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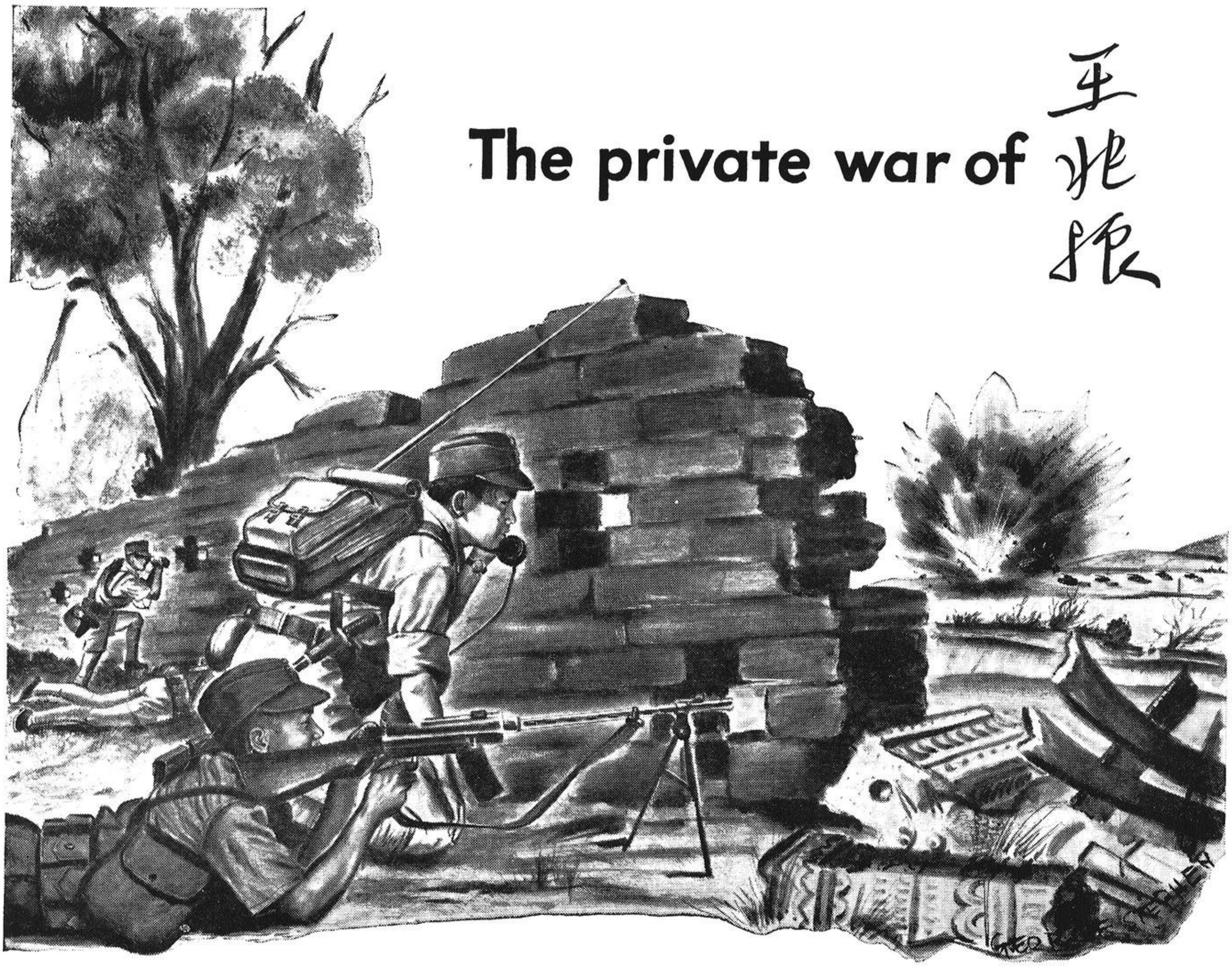
WISCONSIN ENGINEER

March, 1943

MEMBER ENGINEERING COLLEGE MAGAZINES ASSOCIATED

The private war of 王兆振



Dr. Chao-Chen Wang carries a slide rule instead of a rifle. Logarithms are his bullets. Differential equations, his high explosives.

