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WISCONSIN ENGINEER

June, 1946

MBER ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Launching a New Era...

Nearly half a century ago, George Westinghouse developed a revolutionary steam turbine that supplanted the steam engine as a driving force for central station generators.

Always vitally interested in better transportation, Westinghouse quickly realized that here was the *ideal power source* for ship propulsion. Because of its compactness, the steam turbine would permit more space for fuel . . . reduce weight and vibration . . . assure far greater fuel economy.

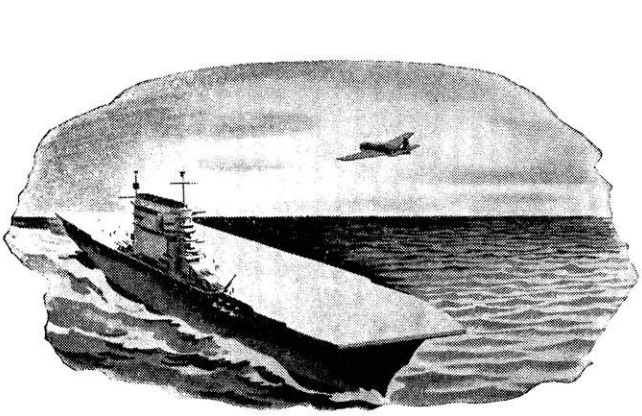
But there was one difficult engineering problem that no one had yet solved—an efficient means for coupling the rapidly whirling turbine shaft with the ship's slow-moving propeller.

George Westinghouse supplied this missing link—with the help of marine experts, Rear Admiral Melville and John H. MacAlpine—by developing the first practical *gear-reduction turbine drive.*

After six long years of study and experiment, Westinghouse built two 3250 horsepower geared turbines which were installed in the collier, U. S. S. Neptune—launched on June 21, 1912.

The trial run was a notable success. It was one of the great achievements of George Westinghouse's remarkable career—*for it initiated a completely new epoch in marine propulsion.*

Westinghouse
PLANTS IN 25 CITIES · OFFICES EVERYWHERE



TODAY—The world's greatest warships and maritime vessels are powered by reduction-geared turbines, pioneered by George Westinghouse in 1912. Many of them are driven by Westinghouse propulsion equipment. Recently, the U. S. Aircraft carrier Lake Champlain crossed the Atlantic at the *record-breaking* average speed of *32.048 knots.* The geared turbines in the Lake Champlain—as well as in all other Essex class carriers—proudly bear the nameplate of the Westinghouse Electric Corporation.

Tune in: JOHN CHARLES THOMAS—*Sunday, 2:30 pm, EDT, NBC* • TED MALONE—*Monday through Friday, 11:45 am, EDT, American Network*

Straight talk about your after-college job

No. 6. An Engineer Needs Enthusiasm

AN ENGINEER gets more enjoyment from his work and does a better job when he can be enthusiastic over his company's achievements and the part he plays in these achievements.

Enthusiasm, we have observed, can make the difference between a good beginning and a poor one in the critical first years of an engineer's career.

We like to point this out to young engineers who are thinking of joining The Timken Roller Bearing Company, because its record of achievement, past and present, is a continual source of inspiration to our engineering staff.

■ As the leading manufacturer of anti-friction bearings for many years, our company is one of the best known in America. Because it has produced bearings for every application needed by industry, its reputation for quality and advanced engineering stands unquestioned everywhere.

The Timken Roller Bearing Company has spent millions in research and development. From the genius of its engineers have come a continual stream of important contributions to many fields of engineering.

■ In such an atmosphere, the enthusiasm of young graduate engineers invariably runs high.

To help them get the best possible start, we operate a "Work-as-You-Learn" Plan of training. The men selected are rotated from department to department, performing productive work all the while. When we are satisfied that they have gained a good basic understanding of our business, they are assigned to a regular line of work.

We are interested now in talking with men who will soon get a degree in Engineering. If you would like to know more about our company and its training plan, write The Timken Roller Bearing Company, Canton 6, Ohio.

The Timken "Work-as-You-Learn" Plan of Training

1. Bearing Manufacture
2. Tapered Roller Bearing Design
3. Industrial Application Engineering
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5. Railway Application Engineering
6. Alloy Steel Production and Sales
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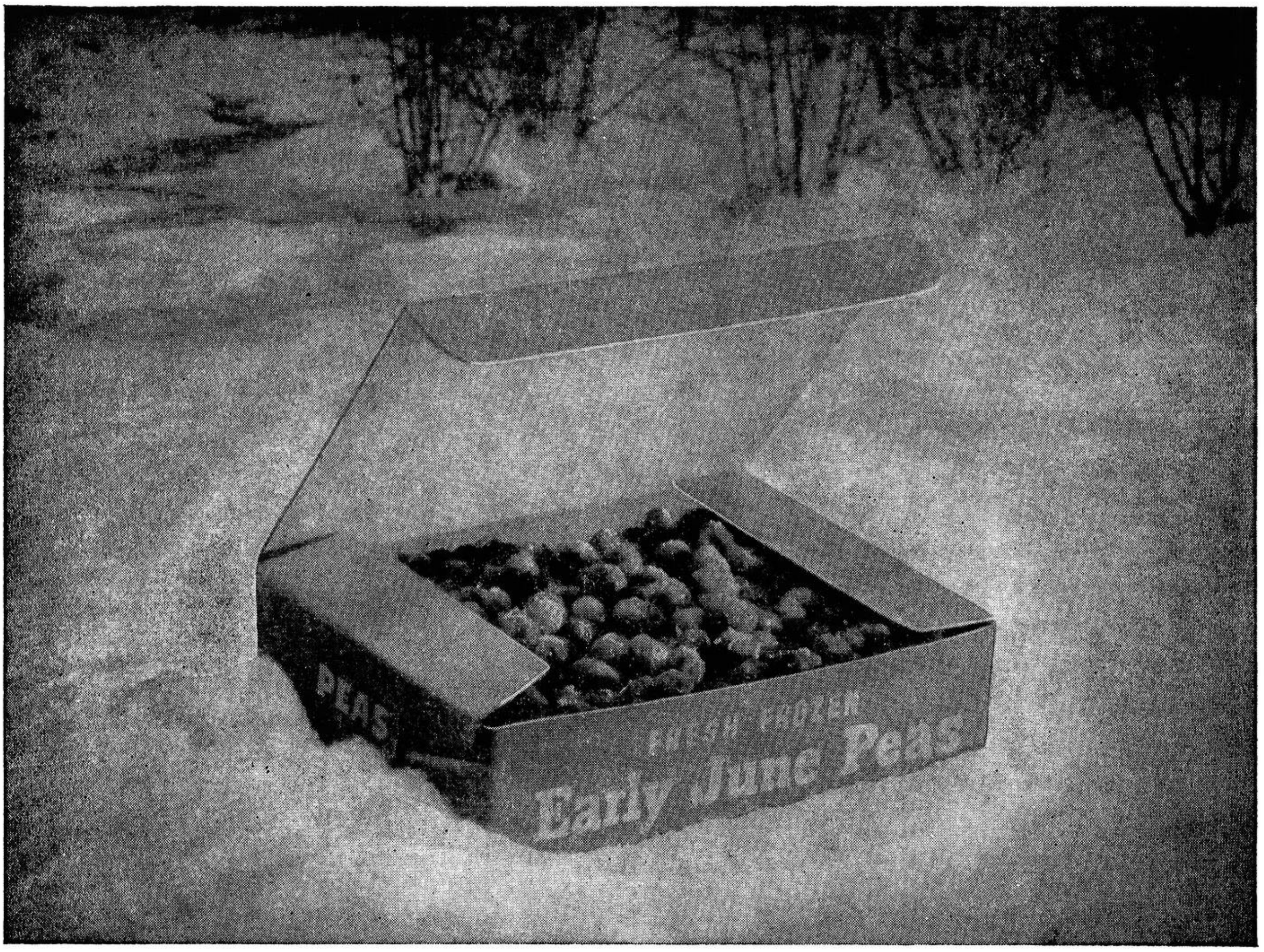
THE TIMKEN ROLLER BEARING COMPANY

PRODUCTS: World's largest manufacturer of *tapered roller bearings.* Specialists and large producers of *fine alloy steels* for industry. Manufacturers of *removable rock bits.* U. S. PLANTS: (All in Ohio) Canton, Columbus, Mount Vernon and Wooster. FOREIGN ASSOCIATE PLANTS: British Timken, Ltd., Birmingham, Wolverhampton, Northampton, England; S. A. Francaise Timken, Asnieres (Seine) France. SALES OFFICES: In principal cities.



A JUNE COLD WAVE THAT *Saves* CROPS!

IT takes cold in *three* forms to capture and hold the fleeting flavor of June peas! (1) They must be chilled and washed under a shower of ice-cold water; (2) subjected to the high-velocity arctic blasts of the fast freezer at sub-zero temperatures; (3) stored under properly controlled temperature conditions awaiting the call of your dealer and their ultimate arrival on your dinner table.

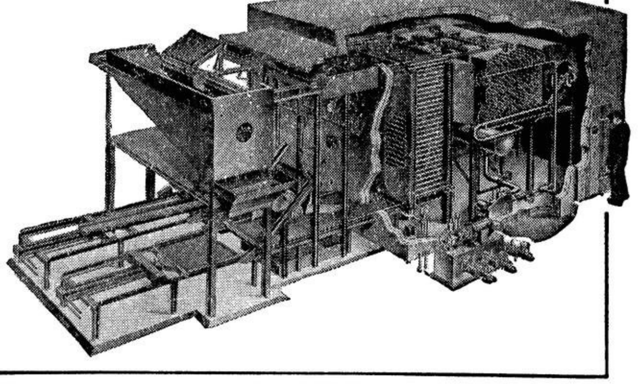
As the technique of freezing has become better and better perfected, one thing is clear. America's desire for fresh frozen foods the year around will not be fully satisfied until they are available through virtually every food merchant in the nation.

• • •

To this end York is applying every facility—engineering and manufacturing—to help processors bring you more varieties and greater quantities of frozen foods.

York Corporation, York, Pennsylvania

More than half the nation's frozen foods are commercially processed by York refrigeration and quick freezing equipment. Illustrated here is the York Continuous Fast Freezer. Compact, completely automatic, sanitary, food is untouched by human hands throughout the entire operating cycle.



YORK *Refrigeration and Air Conditioning*

York refrigeration air conditioning

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

Receiving Atomic Bomb Project award is A. L. Conn, a Standard Oil (Indiana) research worker. Making presentation is Dr. Robert E. Wilson, Chairman of the Board of the company. Others are (left to right) J. K. Roberts, General Manager of Research; Dr. Harold C. Urey, Nobel prize winner and a leader in atomic bomb research; A. W. Peake, President of the company; Dr. R. E. Humphreys, former head of manufacturing and a famous chemist, and Dr. M. G. Paulus, Vice President in charge of manufacturing.

What they did they aren't telling

The above picture shows a notable moment in the history of petroleum research. A. L. Conn, representing a special Research Department group of Standard Oil Company, has just received a framed certificate from Dr. Robert E. Wilson, Chairman of the Board of the company.

The certificate reads:

An Award for
Chemical Engineering Achievement
to
Standard Oil Company (Indiana)
In recognition of its unique
and meritorious contribution
to the
Atomic Bomb Project
A great military and industrial accomplishment made possible by a patriotic pooling of the scientific knowledge and engineering experience of American industries and universities in the research and development, design, construction and operation of manufacturing facilities under the direction of the
Manhattan Engineer District
Corps of Engineers, U. S. Army
Presented by
Chemical and Metallurgical
Engineering
February 26, 1946

Dr. Wilson had previously received the certificate in a ceremony in New York at which Chemical and Metallurgical Engineering's seventh biennial award for chemical engineering achievement was divided among many companies which had a part in the atomic energy work.

Much was said at the Whiting presentation about atomic energy in general, but not one word about what the Standard of Indiana research workers did. That is still a secret.

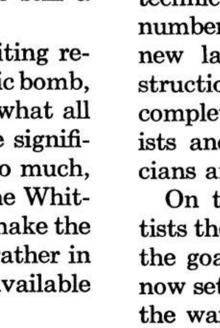
Whatever it was the Whiting researchers did about the atomic bomb, it was only a small part of what all American industry did. The significance of the picture is not so much, therefore, in the fact that the Whiting group did something to make the atomic bomb possible, but rather in the fact that this aid was available when the nation needed it.

