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NOVEMBER
1955

The Wisconsin

engineer

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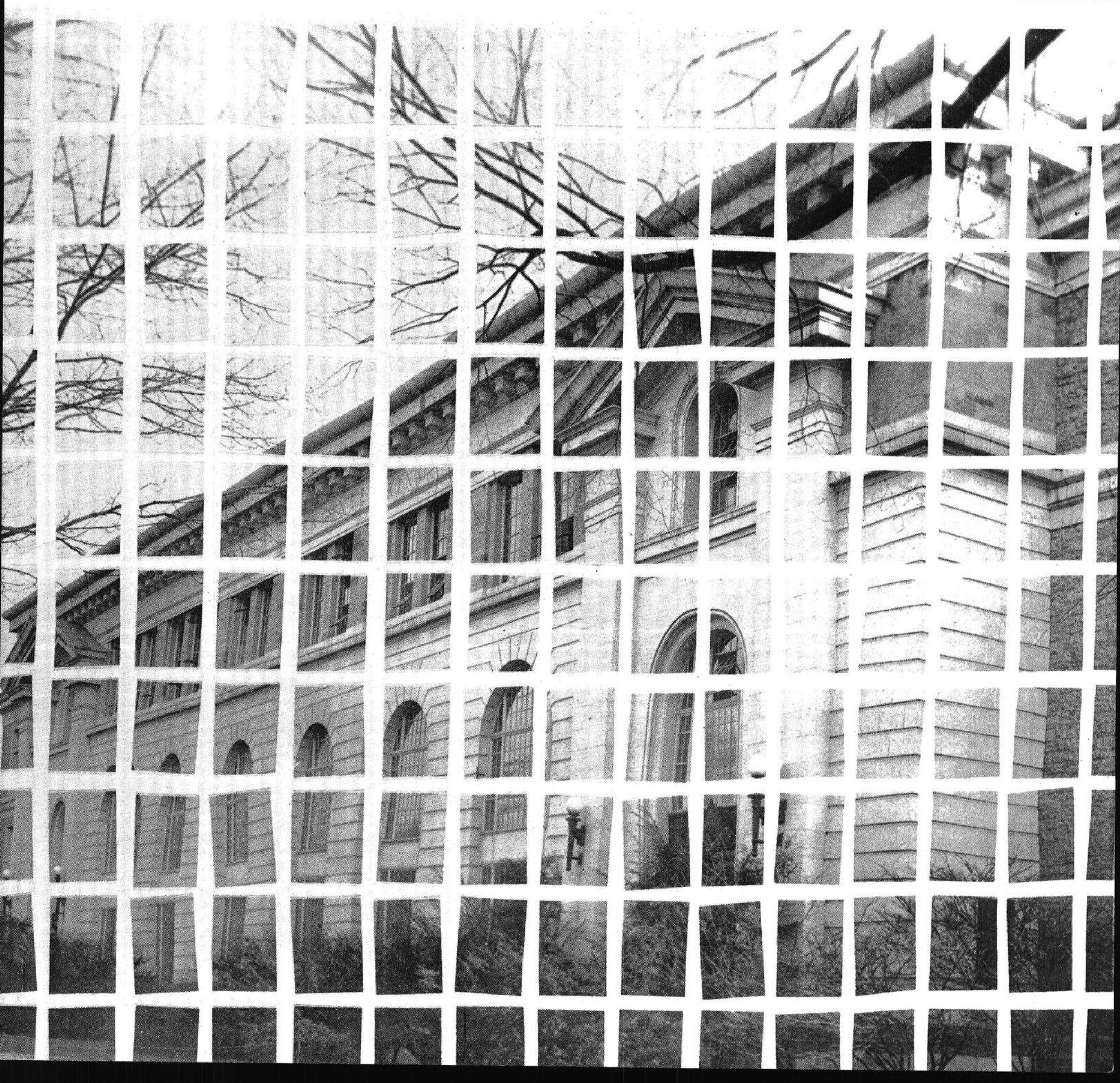

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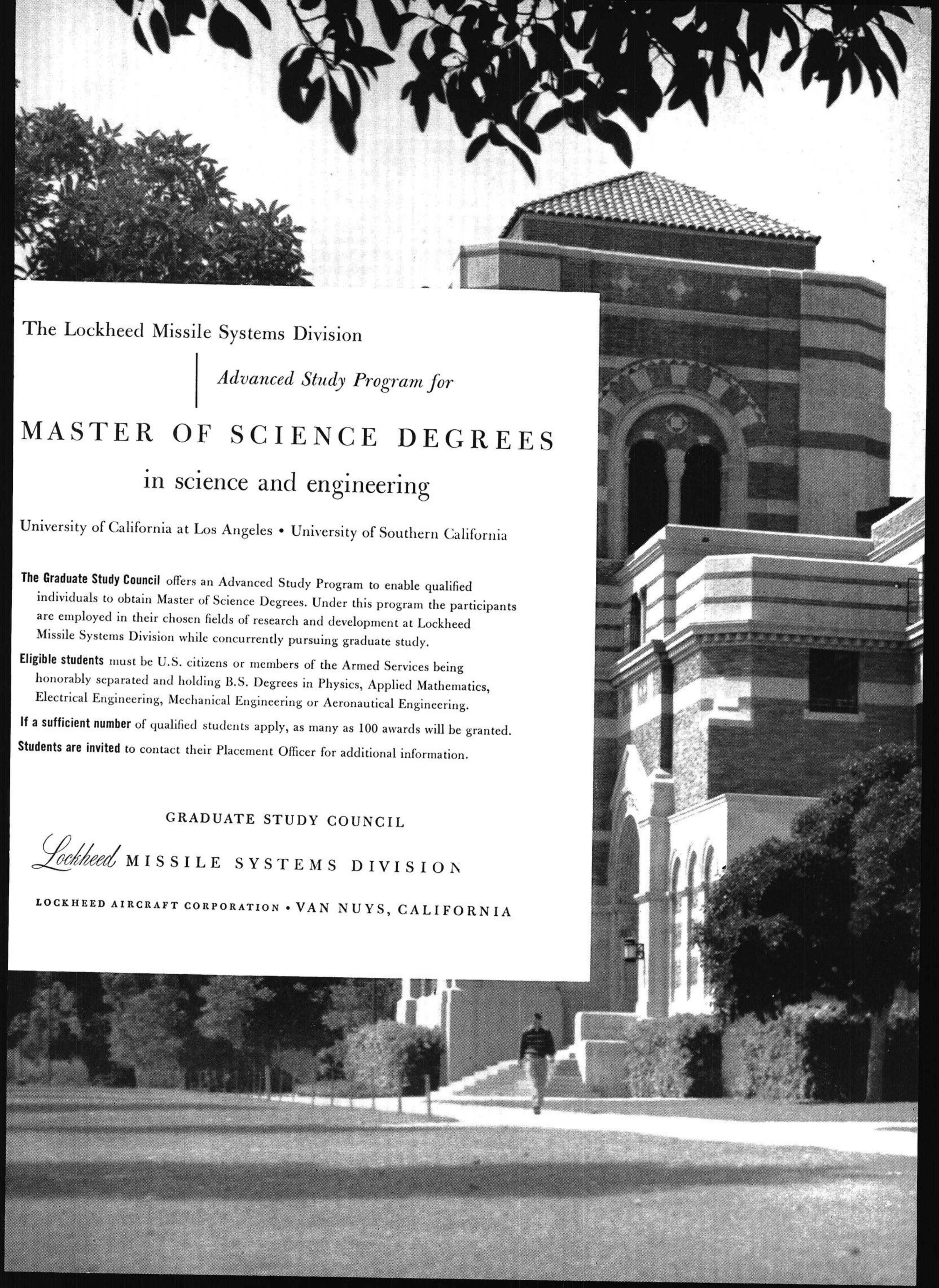

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WISCONSIN ENGINEER

The Student Engineer's Magazine

FOUNDED 1896

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That is the question graduate and professional engineers will be made to answer in the future. Now is the time to start thinking about it.

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This article covers the basic aircraft instruments.

FROM STEEL TO PLASTICS . . . . *Dave Fisher* 20

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Cover

There is no need to go into a discourse explaining that the cover pictures the Mechanical Engineering Building. That sight is old stuff to most of us, but the jig-saw puzzle effect is just a little different. We could try to give this unusual representation some symbolic meaning such as engineering is a jig-saw that only we engineers can put back together, but we don't intend to do that. If there is some symbolism, it is left for you to determine. We were only interested in the artistic effect.

IN THIS ISSUE . . .

by Alan Black, e'58

DAVID EVJUE

Should I join a union? What do I lose or gain if I do? How do other engineers feel about unions? The relationship of the engineer to the union is currently being drastically revised and it's very likely that most of us will someday have to answer these and similar questions.

For some accurate information and a sound basis for answering such questions we suggest you read Dave Evjue's article on engineers and unions.

Dave is a sophomore in Mechanical Engineering and is from Green Bay. At present Dave informs us that his chief aim is to pay the library fines on books he borrowed for research on his article. After this is accomplished, and after graduation Dave plans to enter the personnel side of engineering.

KENNETH HILGENDORF

Whether you're a budding fly-boy, or just plain interested in airplanes and what makes them work (or not work), Ken Hilgendorf's article will probably be of interest to you.

Although this article may be of no *practical* interest to you, that shouldn't keep you from reading it anyway. If we engineers were all of a completely practical nature, what narrow individuals we would be.

Ken calls his article "The Eyes and Ears of the Airplane." It's a straightforward, factual account of the hows and whys of airplane instrumentation. Ken left this article for posterity, for he graduated from mechanical engineering last year.

DAVE FISHER

Remember when there was a lot of theoretical talk about plastic automobile bodies? In case you haven't heard this is no longer theory. It's fact. So says Dave Fisher in his article "From Steel to Plastics". He makes the facts sound attractive too. We confess that we look fondly forward to the day when the wrinkled fender can be fixed as easily as a flat tire is repaired. It's possible. But there's more to the article: some talk about fibre-glass boats for instance, and some mildly technical stuff for dyed in the wool enthusiasts.

We think there's something for you.

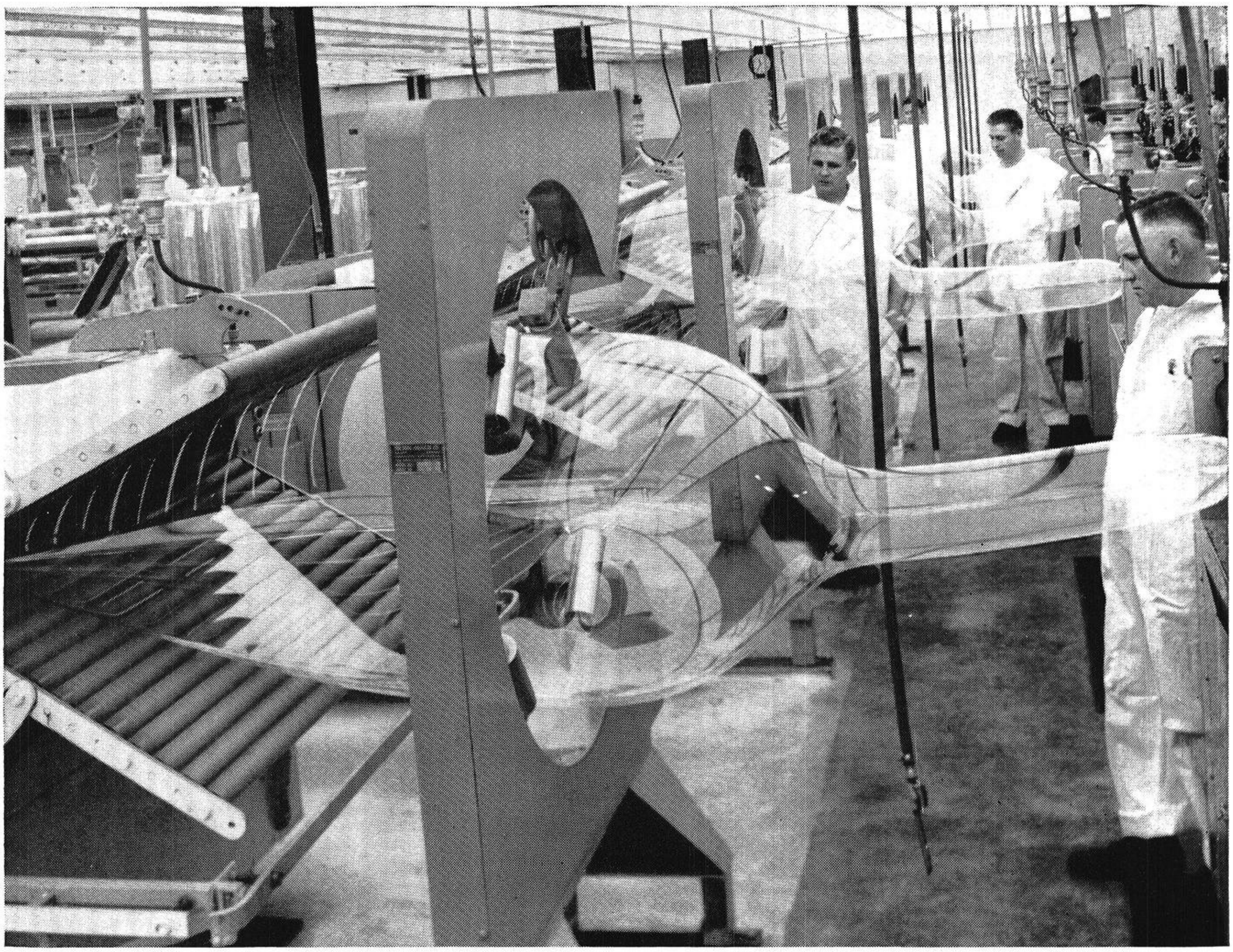
During the summer Dave works as a draftsman for the Public Service Corporation in Green Bay, where he lives. During the rest of the year Dave plans to devote most of his time to being a sophomore in Mechanical Engineering.

DONALD EDWARDS

There is, somewhere further on in this magazine, an article by Don Edwards called "Automation." And therein hangs a tale. It seems that since automation first made it's debut every technical magazine in the country has carried an article which "explains" automation. As a result articles on automation are supposed to be poor copy and we hesitated to jump on the band wagon with an article pressed from the same mold.

But automation is becoming more and more important to the engineer and we felt we couldn't ignore the subject. Fortunately, Don Edwards, from our own story staff, got us off the hook. Don, a senior in Mechanical Engineering from Sturgeon Bay, Wisconsin, has written an article which we think is a little more than the usual statistical tabulation. We hope you agree.

In addition to performing yeoman service for the Wisconsin Engineer Don is a member of Tau Kappa Epsilon, Pi Tau Sigma, and Tau Beta Pi, and is an instructor in the mechanics department. After graduation this year, Don hopes to get his masters degree in Mechanical Engineering.



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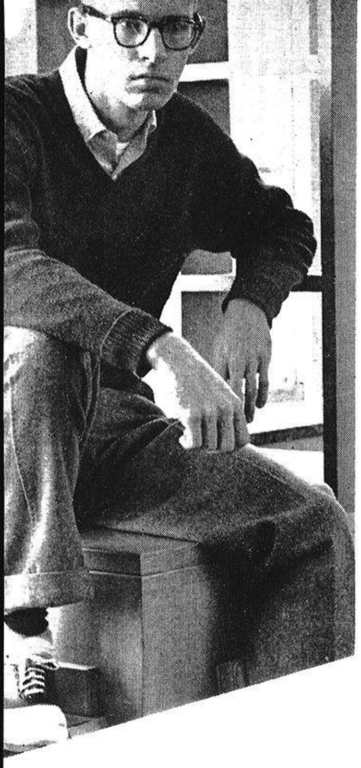


ONE MAN'S OPINION, BUT . . .

THE BURDEN OF PROOF LIES WITH YOU

"A man is innocent until proven guilty", and an engineer is just another engineer until proven otherwise. We're all familiar with that first phrase, but for some reason we don't even recognize the second. An engineer is just another engineer (if that) until proven otherwise. And the burden of proof lies with you as an engineer.

There's a shortage of engineers and all that, and you will probably have no difficulty at all in finding a job, but if you think that makes you a success, then take off those rose-colored glasses my friend. You may have a job, granted, but where you go from there is strictly up to you. In other words, you've got to produce. Not only that, but you've got to let people know that you are producing. As I said before, the burden of proof lies with you.

During the last two summers I worked with Du Pont and Procter & Gamble, both of which employ large technical staffs. Both required their engineers to give oral progress reports complete with charts, diagrams, and illustrations, before other engineers as often as once a week, as practically all companies do. Who attended these meetings? Why the group leader, the section leader, the department head, other department heads, the chief engineer, and the vice-president in charge of development. Now let me ask who it is that determines any salary increase or promotion you may deserve? I think you know that answer as well as I do. The net effect of such group performances is that you are in direct competition with all the other engineers in your group for promotions and raises. It's your own ability to "sell" yourself that will determine whether you move or stall.

To sell yourself in this fashion is to tell clearly and convincingly that what you have been doing is significant and worthwhile.

Are you prepared to do this? Can you stand up before a group that includes your bosses and give a convincing report, knowing that you and your work are up for inspection?

It seems to me that your oral talks are much more important than your written reports in determining your future. Weekly progress reports probably don't get beyond your immediate supervisor, for he includes your work in a paragraph or two in his own report, and so on. Your final report on a project likewise may not be read by busy superiors unless your work has been truly significant.

How does your training and ability stand up against the requirements in this matter? You've had a college speech course in your freshmen or sophomore year, but that probably did not help much beyond relieving stage fright if you were inexperienced. Has your engineering 99 course given you the knowledge and ability to step out into the so-called rat-race of business? That depends upon the whims of your instructor, and not all instructors are equally capable in this important matter, but the answer is that one course usually won't do the trick.

If you feel yourself lacking in self-expression, and which of us don't, it has been left largely up to you to correct the situation personally.

But how can I do it, you ask? Time seems to be a limiting factor.

The time is there if you will only put it to work. A good way to help you gain poise and experience in self-expression is to work on some extra-curricular activities which require it. I don't think there is any better training in salesmanship than to try to sell an idea to a group of over-optimistic college students planning some project or event such as campus carnival, the engineering exposition, or winter week. Try it and you'll see what I mean.

Writing is closely related to speaking in that behind them must be effective thinking. It goes without saying that effective practice in writing can be gained by working for the *Wisconsin Engineer.* As far as I am concerned, the purpose of the Engineer is not only to help those of proven and exceptional writing ability (as so many seem to think), but also those who do need the practice in self-expression. As a matter-of-fact, you'd be surprised at the amount of copy that must be rewritten by some of our staff before the stories get into the magazines, so you see, all of the staff members are hardly professionals.

You may feel that I'm not talking to you. Don't be so hasty to disregard all this. Anyone can write a good report, or good article, or deliver a good speech until he has to do it, and then. . . .

When industry reports that almost 50% of an engineer's time is spent writing or speaking for a definite purpose, you had better give your own talents a critical appraisal. You can't afford not to. And nobody will do if for you.

—R. A. H.

What is this...this AUTOMATION?

ARTICLES ON AUTOMATION ARE MANY AND VARIED, BUT HERE'S A COMPREHENSIVE ONE AIMED DIRECTLY AT YOU. IT IS THE FIRST OF TWO COVERING AUTOMATION, AS SUCH, AND ITS EFFECT UPON SOCIETY

by Don Edwards, m'56

Automation is that exciting new word everyone has seen bantered about in tons of news-print and books in the past few years. But, where did it originate and what does it mean?

The word automation was coined by two men independently of each other at about the same time in the late 1940's. John Diebold coined the word as a shortened form of automatization in the writing of the Harvard report, *Making the Automatic Factory a Reality*. Diebold said "Automation is a new word denoting both automatic operation and the process of making things automatic." Del S. Harder, Vice President-Manufacturing of the Ford Motor Co., coined the word to mean "automatic handling of parts between progressive production stages." Since the word originated from two different sources and had somewhat different meanings, there has been considerable confusion among writers on the subject as to how automation should be defined. A more recent definition by Del S. Harder seems to present the majority opinion, however. "Automation is a philosophy of design, it is a manufacturing method, and it is control within a machine."

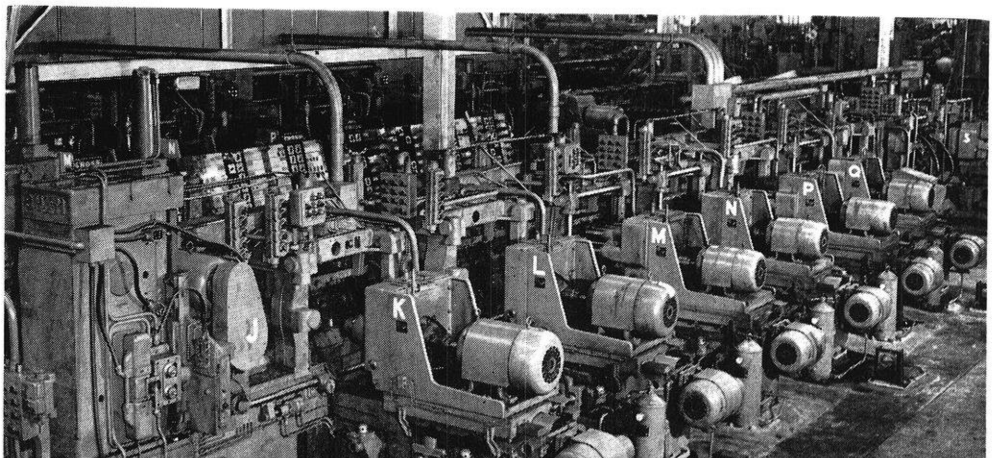
Automation has been hailed as the most significant development in production since the Industrial Revolution; in fact, it has been called the Second Industrial Revolution by many writers. Webster defines the Industrial Revolution as "the change following and resulting from the introduction of power-driven machinery to replace hand labor." The Second Industrial Revolution may be defined as the change following and resulting from the introduction of machinery to replace *brain* labor. Where the First Industrial Revolution provided power driven machinery to perform the brute labor of our society, the second revolution will make possible the automatic control of these processes. Harry M. Davis put it another way in an article in Scientific American when he said "The first phase of the Industrial Revolution meant the mechanization then the electrification of brawn. The new revolution means the mechanization and electrification of brains."

Many writers on automation speculate on the social and economic impact that it will have on our society. That automation and the Second Industrial Revolution will create far reaching social and economic changes can be denied by no-one. The magnitude, velocity, and nature of these changes, however, can be argued by everyone. The effects on labor, productivity, standard of living, amount and use of leisure time, and the nature of work are indeed interesting to speculate on.

