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The WISCONSIN ENGINEER

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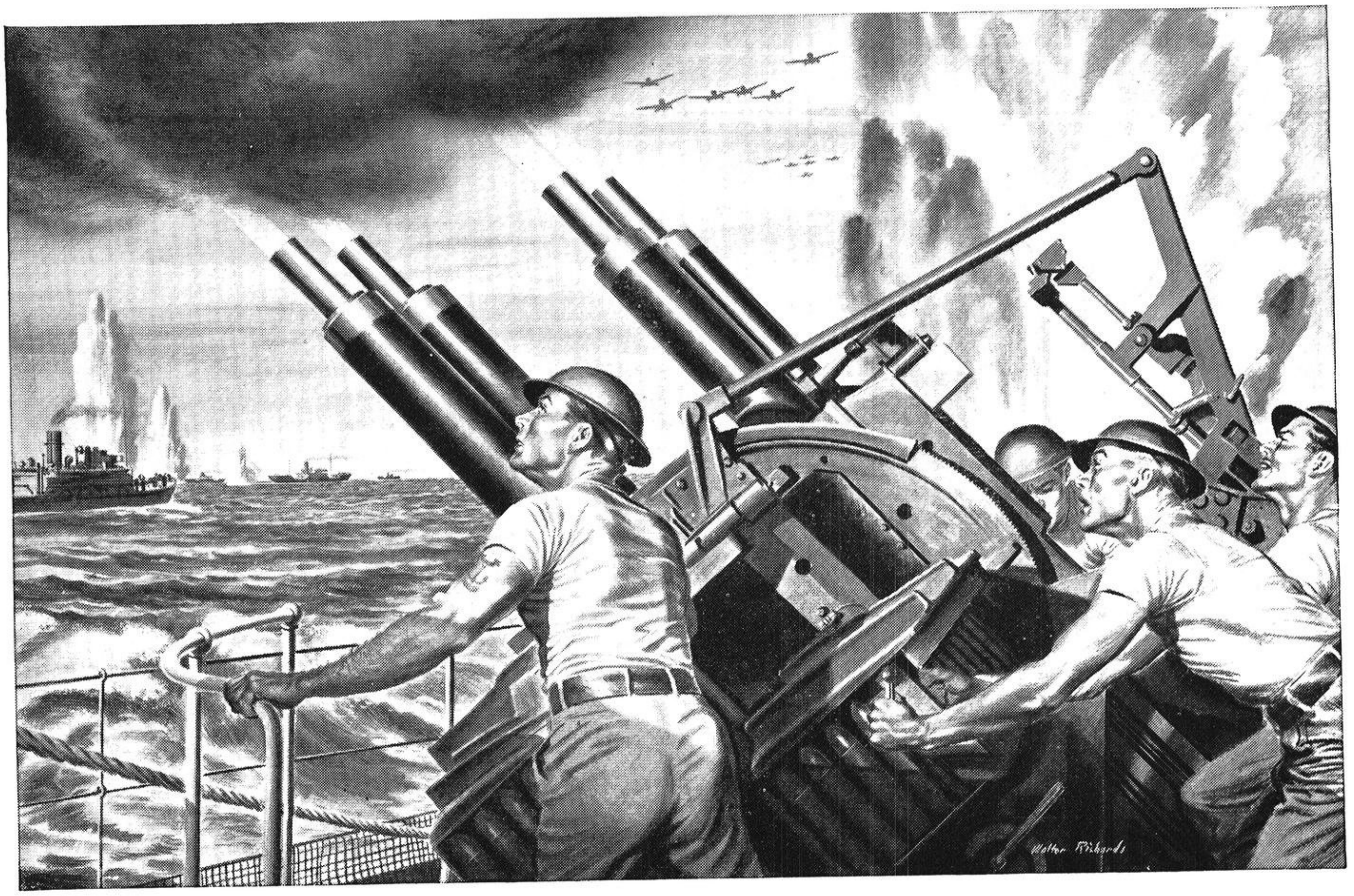
May, 1942

Engineering Yearbook

Synthetic Rubber ★ Jet Propulsion

MEMBER ENGINEERING COLLEGE MAGAZINES ASSOCIATED

"TO PROVIDE FOR THE COMMON DEFENSE, TO PROMOTE THE GENERAL WELFARE"



Bad medicine for big bombers

ONE WAY to spoil a bomber's aim is to hang a curtain of steel over your ship and dare him to come down through it. To get that curtain of steel up there requires quick-firing, flexible guns.

To the plant of the Westinghouse Electric Elevator Company the Navy, a few months ago, brought its plans for such a gun. And to Westinghouse was given the important job of building the mounts that would control the aiming of these batteries of quick-firing guns.

And the Navy said, "Well done!"

Today, over the Westinghouse plant, there floats the Navy's "E" pennant—for excellence—eloquent testimony to the manner in which this Westinghouse plant performed the job. How was this plant able to get into growing production of these mounts so quickly? The answer lies in a Westinghouse characteristic called "know how"—the ability to get things done in the best possible way.

This Westinghouse "know how" makes itself felt wherever Westinghouse craftsmen build things. Whether for the common defense or the general welfare, this "know how" is doing a job. The same skill and ingenuity that made so many splendid things for peacetime living are now being applied to many important war weapons.

"Know how" will work for you again

We look forward to the day when we can give your home, your farm, or your factory the full benefit of Westinghouse "know how" again. To speed that day means just one thing to us: to produce, in ever increasing quantities, the tools with which to get the victory job done.

Proudly We Hail Our 600

• No group at Westinghouse has met its responsibilities in our war effort with more zeal and ingenuity than the 600 young engineers who only last year were your college mates. Already, their work in research and design has made vital contributions to our country's drive for victory.

This year, hundreds who are now college seniors will find at Westinghouse, as perhaps nowhere else, an opportunity to apply their schooling and intelligence toward winning the war.

Westinghouse

"An Engineer's Company," Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

The ★ WISCONSIN ENGINEER

Founded 1896

Volume 46 MAY, 1942 Number 8

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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In This Issue . . .

At least five of the current ECMA magazines carry articles about synthetic rubber. So do we. It seems that the question is not whether a synthetic rubber can be evolved, but whether or not it can be put into production in time to be of any avail. The government is pouring millions of the U. S. Mint's specialty into a subsidization program, designed to bring about effective production in the shortest possible time. Page 5.

The idea of driving an airplane without using a propeller sounds a bit fantastic at first thought, perhaps because all power driven aircraft since the Wrights have used propellers. However, it can and is being done today—with jets. A plane of Italian design, flown by jet propulsion, has attained a speed of 130 miles per hour, and the surface has just been scratched in the development of this form of prime mover. John Erwin's article on page 10 discusses the method of jet propulsion.

The societies take up the next ten pages. A description of each one's activities for the last year and of their plans for the next is included. We hope that the membership in these groups will advance by leaps and bounds next semester. Association with your professional society is well worthwhile.

What to do with old text books? Some sell 'em; some keep 'em. To Sell or Not to Sell gives reasons for both sides. Don Niles is the author. Page 24.

The regular features make up the rest of the book. The campus notes are especially full this time. The humorous picture page is dedicated to the seniors who have gone through the mill.

On the cover we have poor Emil, created by Bob Hodgell, toting an army rifle. The cover picture is of the R.O.T.C. on maneuvers.

The frontispiece, courtesy Westinghouse, is an artistic view of high power transmission lines.

WHAT ABOUT SYNTHETIC RUBBER?

by Roger Lescohier ch '43

Small Illustrations Courtesy Aero Digest

As LONG as there was plenty of rubber around, no one cared much where it came from or what made it bounce. Now that we're walking again, we're wondering what we can do to get tires back.

The American people have developed a genuine fondness for traveling around while sitting down—tires consuming seventy per cent of the rubber produced. The remaining thirty per cent of our normal annual consumption of 600,000 tons is distributed among some 30,000 commodities, varying from rubber lined chemical processing vats to bathing suits and children's toys.

This 600,000 tons a year represents enough rubber to make a sidewalk eight feet wide and two inches thick around the earth at the equator without stretching either the truth or the sidewalk. Since the Japanese started marching, we have been completely severed from ninety-five per cent of our crude rubber supply. At the same time, because of the war effort and in spite of civilian restrictions, our needs have increased. We must have rubber tires for trucks and field artillery; rubber padding for tank interiors; rubber engine mountings; rubber life rafts; hundreds of miles of rubber insulations for electric wires; rubber for balloons; for gasoline hoses and bullet-proof tanks; for hydraulic brake lining and a host of other uses. The battleship North Carolina alone required eighty tons of rubber in her building. Five per cent of our normal supply will cover about as much of our present needs as a single tire patch does your inner tube. Obviously something had to be done about it—and quickly.

Inspecting an "Ameripol" tire, which is identical in appearance to a natural rubber casing.

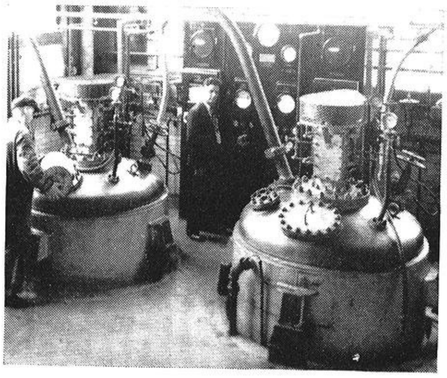
First we arranged for the maximum conservation of the the rubber on hand; then we tried to figure out where to get some more. In order that conservation of rubber might be undertaken immediately after the outbreak of the war, the Office of Production Management issued several orders: first, it froze all tire stocks; second, it limited the use of rubber in all possible instances; third, it delegated the Office of Price Administration to establish the present rationing of tires. We have a stock-pile of about 410,000 tons now on hand. Our present supply is the stock-pile plus what is now in consumption, enough with careful planning to keep us going perhaps eighteen to twenty-four months. So much for conservation of present supplies. Where are we going to get more rubber?

Guayule Rubber

There has been much in the press lately about rubber from South and Central American plantations and from the guayule bush growing in the Salinas Valley in California. The guayule bush does yield a fluid similar to latex from which rubber may be extracted. However, the guayule bush possesses the same drawback as rubber trees —it must grow up before it yields rubber. It takes from three to four years before a guayule shrub is large enough to be harvested, and we can't wait that long. Incidentally, guayule is harvested like sugar cane. It is cut off near the ground, taken to a plant where it is masticated between rollers, the juice being squeezed out and the husk discarded. The rubber, which is in an aqueous suspension, is then extracted from the juice.

The original rubber tree (Hevea braziliensis) was a native of Brazil. We might expect that it could be cultivated easily in its natural surroundings. Such is not the case; the original rubber tree was adapted to growing in a wild condition among many other types of tropical vegetation. It has been found that when cultivated and thousands of them grown in close proximity, the tree is susceptible to leaf blight. The development of a tree resistant to this disease has lost valuable time; and because of this unfortunate situation, the production of rubber in the Western Hemisphere has been limited. There are successful plantations in South America pioneered by Goodyear, Firestone, Ford, and others, but their contribution in the next few years will necessarily be small. It is apparent that the only reasonable recourse left in this emergency is synthetic rubber.

Before considering the production of synthetic rubber, we should mention some of the characteristics and properties of the natural rubber that it is to replace. Rubber is a hydrocarbon found as a colloidal suspension in the so-called latex solution which is extracted from the rubber tree. Rubber may be coagulated from its solution by treatment with a dilute acid such as acetic acid or electrolytes like calcium chloride. The resultant coagulant is washed and dried; then various treatments may be applied. The product may be bleached and dried in air, in which case crepe is the result, or it may be smoked and the resulting substance will be of proper consistency for vulcanization. The latter treatment is more common for we find most of the imported rubber already treated in this manner. Various substances, such as sulfur and other activators are added to the crude rubber before vulcanization to produce a stable adaptable form of processed rubber.



Polymerizers with control panel in rear.

Natural rubber is composed of long molecular chains formed of links of five-carbon units. The units are known as isoprene, the type of chain structure as polymer. Unvulcanized rubber is believed to consist of fibrous material in which the fibers are oriented parallel to each other, but loosely held together. Vulcanization apparently causes an additional lateral linkage which strengthens the general structure and renders the rubber more serviceable.[1]

Polymerized Isoprene

As far back as 1879, a Frenchman, Gustave Bouchardat, produced a substance remotely resembling natural rubber by polymerizing isoprene. He postulated that natural rubber might be a polymer of isoprene. Later investigators have substantiated his assumption by identifying the chemical derivative of rubber that points to this structure. We do not know how nature synthesizes rubber nor are we certain that the monomer isoprene is the unit polymerized. We know something about the non-hydrocarbon constituents of rubber, the sugars, proteins, and resins. Some of these substances serve as protective colloids to stabilize the emulsion while the nitrogen compounds serve to prevent oxidation.

Though it has been more than sixty years since isoprene was first polymerized to produce a substance remotely resembling rubber, no one has yet been able to discover the conditions for polymerizing isoprene which will yield a product that even closely resembles natural rubber in strength and elasticity. If nature does make rubber by polymerizing isoprene, she does it in an environment that man has not been able to duplicate. Hence there is no product that can be called synthetic rubber in the strict sense of the term.

Synthetic Elastomers

Although rubber has never been synthesized, science has succeeded in producing polymeric substances differing from rubber in chemical composition, but approaching it in physical properties far closer than polymerized isoprene. Most people do not realize that literally hundreds of elastomers (rubber-like products) have been studied in the laboratory and that at least ten different kinds of synthetic rubbers have been developed which are both technically and economically practicable. There are five different kinds in commercial production. They are:

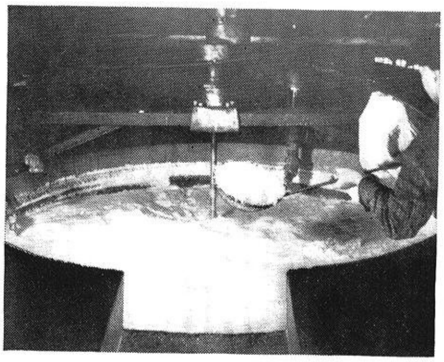
(1) **Polymerized Butadiene:**

Formula $CH_2=CH-CH=CH_2$

Butadiene is polymerized to a structure assumed to be $(CH_2=CH-CH=CH_2)n$ where **n** is the number of butadiene units in one unit of the polymer. Commercial polymerization is carried on by holding butadiene at a slightly elevated temperature for several days in the presence of a catalyst, metallic sodium. To the best of our knowledge, all of the Russian synthetic rubber is of this sort. Minor quantities of a similar product were produced in Germany before the war, but it was reported from Germany in the summer of 1939 that they had decided to drop production of this type in favor of the inter polymers of butadiene with styrene, and vinyl cyanide.[2]

(2) **Buna S.:**

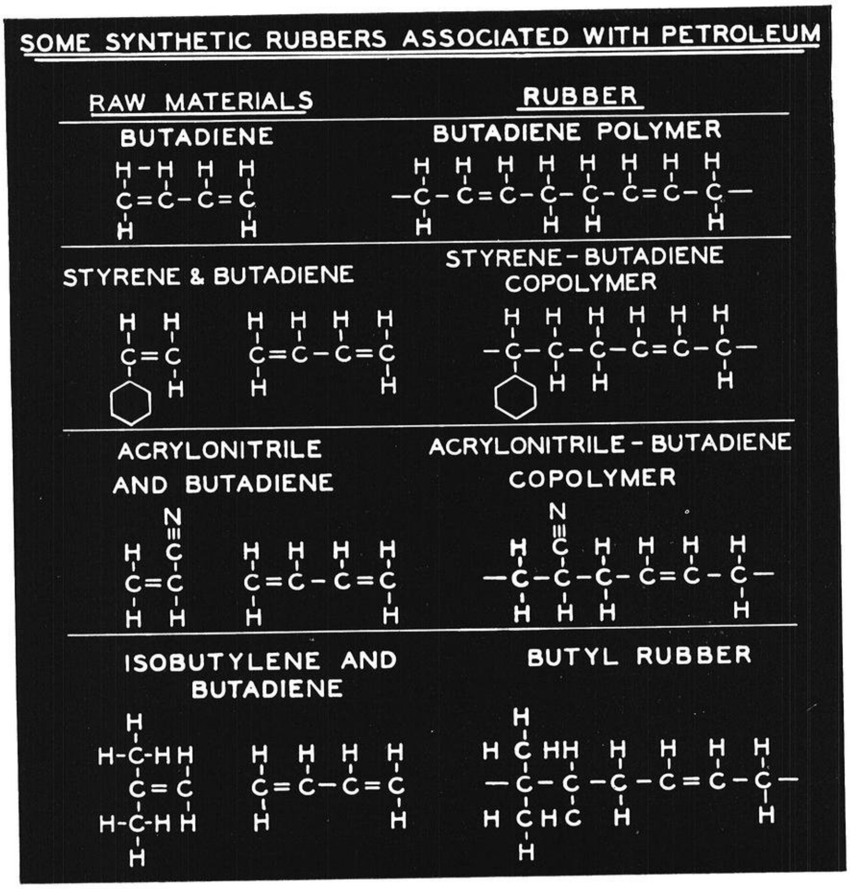
This product, made by the inter-polymerization of butadiene and styrene, was developed by the I. G. Farbenindustrie A. G. and had been produced by them in Germany since 1935. It is believed that this product accounts for more than ninety-five per cent of the German synthetic rubber production. Polymerization is effected by emulsifying butadiene and styrene in water with soap or a synthetic emulsifying agent and holding the emulsion at a slightly elevated temperature for several days. There is no substantial production of this type of synthetic rubber in the United States today. However, plants are now being constructed with government capital, and a large expansion of these plants is being contemplated even before the original construction has been completed.[2]



Vat of solution of raw synthetic rubber after coagulation.