Yet he's waging just as deadly a war, against the hated Japs, as any of his brave compatriots in far off China.

For his is a war of electronics at work!

Since joining Westinghouse last summer, this young Chinese scientist has made several important contributions in the field of electronics design.

One of them—*a new method for measuring the output of ultra high frequency radio tubes*—may prove as valuable to the United Nations as a million machine-gun bullets fired at the enemy!

Dr. Wang is an expert in the mathematics of ultra high frequency communications. He does his "Jap fighting" in one of the Westinghouse Electronics Laboratories.

Here he employs his special genius in calculating — in advance — the performance and characteristics of electronic tubes *before* they actually take form.

★ ★ ★

Dr. Wang, and other young engineers who enter our employ every year, are constantly contributing to the "know how" of the Westinghouse organization.

Westinghouse believes in helping young engineers grow and advance as rapidly as possible—for upon these scientists of tomorrow our whole future depends.

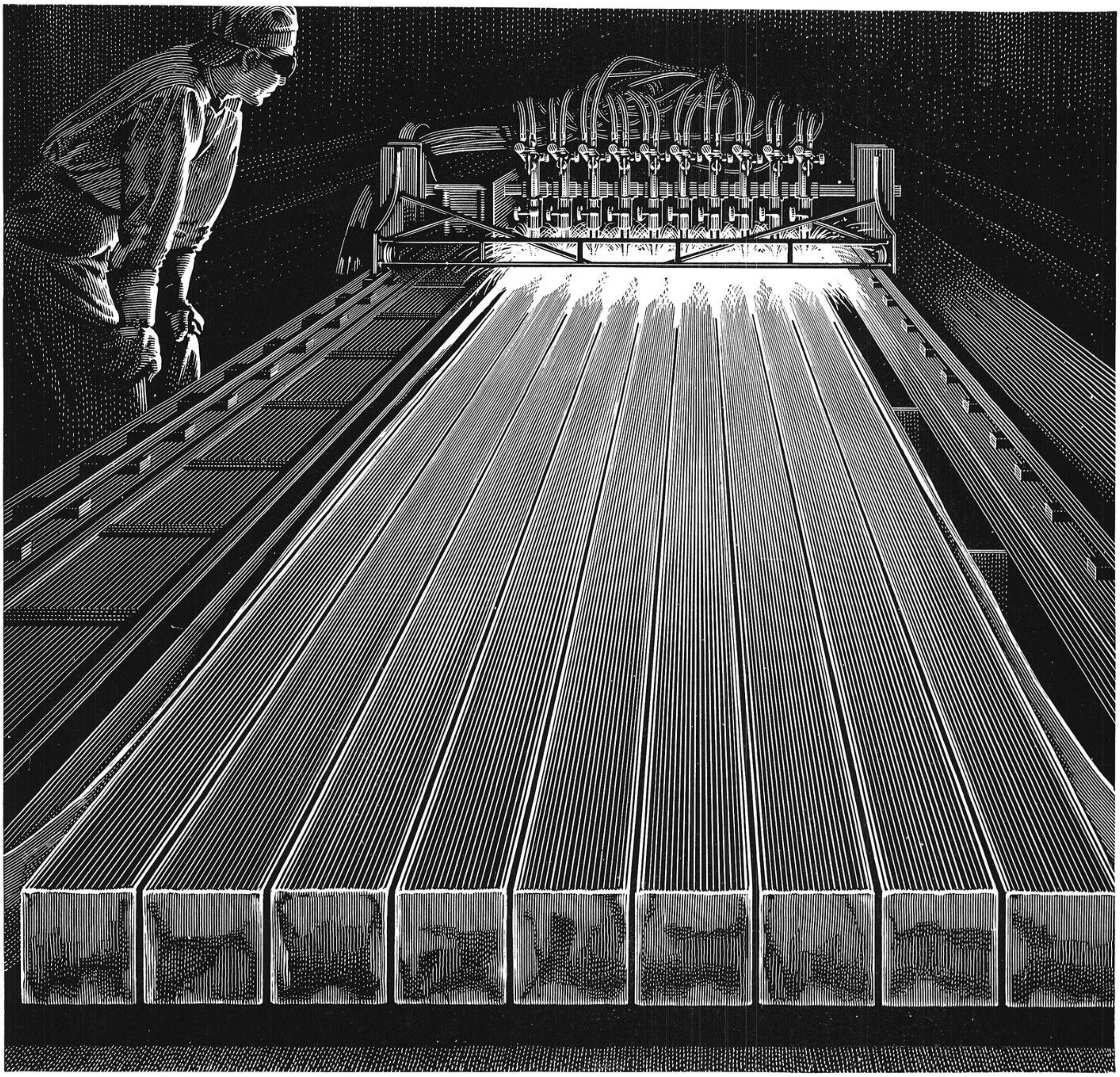
Westinghouse Electric & Manufacturing Company, Pittsburgh, Pennsylvania.

TUNE IN the Westinghouse Program starring John Charles Thomas—NBC Network, Sunday, 2:30 P.M., Eastern War Time.

DR. CHAO-CHEN WANG studied electrical engineering at Chiaotung University in Shanghai. He was sent to Harvard University by the Chinese Government where he specialized in ultra high frequency communications. Before joining Westinghouse, he received his M. S., in 1938, and his Ph.D., in 1940.

Westinghouse

PLANTS IN 25 CITIES—OFFICES EVERYWHERE



SLICING STEEL SLABS—and production schedules

STEEL billets were needed. Only slabs were available. That was the problem presented by expanded war-time demands which had to be licked, quickly. It was—by the process illustrated above. Ten oxyacetylene cutting torches, mounted on a frame propelled by two Airco Radiagraph machines, streak down the 140″ steel slabs and slice them into billets.

It's one of the many examples of how American resourcefulness, teamed with specialized knowledge, is making minutes more productive. Oxyacetylene cutting and welding and the electric arc are blazing new trails to faster and better production in almost every war industry. The minutes, hours, even days of production being gained by these modern tools are now helping us to overcome our enemies' headstart.

If you work with metals you should know the complete story of the oxy-acetylene flame and the electric arc—their speed, efficiency and broad range of usefulness in metal working. This knowledge is vital today—invaluable in the peace to come.

"Airco in the News" shows many interesting uses of the oxyacetylene flame and electric arc. Write for copy.