When the armed forces suddenly needed scientific work of an unusually high order, the laboratories of American industry, developed in a competitive economy under a system of free enterprise, stood ready to do the job. Technical skills built up through years of research were available. No comparable job was done in the government-dominated laboratories of any totalitarian power.

Dynamic Research

Here in the midwestern part of the United States is a research institution capable of attacking a great variety of problems in petroleum chemistry. Its personnel totals 200 scientists and about twice that many technicians and assistants. And their number is growing. When the great new laboratories now under construction in Hammond, Indiana, are completed they will house 420 chemists and engineers and 800 technicians and helpers.

On the threshold of what scientists themselves regard as a new age, the goals of petroleum research are now set beyond the achievements of the war years. Where experimentation may lead, no one fully knows, for it is the nature of research to pioneer into the unknown. These research workers will follow their great opportunity wherever the stream of development may lead.



STANDARD OIL COMPANY
(Indiana)

Off to a good start

JOE always had definite ideas about marriage. At the garage where he worked before doing his hitch with Uncle Sam, he used to tell the boys: "I got it figured out. Wives are like piston rings. Get yourself the right one to start with, and you got nothing to worry about!"

So now Joe is off to a good start.

And any engine . . . whether in a bus, truck, locomotive, ship, airplane or passenger car . . . is off to a good start for smooth, economical performance if it's equipped with Koppers American Hammered Piston Rings.

These rings incorporate today many improvements and refinements developed by Koppers during the war. They have proved themselves able to withstand successfully the terrific heats, the tremendous explosive forces, the constant wear and tear and grueling punishment that piston rings must take in an engine. And their use assures many thousands of additional miles of service between engine overhauls.

To the manufacture of piston rings, Koppers brings the same engineering background, the same accumulated skills and knowledge as it does to the design and building of coke ovens; to the pressure-treatment of millions of feet of lumber every week; to the making of couplings, propellers, road surfacing and roofing materials.

It is this engineering and chemical skill, applied to almost every major field of endeavor, which has made Koppers "the industry that serves all industry." Koppers Company, Inc., Pittsburgh 19, Pa.

The industry that serves all industry

KOPPERS

WISCONSIN ENGINEER

Founded 1896

Volume 50 — JUNE, 1946 — Number ~~9~~ 10

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In This Issue . . .

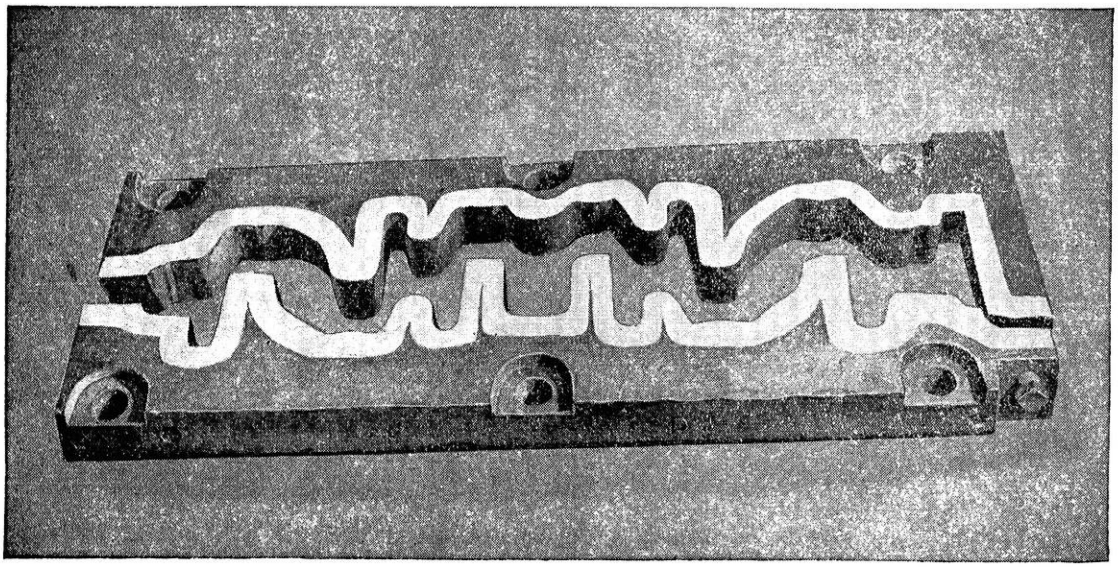
COVER:

Most powerful single-unit of its type is this 3,000-h.p. Diesel-electric locomotive built by the Baldwin Locomotive Works and Westinghouse for fast-freight service on the Seaboard Air Line Railway.

—Courtesy Westinghouse

HAYNES STELLITE

Makes Dies Last Longer and Saves Refitting Time



This crankshaft trimming die is hard-faced at points of wear with HAYNES STELLITE. It trimmed from 150,000 to 155,000 pieces before it was returned to the die shop for touching up. Before the practice of hard-facing these trimming dies was adopted, they produced less than 500 pieces before it was necessary to refit them.

HAYNES STELLITE increases the life of all types of dies because it resists abrasive wear even on hot work. Maintenance costs are reduced—as dies have to be changed less frequently, and, also, you can refit a hard faced die in less time than is required for refitting a plain steel die.

For further information on savings that can be made by hard-facing with HAYNES alloys, write for the 100-page book, "Hard-Facing With Haynes Stellite Products."

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LIGHT METALS

by R. J. Meisekothen, ch'46

THE post-war possibility of a total national output of two billion pounds of aluminum a year is raising some eal problems today with the nation's economic plan-ers in general. How to maintain and utilize the greatly xpanded production capacity of aluminum and its light-etal twin, magnesium, is a big question for post-war lanners.

The before-and-after annual production capacity of all Jnited States plants is shown by the following compari-ons:

Aluminum	
Before the war	160,000 tons
Present capacity	1,250,000 tons
Magnesium	
Before the war	3,000 tons
Present capacity	300,000 tons
Steel	
Before the war	60,000,000 tons
Present capacity	90,000,000 tons

Thus with an increase of from six to eight times in luminum capacity and a hundredfold gain in magnesium apacity there was a step-up of only one-half in steel fa-ilities.

Studies of the anticipated market for aluminum during eacetime foresee a demand for only 450,000 tons of the irgin metal plus 300,000 tons of the secondary or reused upplies. This means that light metal producers must find way of bridging the gap between the 1,250,000 tons of ossible supply and the present estimate of 450,000 tons emanded.

This condition offers a challenge to the engineering lent of America and we should see some interesting de-elopments in the near future. The potential supplies of luminum and magnesium are so nearly unlimited that ey stretch the imagination.

On existing evidence aluminum and magnesium togeth-r do not figure to replace steel as the basic metal of indus-y. At the same time the light metal producers confi-ently expect that their production curve, perhaps after brief post-war setback, will continue its upward trend achieve second place after steel, in a post-war world at seems sure to make use of all metals as well as of the emically produced raw materials such as synthetic rub-er, plastic, nylon, and others still incubating in wartime st tubes.

About 90% of the aluminum producers' wartime output as allocated to the aircraft builders. A four engine bomber of the B-29 type contains 17½ tons of aluminum. Three-fourths of the weight of a plane is aluminum. Naturally aircraft are not being forgotten in the post-war planning of the aluminum companies. They foresee a long period of commercial expansion ahead comparable to that of the automobile industry from 1918-1943.

Passenger car applications of aluminum make another chapter in the post-war possibilities of aluminum. Weight saving arguments appeal even more quickly to truck and bus builders. To the commercial carriers, each pound of weight saved means a pound can be added to the payload. For this reason considerable work has been done in efforts to engineer aluminum alloys into truck and bus parts. One promising application is the rear axle assembly. Its entire weight is "unsprung" or dead weight. For good riding qualities, especially when light loads are to be carried, a low ratio of "unsprung" weight is held desirable. So the possibility of saving from 40% to 50% of the axle assembly weight gets serious consideration.

Another mode of transportation that looks to aluminum for future designs is the railroad with its light-weight streamlined trains.

Aluminum is finding many other applications, which are important though not so spectacular. The beer industry uses aluminum for beer barrels and aluminum foil for beer bottle labels. One company figures that if processes now in use live up to expectations, aluminum could be bonded to steel, perhaps to replace tin in the canning industry. Aluminum foil is being bonded to cardboard for packaging foods for overseas shipments.

Aluminum can be anodized (surfaced with a protective coating of the oxide) in various colors, a fact which interests costume jewelers and makers of decorative hardware. It can be drawn so fine that a pound of aluminum thread can be made to reach seven miles. This quality can be used in decorative insertions for draperies, table linen and other textiles. And the idea of aluminum cloth shoes is not fantastic enough to startle the designers of women's apparel.

Aluminum foil of uniform thinness is important to radio and sound detection equipment. In the last six months processes have been developed for rolling aluminum so thin that it makes 60,000 square inches to the pound. It can be slit 64 times per inch after rolling, and the resulting strips would reach a theoretical 64 miles a pound.

(continued on page 20)

THE ISOLATION OF MECHANICAL VIBRATION

THE results of mounting an assembly subject to vibration on flexible supports (such as steel springs) can be very confusing. If the engineer proceeds without an elementary knowledge of the theory of vibration control such mountings may be of no value or may very well be worse than useless. It may happen that dangerous amplitudes of vibration will be built up if guess-work is employed. A study of what happens in the ideal case will be of value.

Assume we have a mass subject to vibration of a certain frequency. In an attempt to isolate the mass from the vibration we mount it on a flexible material in such a way that the mass can vibrate freely in the up and down direction. There are two frequencies which have to be considered. One of the frequencies is that of the disturbing force. It is at this frequency that both the support and the mass which we wish to isolate are vibrating. The other frequency is the "natural frequency" of the mounted system. This natural frequency depends on the mass that is being supported and the stiffness of the flexible support. Two points are to be noted: The mass does not have a natural frequency itself, and the natural frequency can be changed by using different kinds of supports.

The natural frequency can be calculated by means of this formula:

$$f_n = 187.6\sqrt{k/W}$$
(CPM)

Where k is the stiffness of the springs in pounds per inch.

W is the weight in pounds of the assembly being supported.

If the stiffness of the supports is not known, the deflection of the supports can be observed when the mass is lowered on them. In this case the frequency is given by this formula:

$$f_n(\text{CPM}) = 187.6/\sqrt{d}$$

Where d is the deflection in inches.

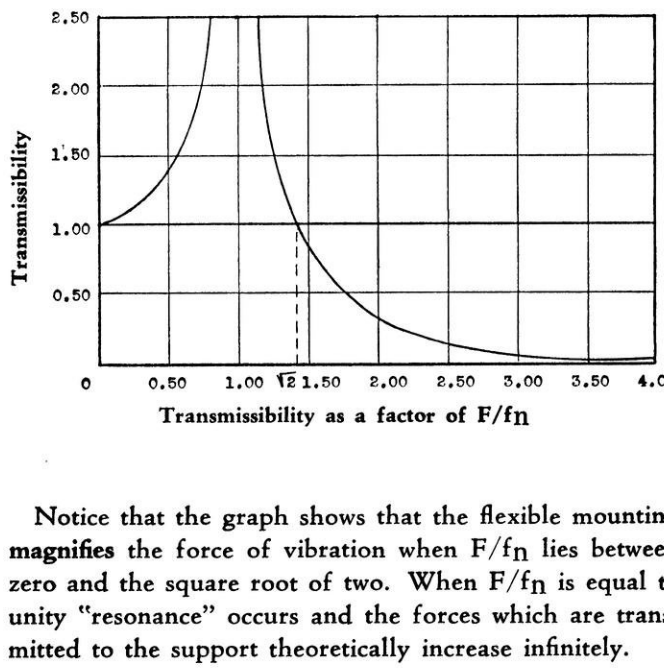
There are many materials which can effectively serve as vibration absorbers if properly used. The more common are steel springs, rubber, and cork.

The ratio of the force transmitted to the supporting structure to the vibration force is called "transmissibility" and is a convenient measure of the efficiency of the absorbing system. The lower the transmissibility the highe[r] the efficiency.

$$\text{Transmissibility} = \left| \frac{1}{\frac{F^2}{f^2_n} - 1} \right|$$

Where F is the frequency of the disturbing force.

f_n is the natural frequency of the system.