(3) **Buna N or Perbunan:** This product, made by the interpolymerization of butadiene and vinyl cyanide was

also developed by the German I. G., having been first announced in 1935. Since the start of the war in Europe,



—Courtesy Oil and Gas Journal

production has been undertaken in this country and is commercially sold under a variety of names, including the German name, Perbunan. The various brands are not identical, differing slightly in the ratio in which the two components are present; and presumably in the nature of the emulsifying agent; polymerization, catalysts, etc.[2]

(4) **Polysulfide Rubbers:** These products have been made commercially in the United States since 1930 by the Thiokol Corporation and more recently similar products have been made in Germany. They differ from the other synthetic rubbers in that they are made not by polymerization but by the condensation of an organic dihalide with sodium polysulfide. The condensation is carried out in an aqueous medium with the chlorine of the dihalide and the sodium atom of the polysulfide combining to form salt, which is removed by washing.[2]

(5) **Neoprene:** This synthetic rubber, made by the polymerization of 2-chlorbutadiene, was invented in the laboratories of E. I. du Pont de Nemours and Company in the late 1920's, and the first plant for its commercial production was completed in 1931. Chlorbutadiene, more commonly knwn as chloroprene, is made by the addition of hydrogen chloride to monovinylacetylene under the influence of a cuprous chloride catalyst. Monovinylacetylene is made by the condensation of two molecules of acetylene. Chloroprene is polymerized by emulsifying in water with soap or a synthetic emulsifying agent. The resultant emulsion polymerizes much more rapidly than emulsions of butadiene or the mixed emulsions of butadiene with styrene or vinyl cyanide. The time of polymerization depends upon the nature of the emulsifying agent and other components of the system; and is normally only a few hours.

It should be pointed out that such names as neoprene, Buna S, and Buna N are in reality generic terms since there are many modifications of each of these products. Their properties vary over a wide range depending upon the environment in which they are polymerized and, in the case of the Buna's, upon the ratio between the quantities of the two constituents. Polymerization catalysts are commonly employed which are usually oxidizing agents. When polymerization has been carried to the desired point, the emulsion is coagulated by some convenient means such as the addition of an acid or an electrolyte, as was mentioned for natural rubber. Stabilizers, such as the secondary amines, may be added to prevent further polymerization.[2]

It might reasonably be asked, "Why make so many different kinds of synthetic rubber? Why not standardize upon one kind and so facilitate production?" The answer is simple. The production of a number of synthetic rubbers is necessary because no single product possesses exactly the properties of natural rubber. Most of the synthetic rubbers are superior to natural rubber in some respects, but in other respects they may be inferior.

Physical Properties

The sodium polymerized butadiene polymer, as made in Russia and formerly in Germany, is inferior to natural rubber in practically all respects and is inferior to the Buna S, Buna N and neoprene types. It may safely be said that its large-scale production is possible only when it is shielded from competition with natural rubber and the other synthetics.

The Buna S type displays properties quite similar to those of natural rubber when compounded with carbon black. This ingredient is universally used in all tire tread compounds made from natural rubber. However, when compounded without carbon black, Buna S is inferior to natural rubber in tensile strength and in elasticity. It would not make good rubber bands or elastic garments.

The Buna N or Perbunan type is markedly superior to natural rubber in certain respects, especially in its resistance to deterioration by oils and solvents. By reason of its superior properties the I. G. Farbenindustries was able before the war to produce it not only for use in their own closed economy, but also to find a substantial export market at a price several times higher than that of natural rubber. An example of the oil resistance of the Buna type rubbers is shown by a test run by the B. F. Goodrich Company on a miniature tire of Ameripol, the product of B. F. Goodrich and Phillips Petroleum Company. The test tire, and a similar sample of natural rubber were immersed in oil at 160° F. After two weeks' immersion, the natural rubber had swelled 40% in diameter and increased 180% in volume. The synthetic tire showed no effects and retained its original dimensions.

The neoprenes have mechanical properties quite comparable to those of natural rubber whether vulcanized in a pure gum type of formulation or compounded with carbon black as for tire treads. They are superior to natural rubber in resistance to deterioration by sunlight, heat and oils; and due to their chlorine content, are relatively non-inflammable.

The polysulfide rubbers are superior to all the other synthetics in resistance to swelling by oils. They are quite resistant to oxidation deterioration, which property they share with the neoprene and Perbunan types. However, they are quite inferior to natural rubber in tensile strength and in elastic recovery, especially at elevated temperatures. Despite these shortcomings, their excellent oil resistance has enabled them to find a substantial commercial market.

Now that we have seen, in a general way, something of the nature and properties of the synthetics and our need for them, what about their large scale production? Is it feasible? What raw materials are required? Can we ever become independent of our natural rubber supply? If so, how soon and at what cost? Indications are that if we are willing to spend enough time and money we can eventually become independent of natural rubber supplies. Whether we can do so before our present reserves are exhausted, and so prevent curtailment of war equipment requiring rubber, it is difficult to foresee.

The government has just recently embarked upon a project for producing rubber, the magnitude of which staggers the imagination. Under contract now are plans calling for a yearly production of synthetic rubber totaling 600,000 tons or about twenty times our capacity. This will utilize some 1,925,000 gallons of petroleum fractions per day and will cost anywhere from $700,000,000 to one billion dollars. This program was begun only after public opinion and the fortunes of war forced the government to take decisive measures.

Before the War

Prior to Pearl Harbor the rubber industry had found it almost impossible to create on the government's part any active interest in synthetic rubber. In the summer of 1940, Standard Oil, Goodyear, Goodrich, and Firestone approached the National Defense Advisory Committee with proposals to make 108,000 tons of synthetic rubber yearly. The corporations had already invested millions in the developmental work and desired government loans for expansion. But Jesse Jones thought the possibility of a rubber shortage too remote and the cost of producing

(continued on page 34)

—Courtesy Oil and Gas Journal

Close-up showing curds which rise to top of solution. Note stretching of one of these raw particles.

ENGINEERS' GOVERNMENT

Polygon . . .

Polygon is the coordinating group for activities between the professional societies. The board consists of one elected representative from each of the six societies. They sponsor such activities as dances, smokers, expositions, St. Pat elections, and other social activities which affect the entire engineering college.

During the past year, Polygon has sponsored a dance and a smoker in the fall, and the button and ticket sales for the election of St. Pat and the St. Pat's dance this spring.

Polygon was financially successful due to the excellent turnout at the St. Pat's dance that more than made up for the deficit from the other activities. Because there was no exposition this year and it is doubtful if there will be another one for some time, they have invested $370 in a $500 war bond that will mature in twelve years. They also sent part of the money from the profits of the button sales back to the various societies.

FINANCIAL REPORT OF POLYGON ACTIVITIES

April 29, 1941 . . . October 15, 1941

	Disbursements	Income
Balance on hand, April 29, 1941		$1,605.99
Exposition income, May, 1941		23.65
Exposition expenses, May, 1941	$ 276.41	
Division of Exposition profits, June, 1941	420.81	
Totals	$ 697.22	$1,629.64

October 15, 1941 . . . April 27, 1942

	Disbursements	Income
Balance on hand, October 15, 1941		$ 932.42
Smoker, October, 1941	$ 22.20	
Dance income, November 28, 1941		200.95
Dance expenses, November 28, 1941	275.23	
Dance, Buttons income, March 28, 1942		752.70
Dance, Buttons expense, March 28, 1942	466.00	
Division of part of year's profits	122.00	
Incidental expenses	21.00	
$500 War Bond	370.00	
Totals	$1,276.43	$1,886.07
Cash on hand, April 27, 1942		$ 609.64

Respectfully submitted, April 27, 1942
James G. Rogers,
Treasurer

The officers for the coming year are: Harold Holler, President; John Meigs, Secretary; Art Petschel, Treasurer. Other members on the board are William Wilcox, Michael Dunford, and Edward Dickinson. The advisors are Professor J. F. Oesterle and Professor E. T. Hanson. This board has laid the groundwork for their next year's activities by scheduling a smoker and a dance for next November, and a St. Pat's dance for March. Also under consideration for next year are a hobby show, an all-engineering picnic, and an engineers' day. Polygon is looking for more ideas. If you have any suggestions for any engineering activities, see one of the board members or drop this magazine a line.

The Presidents' Council . . .

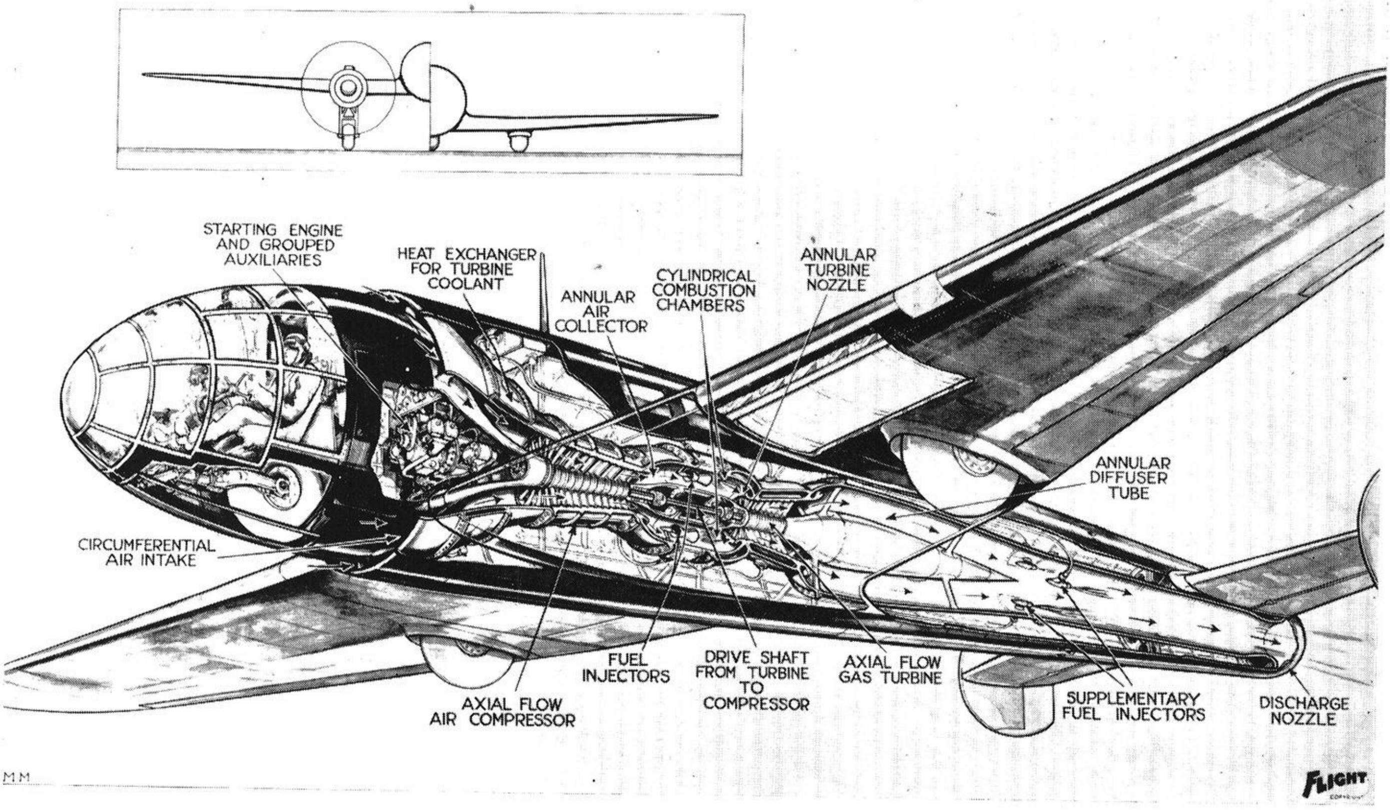
This is a new organization formed a month ago to talk over the problems that confront the presidents of the professional engineering societies. It is a discussion group consisting of the presidents of the six engineering societies and the editor of the Wisconsin Engineer, who acts as secretary.

The presidents have agreed upon a standard meeting night for all of the societies and they desire closer cooperation between the groups by sponsoring joint meetings. Next year, each society will hold its regular business meeting on the second Wednesday of each month and will have a joint meeting with one or more of the other societies on the fourth Wednesday. The joint meetings will depend upon which of these societies will be able to obtain well known speakers that will interest everyone. An excellent example of a joint meeting was the May 13 meeting sponsored by the A. I. Ch. E. They had Dr. Gustav Eglof speak on "Synthetic Rubber," and they invited the A. S. C. E. and the S. A. E. to a joint meeting in the Union. These meeting nights will be listed on the University calendar. The publicity for the meetings will be more widespread and advance notices will appear in the Wisconsin Engineer and in the Daily Cardinal.

Next fall a coordinated membership drive will be put on by all of the societies at the time of registration. A membership blank will be given to each underclassman by his advisor. Wherever possible, local membership will be stressed rather than national because of the difference in price and the fact that the vast majority of students become affiliated with the national organization of their own accord before graduation.

This group is cooperating with Polygon in obtaining a large bulletin board with movable type for the lobby of the Mechanical Engineering Building. This will carry a complete list of all of the Engineering activities.

Next year promises to be an excellent one for the College of Engineering because of the interest shown both by the Presidents' Council and Polygon Board in the engineering activities.



JET PROPULSION . . .

by John Erwin m '42

Cuts and Data Courtesy FLIGHT

THE idea of driving an airplane without using a propeller sounds a bit fantastic at first thought, perhaps because all power driven aircraft since the Wrights have used propellers. However, for the past thirty years or more, experimenters have been trying to evolve other systems that will increase efficiency and supersede present methods. It has only been in the last five years that intensive research has been put to the problem, and only in the last two that practical results have been achieved.

Modern aerial warfare demands high speed, high altitude flight. Airplane engines have reached a point in their development such that their propellers cannot absorb the engine power output without a decrease in efficiency —the main limitations being the tip speeds, interblade interference when more than two or three blades are used on one hub, gear and shaft complications when counter-rotating propellers are used, and the decreased air density at high altitudes. By no means have these methods reached the end of their utility, particularly when you consider the great improvements that have been made: the advancements in propellers, and the two-stage, two-speed exhaust turbo-superchargers. However, forward looking engineers and scientists are realizing the possibilities of two other methods of driving aircraft—jet propulsion for high efficiency high-speed sub-stratosphere and stratosphere flight and rocket propulsion for stratosphere and beyond flight.

As this article is concerned primarily with the jet or efflux system (rocket advancement having been written up in the Wisconsin Engineer of November, 1939), it may be well to note the distinguishing difference. By definition, the rocket carries all the constituents of its combustion process with it; hence including oxygen and making it independent of its medium. The reaction jet depends on the presence of air for its operation. Both methods will see much development in the future, but for the present the air blast seems more practical.

The physics behind the idea is as simple as Newton's Second Law—action is proportional to reaction. The air which enters the airplane is caused to move rearward and the reaction causes the airplane to move forward—exactly the same principal as in the conventional craft, but the methods of accomplishing the air motion are radically different.

The illustration heading the article shows FLIGHT'S conception of a small monoplane using an axial compressor driven by a gas turbine. This may well be one form the machines will take, although the power plant consumes most of the fuselage space. Details of its power plant are not given, but a Campini design of a few years back featured a two-stage centrifugal compressor driven by a radial reciprocating engine and the present plane may be of that type. In this case, one portion of the air delivered by the compressor is used to scavange and charge the engine cylinders into which the fuel is injected. The other portion of the air cools the engine cylinders, thus absorbing heat, and is mixed with the engine exhaust in a final expansion chamber. Additional fuel could be injected into the final expansion chamber, possibly providing an additional boost for take-off or emergency.

Design and experimental work is proceeding in many countries at present, the foremost being England, Sweden, Germany, Italy, Switzerland, and the United States. A resume of the favored types of each country will indicate trends and the advances so far achieved.

From Sweden come the Milo and Ljungstrom designs, both for streamlined units, presumably intended for wing installation. As illustrated in Figure 2, the air enters the Milo unit by an axial orifice, is compressed in a multi-stage blower, A, and delivered to chamber B. This chamber houses an annular combustion chamber, C, and the turbine, D, which drives the blower. The air, preheated in its passage over the walls of the combustion chamber and the turbine casing, at the rear, reverses the direction of flow and enters the combustion chamber past fuel nozzles, E. From the combustion chamber the flow is again reversed, and the gases expand through the turbine and pass with an accelerating velocity through an outlet conduit of diminishing cross-sectional area to the discharge nozzle F. Another illustration of the Milo plant shows two of these units installed in the wings of a high altitude aircraft. From each of the compressors a supply of warmed air is tapped to charge and heat the pressure cabin.

The Ljungstrom design employs a pair of twin-rotor, screw type compressors gear driven from the turbine shaft, similar to the Milo plant, but with the added consideration of a means for suddenly increasing the power output in case of emergency.

The advantages of using a turbine, particularly a turbine of the gas-driven type, are obvious. Just as the steam turbine has replaced the Diesel engine in the generation of electricity, so is the turbine destined to replace reciprocating engine for aircraft, and in the main, for the same reasons. The overall thermal efficiency can be greater, particularly in high altitude flight, due to reduced back pressures. The power output per unit weight can be increased with turbines, due to higher speeds, lack of such complications as valving, timing, high pressure fuel injectors, and due to the design. A turbine with five

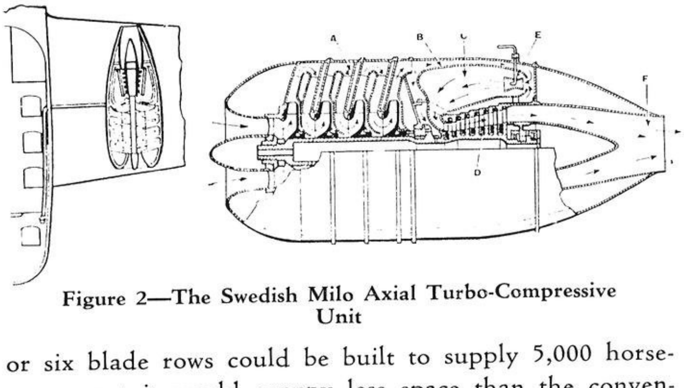


Figure 2—The Swedish Milo Axial Turbo-Compressive Unit

or six blade rows could be built to supply 5,000 horsepower, yet it would occupy less space than the conventional 1,000 horsepower engine. This much horsepower will soon be in use, and if it can be provided by a relatively simple turbo-compressor the gain over a 24 or 36 cylinder engine is obvious.

