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March, 1953

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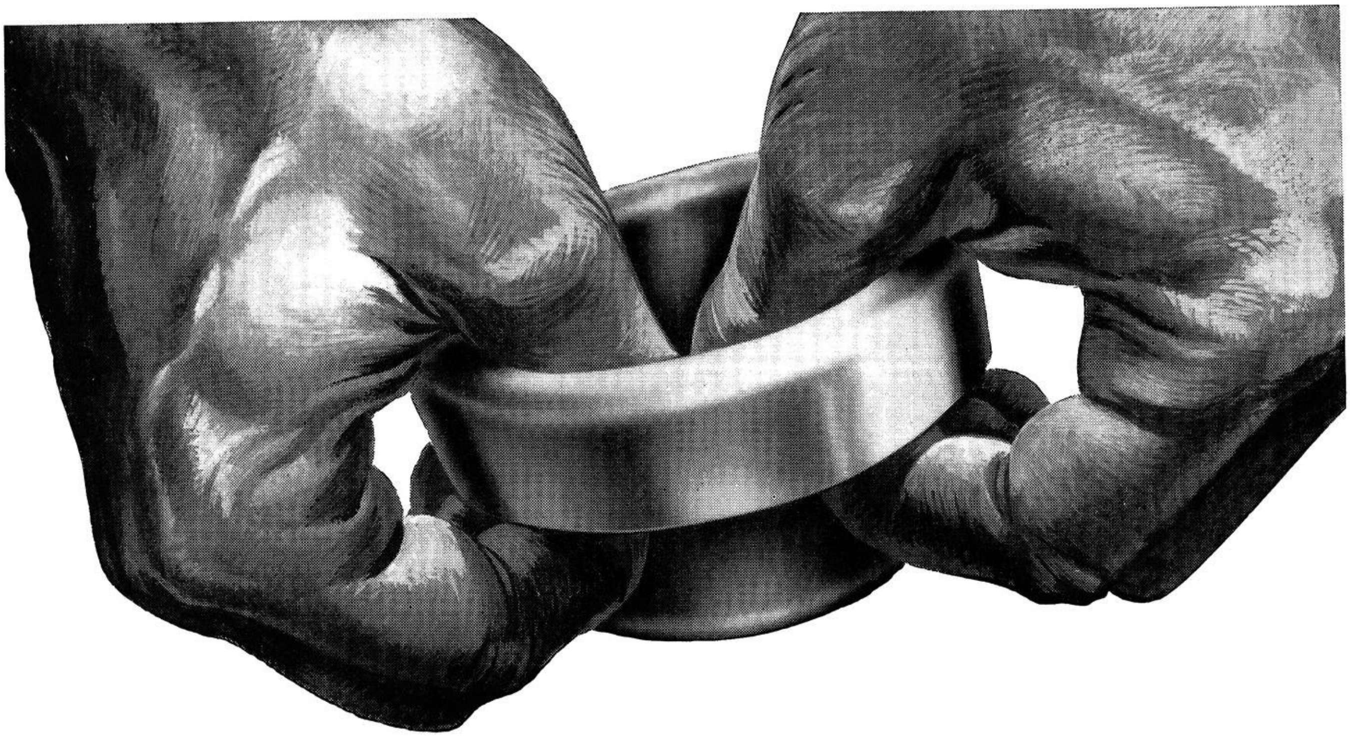
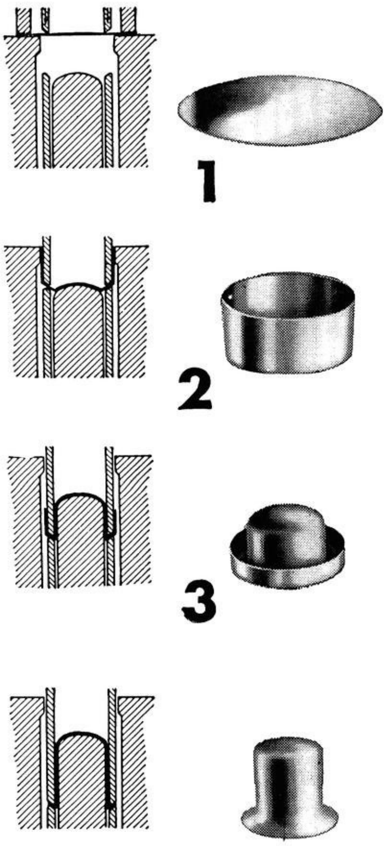


How to turn a high strength steel cup inside out, cold



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This method is used to draw cups for large, low-pressure cylinders. These cups, $14\frac{1}{2}$ in. in diameter and $24\frac{1}{2}$ in. deep, are drawn cold, from 12-gage steel blanks in one continuous stroke in a reverse draw press. The diagrams at left show how it is done.

Starting with a 38 in. diameter steel blank (Fig. 1) the press first draws the steel into a shallow cup (Fig. 2). As the stroke continues, the cup is literally *turned inside out* (Fig. 3) to form the finished cup (Fig. 4) which has very uniform wall thickness. Two of these cups are then welded together to make a cylinder.

Made with high strength steel, cylinders weigh about 20 lbs. less. The maker gets 26% more cylinders from each ton of steel used. Lighter weight makes cylinders easier to handle, and also pays off in lower freight costs—both on the steel from our mills and on cylinders shipped. (A customer 500 miles away saves as much as $100 per carload.)

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Costs would tumble.

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Prices would tumble.

Finally, suppose the consumer did his part, and bought. There would be such business as the world never dreamed of. More store clerks would be needed to handle the demand, more transportation workers to haul the goods, more workers to produce them. The more demand and production, the lower the costs and prices; the lower the costs and prices, the more the demand and production. And everyone would have more and more of the things he wants.

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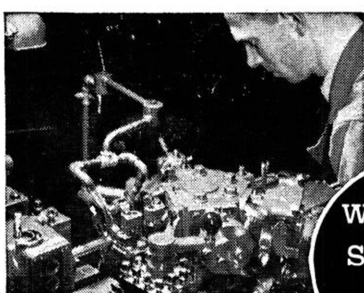
There are employment opportunities at Warner & Swasey for young men of ability and character who believe as firmly in the principles of Americanism as they do in the principles of sound engineering. Write Charles Ufford.



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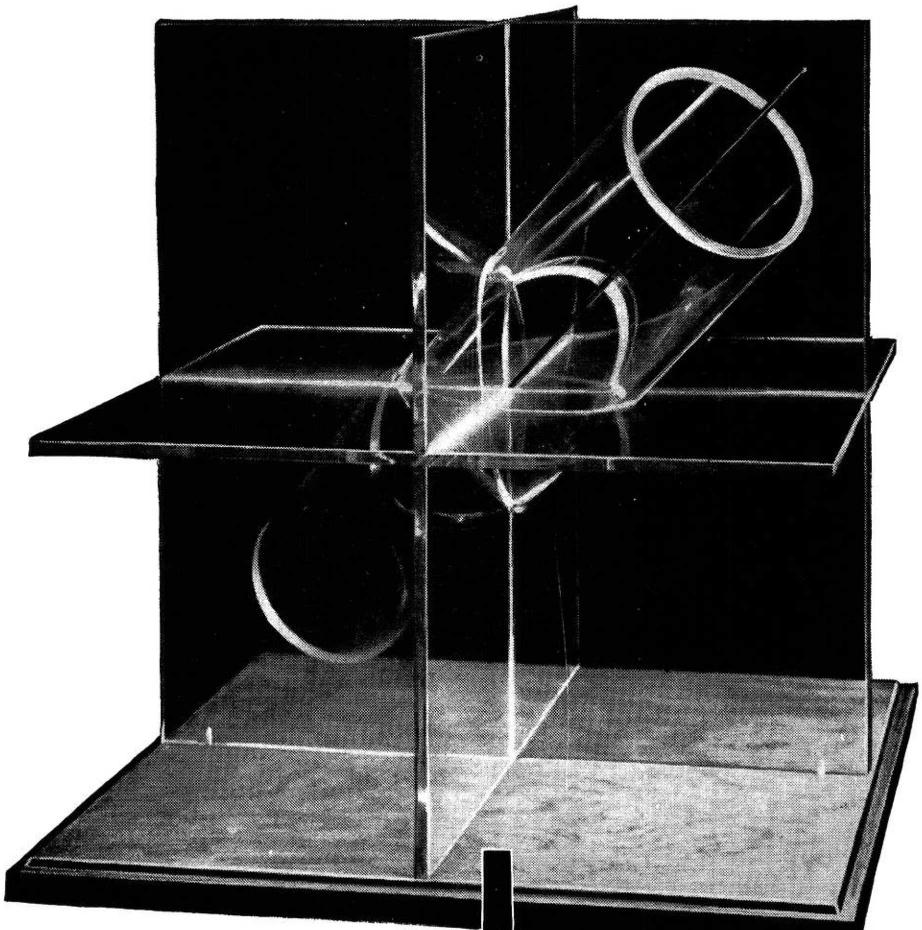

A Bearing Theory with a bearing on your job future

The futuristic-looking object in the picture above is a demonstration model of Maxwell's distortion energy theory concerning the yielding of ductile materials.

And it's used by our General Motors research engineers in their study of "bearing fatigue."

From this study they have succeeded in discovering new facts about the "thick and thin" of bearing surface metals—and thus added to wearing qualities of journal and engine bearings.

We publish it here to point up a fact that should not be overlooked by the engineering student with a bent for research.

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For GM is not only a leading producer of motorcars and trucks. It also manufactures many other types of civilian goods from heating and air conditioning systems to refrigerators, from fractional h.p. motors to Diesel locomotives.

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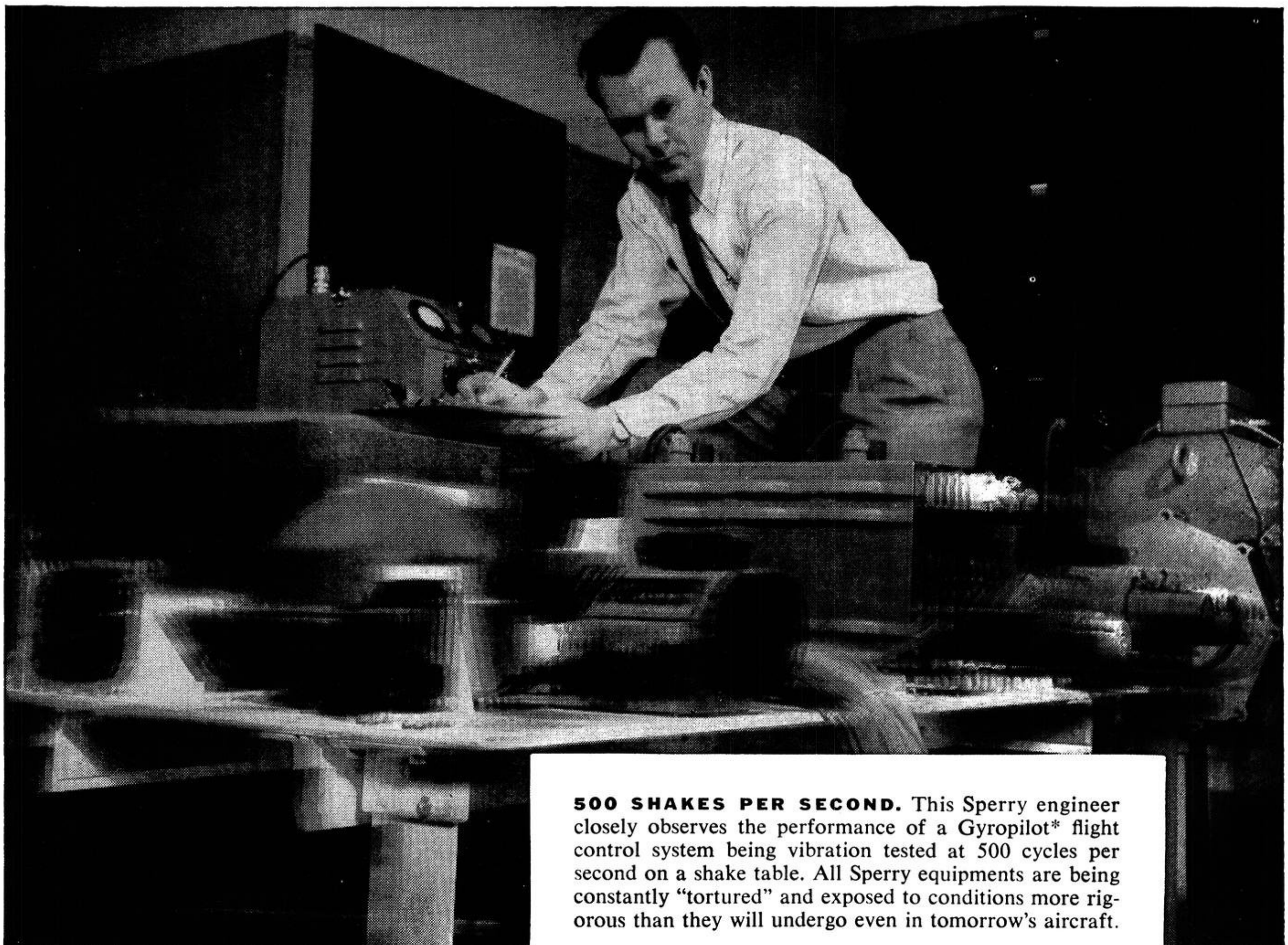

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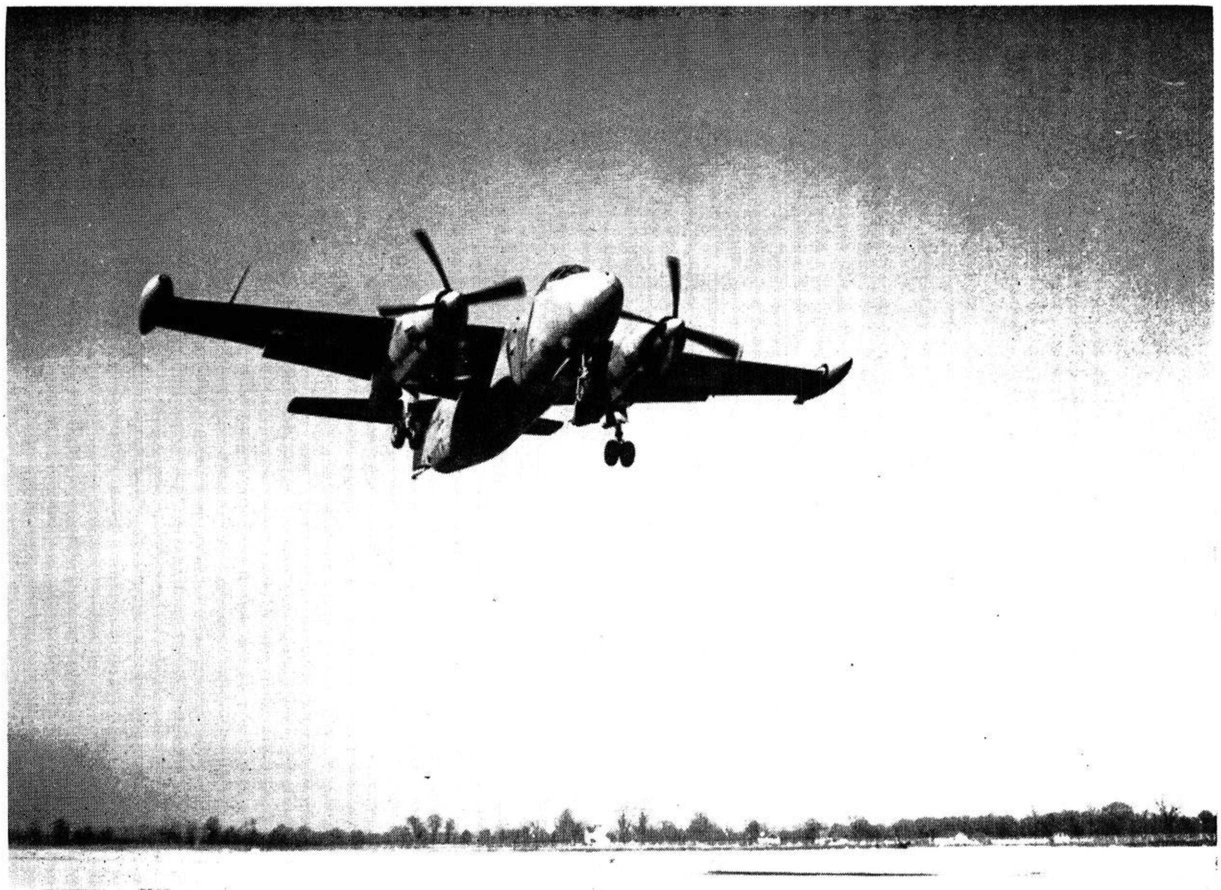


Courtesy North American Aircraft Co.

ATOM BOMB CARRIER: A new Navy attack bomber capable of delivering an atomic bomb from either carrier or land stations, the North American AJ-2 Savage, takes off on its first flight at Columbus, Ohio, where it is being produced. The AJ-2, an advanced version of the AJ-1 Savage, is the largest carrier-based bomber in the Navy's arsenal. It weighs 26 tons, is 65 feet long, 21 feet high and has a wing span of 75 feet. It is powered by one Allison turbo-jet and two Pratt and Whitney reciprocating engines.

THIS-n-THAT

CORRECTION

Due to an oversight in editing, several inaccuracies appeared in the article "For the Surface You Love to Touch —Superfinish" by Stephen Carter, which was published in last month's **Wisconsin Engineer.** It was clearly pointed out that SUPERFINISH is a registered trade mark belonging to the Chrysler Corporation referring to a specific process in which a vitrified bond abrasive stone makes an area contact with a cylindrical or flat surface producing the required finish by a "scrubbing" action. This process is not to be confused with ordinary grinding. Also, credit was not given the Giholt Machine Company for certain material published by them and used in this article.

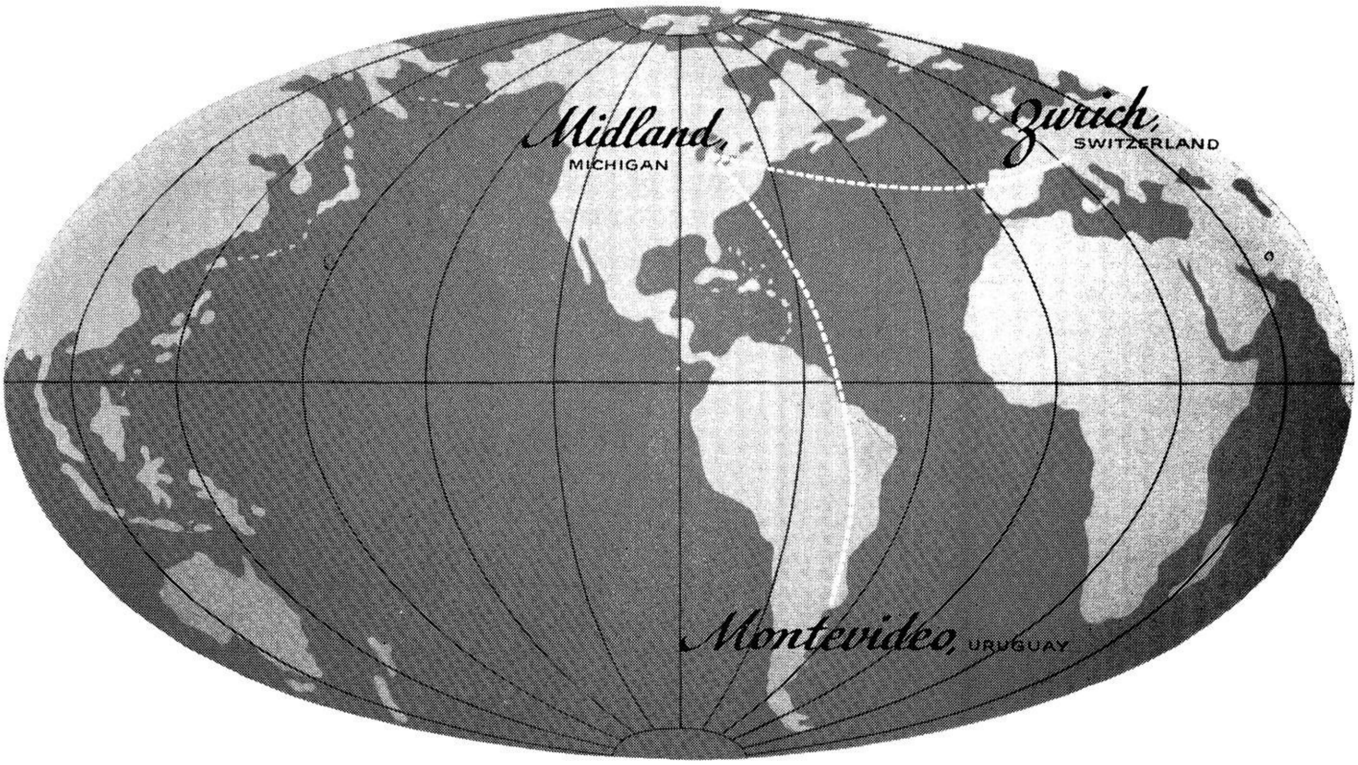
SCHOLARSHIP

Mr. Norbert J. Nitka, a student at the University of Wisconsin, was one of eighteen university students from fourteen different states to have been awarded RCA Scholarships for the current academic year. These undergraduate students, majoring in various fields of science or in branches of engineering, have each received scholarship grants of $800.

The objective of the RCA Scholarship Plan is to encourage the training of scientific personnel for the growing requirements of the electronics industry.

DOW ADDS NEW EXPORT COMPANIES

Dow has recently formed two subsidiary export companies to serve foreign industry's increasing demands for high-quality chemicals.



In the Western Hemisphere, Dow Chemical Inter-American Limited with sales offices in Montevideo, Uruguay will supply chemicals to Mexico and to many countries in Central and South America.

Industries in other continents—Europe, Asia, Africa, and Australia—will be served by Dow Chemical International Limited. Its first sales office will be in Zurich, Switzerland.

These two new export companies are only one example of the continued growth taking place at Dow. Each year finds new Dow plant facilities, increased production, new products developed . . . an over-all growth and expansion that requires a steady influx of men of varying talents, as well as providing excellent opportunities for those within the Dow organization.

Dow's Booklet, "Opportunities with The Dow Chemical Company," especially written for those about to enter the chemical profession, is available free, upon request. Write to The Dow Chemical Company, Technical Employment, Midland, Michigan.

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The Student Engineer's Magazine

WISCONSIN ENGINEER

Founded 1896

Volume 57 MARCH, 1953 *Number 6*

In This Issue . . .

Cover

The two scholastically outstanding freshman engineering students being congratulated by their advisor. Left to right: Arthur L. Morsell, Ch.E. 1; John H. Baumgartner, Ch.E. 1; Professor K. G. Shiels, Freshman Engineering Advisor; and Mary R. O'Keefe.

Frontispiece

Assembling huge turbines is a major task. Under watchful eyes, an overhead crane carefully lowers a section of a General Electric turbine shell into position.

Articles

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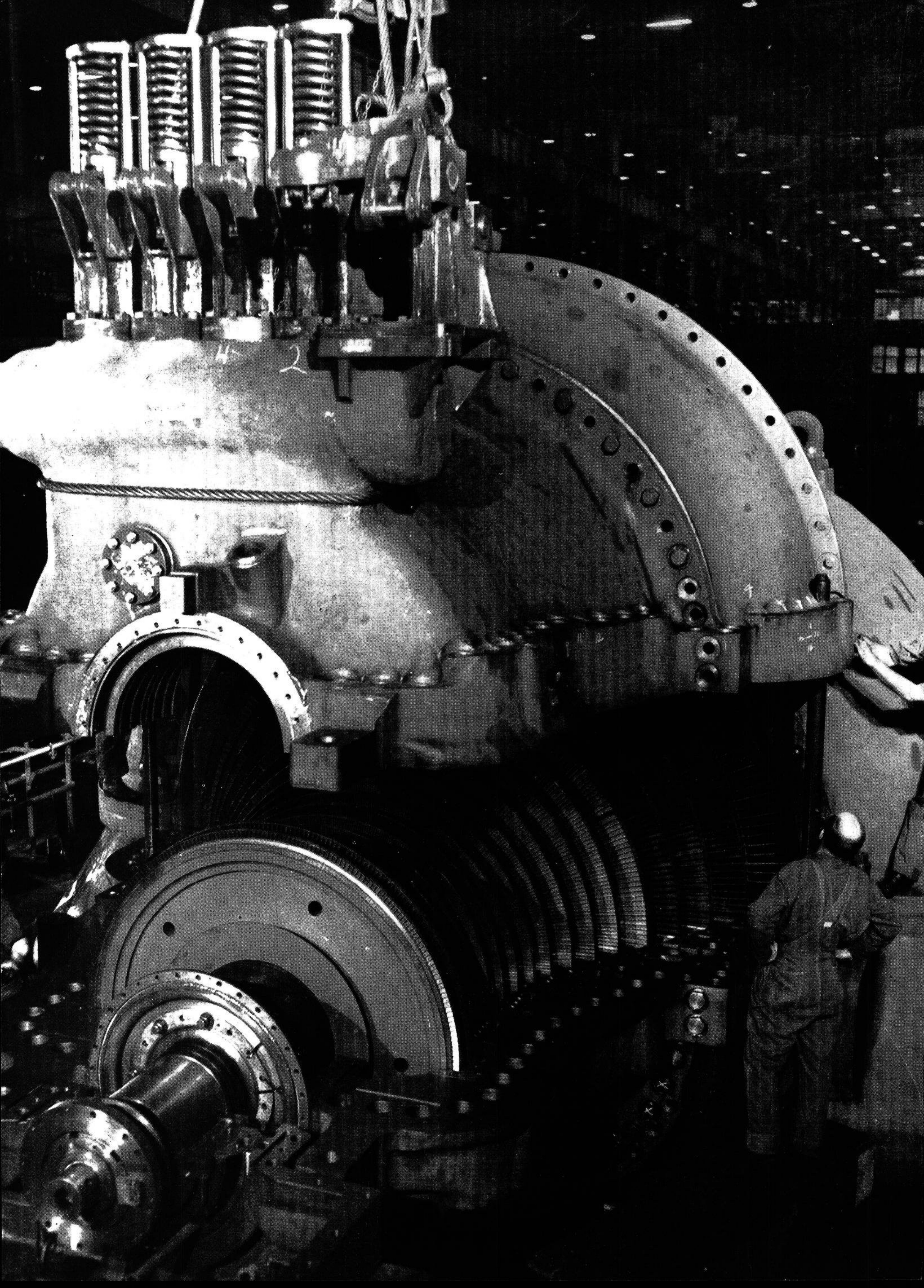


editorial

Graduation and the Draft

Perhaps the greatest questions facing the graduating high school student today are—Where do I stand with the Draft? Should I go into service immediately or should I try to get my college education first? And what will people think if I am deferred because I am in college?

Unfortunately, the fellows are afraid that they will be draft dodgers if they are given educational deferrments. This is not so! Uncle Sams needs educated men; he wants you to get an education. A 1-D (for ROTC students) or a 2-S classification does not mean that you are evading a duty to your country; it simply means that you are postponing your service in order that you may serve your country more efficiently in the future.

The Army, as well as private industry, is faced with an acute shortage of Engineers. You serve your country best by going to college first.

J.E.B.

Joy-Stick Autos

by Carl Thelin, me'53

One simple control can replace the steering wheel, brake and accelerator pedals in the automobile of the future. Nicknamed the "joy-stick," it should be less expensive yet easier to handle, and more safe than the units it replaces. Its greatest disadvantage is its newness; public resistance to such a radical innovation would be difficult to overcome.

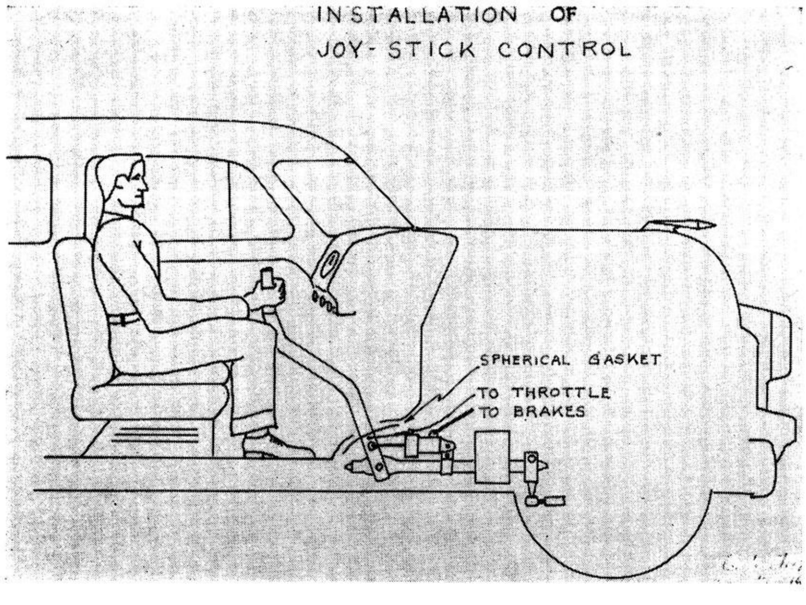
SIMILARITY TO AIRCRAFT-TYPE CONTROL

Appearance This unit is called the joy-stick because of its similarity to the one used in aircraft to control the elevators and ailerons. The name also has good promotional possibilities. The two controls are alike in both appearance and function. This stick, like the later aircraft types, is bent to take advantage of the clearance between the operator's knees. The control head on the upper end is more elaborate than the simple bicycle grip of the early aircraft joy-stick. The stick is mounted universally so that it can operate two controls in varying degrees of combination.

Motion in Use Both sticks are arranged so that their motion in use is correlated with the expected result. In aircraft, pushing the stick forward and away from the pilot causes the airplane to dive. This is a natural way to connect the linkage for two reasons. First, the forward and downward motion of the head of the stick could be thought of as "pushing down of the nose of the airplane"; secondly, as the airplane starts to nose over, the pilot's weight is shifted forward, making it easy to maintain control in that position. The same idea of making the head of the stick move in the same manner as the pilot's head is followed in the climbing and banking maeuvers. The motion of control would be just as natural in the automobile if the joy-stick were used. Moving the head to the left or right would cause the car to turn to the left or right respectively. Pulling back on the stick would make the car go faster; pushing forward would apply the brakes to stop the car. These motions should be natural to the driver because he expects his head to be thrown forward when stopping and backward when accelerating.

ADVANTAGES

Continuity of Motion When using the joy-stick, the driver slows down the engine, then applys the brakes in one continuous motion. The movement of the stick from between the driver's knees, forward toward the instrument panel would close the throttle, pass through a neutral point—coasting in gear—and apply the brakes. The oppo-



Installation of joy-stick control.

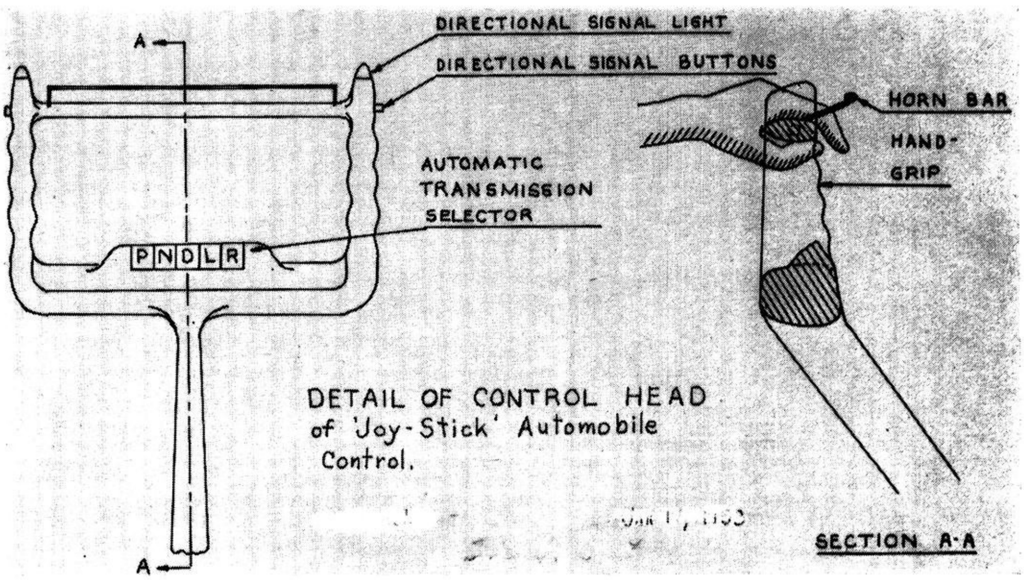
site motion would release the brakes and apply more throttle. This continuity saves reaction time in an emergency because it saves the time required to move the foot from one pedal to another.

Assistance From Momentum—The forward motion required to apply the brakes is a safety feature because of the added braking force made available. When a sudden stop is required, the driver would quickly push forward on the stick, applying the brakes very suddenly. As the car decelerates the driver's body would be pitched forward, and its momentum would add to the pressure on the stick, applying the brakes with additional force.

The momentum would have the opposite effect in turning, but it would also be a safety feature. If the driver pushes the stick to his right to turn the car to the right, his weight will be thrown to the left, tending to straighten the turn. In the event of a skid, or in a turn so sharp that a skid is likely, this would provide some degree of automatic recovery. The rocking of the driver's body would cause the front wheels to turn toward the outside of the skid, as they should, in order to end the skid.

and pivots. The long stick gives the driver great leverage and rapid steering control. He does not have to turn a wheel many times to turn the car sharply; his hand never leaves the stick, as it does when he spins the steering wheel. The length of the stick might make power steering unnecessary, but if it were required, because of the still excessive effort required for parking, it would be simple and less expensive than the units now used. The present power steering units must convert great rotary motion into relatively small linear motion to operate the steering cross-arm. The joy-stick would actuate the power booster with a simple cam or lever. The booster would be merely an amplifier of power, not a motion changer. It could also be a steering-shock obsorber, as the present units are. Even if power steering were not used, it would be advisable to employ a shock and vibration damper somewhere on the main-pivot shaft.

Safety in Collision In the case of severe collision, the joy-stick would not be the same chest-puncturing hazard as the ordinary steering column. The joy-stick would simply fold over until the control head struck the dash-board.



More Braking Power The length of the stick would give the driver more leverage in applying force to the brake-master cylinder, making power brakes unneccessary even for normal stopping service. Power brakes are being used on automobiles today not only to provide for emergency stops but to relieve the driver of the leg fatigue resulting from stopping his heavy car so often in traffic. The momentum effect provides the reserve needed for emergency stopping; the additional leverage and continuity of motion should provide some relief from traffic fatigue. The reaction time for emergency stopping should be reduced somewhat. First, because the motion from driving to braking is continuous, and second, because there is no time-lag in application as there might be with a power braking system.

Simplified Steering Linkage The steering linkage is greatly simplified. The complicated and expensive "steering box" is eliminated. In its place is a series of levers

Additional safety could result from redesign of the instrument panel. The panel could be made just as smooth and free from sharp edges and protruding knobs as the right-hand side is now. This redesign would be possible because of the absence of the steering column underneath the panel and the greater field of vision across the board made possible by the absence of the steering wheel. The knobs would be spread along the bottom and the instruments arranged so that no sharp-edged dial hoods would project above the panel.

DISADVANTAGES

Automatic Transmissions Only The joy-stick could be used only in cars equipped with automatic transmissions. Either a column shift or a floor-board shift lever would interfere with the use of the joy-stick. It would also be difficult to synchronize the cluth pedal and the stick to get coordination in shifting. The joy-stick must be

(please turn to page 66)

CHANNEL WING

ABSTRACT

The Custer Channel wing utilizing the speed of airflow through its channels rather than forward airspeed of the ship itself develops high lift of a magnitude capable of vertical ascent and static sustenation.

Research has shown that the application of modern high thrust reciprocating and propulsion engines to a channel wing aircraft would result in supersonic flight coupled with the advantage of low speed landings and take-offs.

The adaptation of the channel wing to modern aircraft will result in ships that are easily maneuverable, stable, and provide the maximum in economy, flexibility, safety, and utility.

INTRODUCTION

For many centuries man has felt the presence of the atmosphere about him. He has utilized the power of the winds to propel his ships and has observed the effects of these air movements on the sea and on structures he has built. Many far-seeing individuals attempted to duplicate the success of the birds in flight by constructing devices which would allow them to leave the ground and soar freely through the air. Some of these inventions were partially successful but all too many resulted in disaster.

Not until the turn of the twentieth century did man reach the point in his experimentation and scientific knowledge which enabled him to construct an air vehicle capable of conveying him through the atmosphere successfully. The age of practical aerodynamics was born.

History of the Conventional Airfoil

The wings of these early successful aircraft were patterned after those of the birds so far as cross-section is concerned, and were held rigidly to the fuselage of the ship after the manner of a bird in glide. When the plane was propelled forward by mechanical means, a relative velocity of the air with respect to the wing was produced. The shape of the airfoil caused the pressure differential between its upper and lower surfaces to result in the effect known as lift.

This principle is used today in our modern aircraft and only the shape and design of the airfoils and fuselage has changed through experimentation and development.

The Unconventional Type of Aircraft

It is only natural that the advent and rapid progress of the science of aerodynamics should result in aircraft that differ greatly in design from the conventional type. These differences are in design only however, for the basic principle of lift as outlined above holds for all heavier-than-air craft.

The helicopter is capable of rising vertically by mechanically rotating its wings or rotors, thus producing the necessary relative motion between the air and airfoil. The autogiro, forerunner of the modern helicopter, utilizes a conventional airplane engine-propeller unit for motive power and a freely rotating lifting rotor for sustenation. Both of these aircraft are more maneuverable than the conventional type. The helicopter is not only capable of forward motion, but also of vertical lift and static sustenation. The autogiro does not, in flight, power its rotor, but allows it to rotate freely in the relative wind. Although not strictly capable of vertical lift, the autogiro does provide the missing link between the conventional winged aircraft and the helicopter.

In the category of unconventional air vehicles a new design has recently been developed. The results of tests on this design are very encouraging, and evidence to the effect that this particular airplane may outperform the popular helicopter and conventional aircraft of today is **very substantial. This new airship utilizes an unusual type of airfoil known as the Custer Channel Wing.**

AIRCRAFT

by Donald Liska, me'53

History of the Channel Wing

The Channel-Wing ship was designed by Willard R. Custer of Hagertown, Maryland.

During a storm years ago, Mr. Custer observed the wind rip the roof off a barn that was standing perfectly still at the time. The principle involved was that of lift. Air streaming at high velocity over the roof of the barn resulted in a differential pressure between its upper and lower surfaces. The greater static atmospheric pressure inside the barn was sufficient to bodily tear the roof from its constraining walls.

Upon witnessing this occurrence, Mr. Custer decided an airplane could be constructed to take-off vertically from a lot or back yard. After years of research, such a ship was designed which employs a wing in the shape of channels or half-venturi tubes located on each side of the fuselage. The channel is formed by shaping a standard wing section around the tip path of a propeller located at the trailing edge of the channel. Great masses of air are sucked through the curved surface by the propeller, thus creating a controlled lifting effort capable of raising the ship vertically.

Difference Between the Conventional and Custer Type Wing

Air Speed vs. Speed of Air

The basic difference bettwen the conventional straight airfoil and the channel wing is not in the presence of the aerodynamic force of lift, but in the method applied in creating it. It is a recognized fact that air, though less dense than most fluids, does possess mass, and is therefore subject to the laws of motion.

When a force is applied to a mass of air at rest, the air is put in motion and given a certain velocity. This velocity, such as that formed in a wind, is called "speed of air." A solid body, on the other hand, when moving through a mass of air at rest has a velocity known as "air speed". When a streamlined missile moves at high speed through an air mass, it will cause little reaction since negligible work is done on the air. If, however, the air mass is put in motion with the same high velocity, tremendous reactions take place, often times resulting in extreme damage.

The equility of action and reaction, by the law of motion gives an indication of the great difference existing between "air speed" and "speed of air."

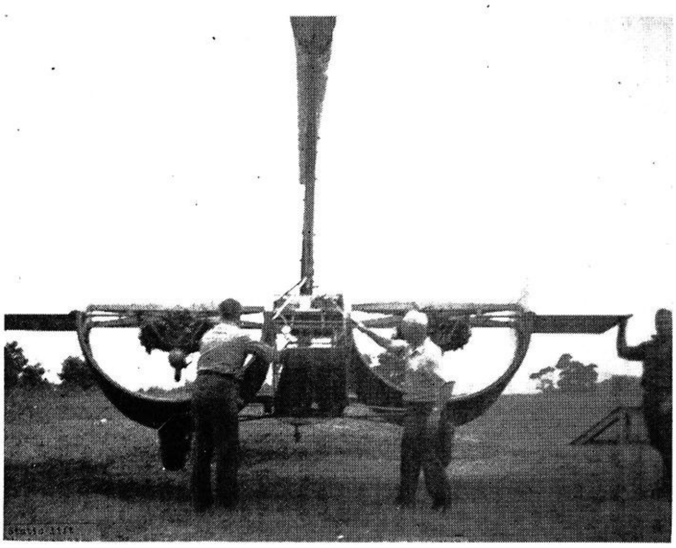
Theory of the Channel Wing

Since an object such as an airplane moves at high speeds while causing little reaction on the air and the air mass moves slowly while producing great reactions, it is apparent that lift is dependent on "speed of air" rather than "air speed". The aircraft wing was designed to obtain a reaction from the air mass through which it moves.

The aviation industry has been handcuffed to the word air-speed, since lift could not be thought of until sufficient forward velocities were developed. The Custer channel wing, which utilizes speed of air rather than air speed, is therefore the first major improvement in aircraft wing design since the conception of the original straight airfoil. The superiority of the channel wing lies in the method of its artificial production of velocity as compared with the velocity caused by the forward motion of a straight wing through the air. For example, measurement of a Gotigen 398 airfoil section with a 65 inch chord would reveal that the difference in dimension between the underside and top or airfoiled side of the wing is 2½ inches. That is, the top side of the wing is 2½ inches longer than the underside. When the wing is propelled through the atmosphere, the air passing over its topside is given a certain velocity due to the greater distance it must travel. This small amount of air motion is what lifts todays modern aircraft. The straight wing produces this motion of air by air speed. In the channel wing the air can be induced by the propellers, to move at any speed desired, from 5 to 1000 MPH while the airship is at rest. Since lift varies as the square of the relative velocity, the lift of the Custer Channel Wing is considerably greater than that of any conventional airfoil.

The mass of air moving through the channel is curved in its path and acts in a similar manner to the straight airfoil to produce strong pressure forces, acting at every point on the outside surface of the channel. These pressure forces, applied normal to the channel, integrate themselves into a resultant vertical life force more than 100% greater than that produced by the conventional airfoil of the same area and aspect ration in full flight. This lift is capable of allowing vertical ascent and static sustenation such as is now displayed by the helicopter.

In addition to the increased lift caused by the high airstream velocity through the channel, the "suction" forces that exist inside the channel are strengthened by two other factors which do not exist in the straight wing. The semicircular shape of the channel serves to protect the negative pressure on the airfoiled side and the shape of the side walls bring about an increase air-stream velocity through the channel. The first advantage prevents the



trouble caused by loss in suction pressure at wing tips, known as "tip effect". The second advantage decreases the absolute pressure by increasing the velocity of the air-stream through the channel, and is known as "Venturi effect". The straight wing does not possess these two advantages.

The three factors of controllable air-stream velocity, absence of tip effect, and the venturi effect, combine to produce a resultant lift force far superior to that produced by any other known aerodynamic method. The manufactured lift at standstill or at small forward speeds is the great difference that exists between the usual conventional airplane and the Custer Channel Wing.

The dimensions of the channel can be proportioned, during manufacture, to suit the specific needs of the aircraft for which it is being constructed. Since the lift of this particular wing is entirely dependent on the velocity of the air passing through it, this velocity will necessarily be based on the requirements of the ship. Furthermore, any modern power plant capable of being equipped with propellers can be used to produce the airflow. The Custer Channels can be designed to accommodate engines of the reciprocating, rocket, jet, jato, or turbo-prop types.

The Boundary Layer

The high efficiency of the channel wing is due to controlling the boundary layer conditions on the topside surface of the wing. The condition of the thin film of air which adheres to all airfoils in flight is extremely critical in determining the performance of the wing, particularly at high speeds. This film condition may be either laminar or turbulent. The condition of turbulent flow in the boundary layer is characterized by particles of air moving in an irregular fashion with components of velocity both normal and parallel to the wing. These normal components cause an exchange in momentum between the high speed particles in the outer layers and the slower particles near the wing. The result is a movement of the film in the direction of the relative wind and a consequent tendency for the wing itself to move in the direction of flow, producing the external force of drag. The same effect is present in laminar flow due to molecular vibration, but it is not nearly as pronounced. In the channel wing laminar flow is maintained at all times thereby decreasing external drag and greatly increasing top speeds.

The detrimental drag effects of a turbulent boundary layer and boundary layer separation at high speeds has been recognized for many years. The aviation industry has attempted to control the boundary layer for almost three decades. Many methods have been proven feasible in practice and wind tunnel tests. Wing slats, which increase the slipstream velocity over the topside of the wing thereby retarding boundary layer separation are in common use. Perforated screens, blowers, rotating cylinders and other mechanical devices for bundary layer control have been designed and are used to some extent, but they have the disadvantage of requiring ducts, compressors, engines and other equipment which adds to the cost and reduced payload of the ship.

The Custer Channel Wing has overcome this difficulty without resorting to auxiliary devices, thereby increasing the top-speed limit, and eliminating the turbulence and stall at low speeds.

Control of the boundary layer results in superior performance, safety, and stability at all speeds and the absence of prohibitive drag forces at very high velocities considerably decreases the power required of the engines.

Test data indicate that a properly designed ship with the channel wing will be capable of attaining supersonic speeds and landing at speeds considerably less than those considered normal today. The ship will do this without the use of slots, flaps, brakes, or other mechanical means.

Performance of the Actual Airship

A prototype, utilizing the Custer Channel Wing, shown in fig. II, was built at Hagerstown, Maryland during the second World War, and was flown and tested over a hundred hours at the Beltsville, Md. airport. The operation of this new design was so successful that it resulted in considerable research by the Army Air Force at Wright Field, Ohio until the end of the war and during the period immediately afterwards.

The pioneers of the Custer Channel Wing Corporation launched a private research program at the end of the war to delve deeper into the commercial possibilities of a channel wing airship. The experimental prototype was stripped of everything which caused the conventional type of airplane to fly, even to the skin covering the fuselage. The result was a crude looking flying machine exploiting a completely new method of producing lift in the form of half-venturi channels mounted on the sides of a conventional airplane frame. A comparable sight may be seen in Detroit where the chassis of a 1954 automobile is tested with nothing but the gasoline tank to sit on. Tests proved that this converted airship is capable of taking-off and landing up-wind, and down-wind in the space required by a conventional ship to warm up. With the aid of no auxiliary devices and nothing but the stripped chassis of a lightweight airplane, it took off cross-wise on the runways used by the conventional ships and hovered beside an automobile, moving at 10 mph. All of these results validated Mr. Custers' earlier claims that an air vehicle capable of use in a small backyard or on a rooftop could be constructed without resorting to the helicopter principle.

During tests, the channel wing ship displayed a static lift of 1144 lbs. applied to the channels of the 1124 lb. airship. This results in an infinite lift coefficient. During flight at 30 MPH airspeed, the lift coeffient was better than 12 as compared with an average coefficient of two for a conventional plane, which may be increased to five by adding flaps and powered lifting devices. In this particular flight, the channel wing ship took off in a distance of 45 feet and displayed a wing loading of 30 lb./sq. ft. over a wing area of 35 sq. ft. as compared with a loading of 90 lb./sq. ft. in transport or military craft of which high forward speeds are required. The difference between the lift force applied to the wings, and the gross weight of the airship is the force which can be utilized in climb. Since this difference is great in the channel wing ship with the throttles opened, the rate of climb is high. In test this rate of climb was better than 1000 feet per minute, at high angles of ascent. These results are very encouraging for the lightweight ship equipped with two small C90 Continental engines developing 800 pounds of thrust at 2500 revolutions per minute.

Indications with the stripped down test model were that a properly designed lightweight aircraft could easily attain air speeds in excess of 150 miles per hour. The results of the test work done on the channel wing ship provided substantial evidence to the effect that a commercial airplane equipped with the Custer Channel Wing would be able to:

1—Take off in a few feet or rise vertically and hover if properly designed for such performance.

2—Attain forward speeds in excess of those of conventional aircraft or the helicopter.

3—Slow down, hover in mid-air and land vertically under full control.

4—Substantially increase payloads, flight range and endurance over that of any other ship.

Although these claims remain to be fully substantiated in commercial practice, the insight provided by the Custer Channel Wing Corporation's research program lends strength to the striking comparison between a conventional aircraft and a channel wing ship.

The greater range and payload of the Custer design is made possible by the unusually high efficiency of the channel wing at both high and low speeds and results in more economical operation.

Safety

With respect to safety, the Custer Channel Wing provides complete control in yaw, pitch, and roll at low speeds. This advantage is not found in the conventional type of airship. Should the power on the channel wing fail, control may be maintained and the ship brought to a safe landing. The glide characteristics of this revolutionary design are comparable to those of the straight wing type, and subsequently its gliding range is as great.

Most accidents in aviation occur during the execution of high speed landings and take-offs. Since the principle of lift of the Custer Channel Wing does not depend on the air speed of the ship, it is capable of slow-speed take-offs and landings on runways considerably shorter than those in use today.

As yet man has no appreciable control over the condition of the weather. In times of bad weather, the conventional aircraft must seek alternate airports at which to land. The ability of a ship equipped with Custer Channel Wings to land safely in extremely small areas at low speeds enables it to come aground under weather conditions which would keep the conventional ship in the air. This factor reduces the necessity of carrying large quantities of gasoline that the conventional ship must carry for use in the quest of optimum weather conditions.

The small area landing requirements will also reduce the loss of time, expense, and risk caused by "stacking" over airports. Ships equipped with the Custer Channel Wing are easily maneuverable, stable, and provide the maximum in economy, flexibility, safety, and utility.

Applications

The applications of the Custer Channel Wing are in-

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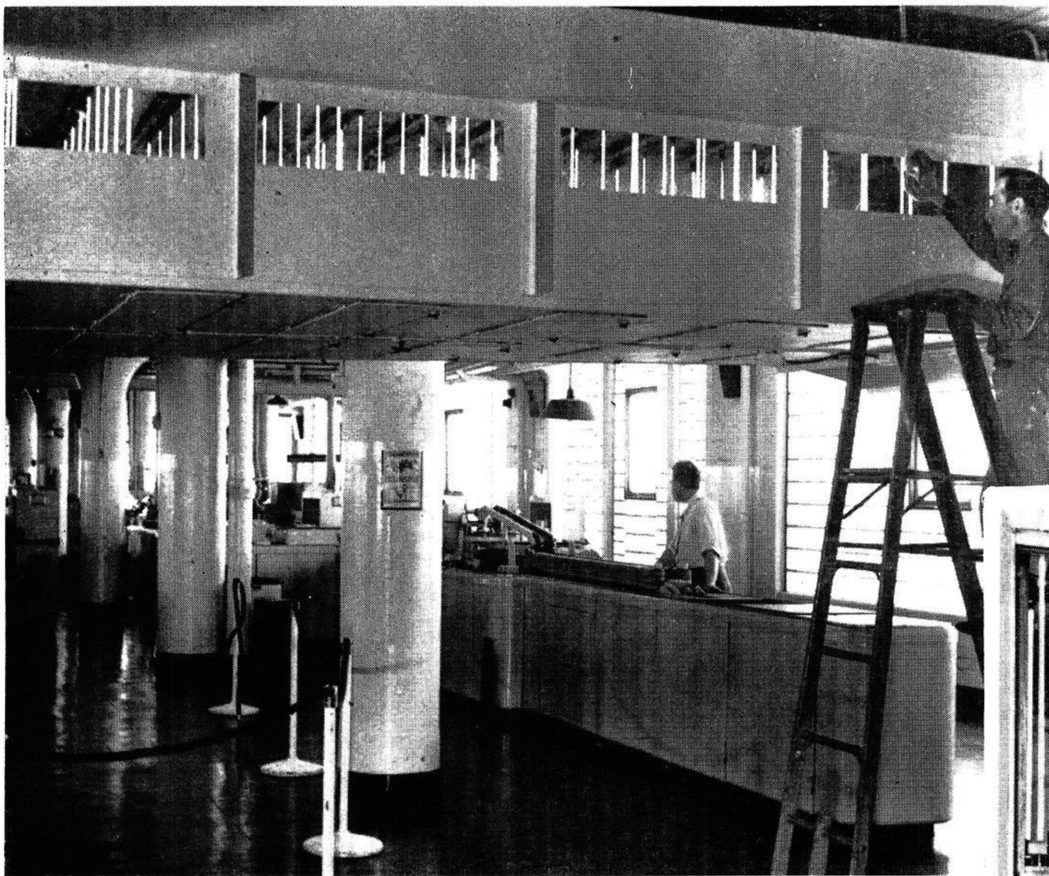
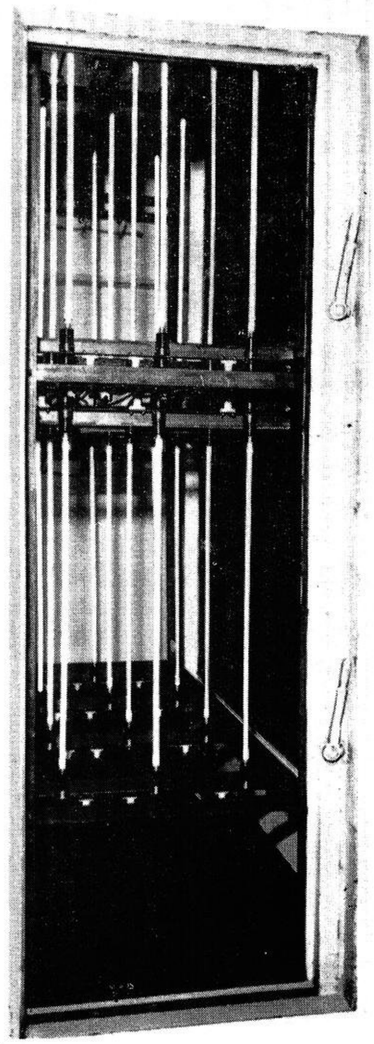


Left — A sterilamp installation in the air-conditioning system of a pharmaceutical laboratory.

Below — An installation in which limited duct length was compensated for by using two banks of lamps.



ULTRAVIOLET RADIATION

by

R. Nagy — *Lamp Research Laboratories*

F. H. Nixon — *Lamp Engineering Dept.*

Westinghouse

DR. RUDOLPH NAGY represents a scientific field seemingly unrelated to the eltctrical industry—biochemistry. Yet, as Nagy himself expresses it, "As long as we have ultraviolet lamps, we will always have biochemical problems that must be answered, such as the effect of ultraviolet on eyes, skin, various molds, bacteria, and chemical compounds." And, we might add, a great many more.

Nagy graduated from the University of Wisconsin in 1932, then went on to gain his Ph.D. in Biochemistry. He first went to work with Dr. Rentschler on the Sterilamp activity. When the war come Nagy was among those who helped prepare the uranium for the first atomic pile. For the last ten years he has been concerned with research on new fluorescent materials for lamps; his section has also made a sizable investigation into numerous aspects of the phenomenon of electriluminescence.

The word lamp usually conjures some picture of a light-giving device. In recent years, however, some spectacular advances have been made by "lamps" in which visible light is but an unused by-product. Such a device is the Sterilamp, whose primary purpose is to sanitize, i.e., kill the bacteria, in air. Proper application of these ultraviolet-emitting lamps produces remarkably high-percentage kills of bacteria.

Sterilization of air in air-conditioning systems can play a major role in preventing the spread of air-borne infection wherever people congregate. Disinfected air from such ducts can have a bacteria count lower than that of outside air, despite the fact that the inside air is recirculated many times. Air sterilization is a necessity in such fields as food, drug, and pharmaceutical production. For processing of products from penicillin to pork, from bandages to beef, modern sterilization methods can be applied easily and profitably to air-conditioning installations.

A most effective and simple method of reducing bacteria and virus content of air is by ultraviolet radiations in air-conditioning ducts. To the five important functions already performed by air conditioning—control of air temperature, humidity, circulation, ventilation, and cleanliness—is added a sixth, air sanitation.

Filters are an effective means of removing dust, pollen, and other large air-borne particles, but against bacteria and virus micro-organisms even the most efficient filter is only partially effective. Bacteria removal is a job best accomplished by the germ-killing rays of ultraviolet lamps. Laboratory tests have led to the development of an efficient, high-intensity, ultraviolet source, the Slimline Sterilamp. Large volumes of air can be disinfected by a small number of these lamps requiring only simple installation.

Initial Research Was Inconclusive

Much of the early research into the effects of ultraviolet on micro-organisms was confusing, and some was contradictory. The pioneer work was done by two Harvard University scientists in the early 1930's. Their results indicated that ultraviolet radiation was more effective at higher velocities of air flow; but they concluded that variation in humidity was the cause, and that ultraviolet sources were ten times as efficient at low humidities than at high humidities. Other research seemed to confirm this theory. However, in none of these tests was the output of the source measured at different velocities, nor was the amount of energy necessary to destroy a bacterium determined.

A short time later, two Westinghouse scientists—Rentschler and Nagy—demonstrated that organisms definitely were more readily destroyed at high air velocities. But at the same time they found no effect of humidity on the rate of bacteria killing. They did learn, however, that the arrangement of lamps with respect to air flow was extremely important if full use was to be made of the available ultraviolet energy. And while other scientists were getting results that indicated that bacteria were extremely hard to kill at high humidity, the data obtained by Rentschler and Nagy showed that even the most resistant organism can be readily destroyed at high humidity. Plainly, much more information was needed, so an intensive study was undertaken in 1941.

Recent Results Clarify the Situation

Since 1941, considerable data has been collected in the Westinghouse Lamp Research Laboratories during studies on the bactericidal efficiency of ultraviolet lamps in air-conditioning ducts. The effects of different duct sizes, lamp types, wattage, and arrangements, variable humidity, air speed, different kinds of bacteria, and various methods of collecting bacteria samples were studied. Parallel to the bacteriological work, considerable experimentation was done on the development of an efficient ultraviolet source especially for air ducts.

Bacteriological tests to determine the effectiveness of ultraviolet lamps in ducts were made in an air-conditioning system supplying 5800 cubic feet per minute of air to an auditorium. Sterilamps were placed across the center of an enlarged portion of the air duct with their axes perpendicular to the air flow. The lamps were evenly spaced, the wiring was arranged so that various groupings of lamps could be operated to change the intensity in the chamber; the air source was adjustable to produce several air velocities.

The different methods of bacteriological sampling used gave comparable results. These were performed over a period of many months with humidities ranging from 24 to 60 percent. Tests were performed using two ultraviolet sources: the standard Sterilamp (type 782) operated at 0.050 milliampere and the newly developed Slimline Sterilamp (type G36T6) operated at 420 ma. The percent survival of the two lamps is shown in Fig. 1. A comparison of these curves shows that the newer lamp is much more effective in killing organisms than the earlier version. Examination of Fig. 1 also shows that less energy is necessary to destroy the organisms at higher velocities than at lower velocities. Results further showed that, at a high percent kill, humidity does not affect the vulnerability of the air-borne organisms to ultraviolet radiations. The apparent greater efficiency of killing bacteria by the ultraviolet radiations at high survival values must be associated with some other factor than humidity. The greater bactericidal efficiency at high velocities would indicate that air turbulence may be this factor.

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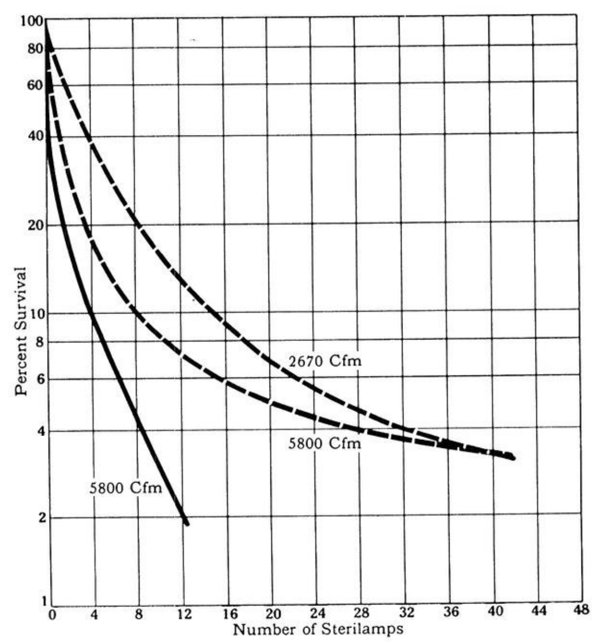
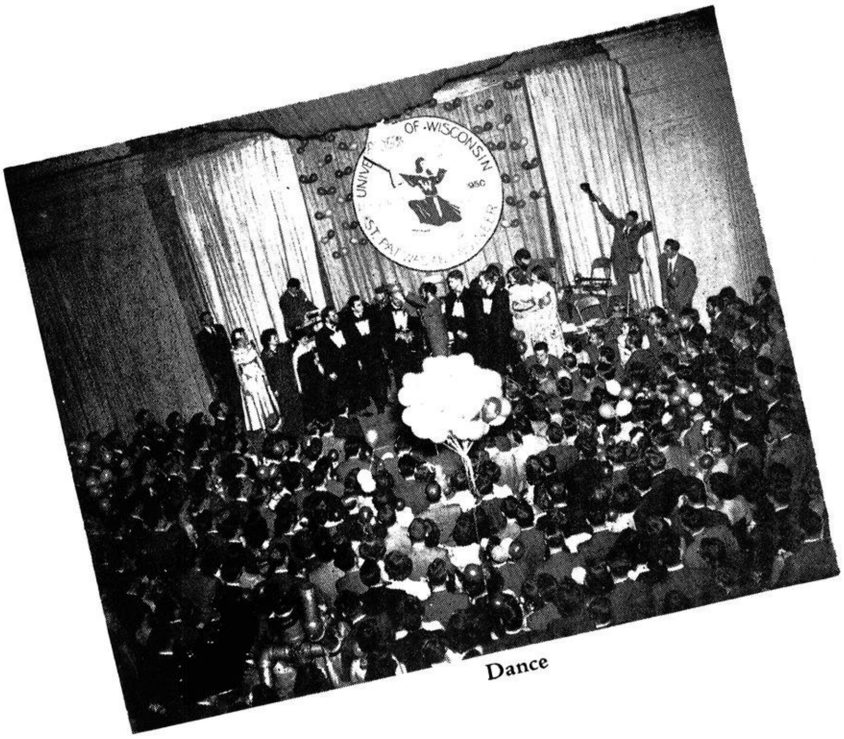
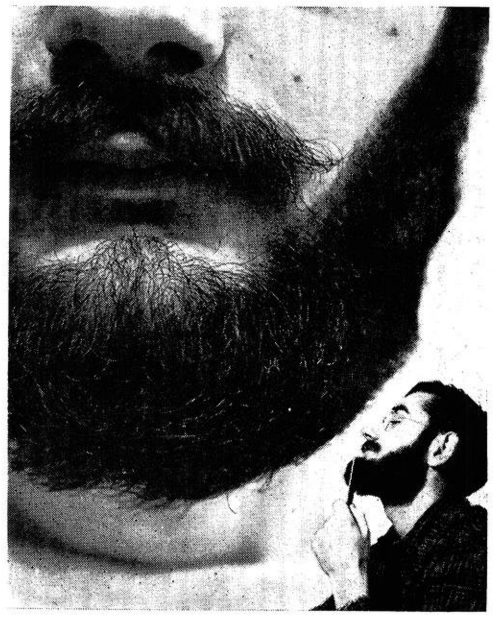


Fig. 1 The percent survival of bacteria exposed to various numbers of Sterilamps. The two dotted-line curves are for the type 782 lamps in an irridiation chamber of an air circulating system. The lower curve is for the newer type G36T7 Sterilamp in an air duct. The effect of different rates of air flow can also be seen in the upper two curves.

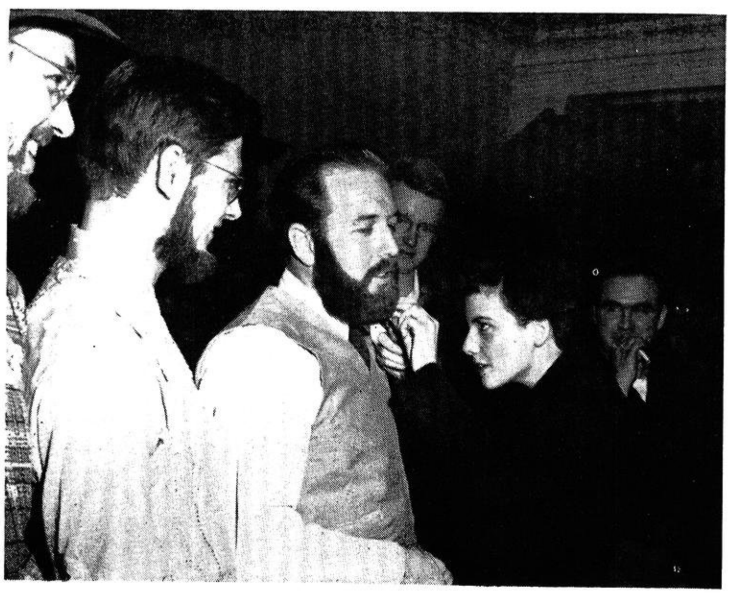
SAINT WAS AN



Dance



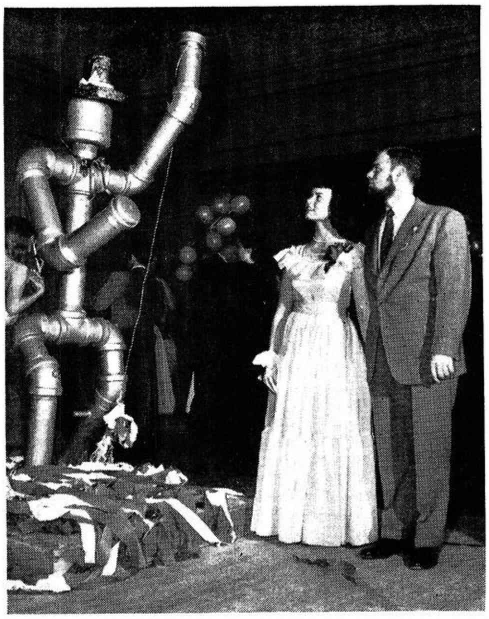
Whiskers



Judging

Pictures taken from our files depicting Saint Pat dances in years past.

PAT ENGINEER



Iron Man

Another Dance

Beard Winners

TESLA

by Del Desens, e'53

The science of electrical power generation distribution, and application, like many other sciences, owes its advancement beyond a certain point to some individual who flashes across the scene like a flaming meteor, leaving a trail of sparkling accomplishments which fill into the waiting hands of eager co-workers.

Such a remarkable individual was Nikola Tesla. Born on July 10, 1856, in what is now Yugoslavia, Tesla began a life of experimentation and scientific curiosity which shaped the world today. During his childhood, he played with water wheels and bug powered windmills, always improving them and increasing their size.

Nikola's father was a minister and hoped that his son would follow him in that work. Nikola had other ideas, and studied very hard with almost unbelievable scholastic achievement as his reward.

Then, before he could enter a university, he fell victim to cholera, and only the promise that when he got well he could study engineering kept him alive. Gradually he recovered and prepared to enter the fall term at the Polytechnic Institute in Gratz, Austria; but he was subject to three years of military service.

He became a "draft dodger" and hid in the mountains for a year, where he dreamed of fantastic projects.

At the age of 19, Tesla, now 6 feet 2 inches tall, began his study of electrical engineering at the Institute in 1875, about five years after Gramme devised the ring armature.

Tesla nearly killed himself by excessive study, and professors secretly urged his father to take him out of school. While he was studying at Gratz, a Gramme machine was purchased. It was a D.C. motor or generator. Tesla objected to the sparking of the commutator; but was told by his professor that, "It is inherent in the nature of the machine. It may be reduced to a great extent, but as long as we use commutators it will always be present to some degree. As long as electricity flows in one direction, and as long as a magnet has two poles each of which acts oppositely on the current, we will use a commutator to change, at the right moment, that direction of the current in the rotating armature."

"That is obvious," Tesla countered. "The machine is limited by the current used. I am suggesting that we get rid of the commutator entirely by using alternating current."

The professor tore apart his proposal in a special lecture; but Tesla held firmly to the conviction that his idea was a correct one.

Thus began a methodical search for a solution to utilize the A.C. theory. In his mind he constructed one machine after another; and as he visioned them before him, he could trace out with his finger the various circuits through the armature and field coils, and follow the course of the rapidly changing currents.

After his graduation from the University of Prague, Tesla started working on the Budapest telephone system and was in complete charge of the exchange when it started operating in 1881.

He then set up a pattern of resting five hours each day, only two of them spent actually sleeping, which he maintained until just prior to his death.

Late one afternoon in February, 1882, while walking in a park, he suddenly became rigid and began spouting technical phrases, much to the surprise of Szigeti, his companion.

"See how smoothly it is running, Now I throw this switch—and I reverse it? See! It goes just as smoothly in the opposite direction. Watch! I stop it. I start it. There is no sparking. There is nothing on it to spark."

"It is the rotating magnetic field that does it. See how the magnetic field rotates and drags the armature around with it? I have solved the problem."

The problem was solved; and expanding the two phase to a three phase system, he mentally constructed dynamos and motors with meticulous care.

He found he could not "give away" his invention when he began work for the Continental Edison Company in Paris.

He was encouraged to come to America by a business friend and arrived in New York with only a letter of recommendation to Edison and a mind full of ideas. Edison told Tesla he was not interested in A.C., but gave Tesla a job as a trouble shooter. Tesla rose rapidly and soon began improving Edison's machines. He designed 24 types of dyanomos, automatic controls, etc. Edison would not pay the $50,000 he had promised Tesla, who had worked day and night on the project.

Tesla quit Edison's employ and designed and manufactured an improved arc lamp. He was forced out of the successful company and ended up broke, spending the next entire year working as a day laborer.

It was then, in November and December of 1887, that he was awarded his first patents; and soon made his professional debut on May 16, 188, before the American Institute of Electrical Engineers. His lecture became a classic in electrical engineering.

"Tesla's lecture, and the inventions and discoveries which he included in it, established him before the electrical engineering profession as the father of the whole field of alternating current power system, and the outstanding inventor in the electrical field."

Tesla's system, employing high voltages for transmission, enabled electrical powerhouses using direct current to cease operating in a one mile radius only, and expand their services to points hundreds of miles away—all this and a three phase system, too!

It was then that George Westinghouse stepped into the A.C. scene to snap up the discoveries and put them to work. Tesla's discoveries were too big for anyone to take advantage of; but Westinghouse was a man of vision, and one month after Tesla's lecture offered him one million dollars cash plus royalty. It was a wholesale deal with 40 basic patents involved—$25,000 per patent.

Westinghouse was in trouble financially and was forced by his financial advisors to get rid of Tesla's $1.00 per horsepower contract, before merging with the U.S. Electric Company and the Consolidated Electric Light Company.

Edison had recently put the fear of God into patent violators and Westinghouse was very skeptical about trying to deal with Tesla. Tesla was grateful for Westinghouse's initial support and tore up the contract, later calculated to have been worth $12,000,000 according to records of the years the patents were in effect.

Tesla then started a series of experiments which reached far beyond his time, studying A.C. frequency currents up to 330 c.p.s., then 20,000 cycles per second. With high frequency, high voltage currents, Tesla fought the fight for A.C. against D.C. at the Chicago World's Fair in 1893 by letting 1,000,000 volts pass through his body, lighting lamps and melting wires in his hands.

His boyhood dream of harnessing Niagara (he had seen postcards of it) came true when in 1893 contracts were signed calling for a Tesla polyphase system to be constructed. Later Lord Kelvin, who favored a D.C. installation, gave in and declared, "Tesla has contributed more to electrical science than any man up to his time."

Tesla's life then became a series of tours and lectures, but he soon tired of it and began an isolated lab in Colorado to study and create lightning. It was here that he developed his famous "Tesla Coils"—air core transformers. His main coil was wrapped about a 75 foot diameter fence-like wall and was about 10 feet high. A 200 foot mast with a 3 foot diameter copper ball was at the top. He produced bolts 135 feet long and the thunder was heard 15 miles away. His heavy load burned out the

The Father of Alternating Current

Colorado Spring Electric Company main generator and he was refused further service. He did manage to light two hundred 50-watt lamps at a distance of 26 miles by wireless transmission of power through the earth.

Tesla continued to work on new projects including wireless transmission of energy anywhere on the earth as well as mechanical vibrations and many other fields in which his results were not recorded.

Nikola Tesla died alone on the night of Thursday, January 7, 1943; but he left his very valuable gift to the world, the alternating current power system, in his memory.

Tesla worked as a consultant in the commercial application of his inventions "at a high salary" for a year. Tesla was convinced that 60 cycles was the proper frequency to us, but Westinghouse engineers had experience with 133 cycles and a conflict developed, and Tesla decided to leave, turning down an offer of one third the net income of the company, $24,000 a year, and a lab of his own.

Tesla then established his own lab in sight of Edison's on South Fifth Avenue, N.Y.C., and the two battled out the problem of A.C. versus D.C. with renewed vigor.

About that time the Thomson-Houston Company and the Edison General Electric Company merged, to form the present General Electric Company.

Reference: PRODIGAL GENIUS, The Life of Nikola Tesla, by John O'Neill. 322 pp.

Engineer's Day

by Don Edwards, me'55

On April 10, Engineering alumni from all parts of the state and nation will descend on the University of Wisconsin campus for Engineer's Day, 1953. They will come to see what is being done and what is new at their university and to cite six engineers and industrialists among them who have rendered distinguished service to the state, university or Engineering Profession.

Engineer's Day was originated in 1947 when a planning committee studied the activities of the Engineering College and, among other things, decided to make an annual presentation of citations to alumni who have performed valuable and distinguished service to the people of the state, University or Engineering Profession. In doing this, the committee was taking advantage of a 1946 action of the Board of Regents which authorized the various colleges to present citations to outstanding graduates. The following year, 1948, the first citations were awarded to four outstanding Milwaukee engineers at a joint meeting with the American Society of Mechanical Engineers in Milwaukee. In 1949, the first annual Engineer's Day was held on the U. W. campus and each year thereafter.

Engineer's Day is part of the public relations program to keep people in the state and graduates familiar with what is being done at the University. In keeping with this idea, programs in the past years have included special exhibits in all departments and tours of new buildings, laboratories, research projects, class sessions and offices. It is hoped that through such a program, engineering alumni will be able to keep in touch with their alma-mater.

Perhaps the best known phase of the Engineer's Day program is the presentation of Distinguished Service Citations to Wisconsin's outstanding engineers and industrialists. The handsome hand-lettered, black-framed citations are awarded at the Engineer's Day Dinner which will be held this year on April 10 in Great Hall, Memorial Union. Six citations will be awarded at the dinner this year. An article and pictures on the citation winners will appear in the April issue of the Engineer.

Ten thousand invitations to Engineer's Day have been mailed to alumni this year. There is reason to believe that these are invitations to the biggest and best Engineer's Day ever. Justification for this bold statement is the Student Engineering Exposition which will open on Engineer's Day and run for three days, April 10, 11, 12. The Exposition will depict by exhibit and demonstration the many scientific, technical and educational activities within the College and by display will show many products and accomplishments of industry. This year marks the first time that the Exposition and Engineer's Day have been held together. Judging by the separate success of these events in the past years, it is no wonder that Engineer's Day, 1953, should be the biggest and best ever.

Highlights of the program for this year will be a ceremony opening the Exposition, the Exposition in the engineering buildings, Engineer's Day dinner and presentation of Distinguished Service Citations. A special program on Saturday, April 11, is being arranged for High School faculty and students. Arrangements have been handled by the Public Relations Committee whose chairman is Professor Ben G. Elliott.

PROFESSIONAL PROBLEMS

by Wm. F. Harrison, ee'53

(The following is a reprint of a student's analysis of his Professional Problems course)

My understanding of this report is to express what I got out of the course—not to criticize what was said, how it was said, or why it was said. From that viewpoint then, I can say the course was both stimulating and disappointing. Said another way, the course projected goals which every engineer would like to reach, and it also made very real the effort that must be put forth to reach these goals.

Basically, the course woke me up to the fact that I was soon to go out and work at a job for which I have been preparing myself for the last three and one-half years. Here and now I realized the various fields open to engineers and the tremendous difference between these fields. I began to realize that I had never given serious thought to what type of job I would like to have. Thus as each speaker spoke, I wondered more and more what type of job I was actually interested in. I believe that if the course did nothing more than make every engineer wonder this same thing, it was well worth while.

One of the gentlemen who drew my attention was Frank J. Roby, who, by the way, I thought gave the most intering talk. Among sales people are those who are said to possess that characteristic of being able to sell someone their "dirty shirt" back to them. I have never considered myself this type of person; in fact, I have always shunned the field of sales for the reason that I felt I lacked all or most of the qualities that make a salesman. However, when Mr. Roby woke me up to just what the engineer in sales does, I almost felt capable of tackling that field. With enough interest and knowledge of my product and a little more practice in meeting and associating with people, I felt as though I might be able to make a success in the field of sales.

My interest was also stimulated by the gentleman who spoke on "Process Industries," Mr. C. W. Humphreys. Previously, I had walked to the placement bulletins on the board, and not once had my eyes stopped to focus on the cards announcing the representatives of an oil company, a rubber company, or an automobile concern, for I was an Electrical Engineer; and I was only interested in companies connected with electronics or communications. But after this talk, I became mildly interested in what some of these companies might have to offer me. Certainly, I had to admit that some of these industries had a wide variety of interesting work for any engineer. Therefore, I plan to take interviews with some of the representatives from these companies next semester.

A second point received from the course was the realization that we weren't being "kidded" when told over and over that companies want engineers who can speak and write fluently and vividly. Most engineers pass off their speech and English requirements as "something we all have to go through." Now, however, I will in the future do my best to correct and improve these factors. An ironic point that can be made though, is that many of these same successful men were not able to deliver a forty-five minute speech without reading their well-prepared material word for word.

(please turn to page 48)

On The Campus

by

Kneeland Godfrey, c'55

SAE

The February meeting of the Society of Automotive Engineers was held in the Union on February 10. The speaker was Mr. Erv L. Dahlund, the Chief engineer at Fairbanks Morse's Diesel Division. The representative of the Beloit firm gave an informal talk entitled "The Chief Engineer's Job." The discussion section which followed the talk ended up the the evening and was even longer than the speech itself.

Faculty Advisor Phil Myers missed the meeting because he has gone to New York to work with the Cooperative Research Council. The group is sponsored by the SAE, API, and several automobile manufacturers.

SAE is again issuing an invitation to all engineers, usually ME's, who are interested in things automotive to join the organization. If you wish to become a member, contact Carl Thelin, Frankenburger, Tripp; or come to the meeting on March 19 in the Popover Room in the Union at 8:00 p.m.

Men newly appointed to positions in the local SAE are: Carl Thelin, St. Pat's candidate for the ME's; Don Haas, Mechanical Engineering Exhibit Chairman; and David S. Vinton, Chairman for the St. Pat's Dance.

Because of the great amount of work to be done for the Exposition, the SAE will hold business meetings between the regular monthly gatherings.

The schedule of monthly meetings for the rest of the semester: March 19, "Two-Cycle Engine Design" by Mr. W. J. Adams of the Products Division of the Bolens Company at 8:00 p.m. in the Popover Room of the Union. April 14, "The Twelve Volt Story" by Mr. J. H. Bolles, Chief Engineer of the Delco-Remy Division of G.M.C. at 8:00 p.m. in Tripp Commons of the Union. May 12, "Carburetion" by Mr. H. N. Hartz of the Marvel-Schebler Products Division of the Borg-Warner Corp. at 8:00 in Tripp Commons.

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ASCE

Mr. Harry Abendroth spoke at the February 18th meeting on his experiences in doing geological mapping in the Transvaal in South Africa. Eleven Badger Beauty candidates were invited.

March 4 was the date of the last meeting, at which Mr. Robert C. Johnson, President of the Siesel Construction Company, talked on the procedure to register as a professional engineer and about the benefits of the professional societies.

Also planned is a meeting at which job opportunities will be discussed in order to give graduating Civils, and those who are looking for a major, some basis on which to proceed. The ASCE Engineer Exposition exhibit is now being planned and appears to be promising.

One fine note of progress that the ASCE has made is in attendance —the average at meetings has increased from about 25 till it now is at seventy five!

AUTOMOBILE CLUB

By Marc Momsen

The organizational meeting of the **University of Wisconsin Automobile Club** was held in the Mechanical Engineering Building on February 19, 1953. About 45 interested students, from all schools on campus, attended and the aims of the club were presented.

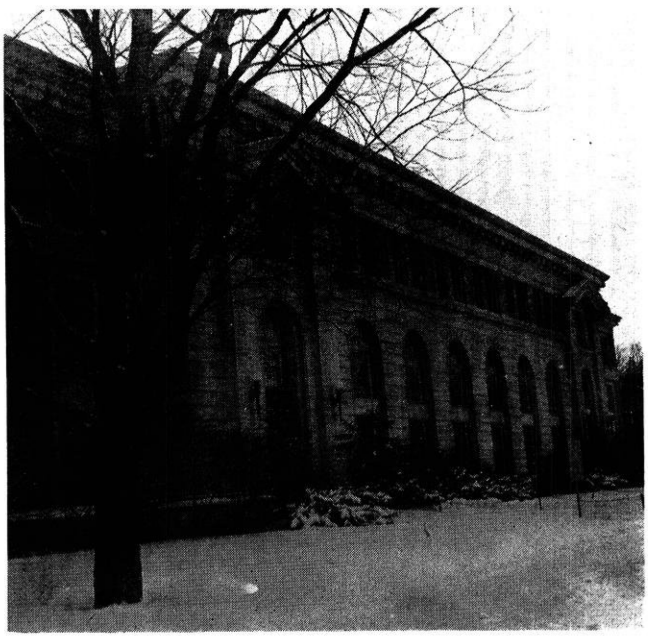
This club is set up to provide both information and a place for the members to work on their cars. Joint meetings with the Wisconsin chapter of SAE are being planned and a search for a suitable workshop is under way. Plenty of hand tools are already available, for rental at 10c per hr. to insure their prompt return, and the larger equipment includes a valve grinder, synchronizer, welding equipment, fuel and exhaust analyzers.

Professor Buroker is advisor to the group with Ray Hilsenhoff as student financial advisor. Other faculty members include H. W. Engelman and C. A. Gilpin, both of the Mechanical Engineering Department.

The club is duly registered with the University and its officers are as follows: William Douglas, pres.; Paul Padrutt, vice pres.; Ken Kulik,

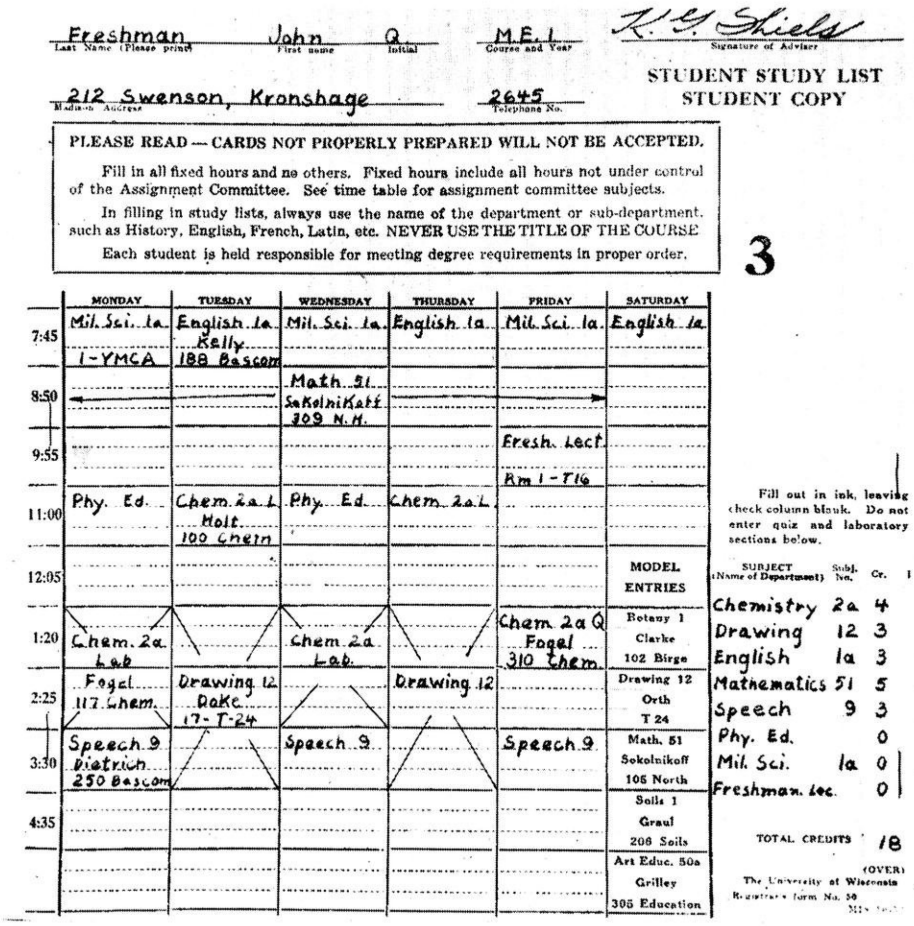
(please turn to page 70)

HIGH SCHOOL SECTION



Mechanical Engineering Building

THE FOLLOWING SECTION IS DIRECTED TOWARD THE HIGH SCHOOL STUDENT IN THE HOPE THAT IT WILL AID HIM IN HIS SELECTION OF ENGINEERING AS A PROFESSION.



Freshman John Q. M.E. I K. G. Shiels
Last Name (Please print) First name Initial Course and Year Signature of Adviser

212 Swenson, Kronshage 2645
Madison Address Telephone No.

STUDENT STUDY LIST
STUDENT COPY

PLEASE READ — CARDS NOT PROPERLY PREPARED WILL NOT BE ACCEPTED.

Fill in all fixed hours and no others. Fixed hours include all hours not under control of the Assignment Committee. See time table for assignment committee subjects.

In filling in study lists, always use the name of the department or sub-department, such as History, English, French, Latin, etc. NEVER USE THE TITLE OF THE COURSE

Each student is held responsible for meeting degree requirements in proper order.

3

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
7:45	Mil. Sci. 1a 1-YMCA	English 1a Kelly 188 Bascom	Mil. Sci. 1a	English 1a	Mil. Sci. 1a	English 1a
8:50	←		Math 51 Sokolnikoff 309 N.H.		→	
9:55					Fresh. Lect. Rm 1-T16	
11:00	Phy. Ed.	Chem. 2a L Holt 100 Chem	Phy. Ed.	Chem. 2a L		
12:05						MODEL ENTRIES
1:20	Chem. 2a Lab		Chem. 2a Lab.		Chem. 2a Q Fogel 310 Chem.	Botany 1 Clarke 102 Birge
2:25	Fogel 117 Chem.	Drawing 12 Dake 17-T-24		Drawing 12		Drawing 12 Orth T 24
3:30	Speech 9 Dietrich 250 Bascom		Speech 9		Speech 9	Math. 51 Sokolnikoff 105 North
4:35						Soils 1 Graul 206 Soils
						Art Educ. 50a Grilley 305 Education

Fill out in ink, leaving check column blank. Do not enter quiz and laboratory sections below.

SUBJECT (Name of Department)	Subj. No.	Cr.
Chemistry	2a	4
Drawing	12	3
English	1a	3
Mathematics	51	5
Speech	9	3
Phy. Ed.		0
Mil. Sci.	1a	0
Freshman. Lec.		0
TOTAL CREDITS		18

(OVER)
The University of Wisconsin
Registrar's form No. 50

A Typical Freshman Schedule

by the Freshman Office

Are you interested in engineering? Perhaps you would like to view a typical weekly program of a freshman engineer.

On Monday morning at 7:45 John reports to Military or Air Science, unless he is taking Band in its place. John successfully passed the algebra test given during Freshman Week so at 8:50 A.M. he reports to Mathematics 51 to develop the concepts of calculus, college algebra, and trigonometry. If John had not passed this algebra placement test, he would have been required to report to Mathematics 50 (algebra) for one semester without credit toward graduation in order that he secure the proper mathematical foundation for engineering.

At 9:55 A.M. John has a free hour, which if he is wise he will devote to study. He finds his 11 o'clock Physical Education class a welcome diversion.

On Monday afternoon at 1:20 John spends two hours in Chemistry 2a laboratory. He has not had high school chemistry and he finds himself at a slight disadvantage for a few weeks, but with good study habits he knows he can eliminate this difficulty. His last class assignment for Monday is Speech 9 and he appreciates this opportunity to develop fundamental skills in direct public speaking. In English 1a, which is one of the most important courses in engineering and in college, John will be trained in composition. On Tuesday afternoon he finds himself spending three hours in engineering drawing, where he will learn to use the language common to all engineering work.

John is a good student who has chosen to carry the full 18 credit load and he realizes that a minimum of twenty-five hours per week outside of class must be spent in diligent study, if he is to maintain a satisfactory college record. At least ten hours per week must be spent on mathematics alone. His friend Frank must earn part of his way through college and was not as strong a high school student, so on consultation with his adviser he is carrying only 15 credits. He plans to spend more than four years in college to complete his course. John finds that his freshman civil engineering friends are carrying surveying instead of Speech 9 or Mechanical Engineering 25 (shopwork), which his chemical engineering friends carry 5 credits of Chemistry 4a with only 1 credit of shopwork.

The freshman adviser office is at all times available to John for consultation on special problems, or just for a friendly visit. John finds the life of a freshman engineer busy and demanding, but also full of interest. He told us that he thought prospective engineering students who are now in high school might enjoy this view of his week.

THE UNIVERSITY OF WISCONSIN ENGINEERING EXPOSITION

MECHANICAL ENGINEERING BUILDING

MADISON, WISCONSIN

High School Seniors
State of Wisconsin

Hi Fellows:

The College of Engineering of the University of Wisconsin is inviting you to be their special guests at the 1952 Engineering Exposition. The Exposition is being held April 10, 11, and 12, with Saturday, April 11, being devoted to high school seniors of Wisconsin. We are happy to say that all of you who can arrange to be part of an organized group from your school will be offered a special orientation program and free admission to the exposition. (All students not arriving in a group will be asked to pay the usual admission fee.) To make it easier for you to get here, I am writing a letter to your principal asking him to organize a group and to arrange for transportation.

The engineering students here have been working since January on the planning and building of exhibits. You will see first hand the spectacular and unusual aspects of engineering. I was recently informed that two Electricals have a flying saucer nearly perfected. Some of the Civil Engineers have a tricky method of determining your height and weight by beam deflection. The Metallurgists are working out a plan for casting aluminum souvenirs. And so it goes—the Chemical, and Mechanical, and Agricultural Engineers—everybody has something. Altogether we expect to have a total of 100 student exhibits representing all branches of engineering.

You will also see a broad cross section of American industry as shown by about 40 industrial exhibits. There will be cut-away models of engines, miniature working models of all descriptions, plus full scale equipment from the chemical, transportation, communication, electrical power, mechanical equipment, and construction industries. About $100,000 worth of equipment will be here for you to see.

If you are interested in engineering as a career you can't afford to miss the 1953 Engineering Exposition. If you're not sure of your vocation, see the boundless opportunities in engineering. If you're going to be an engineer, see what Wisconsin has to offer. Remember though, Saturday, April 11, in Madison.

See you then,

Kenneth H. Schneck
General Chairman

Recently Completed Ch.E. Bldg.

ESSENTIAL CONSIDERATIONS

by Dean M. O. Withey

M. O. Withey

Are you interested in the application of science to the design of construction of buildings, roads, dams, sewage disposal plants, machines, automobiles, farm implements, motors, dynamos, radios, television, telephones or other devices useful to man? Perhaps you prefer to indulge your fancy in research to improve the manufacture of a product, to produce a new material, or to devise a method of utilizing the heat of the sun or the power of the tides. If as a high school student you are so interested and like mathematics and physics or chemistry, and have a good aptitude in drawing and shop work coupled with a keen interest in how machines and motors operate, you should think seriously of a career in engineering.

At the University of Wisconsin six accredited curricula are available in chemical, civil, electrical, mechanical, metallurgical, and mining engineering. During the first year chemistry, English, mathematics and drawing are required in all curricula, with an additional subject which varies with the curriculum considered. In the sophomore year physics and mathematics constitute nearly half of each curricula, with such additional subjects as chemistry, mechanics, surveying, electrodynamics, economics, metallography, foundry, mineralogy, geology, or metallurgy depending on the curriculum considered. During the last two years of the programs the required courses include mathematics, materials of construction, thermodynamics, heat power engineering, electrical machinery, technical writing and the more specialized courses of each curricula. The total number of credits required for graduation in four of the curricula is 146. In chemical and civil engineering a summer session of five or six weeks is added, making the total requirements for them 151 and 152 credits, respectively.

(please turn to page 48)

THE EMPLOYMENT SITUATION

by Professor H. G. Goehring
Engineering Placement Director

The demand for engineers is continuing to increase in the face of a diminishing supply. As a natural sequence the salaries for beginning engineers are following this upward trend. Unless there is a let up in the demand for engineers there is no relief in sight for the next four or five years.

H. G. Goehring

Let us first look at the supply. In 1949 approximately 600 students were awarded Bachelor of Science degrees in Engineering at the University of Wisconsin; in 1950 there were 800 such awards; in 1951, approximately 555; in 1952, slightly more than 400; in 1953 there will be about 340. Present enrollment indicates a decrease in graduates to well under 300 in 1954 and a slight increase in 1955. Similar conditions exist in engineering colleges throughout the country. Enrollment in the class entering in the fall of 1951 showed an increase over the preceding year and that of 1952 exceeded that of the previous year by approximately 50%. The interest evidenced by high school seniors indicates a still greater increase in the fall of 1953. However it will be two years before any increase is felt through larger graduating classes and three years before there will be an appreciable increase.

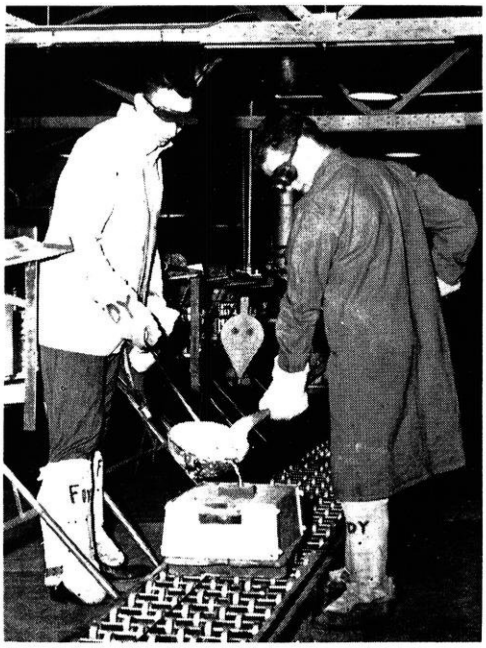
It is now fully recognized that the demand for engineers exceeds the supply and unless this demand lessens, which does not appear likely at this time, there will continue to be a comparable shortage for several years. A survey conducted by the Manpower Committee of the American Society for Engineering Education shows that this country needs a minimum of 30,000 new engineers annually and that the total number to be graduated in 1953 will be slightly over 22,000 with a smaller number in 1954. According to this study, the engineering profession needs 20,000 engineering graduates annually for civilian peacetime needs alone. In addition, the military needs must be added to civilian requirements.

What does this mean to the high school students about to select a college program? All young men to be graduated from high schools should carefully consider their capabilities in Mathematics and the Physical Sciences—their interests in these areas—and their over all high school records. Those who have made above average records in these studies should give considerable thought to engineering as a profession in the light of the excellent long range opportunities presented.

To the college graduate it should mean an excellent opportunity to find out by personal consultation the variety of opportunities available. Companies from all industries are sending representatives to the campus. During the first semester of the 1952-53 year 197 companies sent representatives to talk to 132 mid-year graduates. Approximately 250 companies will be represented on the campus during the current semester. Here is an opportunity for the graduating engineer to learn about employment possibilities in practically any field.

Although many seniors are expecting to enter the armed services shortly after graduation, it is emphasized that the great majority of companies will offer employment regardless of the imminence of induction. Men so employed are granted military leave and their employment continues unbroken during this period. Even though induction into the armed services immediately follows graduation, the opportunity to establish contacts is available right on the campus. Such contacts can be renewed upon separation from the service much more easily than new contacts can be made.

Many opportunities for summer employment are available in all sections of the country. Some of this work is correlated directly with training programs for the graduate and students electing these opportunities will gain worthwhile experience and receive good remuneration for their efforts. Other companies offer shop experience which provides an excellent background for engineering work in the future. The engineering placement office welcomes the opportunity to help all students and alumni with placement problems.



S T U D E N T

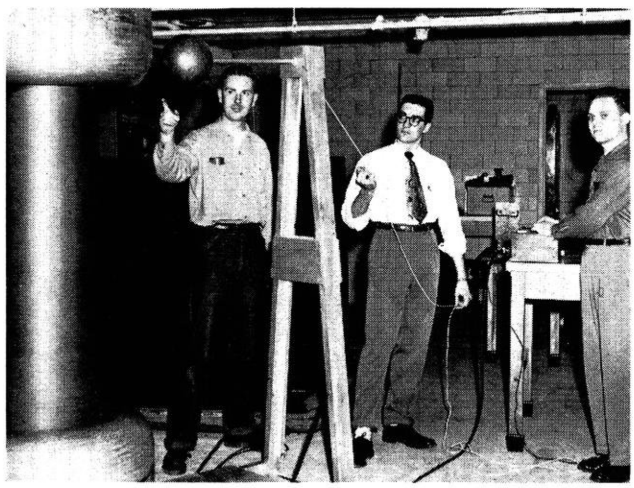
Photos by
Dave Dauterman

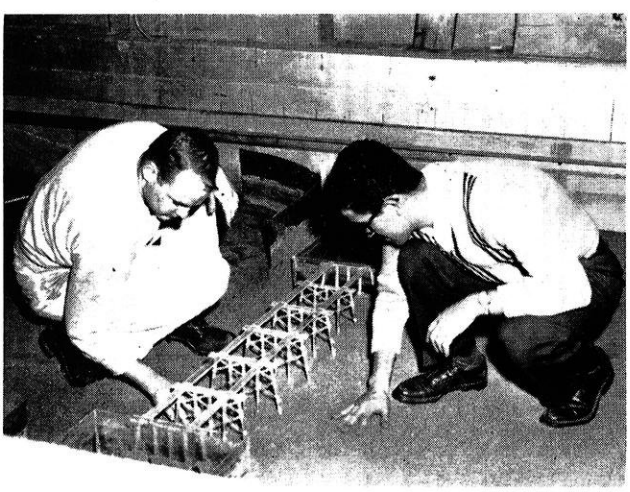
ABOVE: "Pouring off" a Bucky Badger souvenir for the Engineering Exposition. John Walter doing the pouring, and Paul Benson, chairman of the Mining and Metallurgy exhibits, assisting.

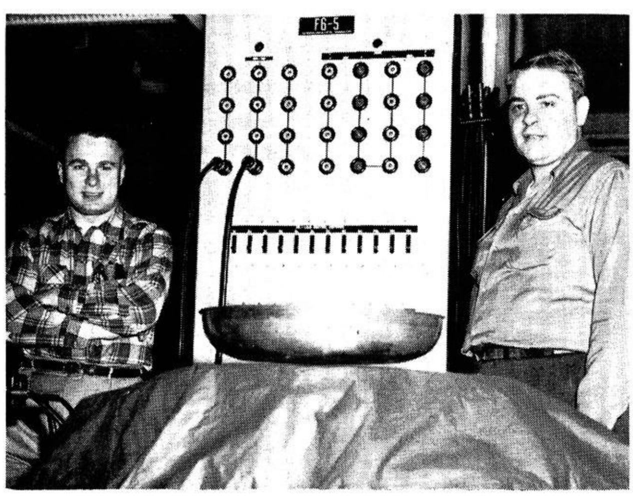
RIGHT: The large Van deGraff generator is a very high voltage piece of equipment. It will discharge an arc about two feet long. Wayne Olson, who is working on the setup, has to be very careful in order to stay alive.

BELOW LEFT: Bill Hunt and Issac Senior are finishing up the work on a model of a bridge that will show the effects of water flow on the foundations of the bridge piers.

BELOW RIGHT: Levetator — better known here as the Flying Saucer — is being built and experimented with by Harold Gattie and John Smith. The aluminum saucer is suspended by a magnetic circuit.

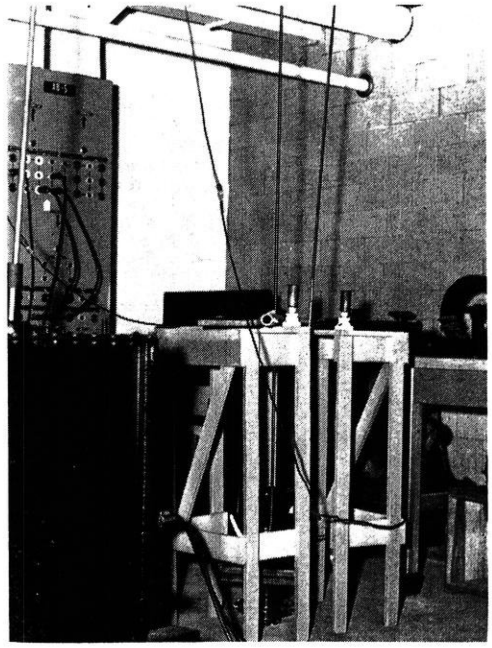




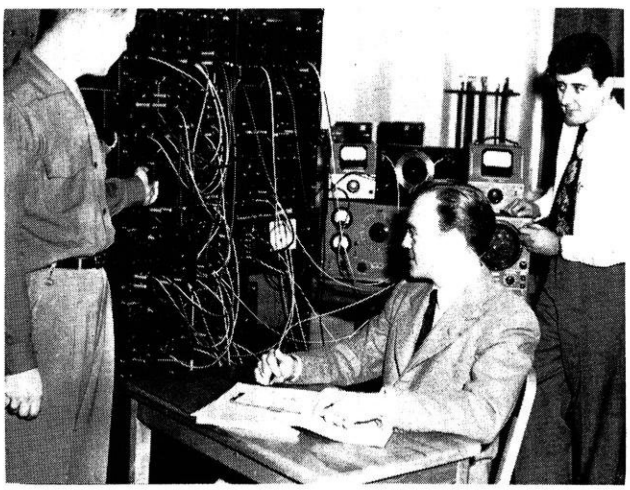


EXHIBITS

These exhibits are being constructed for the 1953 Engineering Exposition.



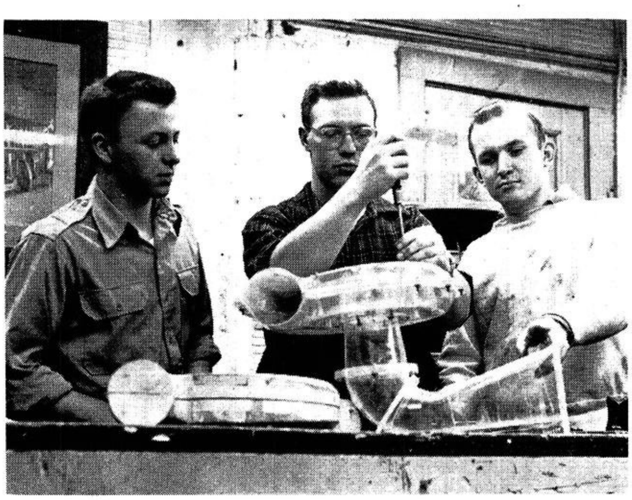
ABOVE: A Jacobs Ladder which consists of two electrodes spaced about three inches apart at the bottom and 4-5 inches apart at the top. An arc, backed by 100,000 volts, actually climbs the ladder over and over. Charles Wittkop and Victor Muth are building this piece of apparatus.

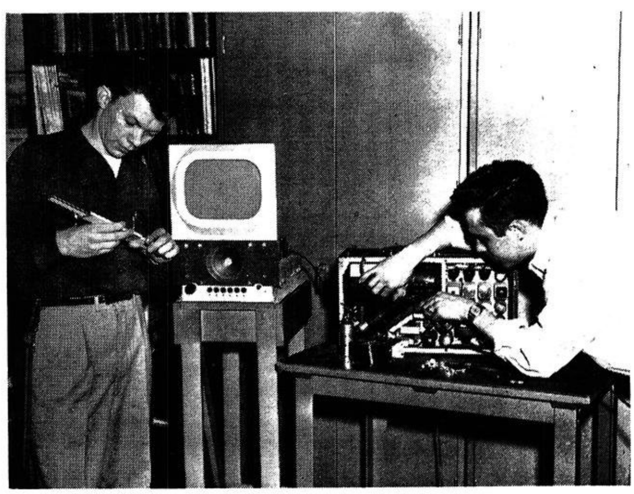


LEFT: Wayne Olson, Bill Miller and LeRoy Shaw are working with an anti-log computor in an attempt to produce a signal which when set on an oscilliscope will look like the letters "U W".

BELOW LEFT: Three students working on a model of a draft tube.

BELOW RIGHT: The spot scanner type television camera and monitor is being built by Cliff Holly and Les Thelaner. For the disk they are using an old record 16 inches in diameter with 40 holes drilled in the form of a spiral.





THE

ENGINEERING

Photos by
Dave Dauterman

Chemical Engineering

by Prof. O. A. Hougen
Chairman, ChE Department

O. A. Hougen

This is a chemical age! During the last ten years the chemical industries of the United States have been expanding nearly three times as fast as the average of all other industries. For all industries of America the increase has been 1.75 fold; for the chemical industries the increase has been 4.5 fold. During these ten years, chemical production in the United States has increased from 4.3 billion to 17 billion dollars a year.

Another significant advantage of the chemical industries is that they are scattered among many small companies where personal initiative and responsibility count and where the opportunities of personal gain are commensurate with individual enterprise. Contrary to common notions, the four leading chemical industries of America, —E. I. du Pont de Nemours and Company, Monsanto Chemical Company, Celanese Corporation, and Dow Chemical Company control only 15 per cent of the chemical industry in America as compared with the steel industry, where 75 per cent of production is controlled by four companies.

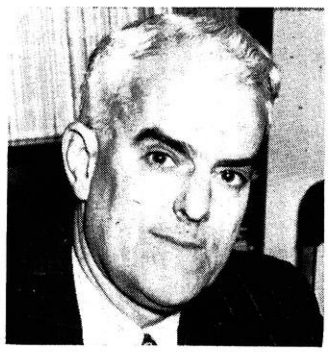
The average age of the chemical engineer in industry is only thirty years. This means that his responsibilities come early in life.

Chemical engineering deals primarily with the problems of chemical production, and with any manufacturing process where chemical changes occur as in the production of coal products, petroleum products, paints, pharmaceuticals, plastics, rubber. The list can be extended to a thousand products.

One prominent duty of the chemical engineer is to translate the work of the chemical laboratory into large-scale production; to design and operate a chemical plant under profitable conditions.

Civil Engineering

by Prof. James G. Woodburn
Chairman, CE Department



J. G. Woodburn

The profession of civil engineering offers many employment opportunities for engineering graduates. Moreover the need for civil engineers increases constantly with the development of modern inventions and processes and with the growth of our population.

Civil engineers have always been connected with the building and maintenance of transportation systems. Only a little over a century ago waterways and postroads were our only routes of public transportation inland from the ocean. Railroads were then in their beginnings, but within 60 years had covered the country with a network of 250,000 miles of mainline track. Long pipelines for transporting petroleum products and natural gas have been laid. In all this work civil engineers have had a large part.

In spite of all the advancement in methods of designing and building highways and of all the billions of dollars that have been spent on our highway system, the fact remains that in many places the quality of roads has not kept pace with the mechanical improvements in the automobiles that have been manufactured or with the weights of loads that are shipped over the highways in increasing volumes. The growth of highway traffic that has resulted from population growth and the establishment of new industries has led to the building of superhighways, expressways, and toll roads. The civil engineer occupies a prominent place in the planning, surveying, designing, constructing and operating of all these transportation facilities.

Another field that offers promise of unlimited growth and opportunity for employment of civil engineers is

(*please turn to page 72*)

Mechanical Engineering

by Prof. P. H. Hyland

P. H. Hyland

Mechanical Engineering is concerned with the release of energy and its transformation into work through machines, for the production of power from fuels, and the design, construction and use of machines to utilize this power for manufacturing the things that satisfy man's needs.

The last twenty-five years witnessed an ever increasing demand for manufactured goods. This need has been met by rapid advances in mechanical engineering technology and a re-evaluation of the curriculum as of 1950. The engineering colleges cannot furnish graduates in sufficient numbers to satisfy the demands of industry for young mechanical engineers.

Mechanical engineering students, like those in the other main fields of engineering are thoroughly trained in mathematics, the physical sciences and engineering principles, and are taught to apply those fundamentals to the problems that are encountered in engineering practice. The mechanical engineering course at Wisconsin main-

(please turn to page 70)

Mechanics Department

by J. B. Kommers
Chairman, Mech Department

The Mechanics Department at the University of Wisconsin provides undergraduate instruction for all students in the College of Engineering and also for students in other colleges who take certain courses. It acts as a service department for undergraduate students in much the same manner as do the departments of English and Mathematics. It does not grant the B.S. degree, but it does offer graduate work leading to the M.S. and Ph.D. degrees. Staff members in charge of graduate study are active in research, and have a close association with the important engineering societies, with various agencies of the federal government, and with industry. They also engage in consulting work to a limited extent.

All the undergraduate courses taught in the department are fundamental and provide the foundation for many of the engineering courses taken subsequently, as well as for later work in the engineering profession. In general, the mechanics courses deal with the effects of forces on bodies at rest or in motion, with the strength and rigidity of the members that make up structures and machines, and with the physical properties of the materials of which these members are made. Excellent facilities are available for the study of mechanics of soils; fatigue of materials; vibration of structures; and the properties of portland cement, aggregate, concrete, wood, and metals.

DEPARTMENTS

Electrical Engineering

by Prof. H. A. Peterson
Chairman, EE Department

H. A. Peterson

Electrical Engineering is a young profession and, therefore, a young man's profession. It was a mere infant—but a lusty one—in 1882 when the first electric generators were put in operation. It is interesting to point out that the first electric generator driven by a waterwheel was put in operation in Appleton, Wisconsin, on September 30, 1882. Since that time growth and development of the profession have been phenomenal until today the American Institute of Electrical Engineers (AIEE) has a membership of over 42,000 electrical engineers. This is more than any of the other founder engineering societies. In addition, there are over 30,000 members of the Institute of Radio Engineers (IRE).

Electricity in the home is something with which all of us are familiar in this present age. Only a few generations ago, it was available in the homes of merely a few. Today it is available in almost every home. Electrical engineers have been the professional group largely responsible for bringing about this condition. Engineers are "doers" and this is some of the practical evidence that electrical engineers have "done" their work well, so that today heavy tasks around the farm home, and other tasks in all homes, can be done quickly, efficiently, and economically without drudgery. The benefits of radio and, in more recent years, television have been brought to many homes. These are some of the more obvious fruits of electrical engineering—benefits to mankind. From these more obvious fruits, we could move on to many others of a very complex nature such as the control of guided missiles, gunfire control, automatic pilots, and high speed electronic computing de-

(please turn to page 72)

POLYGON BOARD AND ITS FUNCTIONS

by Allen Schmidley, ee'53
(President of Polygon Board)

What is Polygon Board and its functions?

Polygon is a central committee, which can act for the interests of the college of engineering and represent the students in their relations to the faculty. Polygon Board, from its constitution, will sponsor all engineering activities such as dances, smokers, expositions, plays, St. Patrick's contests and other engineering activities of general interest.

This year Polygon put on a St. Pat's dance in the Union. The chairmanships for this dance were held by members of the board and all matters of finance and methods of choosing St. Pat, from the entries by the different engineering schools, was done by the fourteen members comprising Polygon.

This year's Engineering Exposition, which will be held April 10, 11, and 12, will be directed by Polygon Board.

The question in your mind may be, how can I get on Polygon Board? Polygon is made up of fourteen members and a presiding president. The fourteen members come from the seven active professional engineering societies, two from each society who serve two semesters on the board. These terms are staggered so one man has had a semester of experience while a new member from the society is being his assistant or junior member. He takes the senior member's place when his term expires. In order to become a Polygon member, you first must become active in your school, join your respective professional society and remain active in the society so the members will get to know you; then when election time comes you may be the person to be nominated and elected. The president of Polygon Board is the fifteenth man on the board and is elected by the Board members from the outstanding senior members. The society which he represents elects a third member to the board to replace him, so that equal representation is maintained among the socieities.

Each member who serves on Polygon Board for a year receives a gold filled key for his services and probably will enjoy a banquet in the spring. The meetings are held in the M.E. building at least once every two weeks. The meetings are open to all who care to come or want to have any points discussed. Any member being absent without a valid excuse is fined one dollar which is deducted from any profit his society is awarded from money made on the St. Pat's dance or exposition. This then behooves every society to send capable and responsible men to the board. In comparison with the Hill, Polygon is the student board of the Engineering College.

Exposition Exhibits

by Dick Groth, ee'55

A clarification of the rules concerning the sponsoring and construction of student exhibits for the 1953 Engineering Exposition have been given by Polygon Board. Inasmuch as there has been much confusion over the interpretation of the regulations concerning exhibits, the following information, direct from Polygon Board, is intended to set everyone straight.

What can be exhibited?

Any exhibit illustrating scientific principles or phenomena, or showing the direct results or effects of scientific principles, can be submitted. This means that it doesn't have to be an engineering project—exhibits illustrating any of the physical sciences can qualify.

All ideas for exhibits must be approved by Jack Miller, student exhibits chairman. Ideas should be submitted to the exhibits chairman of your engineering society, or to Jack Miller (phone 6-8870).

Who can exhibit?

There will be three classes of exhibitors: (1) Engineering societies represented on Polygon Board are going to compete in one division. The projects are worked on individually but are sponsored by the society as a whole. (2) Any organization on the U.W. campus, other than those just mentioned, are eligible to exhibit in the second group. The exhibits submitted by those in this division will be entered in the name of the group and built by its members. (3) The third group is for individual exhibitors. It has been created for anyone not connected with an organization, and also for any others in exhibiting groups who may wish to assume the responsibility for creating and building an exhibit of their own.

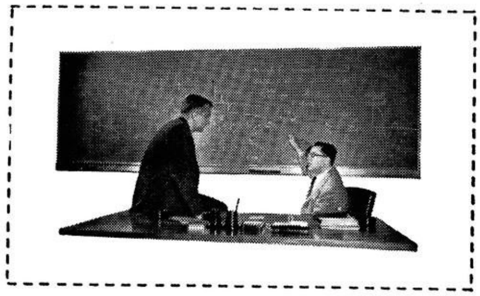
Exhibits can't be entered in two classes. If there is a choice, the exhibitors must decide in which class he wishes to compete.

Prizes.

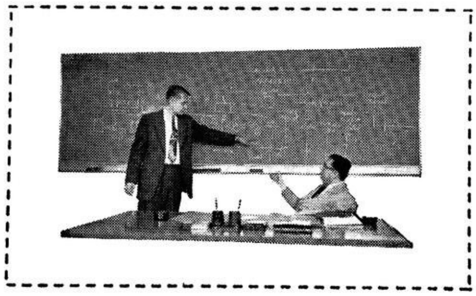
Plans for the distribution of prizes, which were stated in the January **Wisconsin Engineer** have since been altered. Here is the final word: Over $300 in cash prizes and trophies will be awarded by Polygon Board. To the Polygon engineering societies goes $160 in cash prizes—one $25, three $15, five $10, and eight $5 awards. This money will go to the individuals in the society who worked on the winning exhibit.

The other organizations will be competing for three trophies, to be given for first, second, and third places. Three trophies will also be awarded to winners in the individual exhibits category. The combined value of the six trophies is $150.

In closing, don't forget any organization or individual can enter more than one exhibit. At this writing, some engineering societies have 12 exhibits planned. So far there have been nearly sixty exhibits accepted, but Jack Miller gives his assurance that there is room in the engineering building for many more.



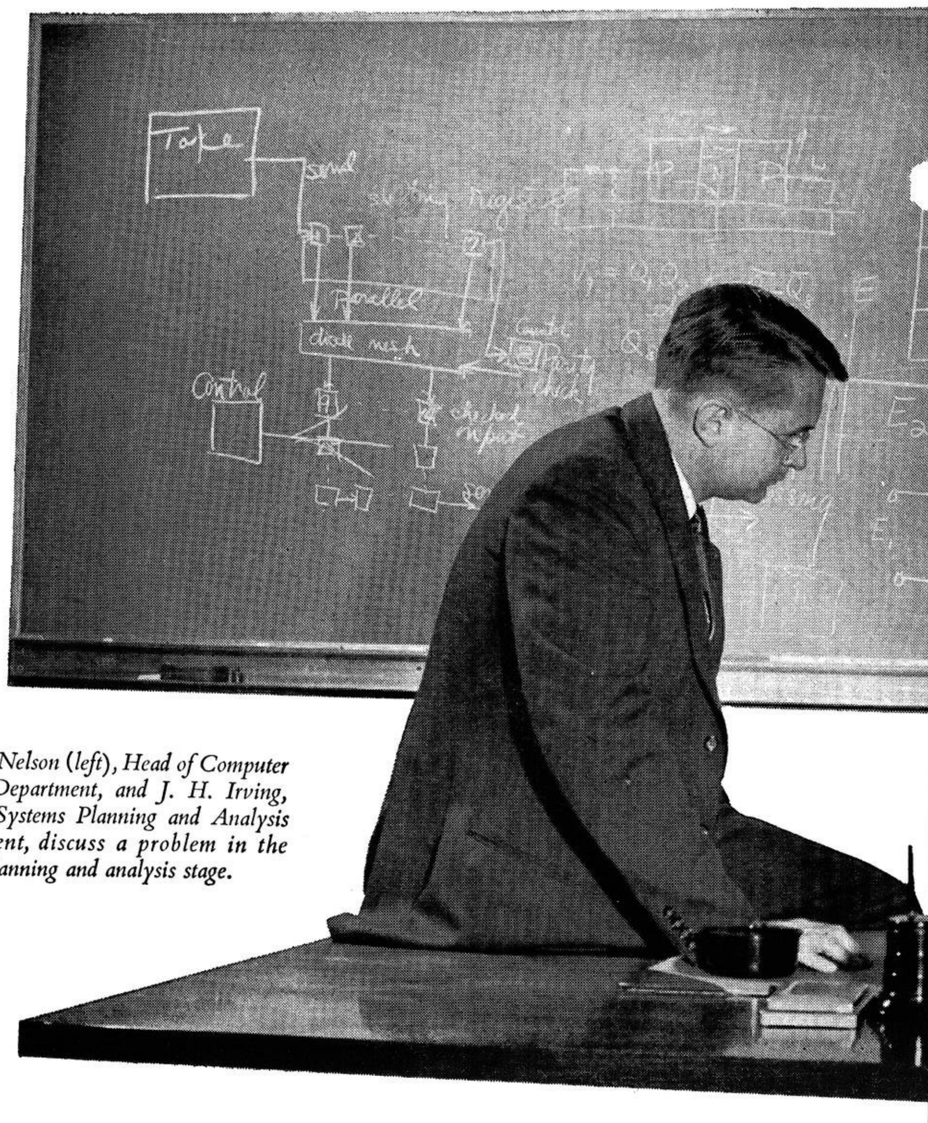
PLANNING THE RIGHT ANSWERS



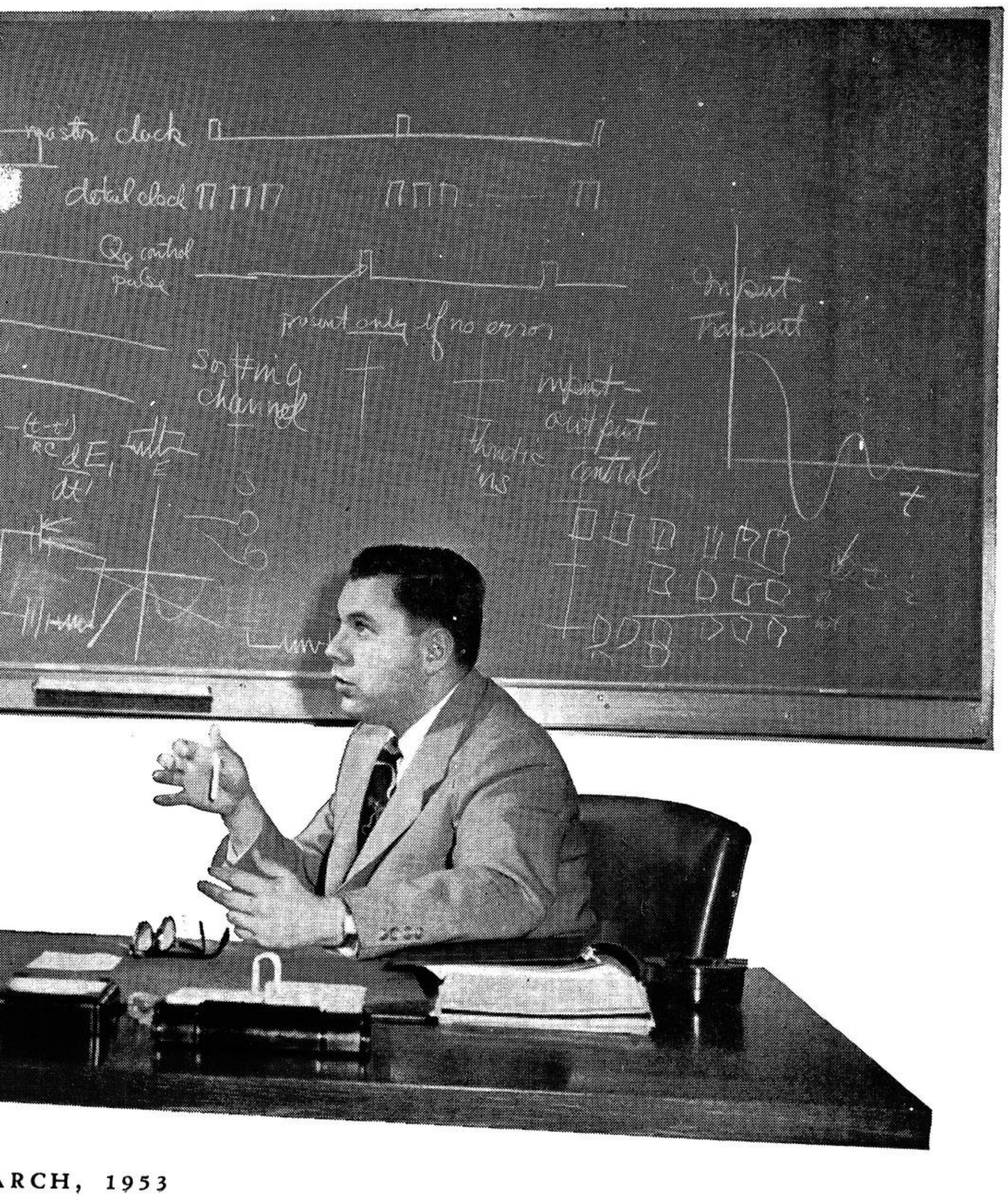
The complexity of modern a defense—extreme aircraft speed highly complex weapons, ne combat strategies, the advanc state of today's technology—pos serious problems for the scient and engineer.

One significant solution li in the extensive use of ai borne automatic equipmen including electronic digit computers, to augment c replace the human elemen in aircraft control.

At Hughes Research an Development Laborator



Dr. E. C. Nelson (left), Head of Computer Systems Department, and J. H. Irving, Head of Systems Planning and Analysis Department, discuss a problem in the systems planning and analysis stage.


master clock
present only if no error
sorting channel
input-output control
Input Transient

WISCONSIN SOCIETY OF PROFESSIONAL ENGINEERS

W. S. P. E.

Edited by

Stephen Carter, m'55

• ELECTION OF OFFICERS

The following members were elected to office in the recent election.

President—Pierce G. Ellis

Mr. Ellis is assistant to the president of the Wisconsin Public Service Corp., Milwaukee. He is a member of the American Society for Engineering Education and Engineers' Society of Milwaukee. He has served as Chairman of the Membership Committee, 1946; Director, 1947-48, and Chairman, University Cooperating Committee, 1949 and 1950. He served as second vice president in 1951 and is now first vice president.

First Vice-President — George P. Steinmetz

Mr. Steinmetz is Chief Engineer, Public Service Commission of Wisconsin. He is a member of ASCE. Served as Director and President of the Southwest Chapter. Is now Chairman of WSPE Defense Committee. He is now serving as second vice president.

Second Vice-President—Albert O. Ayres

Mr. Ayres is President of the Eau Claire Sand and Gravel Company. Has served as Director of the Northwest Chapter and the Eau Claire Technical Society. Served as WSPE Director 1949-1950.

Secretary—Eldon C. Wagner

Mr. Wagner is an Associate Professor of Civil Engineering at the University of Wisconsin in charge of Surveying and Mapping instruction. He is a member of the American Society of Civil Engineers, American Society for Engineering Education, American Congress for Surveying and Mapping, The American Society of Photogrammetry, and the Wisconsin Society of Land Surveyors. He is now a member of the Education Committee.

Treasurer—Lloyd M. Schindler

Mr. Schindler is City Engineer of Appleton. He is serving as Treasurer of the Society.

Directors — William F. Baumgartner, Anthony L. Genisot, Herbert O. Lord

Mr. Baumgartner is Division Engineer, State Highway Commission of Wisconsin, Eau Claire. He serv-

(*please turn to page* 70)

New officers of the Northwest Chapter of the Wisconsin Society of Professional Engineers, elected recently, are, left to right: seated—M. R. Carlson, vice president; W. T. Gohn, president; and Walter E. Hestekin, secretary and treasurer. Standing are E. R. Holm, elected a director for three years; R. P. Boyd and R. F. Bott, holdover directors; and W. F. Baumgartner, retiring president.

Promise of a golden future

Yellow uranium ore from the Colorado Plateau is helping to bring atomic wonders to you

Long ago, Indian braves made their war paint from the colorful sandstones of the Colorado Plateau.

THEY USED URANIUM—Their brilliant yellows came from carnotite, the important uranium-bearing mineral. Early in this century, this ore supplied radium for the famous scientists, Marie and Pierre Curie, and later vanadium for special alloys and steels.

Today, this Plateau—stretching over parts of Colorado, Utah, New Mexico, and Arizona—is our chief domestic source of uranium. Here, new communities thrive; jeeps and airplanes replace the burro; Geiger counters supplant the divining rod and miner's hunch.

From hundreds of mines that are often just small tunnels in the hills, carnotite is hauled to processing mills. After the vanadium is extracted, the uranium, concentrated in the form of "yellow-cake," is shipped to atomic energy plants.

A NEW ERA BECKONS—What does atomic energy promise for you? Already radioactive isotopes are working wonders in medicine, industry, and agriculture. In atomic energy, scientists also see a vision of unknown power—which someday may heat and light your home, and propel submarines, ships, and aircraft. The Indian's war paint is on the march again—toward a golden future.

UCC TAKES AN IMPORTANT PART—The people of Union Carbide locate, mine, and refine uranium ore. They also operate for the Government the huge atomic materials plants at Oak Ridge, Tenn., and Paducah, Ky., and the Oak Ridge National Laboratory, where radioisotopes are made.

STUDENTS and STUDENT ADVISERS: *Learn more about the many fields in which Union Carbide offers career opportunities. Write for the free illustrated booklet "Products and Processes" which describes the various activities of UCC in the fields of ALLOYS, CARBONS, CHEMICALS, GASES, and Plastics. Ask for booklet B-2.*

UNION CARBIDE
AND CARBON CORPORATION
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UCC's Trade-marked Products of Alloys, Carbons, Chemicals, Gases, and Plastics include

ELECTROMET Alloys and Metals • HAYNES STELLITE Alloys • EVEREADY Flashlights and Batteries • NATIONAL Carbons
ACHESON Electrodes • PYROFAX Gas • PRESTONE and TREK Anti-Freezes • PREST-O-LITE Acetylene
BAKELITE, KRENE, and VINYLITE Plastics • DYNEL TEXTILE FIBERS • LINDE Oxygen • SYNTHETIC ORGANIC CHEMICALS

Channel Wing--

(continued from page 19)

definite in number. This type of wing can be designed and adapted to suit the requirements of any type of aircraft from the small private plane to large transports.

In peacetime applications, ships equipped with this new wing will permit the safe transportation of large numbers of people from the rooftops in metropolitan areas. It could conceivably be applied to backyard operations and used on ranches and farms with no prepared airstrip. The farmer would find that the operational characteristics of a channel wing ship are adaptable to crop dusting, herding, and pest control. The conservation department could use it in forest fire lookout and prevention work, and watching over the movements and numbers of our wild game herds. As an observation aircraft it could be used for aerial photography and would be very effective in police and rescue work.

The military forces could find innumerable uses for this type of aircraft. The Custer Channel Wing has direct application to the problems encountered in flight operations from the decks of aircraft carriers. Its landing requirements would allow these decks to be much shorter than those in use today. The transfer of wounded from areas of battle directly to field or base hospitals, would be made possible through the ships ability to land anywhere safely. It will be invaluable in developing efficient operation of cargo feeder lines. Furthermore the channel wing can be applied to any aircraft where hovering and slow-speed, or vertical land is desirable, regardless of the top speed of the ship. This characteristic would be useful for instance, in a place like Korea. The aircraft would be based very near the front, where its ability to hover and to take-off from and land on rough ground would be readily adaptable for rescue and observation purposes. It would make an ideal ambulance and could be used in combat, since it has high speed for quick approach and fast get away, and is able to climb at a high rate.

The recognized aerodynamic principle that lift varies directly as the square of the velocity, thus producing tremendous lifting force at high air speeds suggests the potential benefits to be derived from the adaptations of the Custer Channel Wing to jet aircraft. The Custer Channel Wing Corporation is well advanced with research on jet applications.

The Present and Future of the Custer Channel Wing

The channel wing can be applied to any ship whatever. Transport, trainer, fighter, and above all to freight carrying machines. As a war service ship it far excells the helicopter. It has all the advantages of the helicopter, and conventional ships combined. It is the simplest means known for "convertiplane" that is now in existence.

This fact is recognized by one of the leading manufacturers of lightweight aircraft in the country, Taylorcraft, Inc. of Conway, Pennsylvania. The Taylorcraft Co. is the first aircraft manufacturer to contract with the Custer Channel Wing Corporation for a license to manufacture both private and military aircraft. The first ship to be produced will be on an experimental basis and will comply with the Air Force Specifications for a liaison aircraft. This ship will carry litter patients and one medical attendant or three fully equipped combat soldiers exclusive of the pilot. It will have a normal cruising speed of better than 150 miles per hour, and will be able to land and take-off from unprepared surfaces.

Mr. C. Gilbert Taylor, the creator of the light airplane, speaking for Taylorcraft, said, "The Custer Channel Wing is the first change in basic design of aircraft since the Wright Brothers, and a complete new formula for aerodynamics may have to be developed together with engineering data and new operating rules to cover the aircraft that is now in the process of development by Taylorcraft, Inc."

In this day of exteremly high speed flight, it is only natural that design for the Custer Channel Wing in supersonic flight should be considered. Such studies are now being made and interesting applications have been found. The application of modern turbo and jet engines making use of the Custer Channel Wing to benefit lift and drag characteristics for take-off and landing conditions, result in lift coefficients much higher than those found for present day boundary layer and powered aerodynamic schemes. Modern attempts to produce the so-called negative drag airfoil has also been applied to the channel wing with the most interesting negative drag results.

The extraordinary operation of the channel wing has caused the Custer Channel Wing Corporation to begin construction of an new, modern, sleek-looking airplane that is capable of taking-off without any forward velocity and practically hovering along, or cruising at better than 150 miles per hour. The ultra modern backyard ship will be mass produced to bring the price down within the reach of the average wage earner.

Mr. Willard Custer, the designer and builder of the experimental channel wing says that the application of the full usefulness of the channel wing to aircraft could well result in an airship that would supercede the conventional airplane and helicopter. This is due to the ability of the channel wing ship to go into places where other means of transportation cannot go.

The development of revolutionary aerodynamic inventions such as the Custer Channel Wing give an idication that the horizons of the aviation industry are as yet unlimited. Men like Willard R. Custer are as truly pioneers as those who crossed the great plains westwards in the early history of our country, and the effects of his research should be as profound in the field of aviation, as the accomplishments of the earlier pioneers were on our history and traditions.

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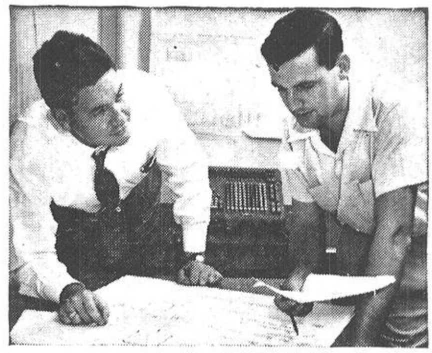
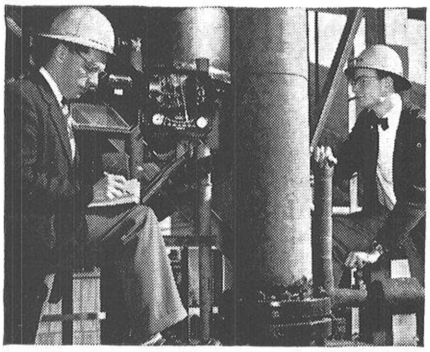
THE DU PONT DIGEST



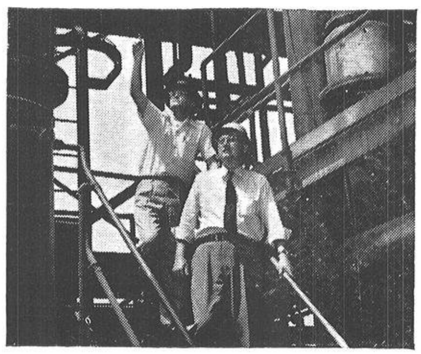
John Purdom, *B.S. in Ch.E., Ohio State '49, and Kenneth Kehr, North Carolina State '50, discuss diagram of a process for improved recovery of an intermediate for high polymers.*

THE ENGINEER'S PLACE IN Plant Development

Another phase of Du Pont production activities offers challenging work for the technical man



E. H. Ten Eyck, Jr., *B.S. in Ch.E., Syracuse '43, Ph.D. in Ch.E., Brooklyn Polytech '50, and W. H. Stevens, Jr., B.S. in Ch.E., Yale '50, take recordings on a new nylon unit.*



D. S. Warner, *B.S. in M.E., Purdue '47, and G. R. Prescott, B.S. in Met. E., Columbia '49, discuss improvements for stainless steel liners in tubes carrying corrosive materials.*

In most Du Pont manufacturing plants you'll find two groups of engineers working side by side to make operations more efficient—to reduce costs and improve quality. The specialized work of one group, the production supervisors, has been rather fully discussed in the *Digest*.

Equally vital is the work of development men—the men responsible for advising management when operational changes should be made for economic or technical reasons.

Engineers from several fields of training are employed in development activities at Du Pont. It seems to have a special appeal for the man who can take on a big problem, analyze its parts, and come up with a thoughtful, reasoned solution.

Individual development studies may begin in a number of different ways. Often they are sparked by the imagination of the engineer himself, who, of course, must be familiar with production costs, activities of competition, and recent or impending technical improvements.

Studies also may be inspired by suggestions of production supervisors or sales personnel, obsolescence of equipment, advances in competitive products, or the presence of unsatisfactory profit margins.

In a single study, the engineer may draw data from laboratories, semi-works and plant-scale experiments, prepare an estimate of profits and investments and consult with numerous specialists on various phases of the problem, both within the Company and outside.

Having collected data from these many sources and perhaps from an independent study of his own, the plant development engineer must then assemble and evaluate the material and prepare a recommendation that is based on sound engineering judgment.

Whether a product or process improves from the standpoint of competition, profit and efficiency depends, in great degree, on the quality of its plant development work. The development engineer's job is a responsible one at Du Pont, and the work of a good man is soon noticed.

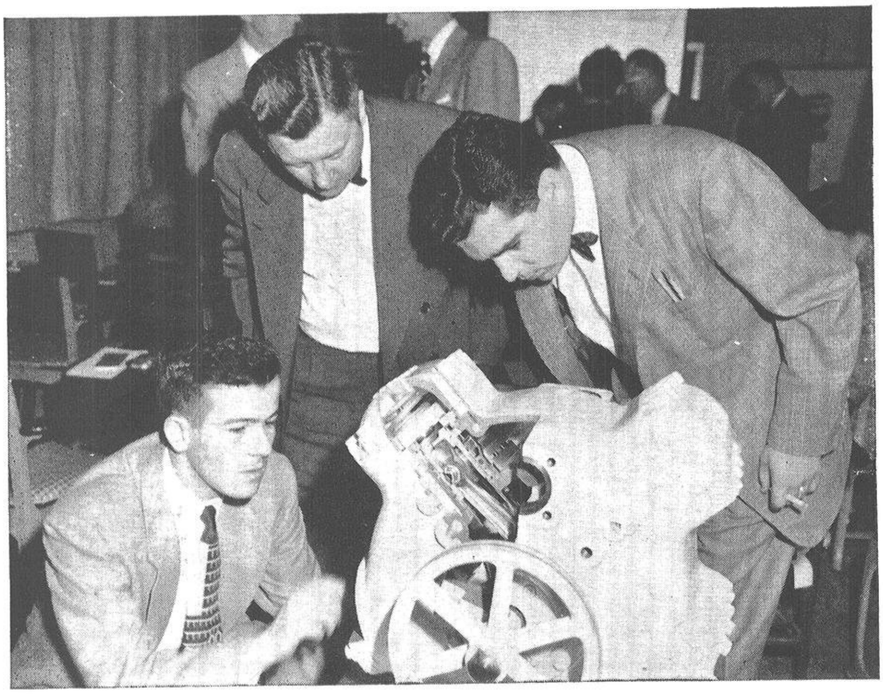
HAVE YOU seen "Chemical Engineers at Du Pont"? New book describes initial opportunities in many fields, tells how experiences are varied to prepare men for administrative and management positions. For copy, write 2521 Nemours Bldg., Wilmington, Delaware.

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

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



Preparing for specific responsible positions with Trane in sales, research and product design, these graduate engineers are attending a streamlined six-month training course at full pay. This interesting course moves rapidly and adapts the graduate's knowledge of engineering to the position he has chosen.

Trane Offers Engineering Graduates

OUTSTANDING OPPORTUNITIES IN AIR CONDITIONING

Qualified graduate engineers can step quickly into an interesting and prosperous career in the rapidly growing field of air conditioning. The Trane Company, leading manufacturer of air conditioning, heating, ventilating and heat transfer equipment, is seeking graduates for responsible positions in sales, research, product design and production.

Those selected will join the Trane Graduate Training Program in La Crosse at full pay. Each man will receive a specialized course to assure personal success in the position he has chosen.

He will learn how Trane equipment is used in jet aircraft, tanks, submarines, ships, skyscrapers, factories, industries, homes and buildings of all types. He will see how rapidly air conditioning is becoming a necessity . . . how it is destined to become a standard requirement in homes, automobiles, schools, offices . . . everywhere.

Graduates move quickly into responsible, well paid positions. Men who joined the company through this training program include the president and numerous company officers, managers of most Trane sales offices and home office sales divisions.

Trane's record has been one of steady growth and leadership for nearly forty years, during both peace and war. Today, new Trane products are being developed constantly . . . creating new departments and promotions . . . assuring continued growth and business opportunities.

For an outstanding career in one of the fastest growing industries, consider your future in air conditioning with Trane. Write immediately to Milton R. Paulsen, Training Department Manager, for the brochure "Trane Graduate Training Program". Next six-month class starts in July.

WHAT OTHERS SAY ABOUT TRANE

How much can graduates of their training program earn? What about competition? Is Trane strong financially? Does the company offer outstanding opportunities to young men?

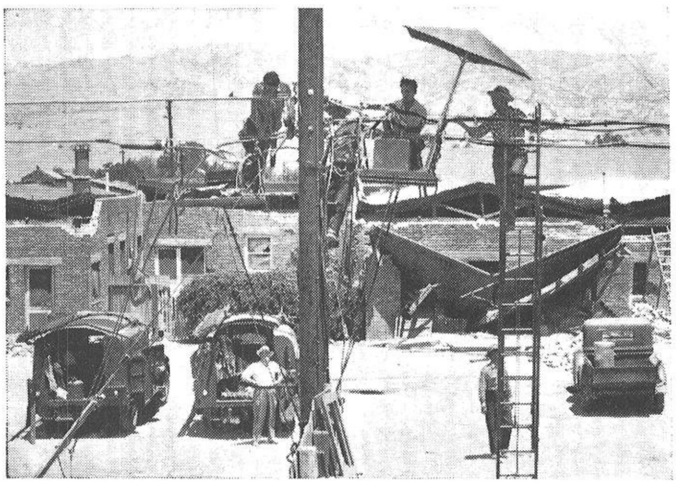
For the unbiased answers, read FORTUNE magazine's report on Trane in their August, 1951 issue. Your library should have a copy. A reprint of this report is included in the "Trane Graduate Training Program" brochure which is in your Placement Office.

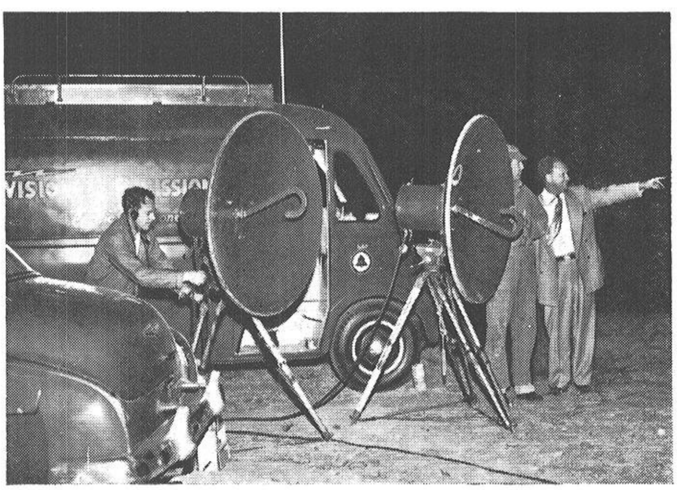
TRANE

THE TRANE COMPANY • LA CROSSE, WIS.

Eastern Manufacturing Division, Scranton, Pennsylvania
Trane Company of Canada, Ltd., Toronto, Canada
Sales Offices in 85 United States and 14 Canadian Cities

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING EQUIPMENT

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Considerations--

(continued from page 32)

The recently accelerated demand for engineers has been caused in part by increased application of the advances in science to the manufacture and use of mechanical, electrical, metallurgical, chemical and constructional equipment, again in part by the realization of the management of the small industries of their need for engineering services in order to remain in competition. The demand has also been increased by the decrease in European engineering graduates during and following World War II due to the impoverished conditions in the Axis countries.

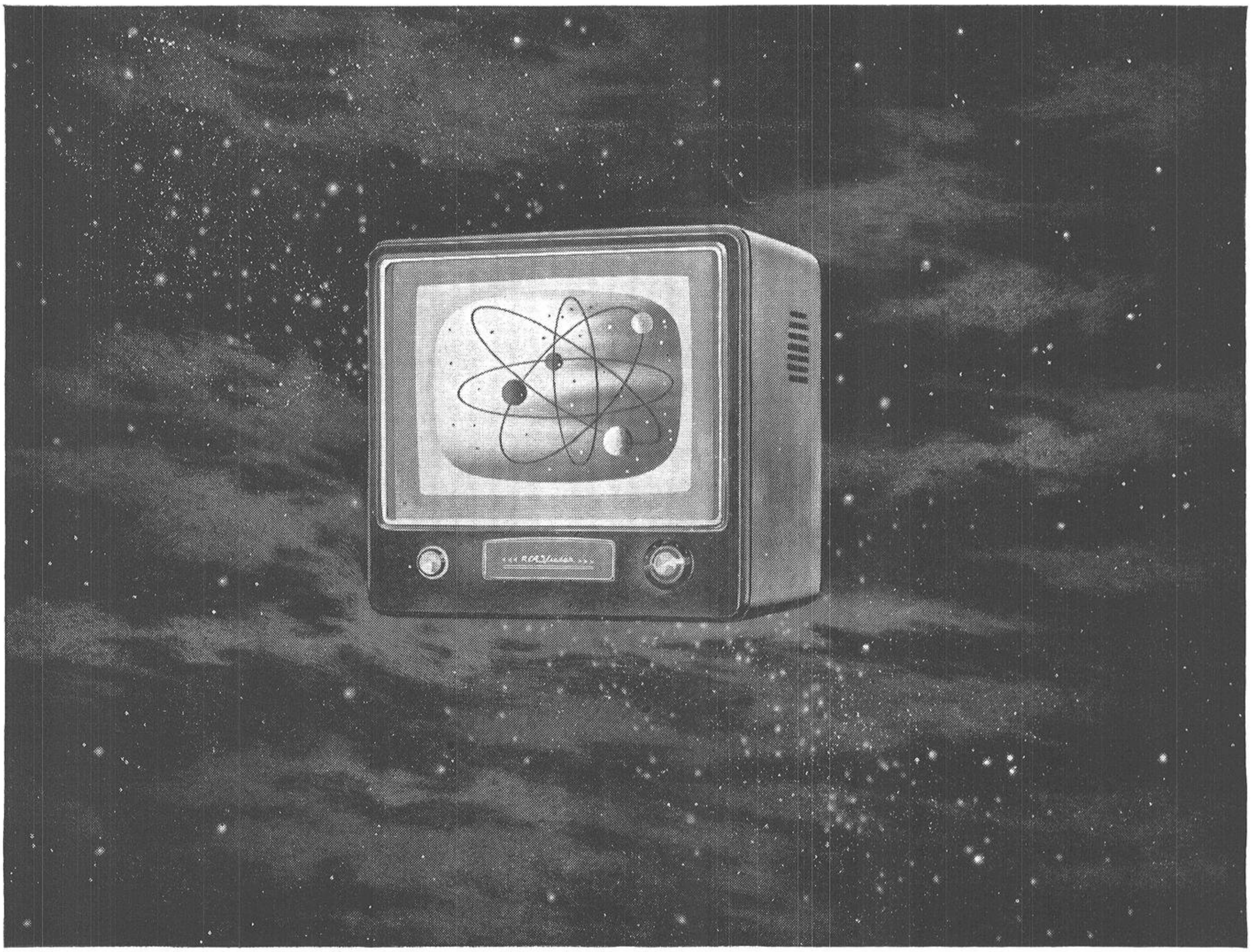
The College has a well qualified staff, excellent buildings supplied with modern equipment and facilities, both for a comprehensive instructional program and for research in the six fields of its curricula. Graduates of the College have risen to top positions in management and in the engineering fields. Further information concerning the employment situation and the various fields are given in succeeding articles. On account of the strong demand for engineers and the importance which they play and will continue to play in our national economy, every student with a sound physique and a determination to succeed, who stands in the upper third of his high school graduating lcass should have the potential to complete an engineering curriculum. For additional information on the fields in engineering and the preparation desired, write to the office of the Dean of the College of Engineering.

Professional Problems--

(continued from page 27)

Another important point, and one with which many of us were already somewhat acquainted, is the fact that success is never guaranteed. Speaker after speaker stressed the point that it takes effort, and plenty of it, to reach towards the top. This was probably the most disappointing part of the course to learn. However, it was inspiring to hear the speaker from Fairbanks Morse quote how man after man had, of all places, started out on the drafting board and climbed up to the higher positions on the company. This was not done by knowing the boss's daughter, an adage that the gentleman from Allis Chalmers refuted. It was done by cooperation with others, hard and serious work, and extra effort which was put forth after office hours. This brings up the point that we are not through studying come February or June. True, we can be through with studying, but it seems to be a well known fact that the ladder of success stands solidly on keeping pace with current events and advancements.

Thus, to sum up this brief summary, I'd like to repeat the main thing I got out of the course is that it finally made me sit up and start to wonder just which way I should turn in June. Secondarily, I discovered that I must learn to express myself easily and accurately, and that I must continually strive to further myself and my education by continually putting forth extra effort and by additional studying. It is these three things that I believe made the course important to me.



ALUMNI NOTES

by

Eugene Buchholz, m'55

Johnson, Frederick M., c'06, district engineer for the Bureau of Public Roads at Springfield, Illinois, has retired after more than 40 years in government service.

Cargill, William W., c'16, president and general manager of the Ray-O-Vac Co. of Madison, has retired. He will make his home in Los Angeles.

Watts, Oliver P., Phd.'05, died at his home Feb. 6. Dr. Watts, emeritus professor of electro-chemistry at the University of Wisconsin, pioneered in the fields of electro-metallurgy, electro-plating, and corrosion studies. He retired in 1935 but had continued research work on metal corrosion. He also invented the Watts process of hot plating nickel.

Plog, Charles B., c'40, and his wife Lois are in Bombay, India, where Charlie is an engineer with the Standard Vacuum Oil Co.

Lenschow, Henry J., c'30, has resigned as city engineer of Tomah, Wisconsin. He is now engaged in private practice in that city.

Hovey, William B., c'32, after spending a number of years in Venezuela with an oil company, is now living in Santa Fe, New Mexico, where he has established a plant making concrete products. His residence is 105 Camino San Acacio.

Petersen, Robert P., c'16, president of the Concrete Products Co. of America, which has factories in Pottstown and Pittsburgh, is featured in an article in Engineering News-Record for January 15. Petersen's company is pioneering in the manufacture of small, pre-stressed concrete bridges under factory conditions.

Guth, Sylvester K., e'30, in charge of lighting research activities at the Nela Park Lamp division of the General Electric Co., received the honorary degree of doctor of ocular science Jan. 25 in Chicago. The honorary degree is in recognition of Guth's outstanding contributions to the profession of optometry. A graduate of the University of Wisconsin, he joined the lamp division in 1930. He has conducted his research in the fields of light, vision and seeing, developing many techniques in evaluating visibility, contrast sensitivity, visual acuity and ease of seeing.

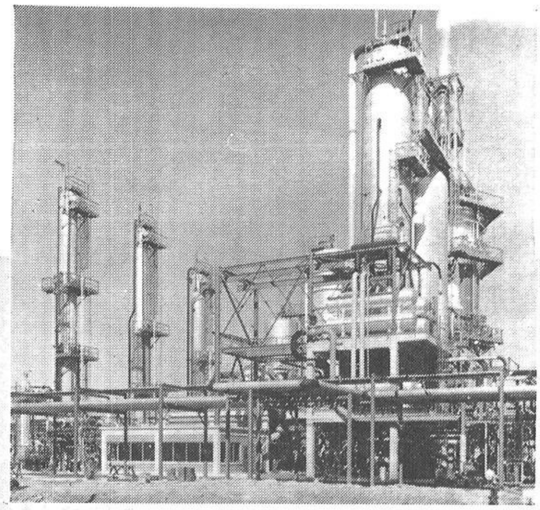
Thorp, George G., m'91, died January 19th at his Maple Bluff home. Mr. Thorp retired in 1935 as president of the Illinois Steel Company. He directed construction of the United States Steel Corp. plant at Gary, Ind., in 1905, at the request of U. S. Steel. Brought to Madison in his youth, Mr. Thorp was graduated from old Madison High School and the University of Wisconsin and taught at the University for one year before becoming associated with steel firms.

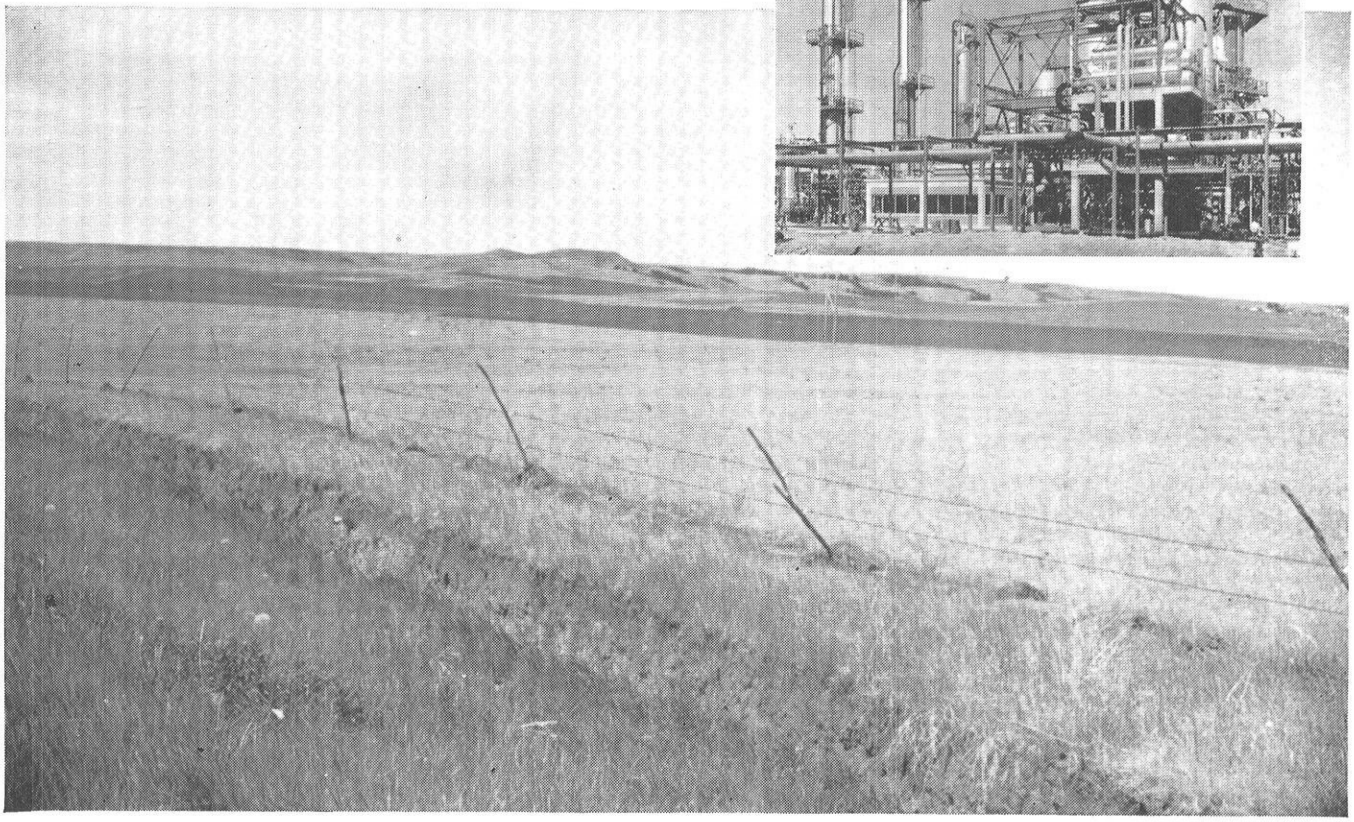
Elliott, John F., c'42, is assistant chief engineer for Brown-Pacific-Maxon, a contracting firm that is working on Navy contracts on the island of Guam. His wife Elizabeth and two children, Jill and Timmy, are with him.

Bespalow, Eugene F., c'21, vice-president and chief engineer of Choctaw Inc., of Memphis, Tenn., is the new president of the Mid-south section of the American Society of Civil Engineers.

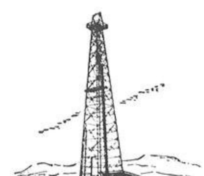
Kloman, Edward J., c'44, is back home in Milwaukee after 21 months of Navy duty in the Korean area. He is now with the Falk Corp., taking a training course leading to sales engineering.

ENGINEERS are planning to transform this flat Dakota prairie into what probably will be North Dakota's largest industry. A new Standard Oil refinery, with equipment similar to that shown, is scheduled to be operating at this Mandan site before the end of 1954. Capable of refining 30,000 barrels a day, it will provide the first major outlet for the Williston Basin production.





OIL is making a prairie plant grow!



Before the close of 1954, a new Standard Oil refinery is scheduled to be operating at Mandan, North Dakota.

Behind this lies a story of Standard Oil's willingness to back its scientists' judgment with millions of dollars.

Two years ago oil was discovered in the Williston Basin. How much oil this basin eventually will produce is anybody's guess, but the current rate is only about 10,000 barrels a day. However, geologists, geophysicists and engineers, working in field and laboratory, have estimated that the basin holds a total of two and a half billion barrels.

On the basis of this estimate, Standard Oil has let a contract for the construction of a new refinery at Mandan and a 215-mile products pipeline from Mandan to Moorhead, Minnesota. A crude oil pipeline of 170 miles will be completed by the time the refinery is ready for operation and a pipeline gathering system of about 40 miles already has been built.

Construction activities such as these and the tireless search for oil are jobs that never end in the petroleum industry.

Young technical men at Standard Oil have found that there still are many exciting frontiers to explore with a company that is constantly building, constantly looking to the future.

Standard Oil Company

910 South Michigan Avenue
Chicago 80, Illinois

STANDARD

SCIENCE HIGH

by Gene Worscheck

—Courtesy Westinghouse

Surge Comparison Testing

HIGH-ENERGY SURGE-COMPARISON TESTER

The use of the surge-comparison principle to check the dielectric quality level of coils and circuits has become widely accepted since the introduction of the surge-comparison tester about three years ago. With this system the coil under test and a standard or comparison coil of known quality are subjected alternately and rapidly to an accurately controlled electrical surge, and the resulting wave shapes are cast upon an oscilloscope screen for visual comparison. If the two coils are alike the wave shapes essentially coincide. If the test coil possesses faults or serious weaknesses the shape of its wave discloses them.

Under normal operating conditions the output of the standard surge-comparison tester is deliberately limited to 100 amperes instantaneous peak output at 10 kv to protect the triggering thyratron in the condenser discharge circuit. This is ample for the great bulk of factory and repair-shop testing of motor and generator coils and similar purposes. However, for testing the coils of large generators and other low-impedance circuits, surges of much greater energy are necessary. To

LIGHTS

provide these for testing its own large generators, Westinghouse engineers have built a special surge-comparison tester employing ignitrons that can deliver 10,000 amperes at 12 kv. This special purpose test unit develops a surge with peak energy 120 times greater than the commercially available models.

This high-energy tester is used widely on turbine and waterwheel generators as they are assembled. It gives assurance that faulty coils will be discovered at an early stage.

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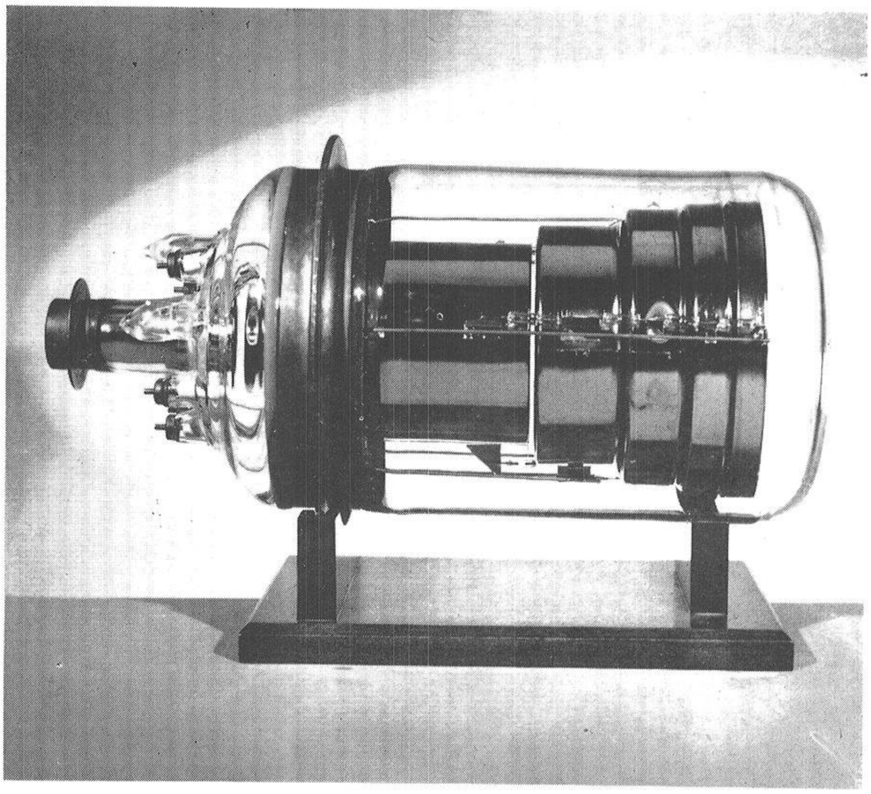
X-RAY IMAGE AMPLIFIER FOR MEDICAL USE



—*Courtesy Westinghouse*

X-Ray Image Amplifier

Radiologists and physicians now have a new tool in the X-ray image amplifier—a device that will give them a 200 times brighter view of their patient's internal organs in living action. An attachment for standard fluoroscopic equipment, the image amplifier is now going into production at the Westinghouse X-ray Division in Baltimore, Maryland after eight years of intensive research. Basically, the amplifier consists of a high-vacuum tube that electrostatically focuses and accelerates an electron stream.

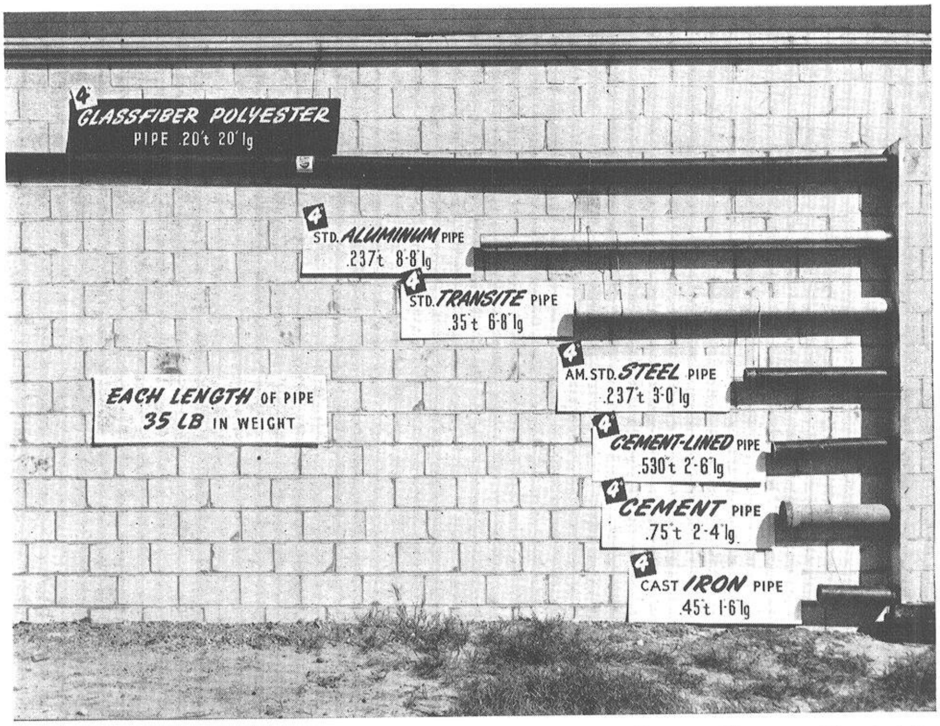
The conditions confronting the physician in present-day fluoroscopy are comparable to those encountered in finding a seat in a movie after leaving the bright sunshine. To see the fluoroscopic image, the radiologist has to dark-adapt his eyes for at least 20 minutes. Now, with the image amplifier attached to his equipment, the physician can step into his dark room and see at once a bright image. He may still have to dark-adapt his eyes, though for only three or four minutes, before he can see all the details. What he sees after that will be a clear, easily discernable presentation of his patient's organs at work.

The new image amplifier increases the brightness of the fluoroscopic image after the X-rays have passed through the patient. This solution to the problem is necessary because the X-ray intensities are already approaching the patient's tolerance level. Since fluorescent screens have a gross efficiency of about 5 percent, even a theoretically perfect screen would be only about 20 times as bright, and screen improvement alone cannot achieve the desired brightness gains.

Increased brightness of the X-ray image has been attained by converting the X-ray energy into light with a fluorescent screen, and thence to electrons by means of an adjacent photoelectric surface. These electrons are accelerated by a high potential placed across the vacuum tube, giving a brightness gain of 10

(please turn page)

or more. A further gain is attained by electrostatic focusing of the electron stream to reduce the image to approximately one fifth its original size. The reduced image, made up of high speed electrons, impinges on a phospor output layer that converts the electron stream back to a visible image, now brightened 200 times or more. As a final step, the intensified image is magnified by means of an optical system without loss of the increase in brightness.



—Courtesy Monsanto Chemical Co.

Equal weights of pipe illustrate light-weight quality of glass fiber polyester.

NEW MATERIAL HAS MANY USES

In technical language, the material is known as **polyester-glass fiber laminate.** It is part glass, part super-tough plastic. Supplies are unlimited for all practical purposes. In 1951, an estimated 32 million pounds of products were made from it. The uses to which manufacturers, builders and engineers cut put it are almost as unlimited as the supplies of the material.

Polyester-glass fiber laminate can be molded into large products on low-cost molds of wood, sheet metal or plaster of Paris—with little heat and low pressure. The molds are cheap. Enormous products of great strength can be produced—all in one piece. Sailboat and motorboat hulls, for example, do not have to be built, member by member. They can be molded all at once. So can automobile bodies. It is only a matter of time until someone will mold the first panel truck, the first telephone booth, perhaps even airplane wings.

The material can stand rain, sun, frost, snow without crazing, cracking or warping. It can take heat up to 500 degrees Fahrenheit. It is absolutely waterproof and airtight. It will not burn. A good electrical insulator, it nevertheless will let in radio and radar waves. It is translucent — will pass light — but you can't see through it. It requires no paint either for color or protection —you can make the finished product in any color you want. Products made from it are incredibly strong. And add to all this that it is not attacked by acids, alkalis, oil, gasoline or corrosive gases.

In making a product from the

(please turn to page 58)

One piece chair.

Science --

(continued from page 56)

new material you start out with a colorless syrupy liquid. The manufacturer buys the syrup from a resin maker and glass fibers from a glass maker. He roughly forms his product with a blanket of glass fibers. Some of the syrup is poured onto the glass mat and the "pre-form" dried. The "pre-form" then goes over the top of a mold—more resin syrup is poured on—and the mold closed. With negligible pressure and little or no heat—the resin-saturated glass fibers set up into the product!

And the product can be almost anything.

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PROJECT CIRRUS

Man can now produce rain under certain conditions which in turn is believed to cause subsequent rains and other weather changes across the country, but no way has been found to break widespread droughts, General Electric weather scientists reported today.

Pioneering work in weather modification has proved that artificial seeding of supercooled atmosphere with dry ice and silver iodide can produce rain, snow and even clouds. However, many complex weather phenomena, not yet fully understood, bar rainfall from drought-plagued areas, the scientists explain in the first complete historical article of man's successful attempt to modify the weather.

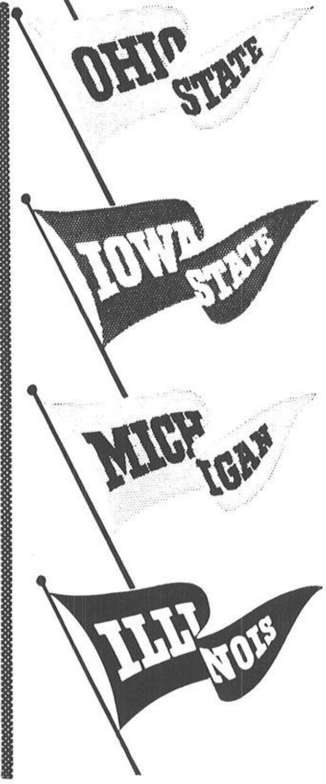
Cloud seeding, possibly at distant points, may someday make it possible to relieve areas stricken by drought, the scientists said.

During 1950, weather scientists Dr. Irving Langmuir, Dr. Vincent J. Schaefer and Dr. Bernard Vonnegut discovered that periodic or regular-interval seeding in New Mexico affected weather generally across the country.

Recently, Dr. Langmuir reported that investigations of periodic commercial seedings in western states during the middle of the week last spring "correlated extremely well" with rainfall patterns that occurred later in the week in eastern states. Seedings as far west as California, he observed, correlated well with periodic rainfall as far east as the Atlantic Coast.

Dr. Vonnegut found that under ideal conditions, widespread seeding could be accomplished with a negligible amount of seeding material. He reported that to realize "a 30 per cent change of rain per day within a given area in New Mexico, the cost of the silver iodide is only $1 for 4,000 square miles."

In 1948 and 1949, studies carried out in Honduras, Guatemala and Costa Rica showed that rain and violent storms could be prevented by overseeding the tops of high cumulus clouds. Proper seeding of the same clouds, on the other hand, produced rain.



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Ultraviolet Radiation - -

(continued from page 21)

Increasing the velocity of air in any duct increases turbulence. Present results show that as turbulence is increased in this manner the organisms are more easily destroyed by the ultraviolet radiations. Some of the organisms in the turbulent flow apparently receive more radiation than would be expected from the average calculated intensity and time. The fact that the amount of radiation needed for a given kill decreases as air velocity increases is shown in Fig. 2.

Operation of the Sterilamp

Most ultraviolet sources operate at highest efficiency under approximately room-temperature conditions. The output of such a lamp, for example, the standard Sterilamp (type 782), diminishes as the temperature increases or decreases from this optimum region; the output at 40 degrees F, for example, being roughly two thirds of the output at 80 degrees F. Air drafts passing over the lamp cause a similar decrease in output by cooling the lamp to a temperature somewhat below its normal operating temperature. An attempt to provide a lamp that gives optimum output under operating conditions prevalent in air-conditionings applications led to the development of an inexpensive, high-intensity ultraviolet source. This lamp is known as the G36T6 in the nomenclature of the industry, but the Westinghouse design is actually made with the smaller T5 envelope, because this makes possible higher intensity under all air-duct conditions than with T6.

The new Sterilamp operates on readily available fluorescent lamp ballasts and has the advantage of being heavily loaded, thus retaining high output under low temperature or severe draft conditions. It can be operated at 120, 200, 300, and 420 ma, depending upon the transformer selected. Approximately 95 percent of the lamp's radiations are at 2537 Angstroms wavelength, which is in the region of the spectrum that has the greatest germicidal effectiveness.

The ability to operate the lamp at high current results in great ultraviolet output, which reduces the number of lamps required to produce a given ultraviolet concentration. The effect of operating current on the ultraviolet output of the new Slimline Sterilamp at ambient temperatures from 30 to 110 degrees F, under still air conditions, is shown in Fig 3. High lamp loading (watts per unit area of bulb surface) causes greater outputs to occur at lower ambient temperatures as the lamp current is increased; optimum output is at 95 degrees F for 100-ma operation, 75 degrees F for 200 ma, 60 degrees F for 300 ma, and 40 degrees F for 420 ma. Air movement displaces these optimum points. Readings for Fig. 3 were taken at 100 ma instead of 120 ma for testing.

When a Sterilamp is subjected to draft, the movement of air cools the bulb, causing the lamp output to change. The ultraviolet outputs resulting from operating the Slimline Sterilamp at ambient temperatures of from 30 to 110 degrees F and subjected to draft velocities of 100, 450, and 950 feet per minute, are shown in Fig. 3. A comparison of these curves shows that the optimum output conditions

(please turn to page 62)

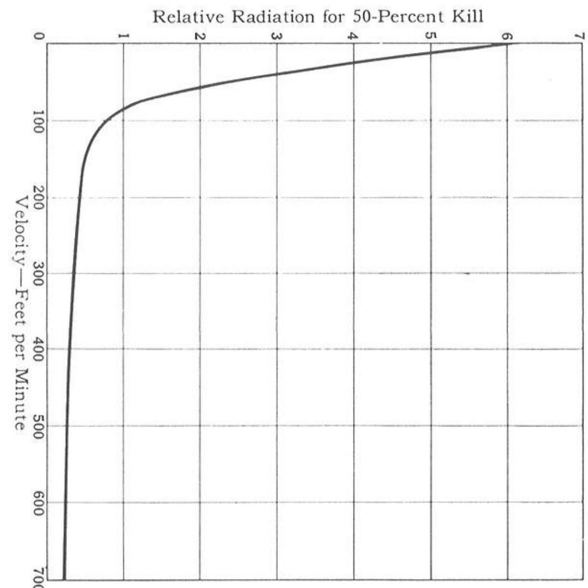


Fig. 2 The relation between the amount of ultraviolet radiatios required for a 50-percent bacteria kill and the velocity of the air in the duct.

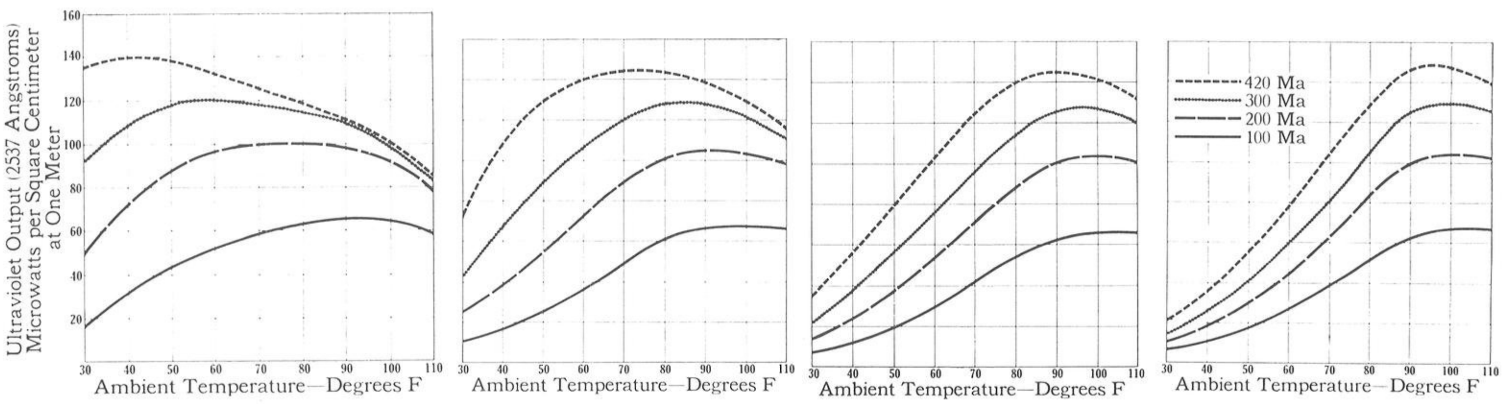


Fig. 3 These curves show the effect of different draft velocities on the ultraviolet output of the type G 36T6 Sterilamp over the same range of ambient temperatures. Curves at left are for still air; successively. from left to right, the other curves are for drafts of 100, 450, and 950 feet per minute perpendicular to the lamp.

Ultraviolet Radiation - -

(continued from page 60)

change as the air velocity and ambient temperature vary. Lamps designed to operate in still air decrease in output as draft velocities are increased. The Slimline Sterilamp, designed for operation in air ducts, produces a comparatively uniform output regardless of air velocity at ambient temperatures between 60 and 90 degrees F; and at ambient temperatures above 90 degrees F, lamp output actually increases with draft velocity. The effect of air velocity on lamp output at 80 degrees F ambient is shown in Fig. 4.

Arrangements of lamps have been studied so as to utilize the ultraviolet radiations to the fullest extent. Drafts parallel to the lamp axis allow slightly greater output under most conditions. When lamps are placed parallel to the air flow, bacteria traveling through the duct are irradiated only while they move opposite the lamp. Radiations emitted from the lamp travel only a short distance before being absorbed by the duct walls. This is especially true if the lamps are mounted on the walls. The same lamps placed perpendicular to the air flow are much more effective because of a greater "ray length," i.e., the ultraviolet radiations are not absorbed by the duct walls. However, if the ultraviolet lamp has not been designed for operation in moving air, the output is unsatisfactory. The output of Slimline Sterilamps operated at different current ratings varies only slightly in effectiveness with the temperature and the air velocity, whereas those lamps designed to operate in still air show a much greater variation in output. The most effective arrangement of Sterilamps operated at 420 ma in air ducts is with lamps perpendicular to the air flow and equally spaced about the center of the duct. In this position the greatest "ray length" with minimum shadow effect (ultraviolet absorption by other lamps) is obtained.

Practical Applications

Through exhaustive laboratory tests Sterilamp ultraviolet applications have been carried well beyond the realm

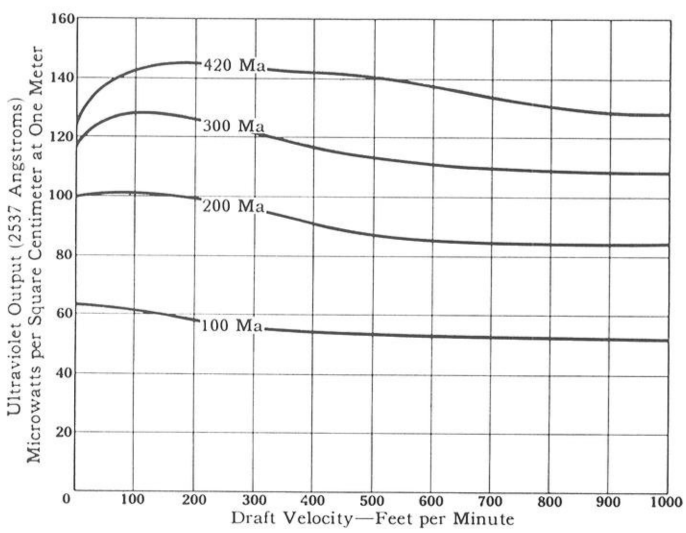


Fig. 4 This group of curves shows the effect of draft velocity on the output of a type G36T6 Slimline Sterilamp, for several values of lamp current.

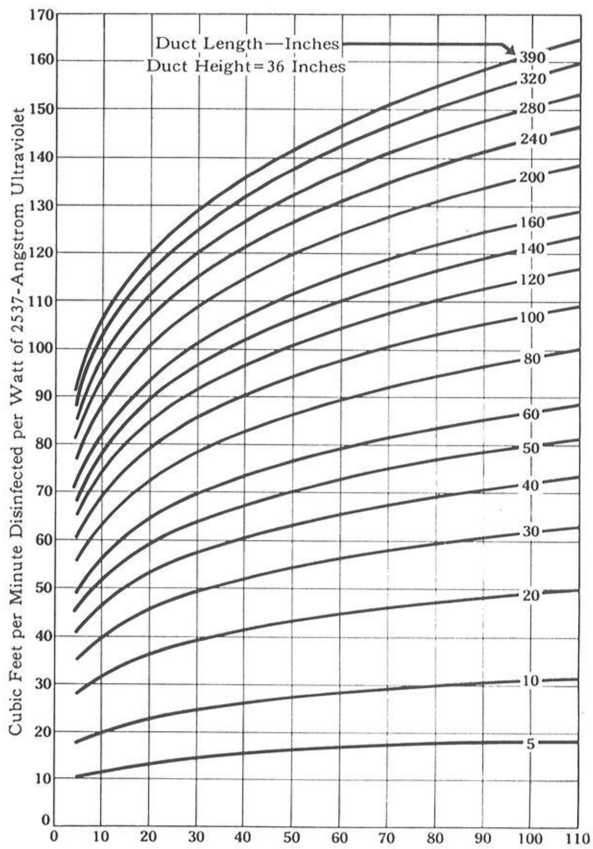


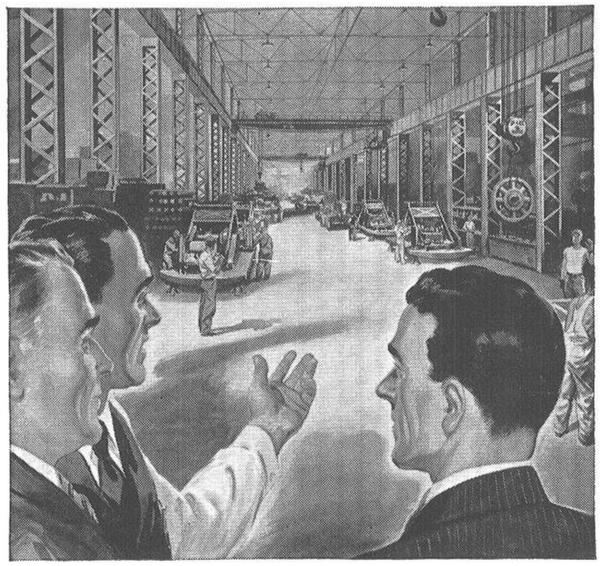
Fig. 5 The computer number of cubic feet of air that can be disinfected to a ten-percent survival value by a watt of 2537-Angstrom radiation from a G36T6 lamp, in various sizes of ducts.

of theory. Using the information obtained, the amount of energy needed to eliminate 90 percent or more of the organisms in the air was determined. The efficiency of the installation at air velocities common to air ducts increases with the size of the exposure chamber, as would be expected from the increase in ray length (see Fig. 5). These curves are helpful in calculating the amount of ultraviolet energy necessary for most ducts. However, in certain large irradiation chambers the length may be as short as two feet while the width and height may be much greater. In such instances, the chamber can be divided into two or more sections to simplify calculations. The ray length increases with the size of the exposure chamber and, therefore, less ultraviolet energy is necessary. A correction factor for the increased ray length for various large irradiation chambers is shown in Fig. 6. All calculations of the energy required for various duct sizes were based on actual energy measurements in a nonreflecting duct. Some increased output is obtained by increasing the reflectivity of the walls.

To determine the amount of energy necessary for other than a 90-percent survival ratio, the experimental curve in Fig. 1 should be used. For example, to obtain a smaller survival value the ultraviolet wattage obtained for 90-percent disinfection should be multiplied by a correction factor; for 95-percent kill, this is 1.8; for 98-percent kill, 3.0; and for 99-percent kill, 3.5.

In the average installation, a 90-percent kill is recom-

(please turn to page 66)



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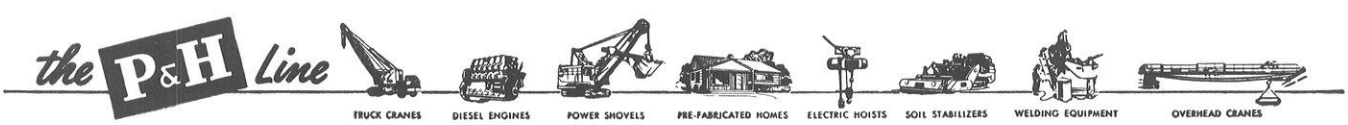

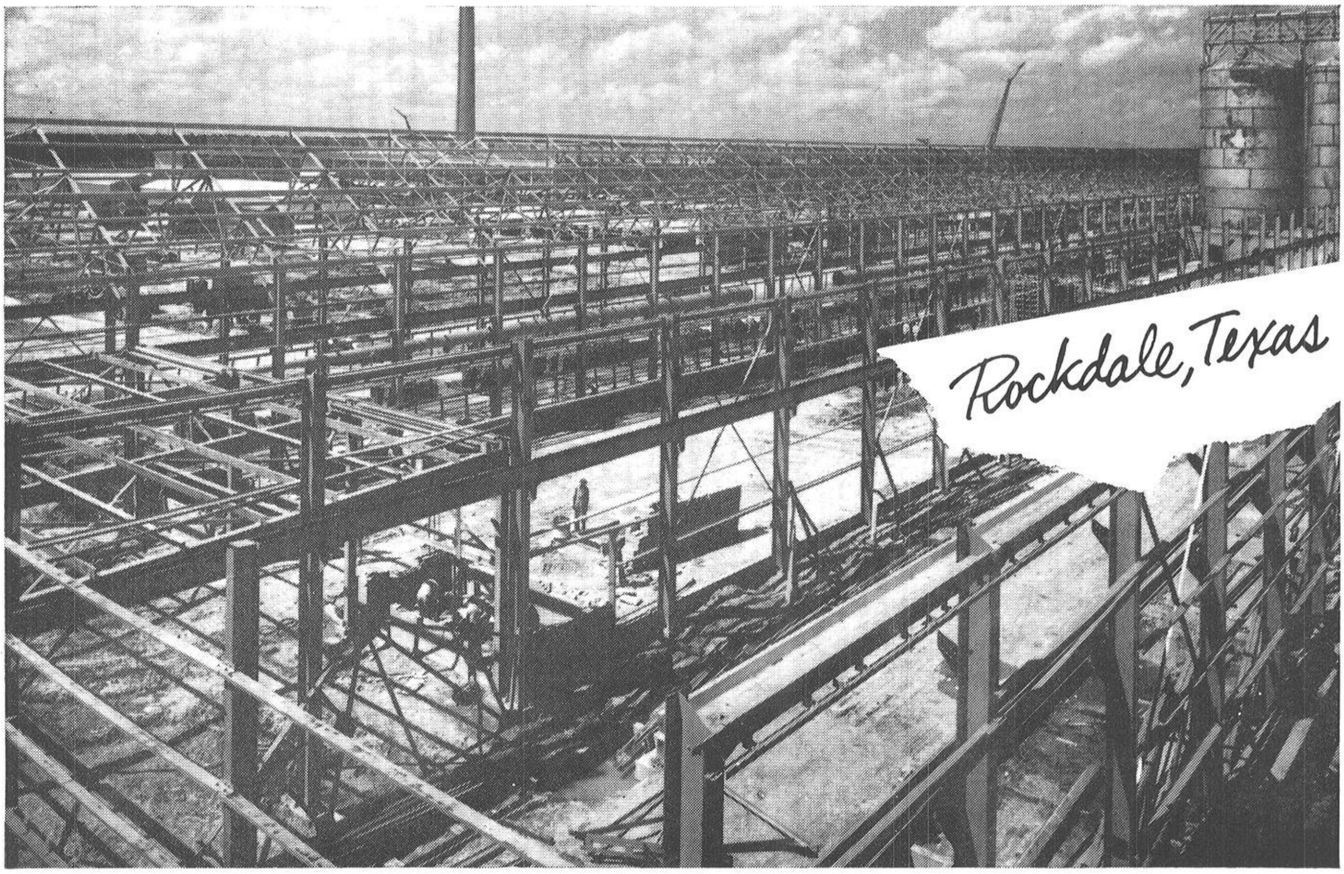

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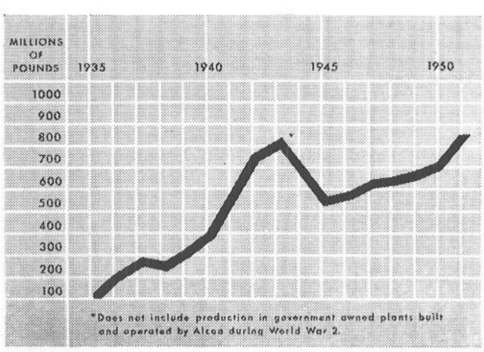
This is a production chart—shows the millions of pounds of aluminum produced by Alcoa each year between 1935 and 1951. Good men



did good work to create this record. You can work with these same men, learn from them and qualify yourself for continually developing opportunities. And that production curve is still rising, we're still expanding, and opportunities for young men joining us now are almost limitless.

Ever-expanding Alcoa needs engineers, metallurgists, and technically minded "laymen" for production, research and sales positions. If you graduate soon, if you want to be with a dynamic company that's "going places," get in touch with us. Benefits are many; stability is a matter of proud record; *opportunities are unlimited.*

For more facts, consult your Placement Director.

Alcoa Aluminum

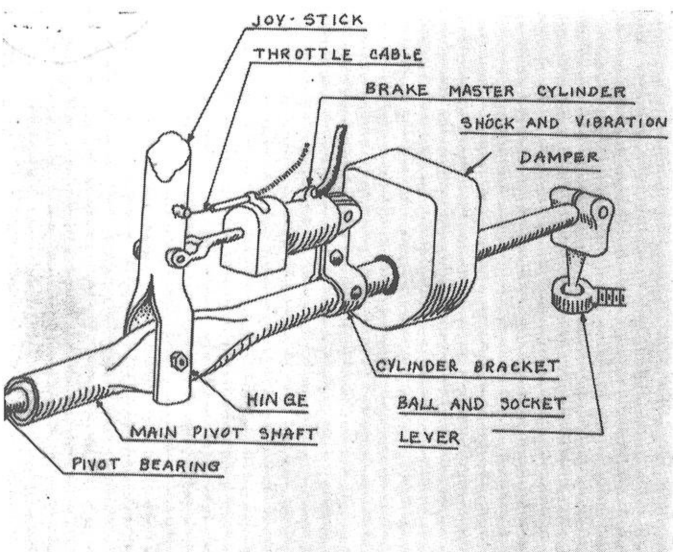
ALUMINUM COMPANY OF AMERICA

Joy Stick Control - -

(*continued from page 15*)

used in a car equipped with an automatic transmission not requiring a clutch pedal and with hydraulic controls suited to remote operation.

Coarse Steering—Another disadvantage, one that can be partly overcome, is the coarseness of the steering. Coarse steering means that a small sideways movement of the stick would produce large turn in the car. This could be dangerous at high speeds. However, the same damping device used to prevent road shocks from reaching the stick could also reduce the rate at which the stick could be moved. Something similar to a hydraulic shock obsorber would provide the limiting control.



DETAILS OF JOY-STICK UNIVERSAL MOUNTING AND ACCESSORIES

Change of Driving Habits The greatest deterrent to the acceptance of the joy-stick would be the motorist's resistance to radical change. The substitution of the joy-stick for the steering wheel would require him to learn new driving habits. A great deal of education and promotion would have to be done to convince the buyer that the safety and savings are worth the change. The serious disadvantages have to be eliminated. The advantages must outweigh the minor disadvantages and inconveniences. However, the simplicity and naturalness of operation should cause ready acceptance once the buyer has driven in a car equipped with the joy-stick.

CONTROL HEAD

Description The head of the stick, which is a yoke with a cross-bar about an inch down from the top, contains the electrical controls for the horn, directional signals and automatic drive selector. The sides of the yoke have handgrips moulded into them. The horn "ring" is either part of the cross-bar or a wire rod behind the cross-bar. The upper tips of the yoke are the buttons for the directional signals. At the bottom of the yoke there is either a row of buttons or a small segment wheel to select

(*please turn to page 68*)

Ultraviolet Radiation - -

(*continued from page 62*)

mended. This is usually equivalent to outside fresh air. such a rate of air sanitization is used in most installations to protect personnel from cross-infection. In some installations, howver, such as hospitals and pharmaceutical laboratories where absolute sterility is often necessary, the highest degree of bacteriological reduction possible is most desirable—at least 98 percent. In these installations the number of lamps in the air-conditioning system is simply increased, using the aforementioned curves (Fig. 1) as a guide.

One method of controlling odors emanating from air-conditioning systems, from the products in the room or

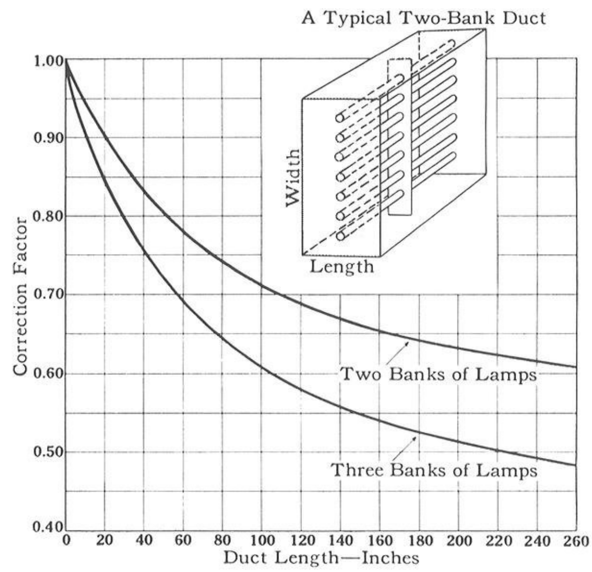


Fig. 6 The correction factor used with Fig. 5 for calculation of air ducts having two or three banks of lamps.

from the personnel themselves, is by ventilation. That is, about ten-percent outside air is mixed with the recirculated air to impart some "freshness" to the indoor atmosphere. Ozone can oxidize many odors. This form of oxygen (O_3) is found in outside air at an average concentration of approximately 0.025 parts per million by weight. Ozone greatly contributes to the "freshness' of clean outside air. However, ozone is a very unstable molecule, reverting to oxygen (O_2) on making contact with organic matter or surfaces, so that little, if any, ozone is ever found indoors. It is possible now to make Sterilamps that produce controlled amounts of pure ozone. These lamps can be combined with non-ozone types in air-conditioning systems to supply ozone concentrations comparable to those found in outdoor atmosphere and thus destroy odors in addition to sterilizing the air.

Thus, using the ultraviolet radiation, indoor air can be sanitized and deodorized merely by installing Sterilamps in air-conditioning systems. The proper design of the duct installation is relatively simple and results are highly efficient in removing bacteria from the air.

Joy Stick Control - -

(continued from page 66)

and indicate the setting of the automatic transmission. Buttons make selection easier and faster but the wheel lessens the chance of accidentally changing the setting.

One Hand Operation The joy-stick can be operated by one hand in almost every situation with all the firmness expected from two-hand driving with a steering wheel. In all the maneuvers it is never necessary to change the grasp, as must be done when the steering wheel is rotated. Two-hand operation might be required for close parking or when driving over very rough roads unless power steering is used.

One-hand operation provides safe control under the conditions when the driver might be adjusting the car radio or lighting a cigarette. It means that the driver has one free hand to use to operate the controls on the instrument panel. Because the driver does not have to change his grip when he make sharp turns, he always has control, and is never caught with his arms in an awkward position when an emergency requires quick steering.

CONCLUSIONS

The Joy-stick type of control is highly recommended if it is used in its most complete form, with power steering and a vibration and shock damper. If it can be used with only the damper, which is also the rate-of-turn limiter, without the steering effort becoming excessive, then this unit would be in a very favorable position with respect to cost competition. Used without any refinements, the joy-stick is hardly preferable because of the two disadvantages of coarse steering and excessive turning and parking effort required.

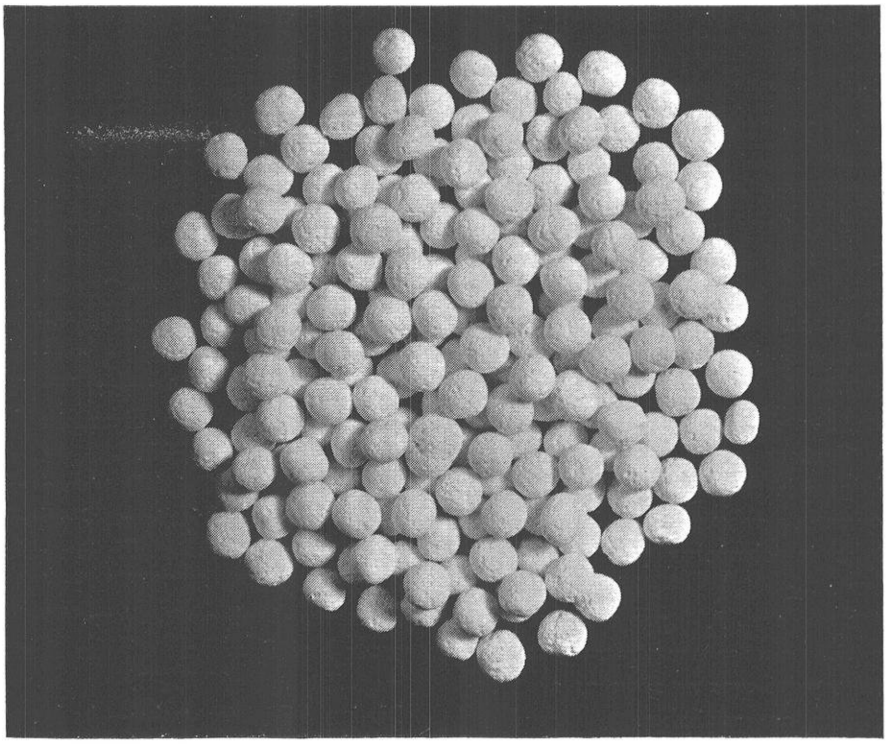
The difficulty found in winning public acceptance will depend greatly upon the initial refinement of the unit. All other disadvantages and inconveniences must be accounted for and eliminated. The product can then be sold by pointing out that because it is new and different it offers many safety features and savings.

What Are These Spheres?

☐ *Catalyst Supports*

☐ *Moth Balls*

☐ *Abrasive Grains*



They are catalyst supports — Norton refractory products made of chemically inert, heat-resistant, wear-resistant materials for use as catalytic carriers in chemical processes. Pictured in spherical shape here, they are also available as pellets and rings.

Composition and Properties

These supports are commercially available in ALUNDUM* (fused alpha alumina) mixtures varying from 77% to 89% alumina with silica as the principal impurity. In addition to their refractoriness, they are chemically inert, mechanically strong and wear-resistant.

Water absorption values of these supports vary from 12% to 22% by weight. Surface areas by the nitrogen absorption method range up to about one square meter per gram. Crushing strengths vary from 20 to 600 pounds, depending on size and shape, and bulk densities range from 60 to 80 pounds per cubic foot.

Many Refractory Products

Catalyst supports are but one of many refractory products made by Norton. These include small furnace refractories such as tubes, cores and muffles; large furnace refractories such as bricks, plates, muffles and other shapes; refractory cements; refractory laboratory ware; kiln furniture for ceramic plants.

In its search for refractory products that can be used at higher and higher temperatures, Norton has developed a line of pure oxide refractories. These refractory shapes, as their name implies, are molded without bond and then fired at sufficiently high temperatures to produce a truly sintered product.

The principal raw materials used in the manufacture of Norton pure oxide refractories are ALUNDUM (fused alumina), MAGNORITE* (fused magnesia), fused stabilized ZIRCONIA and. to a limited degree, fused thoria.

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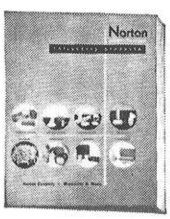

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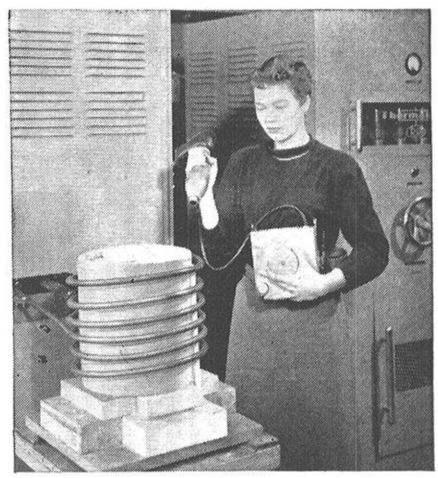

Norma L. Gullberg, A.B., Chemistry, Clark University '46, takes a reading with an optical pyrometer on a high temperature furnace used for catalyst support tests.

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On the Campus - -

(continued from page 28)

sec.; Lonay Nelson, treas.; Canden K. Nelson, chm., program comm.; Thomas Elbert, chm., tools and equipment comm.; Paul Padrutt is also chairman of the shop and facilities committee. Other sub-committees are finance and Engineering Exposition committees.

The group plans a display for the Engineering Exposition to be held on April 9 through 11.

Contact with wholesale parts houses is contemplated and should provide a substantial saving to members in obtaining parts for their cars.

Dues are $2.00 per semester with a $3.00 charge per semester, for garage privileges as soon as such facilities are available.

The officers would like to emphasize that owning a car is not necessary prior to becoming a member of the Automobile Club. Anyone with information and resources is encouraged to join.

W.S.P.E. - -

(continued from page 42)

ed as Membership Chairman of the Northwest Chapter 1950-1951 and as President in 1952.

Mr. Genisot is President of the Genisot Engineering Company, of Rhinelander. He served as engineer with the State Highway Commission of Wisconsin for 10 years and has had his own engineering organization for the last 15 years. He is a past President of the Wisconsin Valley Chapter of WSPE.

Mr. Lord is Chief Engineer and Director of the Madison Metropolitan Sewerage District. He is a member of ASCE, CSSIWA and the Technical Club of Madison. He has served as President of the Southwest Chapter of WSPE.

National Representative—Arthur G. Behling, Edwin J. Kallevang

Mr. Behling is a Consulting Engineer, Milwaukee. He is a member of the Engineers' Society of Milwaukee. He has served as a member of the Public Relations Committee, 1944; Fees and Salaries Committee, 1945; Chairman, 1946-47, and Director, 1949-50. He is now a National Representative.

Mr. Kallevang is Chief Engineer of Wisconsin Power and Light Company, Madison. He served as appointive Director WSPE in 1946, Chairman of the Committee on Legislation in 1946-47, Second Vice-President in 1948, First Vice-President, 1949, President in 1950-51, and Past President Member of the Board of Directors, 1951-52, member NSPE Public Relations Committee 1951-1952. He is a "Member for Life" of American Institute of Electrical Engineers, a Veteran Member of Wisconsin Utilities Association, and a member of an Engineering Committee of Edison Electric Institute.

Mr. Richard C. Clark will serve the Society as Past President. Holdover Directors are Marcus A. Blakey, Milwaukee and Lester O. Hoganson of Burlington.

The newly elected members will take office on July and serve until July 1st, 1954.

Chairmen - -

(continued from page 37)

tains a good balance in basic courses in the three main mechanical areas: heat power, machine design and production engineering. In the senior year the student may elect additional work in any one or all three of these fields.

Air conditioning, refrigeration, and heating and ventilation, a total of nine credits may be elected as a heat-power option.

Internal combustion and gas turbines and jet propulsion engine courses is also an option in heat-power.

For the student who is interested in design, three advanced courses are offered.

For the production minded student, there are available three advanced courses in industrial engineering.

The mechanical engineering course permits a wide selection of courses in any one of the three application field of design, production and operation of mechanical equipment.

For those students who wish to avoid any tendency toward specialization, a general course may be taken which places more emphasis on a strictly balanced course in all three mechanical engineering fields. Because it is important that a student be trained to take his place in society as well as in his profession, the mechanical engineering curriculum requires that he study English, speech, technical writing, economics, contemporary trends, (world politics and affairs) and human relations for engineers. The mechanical engineering course has sufficient flexibility to permit a student to satisfy any reasonable desire with respect to the subjects to be studied, and for those who want a great amount of so-called liberal education than is permitted in the four-year program, a special five or even a six-year program may be arranged.

Chemical - -

(continued from page 36)

The activities of the chemical engineer include a wide variety of personal talents, as in plant operation, sales and marketing, in process design, in equipment design, and in research and development.

The importance of research is highly stressed in chemical industries where 5 per cent of their entire sales are spent on research and development, as compared with only 1.6 per cent for the average of all industries. The chemical industries spend more than three times as much of their percentage sales in developing new products as other industries. Because of this demand and need for research, a relatively high percentage of chemical engineering students is directed into graduate studies.

Biochemical engineering is an adaptation of the chemical engineering profession to the production of fermentation products, dairy products, beverages, leather, textiles, and pharmaceuticals. These industries are of special importance in Wisconsin.

Civil - -

(continued from page 36)

that of structures. Our population is rapidly increasing and as a result there is continuing demand for more housing, shopping centers, office space, public buildings and other structures of all kinds, both large and small. Many civil engineers are employed as a direct or indirect result of this expansion. They are associated with architects in the design and construction of large steel and concrete buildings, with contractors in planning and building housing developments, and with public agencies in city planning, redevelopment of slum areas, and laying out parks and playgrounds. Most spectacular in the field of structural engineering has been the construction of great bridges over rivers and harbors.

With population growth come also increased demands for hydraulic and sanitary engineers to provide safe and adequate public water supplies, and to build sewage collection systems and treatment plants which will return waste waters to the streams in a form least harmful to wild life and most satisfactory from the standpoint of use of the streams and lakes by the public. Hydraulic and sanitary engineering is part of civil engineering. Hydraulic engineers also design and build flood control works to prevent or reduce damages from the floods that follow intensive storms. They design and build the works necessary to provide adequate channels for the inland water transportation that carries millions of tons of bulk products on our rivers every year. Port facilities and breakwaters must be provided for both inland and ocean navigation. Water power plants are designed by civil engineers and built under their guidance, and in the western part of the country 25 million acres are under irrigation with water brought from lakes and streams through thousands of miles of canals.

Many civil engineers also find work as surveyors. Surveying is one of the first jobs to be done when an engineering project is undertaken. There must be surveys of the sites for bridges, buildings, dams. There must be preliminary and final surveys to aid in determining the most economical and feasible routes for highways and irrigation canals, and for new railway locations that are continually being built to shorten distances between terminals. Such surveys have been greatly speeded in recent years by aerial mapping. Surveyors also locate lot lines and settle disputes between land owners, and determine the boundaries and areas of farms. The proper laying out of new housing and other municipal developments depends largely on detailed surveys of the proposed sites. Many surveyors are also employed in making government topographic maps of the land area of the country and hydrographic maps of lakes and coastlines.

As with any profession, continued growth depends on maintaining an adequate supply of young persons eager and qualified to enter that profession. In general, the usual road to becoming a civil engineer involves training in a college of engineering. Such colleges cannot operate without teachers, and teaching staffs must be drawn from among those engineers who have done well in college and who have also acquired practical experience in the civil engineering field. There are many opportunities these days for young men who are interested in taking graduate work in universities with a view to entering the engineering teaching profession through which the supply of civil engineers can be maintained.

Electrical - -

(continued from page 37)

vices requiring for understanding much imagination along with advanced training in science and mathematics.

At the University of Wisconsin in Madison, our new facilities in the new Engineering Building are among the best in the country. Our course of study has recently been thoroughly revised in keeping with present day trends and thinking in engineering education. It is constantly under surveillance so that improvements can be made from time to time to keep it in step with the needs and demands of industry.

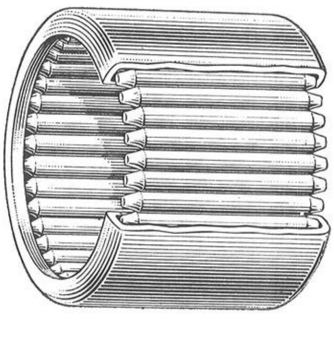
There is a joint student branch of the AIEE-IRE on the campus, with a faculty member in charge as branch councilor. This student branch holds regular meetings and sponsors activities of interest to student engineers. It affords a means for orienting students with regard to professional activities within the AIEE and IRE following graduation.

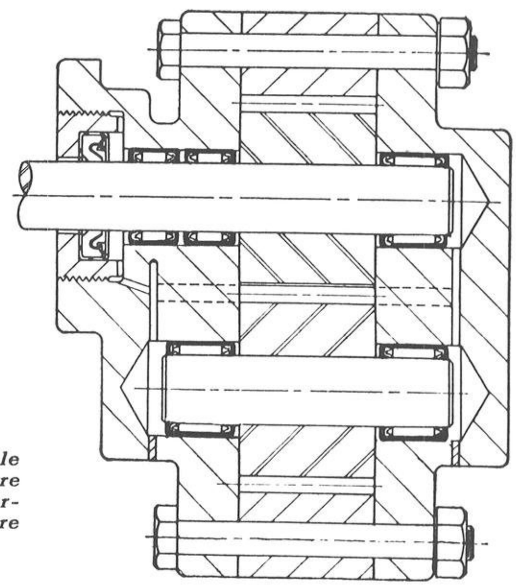
The University of Wisconsin offers excellent opportunities for study leading to the Bachelor of Science (B.S.), Master of Science (M.S.), and Doctor of Philosophy (Ph. D.) degrees in electrical engineering. Students with good high school records and a real interest in mathematics and science would do well to consider the possibilities of enrolling in this course of study which leads to a most interesting professional life, and one which is of basic importance to our economy in time of peace and our security in time of war.

The Torrington Needle Bearing

proper housing design is essential to proper performance

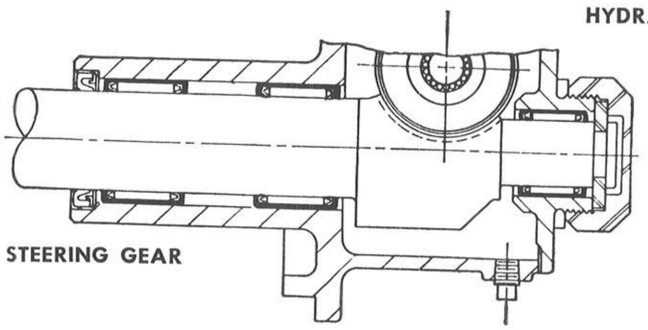
The Torrington Needle Bearing offers many design and operational advantages for a great variety of products and equipment. For example, a Needle Bearing has greater rated radial load capacity in relation to its outside diameter than any other type of anti-friction bearing. It is extremely light in weight. And it is easy to install and lubricate.





Needle Bearings require simple housings. If the housing bores are held to proper size, accurate operation and high radial capacity are assured.

HYDRAULIC PUMP



STEERING GEAR

Housing Maintains Bearing Roundness

The housing is an essential part of the Needle Bearing assembly. Care should be taken to provide a straight, round housing bore to the recommended tolerances.

The thin, surface-hardened outer shell of the Needle Bearing acts as the outer race surface as well as a retainer for the rolls. This shell assumes the shape of the housing into which it is pressed. Consequently, the housing bore should be round, and the housing so designed that it will carry the radial load imposed on the bearing without distortion.

Housing Material Determines Bore Size

The specified housing bore dimensions for any given material should be maintained in order to give the proper running clearance between the needle rollers and the shaft, and to assure sufficient press fit to locate the bearing firmly.

When designing housings of materials that are soft or of low tensile strength, allowance should be made for the plastic flow of the material when the bearing is pressed into place. Bore dimensions in such cases should be less than standard. Needle Bearings can be pressed directly into phenolic or rubber compounds, although metal inserts are recommended.

The new Needle Bearing catalog will be sent on request.

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 • STRAIGHT ROLLER • BALL • NEEDLE ROLLERS

STATIC

BY I. R. DROPS

These jokes approved by the Department of Minors and Morals.

"I wonder what's the matter with our star basketball player—he looks so unhappy."

"It's because his father is always writing him for money."

* * *

Sarge: "I suppose when you get out of the Army you'll be waiting for me to die so you can spit on my grave."

Rookie: "No Sarge. After I shed this uniform, I never want to stand in line again.

* * *

Little Steve, six, was a profanity addict, which caused his mother anguish to no end. One day Steve got an invitation to a playmate's birthday party. As he left the house, his mother's final caution was, "Stephen, I've asked Mrs. Wilson to send you straight home the minute you use one bad word."

Twenty minutes later Steve was back home. His mother was angry. Steve was sent to bed. His attempts at explanation were ignored. A little later, however, his mother softened and went upstairs to see how Steve was taking it.

"Tell me truthfully, Steve, just why Mrs. Wilson sent you home. What did you do." Little Steve, humiliated, but still wrathful, replied: "Do? I didn't do nothing. That party ain't til tomorrow."

* * *

"Mother," began the little girl, "what does transatlantic mean?"

"Across the ocean."

"But, does 'trans' always mean across?"

"Yes, always," said the mother, sternly; "and if you ask me another question tonight, I shall send you right to bed."

After a brief silence, however, the child braved the threatening storm, by remarking: "Then, I suppose transparent means a cross parent."

At the stroke of twelve the irate father stomped to the heads of the stairs and shouted, "Young man, haven't you a self-starter?"

"Don't need one," answered the young suitor, "as long as there's a crank in the house."

* * *

He took her hand in his and gazed proudly at the engagement ring he had placed on her finger only three days before.

"Did your friends admire it?" he inquired tenderly.

"They did more than that," she replied. "Two of them recognized it."

* * *

A Communist was perched atop one of Moscow's highest buildings, contemplating suicide, and a policeman had made his way to the roof to try and persuade the man not to jump. "Think of your mother and father," pleaded the officer.

"Haven't any."

"Think of your wife and children."

"Haven't any."

"Well, think of what your girl friend might think."

"I hate women."

"All right, think of Joseph Stalin."

"Who's he?"

"Go ahead and jump, you damn capitalist."

* * *

Girl: "I said some foolish things to Frank last night."

Girl Friend: "Yes?"

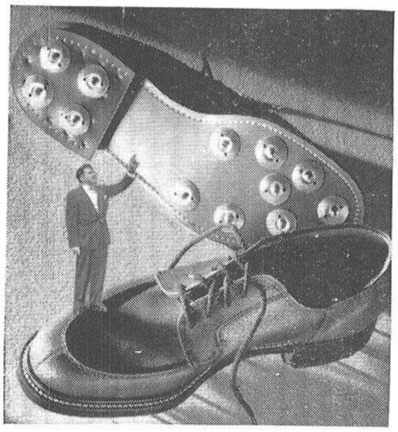
Girl: "That was one of them."

* * *

Tom: "Is my face dirty, or is it my imagination?"

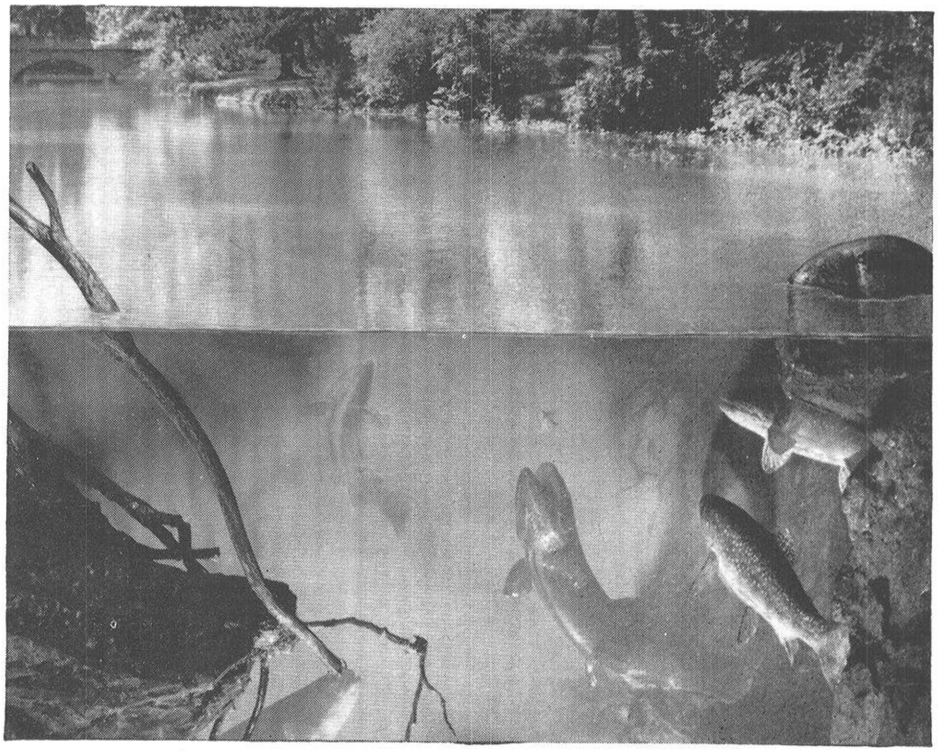
Donna: "Your face is clean. I don't know about your imagination."

Sport is big business thanks to "MAN-MADE MINERALS"



GOLFING FOOT-COMFORT is of prime concern to scores of shoe manufacturers. Coated abrasives by CARBORUNDUM perform a multitude of different finishing operations in the shoe trade.

Made by the Coated Products Division



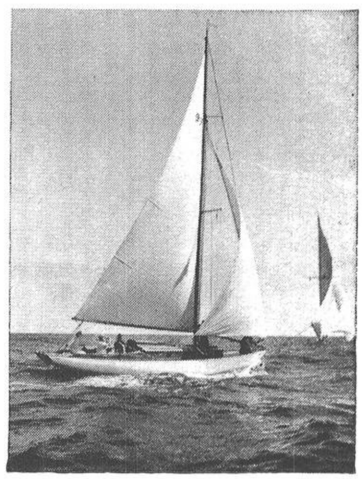
CRYSTAL-CLEAR TROUT STREAMS close by large industrial plants are possible through modern filtration systems utilizing Porous Filter Media. "Man-made minerals" in a special ceramic binder help these systems screen out poisonous wastes to keep streams pure.

Made by the Refractories Division

SUN GLASSES in growing volume are equipped with lenses ground from prescription optical glass—lenses polished to absolute clarity with Abrasive Powders by CARBORUNDUM.

Produced by the Bonded Products and Grain Division

METAL HULLS AND MASTS have provided great impetus to the rapid increase in the sport of sailing. At every stage of manufacture, these metal components are shaped, cut, surfaced and finished with abrasives by CARBORUNDUM. Remember: *only* CARBORUNDUM *offers ALL abrasive products to give you the proper ONE.*



Makers of sporting goods, like producers in a thousand different fields, have been alert to exploit the cost-cutting advantages of the "man-made minerals," silicon carbide and aluminum oxide by CARBORUNDUM. As a result they number their customers in the millions.

"Man-made minerals," in one of their many forms, are at the very heart of mass production of identical, interchangeable parts and sub-assemblies. In another form they are the key to continuous processes, replacing other materials that used to cause costly and frequent shutdowns. Can your manufacturing process use the benefits of... strength, sharpness, hardness, porosity, chemical inertness, resistance to corrosion and abrasion? Continuously, CARBORUNDUM research discovers new ways to make these properties serve industry.

Whether you are a potential customer of CARBORUNDUM or a potential member of our great engineering staff, we welcome your interest—and your inquiries.

Keep your eye on

CARBORUNDUM

TRADE MARK

for significant developments based on "man-made minerals"

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

Products by CARBORUNDUM include Grinding and Cutting-Off Wheels, Discs and Sticks... Coated Abrasive Sheets and Belts... Waterproof Abrasive Paper... Abrasive Grain and Powders and other abrasive products... Electric Heating Elements and Ceramic Resistors... Grain and Briquettes for deoxidizing steel and iron... Super Refractory Bricks, Special Shapes and Cements... Porous Filter Media and Diffusers—and are marketed under the following trademarks:

CARBORUNDUM • ALOXITE • MX • RED-I-CUT • TEXALOX • GLOBAR FERROCARBO • CARBOFRAX • ALFRAX • MONOFRAX • MULLFRAX

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