Since the beginning of the First Industrial Revolution, there have been many examples of automatic machinery and even of automatic factories. "Let's make it automatic" is definitely not a new or novel notion which has come labeled—automation.

In 1784, Oliver Evans built an entirely automatic flour mill near Philadelphia. Grain was fed into the mill by bucket conveyor. Water power moved it over a series of endless belts, and screw conveyors, carried it through coarse and fine grinding operations, until the finished flour emerged.

(Continued on next page)

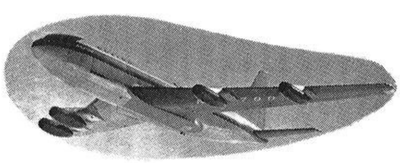


Out for lunch? Nope. It's Automatic . . . This gigantic machine automatically carries six-cylinder engine blocks through a multitude of operations—untouched by human hands.

—Courtesy Ford Motor Company

In 1801, in Paris, Jacquard exhibited an automatic loom controlled by punched paper cards. By 1812, eleven thousand of these machines were operating in France alone.

In 1920, A. O. Smith Corp. built a fully automatic assembly line for the fabrication of auto body frames.



Automatic screw machines have been used by industry for many years as have been other automatic and semi-automatic production machines.

One might be tempted to ask then "Well, what's so new about automation when we've had automatic machinery for so long?" The answer to this question lies in certain technological developments made during World War II.

Until World War II, we depended on the sporadic ingenuity of individual inventors for the design of automatic controls for our machines and factories. During the war, however, it was soon found that the old methods of gun-laying could not cope with the speed and maneuverability of modern aircraft. The search for better methods resulted in extensive research in the fields of electronics, communications and electrical network analysis. The fruits of this research have been the technological basis for the new industrial revolution. Development of techniques for designing stable *feed-back* (self-correcting) control systems has revolutionized the field of automatic control. At the same time, the newly developed electronic *computers* with the ability to follow extensive lines of logical reasoning and to choose between alternatives make it possible to handle large quantities of routine, and not so routine information. Stable feed-back and the computer then are the technological developments which have lifted the fully automatic factory from the pages of science fiction to the realm of reality.

There are two basic types of control: 1) control which is pre-set and independent of the performance of the system being controlled (open-loop control) 2) control which is a function of the performance of the system being controlled (closed-loop control). See fig. 2.

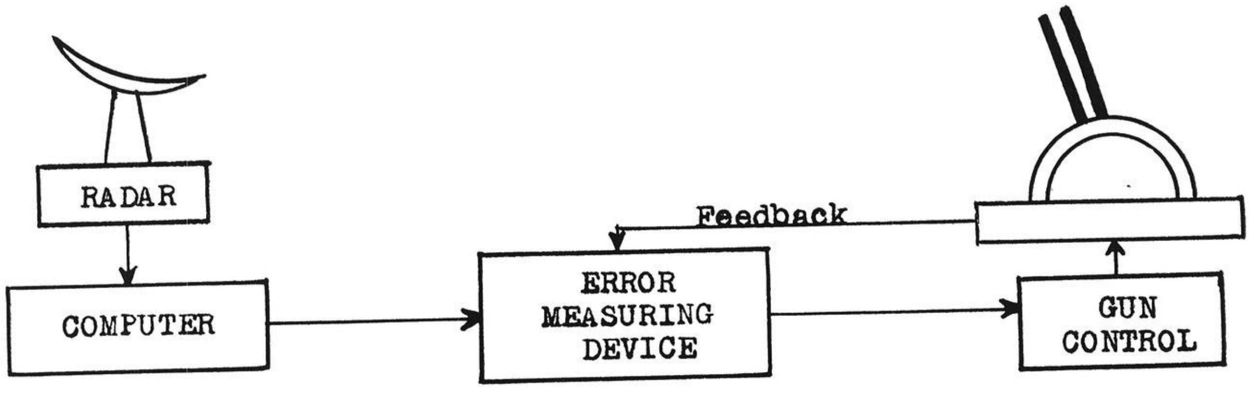
An example of open-loop control is the switch on a study lamp. The function of the control is to turn the lamp on or off; but it will not turn it on if the room suddenly becomes dark, or turn it off if the sun comes from behind a cloud. In other words, the control mechanism is independent on the performance of the system which it controls.

A closed-loop (commonly called feed-back) control system, on the other hand, has the characteristic of being self-correcting. It is a control in which the process by its own product, regulates itself. There have been good examples of closed-loop control systems existing for many years.

A steam engine's speed is held constant by the fly-ball governor regardless of the load on the engine. As the load is increased, and speed tends to decrease, the fly-balls drop and more steam is admitted to the cylinders. As the load decreases, and speed tends to increase, the fly-balls rise and less steam is admitted to the cylinders. Thus the control (steam throttle adjustment) is a function of the performance (speed) of the system being controlled.

A thermostatically controlled home heating system is another example of closed-loop control. The temperature in a room is held at some pre-determined level regardless of outside conditions (within reasonable limits). If room temperature rises, the thermostat senses this and causes the fuel supply to the furnace to be cut back. If the temperature drops below the desired level, the thermostat senses the drop and causes more fuel to be burned. Again we see that the control (setting of the fuel valve) is a function of the performance (temperature) of the system being controlled.

Closed-loop control systems have been called feed-back systems because information about the performance of the system is *fed back* to an error measuring control device. This device compares the fed-back information with some desired performance and translates the error into energy impulses which will cause a control (valve, switch, etc.) to eliminate the error in performance. The idea of feed-back can be illustrated by a simple explanation of a gun position-control system. See fig. 2. The radar tracker picks up the aircraft and feeds its position and velocity into a computer. The computer determines, onthe basis of this information, where the gun should be pointing at any par-



ticular instant. This information on the required position of the gun is fed into the error measuring device. At the same time, the actual position of the gun is *fed back* into the error measuring device. The resulting difference between actual and desired position of the gun is translated into energy pulses which cause the gun controls to move the gun and minimize the error.

Although feed-back control systems were used before World War II, their application was not wide spread due to lack of development and basic knowledge. During the war, considerable numbers of capable scientists went to work on the problem of designing servomechanism (feed-back) systems for position-control of guns. Out of this work came a substantial body of new knowledge. This meant for industry that stable servomechanism, feed-back, or closed-loop control systems could be designed and constructed for performing a great variety of tasks.

The electronic computer is another product of World War II research which has become a basic part of automation's technology. By virtue of their great speed and ability to handle simultaneously many variables, computers will permit us to perform many tasks which, until recently would have been impossible. There are two basic types of computers, the analogue and digital.

In the analogue computer electric analogies to physical quantities are set up to the point that whole physical systems can be translated into terms of voltages. For instance, in studies of water circulation systems or electric power distribution systems a working model of the system can be set up in the computer. By studying this setup, actual working data can be obtained. This technique is also valuable in the study of servomechanism problems.

Digital computers have, however, figured more prominently in the new technological developments. It is this form of computer that will be of most use in controlling the tasks of industry. Digital computers rely on the basic arithmetic of addition and subtraction for their operation. By performing a long series of additions and subtractions in very rapid sequence, it is possible to solve highly intricate problems in a very short time. Everyone has no doubt heard that a computer can do in a matter of minutes what would take a whole platoon of mathematicians most of their lives. Another valuable function of these machines is their ability to make logical choices between a series of predetermined alternatives.

Science fiction writers have long talked about amazing workerless factories where raw materials feed into one end and cars, toasters, or refrigerators pop out the other. That this is *no longer* fiction in the case of continuous process industries is a fact not appreciated by everyone. In an oil refinery, for instance, crude oil flows steadily into one end of the process while gasoline, kerosene, oil, etc. flow out the other end. The whole process is automatically controlled and monitored from a central control room so that a few men can easily run the plant.

—Photo courtesy Minneapolis Honeywell

This tape-controlled automatic boring machine consists of a standard four-spindle precision boring machine, upper right, modified with built-in electrical controls, circuitry, tape "reader" and manual controls housed in a specially-built control cabinet, shown at left. In the foreground an operator uses a perforating machine, similar to a typewriter, to punch hole coordinates and feed instructions on the tape.

AEC's Oak Ridge plant is another example of process industry automation. This immense plant for separating fissionable U–238 from U–235 by the diffusion process is run by 20–30 girls in a central control room.

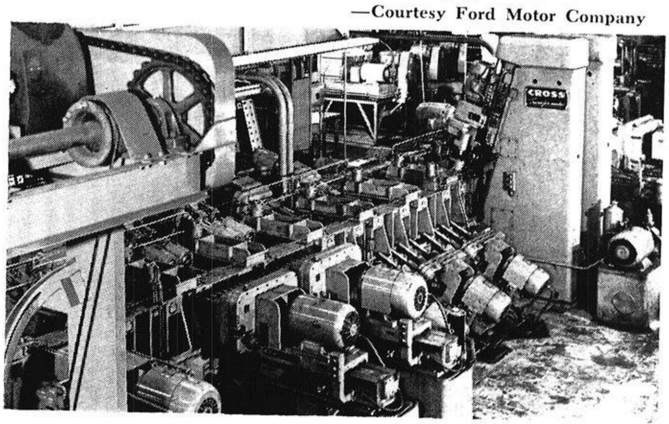
The chemical industry is also automated to a high degree. DuPont likes to advertise plants which run day and night turning out nylon or gun powder, but which need only three men to watch dials.

We can see then that continuous process industries have been able to utilize the technological principles of

(Continued on page 52)

This 14-station transfer-type in-line machine tool is an excellent example of advancement made toward reduction of manual handling and number of individual machines required to produce the same amount of work. Spot facing, chamfering and tapping of bolt holes in top and bottom faces of a six-cylinder overhead valve engine block are machining operations performed by this new transfer machine. It has 176 spindles in action on the block. Work station #11 is a complete roll-over, turning the block 360 degrees to dump chips. Station #12, in turn, is used for automatic inspection, checking 50 holes for depth. Formerly all these operations were performed on a number of individual machines, each requiring manual handling of the heavy block. The block must be positioned on its side at the entrance to the machine. An automatic, hydraulically operated device gently lays the 180-pound block on its side. Then an automatic transfer mechanism moves it into the first machining station. Arduous manual handling of the block has been eliminated throughout the machining process.

—Courtesy Ford Motor Company



To Unionize Or Not To Unionize...

by David G. Evjue, m'58

The controversial question of unions for professional engineers is one you must become aware of now. It is a topic of growing concern to engineers as individuals and industry as a whole. Because your answer to the question is important to your future, you must begin to settle this question in your own mind now.

"Union" seems a harsh and almost sinister word to most engineers as they consider their future work, but if present trends in the field continue there will be continued efforts toward just such associations and many of us may be asked to join them. We will now probably ask ourselves such questions as, "Why do engineers need or want unions?", and "When did this unionization business start and how might I be involved in it?" These are typical questions asked by many people who are unaware that there are engineering unions in existence at the present time.

Moves to organize the engineering profession have been going on since 1918 but have never gotten much attention until recent years. Now we find enemies of unionization movements charging that unions have no place in a professional group. Supporters of the unionization movement fight back saying that the so-called professional status of the engineer is merely a mythical one and they want economic status too. With these arguments flying back and forth, engineers all over are asking themselves these two main questions: (1) Will the over 400,000 engineers in the United States eventually be pulled into unions; and (2) will the engineering unions remain strictly "professional"?

Right now the main union organization for engineers in the United States is the Engineers and Scientists of America, more commonly referred to as the E.S.A. This loose federation was founded in 1952 to bargain for engineers and technicians in industry, and since that time has grown to approximately 40,000 members. E.S.A. has contracts with companies like Boeing, Western Electric, Lockheed, R.C.A., Sperry Gyroscope, Minneapolis-Honeywell, and Pacific Gas & Electric. Since 1918 another union, the International Federation of Technical Engineers, has been affiliated with the A.F.L. Its membership totals about 6000 men, mostly draftsmen in shipyards. It has shown some interest in merging with the E.S.A. although no merger has yet been made.

With large numbers of engineers taking part in this unionization program we begin to wonder just what conditions made them feel that they should be part of an organized collective bargaining unit.

One of the main factors influencing unionization seems to be the size of modern companies. College graduates for the most part are prepared for careers in management but after they are hired they find that their parts in management aren't quite so clearly defined. Many times their jobs for some years will consist mainly or entirely of drawing board work. Here the average engineer feels that he is not rendering the professional service for which he has been educated. This is true especially in an industry such as Sperry Gyroscope where 3,600 out of 16,000 employees are engineers, or at Boeing which has over 5,000 engineers at its plants. In some plants the ratio of production workers to engineers has gone from about 50 to 1 to a frequent 15 to 1. With this expansion, some plants like

Republic Aviation Corporation often have hundreds of engineers working at drawing boards in a single room. Clustering of this type may be practical from the company point of view but does not seem to aid the sense of individuality or professionalism of the engineer since, traditionally, he has worked alone or as one of a small group and has been always identified with management.

Probably the other major factor influencing the engineer's switch to a union for bargaining has been the corruption of the merit system which members of the engineering profession once enjoyed. Formerly, engineers who had a great deal of experience with a firm were receiving about three times the amount that a starting engineer was worth. Then came the present shortage of engineers, the need to draw more young men into the profession and of course a boost in starting salaries to provide added incentive. Successive raises in beginning salaries have decreased the comparative values of the older engineers so that now instead of earning three times the salary of the beginner they are frequently making only about twice the amount paid to those starting in the firm.

After considering the factors important to engineers in E.S.A., Joseph Amann of Minneapolis-Honeywell who was president of the group in 1953 listed three major tasks for member group bargaining:

(1) Provide equitable compensation for engineers and scientists based on their contributions to society.

(2) Remove inequities based on the declining value placed on experience.

(3) Provide sufficient overtime compensation so that employers will stop using engineering overtime as a moneysaving device for poor planning.

As you might suspect, the majority of engineers do not favor the methods of the union at the present time. They argue that although size may somewhat hamper the advancement and obscure the personal and professional aspects of engineering, men who are most capable will soon advance to the better jobs. By way of illustration they point to the increasing numbers of engineers who are now in key executive positions in large firms. Also, union enemies point out that the period on the drawing boards is considered a probation period in most firms, during which superiors judge the maturity and probable future development of the individual. Of course, some engineers can probably be best utilized by placing them on the drawing boards.

Then too, these engineers have answers for the merit system. While most of them feel that more development is necessary in wage scales for experienced employees, the general opinion seems to be that all deserving engineers are working into other management positions. A somewhat lower merit pay scale should decrease any feelings of complacency among older engineers and start them working to improve their positions in their companies. This, of course, will involve a certain amount of overtime but it seems that any recognized profession today demands time. Most doctors, for instance, are on call twenty-four hours per day.

In observing the unions of engineers that have been formed, you will notice that the word union does not appear in the names of the organization. Instead, "association" or some other such term is applied even though the inner operation is the same as most trade unions. Although these men wish to reap some of the values of union bargaining, they do not wish to deprive themselves of the right to be called professional men. In other words, the union men seem to be shopping for a few things from labor, still retaining their status as engineers.

One of the main ways that the E.S.A. is attempting to gain its end is by having a change made in the Taft-Hartley Act. This act now governs labor relations in the United States. Proposed changes in the law involve the word "supervisor". The E.S.A. wants this classification to include only those who have true management functions. This would allow a distinct line to be drawn between labor and management, and by doing this the union could separate the mere laborer from the engineer in management and act accordingly.

After seeing the reasons for and against unions, let us observe the attitude which the engineers themselves are taking on the subject. A survey by the American Society for Civil Engineers showed that 25% of 17,203 responding members favored collective bargaining. Similarly, the American Society for Mechanical Engineers is reported to have found that more than 20% of its members wanted unions. On the other hand, a few years ago the Opinion Research Corporation showed that among members of the American Chemical Society 73% were unqualifiedly opposed to unions, only 6% were in favor of them, and the rest were undecided.

Now we begin to wonder where an engineering union would get its power. That is, would it have to join all of organized labor to get enough massive support to carry on a major strike? If they did join the CIO-AFL would they be able to keep a particle of their professional status? These are questions which will be asked and should most certainly be considered in reaching a decision. Along with them is the question of seniority. Will the engineers' unions insist on strict rights like most unions do, giving consideration to seniority alone; or will the advancements on the basis of skill and ability be continued?

As students, we can now look into the world of the engineer impartially and begin to form opinions on such controversial issues as unionization. Matching facts, one against another, we should be able to take a stand on an issue such as this one. Hourly laborer . . . or professional engineer—which will you be?

END

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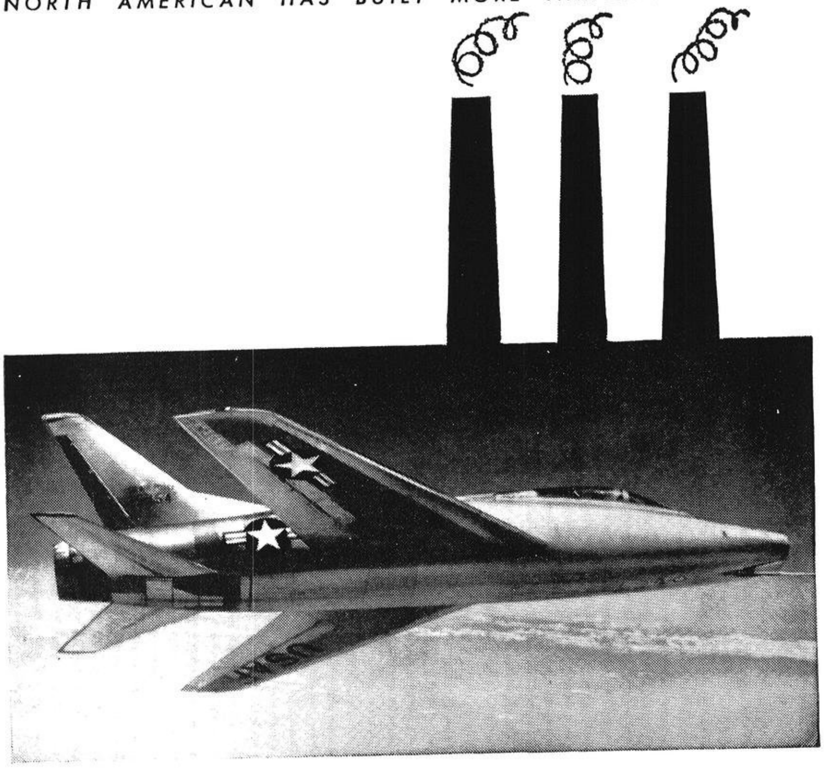

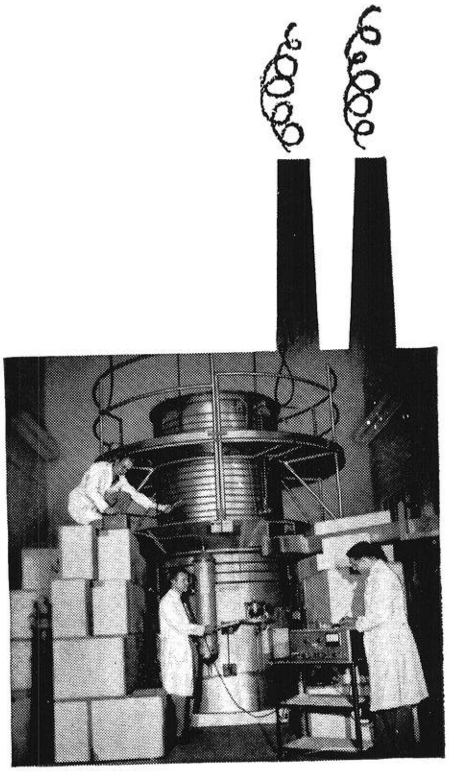

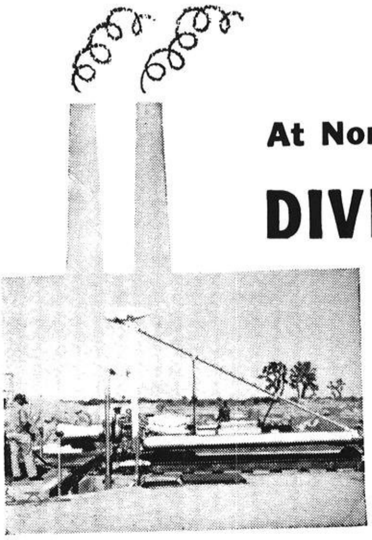

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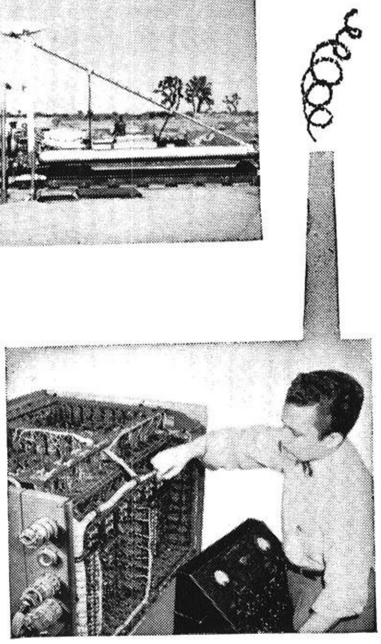

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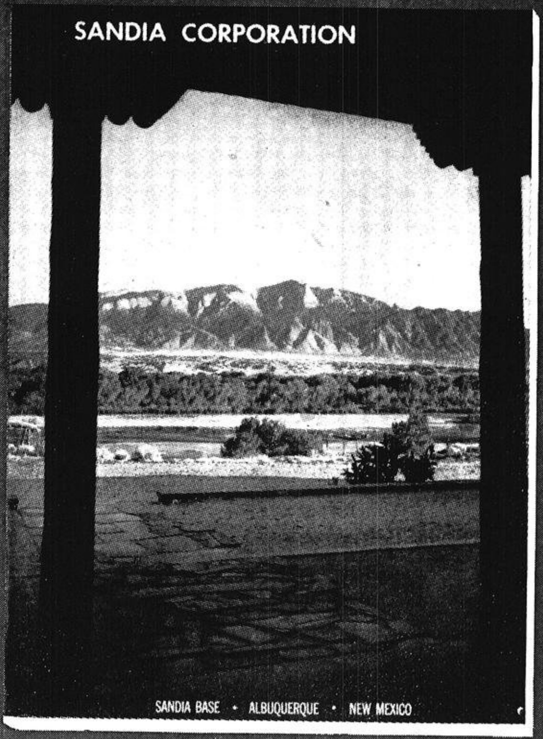
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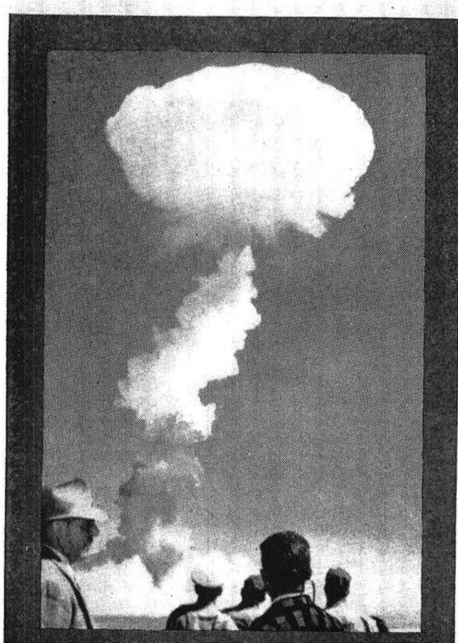

The Eyes and Ears of an Airplane

by Kenneth L. Hilgendorf, m'55

It is through his eyes that a pilot largely obtains his sense of balance and position by noting his relationship with visible objects. Remove either his sight or ability to see outside objects and his sensory powers disappear, often producing sensations completely the reverse to the fact. In clouds, fog, heavy snow, or haze the pilot's true senses not only desert him, but may even deceive him into making control movements which instead of being corrective are the reverse.

For this reason, instruments are fixed into the plane which indicate the facts. In order to use these instruments, the pilot must follow their direction completely, no matter how contradictory they may seem to the senses. This requires intense concentration which may be fatiguing to the inexperienced pilot, but with experience these instruments can prove invaluable.

The Compass

The compass is used to fly in a certain direction or course. Quick reading of the compass is important, and occasionally it is somewhat mystifying. Imagine the pilot sitting in the middle of the compass; then the direction of flight is always in a straight line from this position to the nose of the plane. The north-seeking needle is always pointing north, whatever the direction of flight.

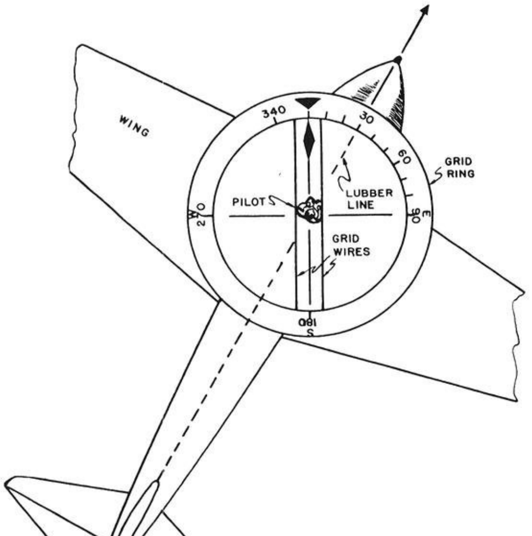

Figure 1.

When making a turn, the compass needle is always in a fixed position, although it appears to move, and the pilot is pivoting around to the right or the left of the north needle. A line is marked on the compass which corresponds to the nose of the plane—this is known as the lubber line. If the plane is turned until the lubber line is on the north wire, the plane is flying north; if the lubber line is on the south wire, the plane is flying south.

Suppose that the lubber line is between north and south, and the pilot is in his normal position. If the pilot wishes to swing the plane and the lubber line over to the west wire, he must turn to the left, as this is the shorter distance. The lubber line should be visualized as turning around the compass needle—not the compass turning in the bowl.

The true aircraft compass is composed of a grid ring, and grid lines as shown in Fig. 1. In this case, the grid lines are turning around the compass needle, or the red north triangle on the grid ring is turning toward or away from the north needle. The grid ring of the compass is movable, and referring to Fig. 1, by turning the grid ring until the red north triangle is opposite the north point of the compass needle, the angle of flight is shown against the lubber line. The compass is marked off in 360 degrees, proceeding from north to east.

The utility of this type of compass becomes apparent when flying in a straight line between two points. The flight path is marked out on a map and the degree of heading is determined. Then, it is necessary to set this heading on the grid ring against the lubber line and keep the compass needle against the red north triangle of the grid ring.

It is necessary to compensate for other faults of the magnetic compass. For example, one fault is known as the northerly turning error. When turning to a course in any direction between northeast and northwest, the compass is sluggish. Turns should be made slowly and stopped about 20 degrees short of the desired direction to permit the needle to settle. The plane should then be holding a correct course. When turning to a course between southeast and southwest, the compass is lively and reliable. Turns should be overshot by about 20 degrees of the desired heading and the compass needle should be allowed to settle. The northerly turning error has no effect on turns that are made east or west.

The flying and holding of a good northerly course is the most difficult and can only be achieved by close observation of the compass, and directing the course of the plane through small rudder movements. When flying a southerly course, the compass is lively and follows rudder movements. East and west courses present no difficulties if the speed of the plane is held constant and the plane held level.

Rate of Climb Indicator

The rate of climb indicator, also known as the fore and aft level (or the pitch indicator) indicates the angle of ascent or descent. A climb indicator is a highly geared leaky aneroid barometer. According to the rate of change of barometric pressure due to increase or decrease of height, so the aneroid leaks and actuates the pointer. The dial is graduated in feet per minute of rise or fall.

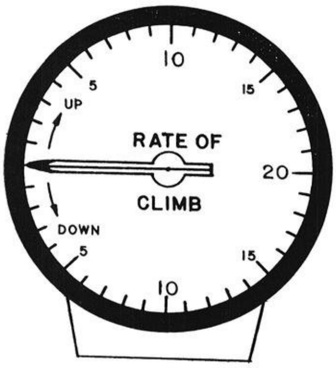

Figure 2.

When flying straight and level the needle is on zero and the airspeed is constant. When descending, the nose of the plane is lowered and the needle drops below the zero mark to a point corresponding to the angle of descent; the airspeed will increase with a constant throttle setting. When ascending, the nose of the plane is raised and the indicator moves above the zero mark to a point corresponding to the angle of ascent; the airspeed will decrease with a constant throttle setting.

When flying level, early and gentle corrective pressure on the stick should be made at the first indication of pitch alteration. Corrective pressure should be released just before the pitch levels out. The pitch indicator is sluggish and does not follow quick movements of the stick, but will continue moving after the stick is in central position. A slower and more gentle movement of the stick permits the instrument to follow more accurately.

Turn and Bank Indicator

To measure the angle of turn and the amount of "lean" of a plane, an instrument known as the turn and bank indicator is used. It consists of a needle and a ball as shown in Fig. 3.

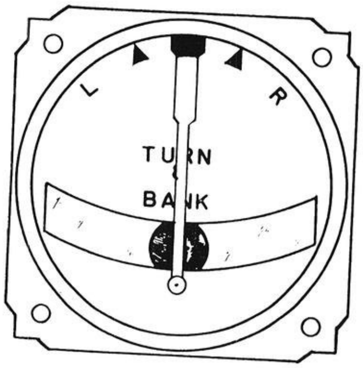

Figure 3.

The needle indicates the direction and sharpness of the turn, following the rudder and being independent of bank. The ball indicates the direction and amount of the bank; it follows the stick movements. The ball also indicates the slip and its direction, or skid and its direction.

In making a turn, the rudder and stick are moved together in the direction of the turn. This is similar to the movement of an automobile as it travels a banked turn in the road. The bank reduces the lateral centrifugal force. Thus, when turning, both the needle and ball of the instrument should be off center and in the direction of the turn.

Gyro-Horizon (Artificial Horizon)

The gyro-horizon is similar to a combination of the rate of climb indicator and the turn and bank indicator. It does not indicate turn, but it is more sensitive and shows the degree of the bank.

In the lighter, small aircraft, the gyro-horizon may not be fitted, in which case airspeed and pitch indicators are used in conjunction.

There are several types of gyro-horizon instruments, all of which are gyroscopic. The gyro is driven either mechanically or by venturi tube suction. If driven by venturi tube suction, the tube is exposed to the weather and is apt to freeze, rendering the instrument useless

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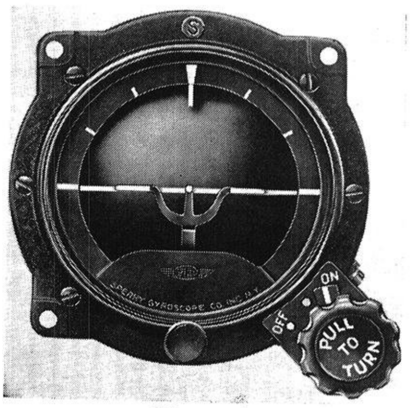

Figure 4.

FROM STEEL TO PLASTICS

Plastic autobodies are now a reality

by Dave Fisher, m'58

Every fall just before the new model American cars reach the market, rumors are heard concerning the features of these automobiles. These rumors may vary from the horsepower of the engines to the gear ratios of the differentials. During recent years body styles have changed, engine designs have improved, and safety features have been introduced, but the motoring public still wants something new in an automobile. Could it be a completely new look which can be achieved with new body materials?

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 it utilizes 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 makes it unlike another, much like metal alloys. These resins are of two types—thermo-setting and thermoplastic. Because thermoplastic resins harden or soften with a variation in temperature, thermo-setting resins are used. Under terrific 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, each with its own purpose. 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. Due to the fact that it will harden if cooked long enough, the resin is removed in a liquid state before it is completely cooked. 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 ultra-violet light which the catalyst is sensitive to. However, this catalyst has a tendency to harden from the inside out losing its drying ability as it approaches the outside. To 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 together 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. By regulating this flow, the glass filaments are broken into slivers and wound around glass tubes. 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 construct a scale model and expand it to full size. 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 sized 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-make 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 or cast in sections for easier handling.

As soon as 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 it 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 are generally used. Once the curing is completed, the hardened glass body is removed from the casts and all rough and unfinished surfaces 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 glass cloth. Then the body is fitted to the chassis and bolted on to the frame.

The relatively new material to automotive engineers is not only light, but it possesses a tremendous amount of strength. If a car with a fiberglass body strikes a tree while traveling 25 miles per hour the body will not dent, but due to its brittleness the results would be a crack approximately a foot long. This crack can easily be repaired in a short time by the owner. 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 and not damaging the glass at all. Lightness and strength are not the only advantageous properties of the glass. It also acts as an insulator to dampen road and engine noises. It will not rot or 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

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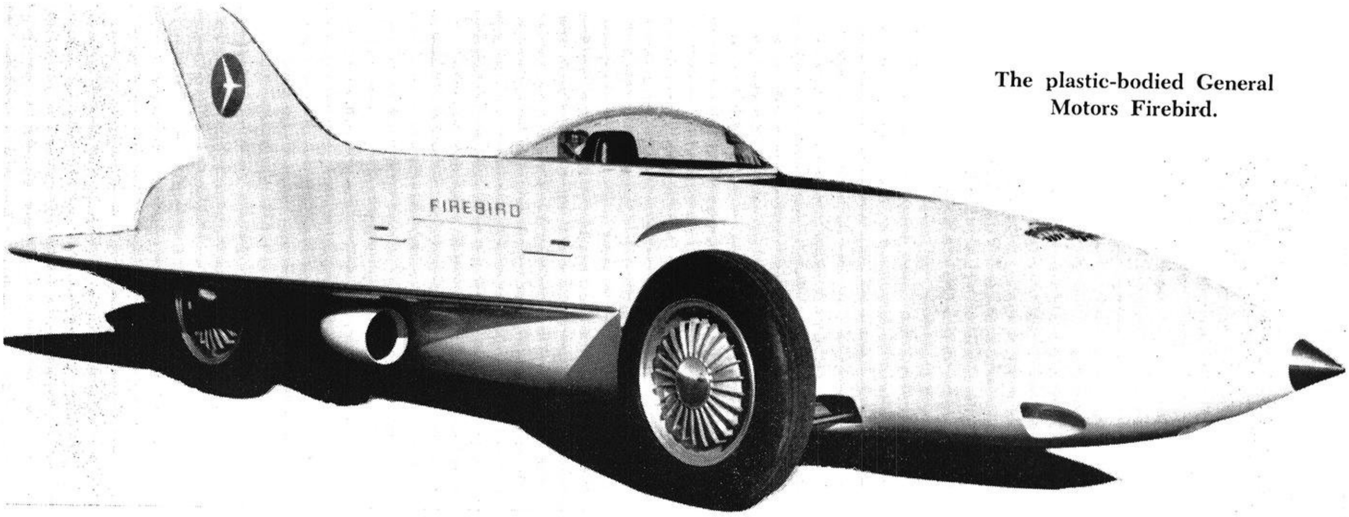

The plastic-bodied General Motors Firebird.

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Steel to Plastics

(Continued from page 21)

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 six inches beyond the portion to be patched. Then the surface is dented so the glass build up 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. 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, which is 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 20,000 pounds pressure per square inch 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% savings 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, and numerous experimental and futuristic cars developed by the manufacturers and auto enthusiasts. Several new model trucks have fiberglass panels, and rear semielliptical springs in cars and trucks may possibly be replaced with one piece fiberglass springs.

Fiberglass has not only received intense interest in the auto industry, but it is also being used for boats, fishing poles, water skis, house awnings, and in several other fields. Plastics are becoming more popular each year and they may well be the ideal material for automotive body manufacture. Fiberglass bodies have opened a new field in safety, economy, and durability.

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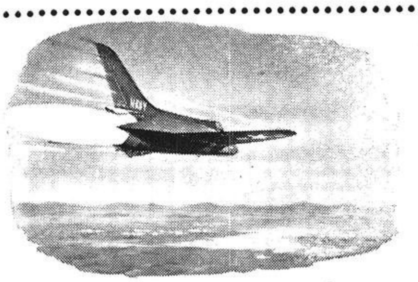
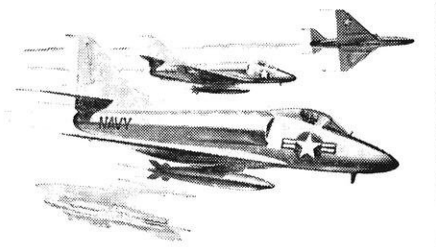
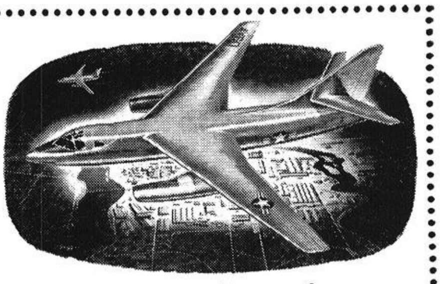


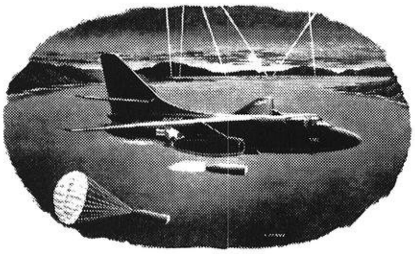
F4D, "SKYRAY"— only carrier plane to hold official world's speed record



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



RB-66 — speedy, versatile jet bomber



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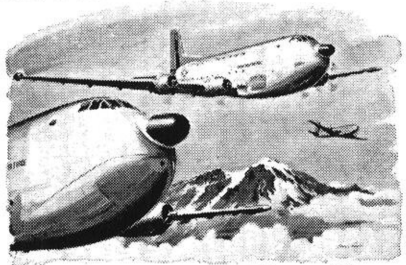
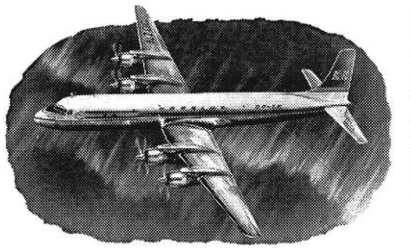


C-124, "GLOBEMASTER"— world's largest production transport



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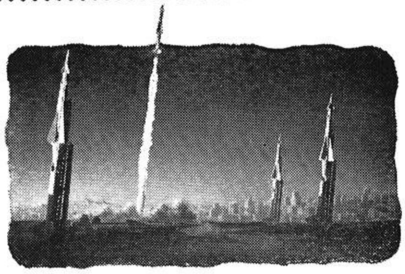
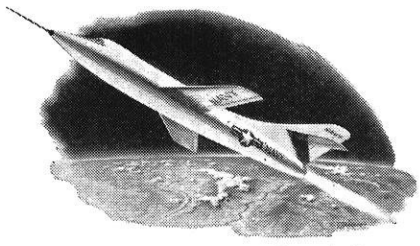


"NIKE"— supersonic missile selected to protect our cities



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

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

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

Challenging opportunities now exist in the following fields:

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

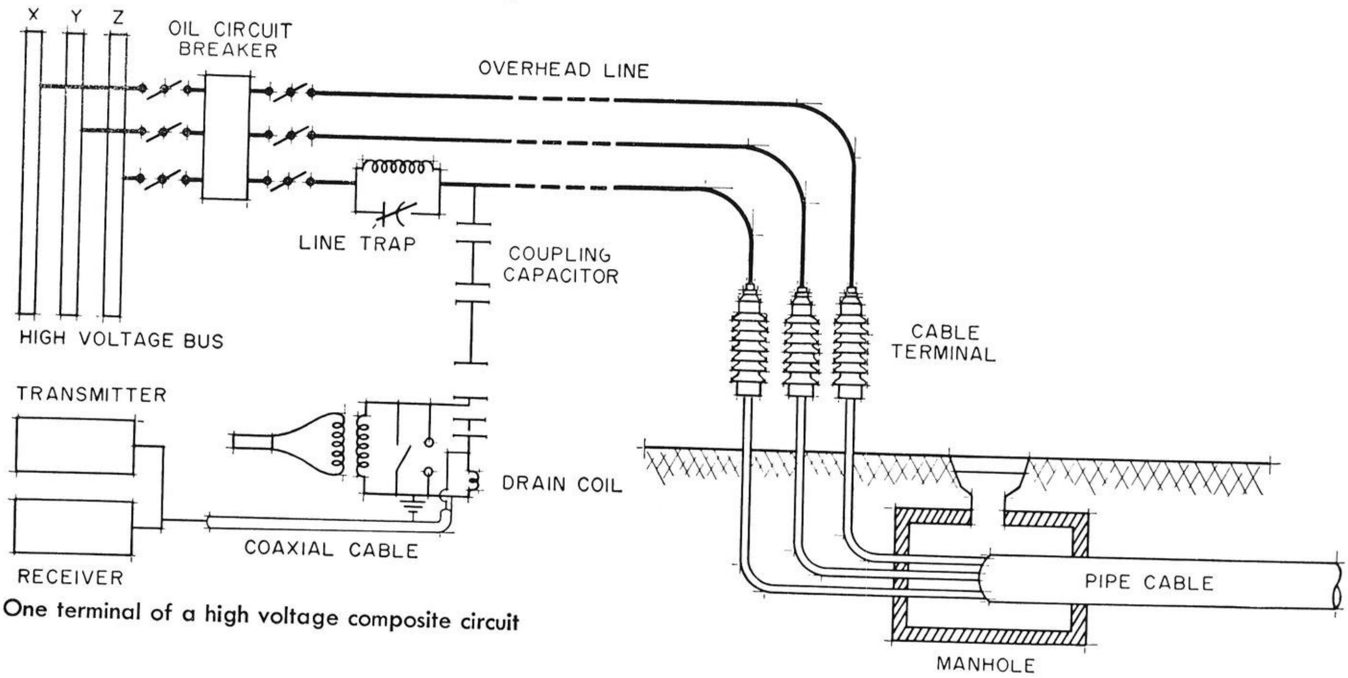
DOUGLAS
First in Aviation

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

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

DOUGLAS AIRCRAFT COMPANY, INC.

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



One terminal of a high voltage composite circuit

HERE'S A PROBLEM FOR ELECTRICAL ENGINEERS

To protect short transmission lines against severe damage due to internal short circuits, Detroit Edison normally uses a pilot wire differential system to activate circuit breakers and thus stop the flow of electricity along the damaged wires. This system is technically limited to the protection of relatively short transmission lines.

Longer lines of all overhead construction can be economically protected by carrier pilot relaying systems. However, where there are long composite lines—overhead lines which go underground and come back overhead again—variations in line characteristics make it difficult to preselect the correct frequency for the usual carrier pilot relay.

How would you determine whether carrier pilot will work on a composite line? And, if carrier won't work, what system would you use to protect this type of line construction?

★ ★ ★ ★ ★

The above problem is typical of those you would encounter as a member of Detroit Edison's outstanding electrical engineering staff. If you can confront and solve such interesting and diversified problems, you have a firm foundation for building a successful career.

The future of Detroit Edison is a bright one. Edison's constant expansion in a thriving industrial area means more opportunities for you. Why not see our representative when he's on campus; visit us when you are in Detroit, or write . . .

THE DETROIT EDISON COMPANY

2000 Second Avenue, Detroit 26, Michigan

FACTS ABOUT DETROIT EDISON
Serving Southeastern Michigan, Detroit Edison supplies electricity for eleven counties . . . covering 7,600 square miles . . . 3.8 million people. Compared to other investor-owned power systems, Detroit Edison ranks eighth in plant investment . . . eighth in customers served . . . and seventh in electricity generated.

W. S. P. E.

WISCONSIN SOCIETY OF PROFESSIONAL ENGINEERS

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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.

PUBLICATIONS AVAILABLE —NSPE

Frequent requests from Chapter Officers have expressed a desire for a listing of the numerous publications of NSPE available for distribution. The subject listing of NSPE publications is set up for this purpose. You will note that the publications listed are FREE, except for those that are otherwise designated.

The NPSE is prepared to supply multiple copies of the majority of these publications and they may be obtained by writing to Mr. Paul H. Robbins, Executive Director, 1121 15th St. N. W., Washington 5, D. C.

SUBJECT LISTINGS OF NSPE PUBLICATIONS

Chapter Activities

Monographs outlining various Chapter functions have been prepared for the use of Chapters: **"Helping the Young Engineer"** and **"Ladies Auxiliaries"**. Others are in preparation and as completed they will be distributed.

Welcome Mr. President—An informative booklet outlining organization functions and suggestions for Chapter Presidents.

Communications

How to Improve Engineering-Management Communications—Executive Research Survey Number One. Based on a survey of more than 300 companies employing engineers, this report contains information on engineering-management relations with respect to the lines of communication between engineers and management. Price $1.00 (members).

Competitive Bidding

About Competitive Bidding—Reprint from American Engineer (NSPE Believes).

Competitive Bidding for Professional Services—Statement of Policy by NSPE.

Contracts

Recommended Procedure for Negotiating Engineering Contracts—Statement of Policy by NSPE. (See Standard Form of Agreement)

Corporate Engineering Practice

Corporate Professional Practice vs. Individual Professional Practice—The Special Committee on Registration Law, NYSSPE. Reprint from American Engineer.

Should Corporations Practice Engineering?—Ronald B. Smith, P. E. and V. George Terenzio, P. E. Reprint from American Engineer. A discussion of the pros and cons of the issues involved in the debate over corporate practice of engineering.

Creed

Engineers' Creed—Suitable for distribution—free; for framing—50¢ each.

Education

Educating the 1950 Model Engineer—Dean S. C. Hollister. The author discusses the philosophy of engineering education. Reprint from American Engineer.

Engineers

There's Nothing Wrong with Engineers—Dr. José B. Calva, P. E. Refutation of the belief that engineers possess a strong inferiority complex. Reprint from American Engineer.

Ethics

See Competitive Bidding.

Canons of Ethics—Suitable for distribution—free; for framing 50¢ each.

Ethics and the Professional—Dean N. W. Dougherty, P. E. A

(Continued on page 28)

Meet the President

ROBERT W. STIEG

Fox River Valley Chapter President

Robert W. Stieg, president of Fox River Valley Chapter, has been employed by the Four Wheel Drive Auto Co., Clintonville, Wisconsin, since his graduation from the University of Wisconsin in 1940 and now is Chief Engineer for the company. Upon graduation, he was first employed as a draftsman and in 1942 was made Chief Cab and Body Engineer during which time he developed special military truck cab requirements. In 1949 he was appointed Chief Design Engineer and was sent on an engineering field study to Hawaii. He was sent on another engineering mission in 1952, this time to Egypt. In 1955, he was appointed Chief Engineer, the position he now holds.

Mr. Stieg was born in Clintonville, Wisconsin, on September 17, 1918 and received his degree in mechanical engineering. He is a member of the Society of Automotive Engineers, American Society of Mechanical Engineers and the National Society of Professional Engineers.

Mr. Stieg is also active in civic affairs in his community being a trustee, Sunday School Superintendent and teacher in his church, Chairman of Finance for the Citizens School Committee, Treasurer of the Clintonville Civic Orchestra, a member of the Congregational Church Choir and the Chowder & Marching singing society and various other organizations.

He presented a paper on multiple drive vehicles before the U. S. Interagency Motor Equipment Advisory Committee. Also, he was a member of the Automobile Manufacturers Association ISO Liaison Committee on International Standardization.

Mr. Stieg was married to Jane Ellen Gibson on March 26, 1951, and they now have two boys, Robert and Philip. In his spare time he enjoys motorcycling, woodworking, and singing.

W.S.P.E.

(Continued from page 26)

study in human conduct. Reprint from American Engineer.

Fee Schedules

Recommended Grades, Duties, Responsibilities and Qualifications for Pre-Professional and Professional Positions—Adopted by NSPE June, 1952.

Report on Fee Schedules—Revised October, 1954. A study of the Salary and Fee Schedule Committee of NSPE bringing together various schedules of fees and related practices of engineers in the consulting field.

Future of Engineers

An Engineers' Report on the Future—Charles F. Kettering. The author tells how the engineering profession promises a better and more abundant life in the future. Reprint from American Engineer.

Engineers for the Future—Reprint from American Engineer (NSPE Believes).

Government

Engineers in Federal Government—Reprint from American Engineer, (NSPE Believes).

NSPE Senate Testimony Treats Federal Salaries—Testimony presented before the Senate Committee on Post Office and Civil Service—Executive Director, Paul H. Robbins.

Our Function in Governmental Liaison—Reprint from American Engineer (NSPE Believes).

Industrial Relations

A Professional Look at the Engineer in Industry—NSPE Engineer-in-Industry Committee. A major publication of vital importance delving into all phases of the professional and economic status of that group which comprises the largest number of engineers in any functional field. Price $1.50 (members).

Collective Bargaining by Professional Employees—Statement of Policy by NSPE.

Professionalism or Unionism—Facing the Issue—Past President T. Carr Forrest, Jr. A discourse on the aspects of unionism for the professional. Reprint from American Engineer.

The Professional Engineer in Industry—Reprint from American Engineer. (NSPE Believes).

The Professional Union—A Contradiction—President Clarence T. Shoch. A discussion of the development of engineers' unions and the reasons why unionism is incompatible with professionalism.

Legislation

A Professional Look at the Engineer in Industry—(See Industrial Relations.)

Legislative Bulletin—Published monthly by NSPE, available to members upon request.

Manpower

How to Attract and Hold Engineering Talent—Executive Research Survey Number Three. This report reflects the experience of more than 200 companies which employ engineers and attitudes of 1,400 individual engineers who are employed in industry. Price $1.00 (members).

How to Improve the Utilization of Engineering Manpower—Executive Research Survey Number Two. This report pools the experience of more than 495 companies employing engineers on the subject of utilization of manpower. Price $1.00 (members).

Membership Promotion

Every Man a Debtor—Sixteen page booklet explaining NSPE organization, programs, activities and objectives.

Membership Kit—This kit is available to Membership Chairmen and contains a general outline of membership campaign techniques and sample materials. Any of the publications listed in this outline are generally available for distribution to membership promoters as membership mailing pieces.

NSPE Philosophy

Engineering Societies of America—Paul H. Robbins, Executive Director, NSPE. Describes organization, programs, activities and objectives of NSPE. Reprinted from G-E Review.

Every Man a Debtor—(See Membership Promotion).

Is Our Registration Requirement Limiting Membership?—Reprint from American Engineer (NSPE Believes).

Why a Professional Society?—Reprint from American Engineer (NSPE Believes).

National Security

Report of Special Committee on Engineering Manpower—Special report to NSPE Board of Directors, Spring Meeting, Charlotte, North Carolina.

The Engineering Profession in National Security—The total welfare and security of the United States and not the best interests of any group or of any individual is the basic consideration for all questions to be resolved in this policy statement of the NSPE.

Natural Resources

Development of Natural Resources—Statement of Policy by NSPE.

Organization

A Model Law for the Registration of Professional Engineers and Land Surveyors.

Model Constitution for Ladies Auxiliary Chapters.

Model State Society Constitution.

NSPE's Constitution and Bylaws.

Professional Development

The following four separate pamphlets are based on remarks of the 19th Annual Meeting:

NSPE's Development of Professional Objectives—Perry Ford, P. E.

The Need for More Effective Professional Action—Alex Van Praag, Jr., P. E.

The Place of Registration in Professional Development—Karl B. McEachron, P. E.

The Professional Development of Engineers and Scientists in Industry—Clark Ransom, P. E.

Professionalism

How a Professional Attitude Can Be Instilled in Engineers—Dean

W. R. Woolrich, P. E. Reprint from American Engineer.

Professionalism or Unionism—Facing the Issue—(See Industrial Relations).

Some Thoughts on Engineers and the Engineering Profession—Speech by Harry A. Winne, P. E., Vice President, General Electric (Retired), presented at the 20th Annual Meeting of NSPE.

The Professional Union—A Contradiction—(See Industrial Relations).

Public Relations

Engineers' Week—Reprint from American Engineer (NSPE Believes).

Engineers' Week—Printed report of the 1955 observance.

Our Public Relations Responsibilities—Reprint from American Engineer (NSPE Believes).

Registration

Is Our Registration Requirement Limiting Membership?—Reprint from American Engineer (NSPE Believes).

Next Step Registration—Informative pamphlet for engineering students and others on values and procedure for engineering registration.

Registration: Then, Now and Tomorrow—Frank H. Prouty, P. E., Chairman, National Bureau of Engineering Registration. Reprint from American Engineer.

The Place of Registration in Professional Development—(See Professional Development).

Salary Survey

Digest of Subject Survey—Pamphlet highlighting the full report.

Professional Engineers Income and Salary Survey—1952 and 1954 statistics covering NSPE members —50¢ each (members).

Society Operations

Annual Report of NSPE—Outlines in detail the functions and activities of the Society and gives a picture of its financial situation, with respect to income and expenses.

Standard Form of Agreement

Standard Form of Agreement Between Owner and Engineer for Professional Services.

Technology

The Case for Technology—Brig. General David Sarnoff. A factual answer to those who believe that the path of technology could lead to ruin. Reprint from American Engineer.

Training

How to Train Engineers in Industry—Executive Research Survey Number Four. This report reflects the experience of more than 200 companies which employ engineers, as well as of many individual leaders in the training field. Price—$1.00 (members).

Unity

Unity for Professional Action—Reprint from American Engineer (NSPE Believes).

Vocational Guidance

Annotated Vocational Guidance Bibliography—Listing of current pamphlets and books of interest to counselors and prospective engineering students.

Engineering . . . A Career of Opportunity—A general vocational guidance pamphlet.

Engineering Horizons of Tomorrow—T. Carr Forrest, Jr., P. E. Reprint of a speech delivered at a High School Career Conference, University of Oklahoma.

List of Accredited Engineering Schools—Reprint from ECPD Annual Report.

Membership Report

The following application for membership and affiliate membership in WSPE were approved by the Board at the October 15, 1955 meeting in Milwaukee.

SOUTHWEST CHAPTER

Thomas Monroe Dunn, Maintenance Eng., Wisconsin Highway Com., 1133 Lakeview Blvd., Middleton, Wis.; Reg. No. E–5927; Sponsor: Page Johnson, Trans. from Idaho.

SOUTHEAST CHAPTER

Milton W. Schaefer, City Engineer, West Bend, 119 Edgewood Lane, West Bend, Wis.; Reg. No.: E–4059; Sponsor: Oscar Egger.

NORTHWEST CHAPTER

Thor Alexander Gustafson, Electrical Engineer, U. S. Rubber, Route 1, N. Shore Dr., Eau Claire, Wisconsin; Reg. No.: E–4253; Sponsor: M. R. Charlson.

WESTERN CHAPTER

ET Robert James Gibbons, Jr. Engineer, Northern States Power, 1821 Hyde Ave., La Crosse, Wis.; Reg. No.: ET–319; Sponsor: Merlin A. Eklund.

MILWAUKEE CHAPTER

Nicholas Amedio Ricci, Elec. System Eng., Wis. Electric Power Co., 231 W. Michigan, Milwaukee 1, Wis.; Reg. No.: E–4524; Sponsor: Lee Hammer.

Albert F. Nystrom, Product Dev. Eng., Inland Steel Products Co., 4261 N. 94th St., Wauwatosa 16, Wis.; Reg. No.: E–5653; Sponsor: Joseph Munbrot.

Total: 5 Members, 1 Affiliate Member.

MEMBERSHIP REPORT

October 15, 1955

Total Members and Affiliate Members as of September 16, 1955	
Members	1,142
Affiliate Members	119
Total	1,261
Losses since September 16, 1955	
Member (Resignation)	1
Total	1
Additions from September 16, 1955 to October 15, 1955	
Applications for membership	5
Applications for Affiliate membership	1
Total	6
Total Members and Affiliate Members as of October 15, 1955	
Members	1,146
Affiliate Members	120
Total	1,266
Gain since September 16, 1955	5

(Chapter News on page 30)

Chapter News

NORTHWEST CHAPTER

WM. A. ROSENKRANZ

The Northwest Chapter held its October meeting on the fifth at Ted Hagg's Supper Club at Sarona. After an excellent steak dinner, members and wives were treated to an excellent talk and film strip concerning the plastics industry presented by Mr. Paul Murphy, Plant Manager of Chippewa Plastics, Inc. of Chippewa Falls. Mr. Murphy's talk included the properties and uses of the principle and most used types of plastics, together with a brief description of the operations at Chippewa Plastics. This company deals almost entirely in extruding polyethylene plastic into seamless tubing which is then sold to firms in the field of fabrication of packaging of various types. The busines meeting was concerned primarily with a review of the efforts expended in the passage of Senate Bill 688A and the significance that this bill will have on the engineering profession. State President A. O. Ayres discussed the efforts made over the entire state by Society members who all worked for passage of this bill.

A Chapter nominating committee was appointed under the chairmanship Al Lokken, and Bill Rosenkranz was appointed chairman of the Engineer's Week Committee.

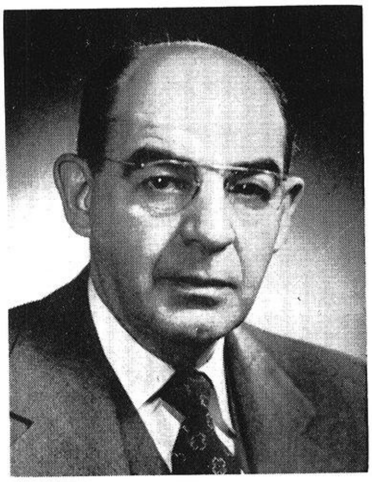
Ballots were tallied on the recent vote on Chapter constitutional amendment. The amendment, which included the changing of terms of Chapter officers from the January through December term to a term extending from July through June, was passed. This change will make the terms of Chapter officers conform to the terms of State officers. As a result of this change the next Chapter officers elected will serve a term of eighteen months.

FOX RIVER VALLEY

V. A. KNEEVERS

The Fox River Valley Chapter of the Wisconsin Society of Professional Engineers held their monthly meeting October 6th at 6:30 P.M. at the Elk's Club in Appleton, Wisconsin.

The featured speaker for the occasion was Mr. F. L. "Bud" Larkin, Vice President of the Wisconsin Power Company, whose subject was "Management Selection and Development". Mr. Larkin has been in charge of his company's employment, training, accident prevention, industrial engineering and



MR. F. L. LARKIN

labor relations since 1934. His long experience in these fields made his subject one of extreme interest to all engineers in the Fox River Valley Area.

Because of the nature of the speakers topic, the Fox River Valley Chapter extended an invitation to all members in the Sub Section of the American Institute of Electrical Engineers and their guests to attend this meeting.

SOUTHWEST CHAPTER

C. M. PERLMAN

W.S.P.E. Member Heads State Office

Ralph D. Culbertson was appointed State Chief Engineer to assume the duties of the office left vacant by the retirement of Charles A. Halbert. Mr. Culbertson leaves his position as Division Engineer for the Chicago and Northwestern Railway Company, Madison Division.

Born 39 years ago in Rockford, Ohio, Culbertson moved to Wisconsin with his parents where his father joined the engineering staff of the State Highway Commission at Green Bay Division. He attended the University of Wisconsin and graduated from the College of Civil Engineering in 1939. Upon graduation he was employed by the Highway Commission on the engineering staff doing highway planning and research. In 1941 he left the state service to become an engineer with the Chicago and Northwestern Railway where he remained until his new appointment.

Culbertson is a member of W.S. P.E. (Southwest Chapter), A.R.E.A., and the Madison Technical Club.

World Traveler

Ken Boller (ME'34), research engineer at the Forest Products Laboratory and a long time member of the Southwest Chapter of WSPE left Sept. 29 on a technical mission which will take him around the World in the next few months. His prime mission will be to lend assistance to the Philippine Government in setting up a new Forest Products Laboratory near Manilla. He will spend about 3 months there, teaching the staff various testing procedures and educating them in methods of machine operation and maintenance. On the way home he will visit Laboratories in Pakistan, India, Rome and Great Britain.

Please mark your calendars for the coming chapter meetings, all of which will be at the Cuba Club.

Tuesday, Dec. 13, 1955; Wednesday, Feb. 22, 1956; Tuesday, Mar. 20, 1956; Wednesday, April 18, 1956, (Election of Officers).

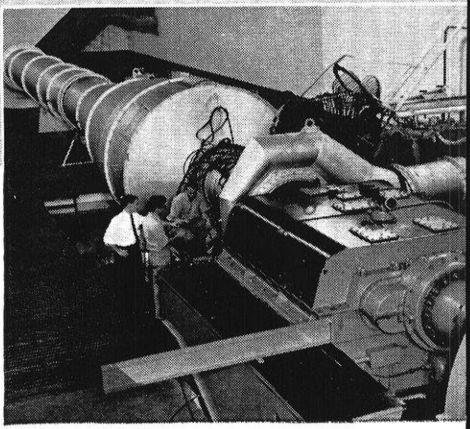
MILWAUKEE CHAPTER

R. M. LYALL

Robert J. Strass, consulting engineer, Milwaukee, has announced that Orville H. Drought, Professional Engineer, is associated with his staff of structural engineers. Mr. Drought was formerly a structural designer for the City of Milwaukee, Bridge and Building Department. END

it takes many engineering skill

McDonnell "Voodoo", *the most powerful jet fighter ever built in America.*



MECHANICAL ENGINEERS are concerned with many phases including experimental testing and development, mechanical design, stress and vibration analysis, combustion research, heat transfer and nuclear reactor development.

J-57 POWERED AIRCRAFT

MILITARY

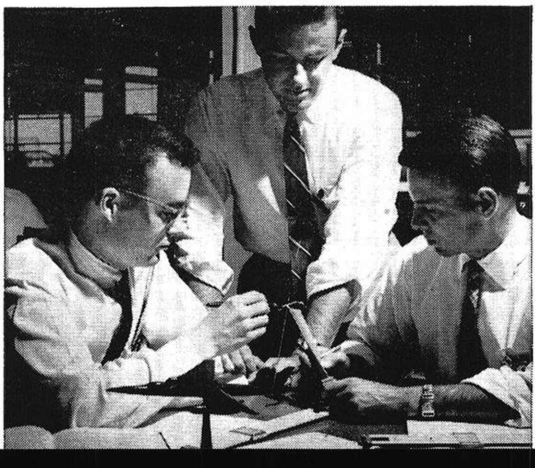
F-100	F8U
F-101	A3D
F-102	B-52
F4D	KC-135

COMMERCIAL

Boeing 707

Douglas DC-8

AERONAUTICAL ENGINEERS work on innumerable internal and external airflow problems concerned with design, development and testing of aircraft powerplants. Some who specialize in analytical engineering forecast engine-airplane combinations a decade in advance of design.



ELECTRICAL ENGINEERS directly contribute their specialized skills to the analysis and development of controls, systems and special instrumentation. An example is the "Plotto-mat" which automatically integrates and plots pressures, temperatures and air angles in performance testing.

o create the top aircraft engines

An aircraft powerplant is such a complex machine that its design and development require the greatest variety of engineering skills. Pratt & Whitney Aircraft's engineering team has consistently produced the world's best aircraft engines.

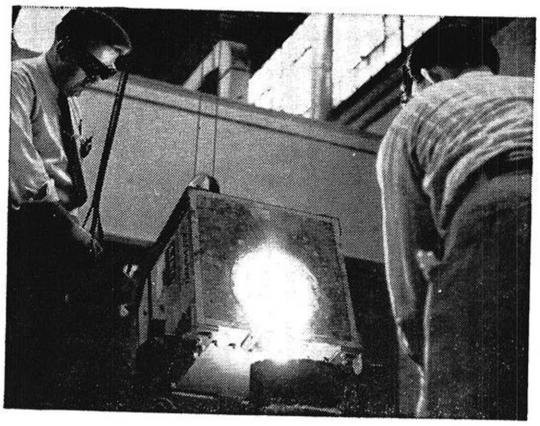
The best planes are always designed around the best engines. Eight of the most important new military planes are powered by Pratt & Whitney Aircraft J-57 turbojets. The first two jet transports in the United States will use J-57s. Further, no less than 76 percent of the world's commercial air transports are powered by other Pratt & Whitney Aircraft powerplants.

Such an enviable record can only be built on a policy which encourages, recognizes and rewards individual engineering achievement.

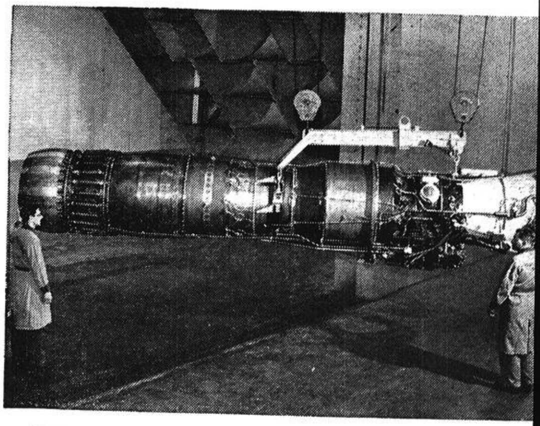
PRATT & WHITNEY AIRCRAFT
Division of United Aircraft Corporation
EAST HARTFORD 8, CONNECTICUT

World's foremost designer and builder of aircraft engines

HEMICAL ENGINEERS, too, play an important ole. They investigate the chemical aspects of eat-producing and heat-transferring mate-als. This includes the determination of hase and equilibrium diagrams and exten-ve analytical studies.



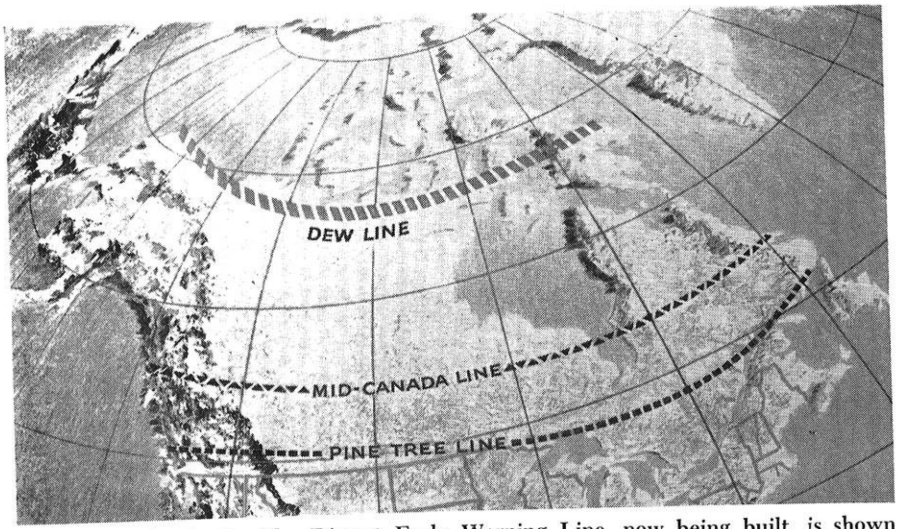
METALLURGISTS investigate and develop high temperature materials to provide greater strength at elevated temperatures and higher strength-weight ratios. Development of superior materials with greater corrosion resistance is of major importance, especially in nuclear reactors.



WORLD'S MOST POWERFUL production aircraft engine. This J-57 turbojet is in the 10,000-pound thrust class with considerably more power with afterburner.

SCIENCE HIGHLIGHTS

edited by Dick Tomlin, ch'56



Protection in depth—The Distant Early Warning Line, now being built, is shown in its relationship to the Canadian-built Mid-Canada and Pine Tree radar lines. All three will function as a protective net integrated into a vast defense communications network.

DEW LINE: ENGINEERING IN THE ARCTIC

The Distant Early Warning system is a joint defense operation of two nations, the United States and Canada, and in concept, construction and execution will be a major engineering achievement. Popularly termed the DEW Line, it is a picket-fence network of radar stations designed to guard against sneak air attacks via the short and direct polar regions. Considering the industrial heart of America as a prime target of any attack, the electronic sentry system will offer several hours of warning—priceless minutes if "Condition Red" is ever sounded.

PURE TITANIUM BY ZONE REFINING

Scientists at the Westinghouse Research Laboratories are purifying titanium and other hard-to-get metals by imprisoning the molten metal inside a cage of its own making. The process, called cage zone refining, uses a unique method to melt a bar of metal while the metal acts as its own crucible, thus preventing contamination by any containing vessel. Object of the process is to prepare super-pure metals.

Zone refining, in which a bar is melted progressively from one end to the other, has become a standard process for purifying certain metals. In transistor research at the Laboratories, for example, it is used routinely to prepare germanium metal having impurities of about one part in 10,000,000,000. The new technique applies this valuable refining process to metals which are so active at high temperatures that they react with any crucible in which we could heat them.

The success of zone refining depends upon the fact that most impurities in metals have a preference for either the liquid or solid state of the metal. Iron, a common impurity in titanium, has a preference for the liquid state of titanium. When a bar of impure titanium is melted progressively from end to end, the iron concentrates in the liquid titanium and follows the molten zone to the end of the bar. This end is then cut off and discarded, leaving the rest of the titanium bar more pure. Each time the process is repeated, more impurities are removed.

HEATERS BOOST OIL PRODUCTION

An electric oil well formation heater has been developed by the Westinghouse Electric Corporation to revive or improve oil production from plugged-up wells.

Lowered into a well to depths of previous production, the long tubular heaters raise the temperature of the oil, thereby melting the wax-like plugging material lodged within the oil bearing "sand."

A total of 24 heaters have been operating in oil wells in Montana for the past 12 months and the oil production from most of these wells has been doubled after only a few hours of heating.

Most prior attempts to boost production by heating the oil have been unsuccessful due to early burn-out of the heaters. In many cases, heater failure occurred within several days to several weeks.

Geologists estimate that over 50 per cent of the total amount of oil around old oil wells remains in the ground stubbornly resisting the most up-to-date methods of recovery. One obstacle to the complete removal of all oil has been paraffin—similar to the substance used by the housewife to seal jelly glasses. So long as the oil remains at the usual high subsurface temperatures, the waxy paraffin stays in the oil as a liquid. The temperature at the bottom of an oil well drops, however, after a number of years of production and then the paraffin starts to solidify.

100,000 WORDS A MINUTE

A new electron-image tube that can translate coded signals from tape, keyboard or radio into clear-

(Continued on page 36)

Science Highlights

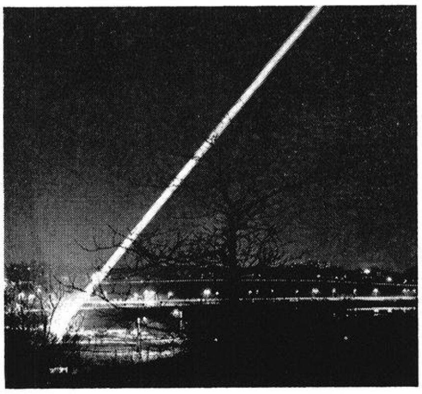
(Continued from page 34)

ly-defined letters and figures at speeds up to 100,000 words per minute for high-speed photographic recording has been announced by RCA.

The new tube fills an acute need for high-speed printing devices operating directly from data in coded form. When it achieves commercial form, its initial application is likely in electronic message transmission and computing systems. Further development is expected to fit it for wider application in general printing as an electronic means of typesetting.

SKY-HIGH 'TRAFFIC LIGHT' USES ONE OF WORLD'S BRIGHTEST SEARCHLIGHTS

A skyway "traffic light" that directs departing planes toward a more sparsely settled take-off route



has been installed near busy La Guardia Airport to minimize air-travel and noise over heavily-populated areas. Operated by the Civil Aeronautics Administration, the beacon is sent skyward by one of the most powerful searchlights ever built. A 2,500-watt short-arc mercury lamp developed by Westinghouse produces a shaft of light of approximately 300 million beam candle power, equivalent in light intensity to about 10,000 automobile headlights. An interesting aspect of the aerial beacon is that its visibility depends on the high intensity light of the beam being reflected from moisture and dust particles in the air. The visible column rises skyward approximately three miles beyond the end of the runway and is tilted toward the airport at about 30 degrees from a vertical position. The beam itself is pencil-thin, with a divergence of but one degree. As planes take off, they fly directly toward the beam and are led down Flushing Meadow away from the residential areas on either side, greatly reducing the noise nuisance.

This type of mercury lamp, developed by Westinghouse for Navy searchlights, is ideal for this application, because of its high intensity and the fact that it can be operated unattended. The mercury arc, burning between tungsten electrodes spaced three-eighths of an inch apart, is a clean "flame," and the lamp is completely enclosed and hermetically sealed in a quartz bulb. Remote control operation from the La Guardia control tower makes it possible to light the beacon only when the runway is in use at night.

FLAME SPRAY CERAMICS

A novel process for coating a wide variety of substances—by feeding powdered ceramic materials through a simple flame gun—has been developed.

Coatings resulting from the process—called "Flame Spray Ceramics"—are superior to those produced by the metallizing processes because of their greater resistance to heat and chemical stability.

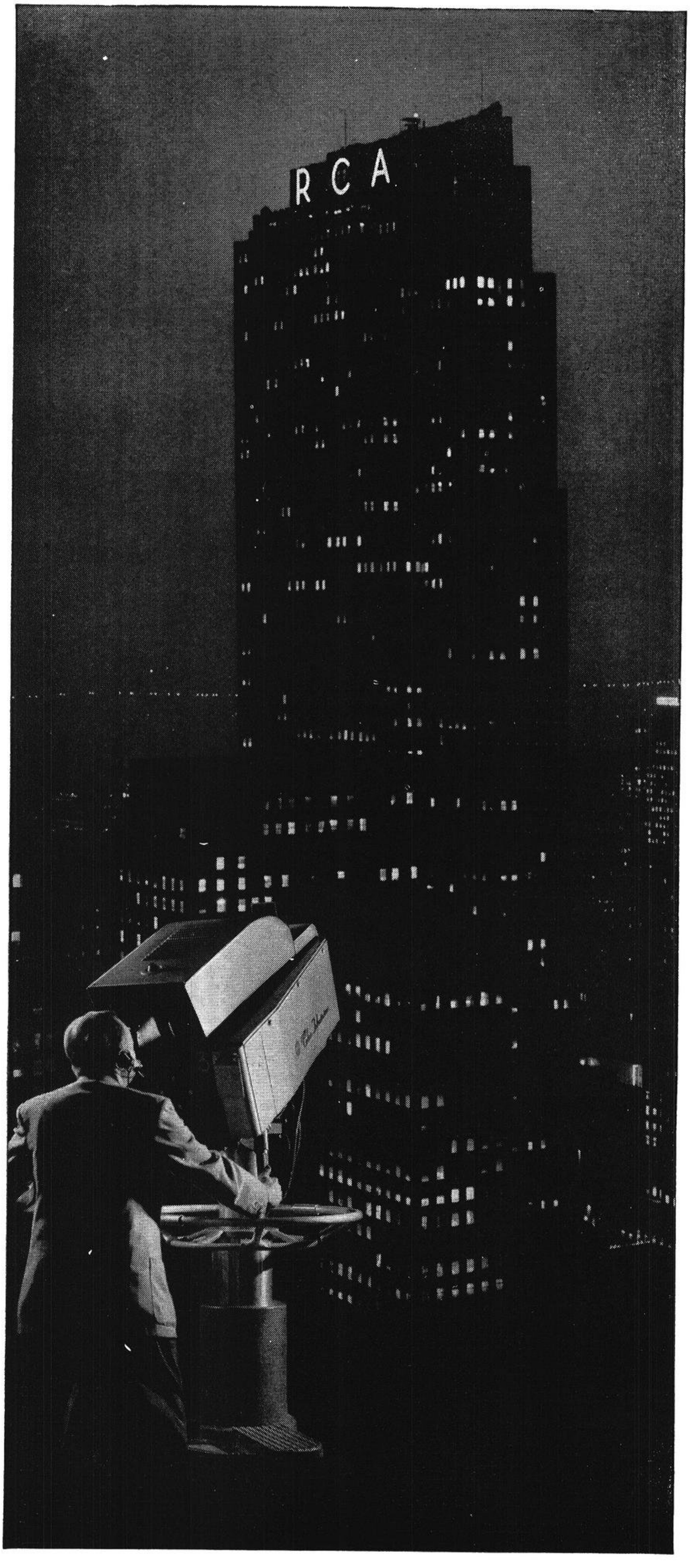
The technique of application is similar to that required for the metallizing processes. "Flame Spray Ceramics" are sintered layers of refractory and chemically inert materials, such as aluminum oxide or zirconium oxide.

The spray coatings do not require that the metal or other base be heated unduly—as opposed to ordinary ceramic coatings which require heating both metal and ceramic to high temperatures.

Since the two basic "Flame Spray Ceramic" coatings—aluminum oxide and zirconium oxide—are stable metal oxides, they cannot oxidize further.

The alumina coating is harder than tool steel and unusually ad-

(Continued on page 56)


RCA

ENGINE-EARS

by Carl Burnard, c'57

BALANCE SHEET

POLYGON BOARD

September 1, 1954 to August 31, 1955

Cash Balance, September 1, 1954			$ 411.91
Cash Receipts			
St. Pat's Buttons		$402.75	
St. Pat's—Ticket Sales		392.50	
Redemption of U. S. Savings Bonds		500.00	
Dividends on Anchor Shares		30.75	
Refund—Gilbreth Speech		7.40	
Pictures		1.50	1,334.90
		-----	------
Total Cash Available			$1,746.81
Cash Disbursements			
Badger Page		$ 40.00	
Pictures		8.50	
Keys		57.75	
Telephone & Telegram		2.75	
Reynolds Award Fund		25.00	
Gilbreth Speech		43.50	
St. Pat's Dance			
Prize Money	$ 10.00		
Tickets	9.45		
Orchestra	235.00		
Posters	8.85		
Master of Ceremonies	5.00		
Programs	21.70		
Advertising	10.08		
Refreshments	20.25		
Rent	65.00		
Decorations	1.07		
Trophies	37.40		
Engraving	30.70		
	----	454.50	
St. Pat's Buttons		221.80	
Banquet		58.10	
Petty Cash		15.00	
Financial Service		15.00	
Distrib. of St. Pat's Events Profits		85.50	

Total Cash Disbursements			1,027.40

Cash Balance, August 31, 1955			$ 719.41
Also on Hand: Anchor Savings & Loan Assoc. Shares			$1,000.00

A.S.M.E.

A.S.M.E. has announced its officers for the fall semester, 1955. They are: Joseph Murray—President; Charles Siegel—Vice President; Carl Shauer—Reporting Secretary; Russell Uttke—Corresponding Secretary; Evelyn Knoke—Treasurer; Milo Swanson—Senior Polygon member; and John Bollinger—Jr. Polygon member.

A.S.M.E. had its first meeting Wednesday, Sept. 28. Mr. Keen of the Keen Manufacturing Company was the speaker of the evening. His topic was the steam auto. In fact he brought his own steam-powered car to the meeting for demonstration purposes.

A.S.M.E. meets once a month. The next meeting will be in early November.

A.S.C.E.

The officers, for A.S.C.E., for the fall semester of 1955 are as follows: Paul Kottke—President; Carl Burnard—Vice President; Ray Taschner—Secretary; Ed Burzinski—Treasurer, Norman Ward and Jim Clapp—Polygon members.

A.S.C.E. held its first meeting Wednesday, September 28. The speaker was Professor Villemont, of the Civil Engineering department. Having returned from a recent, year-long visit to India, he gave an enlightening talk on that country.

The second meeting of A.S.C.E. was October 12. The speaker was Professor A. E. Whitford. He spoke on "Telescopes and Their Uses."

AIEE–IRE

AIEE-IRE has announced its officers for the fall semester, 1955. They are: Charles Luebke—President; Glen Wallace—Vice President; Paul Schmitz—Sec.-Treas.

Speakers of future meetings include a General Electric sales representative from Chicago, and a representative from Wisconsin Power and Light who will give a non-technical talk on Atomic Energy.

AIChE

Nearing the end of a successful membership campaign, AIChE announces a membership of over one hundred students.

An open house was held October 12, at which AIChE's contact man, Professor R. A. Ragatz familiarized the new students with the new buildings on campus.

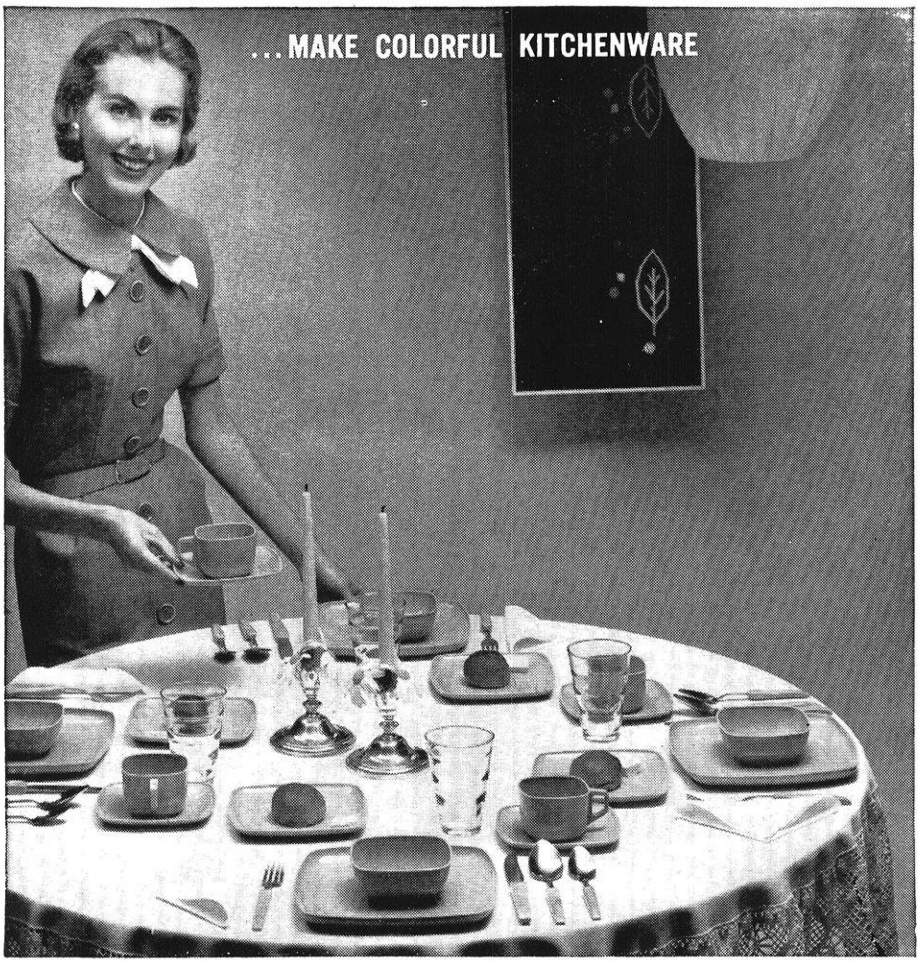
The officers for AIChE are: Richard Tomlin—President; Leland Briggs—Vice-President and Treasurer; and Richard Schwarer—Secretary.

AIME

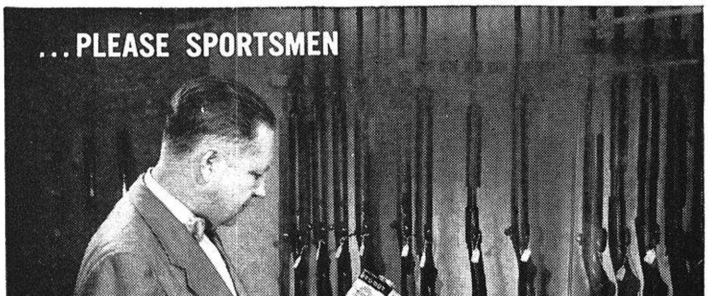
AIEE has announced its officers for this semester. They are: Daniel Schendel—President; Randy Leske—Vice-President; Donald Martens—Secretary; Tom Mack—Treasurer; and Paul Weinert—Publicity Chairman.

END

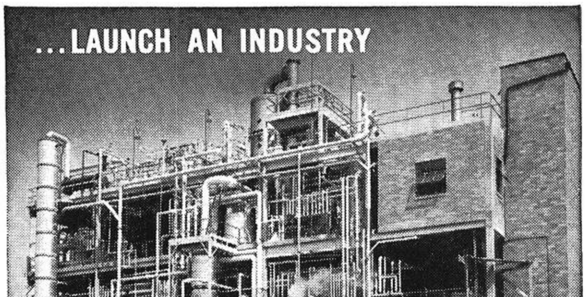
HOW HERCULES HELPS...



EXCITING NEW DISHES AND CUTLERY, both molded with a new Hercules plastic, Hercocel® W, are as durable as they are beautiful. A product of Hercules research, Hercocel W is a low-cost thermoplastic combining high heat resistance and good dimensional stability with exceptional toughness and impact strength. (Tranquil ware dishes by Byrd Plastics, Inc.; cutlery by Royal Brand Cutlery Company, a Division of National Silver Company, Brooklyn, New York.)



HANDY CONTAINERS and display rack for Hercules smokeless powders work two ways—they make it easier for the sportsmen who do their own loading to select the right powder, and convenient for the dealer to arrange an eye-catching display. Hercules powders have long been the favorite with handloaders who want accuracy and economy.



A MILLION POUND A MONTH PLANT is now producing dimethyl terephthalate at Burlington, N. J. Largest single user: Canadian Industries (1954) Ltd., in the synthetic fiber 'Terylene'. Hercules' plant, first to make DMT by air oxidation, is designed to expand as markets grow.

HERCULES POWDER COMPANY
INCORPORATED
Wilmington 99, Del. Sales Offices in Principal Cities

SYNTHETIC RESINS, CELLULOSE PRODUCTS, CHEMICAL COTTON, TERPENE CHEMICALS, ROSIN AND ROSIN DERIVATIVES, CHLORINATED PRODUCTS, OXYCHEMICALS, EXPLOSIVES, AND OTHER CHEMICAL PROCESSING MATERIALS.

G55-9

HERCULES

CHEMICAL MATERIALS FOR INDUSTRY

ACCORDING TO THE DEAN . . .

Your Education in the Humanities is a part of your Engineering Training

W. R. MARSHALL, JR., Associate Dean

In a previous column (Wis. Eng., Jan. 1955) I stressed the importance of graduate work in engineering, and urged all seniors with high scholastic standing to give serious consideration to advanced study. However, whether or not you continue into gradute work your education does not cease at the end of four years of under-graduate study,—nor at the end of graduate study, for that matter. Thus, when you enter industry your education in engineering continues intensively, and at the same time, you continue your liberal education after college for all your life. For these reasons, I am prompted in this column to call your attention further to the length, breadth, and depth of an engineer's education. I regard these observations pertinent in view of the great emphasis which is continually placed upon the fact that it is important for engineers to have a greater acquaintance with the humanities and social sciences. In this respect, we might note that studies have been are being, and will probably continue to be made of the importance of non-technical branches in an engineer's education. With these observations in mind, but without any comment pro or con, suppose we summarize the kind of an education which an engineer has when he graduates.

An engineer is a professional man who serves society in the practice of his profession. Accordingly, his complete education must of necessity fulfill two objectives, the technical and the social. In the technical phase the engineer must be a specialist in his field. Therefore, for one to accuse him of being narrow because of his specialization represents an inconsistency and contradiction on the part of the accuser. To prove this one would need only to ask the individual making the accusation what kind of a medical, legal, or business practitioner he himself would employ. His answer would probably be, "The best specialist I could find."

Let us view the technicl phase in another way. An actor once related that when he was young, all the important roles needing a man were for older men; when he was old, all the roles needing a man were for younger men. When an engineering education is attacked for its special technical nature, it is usually accused of being so narrow it cannot encompass the humanistic subjects. If the engineer expands his education to include these fields and thereby neglects his specialty, then in a few years his education will so diffuse that his ability to cope with specific technical problems will be questioned.

The second phase of the engineer's education is the social objective. With this in mind, let us first list some of the important things which an engineer should achieve just to become an engineer. He should posess leadership, initiative, resourcefulness, originality or creativeness, a sense of social responsibility, an ability to work independently or with others, an ability to profit by his experiences and an ability to administer. If you were looking for a new neighbor whom you would like to invite into your community, what would you list as the characteristics of this man? If he had the qualities listed above, qualities which good engineers do have, would he not make a good citizen? Would he not be able to take his place as a worthy member of any democratic society? In other words, the engineer's education prepares him to assume social responsibility in a very real sense.

For this reason, therefore, we can conclude that a characteristic inner urge to know and understand will induce an engineer to be a part of, and contribute to, any physical surroundings or intellectual atmosphere. By virtue of the very nature of his training he can participate in both the physical and intellectual. The record is quite clear that the fact he did not specialize in the humanistics—and that is really what the critics who deprecate an engineering education are asking, more course time devoted to non-engineering subjects—is a greater challenge to the engineer than to the non-engineer. The engineer is conscious of the fact that his education must continue. He knows how to educate himself. In the final analysis, therefore, he will have the necessary non-technical information when he needs it because he has learned to anticipate his problems, to get the facts, and to interpret them. I contend today's engineer receives a basic education for his life to come because it is one which not only meets the technical requirements but also recognizes the social responsibilities.

—W. R. M.

CAMPUS NEWS

compiled by Dick Peterson, m'57 and Larry Barr, m'57

INSTITUTES

ELECTRICAL CONTRACTORS INSTITUTE

November 28, 29

This is the first of two such meetings for electrical contractors. Twenty-five per cent of the time will be spent on fundamentals of electricity and problems of everyday practice. One full day will be spent studying the Code. The final half-day will cover business ethics and selling the job. The spring meeting will stress residence, farm, and industrial wiring, and there will be a full day on estimating.

Fee: $15. Ralph D. Smith, Institute Coordinator.

SURVEYORS

November 30, December 1, 2

Problems of surveying, especially land surveying, and new developments both in methods and new instruments will be considered in talks, demonstrations, and discussions. This institute is planned in cooperation with the Wisconsin Society of Land Surveyors.

Fee: $20. Leonard F. Hillis, Institute Coordinator.

INDUSTRIAL PLANT MAINTENANCE

December 5, 6, 7

This institute is planned for plant engineers, plant managers, maintenance supervisors, and others concerned with maintenance problems. Up-to-date information will be presented on such topics as planning and scheduling, preventive maintenance, application of industrial engineering to maintenance activities, training maintenance workers, and selling man-

(Continued on next page)

SCHOLARSHIP AND FELLOWSHIP AWARDS—1955–1956

UNDERGRADUATE AWARDS

Scholarships	Winners	Class	Stipend
Louis Allis Engineering Scholarship	Robert F. Engel	EE 4	$500
American Smelting and Refining Scholarships	C. Barclay Gilpin	Met E-3	$500
	John W. Nyhus	Min E-3	$500
American Society for Metals Scholarship	Arthur J. Hundhausen	Met E-2	$400
Bates and Rogers Foundation Scholarships	John A. Moller	CiE-2	$400
	Russel P. Wibbens	CiE-2	$400
	Charles H. S. Charlson	CiE-3	$400
	Edward J. Rice	CiE-3	$400
Charles and Constance Bleyer Memorial Scholarships in Engineering	Jon H. Baumgartner	ChE-4	$325
	Kenneth C. Holtz	EE-4	$325
Foundry Educational Foundation Scholarships	Richard E. Duchow	EE-2	$275
	James A. Behring	Met E-3	$350
	John A. Hren	Met E-3	$350
	Robert I. Kernland	Met E-3	$350
	James J. Wert	Met E-3	$350
	Donald Behnke	Met E-4	$400
	Joseph F. Duwell	Met E-4	$400
	Malcom Grahm	Met E-4	$400
	Richard M. Gregory	Met E-4	$400
	Glenn N. Reinemann	Met E-4	$400
	Paul A. Weinert	Met E-4	$400
	Wallace Yeskie	ME-4	$400
General Electric Engineering Award	Robert A. Hentges	ChE-4	$500
Grainger Charitable Trust Engineering Scholarships	Donald A. Boelter	EE-1	$450
	Conrad C. Bjerke	EE-2	$450
Ingersoll Foundation Scholarship	David J. Linskey	ME-2	$300 and Fees
Lakeside Bridge and Steel Company Scholarship	James L. Clapp	CiE-4	$400
	Robert R. Mills Jr.	CiE-4	$400
Maytag Scholarship in Engineering	Richard E. Birner	CiE-4	$200
Milwaukee Society of Iron and Steel Fabricators Scholarship	Thomas C. O'Sheridan	CiE-4	$400
George W. Mead Scholarship in Engineering	John W. Tosch	EE-1	$1200
Monsanto Chemical Company Senior Scholarship in Chemical Engineering	Dietrich E. Weinauer	Bio Chem Eng-4	$400
Colonel John Morse Foundation Scholarships	John G. Bollinger	ME-3	$500
	James F. Spitzer	EE-3	$500
	Robert E. Suelflow	EE-2	$500
	Robert C. Costen	EE-4	$500
	Frederick A. Luhman	ME-4	$500
	James J. Reinhardt	EE-4	$500
Pelton Steel Casting Company Scholarships	Henry G. Goehring Jr.	Met E-3	$500
	Danny E. Schendel	Met E-4	$600
Square D Company Scholarships	Lawrence D. Barr	ME-3	$450
	Raymond E. Harrison	EE-4	$450
Trane Company Scholarships	Dennis F. Meronek	EE-3	$500
	Arthur L. Morsell	ME-4	$500
Union Carbide and Carbon Corporation Scholarship	Robert L. Elton	ChE-3	$200 and Fees
Universal Oil Products Company Scholarships	Richard G. Kott	ChE-3	$333
	James H. Moy	ChE-3	$333
	Duane F. Bruley	ChE-4	$333
	Delbert L. Lehto	ChE-4	$333
Francis D. Winkley Scholarship	John G. Akey	ME-4	$330

(Continued on next page)

SCHOLARSHIP AND FELLOWSHIP AWARDS

(*Continued from page 41*)

GRADUATE AWARDS

Scholarship	Winner	Class	Stipend
Research Fellowships in Engineering	Burzoe E. Ghandhi	ME	$1560/Cal. Yr.
	Allen E. Rabe	ChE	$1300/Ac. Yr.
University Fellowships	William S. Clouser	Mech	$1150/Ac. Yr.
	James E. Foxworthy	CiE	$1150/Ac. Yr.
	William R. Kimel	Mech	$1150/Ac. Yr.
Frank Rogers Bacon Foundation Fellowship	Donald F. Shulz	EE	$2100/Cal. Yr.
Celanese Corporation of America Fellowship	David R. Longmire	ChE	$1800/Cal. Yr. and Fees
DuPont Company Post-Graduate Fellowship	Robert A. Greenkorn	ChE	$2100/Cal. Yr. and Fees
Ethyl Corporation Fellowship	Marshall C. Burrows	ME	$1500/Cal. Yr. and Fees
General Motors Fellowship	Gary L. Borman	ME	$1400/Cal. Yr.
Kimberly Clark Foundation Fellowship	Donald F. Root	ChE	$1500/Cal. Yr. and Fees
Ole Evinrude Foundation Fellowship	Gerald Haft	ME	$1500/Cal. Yr.
Procter and Gamble Fellowship	Dean R. Dickinson	ChE	$1400/Cal. Yr. and Fees
Shell Fellowship	Jame R. Brock	ChE	$1500/Ac. Yr. and Fees
Sinclair Refining Company Fellowship	Richard N. Griffith	ChE	$1500/Cal. Yr. and Fees
Standard Oil of California Fellowship	James R. Laible	ChE	$1500/Cal. Yr. and Fees
Westinghouse Fellowship	Donald F. Fitzgerald	EE	$1700/Ac. Yr.
College of Engineering Research Fellowship	Thomas R. Hoffman	ME	$1300/Ac. Yr.
Ailine S. Andrew Foundation	Mauri Tanttu	EE	$2500/Ac. Yr.

Campus News

(*Continued from page 41*)

agement on an effective maintenance program. A panel discussion on specific maintenance problems will be included.

Fee: $25. Ralph D. Smith, Institute Coordinator.

HEAT-TREATING PRACTICES
December 8, 9

Valuable information on heat treating methods, furnace atmospheres, and properties of heat-treated materials will be presented in this program. Discussion will be devoted exclusively to ferrous metals. Metallurgists, design engineers, tool engineers, and supervisors of heat-treating departments are some of the persons who will be interested in this institute.

Fee: $20. Robert A. Ratner, Institute Coordinator.

STUDENTS WIN AWARDS

Among the winners in the eighth annual Engineering Undergraduate Award contest sponsored by the James F. Lincoln Arc Welding Foundation were three Wisconsin students.

Gordon Ullenberg, EE '55 won $75 for his design of a welded jib crane. Roger W. Sackett, ME-4, won $50 for designing a welded fifth wheel crane. John Lohrey, ME-4, won $25 for his design of a welded shell reloading tool.

Congratulations, fellows, nice work.

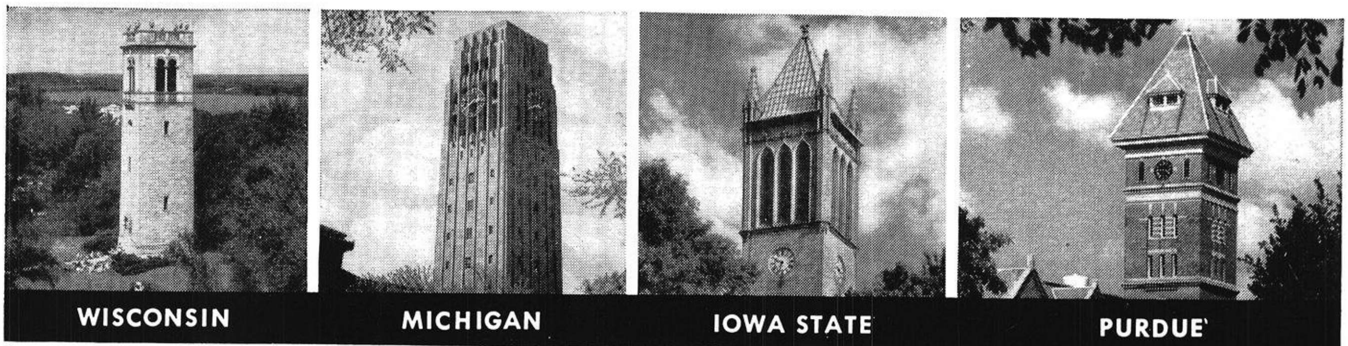
1956 EXPOSITION UNDERWAY

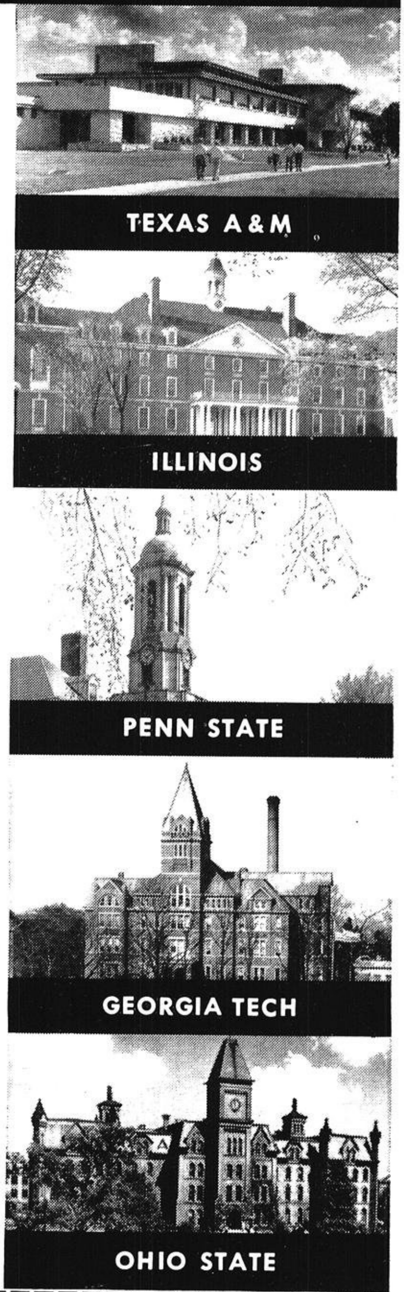
Chairmen for the 1956 Engineering Exposition have been appointed and plans are being made to insure a successful event. The Exposition, which will take place next April, is to include a wide variety of industrial exhibits, student displays, and demonstrations. Chairmen for the Exposition are:

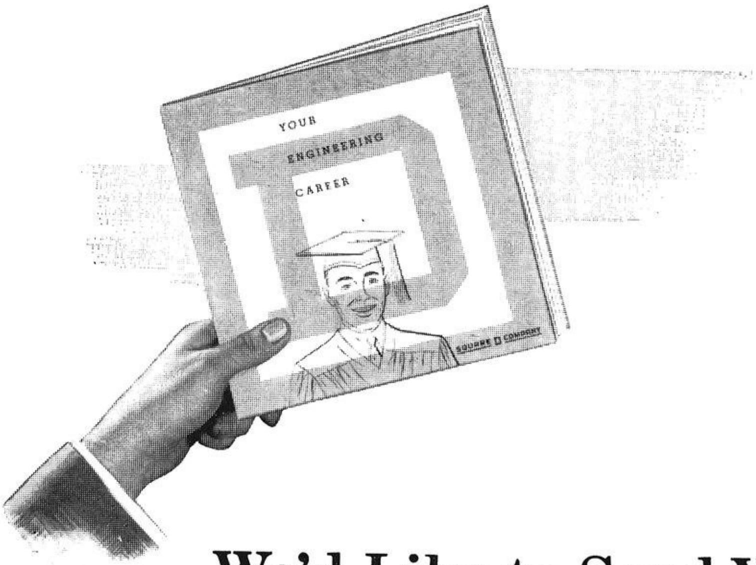
John Bollinger, ME—General Chairman
Ron Douglas, ChE—Industrial Exhibits
Pete Reichelsdorfer, ME—Industrial Exhibits
Roger Jesse, ChE—Student Exhibits
Stuart Charlson, CE—Student Exhibits
Tom Goulet, ME—Incidentals
Leland Briggs, ChE—Finance
Larry Greenfield, EE—Program
Larry Barr, ME—Publicity

The last exposition, in 1953, attracted thousands of people from every part of the state, and attendance is expected to be higher for the 1956 exposition. The objective of the exposition is to display some of the advances made in engineering and manufacturing in recent years. It affords the public a chance to see these advances and an opportunity to talk with the people who make them possible.

The exposition is entirely a student operated affair and anyone wishing to help should contact one of the chairmen. Previous expositions have been very successful with the 1956 edition expected to be the largest to date. **END**







We'd Like to Send You a Copy of this Brochure

Who knows, sending for this brochure may be the beginning of a very gratifying career. That's how it has worked out for scores of men from these nine schools. And we think it's rather significant that the vast majority of those who have joined Square D during the past years are still with us—growing and prospering in the ever-expanding electrical industry. If you are looking forward to a career in electrical, mechanical, industrial or general engineering, we'd like to tell you what Square D has to offer.

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Address________________

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ALUMNI NOTES

by John M. Albrecht, c'56

Mr. James S. Vaughan, who was born in Madison, Wisconsin, and less than ten years ago went to work for the Square D Company as a student engineer at its Mil-

JAMES S. VAUGHAN

waukee plant, has been elected a Vice President by the Board of Directors.

The son of the late Professor Richard E. Vaughan, who was a member of the University of Wisconsin faculty for 40 years, Mr. Vaughan at 40 becomes one of the youngest officers in the 52-year-old history of Square D.

Mr. Vaughan graduated from the University of Wisconsin in 1938 with a degree in civil engineering. He was attending Syracuse University on a graduate scholarship in public administration when called to active military service. He was discharged in 1946 as a Lt. Colonel after five years in the U. S. Signal Corps.

Prior to his election as Vice President, he was General Manager of the Distribution Equipment Division.

Pvt. Ronald G. Rosenkranz, a University of Wisconsin graduate, Class of 1952, died in his sleep the night of June 12, 1955 in Big Spring, Texas, while on pass from Fort Bliss.

Pvt. Rosenkranz was born September 27, 1929 in Rhinelander, Wisconsin. He attended the University of Wisconsin and graduated with a B.S. degree in Mining Engineering. He was president of Delta Sigma Phi fraternity and a member of Polygon Board. After graduation he was employed as a Petroleum Engineer with Phillips Petroleum Company for over two years, his last assignment with the company being at Big Spring, Texas.

In January, 1955 he took leave of absence from Phillips and entered the Army. At the time of his death he was assigned to the 58th AAA Battery, AAA and Guided Missile Center, Fort Bliss, Texas.

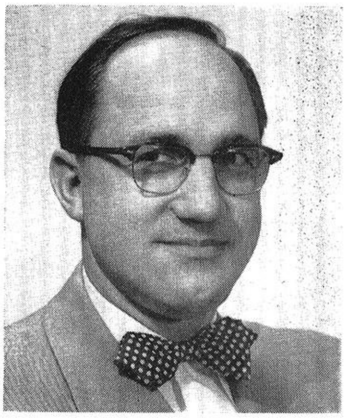
Lindon E. Saline has been appointed manager of headquarters recruiting in the General Electric Company's Engineering Services. Saline will have responsibility for engineering relations with many of the technical colleges in the upstate New York area and supervisory responsibilities in the engineering recruiting headquarters here.

A native of Minneapolis, Minn., Saline received a bachelor of electrical engineering degree from Marquette University in 1945 and his M.S. and Ph. D. degrees from the University of Wisconsin.

Dr. Robert M. Ashby, who received a Ph.D. degree in physics at the University of Wisconsin, was appointed assistant director of North American Aviation's Electro-Mechanical Engineering Department on June 17, 1955.

A native of American Fork, Utah, Dr. Ashby received BA and MA degrees in physics from Brigham Young University in Provo, Utah, in 1934 and 1939 respectively. Dr. Ashby joined North American in 1949 as Electronic Group leader and was named Chief of the company's Flight and Fire Control Section in 1951. He had held that position until his recent appointment.

Located at Downey, California, the Electro-Mechanical Engineer-



DR. ROBERT M. ASHBY

ing Department is engaged in the development of automatic guidance systems, flight- and fire-control systems, autopilots, radar systems and instrumentation for missiles and aircraft.

Samuel Lenher, assistant general manager of Du Pont's Organic Chemicals Department, was elected a director, vice president, and member of the Executive Committee of the Du Pont Company, last May.

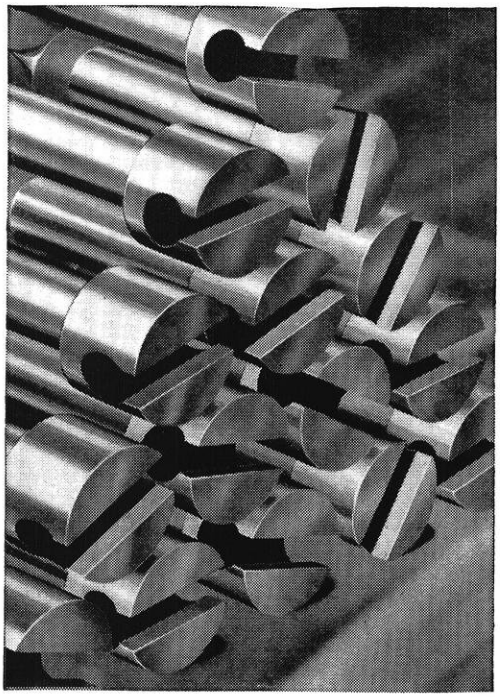
During his 26-year career with the Du Pont Company, Mr. Lenher has been engaged in research, production, sales, and more recently with administrative functions. He has also taken an active role in the affairs of the chemical industry and is currently serving as president of the Synthetic Organic Chemical Manufacturers Association.

Son of the renowned Professor Victor Lenher, Samuel Lenher was born in Madison, Wisconsin. He graduated with a bachelor of arts degree from the University of Wisconsin in 1924, and two years later

(Continued on page 60)

Another page for YOUR STEEL NOTEBOOK

The steel that could take anything but a bath



In steel mills and warehouses, a roller leveler straightens wide sheets and heavy plates between powerful steel rolls.

Stress on the rolls is tremendous. To make them strong and tough enough, one manufacturer used an alloy steel, 52100. Then, to make the rolls *hard* enough, they were heated to a high temperature and quenched in a liquid bath. But the severe quench was causing many of the rolls to warp.

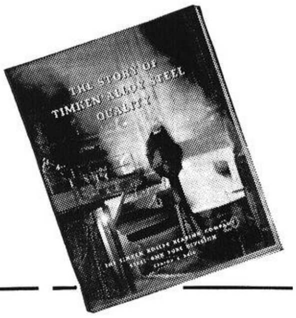
The roll maker took his problem to Timken Company metallurgists, asked if he could make rolls from 52100 steel that wouldn't distort in quenching. They said yes—if the steel were uniform from lot to lot in analysis and hardenability.

TIMKEN® steel quality control solved the distortion problem

The roll maker switched to 52100 steel made by the Timken Company. He found the steel was uniform from lot to lot, heat to heat, year in and year out. Result: he was able to standardize heat-treating practice. Distortion was practically eliminated.

The Timken Company constantly solves steel problems like this one by furnishing steels to the most exacting specifications. Timken Company metallurgists are specialists in fine alloy steels. And they use the most modern quality control methods to assure uniformity, time after time after time.

Want to learn more about steel or job opportunities?



Some of the engineering problems you'll face after graduation will involve steel applications. For help in learning more about steel, write for your free copy of "The Story of Timken Alloy Steel Quality." And for more information about the excellent job opportunities at the Timken Company, send for a copy of "This is Timken". Address: The Timken Roller Bearing Company, Canton 6, Ohio.

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

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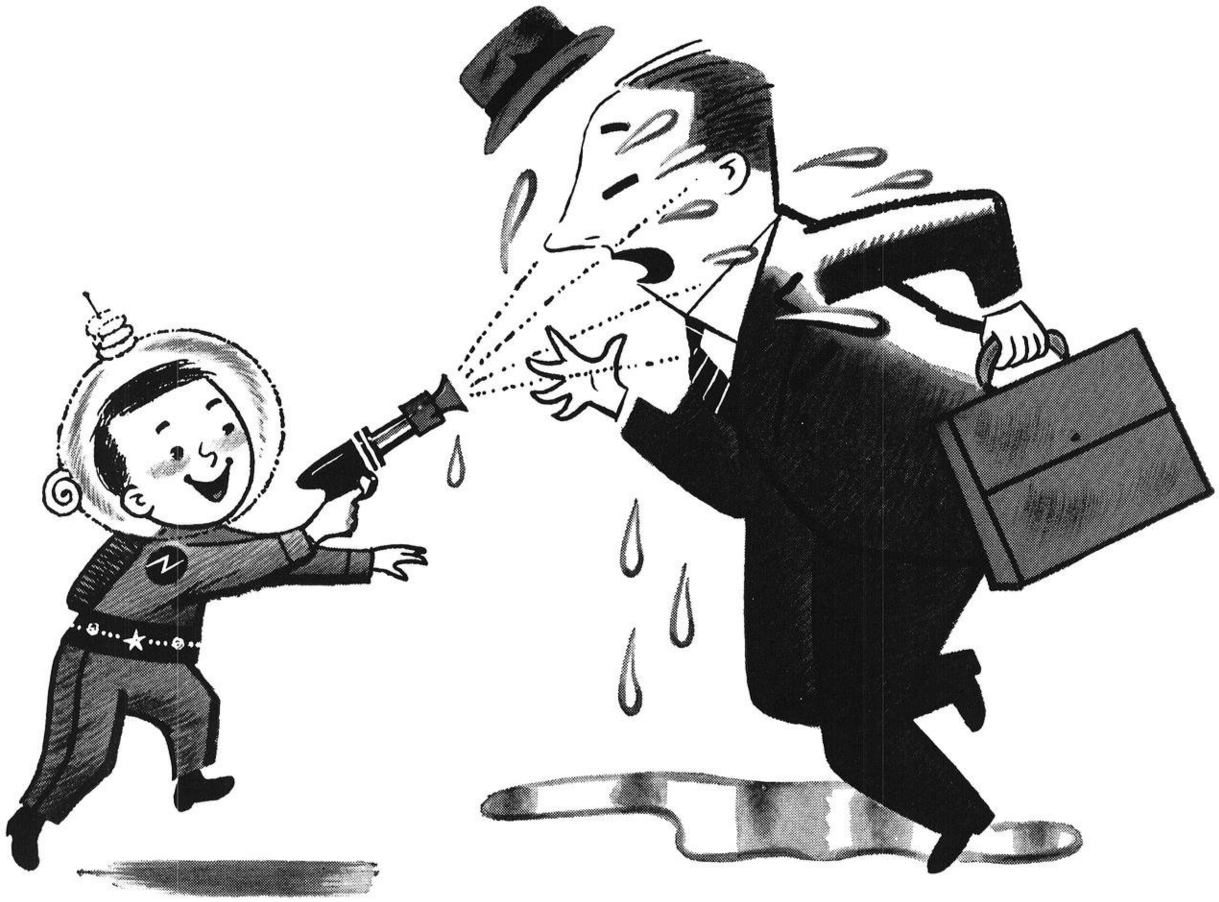
TRADE-MARK REG. U.S. PAT. OFF.
Fine Alloy
STEEL

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



Automation

(Continued from page 13)

automation to make their factories truly automatic. At the same time, however, *unit product* manufacturers have encountered far different and more difficult problems than face the chemical manufacturer or oil refiner. Oil refineries, for instance, can conveniently handle their product in pipes, but this would be rather difficult in the case of an engine block or transmission housing.

There are four basic problems which must be worked out before a unit manufacturing operation can become fully automatic: 1) product and process redesign, 2) machine design, 3) product handling, and 4) overall control.

"What could possibly be more difficult to make automatically than a radio circuit full of tubes, wires, resistors, coils, and condensers? It would take some kind of colossal Rube Goldberg device to put it all together." This is probably what the designers must have thought when they were given the job of producing radio circuits automatically. As it turned out, the solution which they came up with involved a complete rethinking and redesign of radio circuitry. The new designs included circuits printed on ceramic wafers, resistors and condensers in the form of tape, and transistors in place of tubes.

This is a good example of one primary consideration that must be made when thinking of automation—can the *product be redesigned* in such a way that it will still serve the same function, but be better adapted to automatic production? This is something that is often overlooked when speaking of automation in terms of computers and automatic controls. In many cases it will be nearly impossible to automatically produce a product in its present form. But, if the product is thought of in terms of what it is used for and not in terms of how it was made in the past, it may be possible to design a product for automation. It is also more economical to redesign a product than to design needlessly complicated production machinery to make the product.

Process redesign is another primary consideration in facilitating automation. The chemical industry is a good example of how redesign of production methods can lead to automatic production. Fifty years ago chemicals were made in separate batches with manual handling and control. Today we have continuous flow with the entire process automatic. It was the change from batch processing to continuous flow that spelled the difference.

A philosophy of machine design which has been adhered to for many years leads to a specialization of machine in terms of its *product* rather than in terms of its functions. These are single purpose machines which handle one unvarying product.

Many examples of single purpose automatic machines are available. Bottling and packaging machinery is designed to accommodate one size of package or bottle. They are quite useless when it comes to some different size. A whole canning operation may be done automatically. Sheet metal, food, and cardboard are fed into the machines while filled and sealed cans come out the other end packed in cardboard cartons. One operator can tend 104 fully automatic cotton weaving looms. The Ford engine block transfer machine can automatically perform all the machining operations on an engine block.

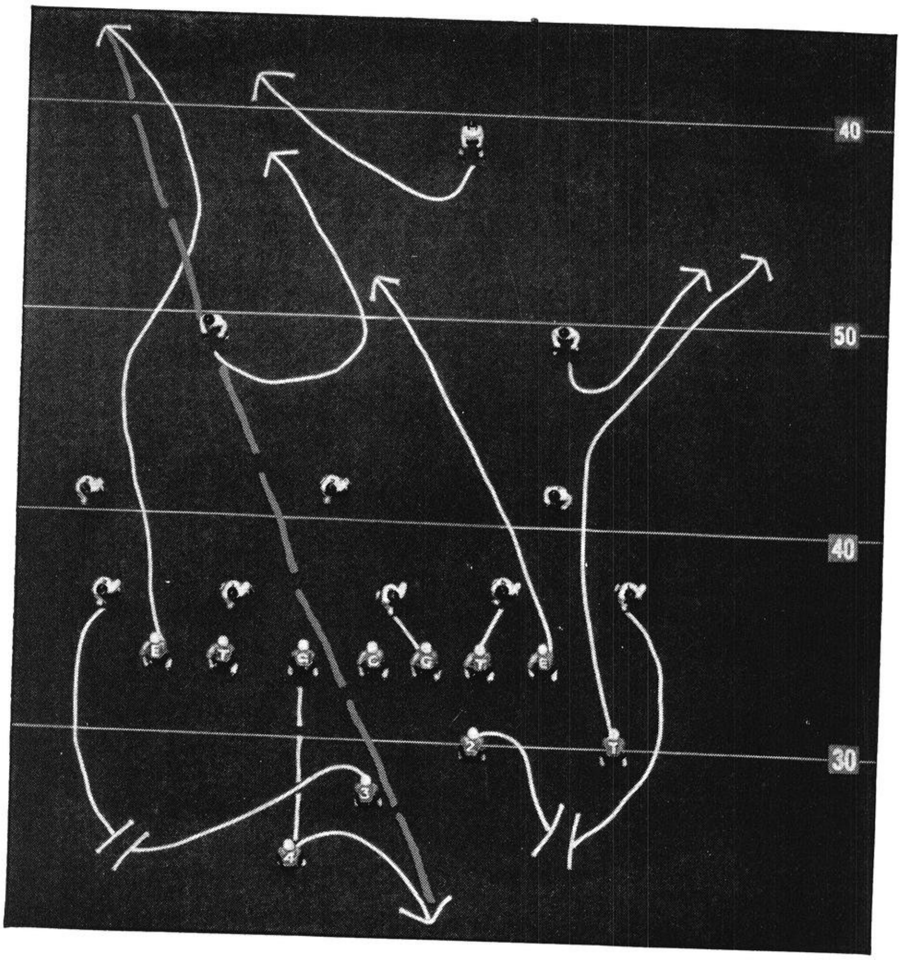
In writing about "Ford automation", D. S. Harder says "In the automobile industry we find that because of our yearly models, certain parts change from year to year and consequently, our automation equipment must pay for itself in this same period." Mr. Harder has here stated the great short-coming of the single-purpose inflexible machine. Unless a very long run of unvarying product can be made, the machine will not be economical. Where does this leave the medium or small sized manufacturer who would like to automate, but can't afford to buy a single purpose and inflexible machine.

A new philosophy of machine design has been proposed which would lead to machines that are designed to automatically perform a group of *related functions* rather than to turn out a specific product. Such machines would be able to handle a group of products which require approximately the same machine operations, but it would be flexible in operation. That is, it would be able to handle a variety of products with a minimum of alteration. It wouldn't be necessary to scrap this type of machine when the product design changed. Limitations would be that the products would have to be within a reasonable size range and a related group of machine operations would have to be performed. Present day automatic chucking and screw machines are a step in the right direction. Such flexible *and* automatic machine tools would soon find use in the small or medium sized factory or shop.

A proto-type of the automatically controlled machine of the future is the numerically controlled milling machine developed by MIT's Servomechanism Laboratory. The two motions of the head and the motions of the table are controlled by means of a pre-coded punched tape. The complete instructions for a series of operations, including position of tool, depth of cut, cutting speed, etc., are calculated and the encoded as punches on a paper tape. The directing mechanism of the machine transcribes the tape code into electrical impulses which through a system of feed-backs and analogs turns the shaft and controls and synchronizes the motions of the head and table. It operates on the same principle of feed-back as the gun position-control system discussed previously. A great variety of jobs can be handled by the machine simply by encoding a new tape.

Another knotty problem to be solved in making a factory automatic is that of transferring parts between machines and loading and unloading of the machine.

(Continued on page 54)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Automation

(Continued from page 52)

Once machines have been made that are automatic and flexible, it remains to build a materials handling system that will move the product between the machines in a continuous flow. This is in accordance with the lesson learned from the process industries. Obviously if the machines are designed to handle a variety of products, the materials handling system will also have to be flexible. This is not an easy problem, but it is being worked on by many manufacturers. Ford, for instance, has developed automatic transfer and machine loading and unloading devices to handle engine blocks, pistons, and cylinder heads.

Now we have a redesigned product flowing steadily between automatic and flexible machines on automatic and flexible transfer equipment. What remains is to tie all the various operations of the plant together with a central control system.

A digital computer will serve ideally as this central "brain" of the factory. Production and assembly lines will be coordinated by the "brain". Automatic inspection devices will feed back information on performance in the factory to the computer where it will be compared with desired performance. Detected errors will be corrected automatically as explained in the discussion on feed-back. The chief problem of applying the computer is that of listing all the alternatives to a particular set of conditions for each production step in the factory. In other words, men will have to supply all the answers to the machine so it will be able to choose among them.

None of the automatic factories as outlined in this article are in existence today. The day of the completely automatic factory is surely coming, but as yet, it is not here. The question is often asked "How soon will automation come? Will it happen overnight, or will it be a long drawn-out process?" Peter Drucker, a noted writer on management, answers it this way: "Most businesses will not convert to automation overnight, but will go at it piece-meal. This will require more capital than wholesale automation, and it will entail greater risks. But the mental strain will be less. Fewer people will have to re-learn fewer things and they will have more time to do it in. While it is a major revolution, automation is not likely to be dramatic; there will be no point when one can say: 'This is the year when the American economy went into automation.' "

Areas other than manufacturing will no doubt be subject to automation. The handling of routine information in offices is already being done by machines and this trend towards automation is sure to continue. Diebold in *Automation* proposed a system of automating the New York Stock Exchange. All transactions would be handled by an electronic computer so that stock brokers could buy and sell while seated in their office. By rethinking our traditional ways of doing things, automation's methods will find wide application.

Next Month: The Social Effects of Automation.

Eyes and Ears

(Continued from page 19)

unless it is protected by an electrical or other de-icing device.

One type of gyro-horizon instrument in use consists of a horizontal line representing the horizon, and a two-armed indicator representing the plane wings. When flying level, the indicator arms are directly on the horizontal line. (See fig. 4) As the nose of the plane goes up or down, the arms go above or below the fixed horizontal line, the instrument indicates nose up or down respectively. Also, the indicator arms bank in imitation of the plane.

Altimeter

The altimeter is an aneroid barometer graduated to register height. It has a large and small hand, similar to a clock, one complete revolution of the large hand being equal to the movement of the small hand from one major graduation to the next. Through a window at the bottom of the dial, the pilot can read barometric pressure in millibars. This dial can be set to agree with the barometric pressure on the ground, in which case the large hand will accurately register height at 50 feet or less.

Airspeed Indicator

The airspeed indicator measures the speed of the aircraft in relation to the surrounding atmosphere—not in relation to the ground. If the plane is flying in a 30 mile per hour headwind, the airspeed indicator will register 30 miles per hour more than the plane is actually flying in relation to the ground.

The face of the instrument consists of a single needle with a graduated dial. The needle is activated by the impact of air against an exterior pitot tube.

Icing conditions can cause trouble, even with these basic instruments, and should be avoided as much as possible. The pitot tube of the airspeed indicator may freeze and indicate a large drop in airspeed on the dial. Also, the turn and bank indicator will cease to function if the venturi tube freezes.

The airspeed indicator and altimeter are common to all planes. The remaining instruments are classified into two categories.

Nose Inclination:

1. Gyro-horizon
2. Rate of climb indicator

Turning:

1. Compass
2. Turn and bank indicator

The gyro-horizon is the least fatiguing for level flight and correcting bank, as it is pictorial and shows the airplane's position in two dimensional planes simultaneously, but it does not show slip or skid.

These directional and positional instruments are the basic instruments associated with the simpler aircraft. In the larger and more complicated planes, more types and quantities of instruments are needed depending upon the complexity of the aircraft. END

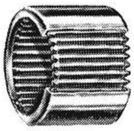
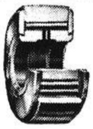
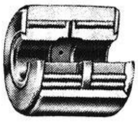
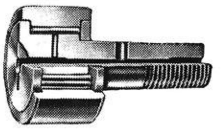
The Torrington Needle Bearing... many types for many needs

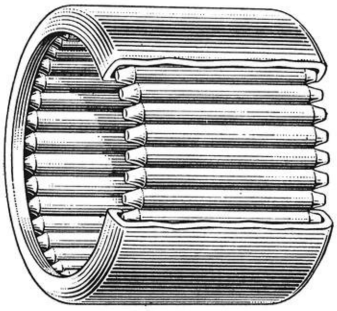
In previous advertisements in this series, the many advantages of the Torrington Needle Bearing and the proper procedure for its installation and maintenance have been discussed. The DC unit type bearing was used in these discussions because it is the Needle Bearing with by far the greatest variety of applications throughout industry.

From the basic Needle Bearing design, however, many modifications have been made. The result is a complete line of Needle Bearings suitable for specific applications. Although these bearings are all different, each offers the advantages which have made the DC unit type so popular. They give the highest possible radial load capacity in a minimum of space; they are light in weight, easy to install and simple to lubricate.

The following chart shows many types of Torrington Needle Bearings, gives their design features and general applications for which they are designed.

The new Torrington Needle Bearing catalog will be sent on request.

TYPE	SERIES	BEARINGS	DESIGN FEATURES	APPLICATIONS
DC	B		Thin, drawn shell, retaining full complement of small diameter rollers. Inner races are furnished when shafts are not hardened.	Wherever high load capacity is needed and space is at a premium.
HEAVY DUTY			The outer race is made in one channel-shaped piece, hardened and ground to precision limits. Heavy inner race.	For heavy-duty applications where split housings occur or where press fit of bearing into housing is not possible.
AIR-CRAFT	NBC		Heavy inner and outer races, with end washers securely fastened to inner race.	Aircraft applications involving oscillating motion only.
	NBE *(left)* NBK *(right)*	 	Similar to NBC except have self-aligning outer races.	Aircraft applications where alignment is difficult or deflection is severe.
	NBF *(left)* NBL *(right)*	 	Similar to NBC except have heavy outer races to carry rolling loads.	For use as rollers under heavy loads at low speeds.
CR	CR		Heavy solid-sectioned outer race and rollers made from high-quality bearing steel. Portion of stud which serves as inner race is hardened. Threaded end left soft to avoid brittleness.	Cam follower applications where maximum load capacity and shock resistance are required.



THE TORRINGTON COMPANY

Torrington, Conn. • South Bend 21, Ind.

District Offices and Distributors in Principal Cities of United States and Canada

TORRINGTON *NEEDLE* BEARINGS

NEEDLE • SPHERICAL ROLLER • TAPERED ROLLER • CYLINDRICAL ROLLER • BALL • NEEDLE ROLLERS

Science Highlights

(Continued from page 36)

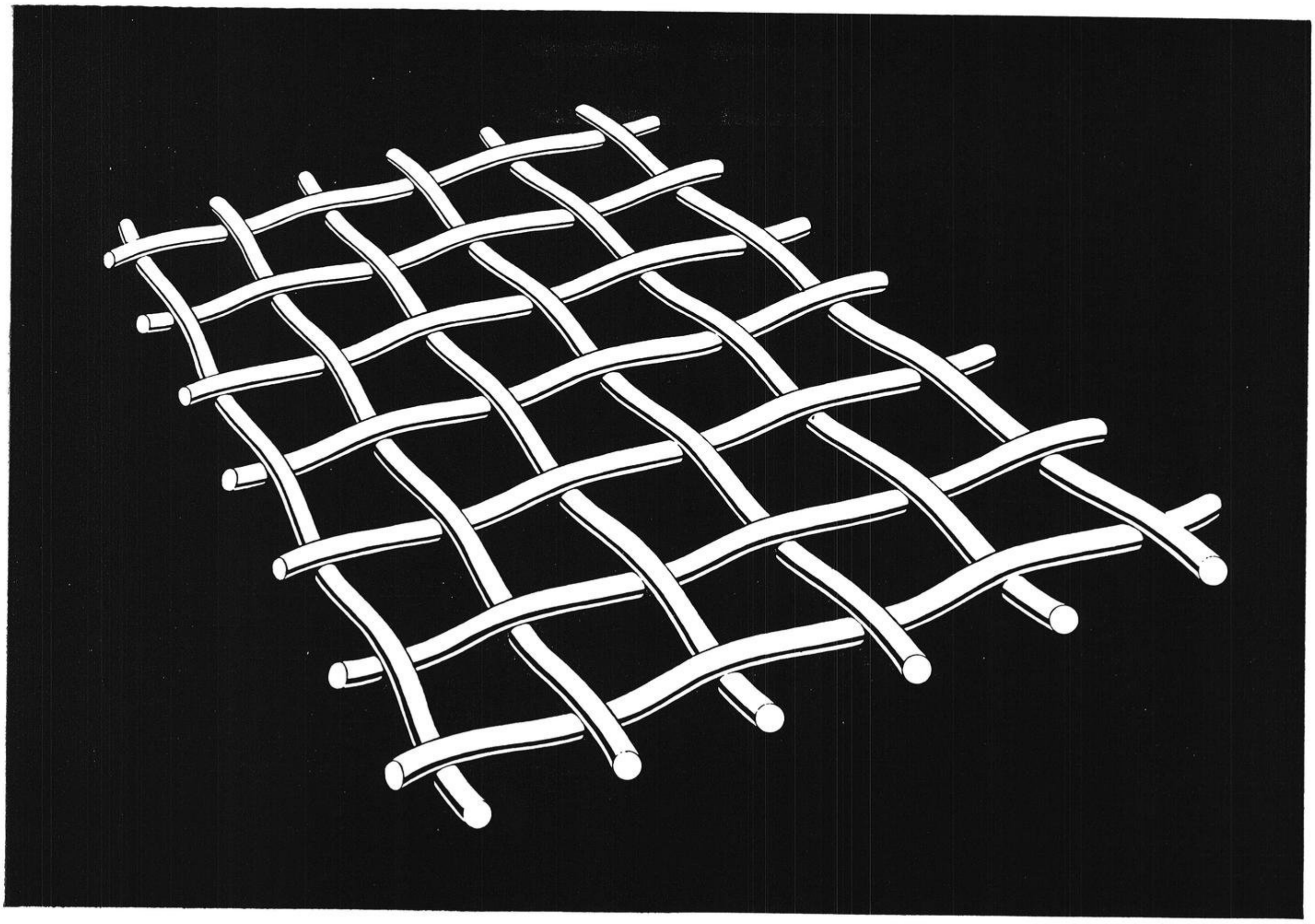
herent in thicknesses up to about 10 mils. If applied more heavily, residual stresses may cause coating failure on sudden heating or cooling.

The hardness of the coating suggests its use for protecting soft metals—aluminum, die-cast alloys, or mild steel, for instance—against erosion and abrasion in pump impellers and housings, fan blades and turbines, and piping subject to cavitation.

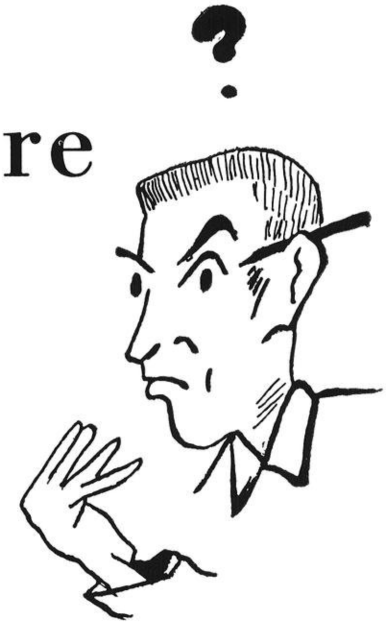
FLAT PLATE T. V. TUBE

A television tube consisting of transparent flat plates has been developed for the Navy in connection with a long-range program for simplifying aircraft instruments. These would both be television picture tubes. As now envisioned, one instrument would be a semicircular plate mounted vertically and directly in front of the pilot. It would be transparent and thus would not interfere with the pilot's vision during flight. Altitude, speed and attitude of the aircraft would be shown on this plate, and physical features such as mountains, which the pilot sees during contact flight, would be depicted artificially. This instrument would tell the pilot all he needs to know to fly the aircraft about its three axes: pitch roll and yaw. The second instrument would consist of a round plate mounted below the first, just inside the cockpit rim. Broad physical features of the earth below would be depicted by analogy, and the appearance would be somewhat similar to that of a radar map. Other information necessary for navigation or traffic control would also be shown on this instrument. By means of calibrations around the rim, the number of miles to the pilots base, fuel remaining, and similar information would be shown in a way that makes the information easy to read and assimilate. An aim of the Navy's long range program is to reduce the control system to two basic controls: a control stick and a throttle.

END



So You Think You're SMART!



by Sneedly, bs'60

Sneedly, as usual, is late getting his **So You Think You're Smart** column in this month and his honor, The Editor, is really breathing down his neck. In order to eliminate this pesky creature, Sneedly feels it will be well worth the time spent to finish this column and remove the threat of the editor's wrath.

* * *

An honorable family of spiders, consisting of a wise mother and eight husky youngsters, were perched on the wall at one end of a rectangular room. Food being scarce, owing to the room being in Russia, the spiders were grumbling when an enormous fly landed unnoticed on the opposite wall. If Euclid could have been summoned from his grave (location, alas, unknown), he would have been able to show that both the hunters and their prey were in the vertical plane bisecting the two opposite walls with the fly 80 inches below the center and the spiders 80 inches above.

Suddenly, one young spider shouted with glee, "Mama! Look! There's a fly! Let's catch him and eat him!"

"There are four ways to reach the fly. Which one shall we take?", came the eager query from another.

"You have forgotten your Euclid, my darling. There are eight ways to reach the fly. Each of you take a different path, without using any other means than your God-given legs. Whoever reaches the goal first shall be rewarded with the largest portion of the fly."

At a given signal by the mother, the eight young spiders shot out in eight different directions at 0.65 mph. At the end of $\frac{625}{11}$ seconds, they simultaneously converged on the fly, but found no need of attacking it since its heart had given way at the sign of enemies on all sides.

What are the dimensions of the room?

* * *

Since Sneedly has already had Mechanics 4 he feels that the next problem will be appreciated by Mechanics 4 students since it is one which gives him an example of what to expect on the final exam problems he will have in January.

Hanging over a pulley there is a rope with a weight on one end; at the other end hangs a monkey of equal weight. The rope weighs four ounces per foot. The combined ages of the monkey and its mother are four years and the monkey's weight is as many pounds as its mother is years old. The mother is twice as old as the monkey was when the mother was half as old as the monkey will be when the monkey is three times as old as its mother was when she was three times as old as the monkey was. The weight of the rope and the weight is half as much again as the difference between the weight of the weight and the weight of the weight plus the weight of the monkey. How long is the rope?

Sneedly thinks the monkey business in this problem is obvious.

* * *

When Sneedly was traveling in Europe last summer, he was passing through a certain country where the king was growing old and, wishing to appoint a capable man to succeed him to the throne, decided to give the crown to the wisest man in the land. He gave a country-wide intelligence test and narrowed the applicants to Sneedly and two other men. Sneedly and these men met with the king one day and he gave them a certain problem. The first man to solve this problem would be crowned king. Here is the problem: The king said,

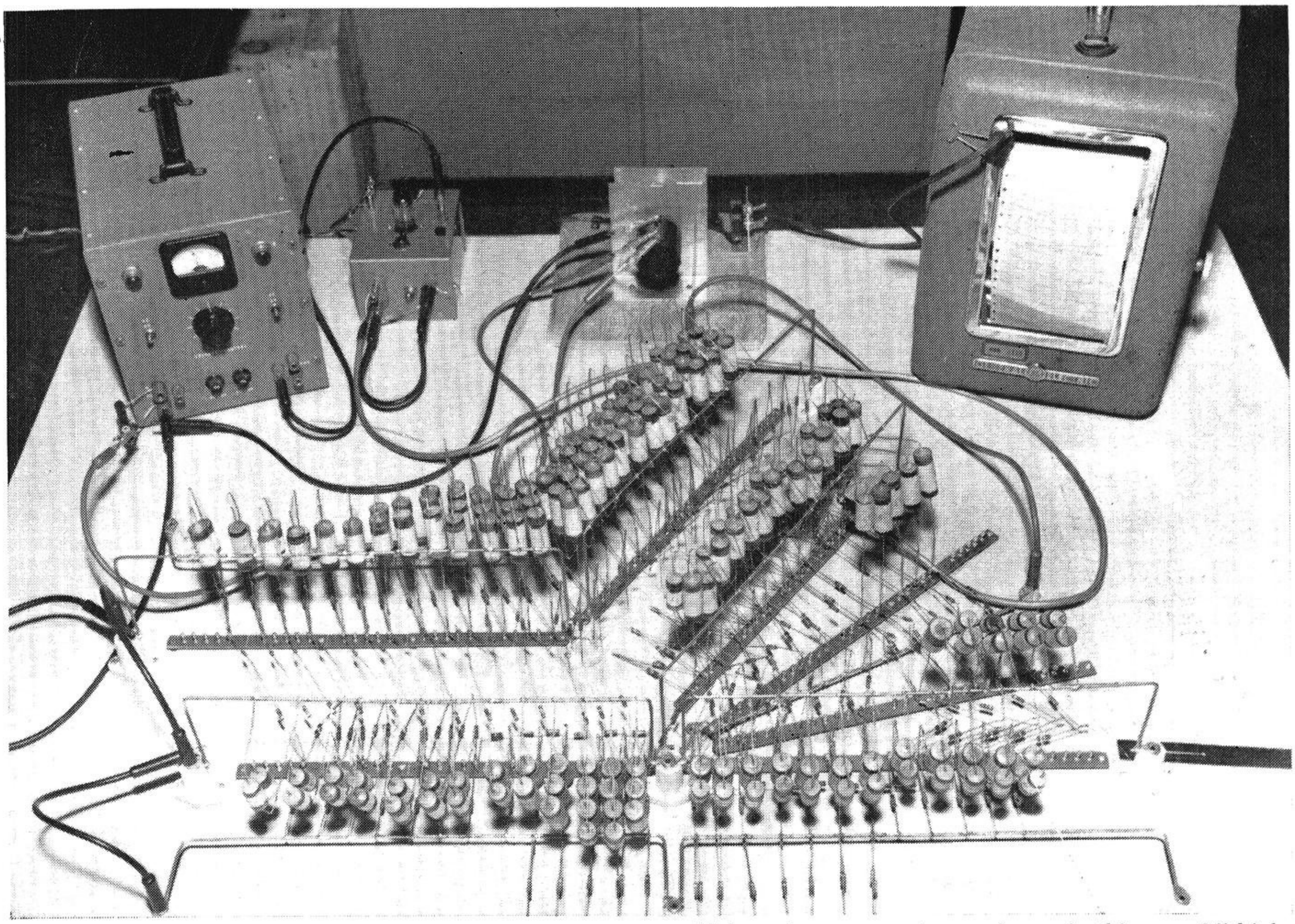
"I'm going to blindfold all of you and put you in a room together. While blindfolded, I'll put either a black or a red mark on your forehead. When I take off the blindfold you will raise your hand if you see a red mark and lower it when you have determined what the color on your own forehead is." The king blindfolded Sneedly and the other men and put a red mark on all their foreheads. Then he removed the blindfolds and immediately the three raised their hands. However, one of the other two soon lowered his hand and said, "I know because none of the rest know." As a result, Sneedly, his-almost majesty is back this month. How could Sneedly have determined the color on his forehead?

* * *

Last month's answers were:

1. Sneedly is 28 and you are 21 years old.
2. It takes John 30 minutes to overtake Joe.
3. The alley will be exactly 13.75 feet wide.
4. The three boxes will hold 4, 5, and 6 clocks.
5. The tank will drain in 8.18 minutes.

END



This analogue computer, a pioneer in this age of "thinking machines", was developed by Standard Oil scientists.

New Electronic "Engineer" Solves Tough Refinery Problem

THE MEN who design modern oil refineries need specific information about temperature distributions in different parts of pressure vessels. Such information, essential to safety and efficient operation, is often extremely difficult to obtain by conventional mathematical methods.

Scientists at Standard Oil's Whiting laboratories recently developed and built an electrical analogue capable of simulating specific conditions within a refinery unit still in the design stage. Using this device, they could determine in advance the temperature distribution in the joint between two pressure vessels having a common head. Thus they were able to duplicate in 20 seconds the heat stress picture within the unit during an 8 hour start-up to shut-down period.

Creative scientific thinking made possible this constructive achievement by engineers who have chosen to build their careers at Standard Oil.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois

STANDARD

Alumni Notes

(Continued from page 48)

received a doctor of philosophy degree in physical chemistry from the University of London.

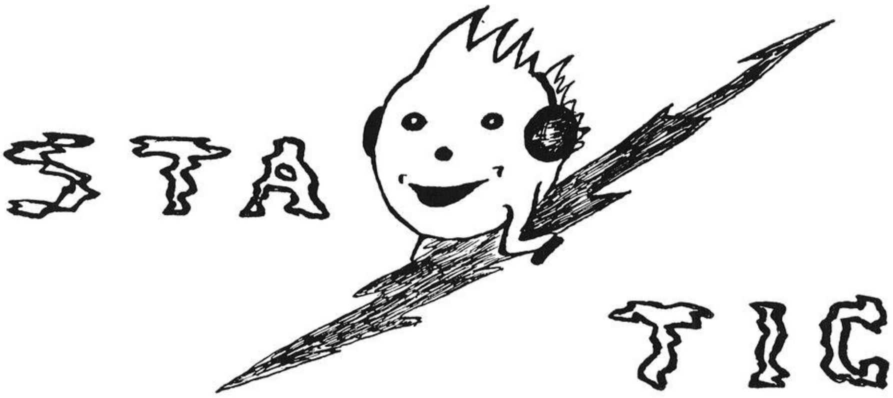
Cummings, Albert Edward, C'15, CE'22, died of a cerebral hemorrhage in New York City on July 20. For the past eight years he was a director of Raymond Concrete Pile Company. He joined the staff of Raymond Company soon after leaving school and was a recognized authority in the field of foundations. He published many articles on foundation matters and frequently lectured upon the subject at engineering schools. He contributed substantially to the development of foundation practices during the period when that practice was emerging from the rule-of-thumb period into a more scientific period.

Culbertson, Ralph D., c'39, became state chief engineer for Wisconsin on September 16, succeeding Charles A. Halbert ('08) who retired on that date after 46 years of state service. Culbertson has been division engineer for the North Western Railway in Madison since 1950.

Plumb, Mahlon J., c'39, together with H. Kenneth Tucker and Milton Pikarsky, has formed an engineering firm for consulting practice in Gary, Indiana. Plumb had been on the engineering staff of the New York Central Railroad Co.

Warzyn, Willard W., c'42, has opened an office for engineering practice in Madison, under the name of the Warzyn Engineering and Service Co. For the past eight years he has been with the Mead and Hunt Company of Madison.

END



I. R. Drops, II

There's been a major shake-up in the staff. They put me on the job and now everybody is "shook"—from the editor to the janitor who reads the dirty jokes that don't get printed.

I'm new on this job. Last month the editor jumped up and down on the copy desk and said "We want progress". Then all the staff members in turn quivered in their boots, shoes, or bare feet, and whispered fearfully, "The editor wants progress, we want progress—even Fala wants progress!"

But I guess the editor changed their minds, 'cause here I am.

Let's get down to business.

Before we do that let me tell you about something that happened to me last summer. I went out driving to Devil's Lake with my date, who by the way was quite a cynical young wench. We were driving along as comfortably as possible and we came upon a lonely stretch of highway. Not to be deterred by her cold shoulders, my faithful car stopped. With the precision of an experienced actor I said, "Look's like we've run out of gas."

At this she seemed to get a little more friendly. She opened her purse, put on some lipstick, and then brought out a bottle. "Look," she said, "a bottle." Said I, "O Boy, you've got a whole quart. What kind is it?"

"Gasoline . . ."

° ° °

I also listened to a temperance lecturer. (That's when I was on the wagon.) He asked the audience this question, "Now supposing I had a pail of water and a pail of beer on this platform, and then brought in a donkey; which of the two would he take?"

"He'd take the water," came Sneedly's voice from the gallery.

"And why would the donkey take the water?" asked the lecturer.

"Because he's an ass," came back the reply.

I immediately saw the logic in the statement and I've been off the wagon ever since.

° ° °

. . . The reason I have to mention Sneedly in this column is that he is doing my typing. I can't type except with one finger so I would never meet a deadline if I worked on this column all month long and if I did that I'd never have a chance to read PLAYBOY and so I wouldn't know any funny jokes to fill up this column and soon everything would come to a standstill. If that sentence gets by the copy editor he ought to be fired.

° ° °

I can't help but get Sneedly into this column once again. This time I have a legitimate reason. Sneedly was on a train coming back to school this fall, when he met one of his former professors (we are bound by oath not to tell which). Knowing of Sneedly's wizardry in the realms of problem solving, the prof suggested a game of riddles to pass the time.

"To make it interesting," said good ole Sneedly, "if I have a riddle that you can't guess, you give me a dollar, and vice versa. O.K.?"

"That's all right with me, but since you've got such a wide reputation as a riddle solver, I'm at somewhat of a disadvantage. How about my giving you only fifty cents?" asked Prof. . . . .

Overwhelmed by this welcome flattery, Sneedly agreed. "O.K., you go first," he said.

"What animal has three legs walking and two legs flying?"

Sneedly thought for a long time, and admitting defeat, he handed a dollar to his companion, and asked "What's the answer?"

Prof. . . . . answered, "I don't know either, here's your fifty cents."

Sneedly is not proud of that one, but I thought you-all might be interested.

° ° °

Now I'll get around to a few raunchy jokes.

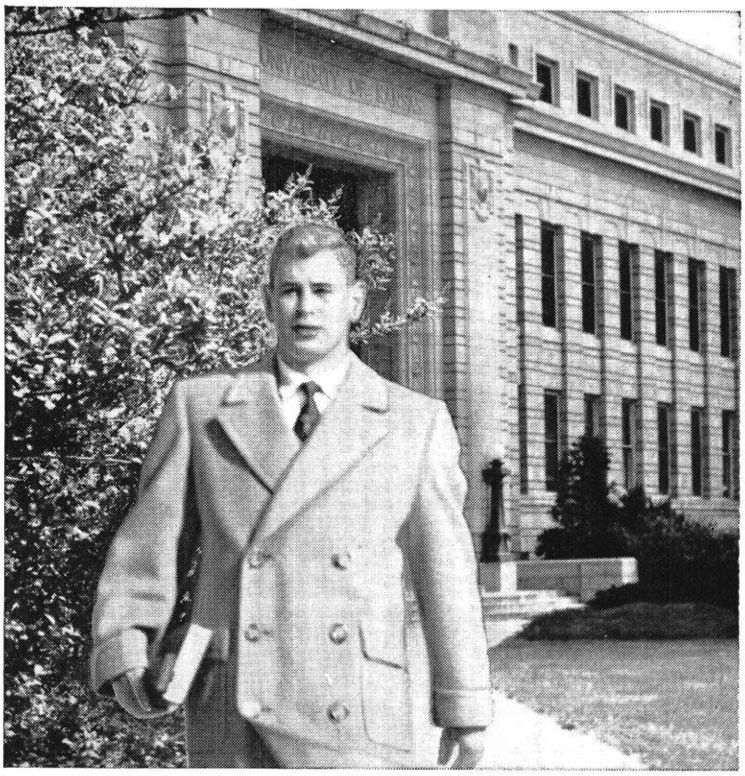
This one came from PLAYBOY: (It was unsuitable for our publication, so we edited it to the extent that we thought necessary to keep within the bounds of propriety.) It's about a deranged woman who has been reading the Bible constantly for the last six or nine years. She says she's cramming for the finals.

This reminds me of the saying which I picked up somewhere in the gutter: after we die we either go to a land of everlasting bliss, or everlasting blisters.

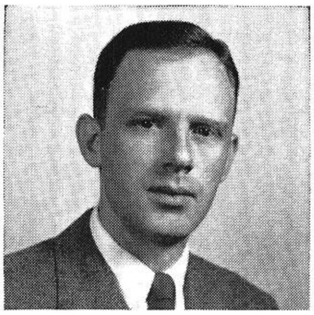
END

Dave Johnson asks:

What's involved in production work at Du Pont?



DAVID L. JOHNSON, JR., expects to receive his B.S.Ch.E. from the University of Kansas in 1956. He is very active in campus affairs, president of Alpha Chi Sigma and a member of several honorary engineering fraternities. Dave is interested in learning more about production work in the chemical industry.



JAMES L. HAMILTON is one of the many young engineers who have been employed by Du Pont since the end of the war. After service in the Navy, Jim got his B.S.Ch.E. from the University of West Virginia in June 1948, and immediately joined Du Pont's Repauno Plant at Gibbstown, N. J. Today, he is Assistant Superintendent of the dimethyl terephthalate area at this plant.

Jim Hamilton answers:

Well, Dave, I've been doing production work at Du Pont for about seven years now, and I'm still getting involved in new things. That's what makes the work so interesting—new and challenging problems arise all the time.

To generalize, though, the duties are largely administrative. That's why effectiveness in working with others is one of the prime requirements. Teamwork is important in research and development work, for sure. But it's even more important in production, because you work each day with people having widely different skills and backgrounds.

A production supervisor needs a good understanding of engineering and scientific principles, too. He has to have that to get the best results from complicated equipment—but he doesn't necessarily need the specialized training that goes with research and development work. A real interest in engineering economics and administration is usually more helpful to him here than advanced technical training. The dollar sign's especially important in production work.

It all adds up to this, Dave. If you enjoy teamwork, and have a flair for large-scale, technical equipment, then you'll find production work mighty rewarding.

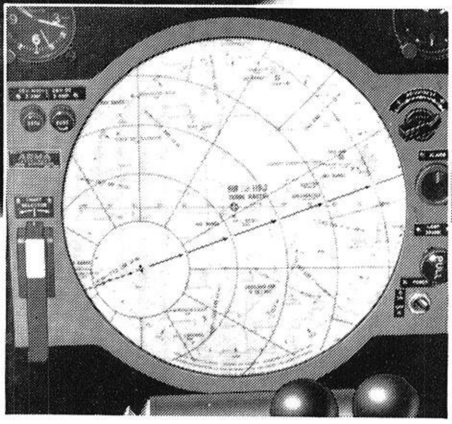
A MORE COMPLETE ANSWER to Dave Johnson's question about production work is given in "The Du Pont Company and the College Graduate." This booklet describes in detail the training, opportunities and responsibilities of engineers who take up this kind of work at Du Pont. Write for your free copy to E. I. du Pont de Nemours & Co. (Inc.), 2521 Nemours Building, Wilmington, Delaware.

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

WATCH "DU PONT CAVALCADE THEATER" ON TV



In the Arma Visual Computer, a single control selects the desired chart from as many as 700 photo slides. Each slide contains punched code holes which automatically tune in the corresponding Omni Bearing Distance station. The image of the plane is governed by a combination of the radio signals and the plane's gyro instruments.

Photography teams with electronics and adds new certainty to flight

Now a visual computer pictures a plane's precise position and heading on projected photos of aeronautical maps.

Arma Division, American Bosch Arma Corp., working with the Air Navigation Development Board and C.A.A., has developed a valuable new aid in air navigation using photography.

With it the pilot, high above the weather, flicks a switch and before him appears a map of the area he's over. On the screen a tiny shadow of a plane moves and shows exactly where he is, where he's heading and whether he's on course.

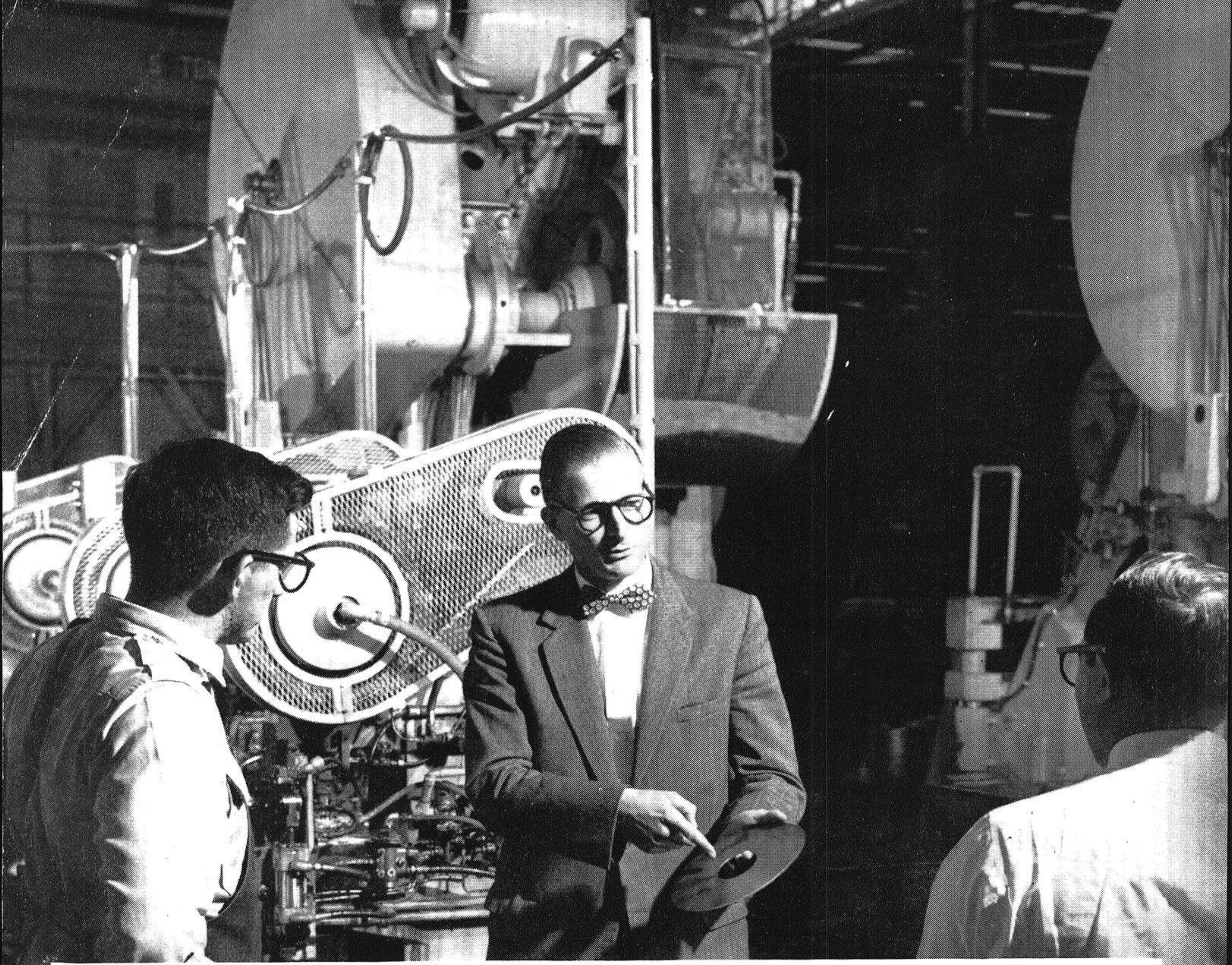
This spells added certainty. Even more! It can mean savings in time and money, too. For the flight can proceed by plan rather than by dog-legs on the beams.

So again we see photography at work helping to improve operations—doing it for commercial aviation just as it does for manufacturing and distribution.

Photography works in many ways for all kinds of business, large and small. It is saving time, saving money, bettering methods.

This is why graduates in the physical sciences and in engineering find photography an important tool in their new occupations. Its expanding use has also created many challenging opportunities at Kodak, especially in the development of large-scale chemical processes and the design of complex precision mechanical-electronic equipment. If you are interested in these opportunities, write to Business and Technical Personnel Department, Eastman Kodak Company, Rochester 4, N. Y.

Eastman Kodak Company, Rochester 4, N. Y.



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General Electric's growth in the next 5 to 10 years presents outstanding opportunities to engineers in the fields of supervision, purchasing, manufacturing engineering, production, quality control, and the specialized administrative functions required to manufacture over 200,000 products for industry, the home, and defense.

G.E.'s manufacturing program builds professional careers through a series of working assignments geared to your interests and abilities. Career potential is varied. In this G-E Tri-Clad* '55' motor factory, for example, Jim Olin, Cornell '43 (center, wearing safety glasses) is superintendent of one of the most modern manufacturing facilities in industry. Accelerated by the trend to continuous processing, facilities such as this at G.E. are raising the demand for qualified manufacturing personnel.

*Reg. trade-mark of G.E. Co.

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