Another important consideration is the fact that these turbines can be run on a multitude of fuels, permitting the use of "safe" liquids, or even of pulverized solids, minimizing vapor lock difficulties encountered at high levels of flight, and eliminating the necessity for highly refined and treated gasolines.

Figure 3 shows the Italian Campini craft which recently flew from Milan to Rome, about 290 miles, in two and one-quarter hours, averaging 130 miles per hour.

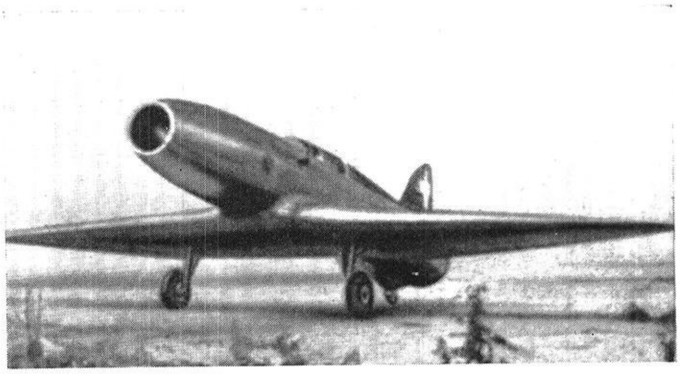


Figure 3—Photograph of the first airplane successfully flown by jet propulsion.

German Investigation

Germany, and the Junkers Company in particular, is also conducting investigations. One design consists of a multi-bank, radial two-stroke engine as the driving unit for the turbo-compressor. To avoid losses caused by reduced velocity of the air for mixing, a special mixing chamber receives the major portion of the air and exhaust gases are added to raise the pressure before transference to the discharge nozzle. Although there may be some immediate advantage in employing a reciprocating engine, the performance and reliability of which can be calculated with accuracy from accumulated data, it would seem that a gas turbine is particularly suitable for this work. The Junkers Company has proposed an attractive plant of this type. This company is anxious to avoid the attainment of super-sonic speeds, not only of the aircraft, but also of the air flowing through the plant, admitting that such speeds introduce problems of an exceedingly complex nature of which there is as yet but little information.

Whittle of Great Britain has designed several plants which are of interest. In 1936 he outlined a "dual thermal cycle," in which all of the working medium, air, was passed through a "lower cycle," and a portion of the medium passed through a "higher cycle." A Diesel engine drives a centrifugal compressor and is supercharged by it. The Diesel exhaust is added to the air from the compressor and the mixture is employed in driving the main unit, a gas turbine driving a large diameter axial blower. The gas turbine exhaust is independent of the main expansion chamber.

Schurter, of Zurich, Switzerland, makes exclusive use of reciprocating engine-compressors. Opposed-piston, high-compression, two-cycle engines are employed with each piston directly connected to a compressor piston plus a rigidly joined small cushioning piston which supplies pre-compression. Combined units of this type offer advantages, since pre-compression of the air is effected at favorably low pressure while high pressures are available for the combustion of the fuel. Unfortunately, the large number of automatically operated valves required involve inherent entrance and exit losses.

Dr. Gustav Eichelberg, also of Zurich, is concerned with the air pressures required for propulsion and for supplying the motive unit driving the compressor. For efficient operation, the effective pressure at the discharge nozzles should be about twice atmospheric pressure, so it varies with altitude. This would cause a decrease in engine output in systems where the engine is supplied by the main air compressor. To increase the exhaust pressure would be inefficient, so to allow optimum pressures to be employed for each function, Dr. Eichelberg suggests that the exhaust from the two-cycle engine drive a turbine which would exhaust separately. The turbine would impel the charging blower, and by adjusting its back pressure would supply charging air at constant pressure for all altitudes.

Thrust Augmentors

Many schemes have been proposed in which a stream of gases issuing from a combustion chamber creates an area of reduced pressure in a tube or duct and induces a supply of air to augment the mass of the propulsive jet. One of the best known and most widely quoted is that invented by Melot and patented in 1920. Referring to the diagrammatic sketch of the Melot multiple nozzle device, Figure 4, the combustion chamber A is charged by relative wind entering by a forwardly facing venturi B and from jet C, carrying in fuel which is ignited by electric or other means. From the chamber the combustion

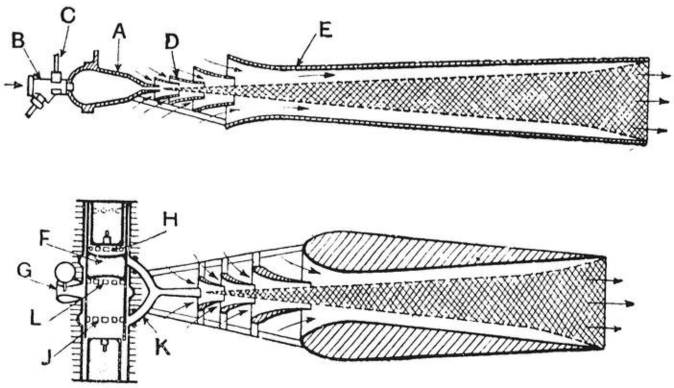


Figure 4—The Melot Thrust Augmentor.

gases are emitted as a stream through a series of nozzles D of increasing diameter through which additional air is sucked into the main diffuser tube E as indicated. The propulsive thrust was certainly "augmented" by the additional mass of air, but not to the degree necessary to enable it to challenge the efficiency of the engine-propeller combination.

One reason for the poor efficiency was the low compression of the fuel-air mixture in the combustion chamber. This was apparently appreciated by Melot, for later he produced the relatively high compression, combustion engine design, also illustrated in Figure 4. The air-cooled two-stroke engine had two opposed cylinders in axial alignment, and a common, free-flying piston F having ported sleeve extensions. In the position shown a charge of air and fuel has been admitted through the venturi G, the common cylinder inlet duct and the piston inlet ports H and compressed in the upper cylinder, which is at the point of ignition. The lower cylinder has discharged its effluents through piston exhaust ports J and the lower branch of the exhaust conduit K which delivers to the multiple nozzle device. A new charge is simultaneously being aspirated by the lower cylinder by way of inlet ports L. Starting is effected by compressed air and electric ignition, but compression ignition is relied upon for continuous running.

American Research

In 1927 two American investigators, E. N. Jacobs and J. M. Shoemaker, undertook a series of tests at the Langley Memorial Aeronautical Laboratory to determine to what extent the Melot type augmentor would increase the thrust reaction of a jet, and thus to obtain some indication of the value of such devices for jet propulsion. The device used followed as closely as possible the earlier type illustrated. Instead of burning a fuel, however, the chamber was supplied with compressed air at ordinary temperatures. Mathematically it would appear that the thrust of a free jet would need to be increased several times in order to make jet propulsion a feasible proposition. The best results obtained indicated a thrust 137% of the theoretical thrust of a free jet. Although the design represents a creditable advance, these results provided no evidence that the efficiency could be raised to the degree necessary for the successful propulsion of aircraft. The progress which has been made, best evidenced by projects now under way at Langley and in private industries in the United States, justifies the confidence which the pioneers displayed in spite of discouragements such as this.

Summary of Advantages

Jet propulsion would be less critical regarding fuels. Cheaper "safety" fuels could be employed without loss in efficiency. As the power is applied directly, no transmission or conversion mechanisms are necessary. Apparently the propeller will eventually limit the power which can be delivered by the single-propeller-to-an-engine combination. By eliminating the propeller entirely, this potential handicap is avoided. The efflux system is better suited for maintaining power output at high altitudes. The main compressor system could also supply air to warm and pressurize the cabin and prevent icing. It would be possible to utilize rotary units entirely, allowing higher speeds with a reduction in size and weight over a reciprocating engine. Pressures would be relatively low, so casings could be light, improving power-weight ratio, hence

(continued on page 39)

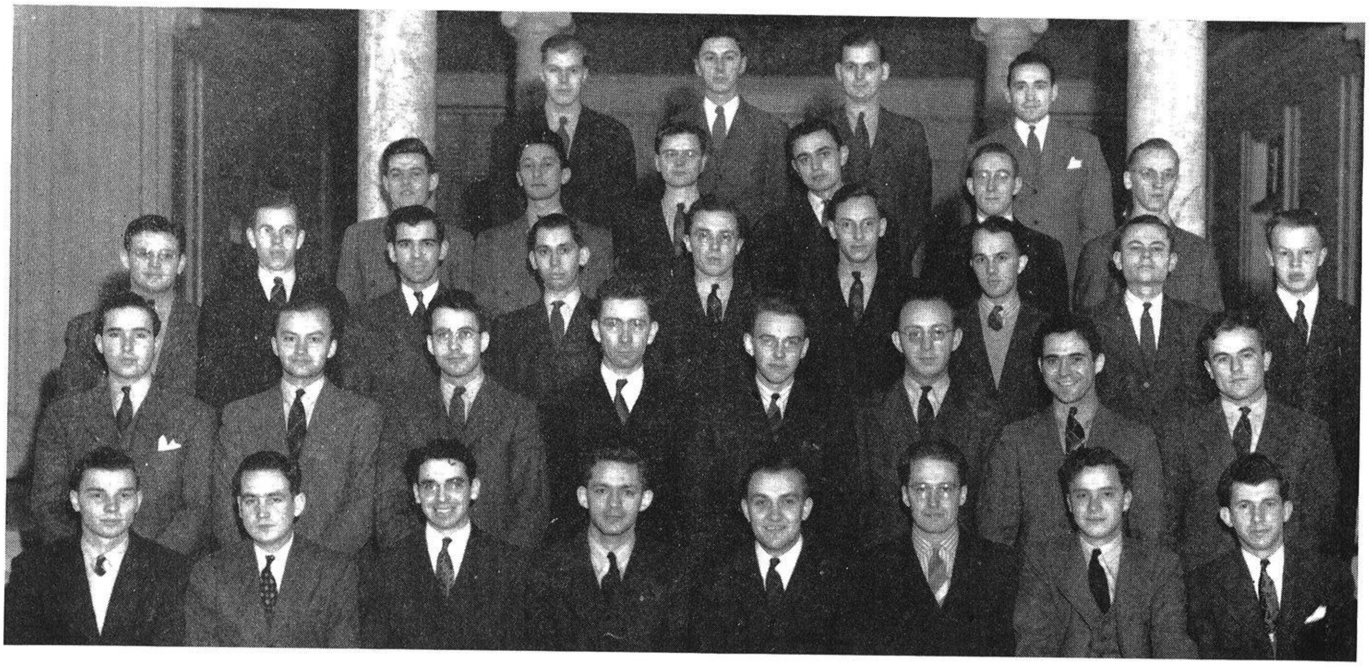
THE

Professional and Social Organizations

in the

COLLEGE *of* ENGINEERING

THE UNIVERSITY *of* WISCONSIN



Senior Members: Bottom Row: V. Loether, C. Rowe, M. Dunford, L. Massey, K. Schultz, G. Dawley, W. Gehrke, R. Bolton. *Second Row:* F. Morley, L. Brann, W. Arvold, R. Baker, C. Lufter, F. Knifer, E. Vetter, G. Stolze. *Third Row:* R. Ulichny, J. Allen, D. Dowie, R. Hahnsch, F. Mueller, O. Hussa, E. Torke, J. deDomaine, D. McDonnell. *Fourth Row:* B. Singer, W. Witter, R. Zedler, G. Stueber, W. DuVall, C. Burczyk. *Top Row:* J. Westfahl, L. Martin, H. Peterson, L. Millonig.

American Institute of Chemical Engineers

1941-42		1942-43
Lester Massey	*President*	Milton Lavrich
Kenneth Schultz	*Vice President-Treasurer*	Merk Hobson
Michael Dunford	*Secretary*	Patrick Martin
Henry Schmalz	*Polygon Representative*	Michael Dunford
Prof. R. A. Ragatz	*Advisor*	Prof. R. A. Ragatz

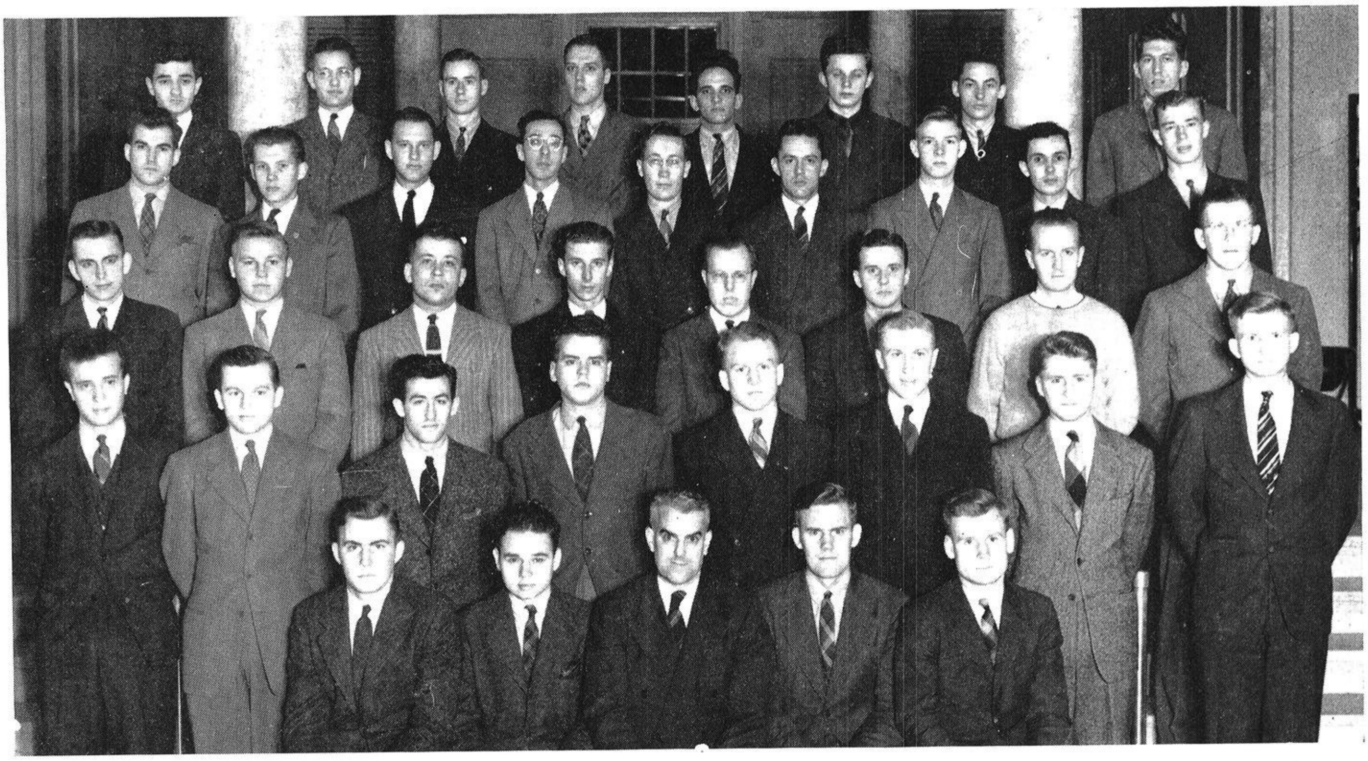
THE present Wisconsin student chapter of the American Institute of Chemical Engineers began as the Chemical Engineers' Society shortly before the first World War; and it became affiliated with the national organization in 1923.

Its purpose is to develop the principles and practice of chemical engineering; to encourage the application of chemistry, physics, and mathematics to the problems of industry; to promote industrial efficiency by substitution of scientific and engineering procedures for "rule of thumb"; and the establishment of high standards of personal ethics.

These monthly meetings of the chemical engineers are comprised of first a business session, then an address by the speaker of the evening, followed by refreshments. Some of the notable speakers this year included Professors Watts and Haugen of the Chemical Engineering Department, Professors Williams and Walton of the Chemistry Department, Pat Norris of Madison Home Insulation, Forrest Anderson of Wilkens-Anderson, and Col. Walsh of the Army, who spoke at a joint meeting of several societies. The high point of the meetings this year was May 13, the date of the joint meeting of the A. I. Ch. E., the A. S. C. E., and the S. A. E., with an address by Dr. Egloff of University Oil Products, one of the nation's foremost petroleum research men.

This society is one of the largest of the engineering societies at Wisconsin, with a membership this past year of over a hundred and sixty. One of its achievements this year was electing Bill Arvold at St. Pat. The Chems also won the contest at the Polygon dance last fall for constructing the best Rube Goldberg invention.

In addition to these outside activities, the A. I. Ch. E. has always endeavored to serve its individual members, by such projects as the newly founded Alumni Service, starting with the class of June, 1941, which keeps each member in touch with his classmates. There has also been posted a map showing the future locations of present seniors upon graduation. On the lighter side we find enterprises like the Society picnic, which was held on Saturday, May 9, at one of the city parks.



Bottom Row: R. Joiner, R. Berzowski, Prof. J. G. Woodburn, M. Thompson, W. Warzyn. *Second Row:* M. Silberman, J. Saemann, S. Resnick, R. Reisingen, R. Birkett, A. Larson, M. Ree, C. Tice. *Third Row:* R. Nordlie, R. Green, R. Milaeger, P. Sodemann, J. Wagner, R. Read, F. Bertle, D. Dixon. *Fourth Row:* R. Luebke, W. Huber, R. Erichsen, H. Bailer, R. Peters, J. Elliott, D. Eklund, R. Schmidt, A. Petschel. *Top Row:* E. Korpady, A. Ingersoll, R. Andrae, R. Strehlow, C. Kaeser, L. Emelity, E. Beck, J. Lippert.

American Society of Civil Engineers

1941-42		1942-43
Alfred Ingersoll	*President*	Richard Andrae
Roger Peters	*Vice President*	Charles Naiser
John Elliott	*Secretary*	Elroy Spitzer
Arlie Dent	*Treasurer*	James Lippert
Paul Sodemann	*Polygon Representative*	Arthur Petschel
Prof. James Woodburn	*Advisor*	Prof. James Woodburn

THE purpose of the American Society of Civil Engineers is to promote contacts of civil engineers with the faculty, with the industrialists, and with many diversified subjects as well as those pertaining to engineering. This purpose is accomplished by meetings with fellow students; and by speakers whose topics range from strict engineering to non-technical subjects.

The past year has had a well balanced program, although a majority of the programs have been on engineering subjects. Mr. Gallistel told of his work as Superintendent of Buildings and Grounds in the maintenance of University buildings. Professor Woodburn spoke on the Bonville Dam and used slides for an illustrative background. Mr. Jaegger, field secretary of A. S. C. E., presented movies and a discussion on "Water Purification." The new Pennsylvania Turnpike was described by B. E. Brevik, with the aid of movies. Structural engineering was studied with an evening devoted to Robertson "Q" Floor. At a joint meeting with the Wisconsin Senior section, Mr. Bloom of the Wisconsin Telephone Company spoke of "New Developments in Sighting Devices and Communication Systems." The first meeting of the year was also a joint meeting with the Wisconsin Senior section and the Marquette student branch. Horace Byers of the University of Chicago told this group of the climatic significance of war with his talk on "Weather and the War." Another topic pertaining to war was Professor Gaines Post's, of the History Department, a resume of "Technology of War in the Sixteenth Century." Dr. Alfred Swan of the First Congregational Church brought out the "Social Responsibility of the Engineer" in his study of human problems.

A social highlight of the year was the party at which a band composed of A. S. C. E. members played and a skit with impersonations of various members of the faculty caused many laughs for those present. This was a date affair as was the mixer held for the movies of the failure of the "Galloping Gertie" Tacoma Bridge. The last two sessions of the year were a joint meeting with the A. I. Ch. E. where Dr. Gustav Egloff, Universal Oil Products, spoke on "Petroleum and the Present War" and the Mid-Western convention of the A. S. C. E. Eight schools were represented at this convention which featured "Aerial Bomb Protection," "Effects of High Pressure on the Body," and "Design and Technique of Welded Joints."

Top Row: D. Stoneman, J. Vlach, F. Odegaard, K. Schroeder, E. Wege, H. Dorward, E. Kleinmann, C. Zarn, E. Parduhn, H. Luebke. *Second Row:* M. Salter, R. Schindhelm, E. Bosley, M. Niese, C. Heffernon, R. Weidner, E. Perchonok, C. Orth. *Bottom Row:* H. Holler, J. Spradling, C. Reuschlein, D. Jelinek, F. Graper, J. Wilson, A. Slemmons, F. Mann, L. Brehm.

American Society of Mechanical Engineers

1941-42		1942-43
Donald Jelinek	*Chairman*	John Wilson
Culver Heffernon	*Vice Chairman*	Edward Bosley
Fred Graper	*Secretary*	John McCann
Earl Kleinman	*Treasurer*	Robert Lanz
John Wilson	*Polygon Representative*	Harold Holler
Prof. B. G. Elliott	*Advisor*	Prof. D. W. Hanson

THE student branch of the American Society of Mechanical Engineers brings the student into contact with industry into which he will later emerge.

The meetings of the group are both technical and social. Speakers have been brought from several of the large industries of the country to address the society. Discussions at these meetings were on such topics as "Powdered Metallurgy" and "Personal Recollections of Rudolph Diesel." Mr. H. T. Scott of the Wisconsin Alumni Research Foundation gave an informative talk on the subject, "Vitamins and National Defense."

Mr. Koehring of General Motors spoke on "Powder Metallurgy" at a joint meeting with the Rock River Valley Section in November. In the spring they had a dinner banquet in the Memorial Union with the Rock River professional and the Marquette student branches of the A. S. M. E.

Their social activities include a party dance with the S.A.E. This spring five of the men from this chapter went to the annual convention at Notre Dame, to meet with the representatives from other engineering schools in the mid-west. Culver A. Heffernon presented a paper on bomb-proof constructions at the convention. Next year's convention will be held at Northwestern University, in Evanston.

Bottom Row: J. Sheng, T. Custin, R. Miller, H. Nettesheim, R. Robbins, G. Acree, L. Elmergreen, R. Beitz, H. Schwalbach. *Second Row:* M. Kaplan, R. K. Miller, P. Fischer, R. Thomasgard, L. Goodman, D. Gold, W. Kemnitz, E. Dickinson, T. Retzer. *Third Row:* F. McStay, B. Hansen, H. May, K. Hornberg, L. Kahl, J. House, A. Lytle, V. Olson, L. Sanden, W. Tice. *Fourth Row:* L. Hamel, R. Kordatzky, C. Rice, H. Schlintz, R. Benckenstein, A. Luebs, F. Hyland, D. Reck, A. Seidel, J. Eising. *Top Row:* W. Vea, H. Schneider, J. Hull, H. Logemann, H. Ellis, N. Schmitz, J. Ancell, G. Hill, L. Krebs, J. Brogden, E. Lundberg.

American Institute of Electrical Engineers

1941-42		1942-43
Roger Robbins	*President*	Edward Dickinson
George Acree	*Vice President*	Myron Larson
Henry Nettesheim	*Secretary-Treasurer*	Art Lytle
Lester Elmergreen	*Polygon Representative*	Edward Dickinson
Prof. R. R. Benedict	*Counselor*	Prof. E. E. Ayres

THE Wisconsin student chapter of the American Institute of Electrical Engineers gives the students a general interest in current engineering problems and methods which are not discussed in the classroom. Their speakers discussed a variety of subjects. Sterling Beckwith of Allis Chalmers spoke on hydrogen cooling of generators; Colonel James Walsh talked on engineers against time; John Wise, State Industrial Commission, discussed electrical safety; and Charles F. Wagner of Westinghouse told of traveling waves. Mr. H. H. Henline, National Secretary of the A. I. E. E., also addressed the society. Other programs included the General Electric House of Magic; and the presentation of student technical papers. These meetings were followed by refreshments and a "bull session" where the members had a chance to meet their fellow students.

Their social activities include picnics in the spring and fall; and a party with the Art Education girls in the Electrical Engineering Lab-Art Education Building. The student branch was represented by ten members at the student session of the Great Lakes District Conference held May 2 at the Northwestern Technological Institute. Joseph Hull presented a technical paper on "Engineering Aspects of Mass Spectroscopy."

Bottom Row: H. Faville, A. Miller, R. Arndt, R. Lescohier, C. Spraker, J. Rogers, L. G. Schneider. *Second Row:* J. Hunter, W. Scofield, L. Sladek, V. Gavic, G. Schmidt, E. Odegaard, J. Gianos, D. Kistler, J. Firey, E. Enters. *Top Row:* K. Schmidt, S. Brigham, D. Stoneman, H. Dorward, H. Thies, J. Meigs, L. Velander, C. Orth.

Society of Automotive Engineers

1941-42		1942-43
Jim Rogers	*President*	Albert Miller
Hugh Faville	*Vice President*	Roger Lescohier
Steve Brigham	*Secretary-Treasurer*	Robert Arndt
Jim Rogers	*Polygon Representative*	John Meigs
L. G. Schneider	*Advisor*	L. G. Schneider

THE student branch of the Automotive Society of Engineers had one of the most successful years in its history. This can be attributed to the fact that the society offered an attractive program of trips, lectures, and movies to its members. It is comprised of seventy mechanical engineers. At their monthly meetings, speakers and movies from nearby industrial organizations have given worthwhile information on all phases of transportation. The society does not restrict itself to consideration of automotive engineering alone, as its name implies. Rather their concern is with all types of transportation, including automobiles, Diesel-powered railways, and aeronautical engines.

During the last year a trip to Milwaukee was made possible by the Milwaukee Society of Automotive Engineers. The students went by bus, first to the Waukesha Motors Plant, and then to a joint meeting with the Milwaukee group to hear a talk on the German Messerschmidt airplane motor. They had an opportunity to inspect one of these motors which the British have sent to this country. The students are always welcome at the Milwaukee meetings and several autoloads travel to that city to attend each meeting. Here at the University they were addressed by Mr. Hollister Moore, Chairman of the Student Relations of the S. A. E. Their programs, which were highly educational, included movies on: "Motorized toboggans," "Four-wheel drive trucks," "Modern airplanes." At one meeting they were entertained by Harry Thies, who put on an amateur magician show.

Bottom Row: G. Erspamer, D. Wright, D. Meves, L. Wartman, L. Grey, R. Ramage, A. McKlosky, Puhl, W. McGuire. *Second Row:* A. Johnson, M. Evans W. Friske, J. Baird, G. Slavney, Prof. J. F. Oesterle, R. Bemm, D. J. Girardi, R. Short, J. Schultz, J. Schlass, H. Kalvonjian. *Third Row:* G. Hakes, R. Rybarchyk, G. Brighty, R. Wieen, H. Zielke, J. Jude, J. Nichols, T. Gaulke, H. Zahalka, R. McIntosh, H. Goldfein, R. Eck. *Top Row:* C. DuMont, C. Phillips, E. Brodhag, J. Hall, R. Kron, R. Edgar, D. Paynter, D. Gibbens, W. Wollering, G. Benson, P. Bevin, C. Hicks, R. Foltz.

Mining Club

1941-42		1942-43
Robert Bemm	*President*	Gerald Slavney
Douglas Bainbridge	*Vice President*	Harry Kalvonjian
Warren Friske	*Secretary*	Harold Goldfein
Robert Short	*Treasurer*	Walter Wollering
Ervin Waulters	*Polygon Representative*	William Wilcox
Prof. E. R. Shorey	*Advisor*	Prof. E. R. Shorey

THE Mining Club is composed of the mining and metallurgical engineers. Its monthly meetings promote fellowship between the students as well as introducing them to the leaders of industry. All students enrolled in the Department of Mining and Metallurgy are automatically members. There have been no dues for the past several years. At each monthly meeting, a dinner for which the members pay a nominal fee precedes the business session. Responsibility for the preparation and serving of these meals rests upon the duly appointed head chef and his assistants. Each December an annual Christmas party is held, complete with turkey dinner and all the trimmings. The Mining School is proud of the fact that with the smallest enrollment of the engineering branches, its proportional student participation is the highest. The comparatively small size of the student membership makes possible a high degree of comradeship among the students and faculty.

During the past year, the Mining Club has had guest speakers who were prominent men in engineering and allied fields. Among those who have addressed the Mining Club this year are F. Ellis Johnson, Dean of the College of Engineering; Mr. Robert Van Pelt, Regional Director of the Chicago Chapter of the American Institute of Mining and Metallurgical Engineers, and Technical Director of the Chicago Museum of Science and Industry; Mr. V. D. Claffey, National Director of the American Foundrymen's Association; Professor J. H. Matthews, Chairman of the University Chemistry Department; Mr. David Zuege, of Sivyer Steel Casting Company, who spoke on the problems of the steel foundry; and Mr. Bradley Booth, who told of the production of silvery pig iron.

The climax of the year's activities was the visit of the Chicago section of the American Institute of Mining and Metallurgical Engineers with which the Mining Club is affiliated. On May 16, they were guests of the Mining Club at a banquet, and then were taken on an inspection tour of the campus.

Bottom Row: L. Brehm, P. Sodemann, W. Dunn, R. Zoellner, H. Holler, J. Wilson, W. Cunningham. *Middle Row:* W. Koss, R. Baillargeon, R. Zoerb, D. Bainbridge, G. Westmont, C. Possell, R. Lanz, E. Bosley. *Top Row:* G. Williams, R. Wicen, J. Smith, W. Ille, R. Bauer, D. Hurock, J. Koss. *Not on Picture:* E. Drott, D. Stoneman, W. Wollering, J. Miller, M. Urbanski. *Honorary Faculty Members:* K. F. Wendt, D. W. Mead, E. R. Shorey, G. L. Larson, J. R. Price, W. S. Kinne.

Triangle

1941-42		1942-43
Robert Zoellner	*President*	Edward Bosley
William Dunn	*Vice President*	William Cunningham
Raymond Zoerb	*Secretary*	Robert Wicen
Harold Holler	*Treasurer*	Lyle Brehm
Paul Sodemann	*Steward*	Harold Holler

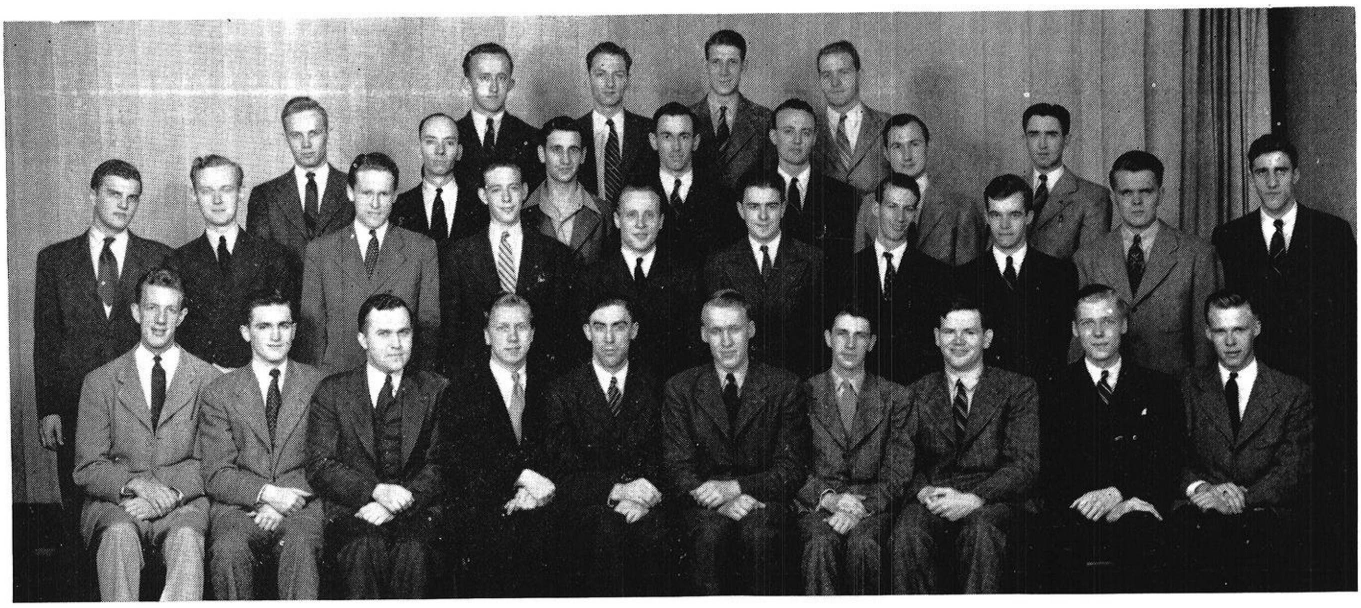
TRIANGLE, a fraternity of engineers, is an organization devoted to high attainment personally and professionally in the field of engineering, through the medium of brotherly communion among the men who comprise its membership. It is a national collegiate fraternity which affords its members all the advantages of fraternal life while in school, and perpetuates that spirit of brotherhood beyond college days by virtue of a common interest in the profession of engineering.

The men selected for membership in Triangle are carefully judged on their personal qualities and future promise as successful engineers. Essentially then, the development of able engineers, in all that the phase implies, is the paramount consideration of Triangle.

In fulfilling the object of the organization, chapters are chartered at leading educational institutions which offer degrees in engineering. At these schools the chapter maintains a chapter house which serves as a headquarters and a home for its members. Each chapter is composed of active members (those who are engineering graduates in residence at the school) and alumni members (those who are no longer registered as students). The chapter house property and equipment are owned by the chapter as a whole, and the current expenses are paid and administered by the active members actually living in the home.

As a means for continued enjoyment of the pleasant and profitable relations inaugurated while in school, Triangle has alumni associations in the larger cities from New York to California. These groups composed of all Triangle men residing in the immediate vicinity constitute a wonderful opportunity for social and professional contacts.

In all its activities Triangle conducts its affairs conservatively and on the basic premise that the ultimate benefit to its members as men, engineers, and citizens, shall shape the policies of the fraternity. Financially, Triangle regulates its affairs so as to permit even the men of limited means an opportunity to participate in the wide-spread benefits of brotherhood.



Bottom Row: N. Larson, J. Hamilton, J. Kelar, V. Olson, H. Nettesheim, D. Reek, M. Larson, H. Schneider, N. Schmitz, D. Ault. *Second Row:* G. McGilvra, R. Crawford, C. Rice. T. Jepson, A. Schultz, J. Salay, G. Heisig, L. Sanden, D. Strate, J. Nettesheim. *Third Row:* E. Nesvig, B. Hansen, J. Asti, H. Schlintz, L. Elmergreen, J. Eising, W. Shink. *Top Row:* A. Baguhn, H. Logemann, R. Krohn, R. Johnson. *Not on picture:* E. Harrison, G. Acree, N. Miller, A. Lytle, J. Maloney. *Honorary Faculty Members:* Ralph Benedict, Edward Bennett, Cyril M. Jansky, F. Ellis Johnson, Royce Johnson, Ludvig Larson, Frederick Maxfield, Gordon F. Tracy, H. B. Wahlin.

Kappa Eta Kappa

1941-42		1942-43
Henry Nettesheim	*President*	Verland Olson
Homer Schneider	*Vice President*	Donald Reek
Verland Olson	*Secretary*	Dan Ault
Joseph Kelar	*Treasurer*	Joseph Kelar

THE preamble of the constitution of Kappa Eta Kappa, professional electrical engineering fraternity, states: "Believing that attainment of education as well as technical training is the aim of all true engineers, we band ourselves together to foster and promote fraternal relationships among the Electrical Engineering students; to strive at all times for the maintenance of a complete and lasting understanding and fellowship between the faculty and students; to unceasingly cherish and develop character and ideals of service as the necessary attributes of the profession."

Delta chapter of Kappa Eta Kappa was formally installed at the University of Wisconsin February 9, 1924. The chapter house is located at 1124 West Johnson, halfway between the Electrical labs and the Mechanical Engineering building. The house accommodates fifteen men, and a table for twenty is maintained. Plans have been made for the house to remain open this summer during the engineering summer session.

Membership is selective, undergraduates in electrical engineering being eligible in the spring and fall rushings. The active membership at present is thirty-six future electrical engineers. While the goal of 100% placement for its graduates has been easily maintained in the last few years, KHK realizes that the alumni relationships and contacts it provides will be invaluable for many of today's graduates and tomorrow's students a few years hence.

KHK has a program designed to fit the time and pocketbook of the electrical engineering student. There is no indebtedness; on the contrary, KHK is the possessor of a $1000 war bond which it purchased from its house fund savings shortly after the outbreak of war. Its members consistently lead in student undertakings, while Kappa Eta Kappa as an organization lends its full support to worthwhile activities. The fraternity activities for the actives, alumni, and faculty include an initiation banquet and homecoming party in the fall, and a reunion banquet and formal dinner dance in the spring. Informal parties, picnics, and exchange dinners are part of the social schedule.

Bottom Row: W. Spiegel, C. Wulff, H. Schlintz, H. Schneider, J. Baird, H. Blocki, J. Erwin, R. McIntosh. *Middle Row:* A. Larson, R. Lescohier, H. Johnson, A. Petschel, D. Caldwell, W. Leffingwell, E. Perchonok, R. Short. *Top Row:* W. Beyer, A. Ingersoll, R. Robbins, R. Bauer, J. Caldwell. *Not on Picture:* D. Niles, E. Jacobson, G. Erspamer, and S. Schinasi.

The Wisconsin Engineer

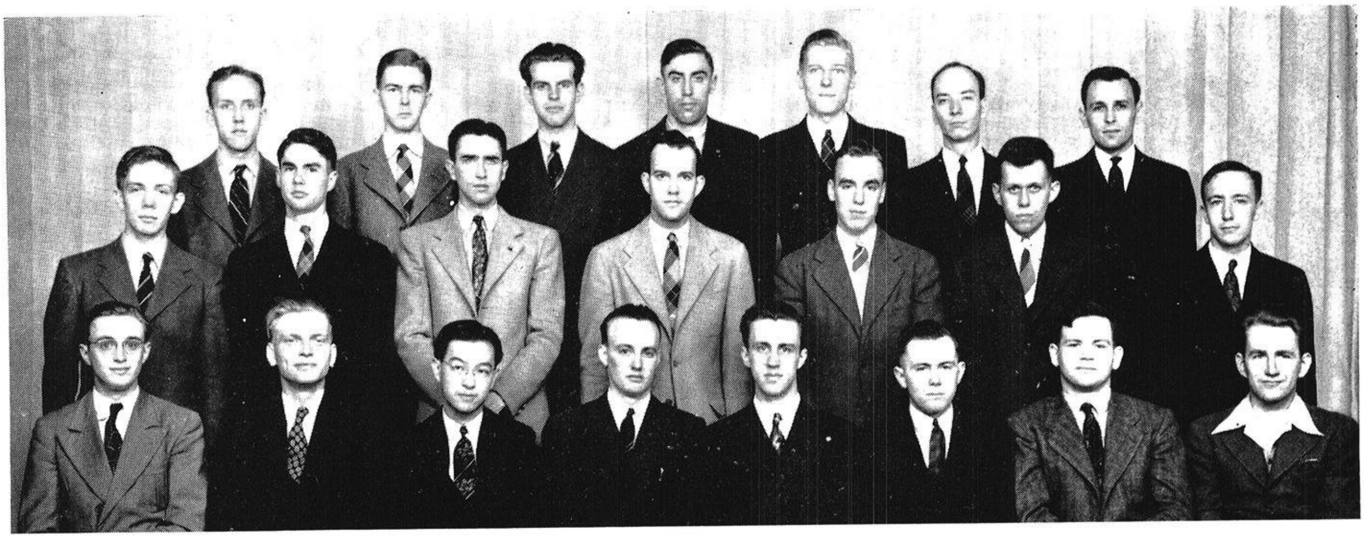
1941-42		1942-43
Homer Schneider	*Editor*	Jerome Baird
John Erwin	*Associate Editor*	Herbert Blocki
Harvey Schlintz	*Business Manager*	Walter Speigel
Wayne K. Neill	*Advisor*	Wayne K. Neill

THE Wisconsin Engineer Magazine is known officially as the Wisconsin Engineering Journalism Association and was founded in 1896. A student publication devoted to science and engineering, it has grown in size and quality until it is one of the leading engineering college magazines in the country. Last fall the magazine, at a conference of the engineering college magazine staffs at Urbana, received a first place award for the Alumni Notes section, and honorable mention for the cover and for student-written articles.

The staff members receive no financial assistance, but their work is rewarded by service keys, a banquet, and a trip to the annual convention of the Engineering College Magazines. The most important benefit derived from working on the staff is the valuable experience gained by working with other people and doing things on one's own initiative.

The magazine is divided into two departments, editorial and business. The editorial staff offers opportunities for those who desire to write technical or non-technical articles, humor, news of the Engineering campus, and Alumni notes. They also handle correspondence, obtain illustrations for articles, and prepare the magazine for publication. The business staff handles circulation, advertising, and the finances. Any undergraduate engineer who has been in school one semester is eligible to work on the staff.

The board of directors, composed of eight faculty members and the editor and business manager, lends continuity to the organization and aids in keeping the finances on an even keel.



Bottom Row: G. Hagensick, R. Imm, J. Sheng, L. Elmergreen, P. Hoffmann, T. Tveit, H. Schneider, H. Schwalbach. *Second Row:* J. Lower, J. Hull, W. Schink, W. Deerhake, J. Cockrell, J. Brogden, N. Davis. *Top Row:* V. Richard, T. Lind, J. House, H. Nettesheim, N. Schmitz, B. Hansen, D. Koch.

Eta Kappa Nu

1941-42		1942-43
Lester Elmergreen	*President*	Paul Hoffmann
Homer Ellis	*Vice President*	James Cockrell
Ted Tveit	*Secretary*	Ju-gee Sheng
Ruben Imm	*Treasurer*	Gordon Hagensick

ETA KAPPA NU, the Honorary Electrical Engineering Society, was established on the University of Wisconsin campus in 1910, being the seventh of 34 national chapters.

The activities of the organization in past years have consisted of giving an award to the outstanding freshman in electrical engineering, cooperation in school enterprises such as the expositions of 1940 and 1941, and in sponsoring the annual senior electrical engineering picnic.

The active chapter has, during the last year, undertaken the project of a study of the curriculum of the Electrical Engineering school and will present the department with a report containing student suggestions. The senior picnic this year gave way to the senior banquet which will be sponsored jointly by all organizations in the Electrical Engineering school.

Honorary Initiates

TAU BETA PI

All Engineering

DONALD BUSWELL
ROBERT BUCKLEY
JAMES COCKRELL
ROBERT DAANE
HENRY GEISLER
JOSEPH HULL
JAMES KOCHA
ARNE LARSON
ANTHONY LIND
DONALD LIVERMORE
ALVIN LOEFFLER
ALDON LOKKEN
JACK LOWER
EWALD PARDUHN
KARL PENNAU
WALTER SIVLEY
LEON SMITH
JAMES THORNBERY
NATHAN VAHLDIECK
MERTON VOGEL
ERVIN WEGE

PI TAU SIGMA

Mechanical Engineering

JAMES COLIZ
FELIX GEIGER
DONALD JELINEK
WAYNE JENS
JAMES KOCHA
ROMAN PITZEN
GEORGE REA
WILLARD SMITZ
ROBERT VERHAEGHE
KARL WEGENER

ETA KAPPA NU

Electrical Engineering

JACK BROGDEN
JAMES COCKRELL
GORDON HAGENSICK
PAUL HOFFMANN
JOSEPH HULL
DAVID KOCH
DAVID SOERGEL

CHI EPSILON

Civil Engineering

WALLACE HUBER
GORDON JAEHNIG
DOUGLAS SCOTT
WALTER SIVLEY
MERTEN VOGEL

TO SELL OR NOT TO SELL

by Don Niles, m '44

THE main reason most of us sell our books is because we have paid for them. Whether one sells to a book store or to an underclassman, the money obtained comes in very handy. A good selling point for the book is to assure the buyer it is well filled with underlined passages and explanations, or with the answers to all the problems indicated in big black figures.

At times the resale value of a book is nil. Notably when it is not to be used the next year. Then you may want to sell it by the pound as scrap paper.

If one kept all the books he met in four years of university he would have a pretty full bookshelf. The value of the books retained would be lessened, as far as use as references are concerned. Some would **never** be used again and would just be getting in the way and collecting dust; these you might want to get out of the way in the most profitable manner possible.

This business of references can be overdone. If you get in the habit of hauling out your math 51 text every time you use the law of cosines you aren't going to develop much confidence in yourself. When working on a problem and the law is to be used, it is a temptation to look it up if a book is nearby, rather than trying to recall it. If a book is not handy, it seems easier to just try to remember it and write it down than to prowl over the house looking for a freshman engineer's math book. After a few times of recalling it from a clear sky, it'll seldom get away again. That is not necessarily a reason for **selling** the book, but it is a reason for leaving it home in the library at least.

Studying in Dorms

From the benevolent angle, it may be a considerable help to some of the lower classmen for you to sell your texts, or maybe rent them, or in extreme cases to loan them your old texts. Marked passages are in some cases a great help, as are checked answer books. Not to mention the probable financial relief to the poor cuss who can't get a second hand book at the store.

A recent publication sent by the McGraw-Hill Publishing Company stated that there would be no shortage of text books.

Even more up to date is the fact that some of us might be toting rifles rather than slide rules in the near future. What's a book or two more or less in such a case, unless it's a book of matches?

There are some good reasons for selling your texts, and now for an equal number of reasons for not selling them.

A well stocked bookshelf of a technical nature makes an impressive sight in any room. If you don't think so, forget your scruples long enough to go into a lawyer's office sometime when you are in a city where no one knows you. Lawyers use long bookshelves yelping under the weight of thick, impressive volumes to bolster up their self-confidence and make the client think he has consulted a very shrewd man. When parents come up to inquire as to what you have been doing with all that money they've been sending up, a stock of well-dusted books helps to allay their fears. Of course, they are useless as an impression factor if they have a layer of dust over all of them.

No matter how brilliant one may be, or what a remarkable memory he possesses, no one can remember **every** equation he tussles with in four years. Anyone who has tried to help a freshman with Math 50 can vouch for that. If the equation of the law of tangents has slipped into the cobwebs, a reference is a handy thing to have around (provided it isn't depended on too much). If you get a job as stress analyst in the summer, a review of some of calculus 102 would be invaluable.

Some books in non-technical courses will make interesting reading later on. We seldom can enjoy the essays and other such seemingly "dry rot" as long as they are being assigned and we have to read them, like it or not. But in looking over English texts now, it is possible to pick out numerous stories that are really enjoyable. Or even in the technical books some of the parts which were glossed over due to time allotments can be much more enjoyable and profitable when looked over at leisure. Have you ever really gone over the parts in the physics 52 text dealing with radio tubes and electron theory? If you haven't, try it sometime and see if it doesn't make a nice pastime for a rainy eve at home; and one which leaves you with a satisfied feeling as though maybe you could be a famous scientist if you really tried.

Mr. E. K. Springer of the machine design department was asked about his views on the subject. He doesn't believe that selling books makes one any more self-reliant, but rather one **should** keep looking in them for a while, especially to learn the derivations which he has found to be an important part of engineering—much as students hate to be told. He thought of two reasons for selling; the financial one and the fact that he himself had found it awkward to transport boxes of them over the country, especially when there was quite often large libraries in the places where he went.

George Smedburg, a research fellow, has never sold a text because he found that he could make use of them later. He has always wanted to go over his old books, and has a brother, a professional engineer, who keeps a library and does go over them.

Some texts have been misnamed and are really encyclopedic handbooks. Notable in this category is the textbook just adopted for the M.E. 25 machine shop course. It's really a job to try to study the thing, what with reading through charts and itemized lists, but you couldn't ask for a better source of information as to how a certain machine works—both as to the theory of its operation and the actual handles to pull and precautions to take. If the truth were known, many sophs finish the course without having read **all** (if any) of the assignments, but it would be a very handy book to have in a factory if you were not in direct contact with the machine shops but would like to know how the parts you are drafting are made. From now on for the duration, it will be much harder to get permission to explore departments other than your own. Last summer it still was easy, but now just try to get in the factory without a pass. It just isn't being done, so read your book instead.

Every year a few tales come out about some misguided souls who sell their texts for some course only to find that the same book is used in a later course. Many are used two semesters in a row. One text which is used for four semesters in a row is machine design. And that is a course in which you might find good use for your **freshman drawing book.**

This article is not attempting to tell you which course to take, but merely to indicate some of the reasons for action in either direction. To sum them up we have—

For Selling	Against Selling
1. Financial advantages.	1. Appearance of book shelf.
2. Learn to be self-reliant.	2. Prodding memory.
3. Economy of space.	3. Read for pleasure later on.
4. Help undergraduates.	4. Might be standard text for later course.

Now to touch on the subject of binding reports and lecture notes. The easiest way to deal with that is to say that if they are bound (either by a commercial firm or by yourself) that they are easier to keep track of. Maybe you won't want to go to the trouble or expense, so let's go on to a discussion of whether or not they are worth keeping, bound or otherwise.

There are really only two important reasons for not keeping them, but their importance can vary. They are: the notes and reports might take up too much room for their worth, and maybe you don't feel that they would do you any good anyway. As for the first, there is really nothing which forms a better dust catcher than a stack of papers. They are hard to keep neat (unless they are bound) and if the pile is of any size it can take the edge off of an otherwise neat room.

If several courses are represented, the stack will not be of much use unless the items are filed and indexed. Filed reports would be helpful, but it cannot be denied that it is a tedious job.

For the second item, well, that's a matter of personal opinion and depends upon what you put into them.

Now as for the advantages of keeping them, have you ever had the chance to use the notes of somebody who took the course before and had a general idea of what the important items are? If you have you can appreciate their value — especially if your own notes are not too copious, or if you were sick for a while. Or have you ever wanted to review a course without re-reading the whole book? A supply of condensed notes can serve admirably.

For your more advanced technical courses the reports, if carefully preserved, may be of value to you after you graduate in case you run into a problem similar to one overcome during the course. Also, those mimeographed synopses distributed in many courses make important reference material later on.

Binding notes and reports is a thing rarely done among students, and paradoxically enough, saving them is almost universal. Perhaps you just tucked them away in your attic at home with the idea that perhaps you might some day find them useful, and in the meantime they weren't doing any damage where they stayed.

It might be a good idea to go up in the attic some rainy day this summer and put them in some semblance of order, and maybe even refresh your memory by reading through them.

So there you have some of the pros and cons of whether or not to keep your notes, your extra material, and your books. If you think about it a while, you can bring out more reasons in your case for one side or the other, and decide which you will do.

RETIRING STAFF

HARVEY SCHLINTZ . . .

If you have ever walked in the Wisconsin Engineer office during the past year, you probably have seen Harvey buried in a check book, trying to write checks fast enough to keep up with the expenditures of the editorial staff. He was the business manager until last March and has been aiding the magazine in an advisory capacity since then.

Harvey Schlintz

Harvey graduated from Madison West High School and then took up electrical engineering at the University. In spite of the fact that he has had to earn a large portion of his expenses during the school year, he still has had time to do a commendable job of keeping the finances of the magazine in working order. Summers he has worked in Madison and enjoyed himself swimming in Lake Mendota. The most enjoyable part of his job as business manager was the trip to the E. C. M. A. convention last fall at Urbana, Illinois. He and five other staff members piled into a 1927 Packard and drove to Urbana.

After graduation, Harvey is going to be with the signal corps at Belmar, New Jersey.

•

JOHN ERWIN . . .

John Erwin was the associate editor of this magazine for the last two semesters. He has been interested in engineering journalism, and is a member of Alpha Tau Sigma, the honorary engineering journalism fraternity. His earlier days were spent in a good deal of travel and at one time or another he has been a citizen of New York, Florida, and Wisconsin.

John Erwin

An active athlete in Wauwatosa High School, he took the State Doubles Tennis Championship before coming to the University. John is an aviation enthusiast. One summer he got up at five each day to get in an hour of flying for his Civilian Pilot's Training Primary Course, before going to work at Allis Chalmers in Milwaukee. It was a full summer, but he plans to do the same thing this year, and thereby complete the secondary course. Erwin plans to go to the Langley Memorial Institute at Langley Field, Virginia, when he has completed his work here. Aeronautic design is his goal. In this issue John has an article on the jet propulsion of heavier-than-air craft; and he prophesies that this form of propulsion will supplant other prime movers on the highways and on the airways in the not too distant future.

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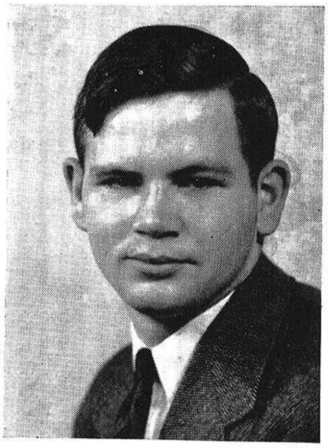
HOMER SCHNEIDER . . .

Homer Schneider was the editor of the Wisconsin Engineer for the past year, and has continued to act in an advisory capacity this semester. Under his guidance the Engineer has grown in size and calibre, and the new staff is more than envious of his ability and appreciative of his work.



Homer Schneider

After graduation from the Wisconsin Dells High School, Homer entered the electrical engineering course here, bringing with him a great store of knowledge which he gained from the operation and maintenance of station W9DLE. The DLE stands for darn little emission.

Forensics and the Wesley Foundation student organizations occupied his time during his freshman year, but not enough to keep him from election to Phi Eta Sigma.

During the summer vacations Homer has had divers jobs. First, as a filling station attendant, next as a photographer, then as a solicitor or barker for the Dells Association Boat Lines. Anyone who heard him uphold the engineers in the St. Pat's Day debate can imagine his success at this job. Between his junior and senior years, Homer was a field inventory clerk for the Wisconsin Electric Power Company, and he worked throughout the area between Milwaukee and Port Washington.

Homer has been a member of several honorary fraternities. Eta Kappa Nu has conducted an analysis and criticism of the electrical engineering curriculum, and Homer has done some work on this project. More recently he has joined Tau Beta Pi and Phi Kappa Phi. The KHK house, EE professional fraternity, has been his home for the last two and one-half years. After graduation Homer will go to Schenectady to enter General Electric's training course.

CAMPUS NOTES

by Don Niles, m'44

DRAWING CONTEST WINNERS

Richard J. Stabnow, electrical engineering freshman from North Freedom, Wisconsin, has won first prize in the recent drawing contest sponsored jointly by the Wisconsin Alpha chapter of Pi Tau Sigma, national honorary mechanical engineering fraternity, and the Drawing Department. The contest required a drawing and a tracing of a discharge casing for a centrifugal pump.

Second and third prize winners are James Miller and G. B. Christensen, respectively. Arthur Larson received honorable mention. The prizes considered by the committee in charge of the contest include a slide rule as first prize, and two engineering handbooks as second and third prizes, respectively.

W. S. Cottingham of the Civil Engineering Department, R. W. Fowler of the Extension Division, and G. F. Tracey of the Electrical Engineering Department were the judges who made the difficult choices.

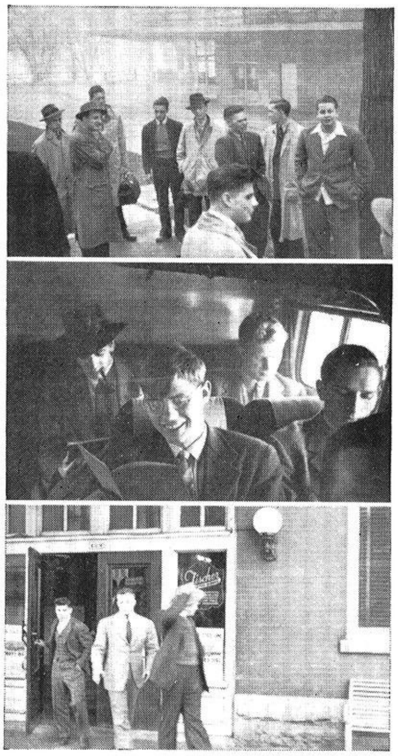
CHEMICAL INSPECTION TRIP

On April 27 and 28, sixty-three chemical engineers under the supervision of Mr. Ragatz and Mr. Reiser traveled to Milwaukee and Appleton for the annual inspection trip.

The stay in Milwaukee was short, being confined to a visit to the Milwaukee Sewage Disposal Plant. Many interesting applications of sewage treatment and purification equipment were observed here.

The group next went to Menasha, where they inspected the Gilbert Paper Company. From here the engineers went to the Hotel Appleton, and for the rest of the day every man was on his own.

Al Jones, Fred Rehm, and Jim Yonk, all of whom have "contacts" at Lawrence College, were successful in lining up about thirty dates for the boys, and the mob retired to the Twentieth Century Club for a quiet evening. Yonk was especially happy, as he dug up an old flame, and they had quite a time remembering the old days. An accurate account of the last hours of the frolic is not available. At any rate, the activities did not stop after the girls were taken to their homes, and water bombs were very much in evidence.



Informal pictures taken by William Stieg, junior chemical engineer. No pictures of the plants were taken due to war restrictions.

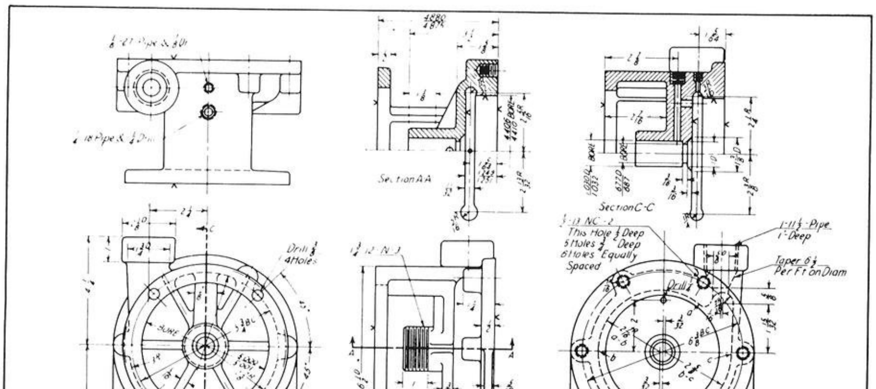
No. 1—Waiting for the bus on Monday morning in front of the Chemical Engineering Building.

No. 2—Paul Opitz trying to study on the bus.

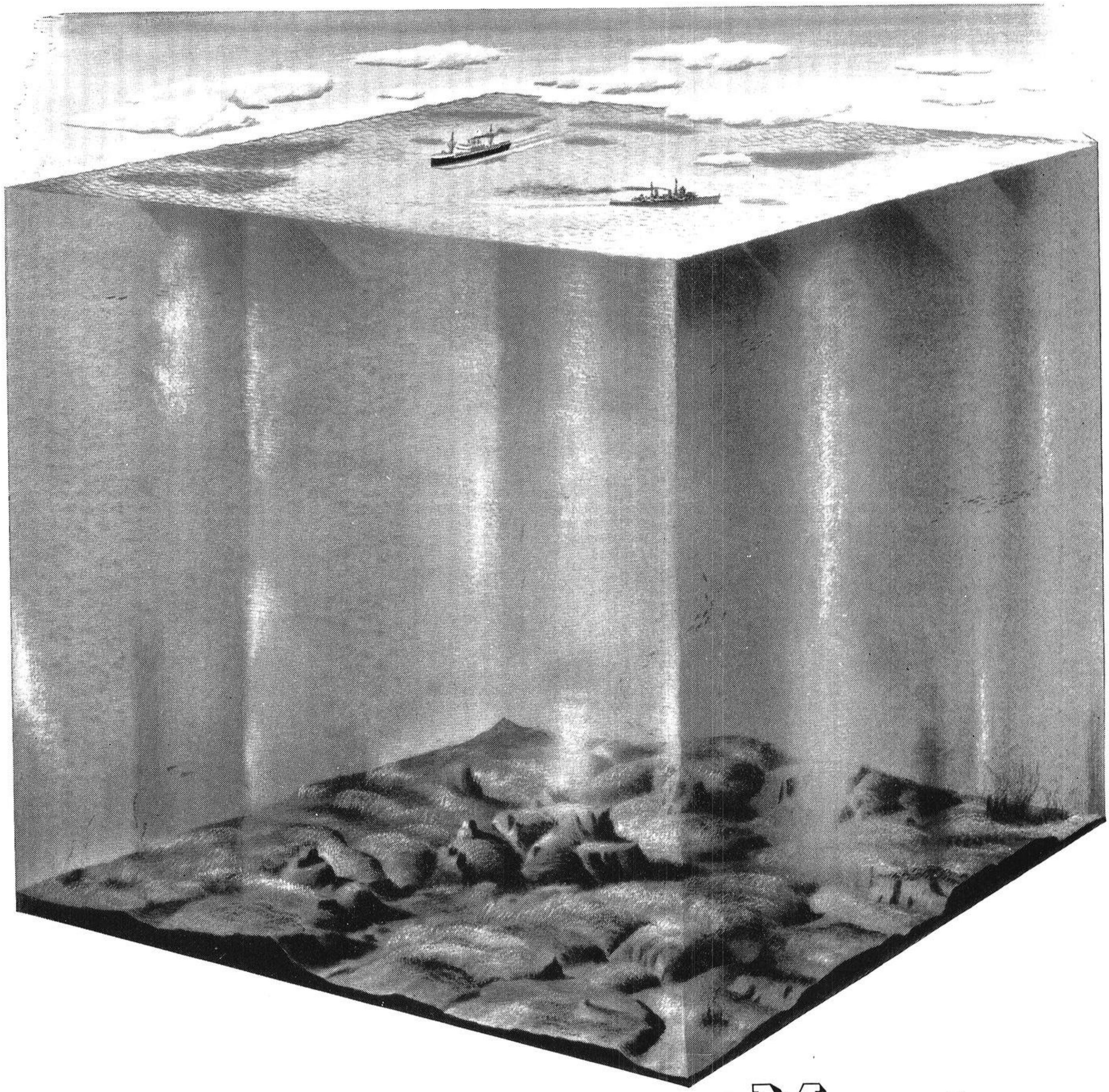
No. 3—Some of the boys leaving the Hotel Appleton.

Tuesday morning the busses took the group to the Institute of Paper Chemistry at Appleton and to the Thilmany Paper Company at Kaukauna. The last place visited was the Marathon Paper Company at Menasha, which makes bread wrappers, waxed paper, and other packaging materials.

(continued on page 35)



Prize Winning Drawing — Richard J. Stabnow



America's unlimited source of Magnesium

EVEN TODAY with astronomical figures a commonplace, nine billion is a number sufficiently vast to jolt the attention of anyone except, perhaps, an astrophysicist.

Imagine trying to count up to nine billion! Yet that is the total you would have to reach if you counted every pound of magnesium that could be produced from a cubic mile of sea water.

When you recall that magnesium, lightest of all structural metals, is vital to the construction of airplanes and other war-time equipment, you begin to realize the importance of those nine billion pounds.

And when you read also that the production of airplanes to be reached by the end of 1943 is set at 185,000, it is reassuring that the ocean can be looked to for this precious weight-saving metal.

Magnesium is now being extracted from sea water. The metal has been rolling out since January, 1941—a chemical and engineering feat accomplished for the first time in history.

Fortunately, for our national defense program, Dow had been producing magnesium from brine since 1915. This had given American industry 25 years of experience in the characteristics and fabricating technique of magnesium.

It was this quarter century of magnesium production by its own American-developed processes that enabled Dow to solve the chemical engineering problem of tapping the inexhaustible waters of the sea as a basic magnesium source.

Within nine months after construction started on the coastal plant, the ocean was giving up its treasure. The waters of the sea were pouring in and the metal was rolling out in ever-mounting volume.

DOW

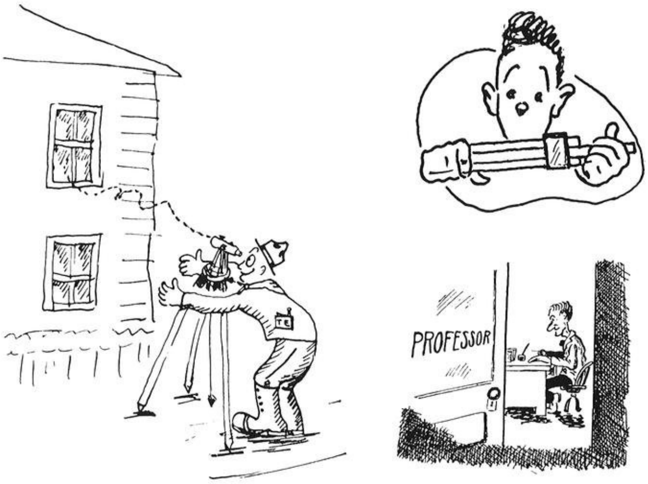
CHEMICALS INDISPENSABLE
TO INDUSTRY AND VICTORY

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN
New York City, St. Louis, Chicago, San Francisco, Los Angeles, Seattle, Houston

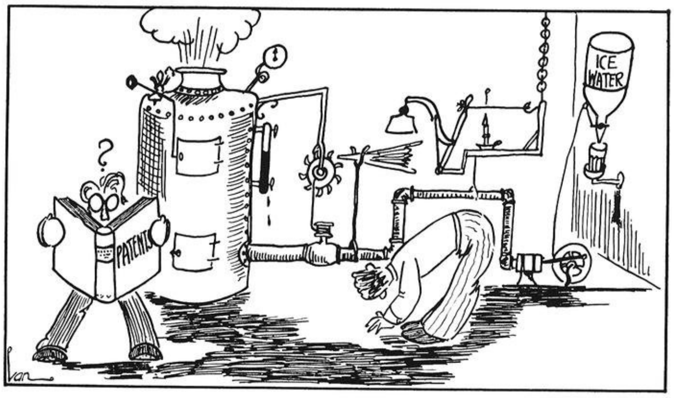
Now and Then...?

or the Royal Road to Success

Dedicated to the Seniors

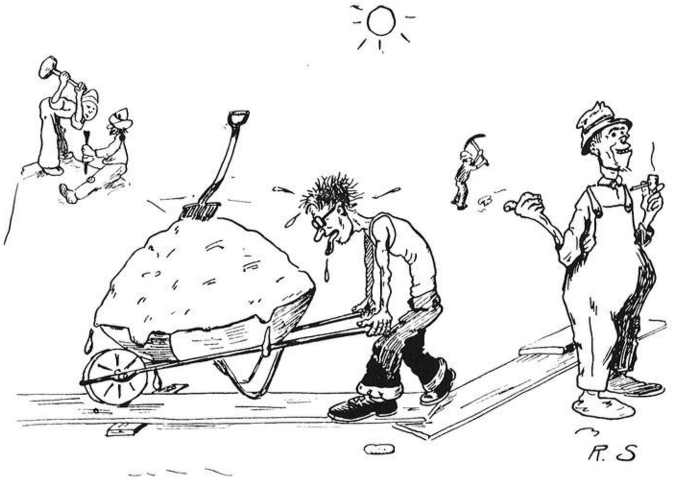


Education — day and night . . .

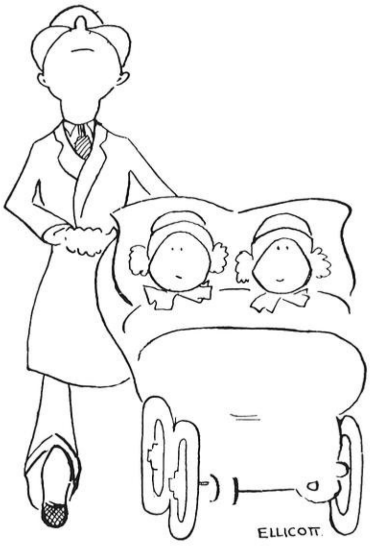


. . . senior thesis . . .

. . . stresses and strains . . .



. . . work day . . .



. . . on the job . . .

. . . thank you, dearie . . .

. . . success?

COLOR FOR RUBIES . . . BACKBONE FOR STEEL!

Chromium, the element that imparts precious color to rubies, imparts something more precious to steel. It gives steel incredible hardness and resistance to heat and corrosion. It makes steel strong, yet ductile and shock-resistant.

Chromium is the key that has opened — and is still opening — great new fields of application for steel. Without chromium, the whole wonderful series of *stainless steels* would not have been possible. From tarnish-free tableware to corrosion-resistant chemical equipment . . . from strong, light-weight truck bodies to streamlined trains and airplanes . . . from heat-defiant boiler tubes to high-temperature steam turbines . . . chromium has made possible a *steel* with properties of the *noble metals.*

But the stainless steels are only one great contribution of chromium. This element has also helped to provide hard, shock-resistant armor plate and armor-piercing projectiles; long-wearing engine valves; strong, tough gears, tools, ball bearings, car trucks, shafts, springs, and dies; and hundreds of other improved articles.

We do not make steel of any kind. But for over 35 years, we have made ferro-alloys and alloying metals used in steel-making. Among these are chromium, silicon, manganese, vanadium, tungsten, zirconium, columbium, and calcium.

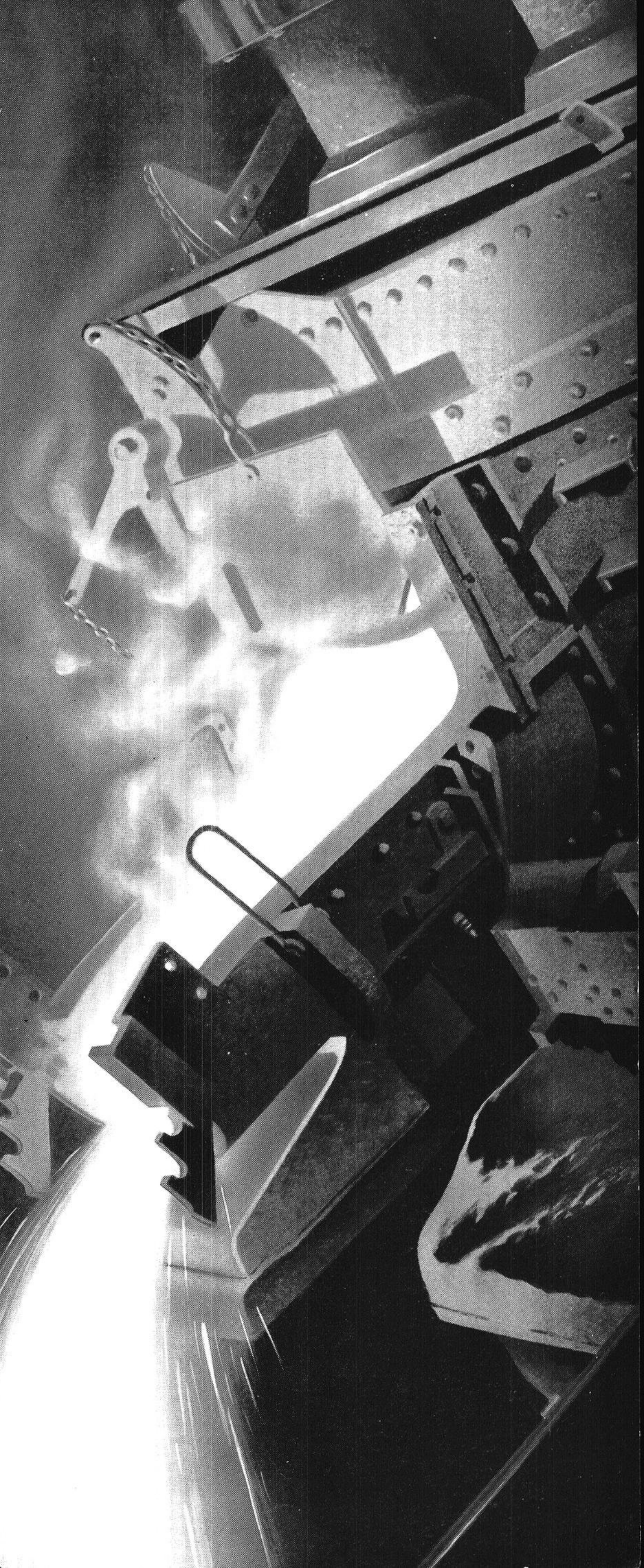
It was our research and development that made the low-carbon grades of ferro-chromium available commercially. Without these, production of a majority of the stainless steels would have been impracticable. Inquiries about stainless and other alloy steels — their manufacture, fabrication, and use — are cordially invited.

The progress made by Electro Metallurgical Company in the manufacture and use of ferro-alloys and in the development of alloy steels has been greatly facilitated by metallurgical research in the laboratories of Electro Metallurgical Company and Union Carbide Company; by the advances in electric furnace electrodes and techniques of National Carbon Company, Inc.; and by the broad experience in the production, fabrication, and treatment of metals of Haynes Stellite Company and The Linde Air Products Company. All of these companies are Units of Union Carbide and Carbon Corporation.

ELECTRO METALLURGICAL COMPANY

Unit of Union Carbide and Carbon Corporation

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



ALUMNI NOTES

by Arne V. Larson, m'43

Electricals

MARTIN, CLARENCE F., '25, formerly in the electrical engineering department of the Chicago Rapid Transit Company, is now in Camp Forrest, Tenn.

JORDON, ROY D., '27, has left the publicity department of General Electric to become a first lieutenant in the Signal Corps at Fort Monmouth, New Jersey. His former position was manager in charge of industrial advertising for General Electric.

BLENCOE, SHIRLEY G., '33, is with the Signal Corps, in Memphis, Tenn.

SMITH, N. W., '35, formerly with the Northern States Power Company of Eau Claire, Wis., has been called to active duty with the U. S. Army and at the present time is with the Signal Corps at Camp Crowder, Missouri.

SCHULTHEISS, CARL E., '38, with the Interstate Power Company, has been promoted to operating superintendent, and was transferred to the Spring Valley district in Minnesota.

SUNDEEN, CECIL E., '38, who is in the educational department of the Wisconsin Electric Power Company of Milwaukee, was in Madison April 30.

BONCYK, CLARENCE J., '40, formerly with the Interstate Power Company, Dubuque., Ia., is now in the Aviation Cadet Engineering school at Chanute Field, Illinois. He expects to finish this course in July.

KAISER, LYLE A., '40, was married to Louise Kalk of Plymouth, Wis., June 1, 1941.

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Civils

KENNEDY, FRANK A., '06, is an assistant superintendent on one of the shifts of the ship building plant operated by the Todd Shipbuilding Corporation at Long Beach, Calif.

VAN METER, THOMAS E., '07, died on January 30. He had been with the Deere Company of Moline, Ill., for many years.

MATHEWS, WILLIAM W., '08, CE'26, superintendent of the sewage treatment plant at Gary, Ind., was host to a party of 38 civil engineering students and faculty members of this college on April 16, when the party visited the plant on its spring trip. He has been in charge of the plant since it was opened in August, 1940. Prior to that date, he was engineer on the construction of the plant for Alvord, Burdick, and Howson, consulting engineers and designers of the plant. **L. R. HOWSON**, '08, is a member of the firm.

STOCKER, EDWARD C., '09, resident engineer for the Texaco Oil Company at Singapore, has not been heard from since last January.

THIESSEN, FRANK C., '10, died suddenly on April 15 at his home in Shorewood Hills, a suburb of Madison. He had been an engineer with the Wisconsin Public Service Commission for many years, and was an instructor in the Extension department of the university for several years.

CLARK, H. WESLEY, '20, city engineer of Niagara Falls, N. Y., has been appointed acting city manager to fill the vacancy caused by the death of the city manager on March 7.

WILLSON, CLARENCE A., '21, CE'26, left early in April to take up duties as senior structural engineer in the Bureau of Industrial Conservation, War Production Board, at Washington, D. C.

C. A. WILLSON

He was instructor in structural engineering in this college for a few years following graduation. For many years he has been structural engineer in the office of the state architect at Madison. He has also been acting secretary for the Wisconsin Registration Board of Architects and Professional Engineers.

SCHNEIDER, GEORGE R., '22, has been appointed chief of the engineering division of the U. S. Engineer Office at Little Rock, Ark.

BAILLIES, DUNCAN S., '29, is an associate civil engineer with the Civil Aeronautics Administration in Chicago, Ill.

HANSON, LORING, MS'32, at one time instructor in mechanics at this college and recently with the Portland Cement Association, has been appointed assistant engineer with the U. S. Engineer Office at Buffalo, N. Y.

WIRTH, HARVEY E., '41, has resigned his position as sanitary engineer with the Wisconsin State Board of Health to take a position in the office of the Quartermaster General at Washington, under the immediate direction of Prof. L. H. Kessler.

PLATT, HAROLD A., '41, is with **H. C. AMUNDSON** '24, city engineer of Baraboo. Since graduation, Platt has been with the U. S. Engineers on the construction of an air field at Fort Wayne, Ind., and with Mead, Ward and Hunt on the work at Camp McCoy.

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Mining and Metallurgy

ALBERS, FRANCIS C., '40, has been granted a leave of absence from Timken Axle Company and has been commissioned ensign in the United States Navy and is on active duty at Washington, D. C.

GIBBENS, JOHN, '41, has been granted a leave of absence by Shell Oil Company, Inc., and has been accepted by the United States Army as a candidate for a commission upon the satisfactory completion of the Air Service course in meteorology. Gibbens is pursuing these studies at the California Institute of Technology.

GOODIER, WILLIAM R., '41, has been granted a leave of absence by Shell Oil Company, Inc., and was ordered to active duty in the United States Naval Reserve and has just completed an intensive training program at the United States Naval Academy at Annapolis. Goodier has been ordered to further duty in a continuation study in communications.

HABUSH, MILTON, '41, is with the Stevens and Koons Engineering Company working on reinforced concrete at the Unatilla Ordnance plant, Hermiston, Ore.

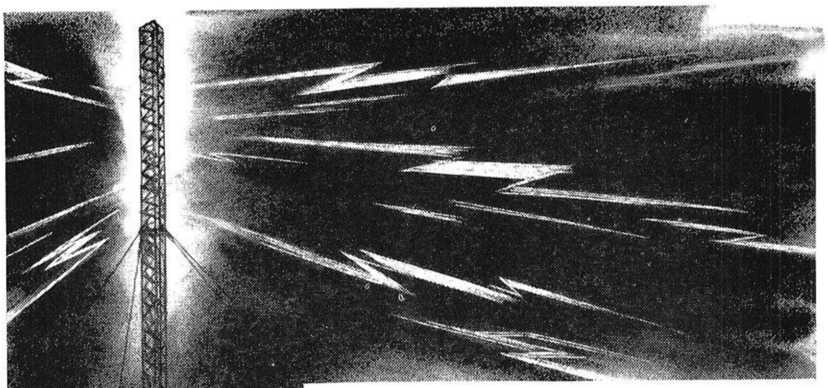
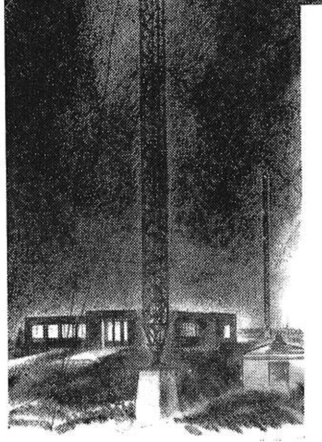
SCHUKNECHT, G. G., '41, is working as chief engineer on the Cocoli Project, Canal Zone, for Hegeman, Swinnerton, and McClure Company.

KOSS, WILLIAM J., '42, has also been commissioned ensign of the United States Navy and is on active duty in Washington, D. C.

STERN, MARVIN, '42, has a position with the American Steel & Wire Company, Duluth, Minn.

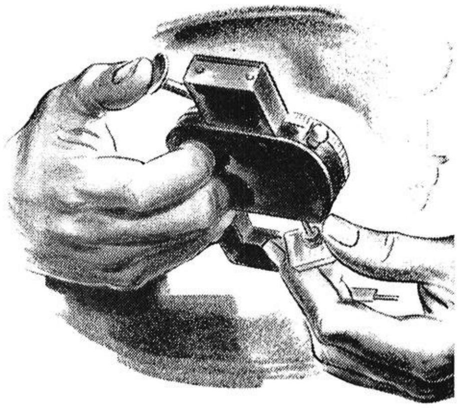
(continued on page 35)

"The next number will be free with 6 box tops, followed by occasional showers"

Doubletalk? No, it's how radio would sound if stations couldn't be kept on their assigned frequencies. The problem was licked once and for all when engineers discovered how to regulate radio frequencies with a tiny disc of quartz crystal, the thickness of which governs the length of the waves. Precision cutting, grinding and finishing of the quartz, a process Carborundum helped pioneer, makes today's accurate control possible.

No larger than a thumb nail, only about 1/16th inch thick, these oscillators must be finished to limits as close as 1/100th the diameter of a hair. With the aid of Carborundum Brand Abrasive Grains and Powders, the discs are made with optically flat and parallel surfaces, and thickness so accurate it must be measured in terms of light wave length.



In the development of many modern aids to living, abrasives have played a vital part. And Carborundum skill and knowledge have made much of this progress possible. These facilities will be at your disposal no matter what industry you go into. The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM
REG. U.S. BRAND PAT OFF
ABRASIVE PRODUCTS

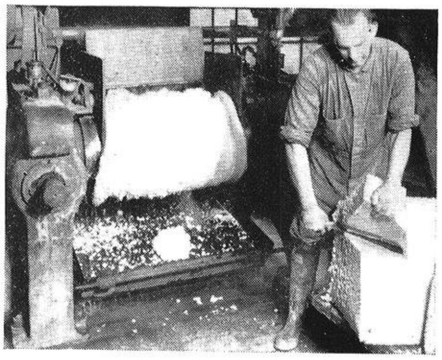
Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company.

SYNTHETIC RUBBER . . .

(continued from page 8)

synthetic rubber too high, so the Reconstruction Finance Corporation only financed four pilot plants of 2,500 tons each.

Now that plans for large-scale production have finally materialized, the manufacture of rubber will consist of the following general steps:



Block of new synthetic rubber being cut into chunks before processing.

(1) Accumulation of suitable base stocks, such as butanes, cracking stocks, crude oil, etc.

(2) Decomposition and/or dehydrogenation of these stocks into butanes, butenes, and butadiene.

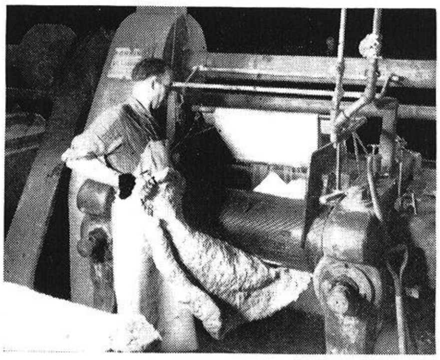
(3) Purification of these products.

(4) Polymerization or condensation operations to produce rubber.

(5) Compounding, shaping, fabrication of the rubber into finished products, including vulcanization.

Source of Base Stocks

The base stocks required for synthetic rubber are furnished by the petroleum industry, being primarily four carbon atom hydrocarbons such as butane, isobutane, butene and others. They are present in the more volatile fractions of distillation units, in natural gasoline, and are formed in cracking operations. It is important to note that these same stocks are required for aviation gasoline. Thus the production of these items must be greatly increased. One source for materials will be the gasoline going to you and me. You have probably noticed that your car's engine knocks easily these days: that's because certain components are being taken from your gasoline for synthetic rubber and 100 octane gasoline. It has been estimated that some 35,000 barrels per day of base stocks will be required for rubber and from 50,000 to 80,000 barrels will be required for gasoline. This is a total of 80,000 to 115,000 barrels a day. A recent survey of the oil industry indicates that about 129,000 barrels a day are available or can be made available. Thus within a period of months, the necessary supply of raw stocks for the rubber industry can be provided. The erection of plants and design and fabrication of the expensive and complicated equipment are jobs requiring hundreds of thousands of man-hours, and cannot be done overnight. This work is going on with all possible speed. It is expected that production will reach 100,000 tons in 1942. Mr. W. L. Batt, director of materials of the War Production Board, told the Truman investigation committee of the Senate in March that 300,000 tons of synthetic rubber will be turned out in 1943, and that our goal should be reached in 1944. Then if all goes well, synthetic rubber should take over just about the time our stock pile runs out. If American industry succeeds in this tremendous undertaking of making a half million tons a year of rubber from petroleum, the Land of the Rising Sun will have learned a lesson.



Removing sheet of raw synthetic rubber from wash mill.

Note corrugated roll.

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(2) Bridgewater, E. R., *Journal of Franklin Institute*, March, 1942, Pages 227-30.

(3) Barthel, Mervin, *The Quadrant*, Winter, 1941.

(4) Hopkins, M. B., *Mining and Metallurgy*, March, 1942, Page 151.

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CAMPUS NOTES . . .

(continued from page 28)

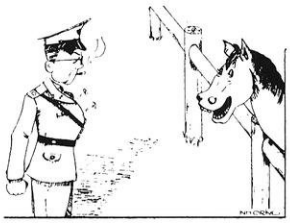
ARMY INSTITUTE AT MADISON

Working in collaboration with the university extension division, the U. S. Army has set up headquarters in the abandoned school at the corner of Johnson and Park Streets. Called the "Army Institute," it is an organization designed to provide a means for enlisted men of our army to get some advanced correspondence "book learning" while they are in the army.

The institute here is the only one in the country, although it was originally planned to provide several. The University of Wisconsin was selected because it pioneered in the field of correspondence study, and the extension division was so well organized for the duties.

Col. Wm. R. Young is the commandant, and Lt. Strong the principal and adjutant. Master Sgt. R. N. Drake is chief clerk. The instructional staff is provided by the university, although the texts are the same as used by the International Correspondence Schools.

The texts are really pamphlets which can be placed in the soldier's pocket wherever he goes.



About two-thirds of the courses are of an engineering nature, although none of them are standard college courses and credits are seldom transferrable. No special allowances will be made at the camps, meaning that the soldier has to do the work in addition to what he does now, and dig it out with instructors.

A student may take only one course at a time—unless he is very exceptional—and must pay $2.00 for each course. Commissioned officers are not eligible to take courses.

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ALUMNI NOTES . . .

(continued from page 32)

Mechanicals

NOVOTNY, CHARLES H., '32, MS'33, is company commander of Company D, 5th Battalion Ordnance Placement Training Center, Aberdeen Proving Ground, Md. He was formerly the fuel and steam rate engineer for the Gulf Oil Corporation, Port Arthur, Tex., and has been in the service since August 1, 1941.

SCHLINTZ, HAROLD, '41, formerly with the United Light & Power Service Company, Davenport, Ia., is now with the Consolidated Aircraft Corporation at San Diego, Calif.

Chemicals

ANDERSON, NILS, PhD'41, is engaged to Mary Anna Backus of La Crosse.

RUNDORFF, ROBERT L., '23, MS'24, ChE'36, gas engineer with the Northern States Power Company of Minneapolis, was a recent visitor in Madison.

HARRISON, DON., '40, has resigned his position with the Connecticut Coke & Gas Company of New Haven, Conn., and will enter naval training at Annapolis, Md.

WESTPHAL, RALPH, '41, was married to Lorraine Jorgensen of Watertown, April 18.

STATIC...

by Roger Robbins e '42

A favorite bit of humor going the rounds in Washington today is the Ballad of Charlie McCoffus. Many a worker, falling victim to the comma hounds or the sticklers for red tape, chants the ballad to soothe ruffled feelings.

A field engineer named Charlie McCoffus
Worked all day in the field and all night in the Office
Checking contracts and vouchers and estimates too
To be picked all to bits by the Washington crew.

For the boys in D. C. in their double-lens specs,
Their sallow complexions and fried collar necks
Care not for the time nor the money they waste.
If a carbon is missing, a comma misplaced,
They bounce back the paper with ill-concealed jeers
To harass the hard-working field engineers.

To get back to Charlie, he struggled along
Till an ache in his head told him something was wrong.
He went to the Doctor, and "Doctor," said he,
"There's a buzz in my brain, what's the matter with me?"

Well, the medico thumped, as medicos do
And he tested his pulse and his reflexes too,
And his head and his heart and his throat and each lung,
And Charlie said "Ah" and stuck out his tongue.
Then the Doctor said, "Gad, what a narrow escape,
But a quick operation will put you in shape."

"Your brain's overworked like a motor run down
And you're flirting with death every time you turn 'round,
I must take out your brain for complete overhauling,
In the interim, take a respite from your calling."

So Charlie McCoffus went under the knife.
He struggled home brainless and kissed his own wife,
While Old Doctor Loomis and two other men
Were putting his brain in order again.
Well, the weeks rolled along and Charlie McCoffus
Never called for his brain at the medico's office.

The Doctor got worried, gave Charlie a ring,
Said, "You'd better come over and get the darned thing."
"Thanks, Doc, I don't need it," said Charlie McCoffus,
"I'm being transferred to the Washington Office."

So Charlie now wears a fried collar at work,
And he hides in the lairs where the auditors (work) lurk,
And his letters bring tremors of anger and fear
To the heart of each hard-working field engineer,
And the pride and joy of the Washington Office
Is brainless, predacious, young Charlie McCoffus.

A small boy was very much interested in watching a bald-headed man scratch the fringe of hair around the side of his head. The man kept it up so long that the boy reached over and said in a loud whisper, "Say, mister, you'll never catch him that way. Why don't you run him out into the open?"

•

Do you know what happens when a body is immersed in water?

The telephone rings.

•

There lived in the same town two men named John Brown. One was a real estate man, the other a minister. On the same day, the minister died, and the real estate man left for Florida. Three days later the real estate man wired his wife, but by mistake the wire reached the wrong Mrs. Brown. The wire read, "Arrived safely, but the heat is terrific."

•

A Northern woman, unaccustomed to the ways of our new army, was traveling in the South and unknowingly entered war-maneuver territory. One day upon coming to a bridge she was waved to a stop by a soldier in full battle array.

"You can't cross this bridge, lady," barked the soldier. "We have just blown it up."

Getting our of her car the astonished traveller walked up closer to the bridge but could see nothing wrong with it. Dumbfounded, she decided to investigate further and walked over to another soldier lying peacefully in some shade. "Young man," she inquired, "can you tell me any reason why I can't cross this bridge?"

"Sorry, I can't tell you, ma'am," was the sober reply, "I don't know. I've been dead for three days."

•

A little nonsense now and then,
A little horse play on the side,
Was relished by the wisest men,
Who really lived before they died.

Latest definition of a worm: "A caterpillar that played strip poker and lost."

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AIR RAID PRECAUTIONS FOR CIVILIANS

1. As soon as bombs start dropping, run like a rabbit. It doesn't matter where—just run.
2. Wear track shoes if possible. If the people running ahead of you are slow, you won't have any trouble passing them or jumping over them.
3. Take advantage of opportunities you find handy when air raid sirens sound the warning of attack or blackout, for example:
   (a) If in a bakery, grab a pie.
   (b) If in the Rathskeller, grab a beer.
   (c) If in the Play Circle, grab a blonde.
4. If you find an unexploded bomb, pick it up and shake it. Maybe the firing pin is stuck.
5. If an incendiary bomb is found burning in a building, throw gasoline on it. You can't put it out anyhow, so you might just as well have a little fun.
6. When the first bombs fall, holler like "bloody murder." It will add to the fun and confusion and scare the kids into hysterics.
7. It is well to have onions or limburger cheese handy as a snack before entering a crowded air raid shelter. It may make you very unpopular, but you'll have a lot more room for yourself.
8. If you should be the victim of a direct hit, don't go to pieces—just lie still. The sanitation squad will attend to you.

CAMPUS NOTES . . .

(continued from page 35)

MINING CLUB GUESTS

The Mining Club will hold a joint meeting with the Chicago Section of the American Institute of Mining and Metallurgical Engineers on May 16 at 1:00 p.m. in the Mining and Metallurgy Building. Twenty members and their wives from Chicago will be guests of the Mining Club.

Gerald Slavney is chairman of the meeting and is being assisted by the following: Jack Schultz and Jerry Schlass, chefs; Harold Goldfein, music; Walter Wollering, transportation; Harry Kalvonjian, reception; Jimmie Judy, chief dishwasher.

The train will arrive at 12:30 at the east side depot and they will be brought immediately to the Mining Building where a rousing reception is planned. A group picture will be taken in front of the building. Schlass and Schultz are serving a baked ham dinner with all the trimmings.

The welcoming address will be given by President C. A. Dykstra of the University and will be followed by Dean F. Ellis Johnson of the College of Engineering and by Governor Julius P. Heil.

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TRIANGLE INITIATES

Triangle, the engineering social fraternity, initiated the following men on April 26:

Edward R. Drott, Jr., Ralph E. Baillargeon, W. Bernard Ille, and Robert H. Lanz.

KAPPA ETA KAPPA INITIATES

On April 25 ten electrical engineering students were formally initiated into Kappa Eta Kappa, professional electrical engineering fraternity. They are: Jack Asti, Alfred Baguhn, Emanuel Harrison, Thomas Jepson, Russell Johnson, Joe Nettesheim, Clarence Rice, Arthur Schultz, Joe Salay, and Donald Strate. A special feature of the program was the presentation of a service plaque to Miss Mary O'Keefe for her unselfish and effective devotion to her duty as assistant to Dean Millar.

Sailors marching to class.

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NAVAL RADIO SCHOOL

About one-third of the boys in the naval radio school have shown promise of being expert radio technicians already, according to the officer-in-charge, Lieut. E. H. Schubert. Another group of several hundred have arrived and are housed in the stadium dorms.

The organization has remained unchanged, although much enlarged. Now, besides Lieut. Schubert, Ensign P. M. Wick, Ensign N. B. Douglas, Ensign G. A. McKinley; Ensign R. P. Ross, Ensign C. L. Nelson, Lieut. M. O. Boudry, and several non-commissioned men have been added.

Lieut. Schubert believes the boys are developing a real Wisconsin spirit, and appreciate the invitations extended by various houses. They are engaging in intramural activities on the campus besides being divided into companies among themselves. The leaders of these sections are D. L. Dreyfus, R. E. Leonard, R. E. Riess, R. W. Forke, C. R. Snapp, and C. F. Cooper.

JET PROPULSION . . .

(continued from page 12)

climb, speed, maneuverability. Without a propeller, much less ground clearance would be required, so greater advantage might be taken of the "blanketing effect" between wing and ground for landing, and perhaps the retracting gear might be eliminated. Better location for the pilot and his armament could be provided. The various designs lend themselves well to enclosure in the wings or fuselage, reducing drag. Boundary layer pressure may be turned to account for the air intake, or it may be controlled over large areas by the proper direction of the discharge. In larger aircraft, as in electric power plant operation, several engines might be provided to run during "peak demand" conditions, but perhaps only one or two would run at optimum conditions for economical cruising.

It should be noted that by employing jet propulsion, whether the power plant or plants are located in the fuselage or in the wings, a number of important modifications in aircraft design become possible. The absence of the propeller confers manifold advantages. For instance, the fuselage may be quite low for servicing, permitting the wings to be placed close to the ground to make possible full use of the "cushioning effect" between wings and ground on landing. The pilot may be seated well forward and given a wide field of view with no interference and a less restricted field of fire.

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Volume 40 of FLIGHT *features a series of articles on jet propulsion of craft. For more complete information, we refer you to the Engineering Library, where these issues of* FLIGHT *are on file.*

CAMPUS NOTES . . .

(continued from page 38)

RESEARCH CONFERENCE

The senior engineering students who held Wisconsin Alumni Research Foundation research apprenticeships presented papers on their year's work May 11 in the Mechanical Engineering Auditorium. Professor R. R. Benedict was technical chairman.

The students and their subjects were: John Brann, "Viscosity of Gases"; William Arvold, "Fixation of Nitrogen"; Charles Phillips, "X-ray Study of the Structure of Cold Rolled Silver"; Lester Elmergreen, "The Measurement of the Properties of Dielectrics at High Frequency"; Donald Bossart, "Diesel Fuel Combustion"; Robert Zoellner, "Low Velocity Air Meters"; Clifford Tice, "Plastic Flow of Thin Slabs"; Culver Heffernon, "Design of a Sheet Metal and Compacted Sand Air Raid Shelter"; Fred Bertle and Melvin Ree, "The Calibration of Circular Weirs and Orifices in the End of Large Pipes."

MINING BUILDING DRILL

Have you been wondering too?

Ever since 1932 when the Mining and Metallurgy Department moved into its present building, Johnny Q. Mechanical Engineer, hurrying to and from classes, has speculated wonderingly on what "that odd-shaped pile of scrap-iron" mounted in front of the building could be.

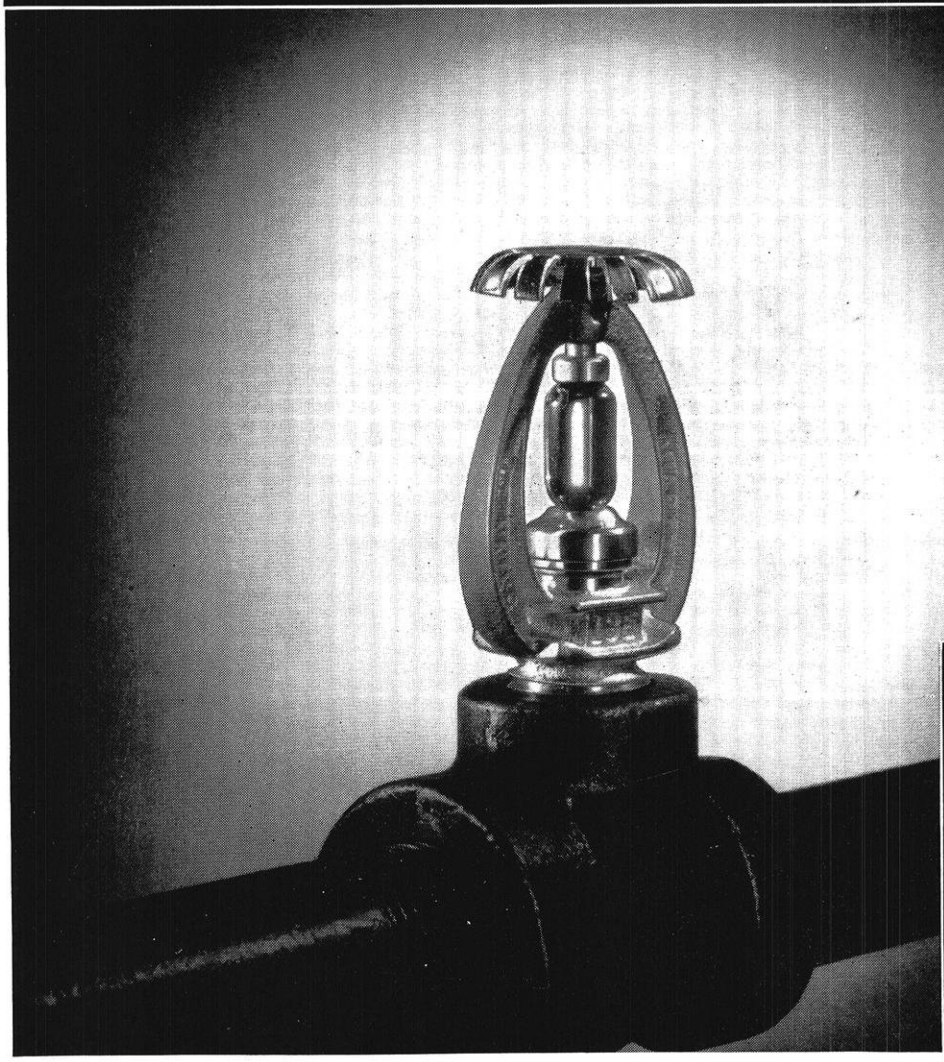
Drill in front of Mining Building.

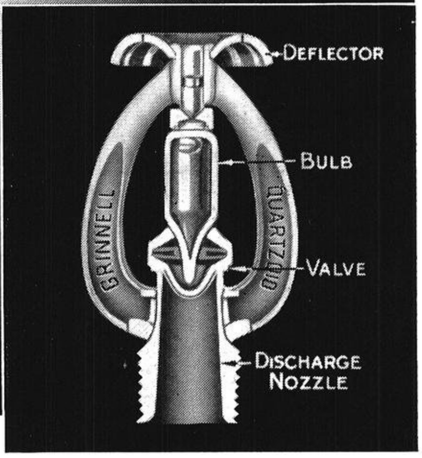
The query became so general that we decided to take the problem to Professor Shorey of the mining school. So gather 'round, fellows, here's the dope: we've been looking at a piston type rock drill, mounted on a tripod. Any lawyers lurking about are free to attempt to move it. The drill itself weighs 285 pounds while the mounting weighs another 150 pounds. Using air at 100 pounds gauge pressure, this drill will bore holes up to 12 feet in depth in the hardest rock.

This piston drill and its type today are being replaced by hammer drills in mining and tunneling operations and in quarrying. However, behind it is a very distinguished record of achievement throughout our mining districts, Tri-State, Lake Superior, Cripple Creek, Couer d'Alene, etc.

Probably no other machine must withstand as much abuse as does a rock drill. Steel strikes steel 1800 hard blows per minute. In addition to this internal mechanical pounding, most drills are subjected to rough handling, to the constant abrasion of dust, and to the corrosive action of impure water. Hats off to the old warrior when next you pass—he's earned his rest.

The little glass fireman that draws no pay...





TAKE a good look at this picture. For without a ladder you seldom get a close-up of a sprinkler head.

This one is said to be the last word—so reliable that industries which equip their buildings with this little "fireman" obtain low insurance rates. Users say it pays for itself.

When the heat of a fire reaches a certain temperature, the little "Quartzoid" bulb you see in the sprinkler head is shattered by expanding liquid inside it. A valve is thus released, and water is directed onto the fire.

For the engineer, there's more to that little bulb than meets the eye. For one thing, it replaces alloys formerly used. For another, it shows how glass can now be made into accurate mechanical parts. The bulb must shatter at a specific temperature. And it must shatter completely, with no splinters to hinder valve action. Too, it must fit its hardware exactly. So it's up to Corning to supply glass free from weakening flaws and to hold wall thickness and O.D. to the small tolerances that can make or break the efficiency of a sprinkler head.

Fussy? Sure. But fussy and tough jobs are stock in trade at Corning. Did you know for instance that Corning makes a light globe that also protects industry because, unlike the "Quartzoid" bulb, it will *not* shatter? That Corning has developed industrial glasses to withstand heat that turns metals to liquid? Or that glass springs from Corning will outlast metals in fatigue tests?

These few examples give you an inkling of the growing usefulness of glass in these days of material shortages. No wonder engineers with urgent problems say "Ask Corning." Corning Glass Works, Corning, N.Y.

CORNING
means
Research in Glass

G-E Campus News

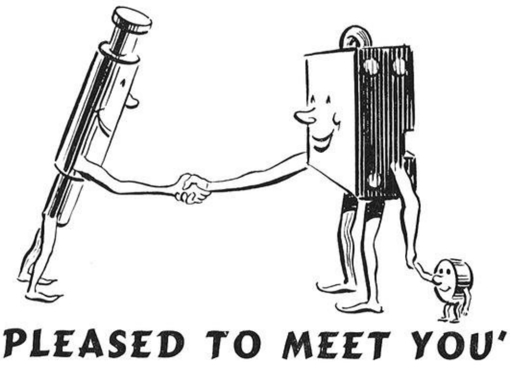
AU-TUBE-IOGRAPHY

GENERAL ELECTRIC'S Radio and Television Department, in its new Radio News Program with Frazier Hunt, is telling the story of electronics to a nation at war—a war in which electronics itself is one of our most powerful tools.

For electronics—the youthful science that embraces all the varied applications of electron tubes—is going into war not only on the front, but behind the front, where it is today revolutionizing many industrial practices.

Unique about this thrice-weekly broadcast (Tuesday, Thursday, and Saturday) is the fact that G.E. is using an electronic device, radio, to carry the story of electronics to America.

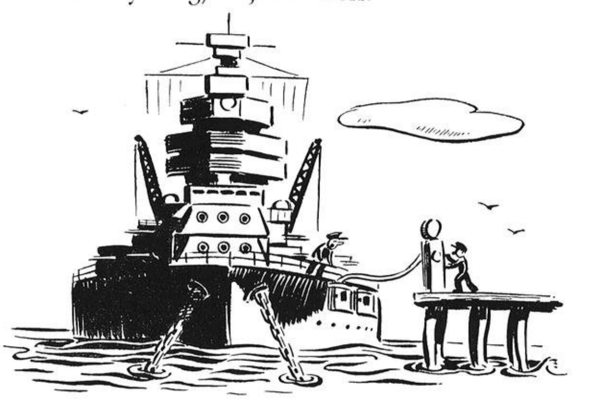
In addition to 51 stations of the Columbia Broadcasting System, G.E. is using the first network of FM stations ever to carry a regular series of broadcasts.



"PLEASED TO MEET YOU"

IT USED to take General Electric 18 months to build one of the great 275-ton machines that cut low-speed gears for cargo-ship propulsion sets. Today that time has been halved by farming out the construction of parts to dozens of subcontractors.

Major parts of the machines come together for assembly from 12 separate subcontractors in five states; miscellaneous smaller parts come from 38 firms in seven states. Jobs of casting, annealing, and machining involve, besides foundries and steel companies, a Navy yard, shipbuilding yards, a locomotive company, and a maker of steel safes. Co-ordinating and checking all these widespread activities is a major achievement in itself, since the finished machine has to be precise enough to cut gears with an accuracy of 3/10,000 inch.



"FILL HER UP!"

BECAUSE the ocean isn't equipped with filling stations every few miles, naval vessels must carry enough fuel for long voyages. And because finding storage room aboard for this fuel is a serious design problem, anything which cuts down fuel consumption is a great advantage.

Most naval ships today are driven by steam turbines connected to the propeller shafts, through reduction gears. And turbine engineers, working with the Navy, have pioneered in the use of higher steam pressures and temperatures—producing turbines of such improved efficiency that in modern ships the fuel consumption per horsepower is from 25 to 40 per cent lower than in vessels of the same type used during the first World War. Thus it has been possible to design ships with greater cruising radius for the same amount of fuel oil, or with more armor and guns for the same over-all weight of the ship.

GENERAL ELECTRIC

952-39-211