Transmissibility as a factor of F/f_n

Notice that the graph shows that the flexible mountin[g] **magnifies** the force of vibration when F/f_n lies betwee[n] zero and the square root of two. When F/f_n is equal t[o] unity "resonance" occurs and the forces which are trans[s]mitted to the support theoretically increase infinitely.

But the purpose of mounting a machine on flexibl[e] mounts is reduction of the transmitted force. This can b[e] accomplished by making F/f_n large. Because F, the fre[-]quency of the disturbing force, usually cannot be changed, f_n is made small. This is done by using soft springs. (A soft spring would have a low k and a large d.) It is i[n] this region, where F/f_n is greater than the square root o[f] two, that flexible mounting is of value.

Every situation where vibration control is to be em[-]ployed should be viewed as a separate problem. In th[e] case of a machine having a mass rotating off center, th[e] source of the disturbing force is in the machine itsel[f]

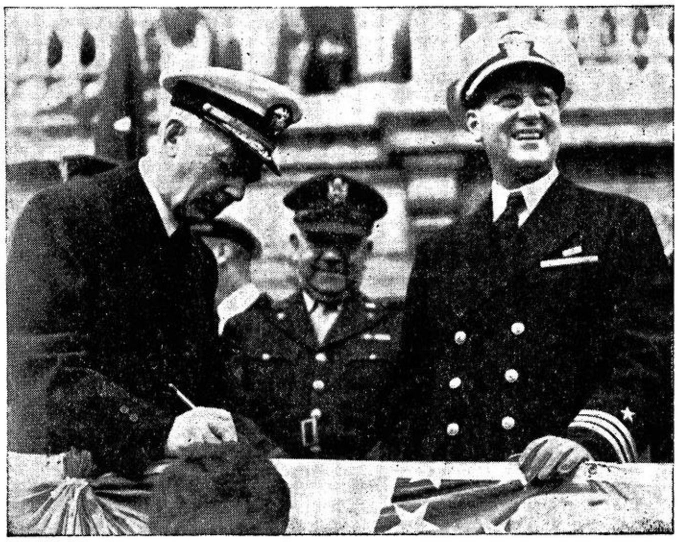
(continued on page 24)

Returning Faculty

Prof. R. A. ROSE

by R. Simonds, e'46

ONE of the last of the engineering faculty to return from military service is R. A. Rose of the Mechanical Engineering Department. Mr. Rose returned to the teaching staff in March, 1946 after serving with the Navy for four years. This makes the second time he has had to give up civilian pursuits and go to war. He also served in the Navy in World War I.



Commander Rose with Admiral Leahy

To most of us not much is known of the life and work of Mr. Rose since he was away when most of us started college, but his has been a full and varied life. He was born on February 5, 1896 at Mankato, Minnesota, where he received his primary schooling, graduating from high school in 1914. From 1914 to 1917 he majored in engineering at the University of Wisconsin. The entry of the United States into the World War in 1917 interrupted his schooling and he enlisted in the regular navy. On completion of his course in the Navy's Electrical School he qualified as an Electrician's Mate, Chief Machinist's Mate, and later as a Warrant Machinist. As Warrant Machinist he served overseas as a Junior Officer on the USS Wathena. Later he attended and graduated from Officer's Steam and Engineering School and was commissioned as an Ensign.

In the interim between wars, Mr. Rose remained active in the Naval Reserve, while continuing with his work in Mechanical Engineering as a civilian. Immediately after the war he spent three years with General Electric where he did work on the development of powdered coal experimental equipment, tested turbo-generators, centrifugal air compressors, air ejectors and turbo-superchargers.

In 1922 he joined the staff of the Steam and Gas Engineering Department at the University of Wisconsin where he remained until he returned to active duty with the Navy on March 1, 1941. It was after he came to the University of Wisconsin that Mr. Rose became interested in diesel engines. He was one of the first men in this country to do research on this type of engine. Diesel engines remained his chief interest throughout his stay at Wisconsin although he has made some excursions into the fields of heating and ventilating and steam power.

One of Mr. Rose's most outstanding jobs of research was his work on photo-electric combustion analysis. In order to complete this research it was necessary to devise an aluminum drum 11.4 inches in diameter by 20 inches long on which was mounted supersensitive plenachrome sheet film. The research included the use of 28 different types of fuels and pictures were made of each minute action in the cycle of the combustion of the various fuels. By photographing the combustion cycles on such a large drum the stages in combustion could be measured down to 1/100,000 of a second.

Because of his valuable and extensive research work, Mr. Rose was listed in "Who's Who in Engineering" in 1937.

While carrying on this busy schedule of teaching and research Mr. Rose remained active in the Naval Reserve. During summer vacations he cruised with the Naval Reserve, serving as Chief Engineer on the USS Wilmington and the USS Paducah as well as Assistant Engineering Officer on the USS Arkansas and the USS Dubuque. In 1925 he was promoted to Lieutenant (junior grade), to full Lieutenant in 1929 and in 1939 he was advanced to Lieutenant Commander, which rank he held when called to active duty in 1941. On March 1, 1941 he reported aboard the ammunition ship, USS Kilauea, as Chief Engineer. While serving aboard the Kilauea he was advanced to full Commander. On January 1, 1943 he was transferred to the Naval Training Schools at Richmond, Virginia, as commanding officer of that station. This school

(continued on page 16)

GRADUATING EXECUTIVES

JUNE HARTNELL

Graduating this semester is June Hartnell, who for five semesters directed the editorial policies of the

Wisconsin Engineer. Prior to that time, she served as Assistant Editor. This fair young damsel, who hails from the proud town of Salem, Wisconsin, graduated from Wilmot High School as Valedictorian in 1943.

Since her arrival at Wisconsin she has diligently pursued her course in Electrical Engineering. However, her activities, in spite of a 2.70 average, have not been limited to the classroom.

She is a member of the University Band, Hoofers, AIEE, and Sigma Kappa. In her sophomore year she was initiated into Sigma Epsilon Sigma and this year into Phi Kappa Phi. June is also an honorary member of Tau Beta Pi.

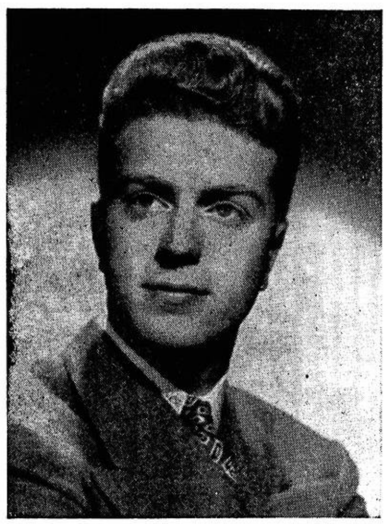
As yet, June has not decided what to do upon graduation. (Ed. note: Prof. Watson gives her three years to stay single.)

JOHN THUERMAN

John H. Thuerman, retiring business manager of the Wisconsin Engineer, is a product of the 1942 class of Wauwatosa High School.

During his stay with the Engineer, John worked as advertising and business managers.

Other activities besides the Engineer have taken much of his time



while in school. John was affiliated with MESW and served as vice-president of the organization in his senior year. He was on Polygon Board for whom he managed the St. Pat's dance this year. During his junior and senior years the varsity golf team claimed a good bit of his time.

Upon graduation, John intends to work for the Chain Belt Company of Milwaukee.

MILDRED SMITH

Mildred Smith, just call her "Millie," M.E. graduating student, is bowing out as the Circulation Manager of the Engineer. During her year of service on the magazine she collaborated in covering campus activities in "Campus Hi-Lites" and "Society Doings," before she took charge of the circulation department.

Taking an active part in the MESW, being Secretary and Treasurer, a member of SAE, plus membership on a great variety of Union Committees including the original "Campacabana" Committee, covers her social activities quite well. For sports she excels in the less energetic department such as sun bathing and riding in a sailboat.

With all these activities Millie found time to make a distinctive scholastic record, winning sophomore honors, elected a Wisconsin Alumni Foundation Fellowship, and a culminating election to Phi Kappa Phi, National Honorary Activities Society.

ELECTRONIC INSTRUMENTATION FOR DIESEL ENGINES

by E. S. Buffa, m'47

THE increased use of electronics in every field of engineering is becoming more evident every day. We hardly expect to see a new piece of equipment that does not contain a vacuum tube.

An excellent example is the development of electronic instrumentation for Diesel engines at the University of Wisconsin, by Philip Myers and Otto Uyehara, working under Professor L. A. Wilson and Professor K. M. Watson. Uyehara and Myers have devised a system whereby instantaneous values of combustion temperature, cylinder pressure, time of fuel injection, and the beginning and end of combustion may be seen as continuous graphs on four cathode-ray oscilloscopes.

The combustion temperatures, which in the past has been an unobtainable item of data, depends upon Wein's Law in the Electro-Optical Pyrometer. The equation stating Wein's Law is used in a form which involves two apparent temperatures at two different wave lengths, a true temperature, and a value of flame thickness and sootiness. The radiation from the hot carbon particles in the cylinder is conducted through a quartz window in the cylinder head, through a lens and a prism system. The prism spreads the spectrum out into its different frequency components. Two different wave lengths of radiation can thus be picked up with the use of two photo-electric tubes which have in front of them shields with narrow slits in them, so that only a small portion of the spectrum is admitted to each photo-electric tube. The voltage generated by the photo-electric tubes will be proportional to the monochromatic intensity of radiation from the quartz window. The two voltages are amplified through two stages of amplification, to give the desired sensitivity, and applied to the vertical plates of two cathode-ray oscilloscopes. The horizontal plates have a sweep voltage applied to them that will move the spot across the screen at a uniform rate corresponding to a given portion of the engine cycle, there being a complete sweep for each revolution of the engine. Thus the values of the two apparent temperatures may be obtained for any given crank. Then by referring to the Wein's Law equation, involving the two apparent temperatures, the true temperature of combustion can be determined.

In order to transform the changes in pressure into changes in voltage so that the cylinder pressure variations can be shown on an oscilloscope screen, a thin metal diaphragm was placed in the cylinder head. The diaphragm will then bulge more or less depending upon the magnitude of the pressure in the cylinder. The outside surface of the diaphragm is polished so that it will reflect light efficiently. A lens then parallels light from a source and the light reflects at an angle from the surface of a partially silvered mirror and strikes the polished diaphragm at right angles. It reflects back along its original path to the mirror where part of the light is allowed to pass through the mirror, since it is partially silvered, and to another photo-electric tube. A limiting shield is placed in front of the light sensitive tube so that engine vibration will not change the amount of light that strikes the photo tube. It may be seen that as the pressure in the cylinder increases the diaphragm will bulge more, and due to an increased angle of reflection some of the reflected light will be thrown out of the path of the mirror and so less light will be impinging upon the photo tube. Conversely a decrease in pressure will cause the diaphragm to bulge less and therefore more light will be admitted to the photo-electric tube. Thus the pressure variations are transformed into voltage variations. The voltage generated by the photo tube is amplified and applied to the vertical plates of another cathode-ray oscilloscope. The same sweep voltage that was applied to the horizontal plates of the temperature indicating tubes is also applied to the horizontal plates of the pressure indicating tube. A continuous graph of pressure versus crank angle is then shown on the screen of the indicating tube.

The information on the indicating tubes is made usable by photographing the tube faces with a synchronized shutter camera so that a picture may be obtained for individual cycles. The film is then projected back on a piece of ground glass to its original size and the data taken from the graphs.

Myers and Uyehara intend to use the Electro-Optical Pyrometer and associated instrumentation to aid them in Diesel fuel research. They also believe that the instruments have great possibilities for gas turbine research in particular and in general that it should be useful whereever pressures and temperatures are rapidly varying.

COLOR TELEVISION

by Alonzo Fairbanks, m'47

THE possibility of the introduction of color television as compared to black-and-white has brought a controversy to the fore between two schools of thought regarding the future of television. The argument in essence is this: CBS spokesmen state that black-and-white television as developed at present is inadequate to commercial home use. They also advocate that the necessary research that still remains to be done on color television can be completed within the next few months and that the public can then enjoy color television.

On the other hand the majority of the television industry argues that while color television would greatly enhance the public acceptance of television, that step would take several years, estimates range from two to five years. It is also argued that black and white television is acceptable in the average home and that it has been well tested under all conditions, while to wait for developments that will undoubtedly come in time will so retard public acceptance of television now that such a step would be all but fatal to the industry.

The whole difference of opinion lies in the factor of time, that fourth dimension. The majority of the industry believes that the transmission of color television cannot be sufficiently developed in time to enhance public acceptance and that black-and-white television should therefore not be withheld from the public.

When the two systems, black-and-white and color are compared certain rather important points are seen to be quite similar while others are quite dissimilar. The aspect ratio in the two systems is the same, being four units wide and three units high, and the number of lines of scanning is 525 in both systems. However the subjective effect of the presence of color improves the resolution of color pictures.

Probably the most significant difference in the two systems is the element of color itself. While color greatly adds to the life-like appearance of the image other factors such as contrast, flicker and definition must be considered.

The details of the black-and-white and color are approximately the same since the image to be transmitted is scanned about the same number of times. Just how much improvement has been made by the introduction of color alone to give life-like qualities to the picture has not been clearly defined.

Flicker in the two systems increases greatly as the brightness of the image increases. Therefore for the same picture tube and accelerating voltages the flicker would be much less apparent in the color system than in the black and white system since the overall brightness of a color picture would be only one-seventh that of a black and white picture. If the same peak brightness is required the flicker might be more apparent in the solid color areas of a color picture than in a black and white picture. Much research remains to be done along this line.

For color television the noise inherent in the system due to thumal and shot-effect sources is about 2 to 5 times more than that inherent in black and white television. This is due to the fact that the band width for black and white transmission is four megacycles and ten megacycles for color transmission. Thus the problem of the enjoyment of color transmission over the greater noise inherent in the system is one that must be explored in the field.

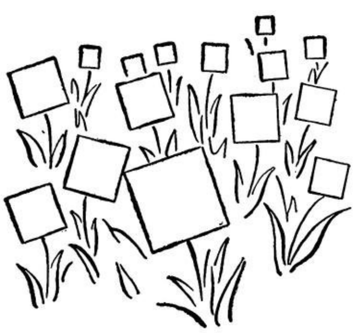
The studio equipment for color television is of necessity more complicated than that for black and white television. For one thing the illumination must be seven times brighter in the case of color television due to the greater color absorption of the filter in the color system. In color transmission the retentivity of the color image on the screens of the camera tubes produces objectionable effects. On this point black and white television will always have the advantage.

Another point upon which much work remains to be done is the point of propagation effects. In the color system shadows cast by objects in the patch of the waves are sharper. This necessitates more complete coverage of an area. A second factor to be considered is the problem of ghost images due to reflected images of objects in the paths of the waves. In black and white television the problem of ghost images does not appear. In the case of color the situation might be different. For one thing the speed of scanning in the case of color is twice that in the case of black and white therefore there is a greater interval of time between direct and reflected images. The better subjective effect in the case of color transmission would increase the possibility of objectionable color effects due to ghost images.

In summary the question that remains is the time required to assess costs and resolve the system uncertainties. These uncertainties are quite capable of engineering solution. Whatever the time required to do so there is no point in delaying engineering studies. The larger question of whether to wait until the studies are complete or to proceed with one system or the other at once must be decided by industry.

NUMBER 3 OF A SERIES

Newsworthy Notes for Engineers



Victory Garden of Crystals

Most synthetic crystals contain water. Under sustained operation, heat drives off the water, destroys the crystal. To lick this trouble—which put vital Navy electronic apparatus out of action, new equipment using a water-free synthetic crystal was developed by Bell Telephone Laboratories.

It was the job of engineers at Western Electric to set up equipment for *growing* synthetic crystals on a mass production basis.

For "seeds" they use tiny pieces of crystal, "planted" in metal pans. Temperature is raised to 110° F, ammonia salt solution is added, the pans are rocked gently by mechanical means. Lowering the temperature starts crystallization. After several days, the salt solution is drained. Then the process is repeated for from 45 to 60 days.

Result: synthetic crystal bars six inches to a foot in length from which the electronic crystals—better than nature's own—are cut.

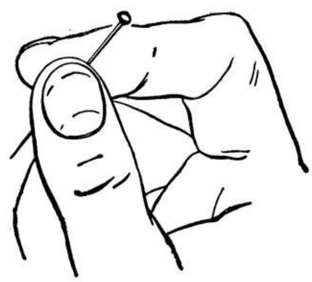
Electrical One-Way Streets

To one group of Western Electric engineers, every day is baking day. The objects of their culinary skill are copper washers and discs—from 1-16th to 1½ inches in diameter—done to a turn in a red hot oven, and with a crust of copper oxide on one side.

Piled in matched sets, these copper oxide discs are called *varistors* (variable resistors). They are high resistance in one direction, low resistance in the other, and so, in effect, allow electrical current only a one-way passage.

As radio moved into very high frequencies, specifications for precision, stability and smaller size of these rectifiers went far beyond anything previously attempted outside the laboratory.

Western Electric's manufacturing engineers set up shop for quantity production of these interesting little devices. The techniques they have developed have great significance for post-war communications.



Smaller than a Pinhead

Thermistor—thermal resistor—is the name of a class of solid variable resistors used as circuit control elements. These tiny units must be sturdy and dependable, yet extremely sensitive in response to temperature variations.

Most thermistors begin life as a metallic oxide paste. This is processed; "fired" under carefully controlled atmosphere and temperature conditions; then formed into beads on fine wires, pressed into discs or extruded as rods.

One interesting manufacturing problem arises from their size, which may be smaller than a pinhead. To manufacture these tiny devices, some of the operations must be performed under microscopes.

Developing and setting up techniques for quantity production of these precise units is another accomplishment of Western Electric engineers.

Manufacturing telephone and radio apparatus for the Bell System is Western Electric's primary job. It calls for engineers of many kinds—radio, electrical, mechanical, chemical, metallurgical. Many of the things they do —whether seemingly little or big—contribute greatly to the art of manufacture of communications equipment.

Western Electric

SOURCE OF SUPPLY FOR THE BELL SYSTEM

ENGINEERING PROBLEMS

ENCOUNTERED IN THE MANUFACTURE OF ETHYL ALCOHOL

by R. H. Wentorf, ch'47

FIRST of all it is necessary to have something fermentable. If what you are after is what is known as rum, use sugar or molasses. In times of national emergency, however, grain will do. Grain yields a product having the more sublime taste of spoiled cabbage and creosote, and hence the product is much more in demand.[1]

The first thing to do is to fix up the grain so that our friends the yeast cells can extract all the goodness from it. An easy way to do this is to wet the grain and heap it up. This produces enzymes. These enzymes do all the work, but don't get drunk at it.[2] In reality, enzymes are substances excreted by something else that we would try to get rid of if it didn't excrete enzymes. This process is called malting. It proceeds in the dark, too. Once the grain is malted, you can introduce yeast cells and they do the rest. (Sugar and molasses need no malting. Just add yeast and water and let her flicker.)

While the stuff is fermenting (By this time we call it a "batch.") we must keep it ever so slightly acid and in the presence of phosphates. Merely placing a bottle of phosphates near the batch won't do any good—you have to put the phosphates **in** the batch.[3]

If the solution is acid, it has a pH of less than seven. In case this is the first batch and you can't hear it talk, you have to find out by engineering methods what the pH is. Usually Bob Kirk knows the answer to this one.

This pH is important, because if the solution isn't pH'd right (you have to also keep it warmed up) you get, instead of what you are after, acetone and butyl alcohol and such other excellent solvents. (Only a fool or a lawyer would want these after all this work. Besides, they aren't good for you. They are even more poisonous than ethyl alcohol).

Bubbles of CO_2 will immediately be evolved after a few days of pH-ing and yeasting. This is a good sign. It means something is happening. The batch is said to be "working". (Just between you and me, this is a lot of malarky. The process is strictly thermoflopic and you obviously can't perform any work unless you increase the inherent incapabilities.) While the batch is working, you can watch it work, if you are that kind of a person, or you can get busy and build a still.

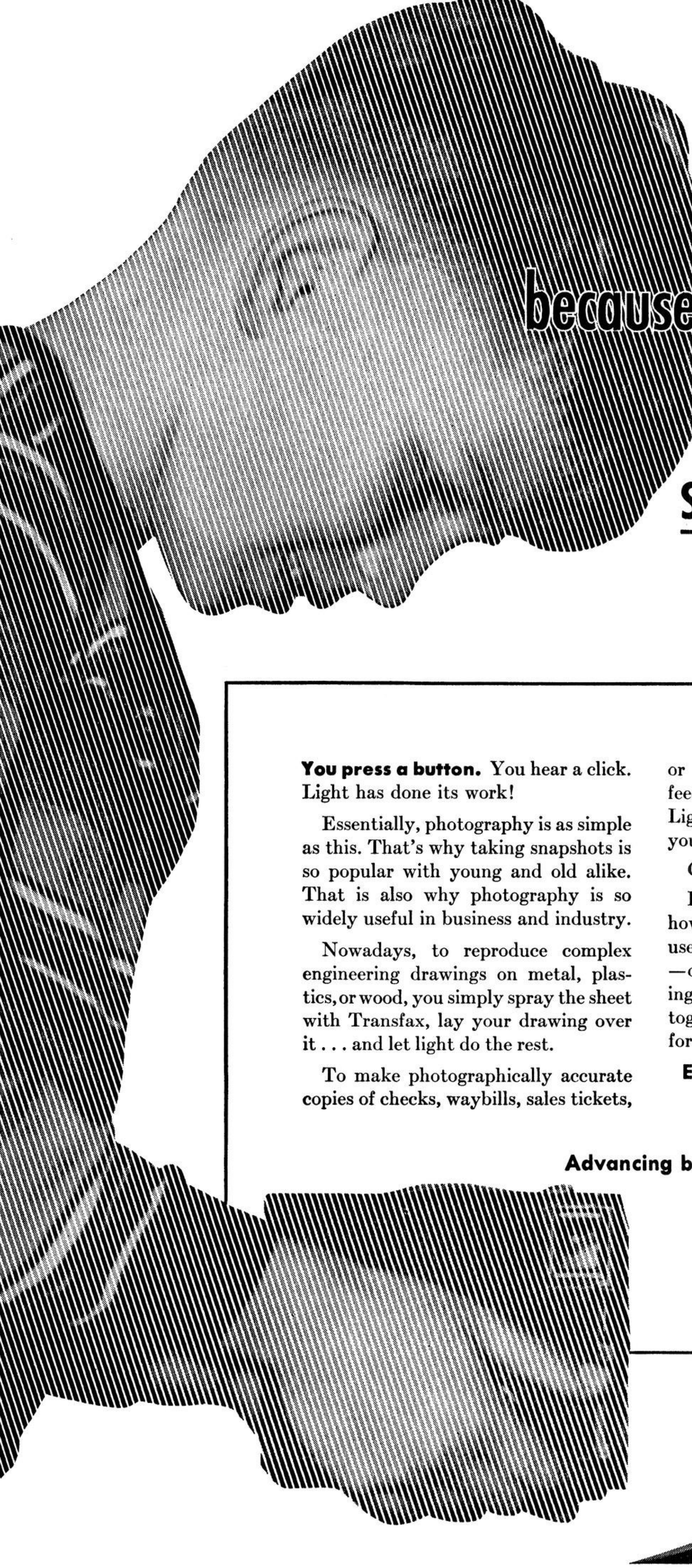
A still is a marvelous invention. Without it we would still be drinking beer. With it we have automobiles, plastics, machine tools, and all the other products of the scientific era. The original idea behind this still business is that you don't want to drink so much water. So you boil off the alcohol and leave the water behind. Just like that. How any thirsty soul could have missed thinking of that one for over two million years is beyond me.

If you have a large enough batch (a bathtub full or so) the best way to get it out of all that water is to run the batch through a stripping column. Steam is blown into the bottom of the column and the alcohol is stripped from the solution and comes out the top of the column. Some Ch E's got this idea watching an air jet in the floor of a carnival sideshow.[4]

In running off small batches, though the usual method is to put a piece of pipe in the top of the oil drum, lead the vapors out of the pipe through a coil surrounded by cold water, and then catch what drips out in a bottle. Moonlight catalyzes the reaction. You can go all out and put a thermometer in the vapor stream. Then you know the temperature of the vapors, so you don't distil too much water. It is cheaper just to taste the stuff. A warm sensation in the throat indicates you better keep boiling if you want your money's worth. After further tests of the distillate show that there ish no warm senshation upon testing, you can shing the Shiffenpoof Shong.[5]

Nobody has gone blind from the intense strain of this work yet, but headaches are a frequent complaint. This is not due to poor lighting, but rather from being lit too often.

1. Data on this problem remains very meager, in spite of a great deal of research.
2. What won't they think of next?
3. If you think you're substituting phosphates for what is known in the trade as "mix" at this stage, you're all wet. This has nothing to do with drinking. Remember that. Two of my partners forgot, and now they're on the inside, folks, looking out.
4. They hurried right back to the lab.
5. We ain't mad with nobody.



because photography is basically a simple process

You press a button. You hear a click. Light has done its work!

Essentially, photography is as simple as this. That's why taking snapshots is so popular with young and old alike. That is also why photography is so widely useful in business and industry.

Nowadays, to reproduce complex engineering drawings on metal, plastics, or wood, you simply spray the sheet with Transfax, lay your drawing over it . . . and let light do the rest.

To make photographically accurate copies of checks, waybills, sales tickets, or other important papers, you just feed the documents into a Recordak. Light automatically records them for you—faster than you can count.

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Hardly. It will pay you to learn now how the photographic process can be used to reduce the complexity—and cost—of plant or office operations. Reading the new booklet, "Functional Photography," can help you find out. Write for it. It is free.

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JET MOTORED PLANES

by G. A. Holloway, m'47

BY 1939 aviation seemed to have reached its ceiling. Engine power, drag, and propeller efficiency despite years of study and research had limited the speed of airplanes to a little over 400 miles per hour.

Only a slight increase of speed was attained with the conventional type of plane after six years of intensive wartime research.

With one jump, jet propulsion, the upper limits of aircraft speed has been raised more than 100 miles per hour. Jet propulsion has remedied many problems, but has created many more peculiar to this type of motivation.

The principle of operation is old and it is simple. Considering two small tanks, the two being filled with some suitable type of fuel, the necessary oxygen for combustion and a means of igniting the fuel, the fuel of the first tank is ignited. The resulting explosion creates a sudden increase of pressure within the tank. However, the pressure being exerted equally in all directions results in no motion of the tank. If the same procedure is carried out with the second tank which has a small hole in one end, the pressure will again be equal in all directions except where the hole exists. Hence there is a resultant force acting away from the hole. This resultant force is independent of the medium outside the tank, therefore the principle of operation may be extended to use in air, water, or even in a vacuum.

There are three distinct types of jet propulsion units. The first, which is the simplest, is the rocket. It is a self-contained unit carrying all the elements necessary for operation within itself. The oxygen for combustion is carried in one tank, usually in the liquid form. The fuel, alcohol or gasoline, is carried in a second tank. The fuel is directed through a jacket surrounding the engine, before combustion, to cool the combustion chamber.

The second type of engine differs from the rocket in that air must be drawn in from the atmosphere and mixed with the fuel before combustion can take place. The usual form of this type of propulsion unit is known as the axial flow engine. The air for combustion enters the front of the unit and is compressed by a centrifugal blower or an axial compressor turning at a high velocity. From the blower the air is directed to a combustion chamber where fuel is injected at high pressure. A continuous explosion occurs in the chamber, heating the gases to a very high temperature and causing them to expand very rapidly. Once the engine is started no further ignition is necessary, but a spark plug is used for starting and a glow plug is used to insure continuous burning.

After the gases leave the combustion chamber they strike the blades of a turbine wheel, driving the wheel at a high velocity. The turbine in turn is connected to the compressor unit supplying the power necessary for the initial compression of the air.

The fuel to be used is of little consequence, kerosene and gasoline being predominant.

The main problem encountered was the development of alloy metals to be used in the turbines which would stand up under the extreme temperatures and the high forces developed when rotating at high speeds.

The third type of jet engine is one wherein a conventional airplane propeller is driven by a gas turbine of the above type. Since jet engine efficiencies are good only at speeds of over 500 miles per hour, a combination drive allows the advantages of the turbine at the more conventional air speeds.

The arrangement consists merely of the jet turbine drive being connected to the propeller through suitable gearing. This is a simple and efficient arrangement and will find extensive uses, not only in the airplane, but also in railway trains, buses, electric power generators, and perhaps in the automobiles of the future.

PROF. ROSE . . .

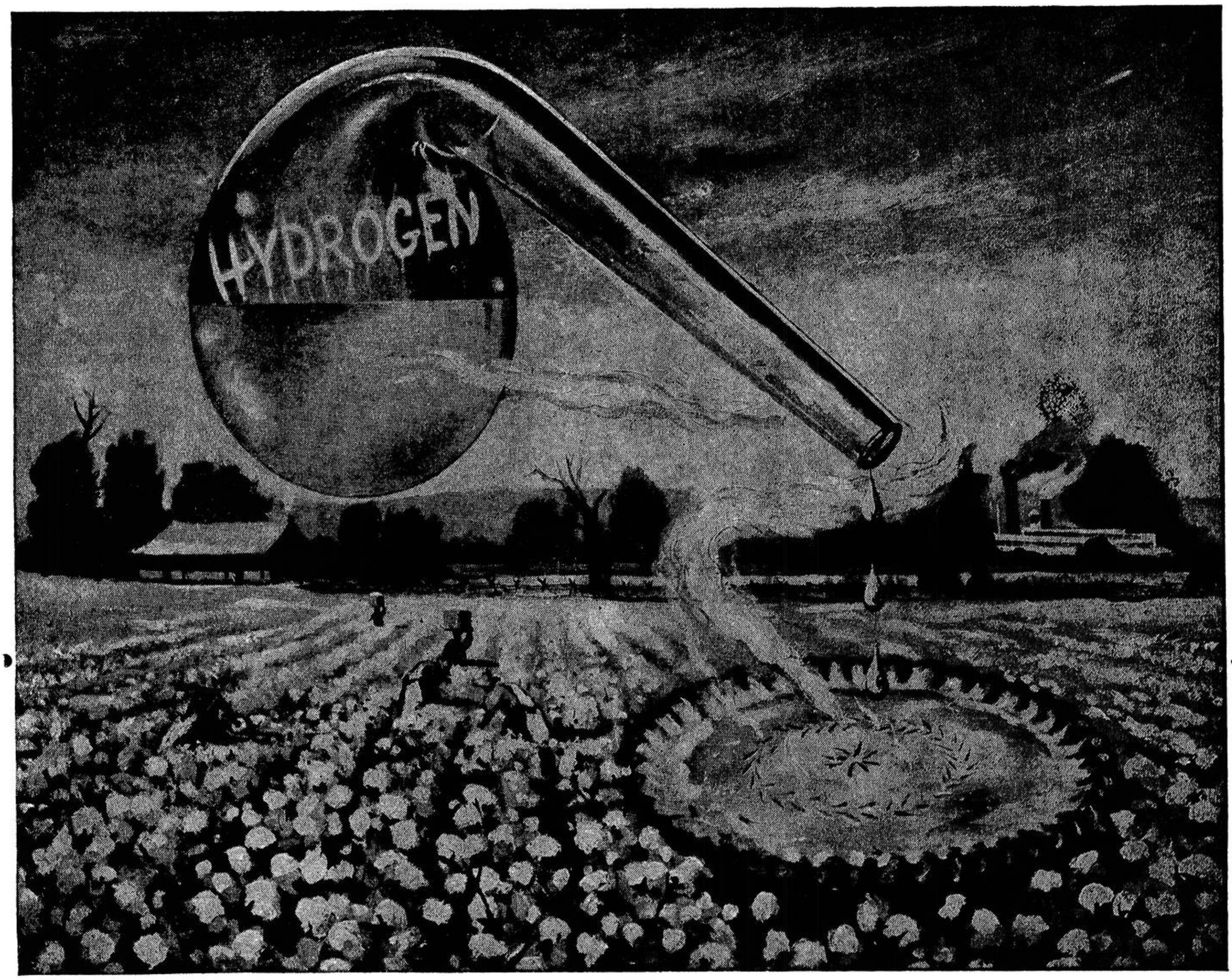
(continued from page 9)

had the finest diesel engine equipment in the country and the school trained most of the operating engineers for our amphibious forces. Five hundred trainees were graduated from the school every week. Commander Rose did excellent work on this very responsible assignment as is evidenced by the many letters of commendation he received from his superiors for his work in the administration of this school.

On November 1, 1944 he was transferred to the Norfolk Navy Yard as Assistant Shop Superintendent, where he had charge of all shops in the yard. This is one of our largest Navy Yards and was a very vital base during the war.

On April 1, 1945 he was transferred to Charleston, South Carolina, as District Redistribution Officer for the Sixth Naval District, where he was in charge of redistributing surplus material for all the nine bureaus and offices of the Navy Department, including the Coast Guard and Marine Corps.

In March of 1946, Commander Rose once more doffed his Navy uniform and returned to the University of Wisconsin teaching staff. He is currently teaching Heat Power Engineering and Naval Machinery.



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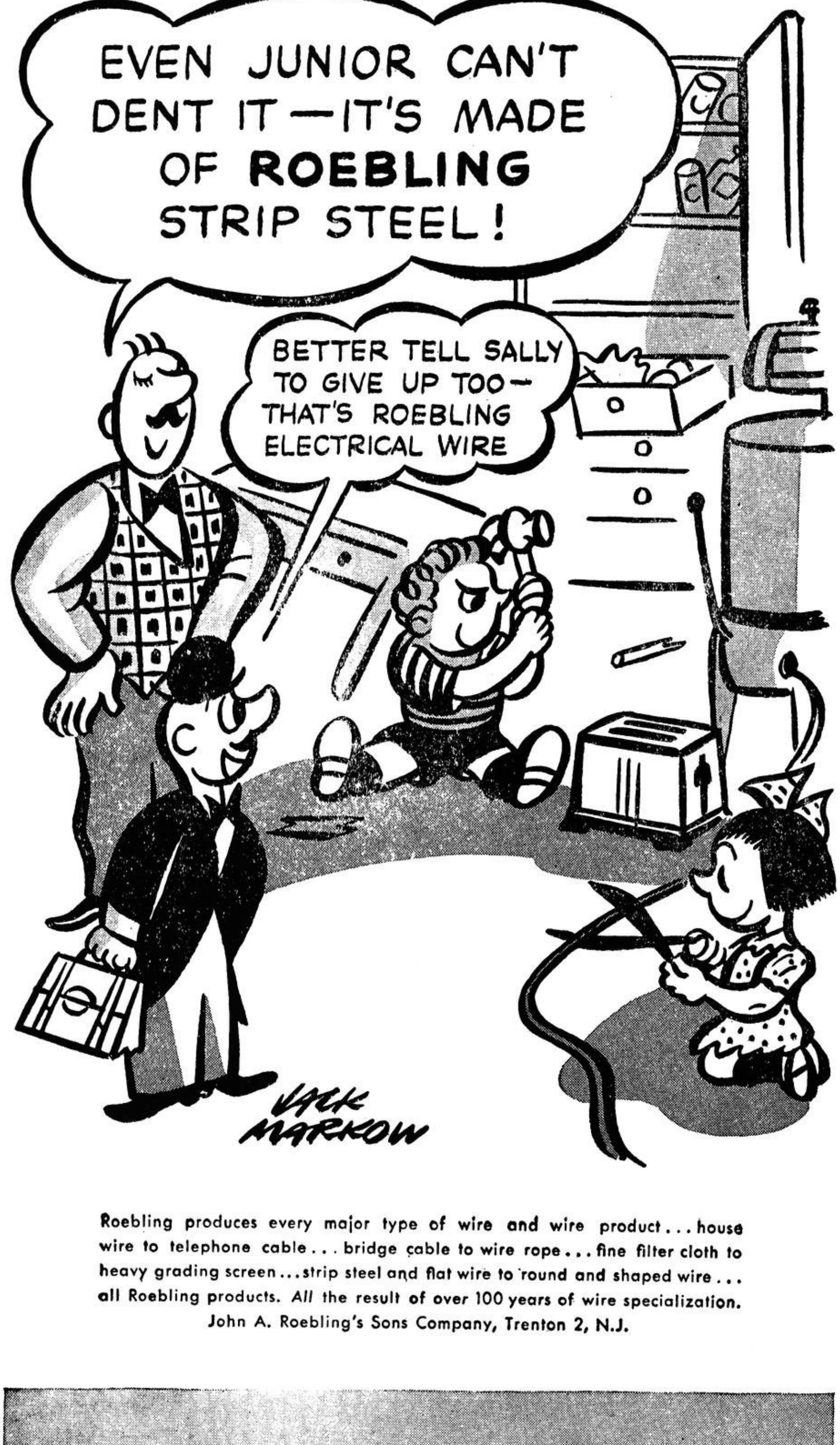

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ALUMNI

by Reinheart

Civils

MEAD, WARD & HUNT REORGANIZES

The well-known consulting firm of Mead, Ward and Hunt, of Madison, has reorganized, as of May 1, into two separate firms. Ward and Strand will comprise one firm. Mr. **CLAYTON N. WARD** was at one time assistant professor of hydraulic engineering at Wisconsin. Mr. **JOHN A. STRAND** is a '32 graduate in civil engineering. Mead and Hunt will comprise the other firm. Mr. **HAROLD W. MEAD** is a '20 graduate and Mr. **H. J. HUNT** is an '06 graduate. All records and plans of the parent organization will be available to both of the new firms.

CUTLER, JOSEPH A., c'09, president of the Johnson Service Company of Milwaukee, has been elected president of the Wisconsin Alumni Association.

TASHJIAN, EDWARD H., c'15, died in Washington, D.C., on April 10. During World War I, he served with the 23rd Engineers in the A.E.F. He was sent to Belgium in the fall of 1928 by the Battle Monuments Commission of Ohio to supervise the construction of a memorial bridge over the Scheldt River near the village of Eyne. His professional career was largely as a construction engineer. He served for a period with the U. S. Treasury Department and more recently on war projects for the Public Roads Administration.

HOLLISTER, SOLOMON C., c'16, dean of the college of engineering at Cornell University, has been appointed vice-president in charge of university development at Cornell. He will continue as head of the college of engineering.

BALLAM, HORACE V., c'25, is executive secretary of the Kramp Construction Company of Berlin, Wisconsin. The main office of the company at present is in Milwaukee.

PRESTON, BURT E., c'26, is county superintendent of highways for Will County at Joliet, Illinois.

BECK, LAWRENCE J., c'29, is associated with the Beattie Mfg. Co. of Little Falls, N. J., in research and development work. He was active in the development of the flame-thrower. "Larry" was business manager of the WISCONSIN ENGINEER during his senior year.

BRYAN, WAYNE G., c'33, has been appointed city engineer for Neenah, Wisconsin. During the war he served as Lt. (jg) on the USS Cockthorn in the Pacific Area.

KNEEVERS, VICTOR A., c'35, engineer with the Plastics Engineering Company of Sheboygan, is a member of the school board of that city.

NOTES

Zirbel, m'48

PRICE, REGINALD C., c'35, assistant professor of engineering at New York University, is accepting a position as engineering economist with the U. S. Bureau of Reclamation. He received the professional degree of Civil Engineer at the recent Commencement.

WILSON, FRANCIS C., c'37, who served as an officer in the navy bureau of ships, is now a general contractor in Milwaukee. He is promoting the construction of pre-fabricated dwellings.

MICHALOS, JAMES P., c'38, assistant professor of civil engineering at Montana State College, has received an appointment to the staff of Syracuse University.

MIELKE, JOHN H., c'40, is a member of the newly formed firm of Ruekert-Mielke, Engineers, of Waukesha.

NOTH, MELVIN J., c'40, who served as 1st Lt., Corps of Engineers, in the Pacific Area, is with the Davy Engineering Company of La Crosse.

SAVORIAS, J. LEE, ex-c'40, who served as major with the 312th Field Artillery, 79th Div., in Europe, is now an inspector in the Bureau of Sewers with the City of Milwaukee. Lee comes from the first families of America; his father is a Mission Indian and his mother is an Oneida.

FLUCK, PAUL G., c'41, after two years' service in the Bureau of Ships, USNR, returned in April to his position as instructor in mechanics in this university.

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CAMPUS NOTES

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AIChE

At the May 16 meeting, Mr. Anderson of the State Conservation Department gave a lecture and showed films on the general subject of "Wisconsin Game Fish."

The following officers were elected for the school year of 1946-47:

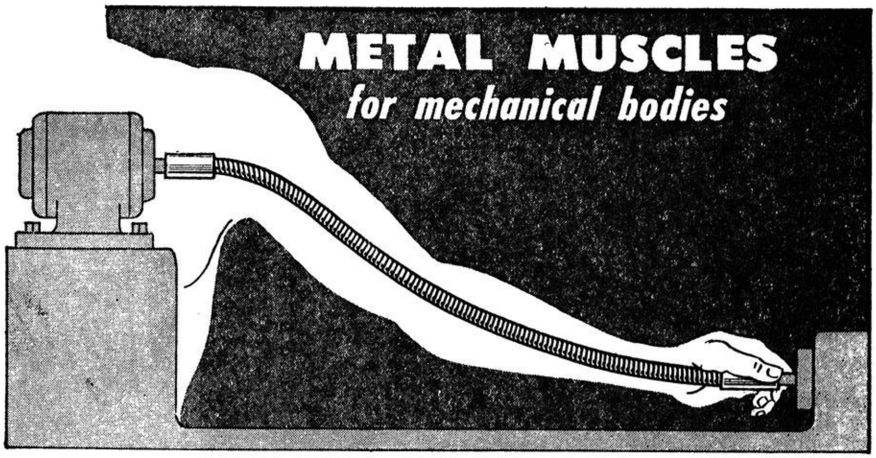
President—Walter Thomas

Vice President, Treasurer—Fred Brosius

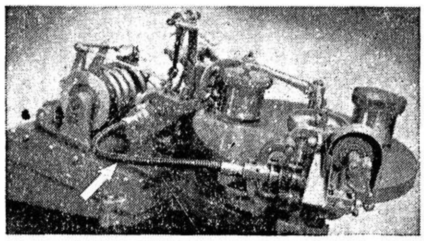
Secretary—Ed Stanky

Refreshments of beer and pretzels were served.

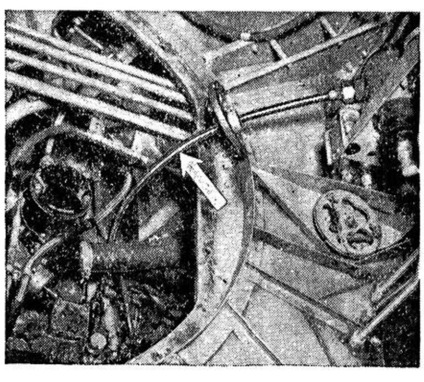
—R. J. Meisekothen,
Acting Secretary



S.S.WHITE FLEXIBLE SHAFTS



In this machine a flexible shaft (arrow) takes power from the main drive and carries it around a right angle turn to drive an auxiliary mechanism. Compare the simplicity of this arrangement with any other possible means of doing this job.



In this application on a large airliner, the flexible shaft takes power from the engine to drive the electric tachometer generator at the upper right. It typifies the ready adaptability of flexible shafts for all kinds of drives.

are metal muscles expressly created for performing two functions in mechanical bodies:

(1) Transmission of rotational power.
(2) Mechanical remote control.

S.S.White flexible shafts offer such important advantages that it will pay to consider their use every time a power drive or remote control problem comes up in engineering design.

Suppose, for example, you have to transmit power from one part of a machine to another where a straight line drive is not practicable. The fewest parts with which it can be done is an S.S.White flexible shaft — a single mechanical element that will provide a positive drive between practically any two points, regardless of turns, obstacles or distance.

This basic simplicity, plus their ready adaptability to a wide range of power drive and remote control conditions and requirements, are main reasons why S.S.White flexible shafts are used to the extent of millions of feet annually — and why engineers will find it helpful to be familiar with the range and scope of these Metal Muscles.

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CROSS SECTION OF AN ENGLISH CHANNEL CROSSER

Here is a weapon that beat the Wehrmacht, a cross section view of the submarine "cable" that piped oil from Great Britain to the Allied forces on the European mainland. Paid out from huge coils in the holds of ships, more than 20 flexible pipelines were laid under the English Channel.

As the picture indicates, this "cable" comprises a lead alloy tube, steel reinforcing tapes, steel wire armor and jute wrappings. It's actually a submarine cable except there's no core. Oil flows in the space normally occupied by the electrical conductors.

The Okonite-Callender Cable Company was one of four American wire and cable manufacturers who together turned out 140 nautical miles of this pipeline. Experience in working with others to solve special manufacturing problems is combined at Okonite with years of research and development work in electrical wire and cable improvement. The Okonite Company, Passaic, New Jersey.

OKONITE
insulated wires and cables
3394

LIGHT METALS . . .

(continued from page 7)

From such wartime developments, added to pre-war experience, comes a growing list of post-war possibilities.

Lifeboats, the superstructure of ships, railroad hopper cars, the upper stories of buildings, household furniture, window frames, screens, and a thousand other things could be made of aluminum by processes already well understood in the metal-working industries. Aluminum may be the answer to the problem of tropical housing; it has a high reflectivity and would reflect 90% of the torrid sun rays.

In conclusion, there promises to be some interesting competition for post-war markets between aluminum and its light metal twin, magnesium, together against a tough competitor, steel.

First cost will continue to be a talking point for steel for a long time; its base price now, weight for weight, is about one-tenth the price of aluminum. There will be plenty of competition among the alloys. It will be a race against the cost of light metal and steel alloys, and a race to increase the strength of each in proportion to weight. Technical discoveries may give temporary or lasting advantages to one or the other.

References:
Business Week
New Republic
Scientific American

THE SPERRY SHIPBOARD STABILIZER

by A. B. Shaefer, e'46

THE Sperry ship stabilizer comprises two electrically driven gyroscopes, a powerful electromagnetic brake, an electric motor, two motor generators, and a switchboard. One of the gyroscopes is small and of three degrees of rotational freedom. The spin axle precesses when the ship rolls through even such a small angle as a single degree. The other gyroscope is very large and of two degrees of rotational freedom.

The main or stabilizing gyroscope, of great moment of inertia with respect to the verticle spin-axis, is non-pendulous and is mounted so as to be capable of precession about an athwartship axis. This gyro is spun by alternating current supplied by a turbogenerator. The spin-axle can be rotated forward or backward about an athwartship axis by means of the "precession" motor which is a small DC shunt motor. The direction of rotation of the precession motor and of the connected main gyro-casing is controlled by the small unconstrained gyro. The spin-axis of the control gyro is horizontal and athwartship, in a casing that can rotate about a vertical axis.

The amount of speed of rotation of the spin-axle of the stabilizing gyro are regulated by a magnetic brake on the armature shaft of the precession motor. This brake has strong springs that seize the armature shaft, thereby preventing rotation of the stabilizing gyro-axle except when the pressure of the springs is opposed by the pull of an electromagnet. The brake coils are in series with the precession motor. Consequently, when current is cut off the precession motor, the magnetic brake seizes the armature shaft and prevents rotation of the main gyro about the athwartship axis.

In operation, the small unconstrained control gyro precesses when the ship begins to roll. This closes an electric circuit which energizes the precession motor which, in turn, causes the main gyro to rotate about its athwartship axis with high angular acceleration. This action causes the main stabilizing gyro to oppose the torque produced by the ship's roll.

Nearly all of the energy that would exhibit itself in the roll of the ship is converted into heat, and the roll is quenched soon after its inception. If any single wave would produce a roll less than that which the stabilizer can prevent, then the control gyro automatically reduces the arc of precession and stops this precession as soon as this single roll has been neutralized. On the other hand, if any single wave would produce a roll greater than that which the stabilizer can neutralize, then the ship will roll through a diminished angle.

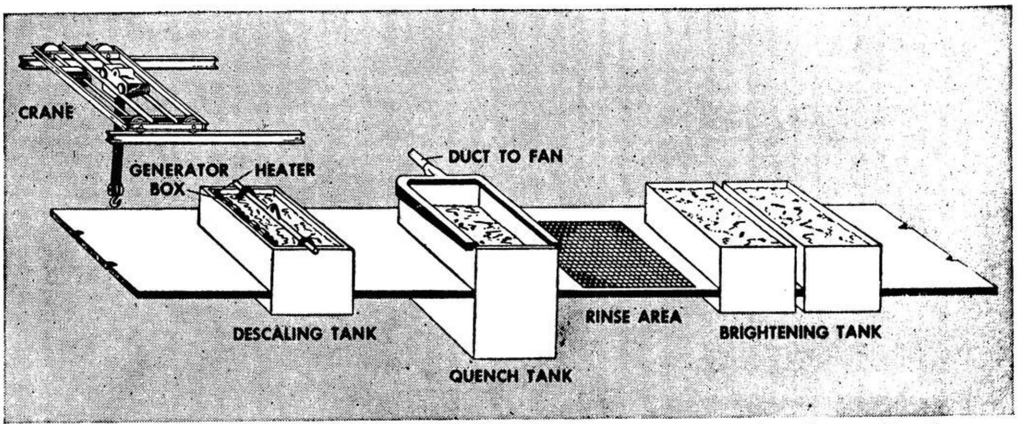
Du Pont *Digest*

Items of Interest to Students of Chemistry, Engineering, Physics, and Biology

Chemistry Finds Better Way to Descale Steel

One of the most bothersome problems in the metal industry is the removal of scale from the surface of stainless steels and other alloys. Scale is a thin film of metal oxide which forms at high temperatures during fabrication or processing. It is very abrasive to dies and other metal-forming tools, and if not completely removed causes serious flaws in the surface of finished products.

Several years prior to World War II, Du Pont chemists, engineers and metallurgists went to work on the problem of developing a quick and positive descaling process. When success came three years later, a secrecy order prevented its public announcement at that time—the discovery went directly into war work.



A typical layout showing arrangement of equipment for sodium hydride descaling. The usual treating cycle comprises sodium hydride treatment, water quench, water rinse and acid dip for brightening.

Process Development

In developing the process, a group of Du Pont Chemists found that small amounts of sodium hydride, dissolved in molten sodium hydroxide, effectively removed scale without attacking the base metal or embrittling it. However, the problem then arose of finding an efficient and economic means of obtaining the sodium hydride. This was accomplished by developing an ingenious apparatus for forming it directly in the molten sodium hydroxide (700° F.) from metallic sodium and gaseous hydrogen.

Metal chambers, open at the bottom, are placed along the inside of the descaling tank and partly immersed in the bath. Solid sodium is introduced into these chambers, and hydrogen gas bubbled through. The sodium hydride formed is diffused uniformly throughout the molten caustic.

Practical Application

The metal to be descaled is immersed in the bath which contains 1.5 to 2% of sodium hydride. Scale is reduced to the metallic state for the most part in from a few seconds to twenty minutes, depending on the size and type of material.

The hot metal is then quenched in water, and the steam generated actually blasts the reduced scale from the underlying metal. A water rinse and a short dip in dilute acid complete the process and produce a clean bright surface.

This process has been called the most significant development in the cleaning of metal surfaces in decades. It is representative of what men of Du Pont are doing to help American industry to better, quicker, more economical production methods.

• • •

MAN-MADE SPONGES PRODUCED BY DU PONT CHEMISTS

Among the most versatile members of the family of cellulose products—whose members include rayon, cellophane, lacquers and plastics—is the synthetic sponge.

Du Pont cellulose sponges have many of the attributes of the kind that grow in the sea, plus several additional advantages. For example, quality can be kept uniform; texture and hole-size can be predetermined; they can be cut to handy shapes, and they may be sterilized by boiling.

The complicated 10-day manufacturing process starts when viscose is produced by adding carbon disulphide to alkali cellulose (from wood or cotton), and dissolving the mixture in water and mild alkali. To produce holes, crystals of the desired size are introduced. Heating in a salt solution hardens the viscose and dissolves out the crystals. Washing, centrifuging and oven-drying complete the operation.

Questions College Men ask about working with Du Pont

"DOES THE DU PONT COMPANY EMPLOY ENGINEERS?"

There are many diverse opportunities at Du Pont for engineers. Principal requirements are for chemical and mechanical engineers, but opportunities also exist for industrial, civil, electrical, metallurgical, textile, petroleum and others. Practically all types of engineering are included in the work of the manufacturing departments and the central Engineering Department. Openings for qualified engineers exist at times in all of these departments.

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

E. I. DU PONT DE NEMOURS & CO. (INC.)
WILMINGTON 98, DELAWARE

More facts about Du Pont—Listen to "Cavalcade of America," Mondays, 8 P.M. EDST, on NBC

The Victrola, made exclusively by RCA Victor, gives higher fidelity and longer record life through its jewel-point pickup.*

Your Victrola's jewel-point pickup floats like a feather on water—

Instead of an ordinary, rigidly mounted needle, your Victrola radio-phonograph has a moving sapphire playing tip that fairly floats over the record.

It follows the groove with effortless ease, achieves new clarity of tone, adds longer life to records, and acts as a filter against surface noise.

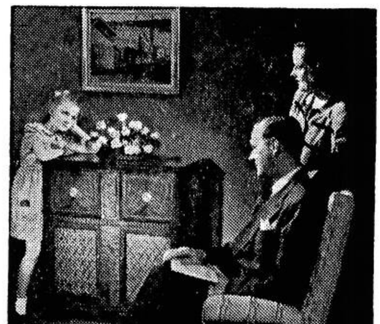
Such a feather touch reduces "needle chatter," gives you all the rich warm flow of the pure music . . . the highest tones, the lowest tones, the overtones. Truly, your Victrola's jewel-point pick-up brings you the ultimate in recorded music pleasure.

This pickup was perfected at RCA Laboratories—a world center of radio and electronic research—where RCA products are kept at the top of the field.

And when you buy an RCA Victor radio, television receiver, Victrola, or even an RCA radio tube replacement, RCA Laboratories is your assurance that you are getting one of the finest products of its kind that science has yet achieved.

• • •

Radio Corporation of America, RCA Building, Radio City, New York 20 . . . Listen to The RCA Victor Show, Sundays, 4:30 P. M., Eastern Daylight Time, over the NBC Network.

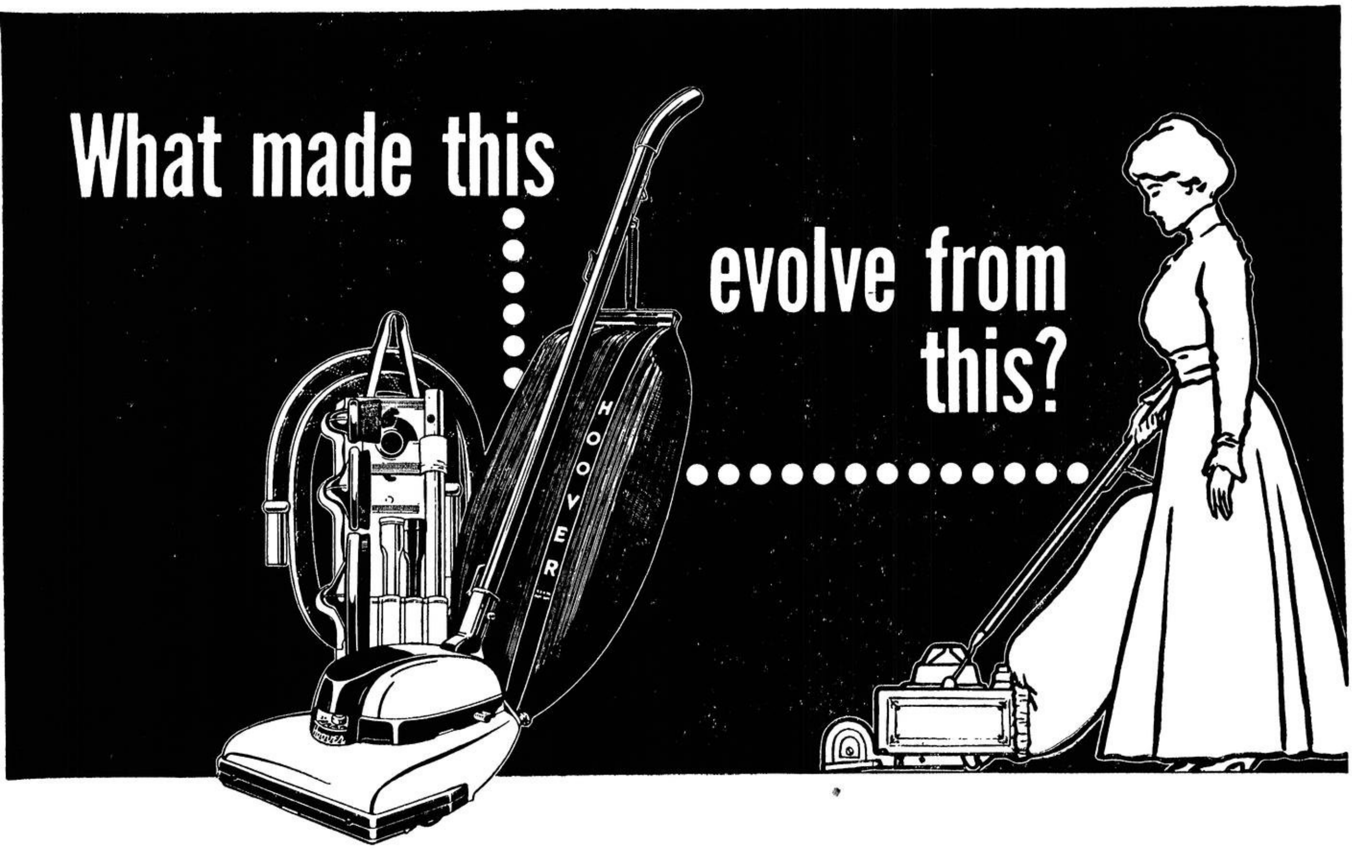


New Victrola radio-phonograph, with Chippendale-style cabinet, priced at approximately $275. "Rollout" record changer handling twelve 10-inch, or ten 12-inch records. Permanent jewel-point pickup—no needles. American and foreign radio reception. An outstanding radio-phonograph combination—thanks to research at RCA Laboratories.

RCA

RADIO CORPORATION of AMERICA

*Victrola T. M. Reg. U. S. Pat. Off.

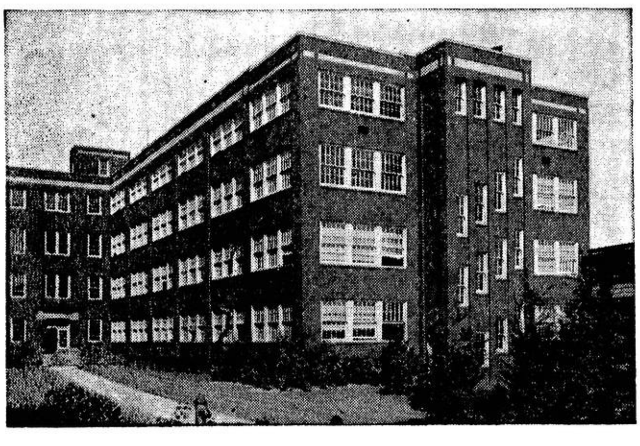


Engineering intelligence, imagination and skill of a high order have been applied continuously, over the forty years of The Hoover Company's existence, to make it possible for women to do a better and easier job of cleaning their homes.

Developing better home cleaners has led Hoover engineers into many fields. This is clearly indicated by the fact that 274 of the 879 patented Hoover engineering developments have been sought and used by other manufacturing industries—many of them far removed from the home appliance field.

Today an engineering staff of 130, one third of them graduate engineers, is required to meet calls made on Hoover engineering skill.

This modern four-story brick building, with a total of 60,000 square feet of floor space and containing up-to-date laboratory equipment, is the Hoover Engineering Department.



The Hoover Cleaner is "born" in the development engineering division, where teamworking skilled designers, inventors and engineers plan tomorrow's electric cleaners.

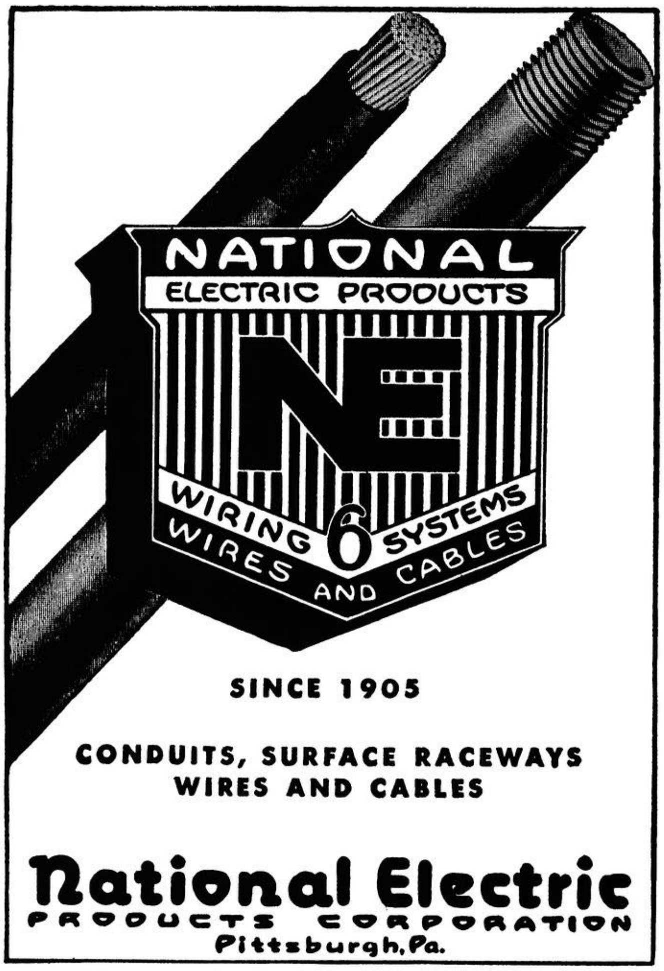
The laboratory division conducts research, studies and tests, rejects or recommends each component part of each new product "to be."

Mechanical engineers measure noise and vibration, design fan systems, study cleaning methods and solve power transmission problems in developing new designs.

Electrical engineers develop and test motors, wiring, switches, lamps, etc., designing the right power plant and accessories for a Hoover.

Product engineers solve manufacturing problems, set up standards, see that Hoover quality is maintained.

THE HOOVER COMPANY • *North Canton, Ohio*



VIBRATION . . .

(continued from page 8)

Usually it is desirable to reduce the vibration transmitted to the floor. When mounted on the proper material the natural frequency of the system is small, F/f_n will be large, and the force transmitted will be small. In an actual instance perhaps 90% of the vibration will be eliminated.

Often it is desirable to protect a delicate instrument or machine from damage due to vibration. In this case the disturbing force is being transmitted from the support to the assembly. Since the mass of such an assembly is small, very soft mountings must be used to make the transmissibility small.

As has been previously stated there is no infallible rule for the selection of the flexible material to be used to isolate vibration. Many times, however, rubber is used for light assemblies, while steel springs and cork are used for massive machinery.

In the foregoing discussion there has been quite a lot of idealizing. For example damping (resistance to motion) has not been considered. Nevertheless the ideal case is close enough to the actual conditions to give a very close approximation in practically all instances.

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Korfund Vibration Control. Bulletin issued by the Korfund Co.

WISCONSIN'S AIR FUTURE

by R. W. Andrae, c'46

NOW is the time for active participation in building a state-wide, nation-wide and world-wide network of airports. One of the greatest factors in establishing world harmony and prosperity is the reduction of travel time brought about by the utilization of the atmosphere as a medium of transportation. Today, the remotest spot on this earth is less than 60 flying hours away which in effect shrinks the surface of the globe to an extent where all peoples must start thinking in terms of living with one another instead of living as separate and isolated countries.

Every city in our state should be considering the possibility of building an airport. The airport is the connecting link between the community and the highways of the air. It is the duty of the University of Wisconsin as a state institution to understand and be in a position to advise and help the state develop into a system of aerial highways similar to our present system of earth-bound roads.

World War II has immeasurably hastened the development of modern aircraft, and the extent of future progress in harnessing space seems limitless. The University of Wisconsin is planning a huge and much needed expansion and building program and it should not neglect this important study of aviation and aeronautics. The University should be prepared to train young men and women in the fundamentals of air transportation, aeronautics, aerial traffic control and airport construction. It should be prepared to lend aid and advice to communities throughout the state on the planning, design and construction of airports as well as their financing, operation and maintenance. This means capable instructing personnel, adequate laboratory working space and equipment, and finally hours of painstaking study and research.

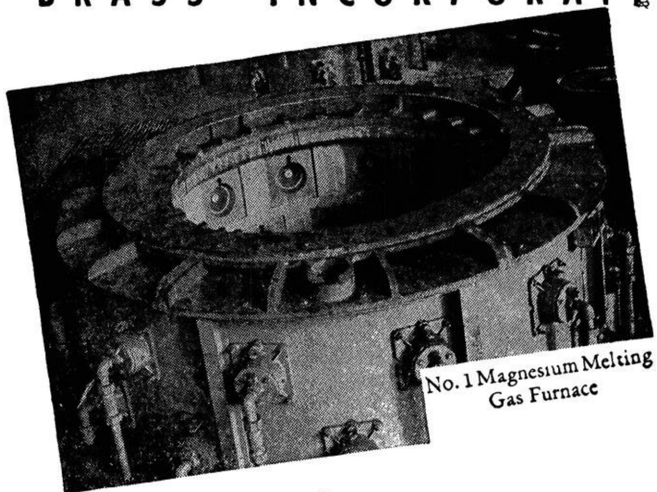
The present curriculum is feeble in its attempt to cover this vital subject. Other universities throughout the country are far ahead in maintaining experimental airports, in aeronautical research and in developing airport construction. They are energetic in acquiring Army and Navy surplus materials.

The heaviest portion of the work of building a network of aerial highways and ports in our state lies on the shoulders of the Engineers. Each field, Civil, Mechanical, Electrical and Chemical, is represented in this task, and, therefore, it is the responsibility of the School of Engineering to see to it that Wisconsin stays abreast with progress in air transportation. Now is the time to lay a solid foundation so that generations of the future will not be forced to back-track and re-build that which was poorly done.

REVERE COPPER AND BRASS INCORPORATED

uses GAS extensively

at the Halethorpe Extrusion Plant, Baltimore



No. 1 Magnesium Melting Gas Furnace

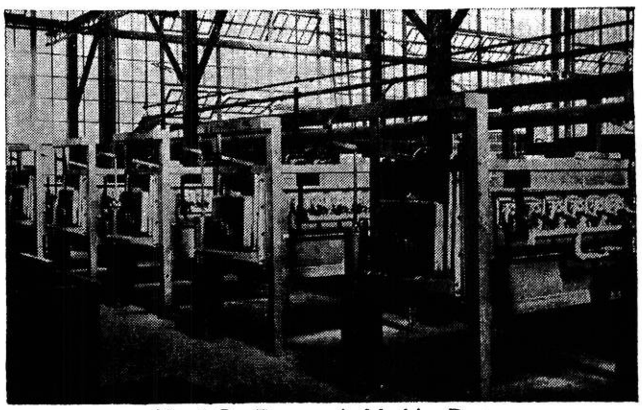
in Magnesium and Aluminum fabrication

There are, for instance, six Gas furnaces for MAGNESIUM MELTING. These furnaces utilize the ultra-modern ceramic Gas burner, thirty to each furnace. The pot, which sits inside the furnace shell, holds a charge of about 4,000 pounds of magnesium. Temperatures range from 1350° to 1500° F. (Photo No. 1).

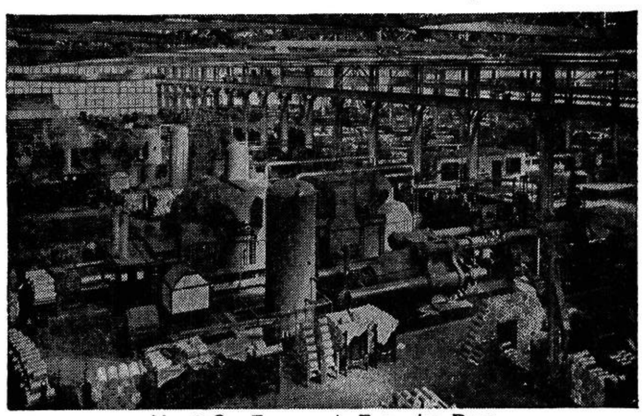
The well equipped MACHINE DEPARTMENT has six muffle type Gas furnaces and a Gas heated salt bath furnace. This equipment provides accurately controlled temperatures ranging from 1400° to 2400° F. for heat treating dies, mandrels and other production tools. (Photo No. 2).

In the EXTRUSION DEPARTMENT, there are four large extrusion presses and between each pair of presses are large, Gas fired traveling furnaces through which billets pass to be preheated before extruding. (Photo No. 3).

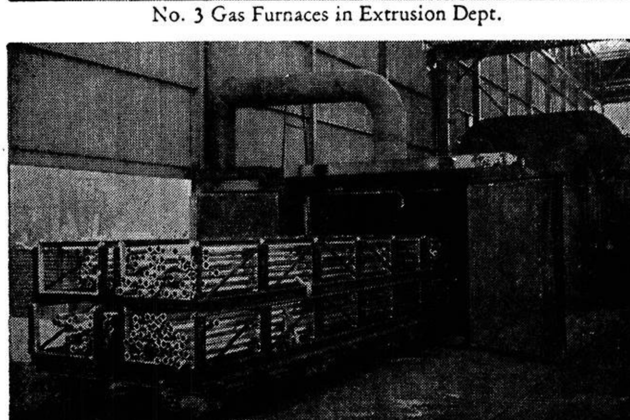
ANNEALING of finished products, such as the tube shown here, as well as treatment of scrap (burning off oil and other waste prior to re-melting) are accomplished in a direct fired, recirculating, Gas unit, automatically controlled. (Photo No. 4).



No. 2 Gas Furnaces in Machine Dept.



No. 3 Gas Furnaces in Extrusion Dept.



No. 4 Gas Furnace in Annealing Dept.

Gas, the most versatile fuel for all types of heat treating will do the speediest, most efficient, most economical job.

AMERICAN · GAS ASSOCIATION

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THE TREND IS TO GAS

FOR ALL INDUSTRIAL HEATING

Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD

HOW G.E. TRAINS DESIGN ENGINEERS

MOST college engineering graduates hired by G.E. are assigned to the Testing Department for 12 to 15 months. At the same time they may enroll in sections of the General Course or be selected to follow one of the specialized training courses of the Design Engineering Program.

ADVANCED ENGINEERING

Besides meeting in class one morning each week, students spend 15 to 20 hours of outside time in solving assigned problems. The programs include a study of the fundamentals of electric machinery, electronics, and fluid mechanics. Student engineers can continue this course for as long as three years.

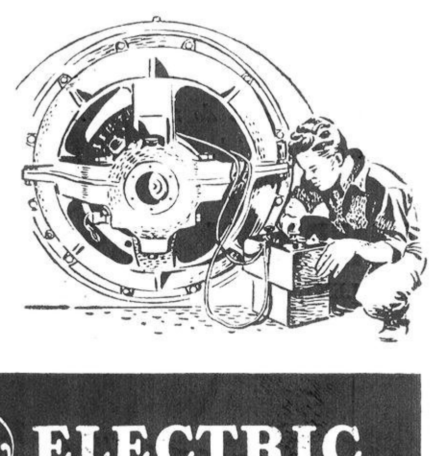
CREATIVE ENGINEERING

The intent of the Creative Engineering Program is to give the student with creative ability the tools that will be helpful in future work. Emphasis is placed on rotating assignment, as it has been found more effective, in developing creative ability, to place young men in contact with several engineers of proven ability. This program—lasting for about a year—also includes some time spent in class.

GENERAL COURSES

The highly specialized sections of the Design Engineering Program are open to selected men—the four engineering sections of the General Course are open to everyone. The sections include the Electrical Section, a course in application engineering; the Mechanical Section, covering the materials and processes used in the electrical industry; the Electronics Section; and the Engineering Fundamentals Section.

The Engineering Fundamentals Section includes a study of thermodynamics, fluid mechanics, chemistry, and metallurgy as they relate to Company products. The section serves as a refresher course for men who are several years out of school and emphasizes to recent graduates the importance of fundamental principles. Experienced engineers recommend that it be taken before any of the other technical sections. *General Electric Co., Schenectady, New York.*



GENERAL ELECTRIC

953-114C-211