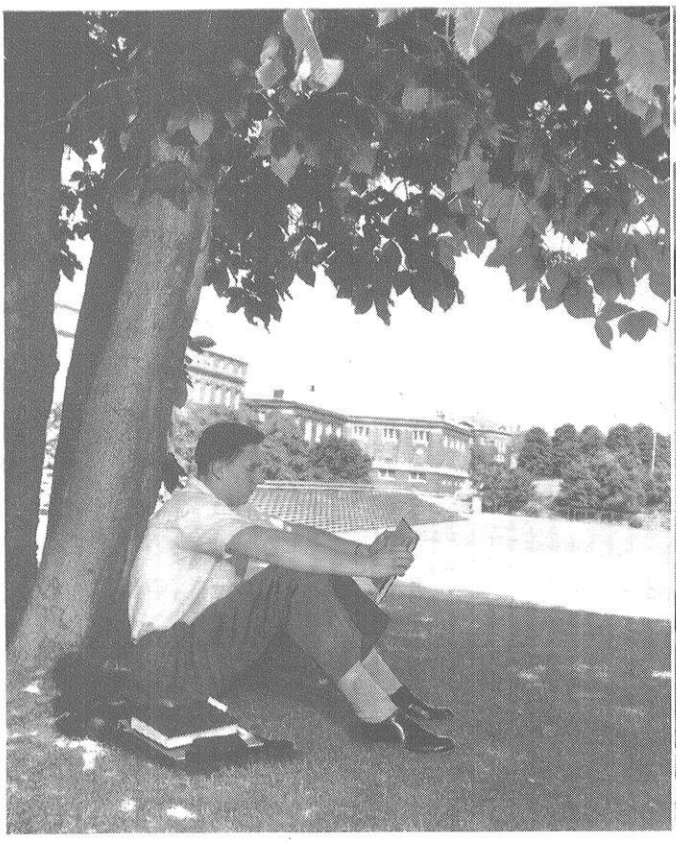
*Reg. trade marks of the International Nickel Co.

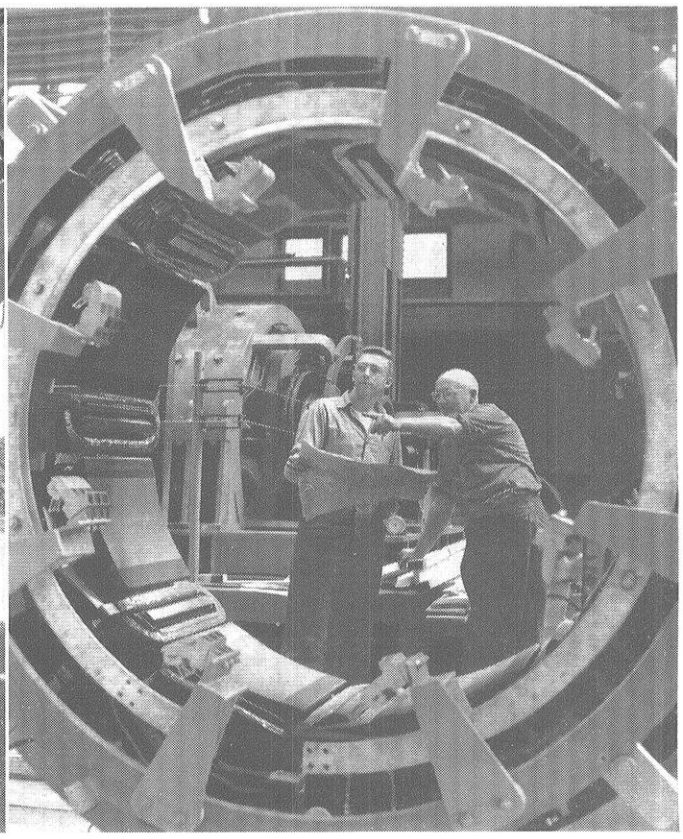
Eastman Kodak Company
Rochester 4, N. Y.



To stand up against intense heat and highly corrosive gases, vital jet engine parts such as rotor blades, afterburner, and insulation bindings are made of nickel alloys. Illustration shows a Pratt & Whitney Aircraft turbojet engine with afterburner.

Kodak
TRADE-MARK





FROM CAMPUS — TO CAREER IS A BIG STEP

When the graduate leaves the college campus to begin his career he is taking an extremely important step. For he is leaving the area of directed-development in college and entering the area of self-development in industry.

Closing the gap between his campus experiences and the realities of earning a living is not easy. The complicated maze of modern industrial society has made this transition a tough task. While the craftsmen of former years grew up with the business, the college graduate of today steps into a strange organization at a relatively high level. He has had no opportunity to understand, through a long period, the methods and operations of the concern.

During his first few years, he is finding his place in the organization—learning its policies and objectives, and at the same time shaping his professional career. He needs all the assistance and guidance he can get.

Here at General Electric, hundreds of young men have found that intensive efforts are made to "bridge the gap" between college and industry—and to help young professional people realize their goals. Through extensive training programs, classroom study programs, leadership programs, and guidance in professional development, carefully selected young men are prepared for positions of responsibility and leadership in their individual fields.

Providing college graduates with the opportunity to know the Company and find the right job in it . . . giving them high-level, flexible orientation and training . . . offering continued opportunity for professional growth are most important tasks at General Electric. Nothing is more important—for our young professional people are our biggest asset.

If you are interested in building a career with General Electric, see your college placement director for the date of the next visit of the G-E representative on your campus. Meanwhile, for further information on opportunities with General Electric write to College Editor, Dept. 2-123, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC