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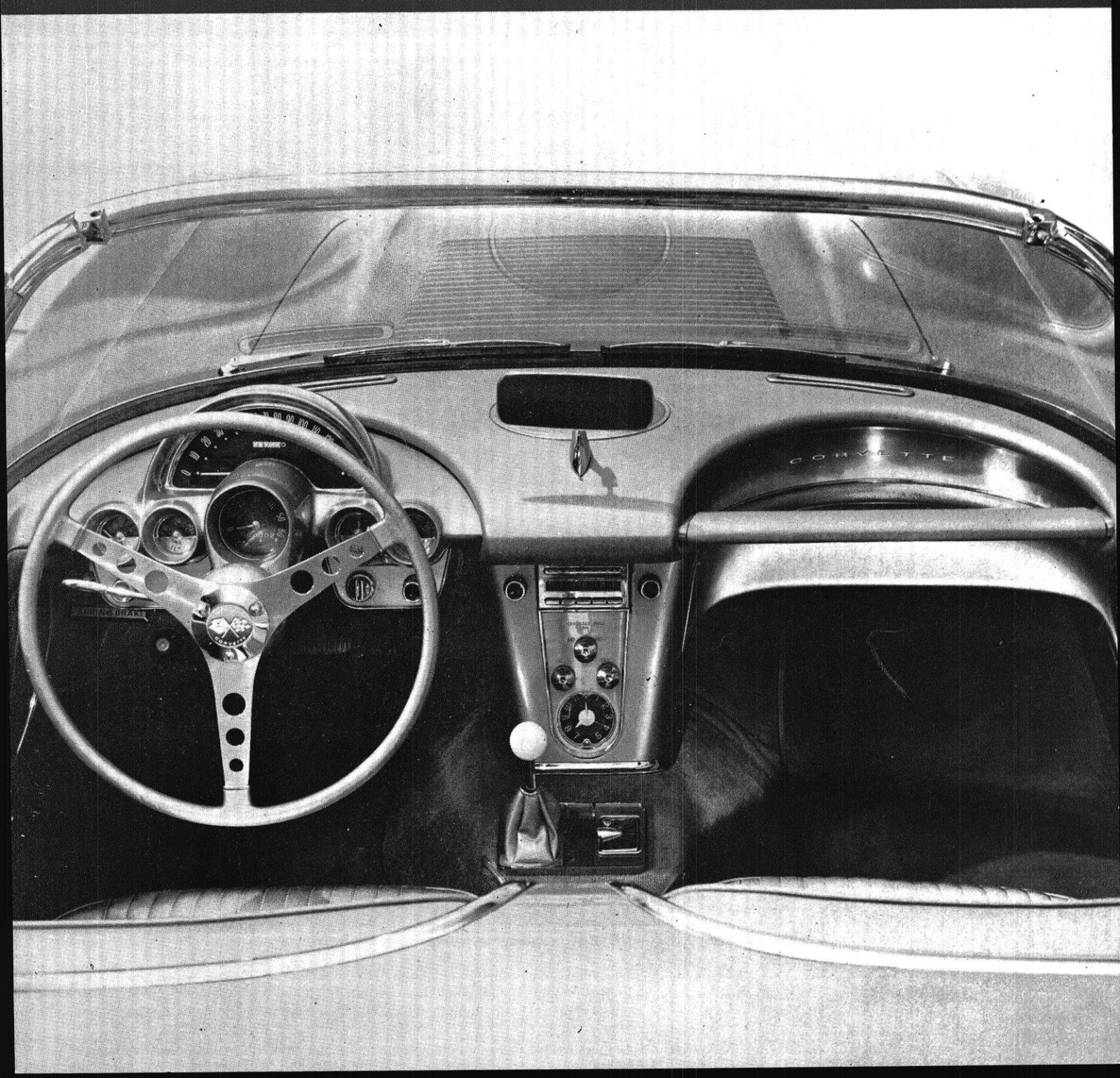
FEBRUARY
1958
The Wisconsin
25¢

engineer



This is the look of boiling steel

The picture was taken with a camera that exposes 3,000 frames per second. One second of action takes more than three minutes to project at normal viewing speed.

The picture was taken looking into an open hearth furnace, and it discloses action that was only vaguely perceived before. This enables U. S. Steel scientists to develop a better understanding of the kinetics of heat transfer and chemical reaction at temperatures approaching 3,000° F.

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Volume 62 FEBRUARY 1958 Number 5

WISCONSIN ENGINEER

The Student Engineer's Magazine

FOUNDED 1896

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Cover

The cockpit of the 1958 Chevrolet Corvette. For further information, read the feature story "The New Look in Autos–Fiberglass" on page 14 of this issue.

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ROOM TO GROW

by
C. M. Forbes
Du Pont
Representative

There's plenty of room to grow at Du Pont. One reason is that the very diversity of our products and processes requires specialists in almost every area of science and engineering. Another reason is that Du Pont continues to expand in many new directions.

For example, in 1957 sales reached $2 billion. Four new plants were being built. New research projects were launched, new products marketed.

In 1957, too, new technical men joined Du Pont in chemical, civil, mechanical, metallurgical, electrical, industrial, petroleum and mining engineering; in atomic energy, instrumentation, chemistry, physics, mathematics and many other fields.

All this activity points to as bright a future today as ever before in our long history. There's a place for the good graduate in this picture. If you would like more specific information on opportunities at Du Pont, we invite you to sign up for a Du Pont interview with your placement director.

DU PONT SUMMER JOB GIVES YOU A CHANCE TO EARN AND LEARN

Du Pont offers college juniors and qualified sophomores in technical fields the opportunity to earn college expense money this summer while they learn more about the kind of work that will be open to them when they graduate.

The Company has 75 plants and 98 laboratories located across 26 states —a spread that often gives the student a chance to work in or near his own section of the country. Some of these locations have openings for summer employment in 1958.

Students work side by side with practicing engineers and scientists. In this way they gain valuable experience to supplement classroom theory.

Last year, 407 students from 113 colleges took advantage of this program. Du Pont pays round-trip transportation expenses from home or school to place of employment. Students are not obligated to continue with the Company after graduation.

For complete details on this program, check with your college placement director.

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Booklets on jobs at Du Pont are yours for the asking. Subjects include: mechanical, civil, metallurgical, chemical, electrical, instrumentation and industrial engineers; atomic energy, technical sales, business administration, research and development. Name the subject that interests you in letter to Du Pont, 2494-E Nemours Building, Wilmington 98, Del.

Personalized Training Relates to Policy of Promotion from Within

Where do your interests lie? What courses have you taken? What are your special abilities? Du Pont tries to match these factors with available jobs to determine your first job assignment within the Company.

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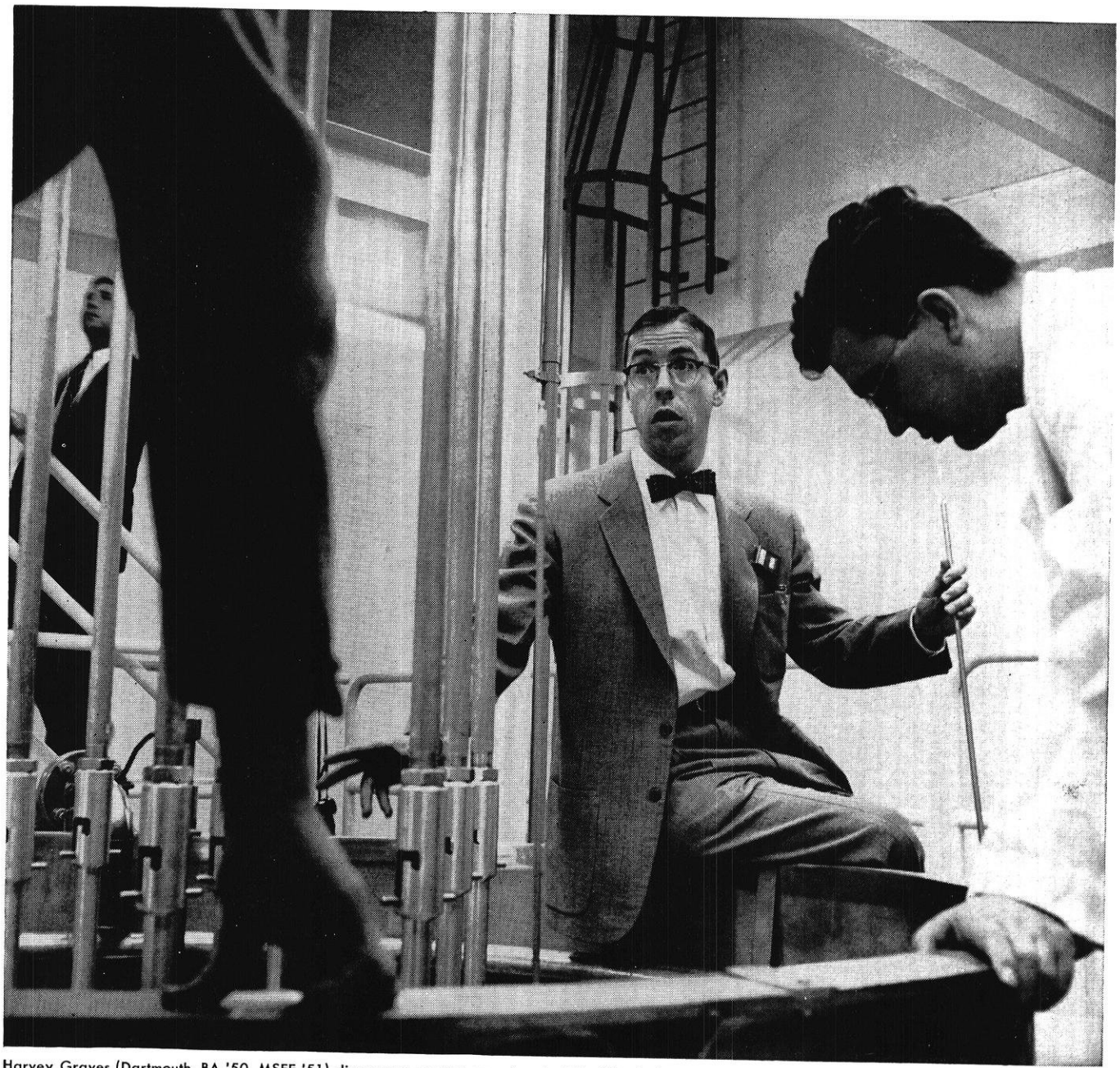
As you might guess, Du Pont's personalized training is closely related to its promotion policy. Almost all advancement is made from within the Company, so if your supervision has indicated that you are ready for promotion, and an opening occurs for which your training has prepared you, you are sure to be considered.

Although Du Pont employs about 90,000 people, management authority is decentralized through many departments into small groups—small enough so that the new man's capabilities can be recognized quickly. This type of organization, plus the Company's steady growth, produces many opportunities for the new man.

★ ★ ★

Du Pont, over the past 25 years, has spent $1 on research for every $3 on production facilities.



Harvey Graves (Dartmouth, BA '50, MSEE '51) discusses a reactor experiment at the Westinghouse Reactor Evaluation Center, in Waltz Mill, Pa. As manager of the Nuclear Design Section, Mr. Graves works with Dr. Wilfried Bergmann (Vienna, PhD '51), on right, and other young scientists who operate the facility.

At 30, Harvey Graves directs nuclear design of two major Westinghouse reactors

After completing the Westinghouse Student Training Course in 1951, Harvey Graves attended the Westinghouse Advanced Design Course* and was sent by Westinghouse to the Oak Ridge School of Reactor Technology for one year. Back at Westinghouse again in 1953, Engineer Graves did advanced work on nuclear reactor development.

In 1955, he was promoted to supervisory engineer on the Belgian reactor project. In 1956, he was again promoted to Manager, Westinghouse Nuclear Design Section. Today, Mr. Graves' 24-man section is developing and designing the nuclear portion of commercial reactors for the Yankee Atomic Electric Company and the Center d'Etude de l'Energie Nucléaire in Belgium.

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Rambling WITH THE EDITOR

The question of the starting salary is an important and yet often misunderstood factor in the selection of the engineer's first job. While most graduating engineers realize that the starting salary is not of paramount importance, they often do underestimate its impact on their future development.

There are two reasons why an engineer's starting salary has an unexpectedly large influence on his professional career. First, no employer can determine an engineer's absolute worth. Second, there is a large spread between the various salaries obtained by engineers of different quality. As a result of these two factors most companies attempt to make an engineer's salary proportional to his contributions. Therefore the engineer with a higher starting salary is likely to get a more responsible job than his lesser paid friend. More responsibility results in the engineer developing his professional competence at a faster rate. More competence means a greater pay raise. And so on. The small differences in starting salaries at first soon began to snowball and become important over a period of years.

In the reverse situation, it is also common practice for the employer to evaluate any engineer-applicant by the amount of his present salary. While it is true that the employer will offer an engineer more than he is presently getting in order to lure him to his own company, it will not be a great deal more. Therefore, if an engineer is working at a low salary, he will not be considered at his true worth when he tries to change employers. He will be offered a salary that is the "normal" amount over his present salary, and this will not compare to the salary of an engineer of similar worth in a company with a higher salary structure. Therefore he will be fitted into the new company's salary structure as if he were a lower quality engineer than he really is. This again puts the engineer in the same position as the engineer who starts after graduation at a low starting salary. In both cases, the original low starting salary has affected the entire professional career of the engineer. His salary and work assignments will be influenced for many years to come.

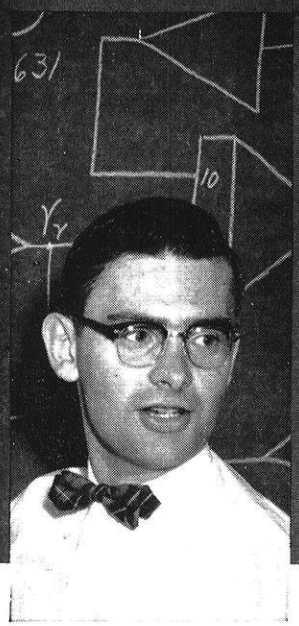
There is one other consideration that affects the salary of the engineer. Most companies try to adjust salaries according to work performance, but this is within a budget that allows only so much money for pay raises during a set period of time. There are also frequently limits to the maximum raise that an engineer may receive during any period of time. Therefore if an engineer is in a lower salary bracket to begin with, it becomes increasingly difficult for him to overcome this handicap.

In conclusion, the starting salary of an engineer is much more important than it would appear at first glance. The salary indicates to the employer the quality of the engineer. It determines work assignments which influence the engineer's development. In transferring to another company it determines his worth to his future employer. Thus starting salary can influence an engineer's career for many years in the future.

High-speed dust splashes out of shock tube at 4,000 feet per second and strikes against a copper plate at Illinois Institute of Technology, Chicago. Experiment simulates conditions that may be encountered by guided missiles and space satellites. The dust was able to penetrate the copper plate, .008 of an inch thick.
—Courtesy Armour Research Foundation

CAN YOU FIGURE IT OUT?

A machine can turn out 20 "A" bulbs and 15 "B" bulbs per day. But, it takes 0.2 hours to make an "A" and 0.4 hours to make a "B." The profit on an "A" is $2 and on "B" $5. How many of each should be made per 8-hour day for maximum profit?



✻ Solution at bottom of page

Sherman Francisco tells what it's like to be . . . and why he likes being . . . a Computer Systems Engineer with IBM.

FIGURING OUT A CAREER?

Selecting a career can be puzzling, too. Here's how Sherman Francisco found the solution to *his* career problem—at IBM:

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***SOLUTION**

If x and y be the number of bulbs A and B respectively, the profit (P) for a day can be represented by

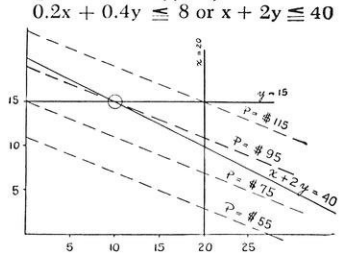
$$P = 2x + 5y$$

subject to the restrictions

$$x \leqq 20, \quad y \leqq 15$$

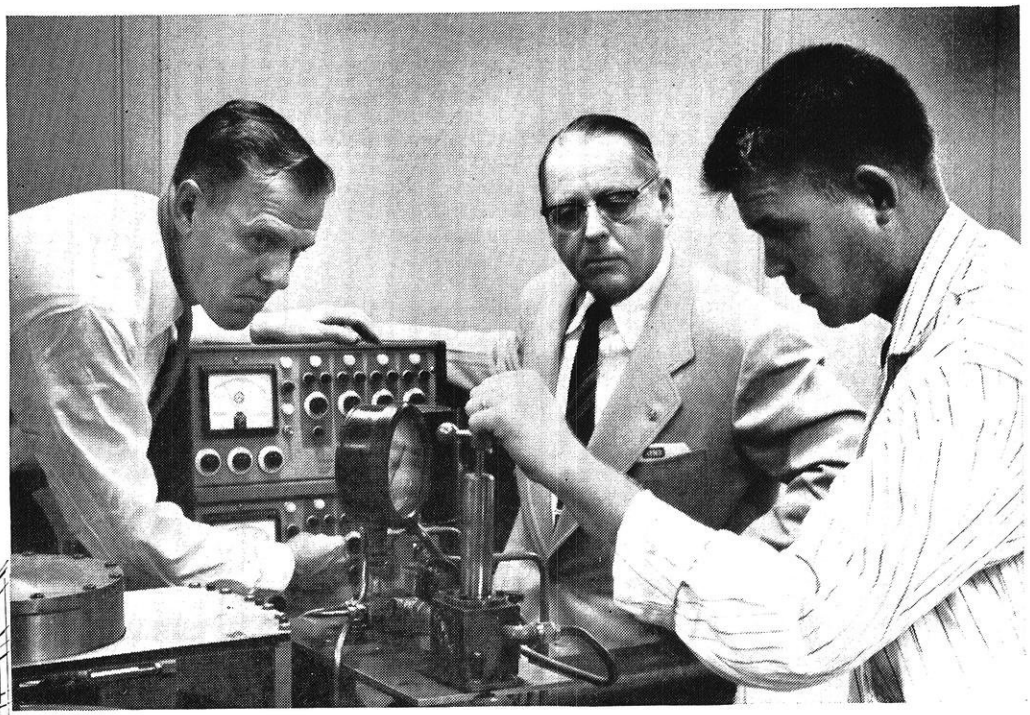
and also subject to the restriction that there are only 8 hours in a production day, i.e.,

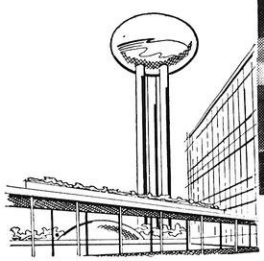
$$0.2x + 0.4y \leqq 8 \text{ or } x + 2y \leqq 40$$



Since $x \geqq 0$ and $y \geqq 0$, the values of x and y must fall on the boundary or within the polygon enclosed by the lines $x = 0$, $y = 0$, $x = 20$, $y = 15$ and $x + 2y = 40$, as shown. The optimal solution occurs at the corner where $P = \$95$. Thus the maximum possible profit is $P = \$95$ at $x = 10$, $y = 15$, i.e., when the machine produces 10 of A and 15 of B each day.

Note: This simple graph method is too cumbersome for more than 2 variables. Modern computers use numerical techniques to handle many more variables – a technique called Linear Programming.





BREAKING BARRIERS in friction research, GM engineer-in-training Donald Hamilton (r.) works closely with Robert Hellmann, M.E. '41, and O. K. Kelley (c.). One of the nation's leading automatic transmission authorities, Mr. Kelley holds 24 patents, directed Transmission Development Section of GM's Engineering Staff before his recent promotion to Chief Engineer of GM's Buick Motor Division.

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How far can an engineer go in General Motors? There is no limit—literally. For example, 14 out of 33 Vice-Presidents are engineers, 23 of 42 Division General Managers are engineers. These men were in your shoes not so many years ago.

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THE NEW LOOK IN AUTOS-FIBERGLASS

by D. L. Fischer ME '58

In the long search for the ideal auto body, the field of plastics has yielded what seems to be an answer—fiberglass. The Chevrolet Corvette is the first American production car to use this new construction with good results.

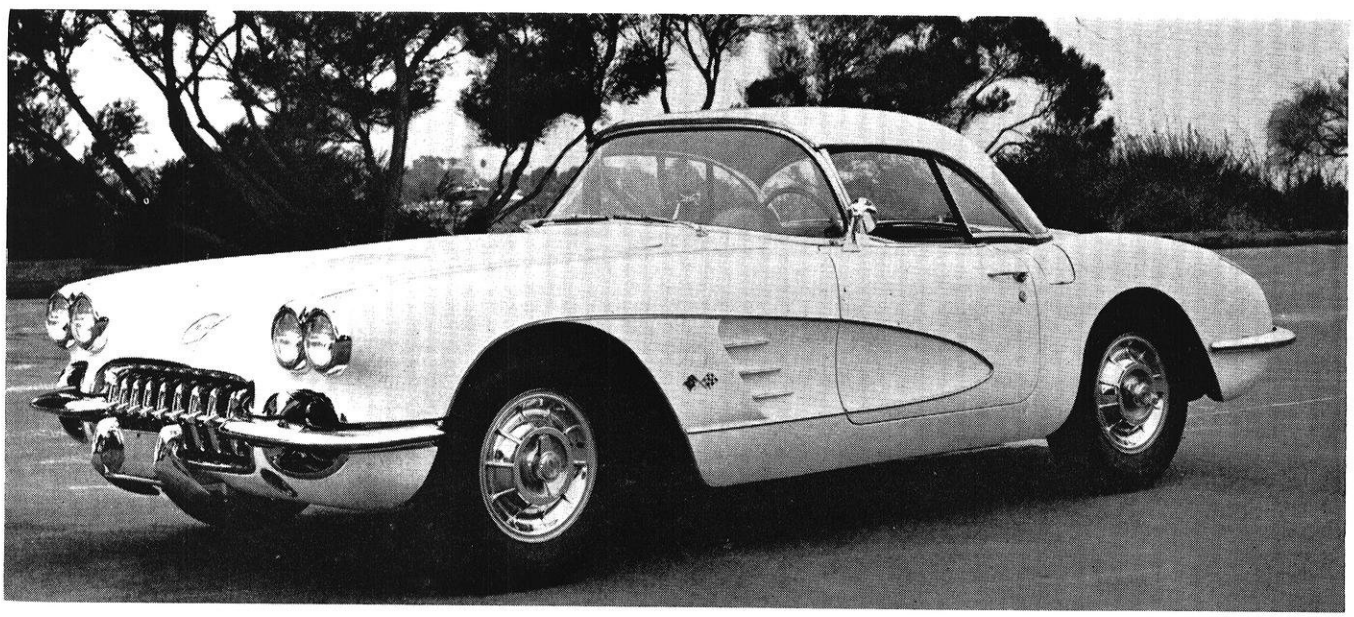
A FEW years ago an engineer at General Motors said that the ideal material for automotive body manufacture should be low in cost, strong, shock resistant, light in weight, non-corrosive, self damping, and easy to mold or press. These requirements may be fulfilled by plastics. Plastics have molding properties which make it possible to produce a car with true aerodynamic designs not possible with metals, and utilize weight-saving qualities to construct an extremely light-weight shell.

To build a car of plastics requires only a fundamental understanding of plastics and a few tools. Plastic resins, which are one of the main components of the body, are basically similar, but each one possesses certain characteristics which make it unlike another. These resins are of two types—thermo-setting and thermoplastics. Because thermoplastic resins harden or soften with a variation in temperature, thermo-setting resins are used. Under very high temperature changes these resins will retain their shape, and still be tough and durable. The most commonly used type of thermo-setting resins is the polyester resin, which is low in cost and requires only a small amount of equipment.

The polyester resin is a mixture of several chemicals. The basic constituents of this resin are diabasic acid, maleic anhydride and glycol. To produce this resin the compounds are heated in a large kettle that is surrounded by tubes containing steam, and as the mixture is cooked a chemical change takes place. Because it will harden if cooked long enough, the resin is removed in a liquid state before it has reached this stage. However, its ability to harden is still present.

The pre-polymer, the name given to the semi-cooked resin, is used to help produce the shell. Since the pre-polymer will not harden for 45 to 200 days, a heat generating catalyst is used to speed up the process. This catalyst is generally a peroxide compound such as methyl ethyl ketone peroxide. Lupercol DDM is the commercial name for the peroxide.

A photo-sensitive catalyst, benzoin, is being experimented with to generate heat by use of an ultraviolet light to which the catalyst is sensitive. However, this catalyst has a tendency to harden from the inside out, losing its drying ability as it approaches the outside. To



The 1958 Chevrolet Corvette with its fiber glass body.

This wood model is composed of a separate model for each panel. It is constructed in such a manner as to also make it suitable for use in making the tools for production.

alleviate this problem cobalt naphthanate is added to produce a chain reaction and give equal drying.

Textiles and mat are the two forms of glass fiber products that are used with the resin in the construction of a reinforced plastic automobile body. The manufacturing of glass fiber begins when the raw materials, which are lime, sand, soda ash, and other chemicals, are placed in a mixing machine and melted. Then the resultant product is placed in small tanks that have 200 to 250 minute openings in their bottoms, through which the liquid is drawn by a controlled flow of air.

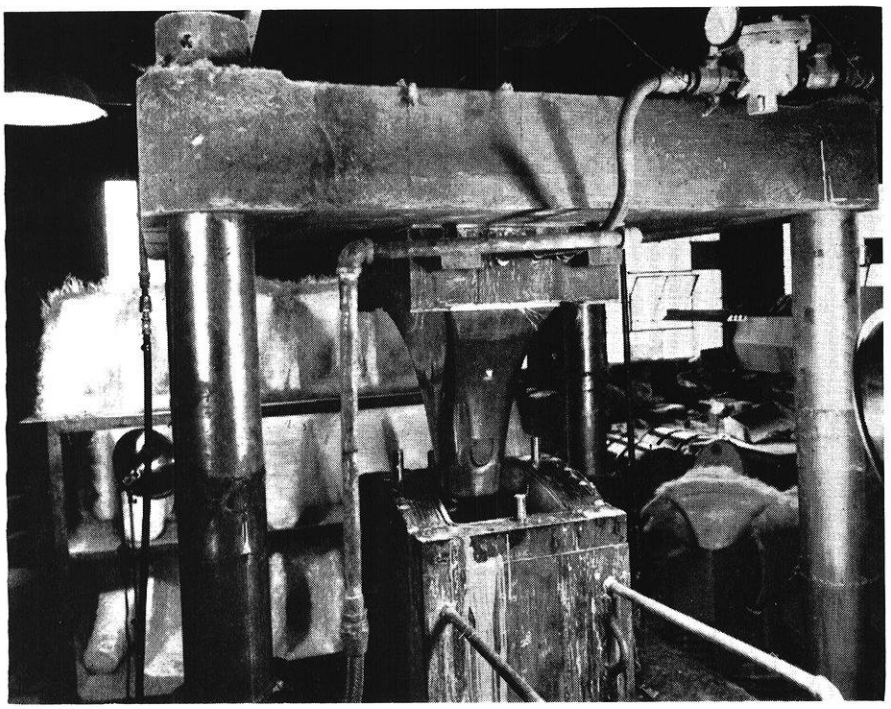
The molten glass is drawn through the openings such that the end strands do not exceed an angle of 45°. All the strands are collected into one fiber by two pulleys where they are fused and then collected on a rotating drum. When the drum is fully wound the fiber is removed and stored until it is broken into given lengths for the mat.

To make the mat, the slivers are placed in definite arrangement, sprayed with a weak plastic binder, and compressed to one-fifth their original size. The weave of the slivers determines the strength of the product. Maximum strength is achieved by having equal amounts of slivers perpendicular to each other.

There are several methods by which a plastic automobile body can be constructed. The best and most expensive procedure is to con-

(Continued on next page)

Here the completed fiberglass body moves down the trim assembly line.



The matched metal die process for plastic parts uses molds made from iron castings or high carbon plate steel.

struct a scale model. The model was first made to one-quarter scale and then remade to full scale. Then the full size model is duplicated by a series of female casts from which the final body is made.

The most popular method is to make a full size model, eliminating the scale model, and then proceeding as in the first method. Using an existing body as a plaster mockup and making casts from this is another method. It is used to reproduce bodies of expensive hand-made cars.

When designing a body it is necessary to house certain components such as the driver, the engine, chassis and running gear. It is important to have a pre-selected frame, and the designer should know the tread width and wheel base. The body usually is placed over the frame and mounted by use of floorboard sections molded to the body. This makes the body rigid in the center and reduces body racking.

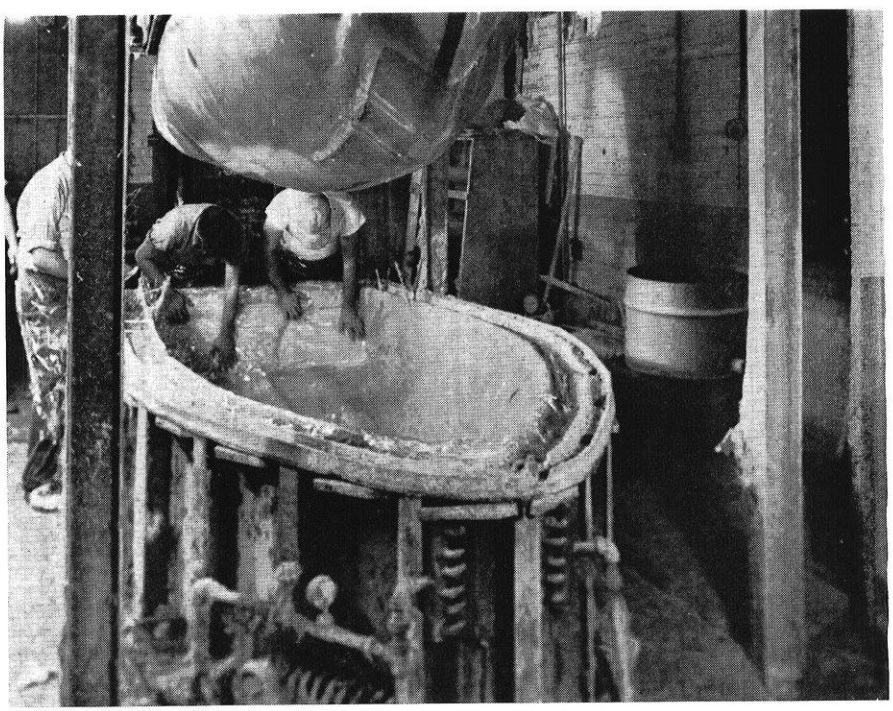
If a scale model is eliminated, it is necessary to construct a full scale wooden mockup. This is achieved by the use of wooden stations, which are rough approximations of the final body, placed wherever the body contour changes. Then the stations are covered with chicken wire and burlap. The next step consists of placing several layers of plaster over the mockup, shaping the contours as the plaster is applied. Once the proper height of plaster is obtained, the final contours are shaped and imperfections removed. Then the surface is sprayed with cellulose acetate to give a smoother surface and to release the plastic if a plastic female mold or plaster casts are used.

Once the mockup is completed there are three methods possible for the construction of the bodies. Two methods make use of molds and the third utilizes the mockup as a mold. The number of bodies to be produced is an important factor between the use of Plaster of Paris molds or plastic molds.

If only one or two bodies are to be produced, the Plaster of Paris mold would be sufficient, but high production is limited because of the brittleness of the plaster. Because they are unbreakable and long-lasting, plastic molds are ideal for high production runs.

The third method, body construction over the mockup, has definite limitations. Since it is easy to damage the plaster, only one body could be produced, and many extra hours of sanding and finishing would be necessary. This extra labor is caused by the outer layer being an unpressured surface due to numerous layers of mat and cloth placed over the mockup to build up the shell.

The smoothest surface of the body is the side compressed to the greatest extent. By use of female molds, as in the first two methods, it is possible to have the outer surface of the body pressed against the mold, thus giving a smooth finish. Whenever plastic or plaster molds are used, they are molded



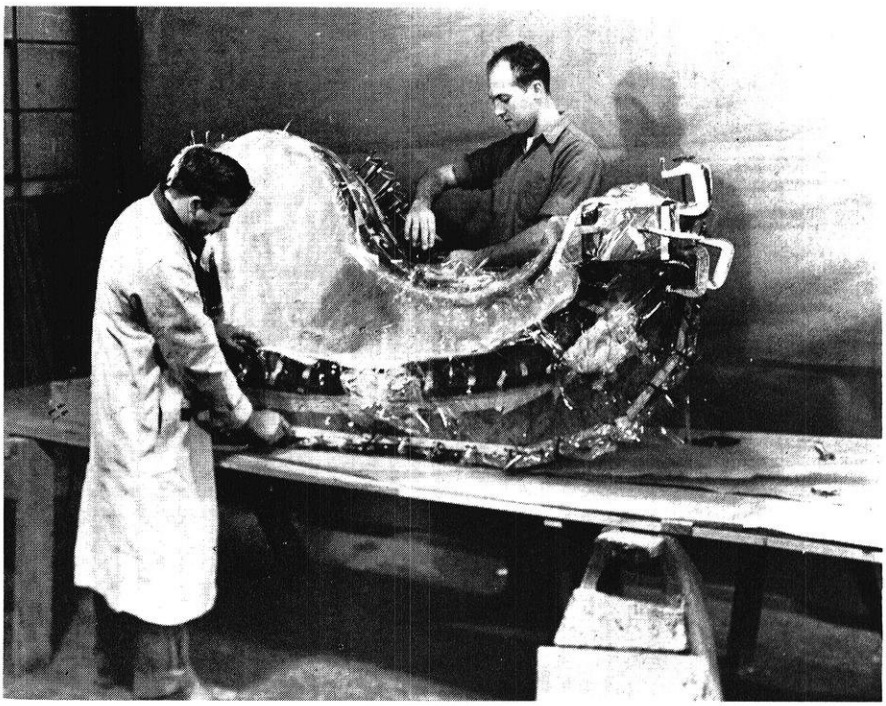
In the pressure bag method of plastic molding a rubber bag provides 50 pounds per square inch pressure to hold the dies together.

or cast in sections for easier handling.

When the casts or molds are completed, construction of the body may begin. Using plaster casts as an example, they are assembled to provide a one piece shell. This procedure reduces the amount of work and provides maximum rigidity for the body. To start the operation, the inner surfaces of the casts are coated with several layers of wax and polished. Then the casts are given a smooth coat of a standard resin mix, commonly referred to as a hot coat.

After the cast has cured or hardened, the construction begins with layers of glass cloth and mat. The exact number of layers may vary, and it is dependent on the amount of shrinkage to be tolerated. However, shrinkage may be minimized by a careful balance of cloth and mat. Since the cloth will not shrink as much as the mat, most builders recommend four to six layers divided into equal portions with the mat on the inner and outer surfaces to give a smoother texture.

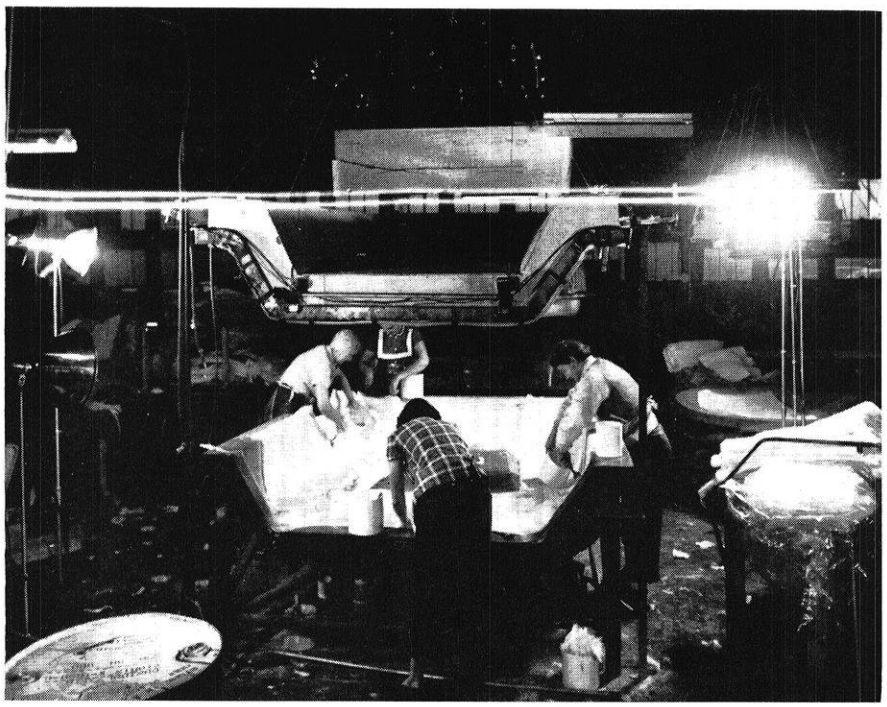
The dry mat is placed over the hardened hot coat, and resin is impregnated into it. After the mat is saturated with the resin, the air bubbles are forced out by rubbing the surface with a rubber-faced squeegee. Best results are obtained by allowing the first layer to dry before applying the second. After the body has been built up layer by layer, it is necessary to let it cure before removing the casts. To speed up curing, infra-red lamps or heating elements placed in the casts are used.



In the vacuum bag method of molding reinforced plastic parts a bag is placed between the mold and the material lay-up. A vacuum pump then empties the bag.

Once the curing is completed, the hardened glass body is removed from the casts and all rough and unfinished surfaces also are removed.

It is possible to cast the doors and hood sections separately or with the body and cut them out after the body is finished. Now the completed body is ready to be mounted. In most cases the body is set over a specially molded floor section and fastened to the section with impregnated cloth. Flanges may be used to help the workmen line up the individual body pieces, and to provide a place to hold the pieces together so that some resin and cloth can be applied from the inside to hold them secure. These flanges are removed after the body is completely assembled. Then the body is fitted to the chassis and bolted on the frame.



Here the vacuum bag method is applied to the making of the panels for the first 300 Corvette bodies.

This relatively new material in the automotive industry is not only light, but possesses tremendous strength. It has a tensile strength of 40,000 psi and a compressive strength of 30,000 psi. If a car with a fiberglass body strikes a tree while traveling 25 miles per hour the body will not dent, but because of its brittleness the results would be a crack approximately a foot long.

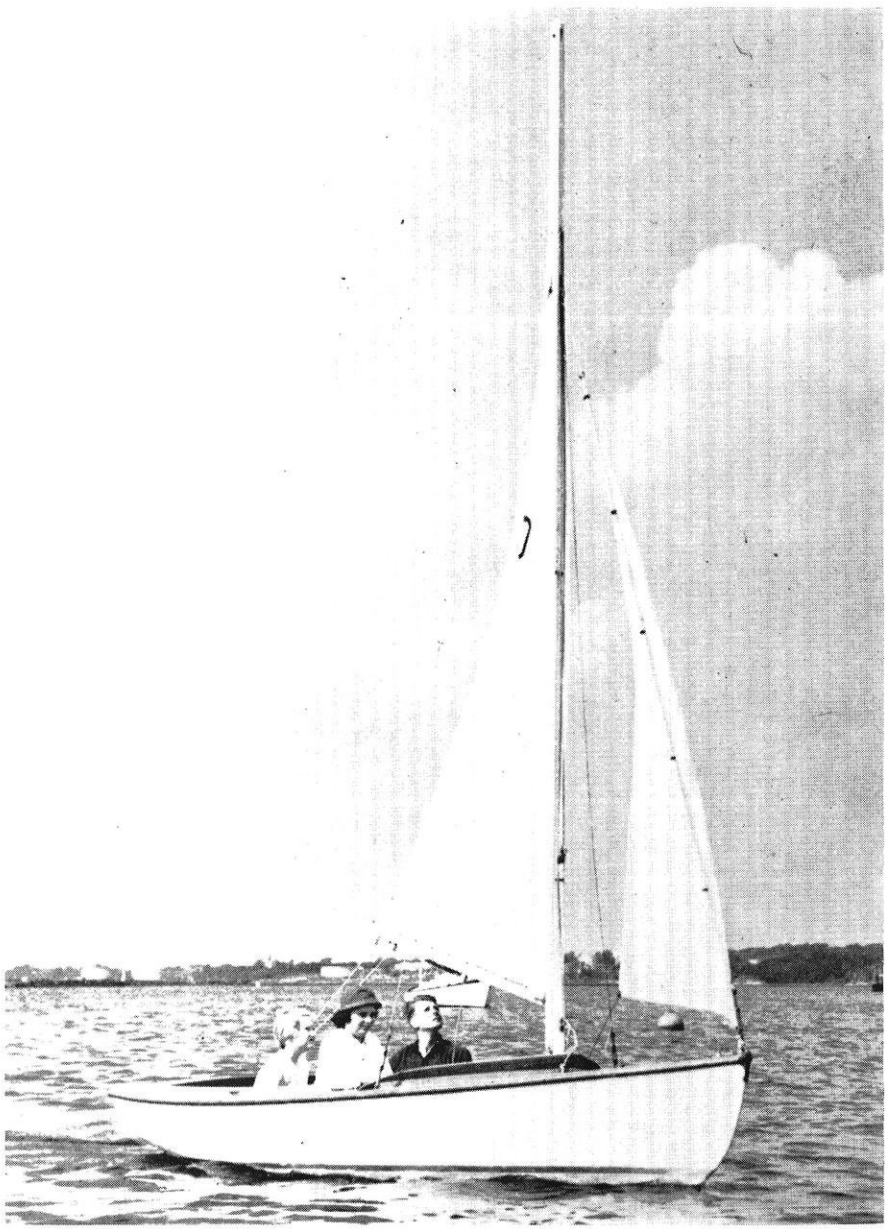
In the recent General Motors Parade of Progress the strength of fiberglass was further demonstrated by severely striking a sheet of it with a hammer with no damage to the glass, Lightness and strength are not the only advantageous properties of the glass. The glass

(Continued on page 44)

THE AERODYNAMICS OF SAILING

by Robert D. Gumm ME '59

Who among us has not felt the call of the sea—the smell of salt spray and the sound of rigging straining in the wind? But who among us has wondered about the mechanics of motion that sends a sail across the sea? The author has, and he explains all to us landlubbers.



For most of us frustrated sailors, a small boat and inland waters offer the only chance to try our hand at the tiller.

THE aerodynamics of sailing has been an important science to man since about 6,000 years before Christ. Down through the ages sailing has risen and fallen in importance until now its prime use is for sport.

All pressure intensities caused by wind increase near the luff (the forward part of the sail) and falls off rapidly towards the leech (the aftward part of the sail).

The importance of the concentration of pressure near the luff is apparent when considering in detail the mechanics of the process by which the pressure on a sail drives a boat to windward (the direction from which the wind blows).

The pressure of the air against a sail at any point has two components; a force acting perpendicular to the surface of the sail, and a small frictional drag parallel to the surface. The frictional drag force at any point, whether it originates as a positive pressure on the windward side or a suction on the leeward (away from the direction of the wind) side, is considered to act exactly perpendicular to the sail at that point.

The resultant discussed above can be resolved into two forces: one perpendicular and the other parallel the axis of the boat. Obviously, only the second of these components has any effect on the driving force.

It is evident from the drawing that the curvature of the sail makes the forward component of

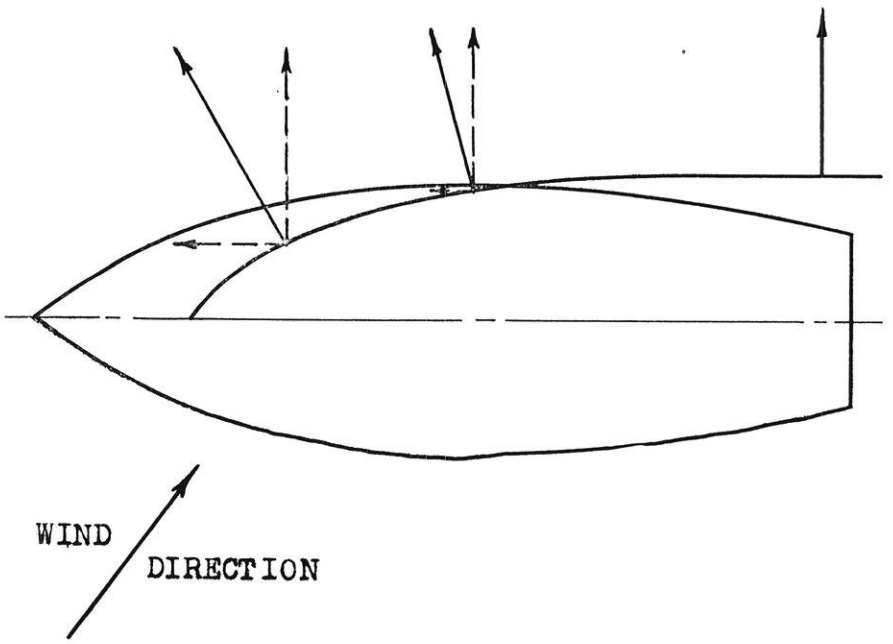
force, parallel to the boat, very small. Practically all of the driving force must be obtained from the portions in the immediate neighborhood of the luff, where the forward component is relatively large.

The remainder of the pressure has little direct effect, except to assist in the making of leeway (drift sideways away from the wind). It is then very desirable that the pressures should be increased as much as possible near the luff and decreased near the leech, as they are far more useful on the luff.

It must not be misunderstood from what has been said that the form of the sail shown is a bad one, or that it would be improved by cutting away a part of the sail near the leech and reducing the distance across the sail.

The leech of a sail acts to guide the air away from the forward part and improves the efficiency of the surface as a whole. If the rear part of the sail was removed, the pressures of small intensity and of little direct use for driving the boat forward would be transferred to points farther forward on the sail. Since it is relative, not absolute, distance with which we are concerned, and if the rear half of the sail is ineffective, it may be presumed that the rear half of the new form would still be ineffective if the sail was to be reduced in breadth by cutting away the leech.

Both the pressure and the suction fluctuate near the luff of the mainsail. Immediately behind the luff there is a high suction and low pressure. A little farther back the suction drops off abruptly and the pressure rises. Still farther from the luff, about one-fourth of the way across the sail, the suction comes up to a peak once more while the pressure falls off to a minimum value at the same point. This is accounted for by mast interference.



Resolution of forces on the main sail.

The mast, not being streamlined at all, disturbs the flow of air very badly. There is, therefore, a region of irregular and eddying flow behind the mast, and this extends onto the luff of the sail. It gives a high suction on the leeward side, for the air flowing around the mast, and failing to close in after passing it, creates a region of dead air when the pressure is below the normal atmospheric value.

On the windward side, on the other hand, the discontinuity of flow prevents any direct impact of the air against the sail or any streamline flow along the windward side. The pressure is accordingly low.

After the air has flowed a few inches beyond the mast it assumes again a streamline flow on both sides of the sail. It is after the assumption of this steady and smooth flow that the second maximum of suction is built up.

The intermediate minimum is accounted for by the direct impact on the leeward side of the sail of the particles of air which are just closing in after having flowed around the mast. Those particles tend to strike against the sail on each side before being straightened in their streamlines with a reversal of curvature in their paths. The result is an increase of pressure and a reduction of suction.

The maximum intensity of suction on this side of the sail is more than twice the maximum pressure on the windward side. Not only is the maximum greater than maximum pressure, but it is found at a more useful point.

The pressure falls comparatively little towards the leech of the sail, but, as has already been shown, the leech is ineffective in produc-

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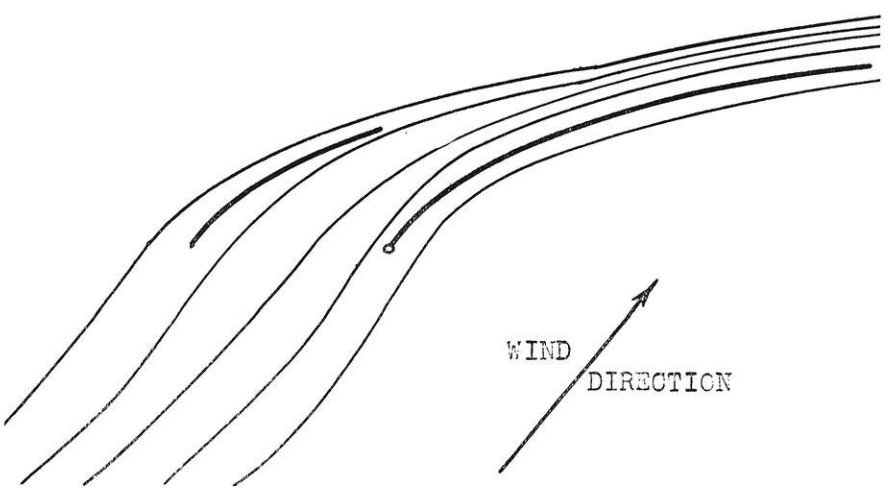


Effect of flow by jib on the main sail.

RIDING ON AIR

by Robert W. Wilda ME '57

Recently a rash of new car ads have begun to deluge the public with a promise of revolutionary new riding comfort. Air suspension has entered the auto industry on a large scale, but has not yet become standard except on the most high-priced cars. The author explores the technical problems behind these claims.

FOR the first time in many years, a completely new type of suspension is entering the auto industry on a mass scale. It is known as "air suspension," and the vehicle actually does ride on air. This is accomplished with a rubber air bag mounted at each wheel in the location normally occupied by the spring. These bags are supplied with compressed air from an engine driven compressor.

When a wheel hits a bump or other obstacle the air bag compresses, increasing the pressure in the bag. This increased pressure increases the resistance of the bag to further compression. Thus the system absorbs shocks and other road hazards.

An engine-driven compressor is used to furnish the air for all air suspension systems. It is mounted in the front of the engine, and is belt driven from the engine crankshaft. The compressor may be a one or two cylinder model, depending on the particular system, and in either case requires about two horsepower to operate. The air goes from the compressor to a high pressure storage tank.

This tank serves as a reservoir for air when the engine is not running, and also steadies the flow of air when the compressor is operating. Oldsmobile uses a high and a low pressure tank; the air exhausted from the air bags goes to the low pressure tank and then back to the compressor as needed. All other systems use one high pressure tank, and exhaust used air to the atmosphere.

The pressure used in the system runs from 260-300 psi at the compressor; 100-150 psi at the air bag. Before going through the distribution valves to the air bags, the air is filtered and dried to prevent blocking or icing of the valves. Copper tubing is used for main air lines, with nylon used for other air connections.

There have been two schools of thought regarding the design of air bags. One design uses a rubber cylinder supported by a metal sleeve. At one end of the cylinder is the piston; at the other end is a mounting plate and air connection. Seals are used at both ends to prevent leakage. The other system uses a metal air dome, fitted with a rubber diaphragm on the bottom. The piston acts on this diaphragm, and seals are used to prevent leakage. The cylinder or diaphragm is of a rubber covered composition, and is flexible and leak proof.

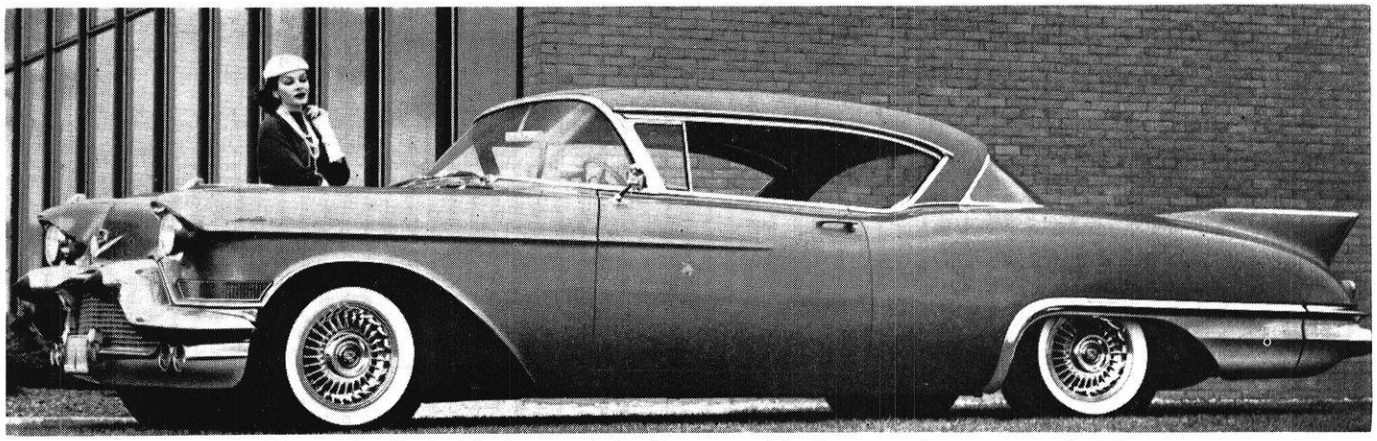
All air suspension systems use a sensing device and auxiliary air system that keeps the vehicle level regardless of load. Some systems use two leveling valves in front and one in the rear, while others use one in front and two in the rear. There seems to be no definite reason for this difference, since both arrangements are used by the same company. When the load in the vehicle is changed, these sensing valves adjust the pressure in the air bags to allow the vehicle to come to a pre-determined height.

Ford uses a special solenoid operated orifice controlled by door switches to correct the height rapidly when loading or unloading passengers. Other systems use only a slow leveling system, which Ford uses in conjunction with its rapid system.

The ride of a vehicle using air suspension is in most cases softer than the ride of a modern spring equipped vehicle. There may be more lean in sharp concerning, but control is better and the vehicle is steadier. Unlike conventional systems, the leveling feature will keep the vehicle flat on long ungraded curves.

Air suspension, by virtue of the compressibility of air, gives a variable spring rate (pounds required to deflect the spring, or air bag, one inch). For each inch of compression the pressure in the bag increases. This increased pressure resists further compression, and for each additional inch of compression a greater resistance is noted. Thus the greater the deflection, the greater will be the resistance to deflection. This desirable feature gives a smooth ride over light bumps, but stiffens up when larger bumps are hit.

The constant height feature is considered by many to be the greatest advantage of the air system. In night driving it keeps the headlight beam on the road, regardless of the vehicle load. It permits a constant level of visibility through the rear view mirror. The ride is also improved because the suspension is always at the position for best riding comfort—and



The Cadillac Eldorado Seville is one of the few cars with air suspension as a standard feature.

can make use of its full travel in sudden compression and rebound.

The initial cost of air suspension runs from $130 to $215. Being new, the system requires more maintenance at present then will future systems. This becomes apparent when compared to the system it replaces, which requires no maintenance at all except on occasional grease job. As time goes by, bugs will be eliminated and air suspension should be as trouble- and maintenance-free as the spring system previously used.

As stated earlier, air suspension is an optional item. Cost considerations dictate that it be interchangeable with the standard suspension system. This is best accomplished by using coil springs on all four wheels. In the past, the trend in automotive suspension has been toward coil springs on the front and leaf springs in the rear. The rear springs also function to absorb the twisting of the axle caused by the sudden torque when power is applied to the wheels.

This system is known as "Hotchkiss" drive. Coil springs cannot absorb this torque, so a system known as torque tube drive is used. In this system, a solid tube between transmission and axle absorbs the torque (wrap up) due to the driving power. To avoid changing from Hotchkiss to torque tube drive (Buick is the only auto using the torque tube), manufacturers have come up with two new rear axle mountings. Both of these permit the use of present drive lines, and both use either coil or air suspension.

The first of these is known as trailing link or arm suspension. In it, the axle is mounted at the rear, or trailing, end of a long arm. This arm is connected to the frame at a point two or three feet ahead of the axle. The air bag or coil spring is mounted between the trailing arm and vehicle frame immediately forward of the axle. The wrap up of the axle when the power is applied is absorbed by the arm. A stabilizer bar is used at both front and rear to maintain lateral stability.

The four link system is a modification of the trailing arm system. In it, the arms are shorter and serve mainly to position the axle. Another pair of arms or other similar arrangement is connected between the top of the differential housing and the frame. These arms prevent axle wrap up and also help to maintain lateral stability.

The Ford air-ride system, used on Ford, Edsel, Mercury, and Lincoln cars, uses the trailing arm type of rear suspension. The standard system on these cars, with the exception of Lincoln, uses the conventional coil and leaf arrangement. This makes two different frames necessary—one for air and one for leaf springs—and does not permit interchangeability of systems. The trailing arm system used with air is said to give superior handling and cornering characteristics because of the more stable rear axle positioning.

Ford uses two leveling valves in the front and one in the rear. Leveling when passengers enter or leave the car is nearly instantaneous. This system uses the rubber cylinder type of air bag, with the

(Continued on page 25)

Chrysler Corporation considers that its torsion-aire suspension system is equal to the air suspension systems that other major auto concerns are introducing.

WATER FLUORIDATION

by Clarence A. Seaton ME '58

The pros and cons of water fluoridation have been heard by all of us for several years, but the engineering aspects of the fluoridation problem are not so well publicized. Here the author describes the technical problems that have to be considered for effective fluoridation.

WHEN fluoridation was first introduced on a large scale in 1945, water departments had very little information to help them in their selection of fluoride compounds or feeder equipment. However, extensive tests have been conducted and much experimentation in the field of water fluoridation has been done.

There are several types of fluorides available for effective water fluoridation. They are available as a dry powder or as a solution. The more common fluorides are, sodium fluoride, sodium silicon fluoride, hydrofluosilicic acid, and hydrofluoric acid.

Sodium fluoride is available in either a dry powder or a solution form. As a solution it may be handled in a saturated or undersaturated condition. Sodium fluoride has a relatively uniform concentration over the ranges of temperatures encountered in water works practice, and therefore can be used in its saturated state. When using the sodium fluoride powder, however, there is a problem of incrustation where there is hard water. This problem is overcome or minimized by the addition of superphosphates with the fluoride.

Sodium silicon fluoride is a dry powder. It has a low solubility. In small water systems, however, enough water can be added at the solution pot, or at the auxiliary solution tank to place the chemical in solution. In larger water systems this chemical is not as effective, because it is necessary to use what is referred to as a slurry of sodium silicon fluoride, and this requires a constant mixing to assure uniform application.

Hydrofluosilicic acid is a liquid with an unusually high concentration of fluoride ions. Because of this high concentration it is a more popular chemical. This acid is usually applied in the concentration in which it is received from the manufacturer, which varies from 22 to 30 per cent. It may also be pumped directly from the manufacturers chemical drum or barrel, into the water system.

Hydrofluoric acid is used only in Madison, Wisconsin. It is a liquid. It was selected for this water system because of a lack of space in the unit well stations for storage of a more bulky chemical. It is a highly corrosive acid, and for this reason is not generally recommended for use in water systems.

The concentration of fluoride varies considerably from state to state. This concentration varies from 0.4 ppm on the west coast to 1.2 ppm in other regions of the United States. The Eastern states, Middle Atlantic, and North Central regions consider 1.0 ppm an effective minimum for dental-caries control. The individual fluorides are measured in accordance with their chemical state, and upon the type of feeder installed in the respective water departments.

There are several factors to be considered when selecting a fluoride. These factors are: chemical cost, solubility, chemical storage space required, feeder space limitations, corrosiveness, and toxic side effects to handlers.

Sodium silicofluoride is the least expensive source of fluoride ion. Sodium fluoride is about two and one-half times more costly, and 30% hydrofluosilicic acid is about three times as expensive.

A comparison of the three more widely used fluoride products shows that one gallon of hydrofluosilicic acid will fluoridate an X

TABLE 1.—FLUORIDE COMPOUNDS

Chemical	NaF[1]	Na_2SiF_6[2]	H_2SiF_6[3]	HF[4]
Chemical content, %	90, 95, 98	98.5	30	70
Available fluoride, %	43	59	23.7	66
Solubility, approx., %	4	0.7		
Pounds/million gal/ppm	19.4	14.4	35.1	12.6
Cost/pound delivered, ¢	12	9.0	9	18
Cost/million gal, $	2.33	1.27	3.16	2.26
Annual cost per capita (100 gpd basis), ¢	8.5	4.6	11.5	8.25
Shipping containers, lb				
bags	100	100		
drums	125	125	100	160
barrels	375	425	420	450

[1]Sodium fluoride.
[2]Sodium silicon fluoride.
[3]Hydrofluosilicic acid.
[4]Hydrofluoric acid.

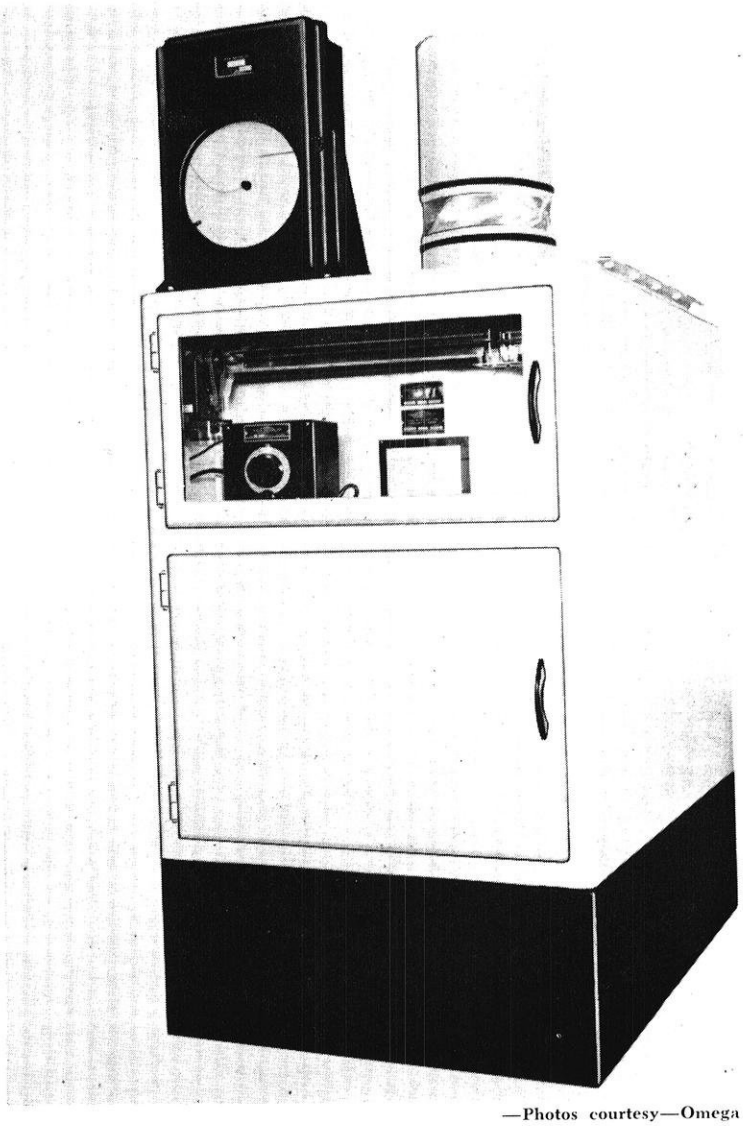
quantity of water. However 17 gallons of a saturated solution of sodium fluoride, or 65 gallons of a saturated solution of sodium silicon fluoride will be required to fluoridate this same X quantity of water.

This inherent advantage in hydrofluosilicic acid is reflected in the lower cost of solution feeders and solution tanks. However, the advantage of the acids high solubility is lost in larger water department installations because the other two less expensive compounds are proportioned directly with dry feeders.

Hydrofluoric acid requires the least amount of storage space. However, because of its extremely corrosive nature, and the dangers involved in handling it, it is not widely recommended, and is used in only one water system in the world, Madison, Wisconsin. Sodium silicofluoride requires the next least amount of storage space. Hydrofluosilicic acid requires the most storage space. However, this latter acid can be stored in tanks placed underground or outside the water pumping stations.

The solution feeder requires the least amount of space. Hydrofluosilicic acid requires no make-up equipment, but is useable directly from the manufacturers tanks. Because of these two factors, many communities with small pumping stations use this particular acid. This acid can also be stored in tanks located some distance from the feeder, which is important when feeder space is limited.

Hydrofluoric acid is extremely corrosive, and is therefore not recommended. The three remaining fluorides differ considerably in their corrosiveness, but manufacturers treat them all the same. Plastic hoses and rubber-lined drums for liquid storage are standard equipment. Hydrofluosilicic acid, if allowed to vaporize, forms hydrofluoric acid on the liquid surface which will eat ceramic crocks or glass-lined tanks. However hydrofluosilicic acid is shipped in rubber-lined tanks from which it can be drawn directly for addition to the water supply, so this hydrofluoric acid formation is thus prevented.



—Photos courtesy—Omega Machine Co.

Complete "packaged" unitized loss-in-weight feeder.

Some fluorides, when added to water, cause a precipitation with the calcium and magnesium present. This is especially true of very hard water. The use of water softeners to reduce the loss of fluorides caused by this precipitation is not ordinarily justified. There is also very little labor involved in removing residues from solution tanks, since sodium fluoride contains insoluble material which also must be removed periodically.

Sodium fluoride is very toxic. The toxicology of fluorides in general indicates that they rank among the substances whose ingestion in small amounts can cause death within a few hours. However there is a wide variation as to what this "small amount" is. Actually, immediate intoxication by the ingestion of fluorides is rare. However, continuous breathing of fluoride dusts can cause respiratory irritation. Where there is fluoride dust present, respirators are standard equipment.

(Continued on next page)

TABLE 2.—ORDER OF DESIRABILITY OF THREE FLUORIDE COMPOUNDS

	Sodium Fluoride	Sodium Silicofluoride	Hydrofluosilic Acid
Cost	2.5	1.0	3.0
Solubility, gallons solution required	17.0	65.0	1.0
Storage space required	1.5	1.0	2.5
Limitations, feeder space	2.0	2.0	1.0
Corrosiveness	1.0	1.5	2.0
Incrustation in feeder	3.0	2.0	1.0
Bulk handling problems	2.0	2.0	1.0
Hazards to operators	1.0	1.5	1.0

Recorder for loss-in-weight volumetric feeder.

Fluorides are not the only chemicals added to a water system. Water departments have been adding various chemicals in both liquid and powder forms for many years. Therefore, when fluoridation was introduced, manufacturers first experimented with introducing it into water systems utilizing existing feeder machines. Today, there are two types of feeders, liquid feeders, and dry feeders.

There are three types of liquid feeders, the positive displacement diaphragm or plunger pump, an adjustable orifice in a constant head box, and a feeder that measures withdrawal of liquid from the solution tank.

The positive displacement diaphragm or plunger pump measures an equal volume of solution per revolution. This type of pump generally has stroke length and stroke frequency adjustments. This feeder generally has a capacity of about 40 lbs. of concentrated sodium fluoride per day, and will fluoridate water under pressure or suction. When inter-wired to the starting switch of a pump-motor, automatic feed results.

In this second type of liquid feeder, the level of the solution in the head box is maintained by means of a float-actuated valve.

The third type of feeder measures the withdrawal of liquid fluoride from the solution tank. This is accomplished by controlling the rate of lowering of an intake device which draws from the surface of the liquid in the tank. When the fluoride solution can flow by gravity to the point of application in the water system, then the second and third types of feeders are generally adopted. However if the solution is applied directly against pressure, then the displacement type pump feeders are used.

There are two types of dry feeders, the volumetric and gravimetric.

In the volumetric type feeder, the dry powder is measured by volume. This is accomplished by means of an adjustable interceptor blade located over a revolving disk.

In the gravimetric type feeder, the applied chemical is actually weighed out. This is usually done by utilizing a traveling belt, movement of which is actuated when the feeding mechanism is out of step with a balance counterpoise—the counterpoise moving along the balance beam at a uniform speed for any given feed rate of the equipment.

When a dry feeder is used there must be an accompanying storage hopper for the chemical and a solution pot for the measured or weighed chemical to fall into. Here water is added to place the chemical in solution or to form what is called a slurry. Then it is conveyed to the point of application, or to another auxiliary solution tank from which it may be pumped or ejected.

The solution feeders are more flexible, because the rate of feed can be controlled by changing the adjustment of the feeding device. On the other hand, dry feeders are easily adaptable to both large and small water systems. However, the selection of the feeder to be used

TABLE 3.—FLUORIDE CONCENTRATION IN AIR

	Unit Type				
	NaF solution	NaF dry feed	Na_2SiF_6 dry	Na_2SiF_6	Na_2SiF_6
Dust collector	No	Yes	No	No	Yes
Fluoride, mg/cu m					
Before loading	0.78	0.0025	0.08	0.08	0.08
Breathing zone during loading	41.00	8.89[1]	3.50	0.46	9.20[1]
11- to 12-min period after loading	3.70		0.71	0.06	1.40
Next 10-min period	1.60		0.14	0.08	0.36
30 min after loading		0.119			

[1] Hoppers filled by pouring directly from bulk containers. In other plants chemical transferred in small containers from bulk drums to feed hopper or solution tank.

in any water system is based upon a number of factors.

These factors are: the rate at which the water is pumped, the number of units required, the construction and location of water works plants or pumping stations, the quality of personnel available for maintenance and operation, the ability to feed fluoride within the accuracy of 5%, and the point of application in the water system, whether under gravity, suction, or pressure. There are also economic considerations involved in selecting the equipment.

Regardless of the manner in which fluorides are used in a water system, there are several standard precautions that are used to protect the handlers of fluoride compounds.

To eliminate all hazards there are four basic safeguards that should be considered at all times. First, there should be a careful choice of the particular compound to be used. Larger communities have graduate chemists on their staffs, familiar with laboratory procedures. The smaller rural communities employ untrained personnel. This should be a determining factor when selecting a fluoride in such a case.

Second, after the fluoride is decided upon, it should be properly handled at all times, because of its toxicity. Third, protective devices should be worn at all times, when in contact with fluorides, or fluoridation equipment. Dust masks and rubber gloves are standard equipment in plants handling the dry chemicals. Complete exterior protection is used when working on hydrofluoric acid equipment. Use of rubber gloves and rubber aprons minimizes contact with other solutions, such as hydrofluosilicic acid, and sodium fluoride solutions.

The fourth safeguard consists of dust collecting apparatus. Studies were made in several communities in Wisconsin of sodium fluoride and sodium fluosilicate installations to determine the fluoride concentration in the air. This concentration was found to be less than 2.5 mg per liter, which is the established allowable exposure over an 8-hour day, five-day week. However, the larger water systems still install dust exhaust or collection equipment to minimize the danger of dust inhallation. Table no. 3 on page 15 shows the results of some of these dust exposure studies.

After the fluoridation program is established in a community, it must be constantly checked to insure the safety of the public. In larger communities this is no problem, for there are many tests conducted hourly to determine the purity of the water, and the fluoridation test is very similar to the chlorine residual test. Smaller communities which employ only a water superintendent must rely upon a colorimetric test. This test has been proven effective in Wisconsin for a range of 1.0 to 1.5 ppm fluoride residual. This test requires a minimum of glassware handling and solution measurement.

Fluoridation systems have been successfully operating for over a decade. The state of Wisconsin has perhaps the most extensive program. Mr. H. E. Wirth, in his paper on the Engineering Aspects of the Wisconsin Fluoridation Program, summarizes the program with six important engineering conclusions which I should like to quote. They are as follows:

1. That establishment and following of an exacting procedural plan is essential in the interest of the public's health.

2. That fluoride compounds, though labeled poisonous can be safely handled, applied and controlled.

3. That sodium fluoride, sodium silicofluoride, hydrofluosilicic acid have successfully been applied to public water supplies in controlled proportions of 1.0 to 1.5 ppm of fluoride ion.

4. That the first cost of fluoridation is minimal, varying from less than $500. to a maximum of $3,000, depending upon community size and desire.

5. That the per capita cost of fluoridation can be as low as 7 cents per year using sodium fluoride, and probably less when using sodium silicofluoride.

6. That any community, no matter how small, having a public water supply can successfully fluoridate its water.

THE END

Suspensions

(Continued from page 21)

piston being an integral part of the lower suspension member. Seals are required at each end of the rubber cylinder.

General Motors uses the four link rear suspension system. The actual set-up of the links varies between the different divisions, with Chevrolet, Pontiac, and Cadillac using a U-shaped bracket between the differential and frame instead of the two links used by Oldsmobile. Buick, because of its torque tube drive, does not use the four link arrangement; it does use a rear stabilizer bar. The ride characteristics of these cars are "pillow soft", perhaps excessively so. Road hugging and recovery ability is superior to present suspension systems.

All GM cars with the exception of Oldsmobile use coil springs all around as standard equipment, with air optional. This eliminates the need for a special chassis for air suspension. Oldsmobile, like Ford, uses leaf springs as standard equipment and requires a special chassis for air.

GM products, with the exception of Chevrolet, use two leveling valves in the rear and one in front. There is no rapid leveling orifice in this system, and it takes from two to four minutes for the leveling to be completed after a load change. Also, all GM products except Chevrolet have an "override" system controlled from the dash. This cuts out the leveling system and allows the air bags to be fully inflated.

Road clearance is increased by about five inches over normal height. This feature is useful in going over very rough terrain, in negotiating driveways, and in tire changing. The GM system use the metal air dome and diaphragm type of air bag. The dome is built into the frame, and the piston is connected directly to the lower suspension member.

The future of air suspension will be determined by its performance. If the public decides it is worthwhile, there is a huge market for the system. If it is just another gimmick to add cost and no more, the public will undoubtedly reject it.

THE END

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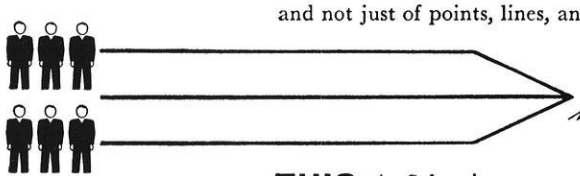
when parallels meet

...as in advancement opportunities at Sylvania

It remained for Nicholas Lobachevsky to solve a riddle that bothered mathematicians for the better part of twenty-two centuries.* He was able to construct a rational geometry by denying Euclid's fifth postulate — by maintaining that parallels *do* meet.

Here at Sylvania Electric we have a noneuclidean geometry of our own, in which parallels also meet. It's a geometry of professional development, though, and not just of points, lines, and planes.



WHAT DO WE MEAN?

THIS: At Sylvania a man advances by one of two parallel paths.

If his interests and talents lie in the areas of engineering and scientific specialization, he advances as a *specialist.*

If his forte is in the areas of organization and administration, he advances through *management.*

These parallel paths meet in a common point: At Sylvania a man knows that he is given the fullest opportunity to develop and exercise his talents. He knows that a man goes as far and as fast as he is able in the path of his choice. Whether he chooses management or specialization, he finds *equal* rewards and compensation.

Graduates and men with advanced degrees in science and engineering will discover Research, Development, Manufacturing and Marketing careers at Sylvania — in specialization or management — in:

LIGHTING, RADIO, TV, HI-FI, ELECTRONICS, SEMICONDUCTORS, PHOTOGRAPHY, COMMUNICATIONS & NAVIGATION SYSTEMS, AIRBORNE DEFENSE, RADAR, ECM, MISSILES, COMPUTERS, CHEMICALS, PHOSPHORS, PLASTICS, METALS & WIRE.

Contact your college placement officer for an interview, or write us and ask for a copy of "Today & Tomorrow with Sylvania".

*WE MEAN NO DISCREDIT TO BOLYAI OR GAUSS. LOBACHEVSKY MUST TAKE CHRONOLOGICAL PRIORITY, HOWEVER.

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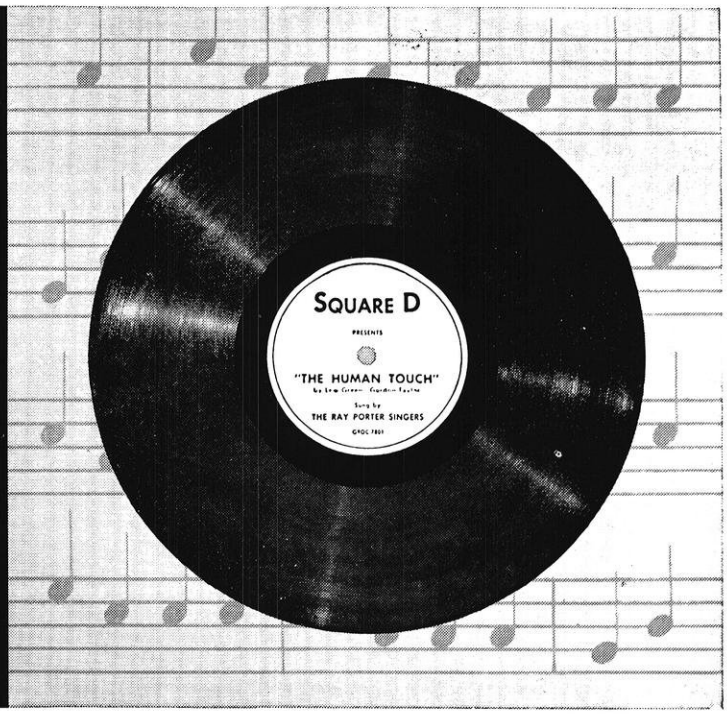
SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N. Y.

LIGHTING • TELEVISION-RADIO • ELECTRONICS • PHOTOGRAPHY • ATOMIC ENERGY • CHEMISTRY-METALLURGY

Question:
What makes a company a good place to work?

Answer:
Among other things, we think "the Human Touch" rates high...



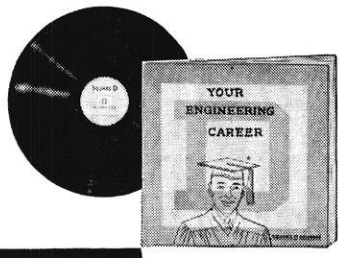
This record tells why—musically

— we'd like to send you a platter

There are a lot of things to consider in selecting the organization with which you will stake your future. For example, how is the company rated in its field? Is it known as a "quality" company? Is it growing? Is it aggressive? Is it big enough to offer you the opportunities you want? Is it too big—to the point where, of necessity, it deals with numbers instead of individuals?

...We think that last factor is mighty important. We call it the "*human touch*" element and it's pretty well explained, *musically*, in a theme song we had recorded for a recent national sales conference. The Ray Porter singers do some rather unusual vocalizing you'll probably enjoy. Clip the coupon and let us send you a record. It's good listening with a little food for thought thrown in.

mail this coupon for your "*Human Touch*" record



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

I'd like a "*Human Touch*" record and a copy of Square D's brochure, "YOUR ENGINEERING CAREER"

I am primarily interested in ☐ Research, Design & Development Engineering ☐ Manufacturing Engineering ☐ Sales Application and Field Engineering

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CITY_____ ZONE____ STATE_____

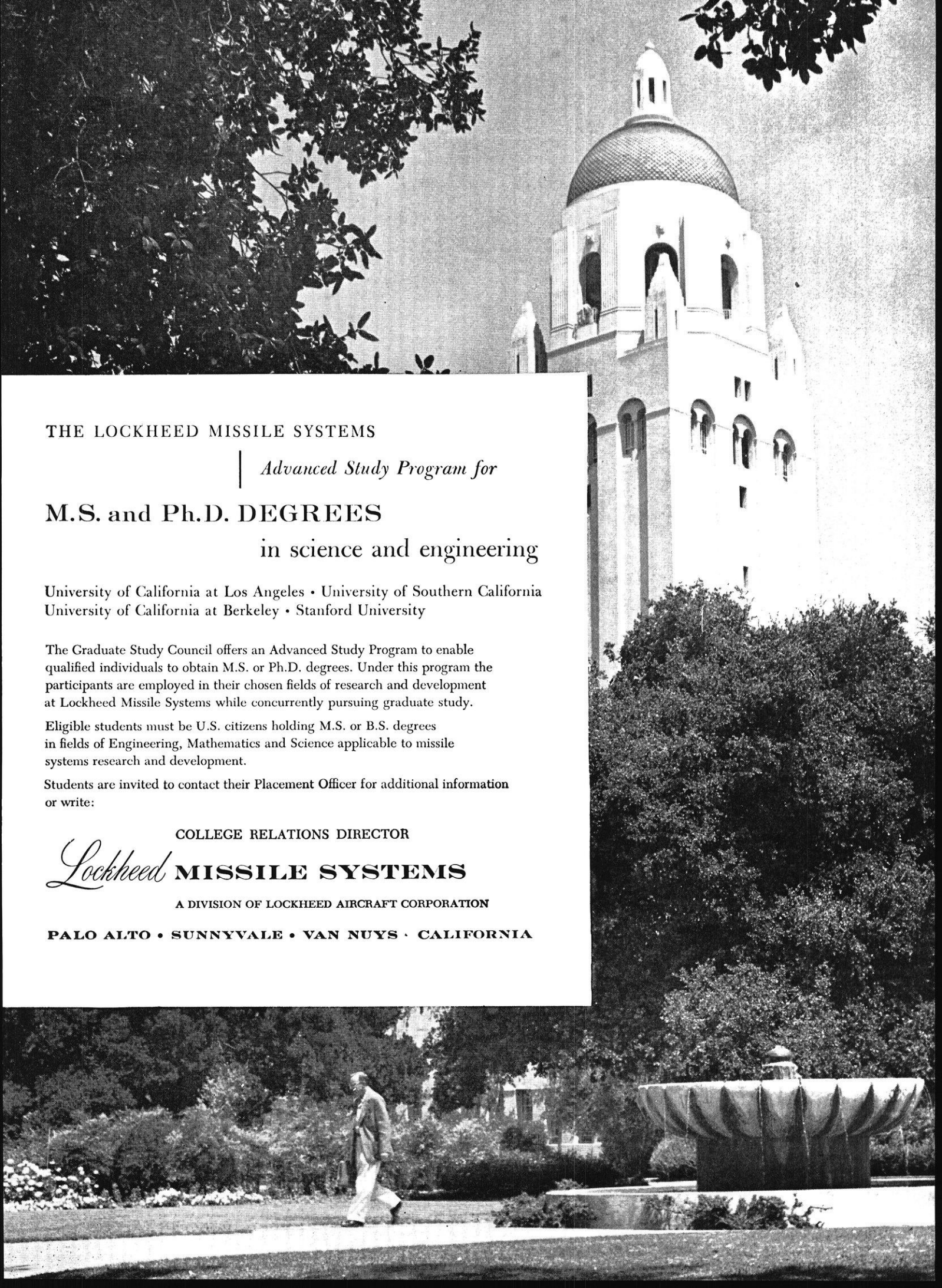
SQUARE D COMPANY

Henri Poincaré...on disinterested fools

"But scientists believe that there is a hierarchy of facts, and that we may make a judicious choice among them. They are right, for otherwise there would be no science, and science does exist. One has only to open one's eyes to see that the triumphs of industry, which have enriched so many practical men, would never have seen the light if only these practical men had existed, and if they had not been preceded by disinterested fools who died poor, who never thought of the useful, and who were not guided by their own caprice.

What these fools did, as Mach has said, was to save their successors the trouble of thinking. If they had worked solely with a view to immediate application, they would have left nothing behind them, and in face of a new requirement, all would have had to be done again."

—*Science et méthode, 1912.*



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The Graduate Study Council offers an Advanced Study Program to enable qualified individuals to obtain M.S. or Ph.D. degrees. Under this program the participants are employed in their chosen fields of research and development at Lockheed Missile Systems while concurrently pursuing graduate study.

Eligible students must be U.S. citizens holding M.S. or B.S. degrees in fields of Engineering, Mathematics and Science applicable to missile systems research and development.

Students are invited to contact their Placement Officer for additional information or write:

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SCIENCE HIGHLIGHTS

by Ed Allen m'60

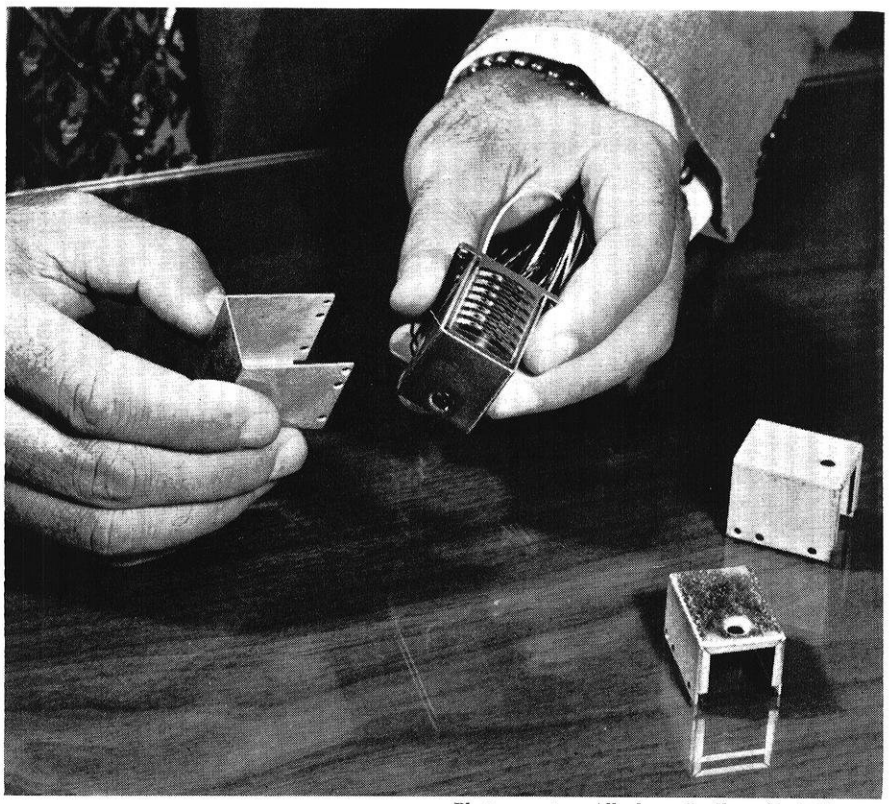
MINIATURE RECORDING HEADS

Tiny inch-long recording heads are helping to write experiences in the upper air where man can't travel. With these small gadgets taking shorthand notes man probably will make these journeys—and maybe soon.

The multi-track magnetic recording-reproducing head, whose name is bigger than itself, is used in missiles to take notes. These notes reveal temperatures, speeds, vibrations, flight and dozens of other items—up to 20 separate records on a single one-inch head. These small gadgets are also used in supersonic planes, at atomic bomb testing sites, and in other areas to record data where man can't go to make records.

The Davies Laboratories Division of Minneapolis-Honeywell Regulator Company makes these special recording and reproducing heads which print electrical impulses on magnetic tape. Part of the secret in their manufacture is the metal which shields the recording-reproducing heads. This material is called Mumetal, and is made by Allegheny Ludlum Steel Corporation. Mumetal is a special metal used in the recording-reproducing heads, and is used especially for shielding against electromagnetic fields. In the case of the recording and reproducing heads this is especially important.

The basic design of the recording device consists of two half sections. These are then lapped individually, assembled in molds and embedded in a special plastic. All the caution that goes into the making of the special recording head is necessary to insure proper, accurate playback later.



—Photo courtesy Allegheny Ludlum Steel Corp.
Miniature recording head.

INDOOR CLIMATE LAB

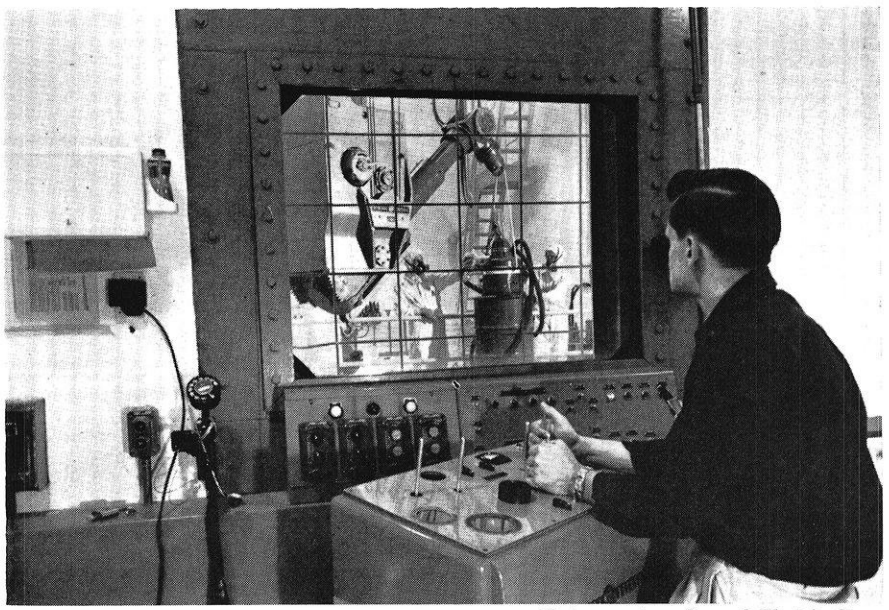
Dial yourself a teacup size hurricane or the sultry Sahara's arid climate; it's all the same to a comparatively new testing instrument that assists science in knowing more about seed germination, insect control, testing telephones or electrical computers, and hundreds of other diversified subjects. The answers supplied by this instrument can help you in your daily life, and also aid industry produce better and less expensive products in the years to come. The unique testing instrument is called a Climate-Lab, and is made by the American Instrument Company, Inc., of Silver Spring, Md. This instrument can duplicate and accurately sustain almost any global climatic condition.

The University of Maryland uses a Climate-Lab to test the bite of mites on hamsters. The "bite-rate" increases greatly under certain climatic conditions. This experiment is seeking answers on the spread of disease by insects in tropical areas.

Food containers are being tested under all kinds of weather conditions for knowledge on food spoilage.

Electronic, automotive and aeronautical equipment is tested for its workability under severe weathering conditions.

The Climate-Lab has a 9.6 cubic foot capacity test chamber which



—Photos courtesy General Electric Co.

New G.E. "Hot Lab."

is highly insulated. The entire test chamber is made of Allegheny Ludlum Steel Corporation's type 304 stainless steel. This material—about 200-pounds of stainless steel goes into each unit—was chosen because of its non-corrosion properties and its ease of maintenance.

The Climate-Lab conditions the air before it enters the test chamber. Controls on the testing equipment are accurate within plus or minus one per cent relative humidity, and plus or minus one degree Fahrenheit in temperature. A constant control system which records time, temperature and humidity is included. The Climate-Lab can recreate any climatic condition up to 99 per cent relative humidity, and up to 160 degrees Fahrenheit.

NEW "HOT" LABORATORY

Mechanical "hands" that can disassemble an aircraft jet engine "bolt by bolt" are part of the remote handling equipment in one of the world's largest shops for handling radioactive equipment. The huge "hot" shop, 160 feet long, 50 feet wide and 63 high, is part of the Atomic Energy Commission's test facilities utilized by the General Electric Company at Idaho Falls, Ida.

Remote handling tools in the "shop" range from a 100-ton crane down through O'Man, a huge mechanical "arm" designed and built by General Electric, to a much smaller master-slave manipulator for making intricate mechanical adjustments.

The O'Man manipulator can handle from 500 to 3,000 pounds, depending on the arm length and position used. This giant manipulator is suspended from a crane bridge and can cover the entire working area of the shop.

Operators of these manipulators and four other electrically controlled wall-mounted manipulators are protected by concrete walls some seven feet thick and by nine windows of lead glass and zinc bromide, six feet thick. Each window contains 500 gallons of zinc bromide to protect operators from stray nuclear radiation.

Enough controls are located at each window to operate any piece of servicing equipment in the entire shop. Radio contact can be maintained by operators in the control galleries with other operating sites and with a lead shielded locomotive used to haul equipment to be maintained in and out of the huge shop.

The shop is serviced by a track system which enters through large remote-controlled double doors at the west end. Smaller entrances are provided for personnel who must enter the "hot" shop.

On the floor of the shop are two large capacity turntables for rotating heavy equipment that must be serviced. Rotation of these nuclear aircraft propulsion equipment components provides easier access by tool and better view from any of the nine observation windows.

Connecting with the main "hot" shop are smaller shops for handling radioactive equipment, including one area for servicing O'Man and other remote handling equipment.

Also connecting with the "hot" shop by water canal is a water-filled storage pool for fuel elements and other radioactive units. The pool, 120 feet long, 60 across and 24 deep, is filled with water that is much purer than ordinary distilled water for sale in drug stores.

Visual observation of work in the "hot" shop is difficult because distances involved between observer

(Continued on page 32)

Science Highlights

(Continued from page 31)

and equipment often exceed 50 feet.

Six of the viewing windows in the main shop are 18 feet above the shop floor and two are 30 feet above it. One window is located in the cell for maintaining the remote handling equipment.

Viewing aids used include binoculars, spotting telescopes, mirrors and closed circuit industrial television, with preparation being made for installation of a television network that includes black and white, color, 3-D stereo vision or any combination of these, with viewing screens at all operator locations.

Depth perception depends to a great extent on the stereo vision of the technician, since size, color and shadows are not always available as depth perception aids.

To help provide operators with needed depth perception, the "hot" shop operations unit has set up a program for selection and development of manipulator technicians with respect to stereo vision.

The four steps in this program are:

1. Examination of prospective remote equipment operators by local optometrists.
2. Elimination of candidates with less than 80 per cent stereo vision.
3. Detailed examination of the remainder of candidates to determine whether they can undergo training and exercise several hours a day to improve their stereoscopic vision.
4. Visual training and exercise, including practical application, as on-the-job training.

Since the average person probably has only about 70 per cent stereo, and less than one person in 10 has perfect stereo as well as perfect vision, it is necessary to select those who can be developed to 100 per cent stereo with a reasonable amount of exercise and training.

About six hours of exercise a month is necessary to maintain the stereo skill acquired in this program.

ELECTRONIC TRAFFIC CONTROLS

The Radio Corporation of America and the Nebraska Department of Roads have unveiled an electronic system for vehicle control requiring no special equipment in motor vehicles. A field demonstration of the system was held recently at the intersection of Nebraska Highway 2 and U. S. 77 south of Lincoln.

To highway officials from many states and representatives of the press, radio and television, the novel system was shown detecting and reacting to the passage of vehicles over a specially equipped 320-foot section of highway to cause these actions:

Operation of lights giving right-of-way at a point of merging traffic;
Warning a driver when he followed too closely behind another vehicle;
Indicating to a driver the presence of an obstacle in the highway ahead;
Simulating the automatic guidance of a car along its traffic lane.

State Engineer, L. N. Ress, told the highway officials that the experimental system is "an extremely promising development that may well mark a turning point in the nation-wide campaign to reduce the heavy toll of accident on our highways."

It was emphasized that the present test installation represents "a purely experimental step designed to study and demonstrate the principles" of electronic vehicle control and evaluate certain features of the present system. It was indicated that a logical next step would be the development of a more extensive test facility, such as a complete mile or two of highway equipped with a variety of safety devices and including fully-equipped test vehicles.

The test installation, in the new main intersection of U. S. Route 77 and Nebraska State Highway 2 on the outskirts of Lincoln, was designed under the direction of Mr. Ress by L. M. Hancock, of the engineering staff of the Nebraska Department of Roads.

The system itself, described basically as a series of electronic elements buried in and along the highway to detect and respond to the passage of vehicles, was developed to its present stage by an RCA Laboratories research team including L. E. Flory, W. S. Pike, and G. W. Gray, under the direction of Dr. Vladimir K. Zworykin, Honorary Vice-President of RCA. The system is based on a concept demonstrated by Dr. Zworykin and his group at RCA's David Sarnoff Research Center, Princeton, N. J., in 1953.

SANDWICH ROLLING

Steel prototypes of the famed Dagwood sandwich have been experimentally rolled at Homestead District Works of U. S. Steel Corp. They are expected to have wide significance in the aircraft and missile fabrication fields. Results of the research and development project produced the widest thin-gage stainless steel sheets in the world. The experiments have achieved a break-through in the rolling of stainless and alloy steel sheets and hold promise of adding a new dimension to future mill-produced materials for aircraft and missiles.

This has been accomplished by a "sandwich" rolling process developed by Howard S. Orr. Through this process, U. S. Steel has demonstrated the feasibility of producing steel sheets up to 90 inches wide—nearly twice the width of light-gage stainless and alloy sheets now being made by conventional methods.

Translated to terms of aircraft material and design, the wide sheets are an avenue toward more rapid production and less weight. Where aircraft requirements call for alloy and stainless steel sheet wider than now available, these material limitations require joining of two or more sheets. As more and more alloy and stainless steel is used in aircraft and missiles, wide sheets offer a significant saving in weight, plus design and fabrication simplification.

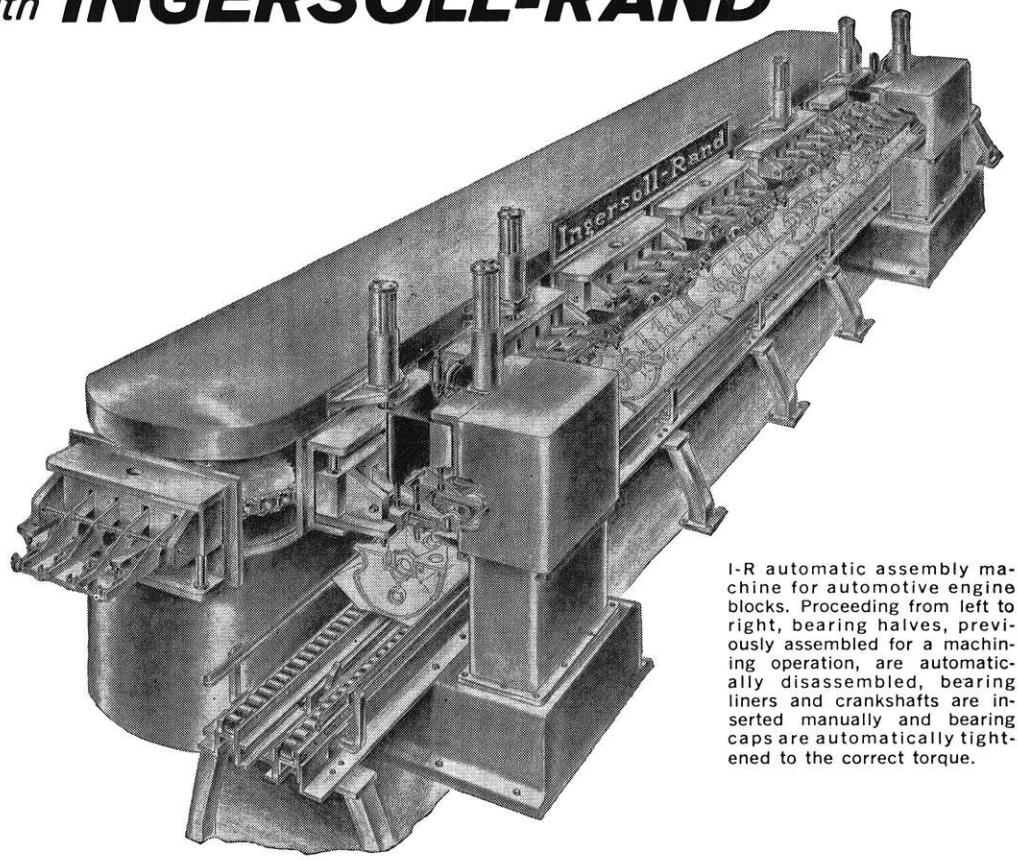
A typical steel Dagwood consists of two carbon steel cover plates each one inch thick. Between them goes a filling of four stainless steel plates each 5/16-inch thick and treated with a separating compound. The sandwich is held together with welded-in side and end bars. Prior to rolling, the sandwich is about three inches thick.

Heated to high temperature the sandwich is put through a rolling mill at Homestead District Works. Reduced each time it passes through the massive rolls, the sandwich becomes progressively thinner, longer and wider until it is a plate approximately ⅜-inch thick, 100 inches wide and 250 inches long.

(Continued on page 40)

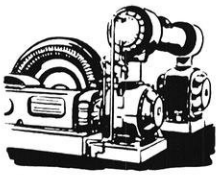
YOUR LEADERSHIP CAREER

with INGERSOLL-RAND

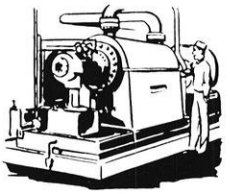


I-R automatic assembly machine for automotive engine blocks. Proceeding from left to right, bearing halves, previously assembled for a machining operation, are automatically disassembled, bearing liners and crankshafts are inserted manually and bearing caps are automatically tightened to the correct torque.

also means **LEADERSHIP in**

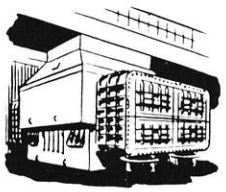


Compressors and Blowers

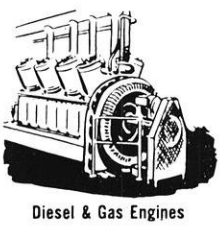


Centrifugal Pumps

Rock Drills



Steam Condensers



Diesel & Gas Engines

If you are interested in automation . . .

Here's what Air-Tool Engineering at Ingersoll-Rand can mean to you

AUTOMATION, today, is the magic word that is opening new horizons for cost-saving economy in practically every industry. Things that used to be done by hand are now being done automatically. Here is a rapidly growing field which offers fine opportunities for you as a mechanically minded engineer.

Many interesting engineering problems arise in the design, development and experimental work on such machinery, and creative engineering is necessary to solve them. Practical engineering ability is also needed for installation and initial operation of such equipment. The early studies of customers' needs and automation equipment sales are also challenging jobs.

Ingersoll-Rand is a recognized leader in designing and building these labor-saving air and electric tools, and is also one of the country's leading manufacturers of air compressors, pumps, rock drills, gas and diesel engines, vacuum equipment. All of these products depend heavily on advanced engineering in their design, manufacture and field application.

Then there are the advantages of living in Athens, Pa., where Ingersoll-Rand builds automation equipment. The picturesque Pennsylvania hills provide many recreational advantages that are particularly appealing to the outdoor man.

If you are looking for a leadership career with long-range job security and excellent opportunities for advancement, you'll find it at Ingersoll-Rand.

For further details, contact your Placement Office, or write to Ingersoll-Rand, 11 Broadway, New York 4.

OPPORTUNITIES FOR ENGINEERS NOW AVAILABLE:

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ENGINE EARS

by Wayne Rogers, me'59

SOCIETY NEWS

BARS

Plans for a receiver to track the American Vanguard satellite when it is launched are being arranged by the Badger Amateur Radio Society who, already is operating an active transmitter in the basement of the Electrical Building

Before Christmas the club set up a portable, six meter, hi-frequency transmitter and receiver in the Memorial Union to send Christmas messages and greetings from the students, by way of short wave radio, to various parts of the country. During this time they handled 111 pieces of radio traffic. The portable equipment relayed the voice messages to the transmitter in the EE Building where it was sorted and sent out to the nets in this vicinity for distribution.

The transmission of student messages from the Union is planned to be a regular project for the club next semester.

The Society is open for membership to anyone, and its officers extend an invitation to anyone interested to attend one or more of their regular meetings to meet its members and to find out more about the club's operations. They meet the second Tuesday in each month in room 142 (basement) of the EE Building.

At the January meeting, the Society elected the following new officers for the second semester:

President—John Lemmer
Secretary-Treasurer—Steve Bomba
Chief Engineer—Reggie Olson
Trustee—Al Laun

ASME

The January meeting was a joint affair with the SAE. During the joint business meeting, the main topic of discussion was the forthcoming St. Pat's Day.

Two ASME members, sophomore Ed Allen and senior Tony DiTraponi, were winners in the St. Pat's Day Button contest. Allen took first place for his design and DiTraponi won third place.

Joe Chojnacki, ASME Chairman of the St. Pat's Day events, explained that registration for the beard length contest had already been made and that registration for the other contests will be soon. He urged the fellows to start on their beards now.

Any ASME member who is interested in selling buttons for St. Pat's Day should contact the Chairman of the events.

The main speaker of the evening was Mr. J. C. Combi of the duPont Company. He spoke on "Research and Development" and showed a movie entitled "Mechanical Research Laboratory."

"How to Size up a Company for Employment" was the topic of discussion of Mr. T. M. Turner of Procter and Gamble at the February meeting of the Society, February 18.

ASME HIGHLIGHTS

The ASME is currently providing a free movie program to all interested students. Most of these films deal with industrial progress in the United States. Some, as titles may indicate, should be interesting as well as informative.

Below is indicated the time, place, and titles thru February:

Time: Wednesdays, 12:00–12.50
Place: Room 105—ME Building
1–22—"Torque Converter Story"—"Tale of Powdered Pig"
1–29—None Scheduled
2–12—"The Benson Barrel"—"Drawing, Stretching, and Stamping"
2–19—"Men Who Make Steel"—"Story of American Whiskey"
2–26—"Challenge on the Lake"—"Aluminum on the Skyline"

AIChE

Mr. R. G. Bell of the DuPont Company was the main speaker at the regular January meeting of the Wisconsin chapter of the AIChe on January 15.

Mr. Bell spoke on "The Experiences of a Young Engineer in the Chemical Industry."

ASCE

At the regular January meeting of the Civil Engineering Society, meeting in room 105 in the Mechanical Engineering building, Don McManus, instructor in the hydraulics laboratory, spoke on "The Problems of the Hydraulic Engineer."

AIEE-IRE

"The Switch Gear" was the topic talked about by Mr. Bowen from Allis Chalmers at the January meeting of the society in the Union, February 14.

Plans are going ahead for an electrical display in the lobby of the Mechanical Engineering Building during the latter part of February and early March.

ASME PRIZE PAPERS CONTEST

This year the American Society of Mechanical Engineers student section is again sponsoring the Prize Papers Contest. This is a

speech contest for undergraduate ASME members who would like to earn money and recognition for their M.E. 99 reports, or for any other technical topics they might wish to present. The University of Wisconsin contest will be held some time in March, the exact date to be determined by its convenience for contestants and judges.

First prize for the local contest is twenty-five dollars, and a Kent's Handbook for mechanical engineers, worth approximately six dollars. The winner will also be given a trip to Milwaukee for the regional ASME conference, where he will compete for further prizes. The regional winner receives fifty dollars and a chance at the $150 national award. Last year only one man entered our local contest, so he automatically received the $25 and handbook, and several other prizes as well. This year is *your* opportunity—maybe you'll be the only entrant!

The entry must be in the form of a speech not more than fifteen minutes long, followed by a five-minute question period. The ASME will give you all the help it can in the preparation of your entry. For further information contact Ed Allen, Al 5-2631, or see any of the ASME officers.

ENGINEERING INSTITUTES

READY MIXED CONCRETE

Movies, actual laboratory tests and demonstrations, and lectures provided the information for a recent Engineering Institute on Ready Mixed Concrete, sponsored by the University Extension Division on January 15, 16, and 17.

The Institute included a laboratory demonstration on sieve analysis of aggregate, noting organic impurities, moisture, and absorption and a demonstration on concrete proportioning, air content, and test specimen preparation. Another lab test dealt with the effect of excess water with a test for ultimate strength, elasticity, and durability.

Mr. E. O. Goeb, Field Engineer, Portland Cement Association, Milwaukee spoke to the group about "Air Entraining in Concrete." George W. Washa, Professor of Mechanics at the University, explained the "Basic Factors in Concrete," and Prof. Paul G. Fluck, also of the University Mechanics Department, spoke about "Aggregate and Concrete Tests."

Talks and panel discussions were also given concerning experiences with and problems of Ready Mixed Concrete.

INSTITUTE ON TIME STUDY APPRECIATION

Time Study appreciation is becoming more and more necessary and important in modern industry. A group of conferees met recently on the University campus to study the requirements, the equipment, and the application of good practices of effective time study.

This conference included: "Evaluation of Worker Performance," "How to Take Time Studies on Machine Operations," "Tools of Work Simplification," "Using Predetermined Times to Set Standards," and a panel discussing "Practical Time Study Problems."

In a very timely action the University Faculty on January 6 established the new "Course in Applied Mathematics and Engineering Physics." It replaces the old "Course in Applied Mathematics and Mechanics" which was somewhat too rigid for today's needs and no longer very popular with the students.

The course represents a joint program of the College of Letters and Science and the College of Engineering. It will provide basic training in related areas of applied mathematics, physics and engineering science, with emphasis on theoretical aspects in the engineering courses.

A number of options are available for the engineering science courses. There is one in Engineering Mechanics, one in Electrical Engineering, and then there is a more theoretical option designed for students whose main interest is in mathematics and physics.

The program will also be offered on the Milwaukee Campus of the University.

Additional information can be obtained by consulting Professor Korevaar, 301C North Hall.

WISC COMPUTER

WISC is now in operation on the University of Wisconsin campus, solving in one day problems which would require months by other means.

WISC is the University's new large-scale electronic digital computer. Recently dedicated in a UW electrical engineering laboratory, WISC gets its nickname from the cap letters of its real name—Wisconsin Integrally Synchronized Computer.

Electronic computers like WISC are called other names, too, like "electric brain," "electric hand," or "giant moron."

The "electric hand" or the "giant moron" nicknames are more correct than the "electric brain" title, UW engineers say, since the computer works only under the guidance of the human brain, even though it does make some simple decisions for itself.

One engineer says the machine can aptly be called a "problem child," since it can solve its problems only under a lot of human guidance.

A dozen UW students, guided by their professors in the electrical engineering department, built the intricate sub-assemblies which make up the machine. The work has been done over the past six years as part of advanced electrical engineering training of the students.

The complex machine is made up of some 1,500 electronic tubes and hundreds of intertwined wires.

WISC is a digital computer of "medium" speed. This means the machine can, for example, multiply two 10-digit numbers—say 8,954,733,274 times 9,673,486,843 — and give the answer in 1/60th of one second.

The heart of the machine is the magnetic drum about two feet long and nine inches in diameter which revolves at 60 revolutions per second. On this drum sections can be magnetized to store "orders" and numbers, just as they can be stored on recording tape.

WISC differs from existing machines in several important respects. One is the use of "integral synchronization." Without this feature such a magnetic-drum comput-

(Continued on next page)

ing machine would use one revolution to look up the instructions, one to look up the two numbers involved, one to perform the arithmetic called for, and a fourth to deliver the result. In the WISC these four operations are performed simultaneously, increasing speed of operation.

Another new feature in WISC is the built-in ability to work with a "floating decimal point." This means that the machine, though limited to 10-digit numbers, can "float" the decimal point over a range of 150 places during the operation. Thus it can work more of the time at full precision—a feature which has to be "programmed in" most machines, with resulting loss in speed.

Work on the Wisconsin computer was started in 1951 with funds from the Wisconsin Alumni Research Foundation (WARF), from the UW Engineering Experiment Station, and from University basic research funds. Total cost of the intricate machine is less than $100,000, considerably less than the cost of similar digital computing machines.

Chief purpose of the entire project is to train young engineers in this highly important and rapidly growing field. WISC also provides a useful addition to the IBM computing equipment now operated on the campus by members of the Numerical Analysis Laboratory. It also helps the University increase its service to industry in the state.

ALUMNI PROMOTED

Dr. Wayne H. Jens, formerly project engineer for Nuclear Development Corporation of America, White Plains, New York, has been named Assistant Technical Director for Atomic Power Development Associates, Inc. in Detroit. The appointment was announced today by Walker L. Cisler, President of APDA—the nonprofit corporation concerned with research and basic design for the Enrico Fermi Atomic Power Plant now under construction near Monroe, Michigan. Dr. Jens will report to Alfred Amorosi, APDA Technical Director.

A native of Manitowoc, Wisconsin, Dr. Jens (36) graduated from the University of Wisconsin with a bachelor of science degree in mechanical engineering in 1943 and earned his doctorate in mechanical engineering at Purdue University, Lafayette, Indiana, in 1948.

Following his graduation from the University of Wisconsin, he worked for one year as a mechanical designer for North American Aviation in Inglewood, California, and during World War II served with the United States Navy as a lieutenant (jg).

From 1948 to 1953 he was head of the Engineering Analysis Group at Argonne National Laboratory, where he assisted in the development of a number of nuclear reactors including that for the atomic submarine Nautilus.

As project engineer for Nuclear Development Corporation of America, he worked on an engineering test reactor for the Belgian government and, as a consultant to APDA, assisted in basic design work on the Fermi reactor.

Dr. Jens is a member of the American Society of Mechanical Engineers, Sigma Xi (National Research Society) and the American Nuclear Society. He is also the author of a nuclear reactor handbook prepared for the United States Atomic Energy Commission and has written several articles on heat generation and transfer for national technical publications.

ALUMNI HAS PAPER PUBLISHED

E. M. Magee is the author of "The Deuterium Isotope Effect on the Rate of Reaction of Hydrogen and Iodine" published recently in the Journal of the American Chemical Society. The paper is based on research conducted at Humble Oil & Refining Company's Baytown, Texas, refinery where he is a research chemist.

Active in American Chemical Society, Magee is attending the "Christmas Symposium" at Case Institute of Technology in Cleveland, Ohio, this week. This symposium on molecular physics in chemical engineering is sponsored by the ACS Industrial and Engineering Chemistry Division.

Magee holds the B.S. degree in chemistry from Texas University, and was a National Science Foundation fellow three years at University of Wisconsin where he received the Ph.D. degree in physical chemistry in 1956. He is a member of Sigma Xi and Phi Lambda Upsilon.

POWER CONFERENCE

A progress report on nuclear developments in the electric power industry will be among featured discussions at the 20th annual American Power Conference to be held at the Hotel Sherman, Chicago, on March 26–28.

Executives of a number of electric utility companies, at a forum on March 26, will describe the current status of the various nuclear reactor projects in which their companies are participating, and discuss plans for future research and development, according to Conference Director R. A. Budenholzer, professor of mechanical engineering at Illinois Institute of Technology.

The American Power Conference, which is held in Chicago each year, is sponsored by Illinois Tech in cooperation with 14 other colleges and universities and nine technical societies.

The nuclear power forum will be one of 30 sessions scheduled during the three-day meeting, which also will include a technical session on nuclear power generation.

The program will include approximately 90 papers covering a wide variety of aspects in the electric power industry and related activities. They will include addresses at luncheon meetings on each of the three days and at the All Engineers dinner on March 27.

New and exotic propellants, such as fluorine, boron compounds, and hydrazine, economics of fuel transportation, experiences in the operation of the first commercial supercritical pressure steam electric generating station, and high voltage transmission will be among subjects to be covered. The latter will be discussed by a group of foreign scientists whose countries have had greater experience in this field than has been the case in America.

In addition, one or more sessions will be devoted to discussions of the generation, transmission, and utilization of electric energy, use of pump storage for hydro-electric stations, steam and gas turbines, industrial power plants, steam gen-

(Continued on page 62)

Full-time, off-the-job GRADUATE

STUDY CENTER. New York's Coliseum Tower houses one of three special study centers set aside for W.E.'s Graduate Engineering Training Program. Other centers are in Chicago and Winston-Salem, N. C. Product design principles are one of the many technical subjects our engineers cover in *Introduction to Western Electric Engineering*, the first phase of the program.

ENGINEERING TRAINING
helps speed careers at Western Electric

Right now, Western Electric engineers are back "on campus" in a unique new Graduate Engineering Training Program. They're attending courses at special study centers established by the company in Chicago, New York and Winston-Salem, N. C. It's a rare chance to study advanced engineering and get full pay at the same time.

These "students" are guided by a teaching staff of top Western Electric engineers, outside experts and professors from leading universities. They're learning the latest technical developments . . . boning up on everything from manufacturing processes to computer applications.

When the program reaches its peak, some 2,000 to 3,000 Western Electric engineers will attend each year . . . studying in an atmosphere as close to a university graduate school as is practical for industry.

This engineering "university" was born because of the ever-increasing complexity of Western Electric's job as the manufacturing and supply unit of the Bell Telephone System. Today W. E. engineers are right in the middle of exciting fields like microwave radio relay, electronic switching and automation. Graduate engineering training is designed to spur their development and advancement throughout their entire careers.

How Graduate Engineering Training would work for you

The program gets under way after approximately six months on-the-job experience. First off:

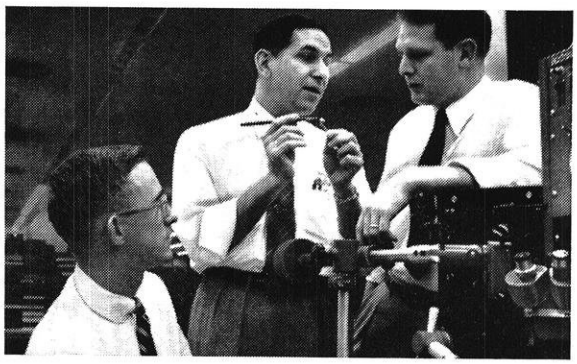
1. A nine-week *Introduction to Western Electric Engineering* helps you learn about your W.E. engineering field, sharpens your skills in getting ideas across. Technical subjects include communications systems, product design principles, military electronic systems.
2. Another nine-week program, *General Development,* starts after your first year with us, helps broaden and strengthen your engineering background. Besides technical subjects like engineering statistics, measurements and instrumentation, and electronics, you receive grounding in human relations and the socio-economic importance of engineering.
3. To meet continuing needs for formalized technical training, *Advanced Development* offers four-week courses tailored to the individual needs of the engineers selected to attend. These courses are designed to help develop creative engineering abilities. Computer applications, switching theory, feedback control systems, and semi-conductor devices and circuits are sample topics covered in this phase.

Besides taking part in the Graduate Engineering Training Program, engineers are eligible for our Tuition Refund Plan for after hours study at nearby colleges.

In short, there's a unique opportunity at Western Electric to develop a professional career . . . and work in the exciting world of communications.

Western Electric

MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM



Knowledge born in the classroom often sparks on-the-job ideas. These engineers are working on transistor manufacturing problems.

OPPORTUNITIES FOR ENGINEERING GRADUATES

(Supervisory and administrative opportunities exist in each field)

Analysis for manufacturing operations:
Machine and tool requirements—M.E., E.E.; Space requirements—M.E., I.E.; Test facility requirements—E.E.; Personnel requirements—I.E.; Electric power, light and heat requirements—E.E.; Raw material requirements—Chem. E., Met. E., Phy. Sc.; Procedures and processes—M.E., I.E., Time and motion studies – I.E., Investigation of manufacturing difficulties—M.E.; Quality control—M.E., E.E.

Planning telephone central offices:
Equipment requirements – E.E.; Power and cable requirements—E.E.

Development and design:
New machines and tools—M.E., E.E.; Material handling methods—M.E., I.E.; New equipment and processes—M.E., E.E.; Repair shop methods—M.E.; Testing facilities—E.E.; Testing methods—E.E.; Job evaluation studies—I.E.; Wage incentive studies—I.E.; Production control studies—I.E.; Improved chemical processes—Chem. E., Met. E., Phy. Sc.; New application for metals and alloys—Chem. E., Met. E., Phy. Sc.; Raw material test procedures—Chem. E., Met. E., Phy. Sc.; Service to military on electronic devices—E.E.

For further information write: Engineering Personnel, Room 1030, 195 Broadway, New York 7, N. Y.

• Western Electric has major manufacturing plants at Chicago and Decatur, Ill.; Kearny, N. J.; Baltimore, Md.; Indianapolis, Ind.; Allentown and Laureldale, Pa.; Burlington, Greensboro and Winston-Salem, N. C.; Buffalo, N. Y.; North Andover, Mass.; Lincoln and Omaha, Neb.; St. Paul and Duluth, Minn. Distribution Centers in 32 cities. Installation headquarters in 16 cities. General headquarters: 195 Broadway, New York, N. Y. Also Teletype Corp., Chicago 14, Ill.

Science Highlights

(Continued from page 32)

In the rolling process each layer of the sandwich undergoes the same amount of reduction in thickness. Rolled to a total reduction of 90%, the 5/16-inch thick stainless steel plates are reduced to a nominal thickness of .033 of an inch each. After cooling, the edges of the huge plate are trimmed and the thin-gage sheets are lifted from atop each other.

The sandwich technique has solved some vexing problems that have prohibited rolling of wide alloy and stainless steel sheets. For one thing, thin-gage sheets rolled singly become cool quickly and require tremendous mill power to achieve reduction as the cooling goes on.

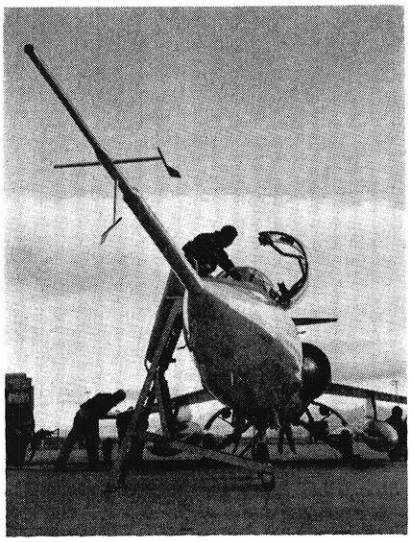
The sandwich technique offers many immediate advantages that have encouraged further experiments to refine the method. Because of its initial thickness, the sandwich tends to retain sufficient heat for the entire rolling operation. In rolling, the sandwich has the working characteristics of the carbon steel cover plates rather than the tough stainless or alloy steels inside. This minimizes the need for excessive rolling mill power requirements. Existing facilities at Homestead District Works are used to experimentally produce the light-gage "difficult to roll" alloy and stainless steel sheets.

The sandwich rolling project is one of several research efforts under way at U. S. Steel to develop metals suitable for missiles and supersonic aircraft.

MICROPHONE TESTED WITH ARTIFICIAL HEAD

"Oscar," a life-size artificial head, is used to test a rugged new transistorized microphone developed for mobile radio transmitters by Shure Brothers, Inc., of Evanston, Ill.

The magnetic microphone has a tiny transistorized amplifier built right in the microphone housing. The use of the artificial head was described at a meeting of the Institute of Radio Engineers at the Statler Hotel in Washington, D. C. The paper, "Transistorized Microphones for Vehicular Communications," was presented by two Shure

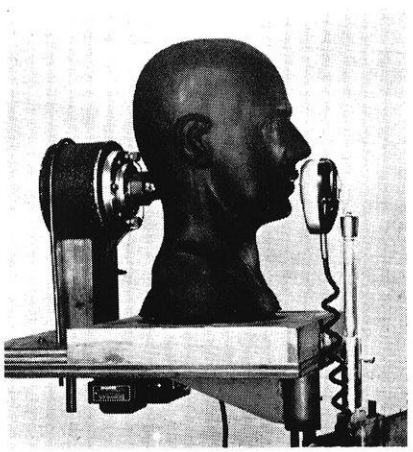


engineers, Leo Rosenman and Harold A. Johnson.

"In making acoustic measurements, particularly on close talking microphones, it is essential to approximate conditions of actual use as closely as possible," the engineers explained. Response curves on the Shure "Transistorized Ranger 505T" were plotted using the artificial head covered with skin-like plastic.

Overcrowding of radio frequency bands has created a need for increased intelligibility and reliability. Because of this, magnetic microphones are being used today in place of the familiar carbon microphone in many critical installations, Rosenman and Johnson said.

"The lower sensitivity of the magnetic cartridges compared to the carbon cartridges has been overcome by the introduction of the transistor, which has permitted the design of amplifiers small enough to be contained in the microphone housing," the engineers reported. "This brought about the development of the 505T transistorized microphone which can serve in many cases as a direct replacement for the carbon microphone with no transmitter changes."



FIGHTER TEST BOOM

That's not a new kind of weather vane protruding from the nose of Lockheed's missile-like F-104A (left)—it's a precision-instrumented "boom" used in flight testing the ultrasonic Starfighter. With a swarm of technicians giving it a pre-flight check from stem to stern, this specially equipped F-104A is being mission-readied at Lockheed's jet center in Palmdale, Calif. Approximately six feet long, the multi-assignment boom has a "nose" (center opening) which accurately measures airspeed and "arms" (T-shaped extensions) which indicate pitch and yaw angles. Note the large pylon fuel tanks suspended from beneath each wing. Both the single-seat F-104A and a two-seat F-104B are in quantity production for the U. S. Air Force.

AUTOMATIC MISSILE-FIRING BASE

"This goes one step beyond push-button warfare, for at the Talos Defense Unit you don't even need to push a button to send this weapon into action."

That was the description given by Dr. Elmer W. Engstrom, Senior Executive Vice President, Radio Corporation of America, of the Talos Defense Unit, the first completely automatic system for firing and guiding missiles to their targets. The base—an electronic control center which can go into action by itself in response to warning signals from remote outposts—was built by RCA on the proving ground here and turned over to the Defense Department on that date.

"A decade ago," Dr. Engstrom said in a brief speech preceding the presentation, "It would have seemed like a figment of science fiction to speak of a base that could fire a missile and guide it to its target without the help of a human hand. But here it is, before you, today."

The Talos Defense Unit (TDU) is composed of three structures—one a long, low concrete and steel building (316 x 80 feet horizon-

(Continued on page 42)

Tear out this page for **YOUR STEEL NOTEBOOK...**

Steel nest that hatched a smoother transmission

YOU'RE looking at a ring gear "nesting" three smaller gears. It's part of one of the smoothest shifting transmissions ever put in a car. But it was almost too expensive to build.

Getting this extra smoothness called for squeezing more gears into the same size transmission case. Nesting was necessary to save space. And the big ring gear had to be extra tough. The problem was to make it economically.

The manufacturer turned to Timken Company metallurgists —acknowledged experts in fine alloy steels. They showed how to save the cost of boring out each gear—by starting with Timken® seamless steel tubing. The hole's already there. And the Timken steel has all the toughness a transmission needs. It's another example of how Timken Company metallurgists solve tough steel problems.

WANT TO LEARN MORE ABOUT STEEL OR JOB OPPORTUNITIES?

For information about fine steel, send for "The Story of Timken Alloy Steel Quality". And for help in planning your future, write for "Better-ness and Your Career at the Timken Company". Just drop a card to The Timken Roller Bearing Company, Canton 6, O.

TIMKEN *Fine Alloy* **STEEL**

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

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

Science Highlights

(Continued from page 40)

tally, 30 feet tall) containing the control center, and the other two circular magazines with the launchers, resembling anti-aircraft guns, in the center and numerous cells on the perimeter to house the missiles themselves. All three are built to withstand the pressures of the missile take-off and near misses from enemy bombs, and all are air-filtered for protection of the equipment and personnel.

In general terms—and within the bounds of military security—this is what the TDU is designed to do:

Suppose a fleet of enemy bombers, or perhaps a single missile, is detected by one of the numerous warning systems spanning the North American continent. A signal is sent to the TDU, where it is received by a series of data-handling and computing machines. These decode the information and analyze the number of attackers, their location, course and speed of approach.

Next a scheduling and programming computer sets the logical points of interception. Then it starts the machinery to load the missiles onto the launchers and fire them at the proper time and in the proper direction.

In this stage—still without the lifting of a human hand—the blast-proof concrete-and-steel cell doors swing open to release the missiles the computer has selected. The cells have reinforced concrete walls two feet thick and are so constructed that, should one of the missiles go off by mistake, the blast would go upward through the roof rather than horizontally to detonate the other missiles.

As a cell is opened, one of the launchers circles to face it and sends a small cart down a railed bridge to the door. Swiftly the missile is loaded on the cart and rolled onto the launcher. Then the launcher swings to the desired position of fire. After an automatic check-out—and at the proper time—the projectile is fired. All of this is done automatically.

There are two stages of flight after the initial upward thrust. First the missile follows a guidance beam to the vicinity of the target. This is a version of RCA's precision, long-range, high-power instrumentation radar which has been tested by the U. S. Bureau of Standards and found to be the most accurate radar in existence. Second, as the missile approaches the target, a secret "homing" device senses its presence and "locks on" to the target to close in for the kill.

During all of this action, the military personnel at the TDU merely observe and monitor the performance of the equipment. However, several modes of operation that are less automatic and employ some human operators are possible. Both the equipment and the operators are maintained in a constant state of readiness by use of automatic practicing devices and system-checkout equipment. These employ tape, bearing data on a simulated engagement, which is played through the system.

One of the numerous advantages of the "Talos" unit is the fact it can fire single missiles or numerous missiles simultaneously at a number of different targets and can continue to fire over an extended period of time. Also, it can carry either a high-explosive or nuclear warhead.

The "Talos" missile is about 20 feet long, 30 inches in diameter and weighs 3,000 pounds. It is accelerated by a large solid fuel booster rocket some 10 feet long, which is jettisoned when the missile reaches cruising speed. At this time the main ramjet engine, using kerosene as fuel, ignites and provides thrust to keep the missile at constant speed throughout its flight. The engine develops 40,000 horsepower.

Completion of the land-based unit now enables the Army to use the same weapon produced for the Navy, an important factor from an economy standpoint.

RCA began work on the design and construction of the land-based unit immediately after it was awarded the prime contract by the Navy in January, 1955. For economy reasons, it constructed only a portion of a tactical system at White Sands, containing only those items necessary to check over-all system performance and test-fire the missiles. However, the complete Talos Defense Unit is designed and ready for production. RCA performed the bulk of its laboratory and production work at the Missile and Surface Radar plant of its Defense Electronic Products unit at Moorestown, N. J., and the Talos Unit itself was assembled at White Sands.

FREE BOOKLET

"Grit Collecting and Grit Washing Equipment," Book 2571, is the latest publication presently being distributed by Link-Belt Company. This 28-page book is profusely illustrated, tab indexed, and three-hole punched for permanent retention in the Link-Belt Sanitary Engineering Binder.

Book 2571 contains design data on seven types of grit collectors, two grit washers, and the Tritor screen, which is a combination grit collector and mechanical screen manufactured by Link-Belt Company. Essential equipment is shown for numerous applications. Detail drawings and specifications are included to assist the engineer in the preparation of his drawings and specifications. The designs include velocity controlled chambers for shallow or deep chambers, chambers with dewatering and washing screws or inclined plane dewatering troughs.

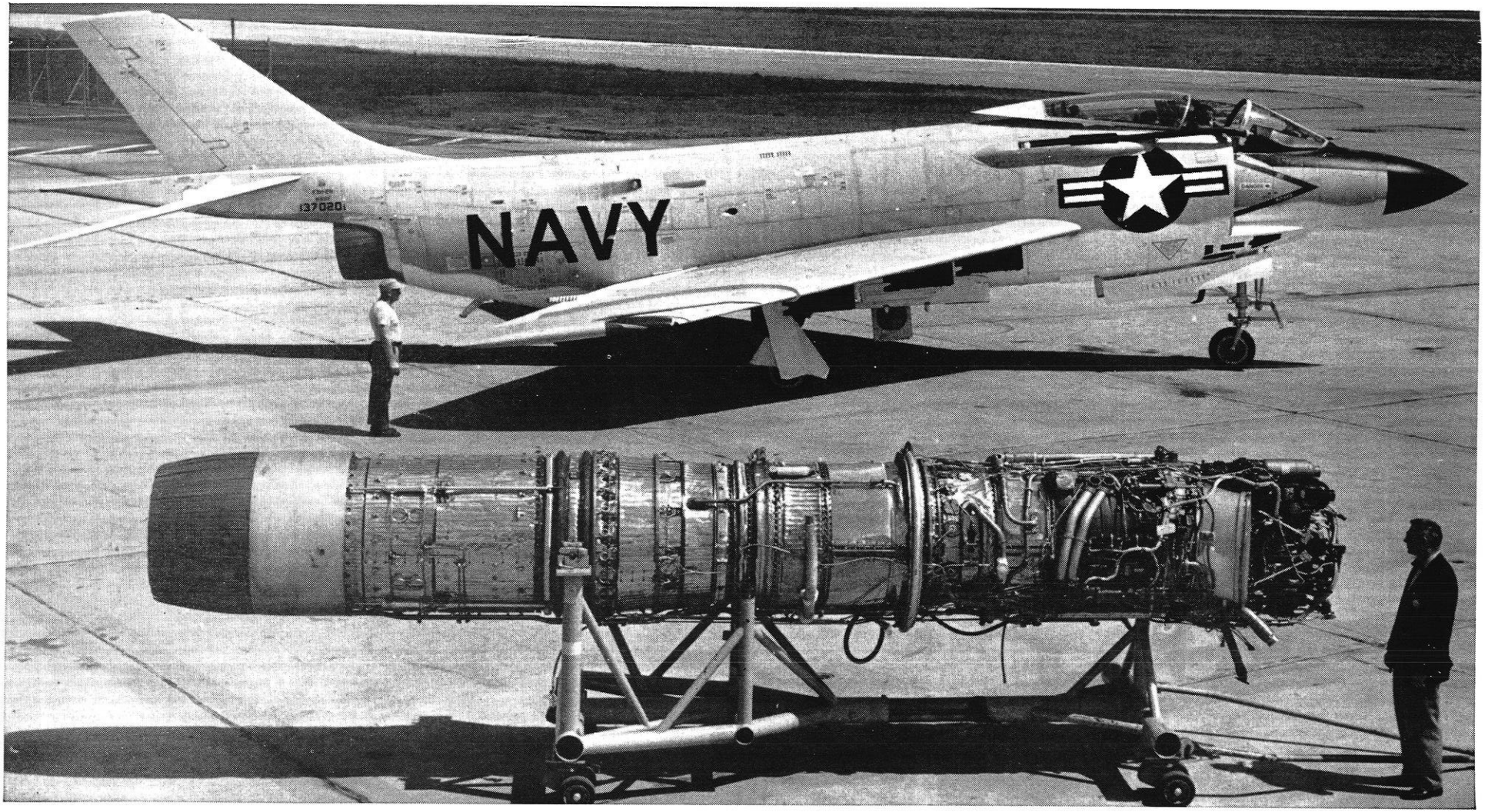
Link-Belt Company has been manufacturing grit collection equipment, along with a complete line of water and sewage treatment systems, for over 25 years. Book 2571 illustrates the various types of rugged Link-Belt equipment that separate grit and similar detritus from sewage with little or no maintenance.

For your copy of Book 2571, write to the Link-Belt Company, Dept. PR, Prudential Plaza, Chicago 1, Illinois, or the nearest Link-Belt District Sales Office.

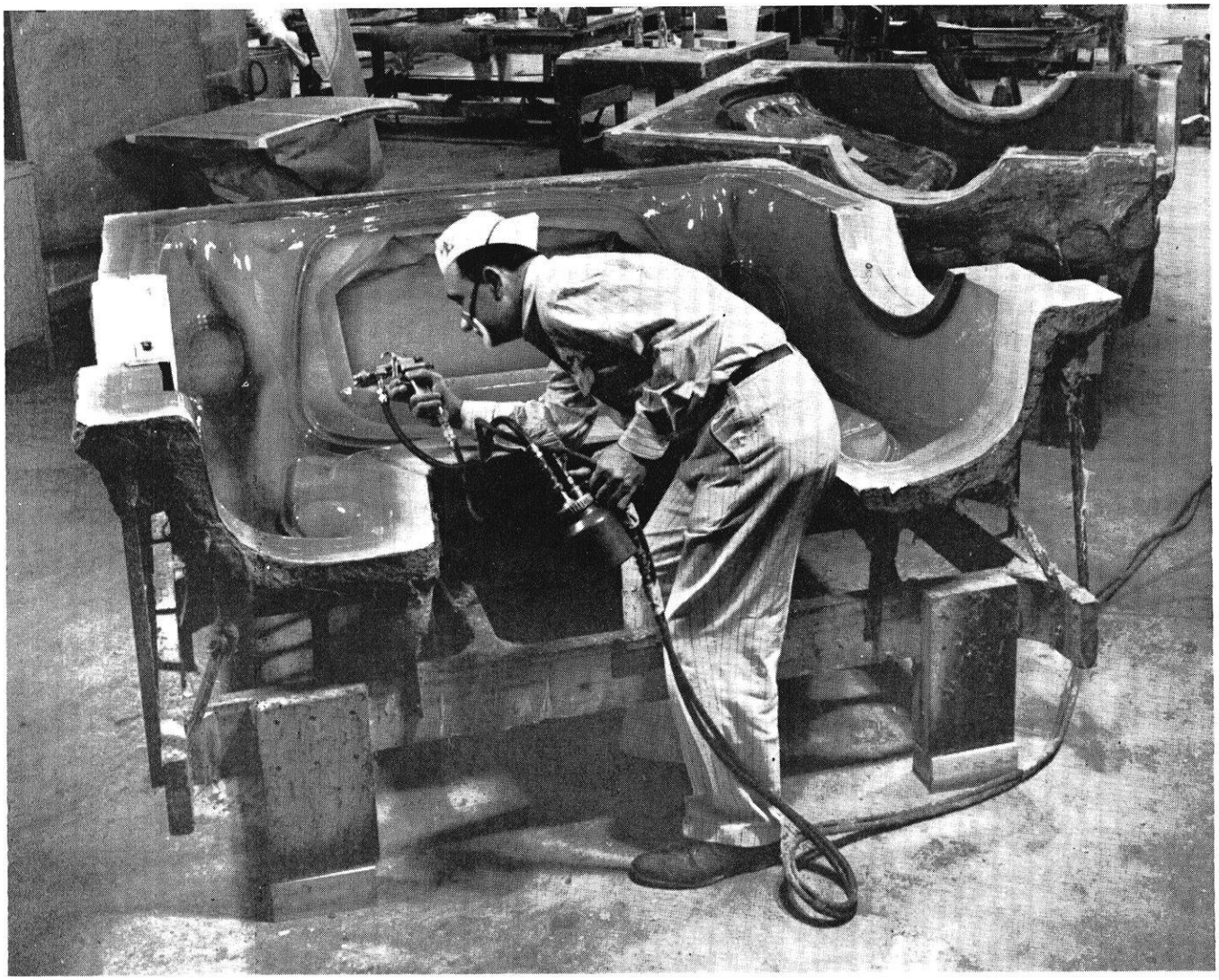
NEW FEATURES FOR HEAVY-CONSTRUCTION EQUIPMENT

The heavy-construction equipment industry is relying on new design to keep afloat in a tide of rising labor costs, narrowing profit margins and sharpening competition, reports Product Engineering, McGraw-Hill publication. Increased wages and equipment costs are cited by a sizeable segment of the 350 major equipment-builders questioned by the magazine as the

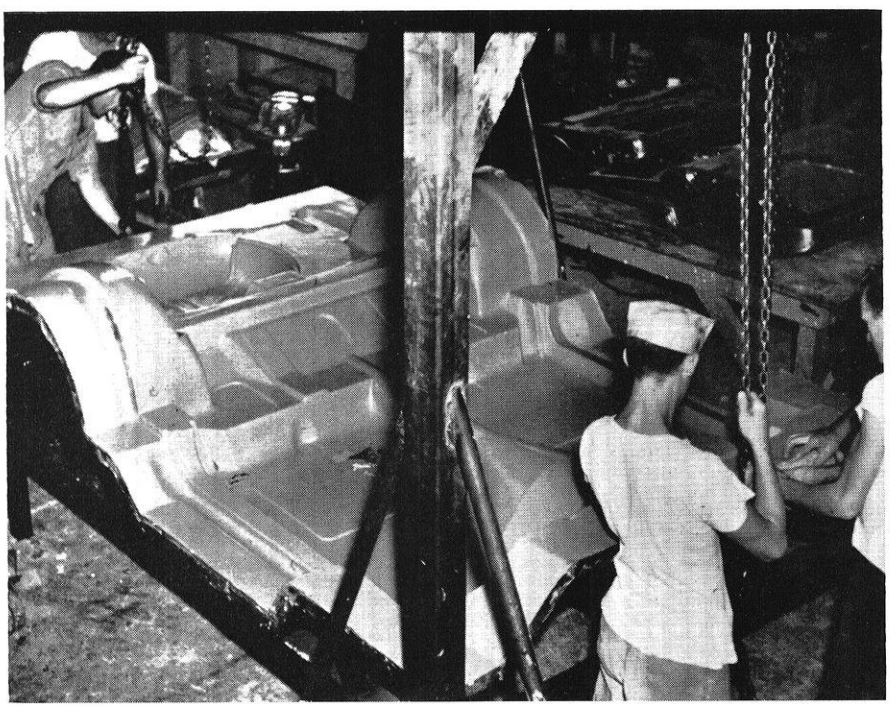
(Continued on page 70)



INDIANAPOLIS, IND.: (Special) It takes a lot of teamwork to carry out the missions of carrier-based fighter pilots of our New Air Navy. And, it takes a lot of teamwork to design, develop and produce a fighting machine for these dedicated men. Such teamwork is exemplified in the Allison J71 turbo-jet engine with afterburner (above) which powers the Navy F3H-2N Demon all-weather fighter-interceptor. Many Allison engineers--out of school only a few years ago and now well entrenched on the Allison Division team of General Motors Corporation--contributed to the operational success of this powerful engine. If you would like to know more about the Allison team, write Personnel Department, College Relations, Allison Division of General Motors Corporation, Indianapolis, Indiana



In the hand lay process of making plastic body panels the molds are made of fitted hardwood. The inside mold surface receives three gel coats of polyester resin as part of a sandwich construction.



At the completing of the vacuum bag process, the resin is baked for 24 hours and the mold separated.

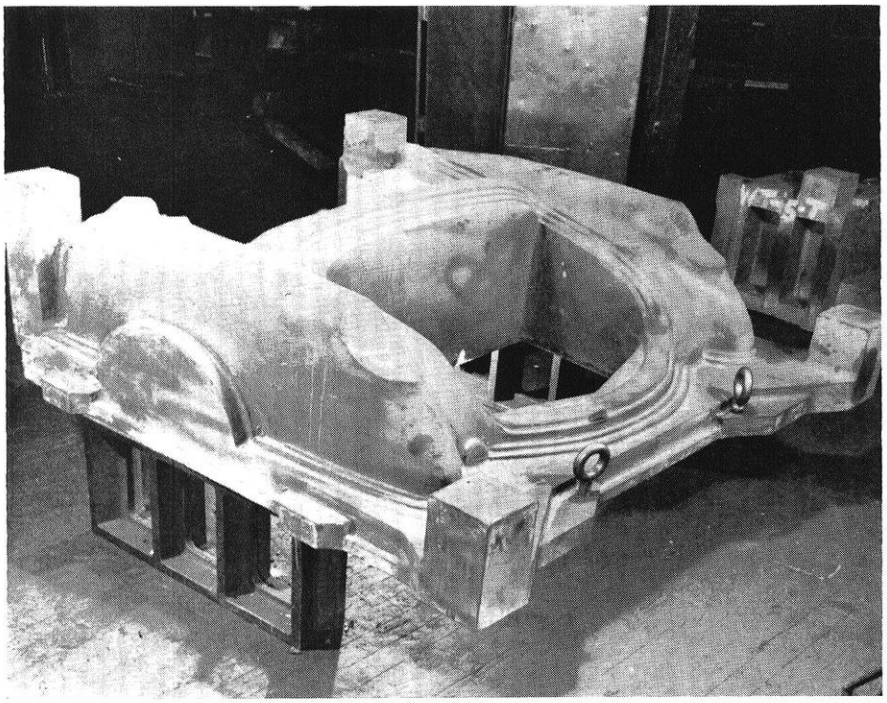
Fiberglass

(Continued from page 17)

also acts as an insulator to dampen road and engine noises. It will not rot nor rust and when painted will give a finish that will not fade, peel, or require waxing.

Repairing auto bodies with fiberglass is not limited to glass bodies alone, but it can be satisfactorily used on metal bodies. Chevrolet engineers have developed a kit that requires only a few tools, and is easy to use. The repairing begins by cleaning the area to be worked with a hydrocarbon solvent like benzene and sanding approximately 6 inches beyond the portion to be patched. Then the surface is dented so the glass buildup will match the contour of the body. After a fine coat of resin is placed on the metal it is covered by a resin saturated glass patch.

(Continued on page 46)



This is a typical rough casting used for the matched metal die process. The casting is cored to allow the passage of steam.

Fiberglass

(Continued from page 44)

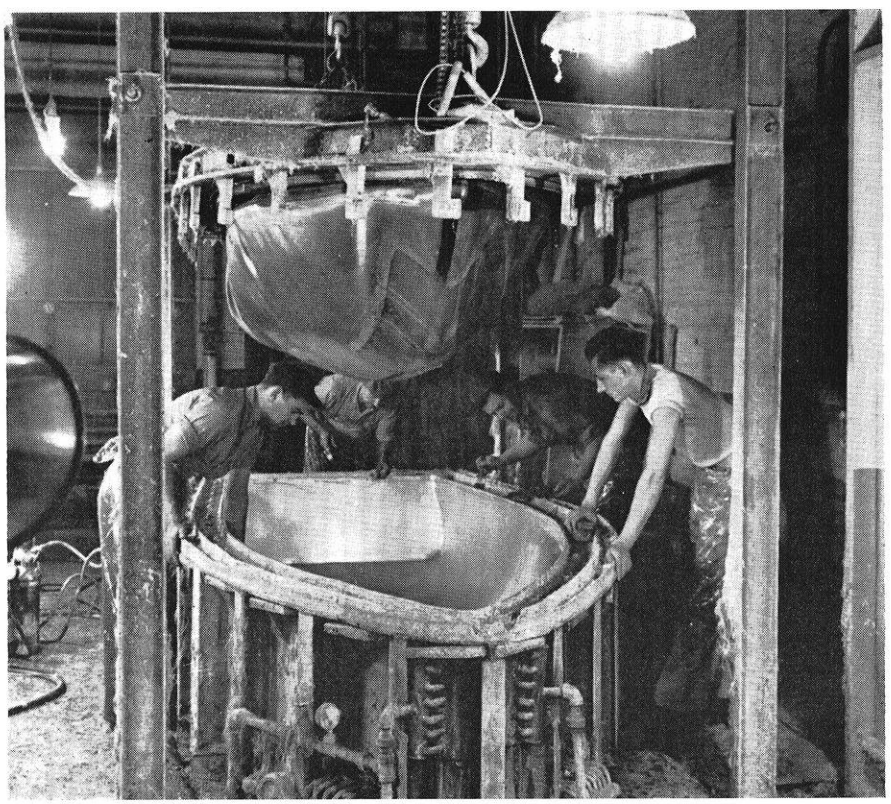
This process is repeated for every layer, and the bubbles and wrinkles are removed each time. Once the layer build-up is completed, a cover patch is placed over the surface to keep moisture out. After the curing is completed, taking only a few minutes, the surface is ready to be worked and sanded like metal. This kit, like numerous others on the market today, is an inexpensive and practical way for amateurs as well as professional body men to repair their cars.

Recently the Chrysler Corporation developed some plastic dies that would withstand over 30,000 psi in stamping out steel parts. Although the plastic dies are not used for long production runs, their primary advantage is the speed with which they can be produced. Plastic dies can be made in three or four weeks as compared to three to eight months for conventional steel dies, and if they would be used on a large scale there would be a 70% saving in cost.

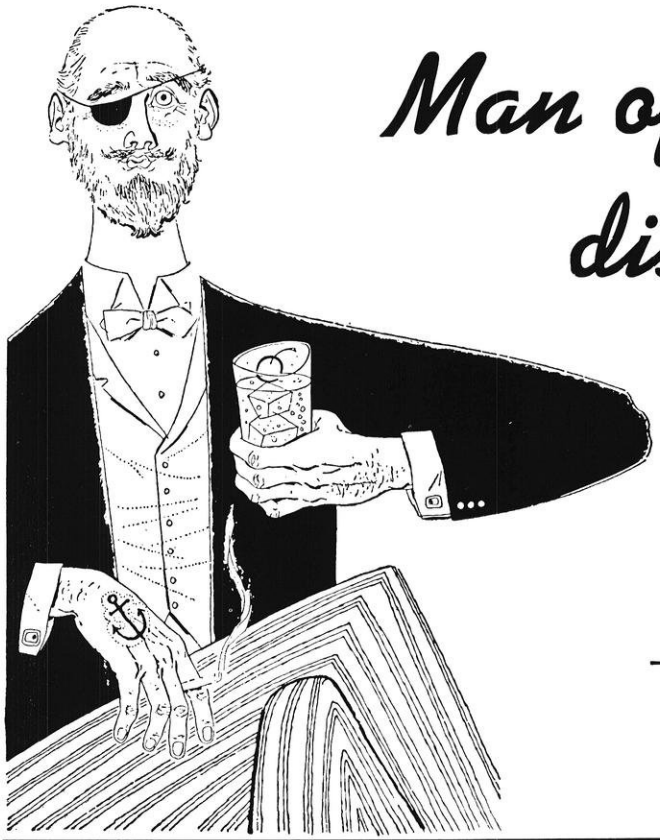
Plastic dies are produced by placing the liquid plastic in a mold and baking in an oven. After the die is taken from the oven, the plaster case is removed, and the die is finished and polished with sandpaper. The dies are fitted to the presses by steel plates attached to the plastic. Although the plastic dies don't last as long as the steel ones, they are ideal for short production runs and make frequent changes possible on low production models.

Although much time is required for production and finishing operations, engineers are overcoming these disadvantages and there is an increasing demand for the new material. Plastic bodies have been proving themselves to the public as demonstrated by Chevrolet's Corvettes, Kaiser-Darrins when they were produced, and numerous experimental and "futuristic" cars developed by the manufacturers and auto enthusiasts. Several new model trucks have fiberglass panels. Rear semi-elliptical springs in cars and trucks may possibly be replaced with one-piece fiberglass springs.

Fiberglass has not only aroused intense interest in the auto industry, but it is also being used for numerous marine, industrial, and household applications. A large shipbuilding concern is using it for panels on walls because of its economy and high quality appearance. Many industrial firms use the plastic for materials handling and storage, and it is also used for house awnings. Plastics are becoming more popular each year and may well become the ideal material for automotive body manufacture. Fiberglass has opened a new field in safety, economy, and durability. **THE END**



Here the pressure bag process is used in the construction of a fiberglass boat hull. The pressure bag is attached to the male die.



Man of distinction . . .

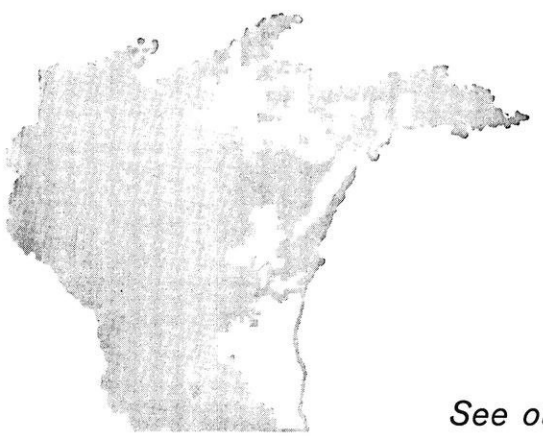
Man of distinction? Of course you plan to be one. Who doesn't? But not like this slightly ludicrous gentleman at the left who exhibits some of the popular advertising concepts of distinction.

True distinction is based on achievement — and there is plenty of opportunity for that at Wisconsin Electric Power Company.

Opportunities for achievement and success are to be found in abundance at Wisconsin Power Company by young engineers of skill, vision and initiative. Problems are here for you to solve — rewards are here for you to earn. Opportunities for personal growth and advancement are unlimited.

A wide variety of interesting work is available. For example, you may take part in designing and building power plants, substations, electric and gas transmission and distribution lines. You may help solve chemical engineering problems, create rate schedules, work on special engineering and economic studies. You may help our industrial and commercial customers solve their power problems. As you grow in stature, you may design electric systems, supervise operations. It is quite possible you may take part in the development of the exciting new techniques of producing electric power from the atom.

Whatever your work may be when you begin your career here, you may be sure that it will be worthy of achievement and will contribute toward your becoming — some day — a real "man of distinction."



We invite you to begin your career here . . . and grow with us!

The area we serve extends from the Wisconsin state line on the south into upper Michigan on the north. It is blessed with a wide diversification of economic activity — including large industrial centers as well as the business and manufacturing activities of many small communities with their surrounding farm areas.

Demands for our services are so great that we are now in the midst of a 10 year expansion program which anticipates the practical doubling of our business within that period. *We invite you to GROW WITH US!*

See our representative when he visits your campus

WISCONSIN ELECTRIC POWER COMPANY SYSTEM

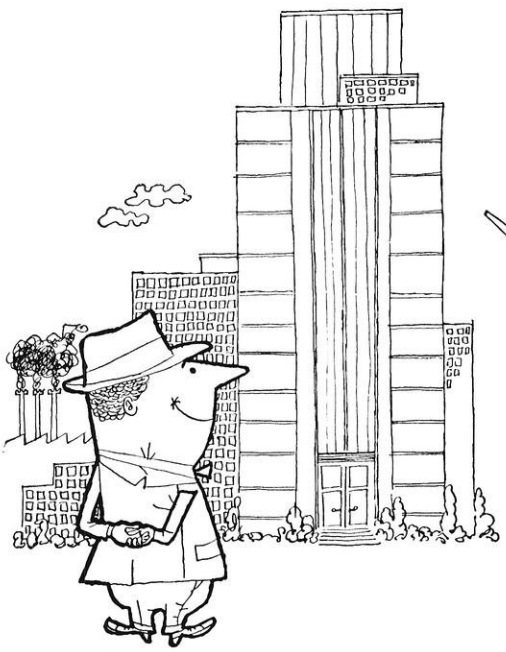
Wisconsin Electric Power Co.
MILWAUKEE, WISCONSIN

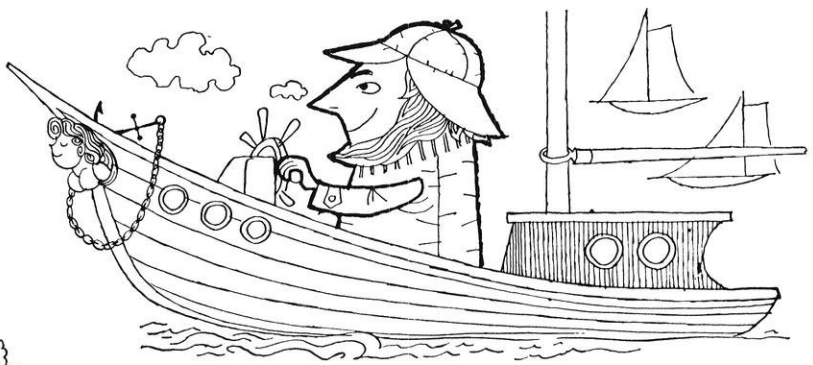
Wisconsin Michigan Power Co.
APPLETON, WISCONSIN

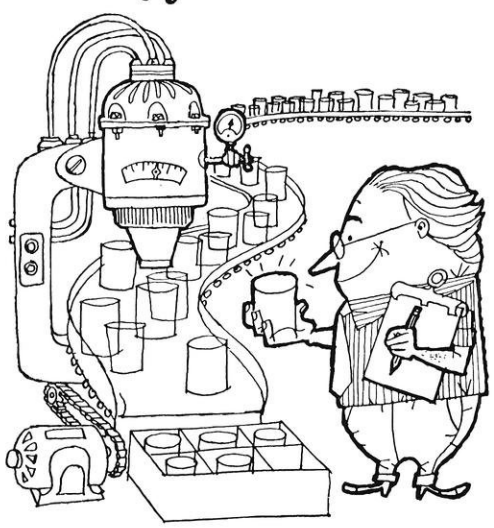
Wisconsin Natural Gas Co.
RACINE, WISCONSIN

Look around you...

PPG *makes big things happen in paints and industrial finishes*







You're living in a world of color. Man takes a brush, dips it into paint, cloaks the drab with new cheerfulness, converts the dreary into compelling beauty. But paint means so much more than mere color.

In addition to soft, pastel hues, home owners in Miami want a house paint that stands up to constant salt air breezes, the blazing rays of a tropic sun, intermittent heavy rainfall. Building superintendents in Gary want a surface coating unaffected by chemically active industrial gases and fumes, extremes in humidity, frequent changes in wind direction. Fishing fleet operators around Puget Sound want an exterior boat finish that resists biting winds, blizzards and protracted cold. The production engineer in a large Atlanta cannery wants a food container coating impervious to chemical reaction, yet taste-free. Yes, there's more—much more—to paint than mere color.

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75th ANNIVERSARY 1883—1958 PPG

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Wisconsin Society of Professional Engineers

WITHIN recent weeks, related developments have provided fresh evidence for those who contend that there is a severe shortage of engineering and scientific personnel and, at the same time, for those who maintain that there is not a shortage. This contradictory situation has existed since 1949 when one of the largest engineering graduating classes in history led to predictions of an oversupply—followed a year later by the Korean War, the increase in defense spending and the subsequent high demand for engineering and scientific personnel.

Since then, many leaders in public life and industry have expressed a fear that the output of trained engineering talent has been lacking in numbers to the extent that the nation's security is in jeopardy, and have called for various forms of "crash" programs to produce more engineers. Others have contended during this period that the "shortage" was synthetic, or highly exaggerated.

Recently, defense budget cuts caused the layoff of a number of aircraft employees, including some 1,000 engineers. This resulted in extensive publicity to the effect that the "shortage" was over and that more engineers would be "laid off" as further cuts were made in defense spending. Now, the launching of the Russian earth satellite has resulted in even more extensive statements and publicity that the United States is trailing Russia in scientific achievement because we have not produced enough engineers and scientists compared to the USSR. New demands are being voiced for "crash" programs to train larger numbers of engineers and scientists. Some leading members of Congress have stated that they will move for extensive Federal scholarship programs when the legislators resume their work in January. In the face of this "on-again off-again" situation, the engineering and scientific professions and the general public are understandably confused and uncertain.

ENGINEERS' CREED

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

I PLEDGE

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

The validity of each point of view regarding the supply of engineers depends on interpretation and analysis of data which has been published in great detail and variety. Despite this wealth of information, however, both points of view probably can be defended if the definitions of two terms—"engineer" and "shortage"—are made by the respective groups.

The National Society of Professional Engineers has observed and studied the various statements, reports and analyses during this period. We recognize an obligation to the nation's economy, the engineering profession and to the young people who may be considering the choice of an engineering career, to lend assistance in the clarification of these conflicting viewpoints, and to the extent possible to assist in the selection of the best alternatives in the future.

It is most imporant that the nation not rush into hastily improvised actions having to do with the education of engineers which would only aggravate a complicated and difficult condition that cannot be solved by spur-of-the-moment solutions.

Based on close observation of the engineering profession's growth and intimate experience in professional engineering activities, NSPE believes that the following factors are sound observations for future guidance:

1. Special action to increase today's supply of engineers is not considered necessary or desirable since engineering enrollments are at an all-time high and are continuing to increase.

2. An artificial stimulation to further increase enrollments in engineering will severely handicap institutions that devote adequate attention to the capable students.

3. Assumption that Russia launched the earth satellite before the United States solely because it had trained more scientific personnel in recent years than this country, we believe is not valid and could lead to unwise and damaging decisions. We believe it would be more logical to assume that the controlling factors were priorities assigned to money and emphasis rather than a shortage of technical personnel in the United States.

4. Emphasis now more than ever should be placed on quality rather than quantity. Potential engineers should be better grounded in fundamentals when they enter the engineering educational program and should be better informed as to the qualifications essential for an individual to become a successful engineer.

5. In view of the present limitations of facilities and faculties, the substantially increased enrollments in our engineering institutions are causing serious difficulties at the present time. Any program which will substantially add to the present number of students must in-

(Continued on page 52)

Meet the President

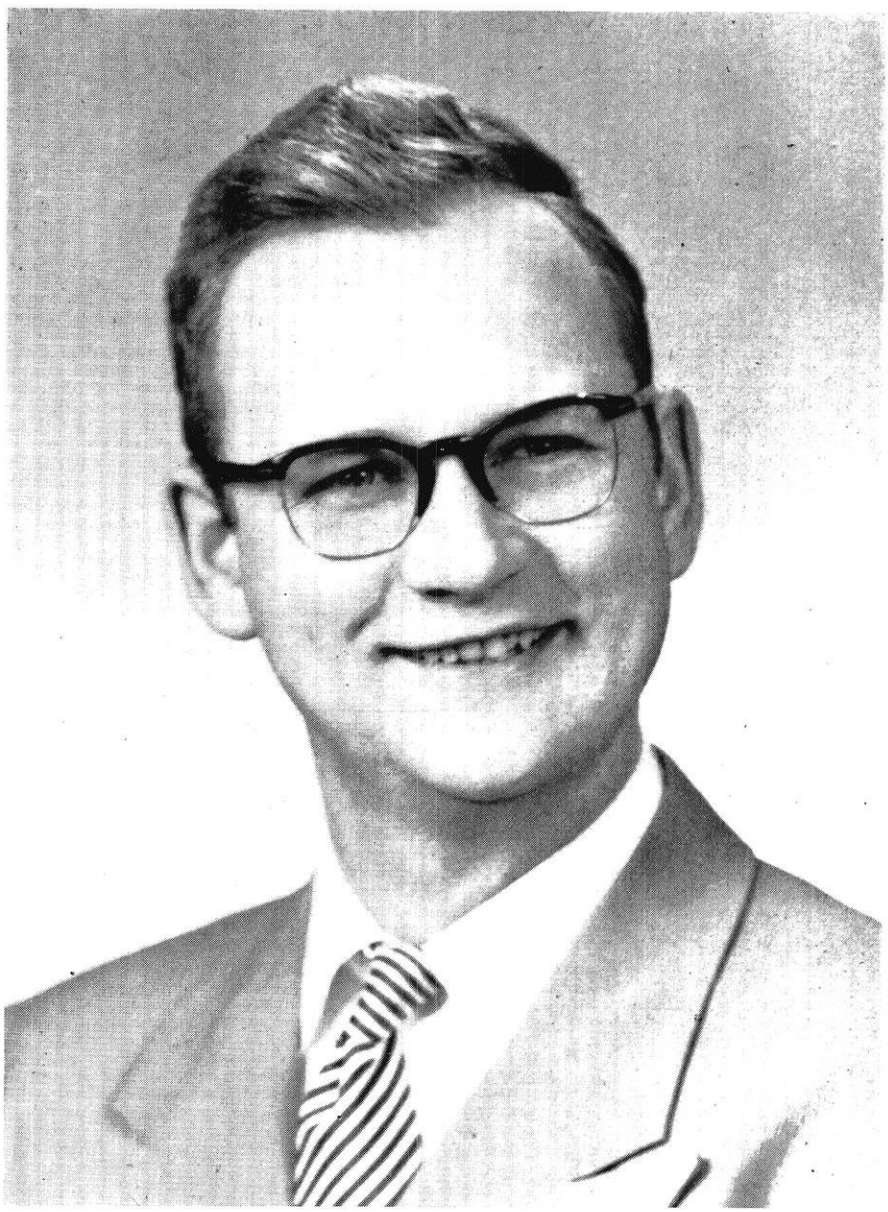
WALTER E. HESTEKIN, President of the Northwest Chapter, was born at Eau Claire, Wisconsin, on August 7, 1924. He graduated from Eau Claire High School and entered Wisconsin State College at Eau Claire. World War II arose and Mr. Hestekin left the College to spend three years in the Navy, a portion of which time was spent at the University of Wisconsin. He received his B.S. degree in Mechanical Engineering from Wisconsin in 1947. He is a member of Tau Beta Pi and Pi Tau Sigma, honorary engineering fraternities.

Upon graduation he joined Hovland Sheet Metal, Inc., mechanical contractors of Eau Claire, Wisconsin. Since 1952, he has been an officer of the corporation and is currently serving as Treasurer.

Mr. Hestekin is registered as a professional engineer in both Wisconsin and Minnesota. Since joining the Northwest Chapter of W.S.P.E., he has served as its Assistant Secretary-Treasurer, Secretary, Vice President, and now President.

He is also a member of the Eau Claire Board of Heating Examiners and Appeals, the Chippewa Valley Sheet Metal Contractors' Association, and the Masonic Lodge.

On January 3, 1948, he was married to Beverly Rekstad of Eau Claire. They are the parents of three children, Kjellrun 9, Susan 7, and Chris 4. Mr. Hestekin enjoys fishing, camping, boating, and curling. He is also an active Scout Leader, having been an Eagle Scout as a youth.



Walter E. Hestekin.

W.S.P.E.

(Continued from page 50)

clude means to resolve these limiting factors.

6. It should be emphasized that projects such as the earth satellite, guided missiles, etc., depend on highly advanced technology — a mere increase in numbers of those with first degrees will not provide the type of highly advanced technical knowledge which is necessary. It should also be noted that any program based on present needs will not succeed in solving today's technological problems. A program starting today will not produce a single highly qualified engineer or scientist for at least six years.

7. Experience has shown that we have wasted engineering talent by using it at a level below that which it is capable of performing. Improved utilization of engineering talent can do more for an immediate need than any other single program.

SOUTHWEST CHAPTER

The Southwest Chapter met at the Cuba Club on Monday, January 27, 1958. At this meeting certificates of registration were presented to newly registered engineers by Dean Kurt Wendt.

An Aerial Tour of Wisconsin was then given to members of the chapter by Mr. Carl E. Guell, Education Consultant, State Aeronautics Commission. The tour was by means of slide projection taken at heights of 600 feet to 8,000 feet and was most colorful. Mr. Guell is an air force reserve pilot and his photographic record and commentary made this one of the outstanding meetings of the year.

The Engineers' Week Committee of Southwest Chapter has made final plans for Engineers' Week which is February 16–22. Under the leadership of Clarence G. Extrom a well rounded plan of activities has been planned for the week.

The Engineers' Week dinner will be held in the Great Hall of the Memorial Union, February 18, 1958. Leading senior engineers of the University and from Platteville will be guests of the chapter.

Several radio and television programs will be presented. The Education Committee of Southwest Chapter, Paul Fluck, Chairman, will also announce during Engineers' Week the prize winners in the essay contest which is sponsored statewide by the W.S.P.E. Subject of the essays, submitted by high school students throughout the state, is "The Future In Engineering For Me."

NORTH WEST CHAPTER

January 2, 1958 Meeting
Engineers Hear Assessor

George Kumferman, Eau Claire's City Tax Assessor, spoke to the Northwest Chapter Wisconsin Society of Professional Engineers Thursday evening in Eau Claire Hotel's Holiday Room. His subject was "The Tax Assessor's Problems" which he developed along the lines of valuations for real estate, and the personal property tax factors. Property taxes, he said, made up approximately 48% of the taxes collected last year in Wisconsin. The state tax commission, he added, has jurisdiction over all tax assessors in the state.

He described the reproduction cost method of figuring assessments on homes and other structures in Eau Claire, and voiced an opinion that 90% of the homes fall into the classifications recognized as classes 4 & 5 & 6, with class 5 being considered an "average home". He also outlined the changing costs variations in assessments by appraisal as compared with the so-called "windshield assessments" which some out-of-state assessors have been accused of making when merely driving past the premises in some instances!

The "uniformity rule" when making assessments, allowing for depreciation and changes to properties, he mentioned, are principles which held important in order to avert undue complaints from taxpayers. In Eau Claire, it was said, homes were assessed on the 65% of total value principle, and the assessments are made between January and May anually, the approximate total in values last year being 74 million dollars worth of real estate. Some 1400 tax assessments were made for personal property tax purposes, he continued, admitting that because few people seemed to know very much about personal property taxes, the situation had proven somewhat more difficult of administration than the customary property tax assessments matter. Their basic rule in his dept, he emphasized, was "Be fair to everyone". Inasmuch as the Board of Review for city tax assessments meets in July each year here, Kumferman concluded saying that the best time to make requests for adjustments was prior to that time, and he also mentioned that a rate of 1½% straight-line depreciation on homes was considered satisfactory for the first 20 years, the depreciation scaling down thereafter to a maximum total of 60% depreciation while a property in normal circumstances remained useful and/or habitable.

A question-and-discussion period followed, with much interest in evidence, not only by local people but also by engineers from Rice Lake, River Falls, and other cities. City Director of Public Works Neal W. Bartholomew introduced Kumferman and led the discussion period with the speaker answering questions.

Chapter President Walter E. Hesttekin presided, and in the business session which followed announced that a state essay contest had been launched to encourage 9th to 12th grade school students in taking up the profession of Engineering for careers, the subject for the essays being, "The Future in Engineering For Me". He appointed the following committee of judges to review entries from this area of west central Wisconsin: Chairman Dale E. Gordon, with L. G. Arnold, Geo. Becker, W. W. Wilson, Ray Gavic, O. A. Ayres, Robert Lundgren, Geo. W. Young, H. J. Fischer, G. N. Leser, and E. W. Deterling.

The contest concludes during the traditional "Engineers Week" observed annually as the week in which Washington's Birthday occurs. Chairman of "Engineers Week" for the Chapter this year is Dale E. Gordon, of Wis. State Highway Commission. Hestekin stated that arrangements are being made to obtain state organization officials from Madison to participate in the banquet meeting during "Engineers Week" to present certificate awards to three Engi-

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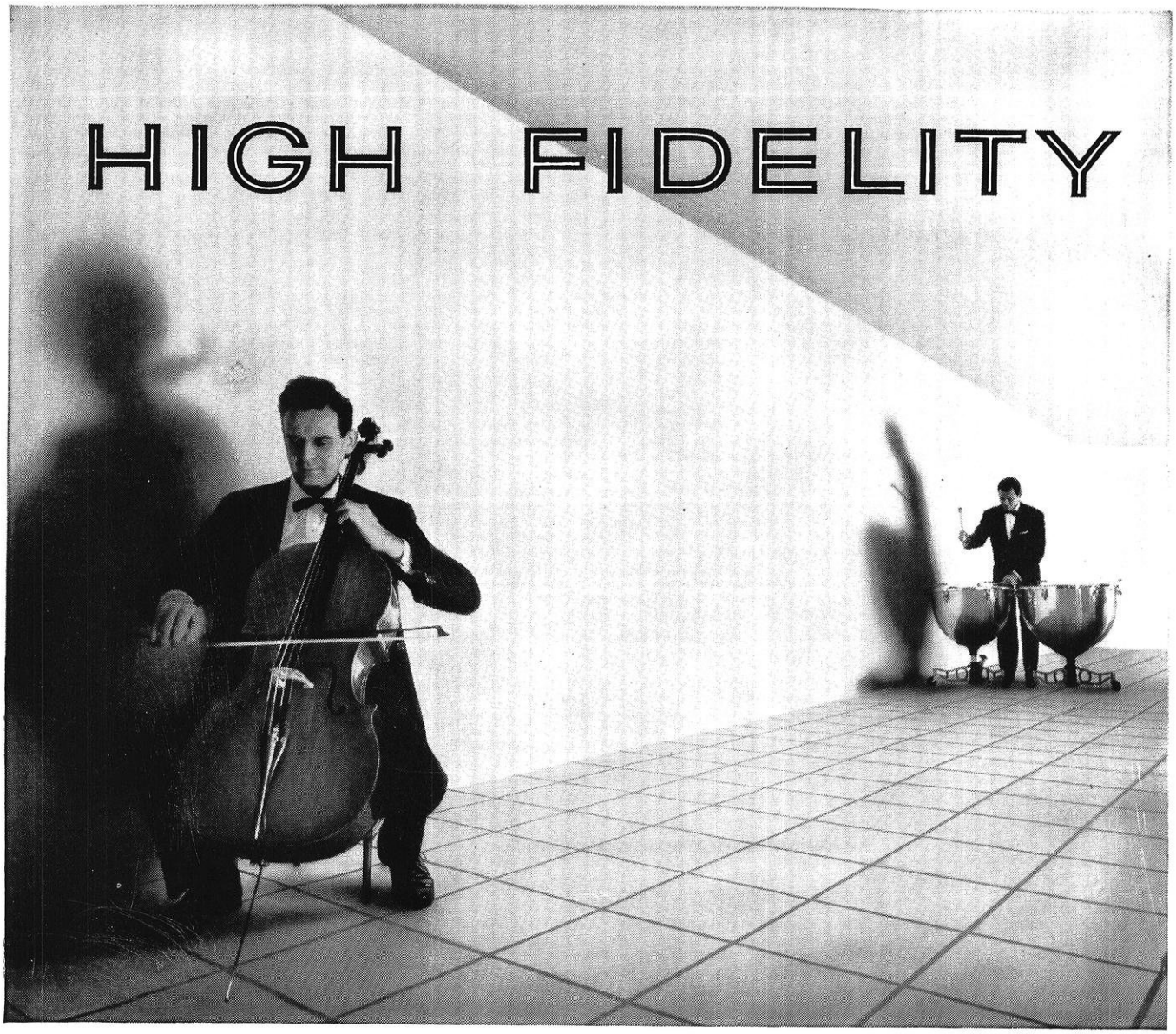

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RCA offers careers in research, development, design, and manufacturing for engineers with Bachelor or advanced degrees in E.E., M.E. or Physics. For full information, write to: Mr. Robert Haklisch, Manager, College Relations, Radio Corporation of America,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

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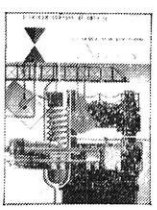
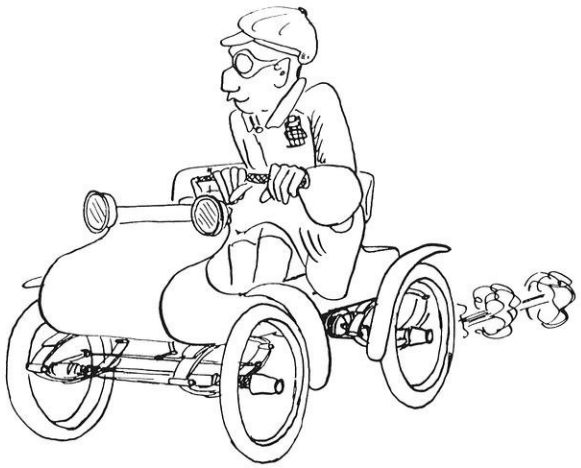
CITY AND STATE_____

COLLEGE_____ DEGREE_____

DATE OF GRADUATION_____





THE ENGINEER OF YESTERYEAR

by Dick Soref

April 1912

THE class of 1912 has set a precedent in the adoption of the St. Patrick's theme followed by many of the engineering schools throughout the country,—a precedent full of possibilities for future development. Though we have always taken pride in our spirit of sticking together, we have never before had a day which was peculiarly our own. We have taken major parts in all-university festivals; we have held our own in inter-college competitions; but we have never had a celebration which was distinctively ours, to shape as we might choose.

In the other engineering colleges which have adopted St. Patrick as their patron saint, the celebration has grown in popularity and in significance each year. It has brought the engineers of the student body, the faculty and the alumni in closer touch and sympathy with one another. This year has provided the opening for us here at Wisconsin. It has given us some little idea of what the day may be brought to mean. "St. Patrick was an Engineer" is being sung throughout the University. Next year when the 17th of March comes round, we will have another chance. Why not try to make it a still more notable Engineers' celebration? Expand it beyond the parade and the minstrels to a day when every engineer cooperates with every other engineer in showing the whole University that he is glad and proud to be an engineer.

October 1913

The campus of the University of Wisconsin, ranking first in beauty of all college campuses of the West and middle West, presents a view that is enchanting in its picturesqueness. No matter from what angle viewed, our campus is naturally beautiful . . .

To every one is Picnic Point visible. Even the Agric is allowed the satisfaction that comes to the Hill student or to any of the denizens on the north half of the campus from gazing out of a classroom window at its alluring tranquility. Perhaps the best view of

the peninsula is obtained from the top of the toboggan-slide where one sees it from the greatest elevation on the campus. The landscape is thus made to include not only the Orchard and University drive but also the northern shoreline of the lake, a small bit of which helps define the slender neck of land terminated by Picnic Point.

An aid to the general charm of the campus is the location of the buildings. Two avenues of stately structures flank the broad expanse of green ascending the hill to Main Hall. When one considers that the engineering building is located just half way up the incline on the north side, engineers of all classes may congratulate themselves. For who has not stood in its sunny portals and watched the interclass-hour procession that for fifteen minutes enlivens the north walk as it does nowhere else around the "U." All go by, from the chemist leaving his dusty retreats in the old Chem Engineering building to the blazee co-ed who flits and sometimes slips merrily by from an hour's session with some antiquary on the Hill from whom she has absorbed, seemed to absorb, Greek or Romance language. The engineer may view them all, and he generally does. Sheltered, as has been stated, by the southern exposure, few students in this particular college fail to avail themselves of the recreation and nicotian relaxation afforded around the engineering entrance.

October 1912

For some time an explanation has been sought of the fact that the waves of wireless telegraphy overcome the curvature of the earth so that it is possible to send messages to stations which lie considerably off a tangent plane through the initial station. It has been suggested that the waves might possibly be reflected from the upper layers of the air which are ionized by the ultra violet rays of the sun. However, since it is possible to send signals over greater distances at night than in the daytime it does not appear that an explanation is to be sought in this direction . . .

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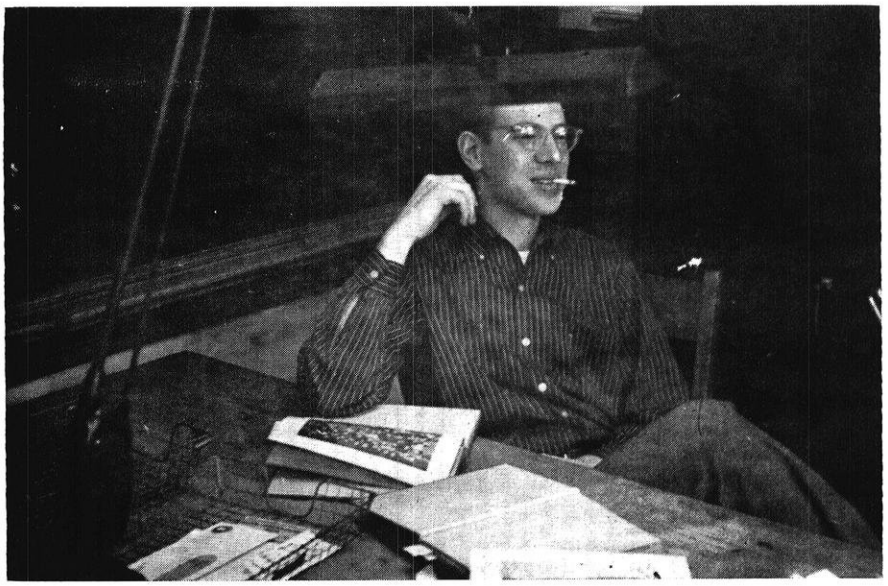
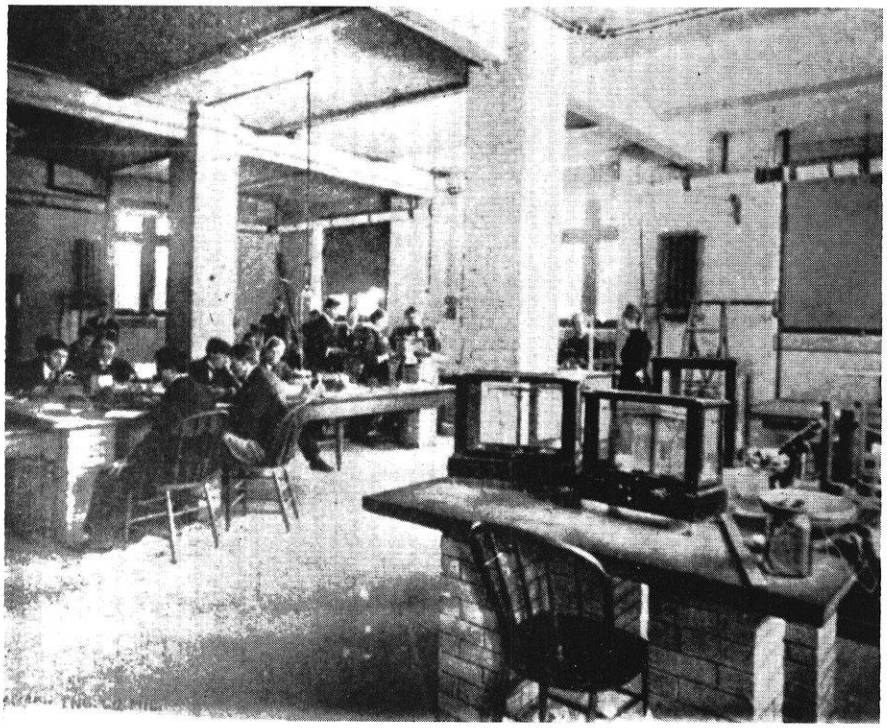
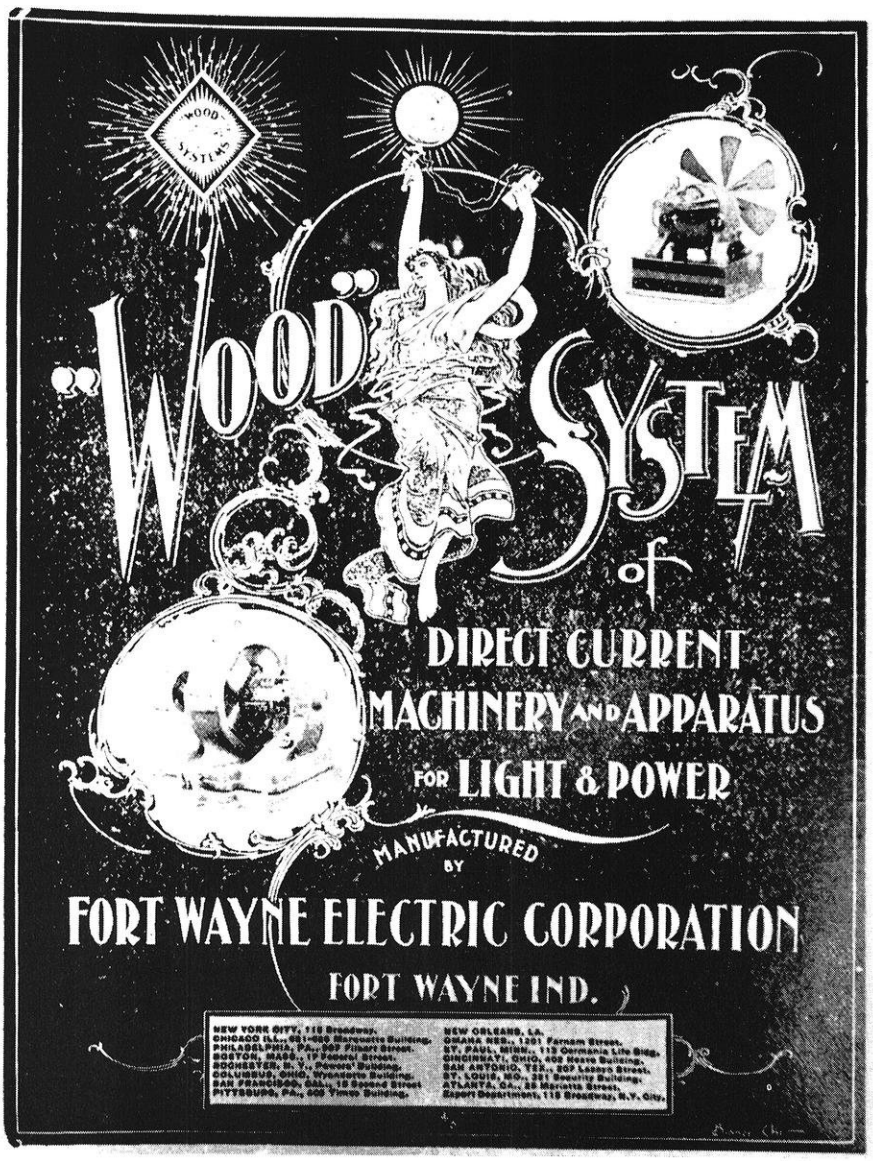


The author at work.



The "old" physics lab. See any difference?



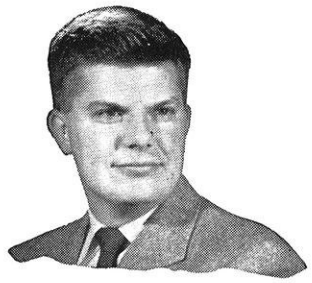
January 1914

At the first meeting of the Student Conference last fall a resolution was passed requiring all Freshmen to wear a green button and prohibiting them from entering a saloon. Much opposition has been brought against the enforcement of this ruling. The chief cause for opposition seems to be that the freshmen dislike to be labeled. The Wisconsin Engineer considers the button to be a good thing. We believe it convenient and fitting that we have a means of recognizing members of this class during the period when they are not required to wear their green caps. The idea of a class button is a good one. We wouldn't mind wearing a little button indicating our class, or better yet we advocate a button for all engineers. Not a big badge, but a neat modest button that could be worn in the lapel and which could be kept standard for years. The opposition against the button will be strenuous for a short time only, but we hope that the Conference will see that their rulings either are lived up to or repealed.

March 1915

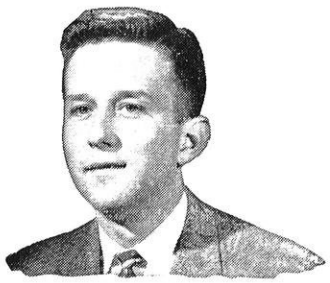
It is a melancholy fact that the United States stands at the very bottom of the list of so-called civilized countries in the number of Nobel Prize recipients. And to add to our shame we are told that the two Americans who have received the Nobel Prize are not even natives of this country. Dr. Carrel is a native of France and Professor Michelson came to this country from Germany. As engineers we must plead guilty to the charge of propagating the pernicious doctrine which demands the measurement of all values by the dollar. No business man uses the phrases, "What will it bring?", "What is it good for?" more often than the engineer. For an engineer to urge that something has a value in itself and is good for nothing but itself would be rank heresy. It is extremely difficult for most of us to grasp the conception that great fields of knowledge, such as astronmy, have a value in themselves. Truth and wisdom, like music, are superior to use; they are an end in themselves.

THE END



Pump-turbine design is now the work . . . hydraulics, the field . . . of John Jandovitz, BSME graduate of College of City of New York, '52.

Water conditioning chemical, service, and equipment specialist in Houston is new assignment of Arthur Brunn, BS Chem. E., University of Tennessee, '56.



Field sales engineering of America's widest range of industrial products is choice of Roy Goodwill, BSME, Michigan State College, '54.

Recent Training Course Graduates

select wide choice of careers at Allis-Chalmers

Starting up a cement plant in Mexico after coordinating all work on it is latest job of John Gibson, BS Met. E., University of California, '54.

Nucleonics is chosen field of R. A. Hartfield, BME, Rensselaer Polytechnic Institute, '53. Currently he is working on design and development of new nuclear power plant.

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	Mining	Crushers	Nucleonics
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ALLIS-CHALMERS

W.S.P.E.

(Continued from page 52)

neers of this area. He also announced that representatives from the Northwest Chapter WSPE from this vicinity expect to attend the annual state meet in Milwaukee on January 18th.

LAKE SUPERIOR CHAPTER

Plans for National Engineers Week, February 16th–22nd, were made at the December 16th meeting of the Lake Superior Chapter of the Wisconsin Society of Professional Engineers held at the Elks Club.

Committees were appointed by William H. Forsyth, President, to prepare a National Engineers Week Program. E. C. Kesting, Construction Engineer for the Wisconsin Highway Commission, Division Eight, Superior, was appointed chairman, assisted by Ellis P. Chellman, Federal Aid Secondary Engineer for the Wisconsin Highway Commission, Superior, and Harvey C. Sargent, Vice-President of the local chapter, Engineer for the Superior Water, Light & Power Company.

Tentative dates for future meetings were determined as follows: January 13th, February 17th, April 21st and June 16th, 1958.

ANNUAL W.S.P.E. MEETING

For the benefit of the engineering students and others who are interested in the activities and functions of W.S.P.E. we present here the program of the Fifteenth Annual Meeting of the Wisconsin Society of Professional Engineers.

THURSDAY, JANUARY 16, 1958

2:00 P.M.—Registration—4th Floor Foyer . $5.00
Convention Office: Pine Room

2:00 P.M.—Board of Directors—Parlor I
- A. L. Genisot, President, Rhinelander, Presiding
- C. J. Nelson, 1st Vice President, Black River Falls
- H. C. Trester, 2nd Vice President, Oshkosh
- A. G. Behling, Past President, Milwaukee
- H. A. Kallsen, Secretary-Treasurer pro tem., Madison
- T. A. Brown, Director, Madison
- W. G. Bryan, Director, Neenah
- W. J. Burmeister, Director, Madison
- L. J. Larson, Director, Milwaukee
- C. E. Pflug, Director, Kenosha
- A. O. Ayres, Nat'l. Representative, Eau Claire
- W. S. Cottingham, Nat'l. Representative, Madison

7:45 P.M.—Bus leaves for Fred Miller Theater Wisconsin Avenue Entrance, round trip $ .30

8:30 P. M.—"The Happy Time" $2.70
Fred Miller Theater, 2842 N. Oakland Ave.
Written by Samuel Taylor, "The Happy Time" stars Charles Korvin, a Czechoslovakian who came to this country in 1937 and made his Broadway debut in 1943. He is most familiar to us from his many movie appearances and was seen locally a few weeks ago on the Loretta Young TV show. "The Happy Time" was played on Broadway in 1950 and was a smash hit and also made into a successful film starring Charles Boyer. It tells a wonderfully warm story of a French-Canadian family and particularly the hilarious antics of their young son.

11:10 P.M.—Bus leaves Fred Miller Theater for Hotel

11:30 P.M.—After Theater Get-together—East Room
Hosts: Milwaukee Chapter

FRIDAY, JANUARY 17, 1958

9:00 A.M.—Registration—4th Floor Foyer . $5.00
Convention Office: Pine Room

9:30 A.M.—Committee Meetings

1. *Program*—Pine Room
   Chairman: Karl O. Werwath
   Committee Members: Carl J. Dvorak, J. M. Holderby
2. *Membership*—Parlor G
   Chairman: Foster C. Koehn
   Committee Members: John K. Primm, Lynn Wilson, Karl O. Werwath, Norman Gehlhar, Wm. T. Wambach, Jr., Leo F. Kosak, Frank L. Carlson, A. R. Dent
3. *Ethics and Practice*—Parlor I
   Chairman: Kurt Roth
   Committee Members: David F. Hanley, William J. Cherones, Laurence F. Motl, George W. Young, T. M. Basterash
4. *Education*—Room 507
   (Joint with Functional Group on Education)
   Chairman: Thomas J. Higgins, Vice Chairman: A. B. Drought
   Committee Members: A. F. Ahearn, O. E. Andrus, W. S. Cottingham, P. G. Ellis, P. G. Fluck, J. R. Frederick, R. W. Gamble, John Gammell, A. L. Genisot, C. W. Giesler, P. J. Grogan, G. F. Hrubesky, D. B. Johnson, E. C. Koerper, E. T. P. Neubauer, M. B. Olsen, C. W. Ottensman, W. A. Peirce, H. A. Peterson, R. E. Purucker, P. C. Rosenthal, W. E. Schubert, V. T. Thomas, T. E. Thoreson, R. W. Vandan Noven, J. G. Van Vleet, H. J. Vick, Kurt F. Wendt, K. O. Werwath
   Advisory Members: C. M. Brown, C. L. Greiber, J. Marks and R. A. Ragatz
5. *Public Relations*—Parlor F
   Chairman: C. W. Giesler
   Committee Members: Robert Claypool, Lester W. Stockner, Richard Jahnke, Arthur M. Moody, Manley B. Monsen, Herbert Nelson, E. C. Kesting
6. *Civil Defense*—Parlor H
   Chairman: Albert R. Striegel
   Committee Members: Stratton E. Hicks, Carl John, Ervin L. Knebes
7. *Interprofessional*
   Chairman: Chas. A. Nagel
   Committee Members: Arthur G. Behling and John A. Lofte
8. *Fees and Classifications*
   Chairman: Leo F. Kosak
   Committee Members: W. G. Youngquist and Archie Becher
9. *Resolutions*
   Chairman: V. Robins Tate
   Committee Members: Kurt F. Wendt and A. Owen Ayres
10. *Publications*
    Chairman: C. M. Perlman
    Committee Member: Douglas F. Haist

12:15 P.M.—Speakers' Table Assembly—Room 508

12:30 P.M.—Luncheon—Crystal Ball Room $2.75
C. J. Nelson, Vice President, WSPE, Presiding

1:30 P.M.—Report on the Work of the NSPE
H. G. Kennedy, Vice President
National Society of Professional Engineers

2:30 P.M.—Functional Group Meetings

1. *Education*—New Room
   (Joint with Education Committee)
   Chairman: Thomas J. Higgins
   (a) "The United States in Education Abroad—In General"—Dr. John Guy Fowlkes, Professor of Education, University of Wisconsin—Madison
   (b) "The ICA—Wisconsin Engineering Educational Project in India"—M. O. Withey, Emeritus Dean, University of Wisconsin, Madison
2. *Industrial*—Parlor C
   Chairman: W. C. Lallier
   A discussion of the establishment of additional autonomous chapters in WSPE to increase industrial membership Society participation.
3. *Consulting*—Parlor E
   Chairman: Robert J. Strass
   Discussion led by Carl F. Schoenbaum, P. E., of Carl F. Schoenbaum and Associates, Consulting Engineers, Canton, Ohio, and Chairman of the Consulting Engineers of Ohio, a functional section of the Ohio Professional Engineers Society. Mr. Schoenbaum is one of the country's leaders in organizing and developing Consulting Engineers functional sections.

6:00 P.M.—Reception—5th Floor Foyer
Dutch Treat—Cash Bar

6:45 P.M.—Speakers' Table Assembly—Room 508

7:00 P.M.—Annual Banquet—Crystal Ball Room $5.50
A. L. Genisot, President, WSPE, Presiding
1. *Introduction of Old and New Officers*
2. *Presentation of Outstanding Engineer Award*

9:00 P. M. to Midnight—Dancing to the music of Steve Swedish and His Orchestra

SATURDAY, JANUARY 18, 1958

9:00 A.M.—Registration Continues $5.00
Convention Office: Pine Room

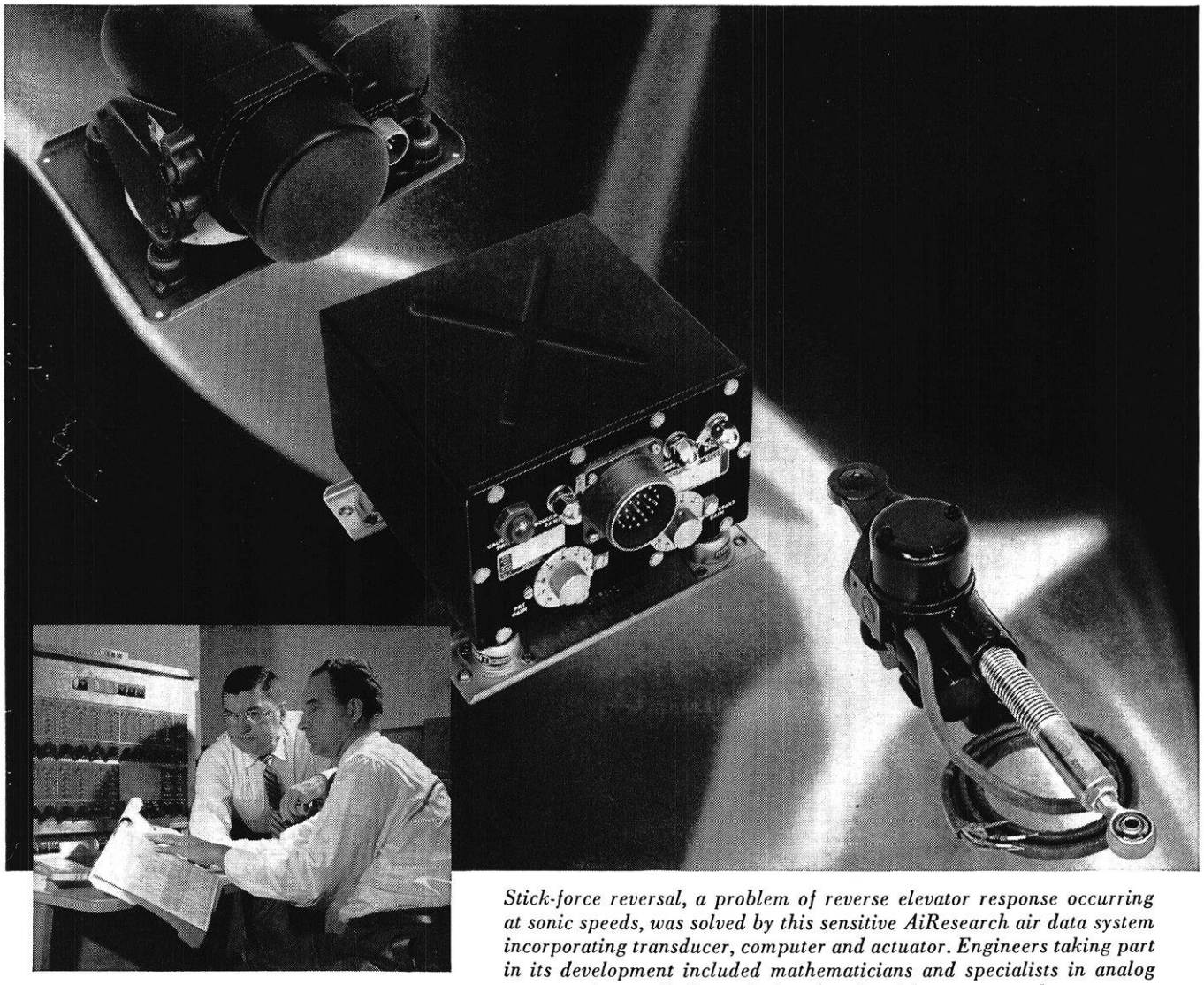
9:30 A.M.—Business Meeting—East Room
President A. L. Genisot, Presiding
1. President's Report
2. Secretary's Report
3. Treasurer's Report
4. National Representatives' Reports
5. Committee Reports:
   Program
   Membership
   Ethics & Practice
   Education
   Public Relations
   Interprofessional
   Fees & Classifications
   Civil Defense
   Resolutions
   Publications
6. Functional Group Reports:
   Consulting
   Education
   Industrial
   Public Employment
7. New Business
8. Report by W. A. Piper, Secretary, Wisconsin Registration Board of Architects and Professional Engineers

12:15 P.M.—Speakers' Table Assembly—Room 508

12:30 P.M.—Luncheon—Crystal Ball Room $2.75
H. C. Trester, Vice President, Presiding
1. *Recognition of New Members*
2. *Presentation of Awards*
   Thomas J. Higgins, Chairman, Education Committee, introducing:
   (a) A. Bernard Drought, Dean, College of Engineering, Marquette University
   (b) Fred J. Van Zeeland, Dean, Milwaukee School of Engineering
   (c) Kurt F. Wendt, Dean, College of Engineering, University of Wisconsin—Madison
3. *Citation Presentation by Dean Kurt F. Wendt to Outstanding High School Science Teachers*
4. *Address:* "Post-Graduate Training Programs for High School Science and Mathematics Teachers"
   Dr. Harvey Sorum, Professor of Chemistry
   University of Wisconsin—Madison

(Continued on page 64)

IF college has sharpened your urge to know more...



Stick-force reversal, a problem of reverse elevator response occurring at sonic speeds, was solved by this sensitive AiResearch air data system incorporating transducer, computer and actuator. Engineers taking part in its development included mathematicians and specialists in analog computation, preliminary design, fractional hp motors and gears.

Your formula for advancement in present day technological industry is growth in knowledge and ability.

Applying this principle at Garrett, engineers are achieving outstanding reputations for excellence in the following aircraft, missile and industrial fields: air conditioning and pressurization; heat transfer; cryogenic and nuclear systems; pneumatic valves; controls and air motors; system electronics; computers and flight instruments; gas turbine engines and turbine motors; prime engine development and industrial turbochargers.

Upon employment, you may choose either a direct assignment or enter a 9 month orientation program which permits you to survey Garrett engineering activities to aid you in selecting your field of interest. With company financial assistance you can continue your education at neighboring universities.

Typical project work is done in small groups where opportunities for learning, added responsibility and advancement are enhanced. To receive full information write to Mr. G. D. Bradley

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AIRESEARCH INDUSTRIAL • REX • AERO ENGINEERING • AIR CRUISERS • AIRESEARCH AVIATION SERVICE

Campus News

(Continued from page 36)

erators, and heating and air-conditioning.

The colleges and universities cooperating in the conference are Illinois, Iowa, Iowa State, Michigan, Michigan State, Northwestern, Purdue, Minnesota, Wisconsin, Texas A. & M., New York, California Institute of Technology, Georgia Institute of Technology, and Massachusetts Institute of Technology.

The cooperating societies are American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Institute of Mining, Metallurgical and Petroleum Engineers, American Society of Civil Engineers, American Society of Heating and Air Conditioning Engineers, American Society of Mechanical Engineers, National Association of Power Engineers, Western Society of Engineers, and Engineers' Society of Milwaukee.

ASME NATIONAL MEETINGS

The heaviest schedule of national meetings and conferences in its history was announced today by The American Society of Mechanical Engineers. The Society will sponsor or co-sponsor twenty-four major events at locations throughout the country during 1958 dealing with dozens of technical subjects. All ASME meetings are open to interested persons, whether members of the Society or not.

In addition to its own meetings, ASME will take part in the 1958 Nuclear Congress to be coordinated by Engineers Joint Council in Chicago, March 16–22, and in the Third U. S. Congress of Theoretical and Applied Mechanics, June 11–14, at Providence, Rhode Island.

The announcement noted a trend toward increased emphasis on conferences dealing with a particular field of engineering "as a result of the increased complexity of subject matter in virtually all fields of engineering."

"This increase", it was said, "has made it desirable to devote more time and effort to covering advances in each field than is possible at 'general' meetings where each of the 23 Professional Divisions of the Society present programs during a period of four or five days."

Typical of the trend toward specialized meetings are four new conferences to be sponsored by units of the Society during 1958 including one in Pittsburgh, April 14–15, under the newly formed Maintenance and Plant Engineering group of ASME. Other conferences that will be held for the first time this year are Production Engineering, Worcester, Mass., April 10, Materials Handling, Cleveland, Ohio, June 9–12 and Process Industries, Buffalo, New York, Sept. 15–17.

Beginning March 17, the Society will join the American Rocket Society in a four-day ASME-ARS Joint Aviation Conference to be held in Dallas, Texas. During September the International Conference on Air Pollution, second event of its kind, will be held in New York under sponsorship of the ASME Air Pollution Controls Committee. **THE END**

W.S.P.E.

(Continued from page 60)

2:30 P.M.–Public Meeting. Sponsored by Milwaukee Chapter, WSPE, at which Certificates of Registration as Professional Engineer and as Engineer-in-Training will be awarded by a member of the Engineering Division of the Wisconsin Registration Board of Architects and Professional Engineers.

3:15 P.M.–Adjournment

3:30 P.M.–Annual Business Meeting
Milwaukee Chapter–East Room
E. C. Koerper, President, Presiding

LADIES' PROGRAM

SCHROEDER HOTEL
MILWAUKEE, WISCONSIN
JANUARY 16, 17, 18, 1958

THURSDAY, JANUARY 16, 1958

7:45 P.M.–Bus leaves for Fred Miller Theater Wisconsin Avenue Entrance, round trip $.30

8:30 P.M.–"The Happy Time" with Charles Korvin–Fred Miller Theater $2.70

11:10 P.M.–Bus leaves Theater for Schroeder Hotel

11:30 P.M.–After Theater Get-together–East Room

Hosts: Milwaukee Chapter

FRIDAY, JANUARY 17, 1958

12:00 P.M.–Luncheon–Empire Room . . $2.75
(Prizes, favors)
After the luncheon, you will have a choice of spending the afternoon at:
(a) Bridge
(b) A special tour of the new War Memorial Center and a visit to the Layton School of Art for a fascinating demonstration of an industrial design creation. The ladies present will act as a "product opinion panel" for the design.

6:00 P.M.–Reception–5th Floor Foyer–Dutch Treat

7:00 P.M.–Annual Banquet–Crystal Ball Room $5.50

For members and ladies–Informal

9:00 P.M. to Midnight–Dancing to the Music of Steve Swedish and His Orchestra

SATURDAY, JANUARY 18, 1958

12:30 P.M.–Luncheon–Crystal Ball Room $2.75

For members and ladies

1958 CONVENTION PROGRAM COMMITTEE

Karl O. Werwath, State Program Committee Chairman, General Chairman
Mrs. E. C. Koerper, Ladies' Program
A. L. Genisot, State President
Alan Bate, Chairman, Reservations
Mrs. Wm. J. Cherones, Luncheon
Mrs. Harry Gute, Telephone
Mrs. J. Randall Meyer, Hostess
Mrs. George Sievers, Bridge Party
Thomas J. Higgins, Education Committee
C. J. Nelson, Opening Luncheon
C. M. Perlman, Publications
George W. Linn, Theater Party and Reception
H. C. Trester, Closing Luncheon
Robert W. Smeaton, Publicity, Local
John Morris, Asst. Reservations

IKE'S SCHOLARSHIP PLAN HIT

President Eisenhower's proposal for 10,000 undergraduate scholarships annually for the next four years will create additional burdens for colleges already struggling financially, and will place the wrong emphasis on the engineering-scientific manpower problem, a spokesman for the National Society of Professional Engineers has stated.

Dr. Clark A. Dunn, vice president in charge of educational matters for the 43,000-member Society, and director of the Engineering Experimental Station at Oklahoma State University, said the Administration plan "will complicate and aggravate an already serious situation in the colleges."

Dr. Dunn emphasized that "tuition does not cover the cost of collegiate education," and the difference must be made up from private or public assistance.

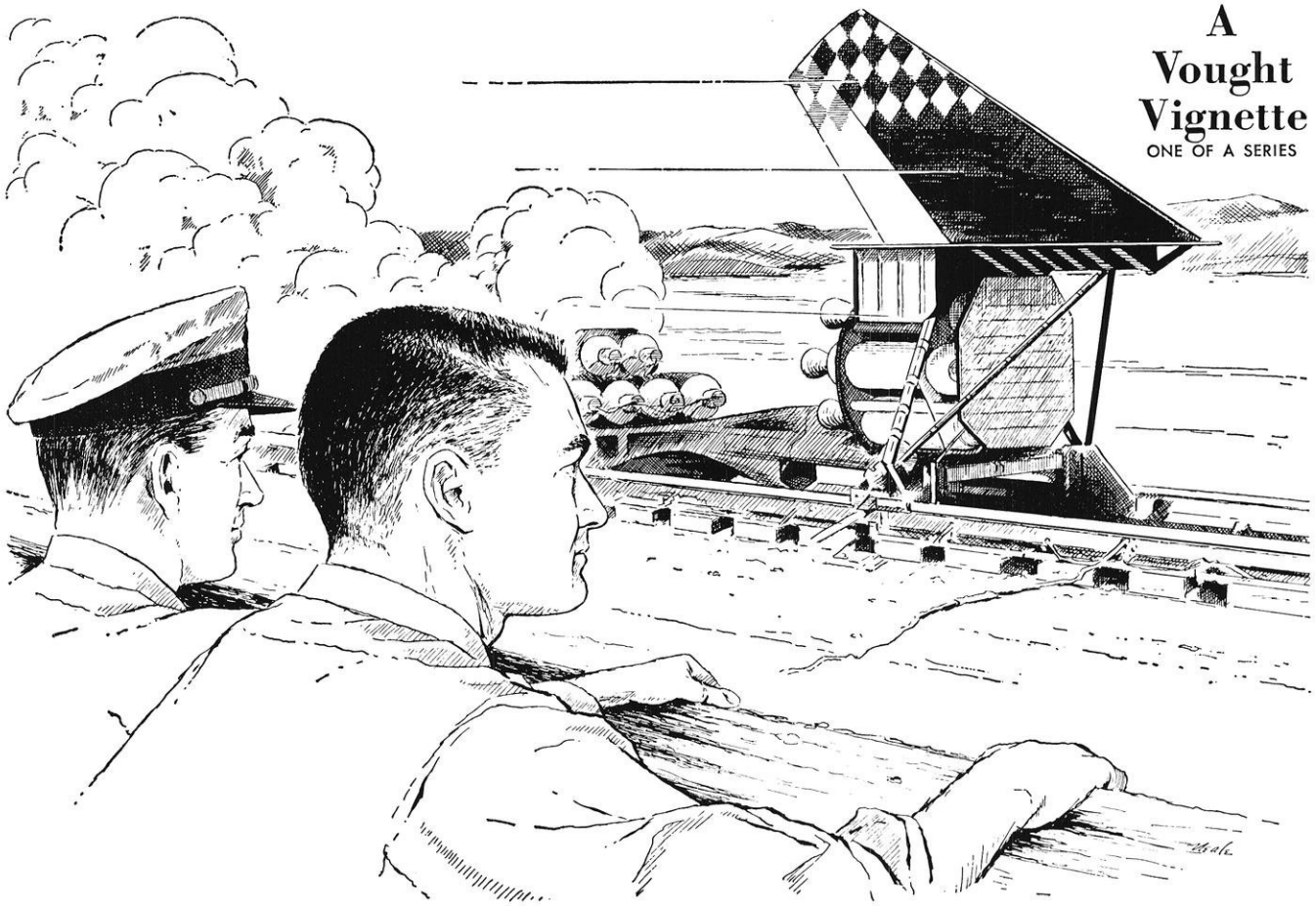
"While the reported plan does call for some small aid to graduate schools, it does not provide any aid for the colleges to meet the added costs which will result from the 40,000 students attending under Federal scholarships at the height of the program," he said.

Dr. Dunn pointed out that "studies of the Society over a long period have also indicated that the emphasis in science and engineering should be on quality rather than quantity. Engineering enrollments are at an all-time high and are continuing to increase. The educational institutions are already handicapped severely in giving adequate attention to capable students. A new influx of additional enrollments will strain the faculty and facilities of the institutions beyond the breaking point unless some substantial assistance is provided. The colleges are now in a serious plight with regard to faculty salaries and are losing faculty staff to industry and others through substantially higher salary offers."

Dr. Dunn said that some features of the Administration plan are sound and should be supported, such as the provision of additonal graduate fellowships, including some supporting funds for the graduate schools. He also praised the plan's increase in the appropriations for the National Science Foundation.

Dr. Dunn explained that those pressing for Federal aid in the engineering and scientific educational field should remember that technological developments such as the earth satellite and guided missiles depend on highly-advanced tech-

(Continued on page 66)



A Vought Vignette
ONE OF A SERIES

The structures engineer who found a fast detour

"Advise and assist on structural problems. Do what you can to keep the program moving . . ." With this outline of his liaison duties, Stress Analyst Ed Clay accompanied Vought's Regulus II missile to its desert test site.

On the desert, Ed found a dearth of structural problems. Regulus II reliability gave the flight test program tremendous momentum. In quick succession the missile notched 10 flights. When time came for a critical high-speed test, the program was three months ahead of schedule!

Then, the very fact that things had moved so fast threatened to rob the program of the time it had gained.

As Vought had planned, a wind tunnel flutter test had to precede the upcoming high-speed flight. But Vought's prearranged date at a government tunnel was over a month away. The facility was booked solidly up to the appointed day. And Vought's own Mach 5 tunnel was under construction.

Then Ed revealed the scope of his liaison. It had ranged to the rocket test track at nearby Edwards Air Force Base. There, with the help of a cooperative track project engineer, Ed had spotted a rusting rocket sled, left behind from a radome test. Now, if the sled could be rigged to carry that spare Regulus fin, Ed figured, they might get flutter data before the tunnel test.

That changed Ed's state of liaison. All Vought was suddenly at *his* service. Shopmen reworked the sled to mount the fin. Instrumentation technicians fitted the fin with gages and transducers. Vought's top flutter men double-checked, raised their eyebrows, then endorsed the whole thing.

At the track, moments before the rockets exploded, Ed had a twinge of doubt. His sled was a monster, indeed. Air loads would be terrific . . .

Then the sled shot off on the first of two successful trips that revealed all the data required.

At Chance Vought, there's liaison in spirit as well as in name. It allies engineers of many specialties and viewpoints against mutual problems. It builds channels instead of walls between diverse technical areas. It's another reason why top engineers are choosing Vought — *to keep abreast of all fields while advancing in one.*

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

W.S.P.E.

(Continued from page 64)

nology, and that a mere increase in numbers of those with first degrees will not provide the type of highly-advanced technical knowledge which is necessary.

"The emphasis of a Federal program for collegiate education, if one is enacted," he said, "should be confined to graduate work and assistance to the colleges in meeting the crushing burdens of increasing undergraduate enrollments."

NEW ENGINEERING OPPORTUNITIES IN STATE SERVICE

Building Plan Approval. The Industrial Commission will appoint two engineers to review plans for public buildings and places of employment. They check conformance to building code requirements, consult with and advise architects and engineers on structural design, materials, mechanical equipment and electrical installation requirements. Training may be in mechanical, structural, civil or electrical engineering. The positions are in Madison.

Specification Writing. The Bureau of Purchases in the Capital will hire an engineer to write specifications for purchasing engineering equipment, building construction items, hardware, etc. He should have two years of experience in purchasing, or in work with specifications. Civil, mechanical or structural background would be desirable.

Interstate Highway System Design. Civil engineers are being appointed in Milwaukee, Waukesha and Eau Claire for design and construction of expressways, turnpikes and interstate bridges. The Highway Commission starts graduates in a rotation training program with fast promotion to the II and III levels and competitive promotion to top level responsibilities.

Airport Consultation and Design. The Aeronautics Commission will appoint a civil engineer to be trained as an Airport Development Engineer. He will survey proposed airport sites, evaluate survey data, prepare findings of necessity and inspect airport construction. This man should have or be willing to secure a pilot's license so he can fly the Commission plane on his assignments out of Madison.

General Information. The state career srevice has been well established in Wisconsin since 1905. Engineers are assigned to engineering work. Professional standards are high. Most positions involve experience that meets the requirements for registration. There is very little travel involved except in the Aeronautics Commission position. Starting salaries are between five and six thousand. Merit raises and promotion within the service provide good salary advancement. Fringe benefits include sick leave, vacation, group life insurance, retirement and Social Security . . . Bureau of Personnel, Capitol, Madison.

OBITUARIES

MR. SIDNEY P. HALL

Sidney P. Hall, 70, of 2215 Rudolph Road, a resident here for the past 45 years, died at Luther hospital following a heart attack at his home.

Mr. Hall, a civil engineer, was graduated from the University of Wisconsin in 1910.

He was a member of the National Association of Professional Engineers and the Wisconsin Association of Professional Engineers. He was a former employe of the State Highway Commission, had served on the DeMolay advisory board. He was a member of the Eau Claire Lodge F & AM No. 112 of which he was a past master.

He is survived by his wife Roy D., two sons, Charles H. of Mexico City, Mexico and Sidney D. of Milwaukee, one brother, Charles N., and one sister Mrs. A. A. Chamberlain both of Huron and four grandchildren.

W. F. BAUMGARTNER

William F. Baumgartner, 69, of 909 Fifth Avenue, died Monday night at the Sacred Heart hospital after a brief illness.

Mr. Baumgartner was employed by the Wisconsin Highway Commission for 42 years, and was appointed district engineer of the commission office here in 1935. He retired December 31, 1954.

Surviving are his wife, Lillie, two sons, William S. of San Francisco and Thomas of Eau Claire, and one grandson.

THE END

MEMBERSHIP REPORT

Total members and Affiliates:	
Members	1197
Dues exempt	3
Retired	4
Affiliates	118
	1324
Losses:	
Resigned – R. Lindenaur, EIT, SW; Vincent E. Myers, OS; Transferred to Colorado, K. R. Wright, SW	3
Change of Classification EIT to PE– T. J. McCabe, Milw.	1
Active to Retired – E. J. Archambault, Milw.	1
Additions:	
New Members	4
Affiliates	3
Total Members:	
Members	1201
Dues Exempt	3
Retired	5
Affiliates	119
	1328

APPLICATIONS FOR MEMBERS AND AFFILIATE MEMBERS

Name and Position	Address	Reg. No.	Sponsor
MILWAUKEE Edwin Oscar Martinson Research and Development Koehring Corp.	1701 W. Wisconsin Ave. Milwaukee, Wis.	E-4498	E. C. Koerper
William Paul Chapman Director of Research Johnson Service Co.	3816 N. 40th St. Milwaukee 16, Wis.	E-6475	J. R. Meyer
FOX RIVER VALLEY Herbert Edward Kese Civil Engineer Immel Construction Co.	1003 W. Spring St. Appleton, Wis.	E-6270	R. W. Stieg
Chas. Harland Bennett Sales Engineer F. Hurlbut Company	201 Cedar St. Green Bay, Wis.	ET-1377	T. J. Driscoll
WISCONSIN VALLEY Alan Raymond Engler City Engineer Wisconsin Rapids	1631 Chestnut St. Wisconsin Rapids, Wis.	E-5632	C. Cajanus
SOUTHWEST Thomas Martin Germanson Civil Engineer Mead and Hunt, Inc.	1706 Niemann Pl. Madison, Wis.	ET-1648	H. H. Buer
WESTERN Dale Robert Clausing Industrial Engineer The Trane Co.	2709 David Place La Crosse, Wis.	ET-1506	R. C. Bradford
Total—Members 4 Affiliates 3			

"They all agree..."

"Since the day we decided to get married, I've been doing a lot of thinking about our future. It's time I made a choice on a career. I've talked to the Dean of Engineering, most of my professors, and to some of the fellows who have graduated, and you know, they all said the same thing.

"They all agree that the aircraft and missile industry holds the best opportunities and the brightest future for an engineer these days. What they said makes sense, too, because developments in this field today really give a fellow an opportunity to make important contributions on vital projects.

"Not only that, but the aircraft industry is noted for its good salaries. Generous benefits, too. And advancement in both salary and position is limited only by how far I want to go."

Unlimited opportunities, high salaries, company-paid benefits unheard of until a few years ago — these are only a few of the reasons why so many young engineers with a keen eye to the future are choosing the aircraft industry.

It is only natural that many engineering graduates should consider joining Northrop Aircraft, Inc., because the company shares its many successes with every member of its engineering and scientific team. Advanced projects at Northrop are now in production, and active top-priority projects mean rapid advancement and success for the individual engineer.

Such projects include the famous Snark SM-62, world's first intercontinental guided missile, now being activated in the first United States Air Force missile squadron; the USAF T-38 supersonic twin-jet advanced trainer; and other important missile and manned aircraft weapon systems and components.

Engineers in more than thirty categories contribute to Northrop's success in an ideal environment with the latest tools of science, in its new Engineering Science Center. Here you will work with leading scientists and engineers who respect, acknowledge, and reward your individual ideas and abilities.

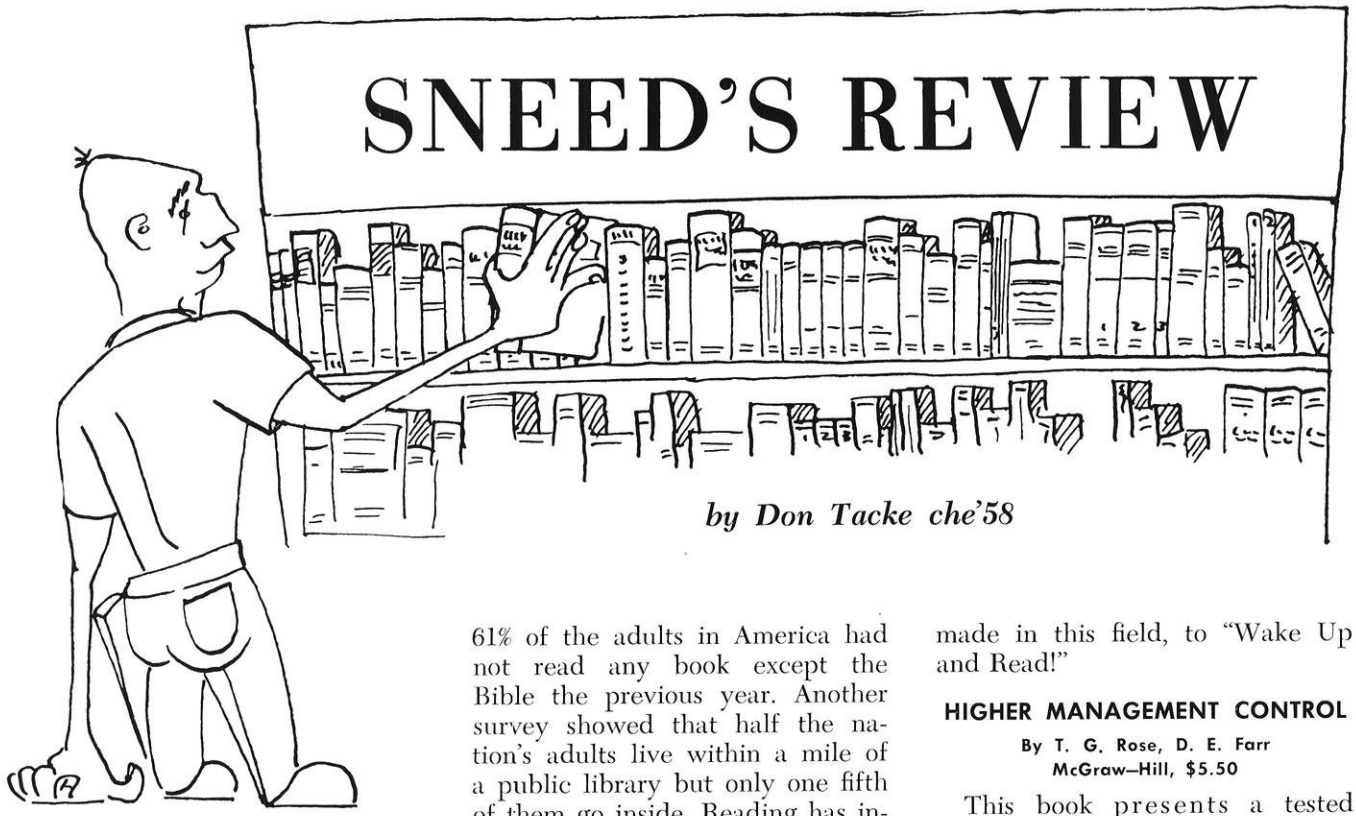
Why not write us now . . . regardless of your class at college. Ask us how you might best gain a career with Northrop. Write to Manager of Engineering Industrial Relations, Northrop Division, Northrop Aircraft, Inc., 1033 East Broadway, Hawthorne, California.

NORTHROP

A Division of Northrop Aircraft, Inc.

BUILDERS OF THE FIRST INTERCONTINENTAL GUIDED MISSILE

SNEED'S REVIEW



by Don Tacke che'58

THE National Book Committee is sponsoring National Library Week March 16–22, 1958. This is an enormous program to make people word-conscious and reading-conscious for at least one week of the year. Following is a short explanation of this program.

THE AIMS OF NATIONAL LIBRARY WEEK

By Marchette Chute

The United States could not exist without the written word. Take it away and the country could not operate. Very little work could be carried on or knowledge transmitted, and the civilization we know would grind to a halt.

Nor can the United States exist without readers. Ours is a government of the many, not the few, and it is based on trust in its citizens. It trusts them to have formed the habit of finding out, and that means the habit of reading. We live in a complicated and difficult time, when we must be well informed if we are to survive, and as a democratic nation we depend on knowledge as we never have before.

Yet, as a nation, we have not formed the habit of reading. A Gallup poll of 1955 showed that 61% of the adults in America had not read any book except the Bible the previous year. Another survey showed that half the nation's adults live within a mile of a public library but only one fifth of them go inside. Reading has increased in recent years as measured in newspaper, magazine and book sales and in the use of public libraries, but the increase has not been as great as it has been in many other uses of leisure time.

Certainly the people of the United States have plenty of time for reading. We have cut the sixty-hour week to forty hours. We have invented electrical appliances that replace a great deal of manual labor. We have lengthened the life span. The opportunity exists, and the leisure, but the American people have not yet learned what can be done with it.

It is to help them learn that National Library Week has come into being. Its purpose is to encourage the people of the United States to do more reading, and its theme for the first year is "Wake Up and Read!" We cannot afford a country of lazy minds and the boredom that comes from knowing little and caring less. We cannot afford a nation of non-readers.

This is the goal of Library Week. Its success will lie in the hands of the men and women who want to awaken their fellow citizens to the delight, the value and the magnificent opportunities of the habit of reading, and who will encourage them, in the first concerted national effort that has ever been made in this field, to "Wake Up and Read!"

HIGHER MANAGEMENT CONTROL

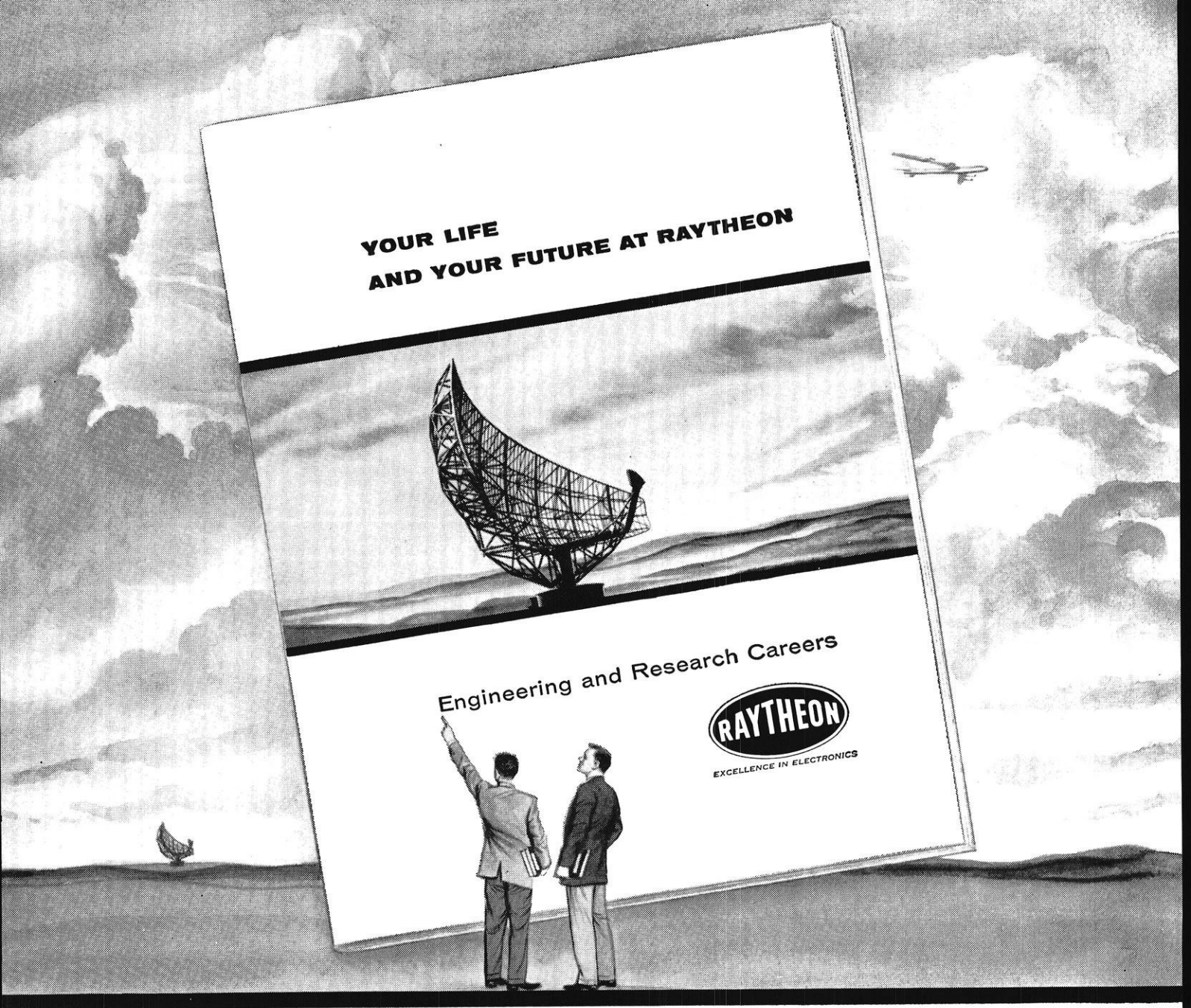
By T. G. Rose, D. E. Farr
McGraw–Hill, $5.50

This book presents a tested method of assembling and interrelating significant facts and figures that will most quickly and clearly show the progress of affairs in a company. It brings together financial, sales and operational thinking and shows how to select the key figures from the information available on business, operations, profit and loss and financial activities, and then interlock them in a convenient control structure as a basis for top-level decisions. The book will be of special interest to presidents of small and medium-sized businesses, controllers, industrial engineers, works managers and sales managers.

SCIENTIFIC USES OF EARTH SATELLITES

Edited by James A. Van Allen

Leading scientists, technicians, and military experts in the field of high altitude research discuss the ways in which man-made satellites can contribute to our knowledge of the universe. Among the problems treated are the optical and visual tracking of a satellite, satellite instrumentation, meteorological measurements from the vehicle, and the possibilities of observing cosmic rays, auroral radiation, the earth's magnetic field, the ionosphere, and meteorites.



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Application and Sales Program — advantages to you in world-wide field engineering activities; rewarding opportunities in electronic sales.

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Name of College or University_____

Science Highlights

(Continued from page 42)

main reasons for contractors to demand equipment with greater capacity.

One company spokesman put it this way: "Our users need more horsepower, more capacity, more ruggedness to endure around-the-clock operations, to produce more yardage at lower cost and to beat the profit squeeze. Earth-moving bid prices have remained fairly constant while labor, operating and equipment costs have jumped sharply."

A shortage of experienced machinery operators has forced design to figure out easier-to-operate methods; controls that last longer despite rough treatment; and transmissions, largely hydraulic, that will not only make shifting simpler but protect equipment from damage resulting from mishandling.

Of additional significance to future design in the construction-equipment industry is the $33 billion federal road-building program which between now and 1975 will require $7.3 billion worth of machinery. Production output of the industry is expected to increase by 45 per cent during the first three years of the program. The industry could meet the program's needs with existing equipment, but such a prolonged project enables equipment makers and their customers to apply new design approaches that would be prohibitive during short-term projects.

Industry leaders are advancing along six separate design fronts: improving rubber tires and expanding their use, improving metals, searching for more efficient lubricants, upgrading the horsepower of power plants while reducing their size and weight, simplifying work for the machine operator and making servicing easier.

But most of all, the heavy-construction equipment manufacturer wants versatility, the magazine found out. In demand is the tractor that can be a dozer, a prime mover, a crane, a backhoe, a front-end loader and a shovel. Also in demand is the mobile crane that can be a shovel, a crane, a materials-handling unit, a piledriver and a hoe. **THE END**

Sailing

(Continued from page 19)

ing driving force. On the leeward side, on the other hand, the suction on the sail is localized where it will exert the maximum of power in pulling the boat ahead.

The jib has a relatively high performance as compared to the mainsail. This is due partly to its high aspect ratio, or ratio of height to breadth, and partly to the fact that there is no mast interference. Considering the two sails, jib (a triangular sail set forward of the mast) and mainsail (the large fore and aft sail set aft of the mast), contributing separately to the driving force, the jib furnishes more than twice as much force in proportion to its area than does the mainsail.

The jib prevents the loss of efficiency by the mainsail because it prevents the breaking down of the flow. It acts as a guide vane to bring the air onto the mainsail at a proper angle, as the air which has just flowed off from the jib is traveling at a smaller angle to the axis of the hull than in the free space above.

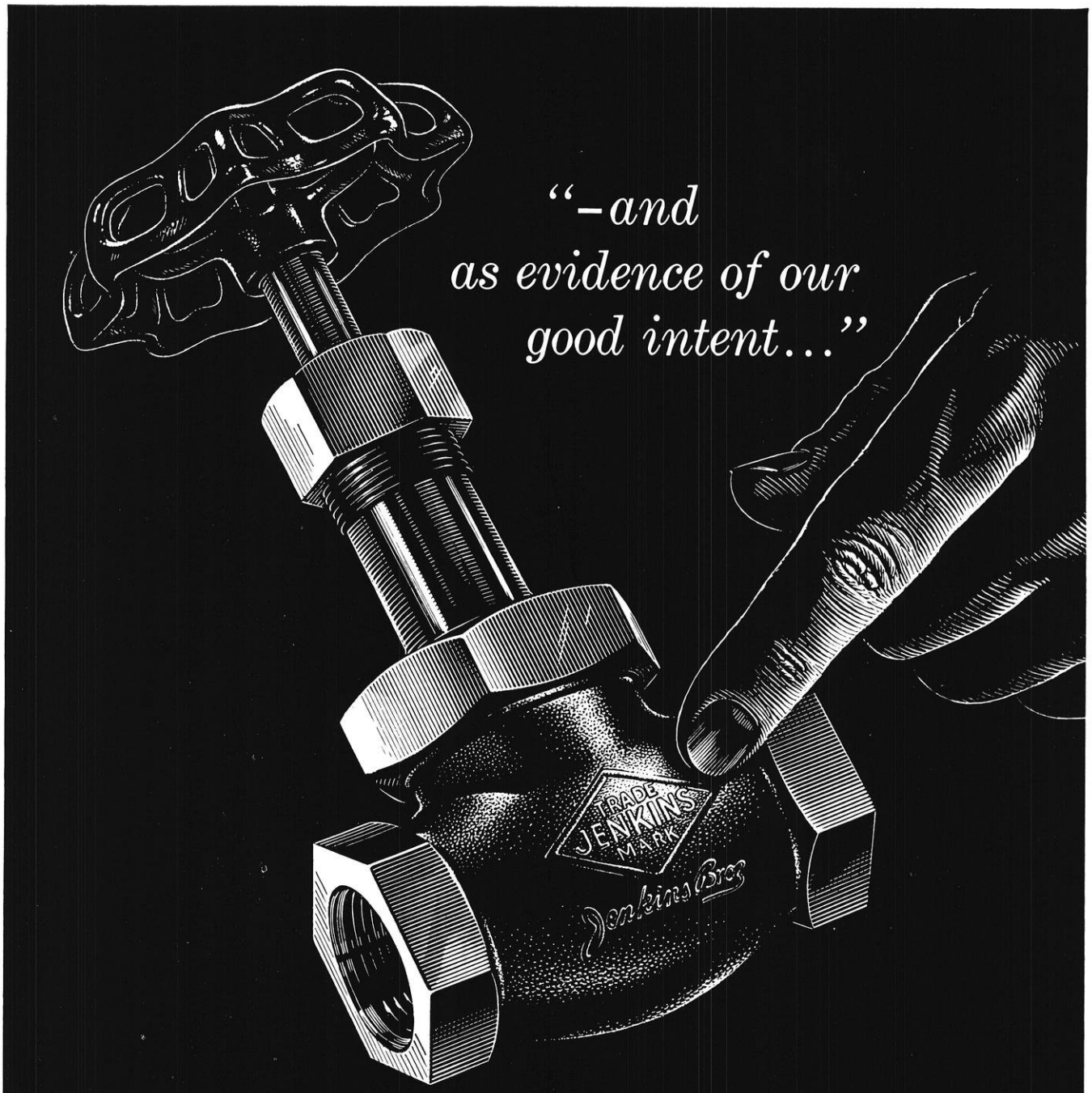
The jib also guides the flow of air onto the base of the sail where there is more area of working surface.

The twist of the mainsail is brought about by the pressure on the windward side and the suction on the leeward side.

Twist of a mainsail is harmful in the fact that the flow tends to miss the sail. That is, the air doesn't strike the sail in a perpendicular vane, instead it tends to flow over the sail. This flowing over does not produce a driving force. Therefore, steps should be taken to reduce twist.

Since the usefulness of the jib in helping out the mainsail is a function of the amount of twist in the mainsail, some attention should be paid to the factors causing that twist.

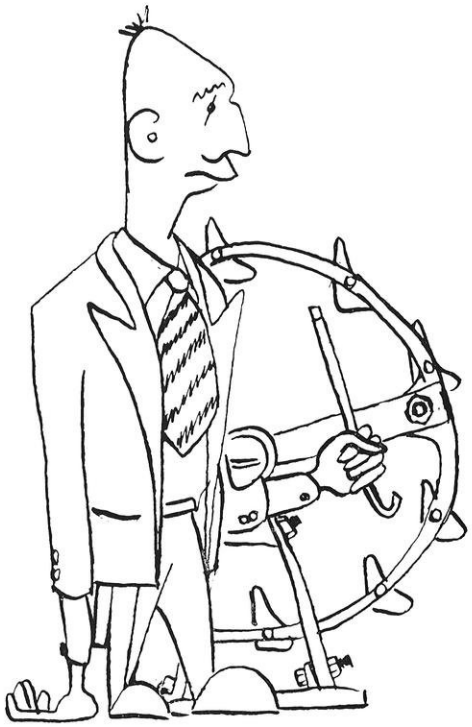
The weight of the boom and of the sail itself tend to reduce the twist, while the aerodynamic forces tend to increase it. The amount of twist of a given sail on a given boat will increase with increasing wind speed. Therefore, the importance of the jib is greatest in heavy winds. **THE END**



It was considered a bold stroke, in Nathaniel Jenkins' day, to fix one's mark or name to the product of his invention. In 1864, product quality control was largely a matter of good intent and determination on the part of the maker. Nathaniel Jenkins *had* that determination and, as evidence of it, put his Diamond mark and signature on every Jenkins Valve.

Over the years, many new and different types of valves have joined the Jenkins Valve family. And because the rigid, quality specifications set by the founder have never been compromised, the Jenkins Diamond trade-mark has steadily gained in value.

Indeed, to buyers and specifiers of valves everywhere, this mark has become a trusted symbol of efficient, economical valve performance. Jenkins Bros., 100 Park Avenue, New York 17.



THE FERROUS WHEEL

words and pictures
by Tony DiTrapani

C. E., Class of '55. And you?

I just bought a new textbook and was hurrying to get to class before the next edition came out.

Then there was the fellow who had the hobby of collecting stones and keeping them in his bathroom.

He had rocks in his head.

* * *

Heard an engineer relating his adventures in the Korean war:

"Ammunition, food, and whiskey had run out," he said, "and we were all parched with thirst."

"But wasn't there any water?"

"Sure, but this was no time to be thinking of cleanliness."

* * *

Prof: I will not begin today's lecture until the room settles down.

Voice from rear: Go home and sleep it off.

* * *

A diner in a restaurant rushed over to the manager.

"I've been robbed," he screamed. "Somebody's stolen my topcoat."

"What kind of a topcoat did you have?" asked the manager.

"It was a brown coat with raglan sleeves," replied the man.

"Hmmm," pondered the manager, "Come to think of it, I saw a man walking out of here wearing that very coat."

"Quick, quick!" shouted the customer. "What did the guy look like?"

"Terrible," he sighed, "the sleeves were too short for him."

Wine, women, and song are getting me down—I'm gonna hafta quit that darn singin' . . .

Question: Why didn't the little bee buy his gasoline at the TEXACO station?

Answer: He was an ESSO bee.

* * *

The lion was stalking through the jungle looking for trouble. He grabbed a passing tiger and asked, "Who is king of the jungle?"

"You are, O mighty lion," answered the tiger.

The lion then grabbed a bear and roared, "Who is boss of the jungle?"

"You are, O mighty lion," answered the bear.

Next the lion met an elephant and asked, "Who is boss of the jungle?"

The elephant grabbed him with his trunk, whirled him around and threw him up against a tree, leaving him bleeding and broken.

The lion got up feebly and said, "Just because you don't know the answer is no reason for you to get so rough."

* * *

Then there were the two red corpuscles who loved in vein.

* * *

"Let's organize a fraternity."

"Why?"

"I've just discovered a new grip."

"Do you mean to tell me," said the judge, "that you murdered your own dear grandmother for a paltry three dollars?"

"Well, judge, you know how it is. Three bucks here, three bucks there—it adds up."

* * *

"Doc, you've got to help me. Last night I drank two quarts of stolen gold paint."

"Good Heavens! How do you feel now?"

"Guilty."

Bust Creme

Dishes and vases you bust can be repaired quickly and easily simply by smearing on a little BUST CREME.

* * *

"Mommy, can I go out and play?"

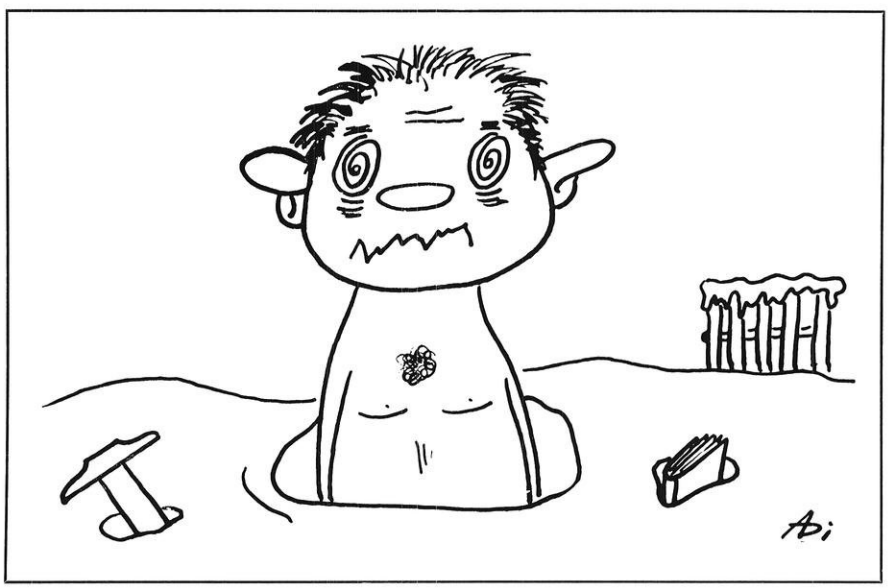
"What, with those holes in your pockets?"

"Naw, with the kids across the street."

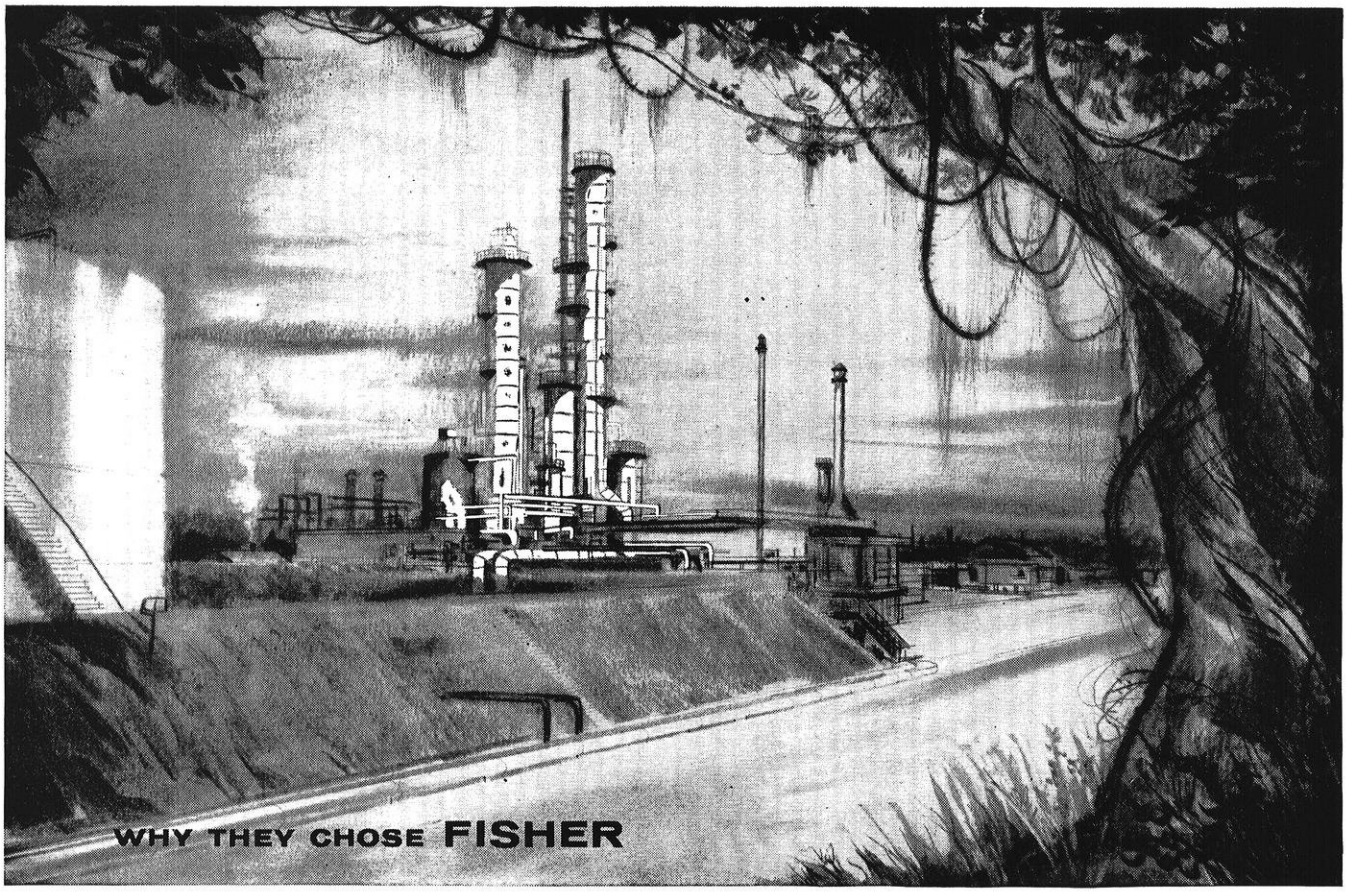
* * *

I was wandering through Madison the other day, wasn't doin' anything, just sort of wandering around, when I comes upon this guy sprinkling purple dust around his front yard. So I says to him, I says, "Hey, what are you doin' that for?" And he says to me, he says, "It keeps the elephants off my grass." So I says, "Shape up, there, man, there haven't been elephants in Madison for thousands of years." And he says, "Well, confidentially, it's a good thing. This stuff isn't any good anyway."

And I met another one of these balmy guys just last week, riding a bus. He was tearing up little pieces of paper and throwing them out the window as we rode along. Naturally I'm wondering what it's all about, so I ask him, and he says, "Why, it keeps the elephants away." I'm pretty T.O.'d by this time, so I says "But there AREN'T any elephants around here!" This was his big moment, see, so he turns to me and kinda smiles and says, "Effective, isn't it?"



Do you ever have that snowed feeling?



A thousand miles up the Amazon

CONTROLS MUST FUNCTION... *WITHOUT PAMPERING!*

A thousand miles up the Amazon puts you about 200 miles south of the Equator—and a whale of a long way from service, as we know it. But, nevertheless, there stands the Manaus Refinaria del Companhia de Petroleo da Amazonia, complete with the most modern refining equipment.

Here, every bit of equipment must stand on its own merit... there is no time for pampering. Sources of supply and repair are too far away to help much.

So, when they hacked this refinery out of the jungle, they chose *Fisher* control valves and liquid level controls.

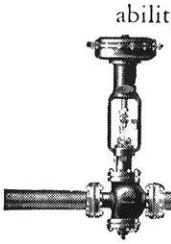
In a recent report, Arturo Amorim, Vice President and Director of Operations, states, "... All are delivering excellent performance"!

Which again proves that you can't beat more than three quarters of a century of *Fisher* engineering know-how for day-after-day dependability.

Manaus Refinery
COMPANHIA de PETROLEO da AMAZONIA
Designed by
SOUTHWESTERN ENGINEERING COMPANY
Los Angeles, California
Inaugurated September 6, 1956

Fluid Catalytic Cracking Unit
Designed by
UNIVERSAL OIL PRODUCTS COMPANY
Des Plaines, Illinois

CONTROL VALVES—LIQUID LEVEL CONTROLS
Supplied by
FISHER GOVERNOR COMPANY
Marshalltown, Iowa / Woodstock, Ontario



FISHER GOVERNOR COMPANY
Marshalltown, Iowa/Woodstock, Ontario

FISHER® Controls
SINCE 1880

WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROLS

So You Think You're SMART!

by Sneedly bs'61

ASURE means of identifying Engineers this time of year is the beard he fluourishes—green, red, orange, or the mundane brown or black. If you see a man with a beard, you can bet that he's an Engineer because very few hill students can grow beards. A lot of them try, only to discover after several weeks that nothing has appeared and they have been shaving since sixth grade for no good reason. Poor devils! The best they can do is gape in admiration as a Schweppesman-like Engineer swaggers past.

* * *

The problem of the equilateral triangles and matches can be easily solved by forming a triangle in a horizontal plane and placing a match at each of the three vertices and forming a pyramid. Result: four equilateral triangles, count 'em.

* * *

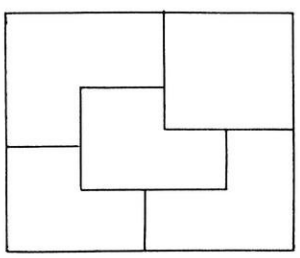
The line BC in the circle problem comes out to 4 inches.

* * *

The salesman's home is between the two cities so that Train A arrives at 9:00, while Train B, going in the other direction, pulls into the station at 9:02. The next A Train comes at 9:10. The maximum amount of time that the salesman can wait for the A Train is 8 minutes. For the B Train he can wait a maximum of 2 minutes. Assuming that the salesman arrives at the subway platform in an entirely random manner, he will take the A Train four times more often. This means that he will visit city A four times more frequently than city B.

* * *

The accompanying diagram shows how one would divide the land to satisfy the conditions of the will.



Now for this month's problems. Don't forget the $10.00 cash prize that awaits the writer of the correct solutions. The earliest postmark decides the winner, so don't put it off! Send your solution to:

SNEEDLY
c/o The Wisconsin Engineer
Mechanical Engineering Bldg.
Madison, Wisconsin.

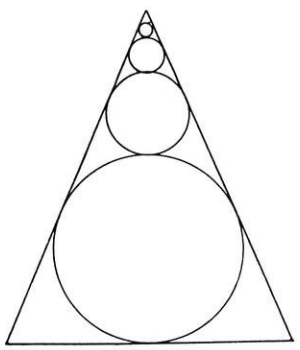
* * *

Here's the first one:

There are four flies on the four corners of a square. Each one faces the fly next to him, in a clockwise direction. Each starts walking at a certain instant, always walking directly toward the fly he was originally facing. All walk at the same speed. When they meet at the center, how far has each walked?

* * *

Circles are stacked so as to fit in a triangle of 8″ base and 10″ altitude as shown:



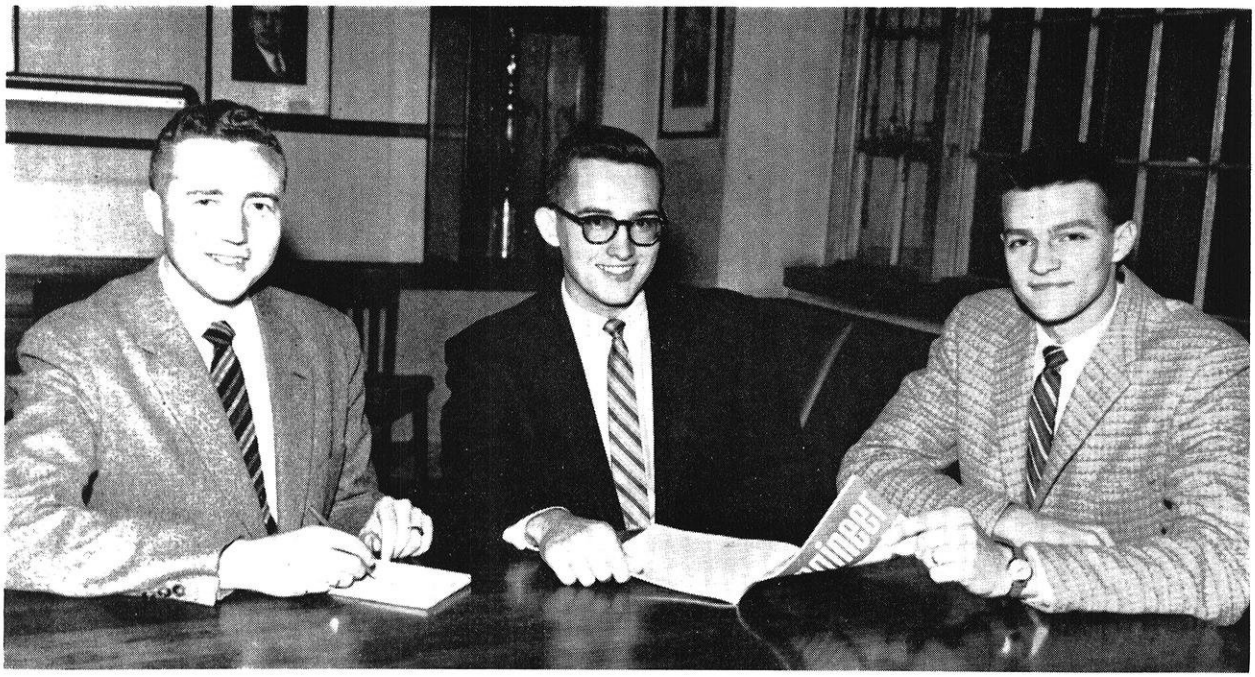
Each circle is inscribed in the triangle and resting on the circle below.

There are an infinite number of circles involved.

a. What is the sum of the circumferences of all the circles?
b. What would be the total surface if the figure represents spheres in a cone?
c. What fraction of the triangle's area is covered by these circles?

* * *

Bill and David start towards each other from opposite ends of a 40 mile road at the same time. Bill travels at 3 miles per hour, and David at 5 miles per hour. At the same moment, a bee starts with Bill and flies at 20 miles per hour, flying back and forth between the two boys during their journey. What is the total distance the bee has flown when the two boys meet?

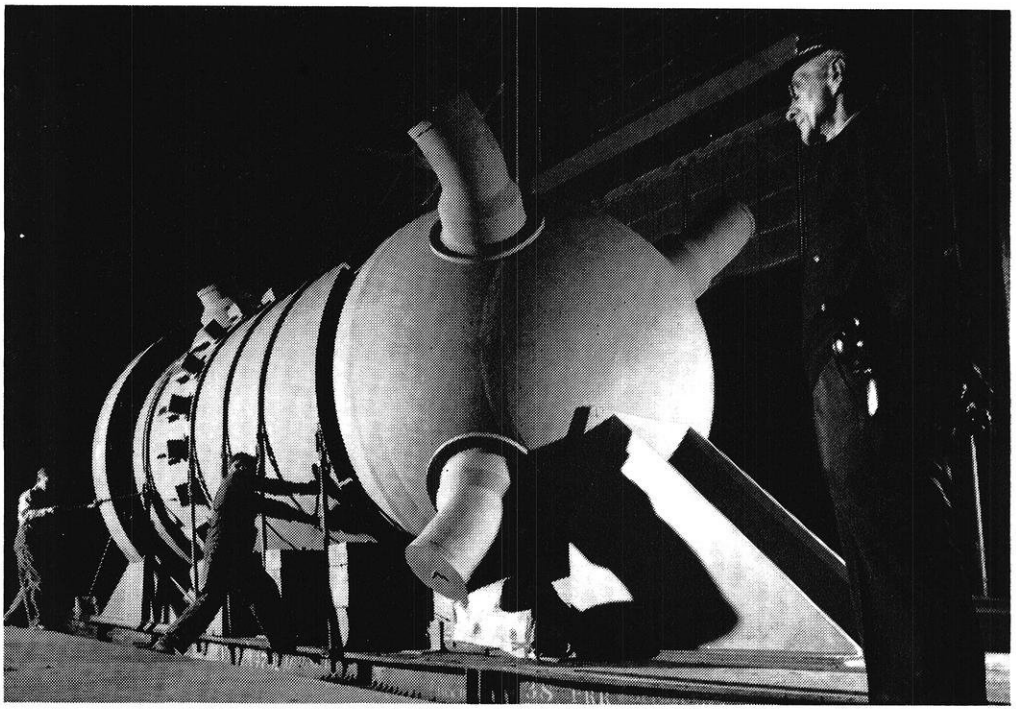


BOY! ARE WE TIRED OUT

In fact we're about ready to retire, all three of us. My name is Russ Jacobson and that's me grinning at you from the left side of the picture. In the middle is my boss Jim Schilling and that's big Al Clauer on the right. We're the fellows that have been responsible for putting out *The Wisconsin Engineer* this year. Jim is the Editor-in-Chief, I'm the Associate Editor-in-Chief and big Al is the Business Manager. Jim and I are EE's and Al is a Met E. We're all Seniors graduating in June and now we need to find fellows that can take over our jobs in the future. We all joined the staff of *The Wisconsin Engineer* when we were Sophomores and after a couple of years of learning the ropes we were given our present jobs. I've found it's been a splendid opportunity to learn something about the publishing business and more particularly technical publications. We need men for both the editorial staff and business staff so if you're a Freshman, Sophomore, or Junior in Engineering and you think you'd like to find out more about the positions we have available why don't you contact me. My name again is Russ Jacobson and you can call me at 3–7375.

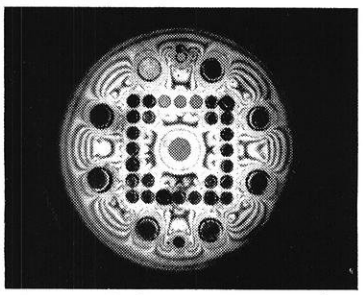
Remember there are plenty of rewards for working on your magazine. For one thing you get to see your name in print and everyone is human enough to like that even though we are engineers. Then of course there's our free banquet every year and we all get citations and keys as awards for a job well done. But perhaps the biggest satisfaction comes in looking at the magazine and seeing the story we wrote or laid-out, or the picture we drew. So if you're really interested and not afraid of a couple of hours work every month give me a call—that number again is 3–7375.

PHOTOGRAPHY AT WORK—No. 25 in a Kodak Series

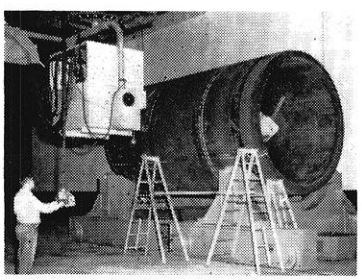


Nuclear reactor vessel for Shippingport, Pa. power plant designed by Westinghouse Electric Co. under contract with the A.E.C. for operation by Duquesne Light Company.

Where atoms turn into horsepower



Photograph showing patterns of stress concentration. It was taken of a plastic model of a reactor vessel loaded to simulate the strains a real reactor vessel would undergo.



Radiographs of the reactor vessel welds were made with a 15,000,000-volt betatron. Every bit of the special steel, every weld had to be proved sound and flawless.

Combustion Engineering designed and built this "couldn't-be-done" reactor vessel for America's first full-scale nuclear power station. And photography shared the job of testing metals, revealing stresses and proving soundness.

COUNTLESS unusual—even unique—problems faced Combustion Engineering in creating this nuclear reactor vessel. Nine feet in diameter with walls 8½ in. thick, it is 235 tons of steel that had to be flawless, seamed with welds that had to be perfect. And the inner, ultrasmooth surface was machined to dimension with tolerances that vie with those in modern aircraft engines.

As in all its construction, Combustion Engineering made use of photography all along the way. Photography saved time in the drafting rooms. It revealed where stresses and strains would be concentrated. It checked the molecular structure of the steel, showed its chemical make-up. And with gamma rays it probed for flaws in the metal, imperfections in the welds.

Any business, large or small, can use photography in many ways to save time and money. It can go to work in every department—design, research, production, personnel, sales, and accounting.

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With photography and photographic processes becoming increasingly important in the business and industry of tomorrow, there are new and challenging opportunities at Kodak in research, engineering, electronics, design and production.

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One of a series

Interview with General Electric's Hubert W. Gouldthorpe Manager—Engineering Personnel

Your Salary

Although many surveys show that salary is not the prime factor contributing to job satisfaction, it is of great importance to students weighing career opportunities. Here, Mr. Gouldthorpe answers some questions frequently asked by college engineering students.

Q. Mr. Gouldthorpe, how do you determine the starting salaries you offer graduating engineers?

A. Well, we try to evaluate the man's potential worth to General Electric. This depends on his qualifications and our need for those qualifications.

Q. How do you evaluate this potential?

A. We do it on the basis of demonstrated scholarship and extra-curricular performance, work experience, and personal qualities as appraised by interviewers, faculty, and other references.

Of course, we're not the only company looking for highly qualified men. We're alert to competition and pay competitive salaries to get the promising engineers we need.

Q. When could I expect my first raise at General Electric?

A. Our primary training programs for engineers, the Engineering Program, Manufacturing Program, and Technical Marketing Program, generally grant raises after you've been with the Company about a year.

Q. Is it an automatic raise?

A. It's automatic only in the sense that your salary is reviewed at that time. Its amount, however, is not the same for everyone. This depends first and foremost on how well you have performed your assignments, but pay changes do reflect trends in over-all salary structure brought on by changes in the cost of living or other factors.

Q. How much is your benefit program worth, as an addition to salary?

A. A great deal. Company benefits can be a surprisingly large part of employee compensation. We figure our total benefit program can be worth as much as 1/6 of your salary, depending on the extent to which you participate in the many programs available at G.E.

Q. Participation in the programs, then, is voluntary?

A. Oh, yes. The medical and life insurance plan, pension plan, and savings and stock bonus plan are all operated on a mutual contribution basis, and you're not obligated to join any of them. But they are such good values that most of our people do participate. They're an excellent way to save and provide personal and family protection.

Q. After you've been with a company like G.E. for a few years, who decides when a raise is given and how much it will be? How high up does this decision have to go?

A. We review professional salaries at least once a year. Under our philosophy of delegating such responsibilities, the decision regarding your raise will be made by one man —the man you report to; subject to the approval of only one other man —his manager.

Q. At present, what salaries do engineers with ten years' experience make?

A. According to a 1956 Survey of the Engineers Joint Council*, engineers with 10 years in the electrical machinery manufacturing industry were earning a median salary of $8100, with salaries ranging up to and beyond $15,000. At General Electric more than two thirds of our 10-year, technical college graduates are earning above this industry median. This is because we provide opportunity for the competent man to develop rapidly toward the bigger job that fits his interests and makes full use of his capabilities. As a natural consequence, more men have reached the higher salaried positions faster, and they are there because of the high value of their contribution.

I hope this answers the question you asked, but I want to emphasize again that the salary *you* will be earning depends on the value of *your* contribution. The effect of such considerations as years of service, industry median salaries, etc., will be insignificant by comparison. It is most important for you to pick a job that will *let* you make the most of your capabilities.

Q. Do you have one salary plan for professional people in engineering and a different one for those in managerial work?

A. No, we don't make such a distinction between these two important kinds of work. We have an integrated salary structure which covers both kinds of jobs, all the way up to the President's. It assures pay in accordance with actual individual contribution, whichever avenue a man may choose to follow.

*** We have a limited number of copies of the Engineers Joint Council report entitled "Professional Income of Engineers—1956." If you would like a copy, write to Engineering Personnel, Bldg. 36, 5th Floor, General Electric Company, Schenectady 5, N. Y.** 959-7

LOOK FOR other interviews discussing: • Advancement in Large Companies • Qualities We Look For in Young Engineers • Personal Development.

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