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WISCONSIN ENGINEER

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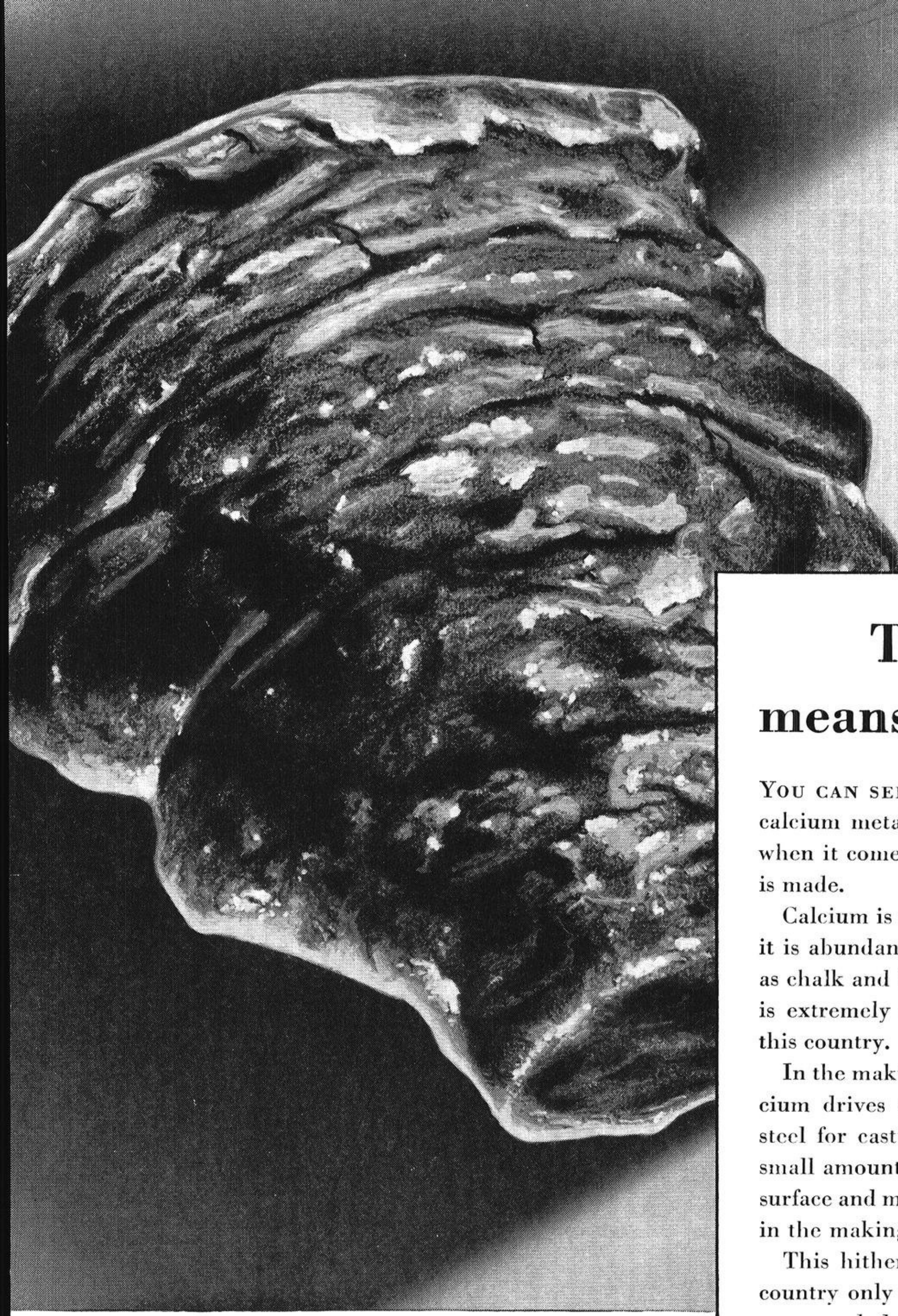
In This Issue . . .



This "Carrot" means healthy metals

You can see why metalworkers call this lump of calcium metal a "carrot." This is the way it looks when it comes from an electrolytic cell in which it is made.

Calcium is a soft, silvery-looking metal. Although it is abundantly present in such common materials as chalk and limestone, its recovery as a pure metal is extremely difficult. Yet it is vitally essential to this country.

In the making of stainless or high-alloy steels, calcium drives out impurities, giving cleaner, better steel for casting or rolling. In magnesium casting, small amounts of calcium improve the finish of the surface and minimize scaling. Calcium is an essential in the making of many metals.

This hitherto rare metal has been made in this country only during the past few years. Before Europe exploded, the United States was dependent upon France as a source of supply.

But back as far as 1935, thinking that this country should have a domestic source, Electro Metallurgical Company, a unit of UCC, started a major research program. After four years of work . . . as French supplies dwindled . . . a plant was put into operation for the manufacture of the gray metal. Today, Electro Metallurgical Company produces many times as much calcium metal as this country ever imported . . . and production is increasing.

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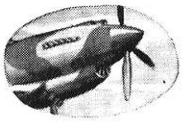
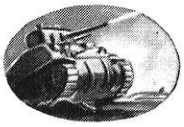


IN THE AIR SOONER! Vital aircraft parts flow from production lines quicker because the use of calcium metal results in better metal.

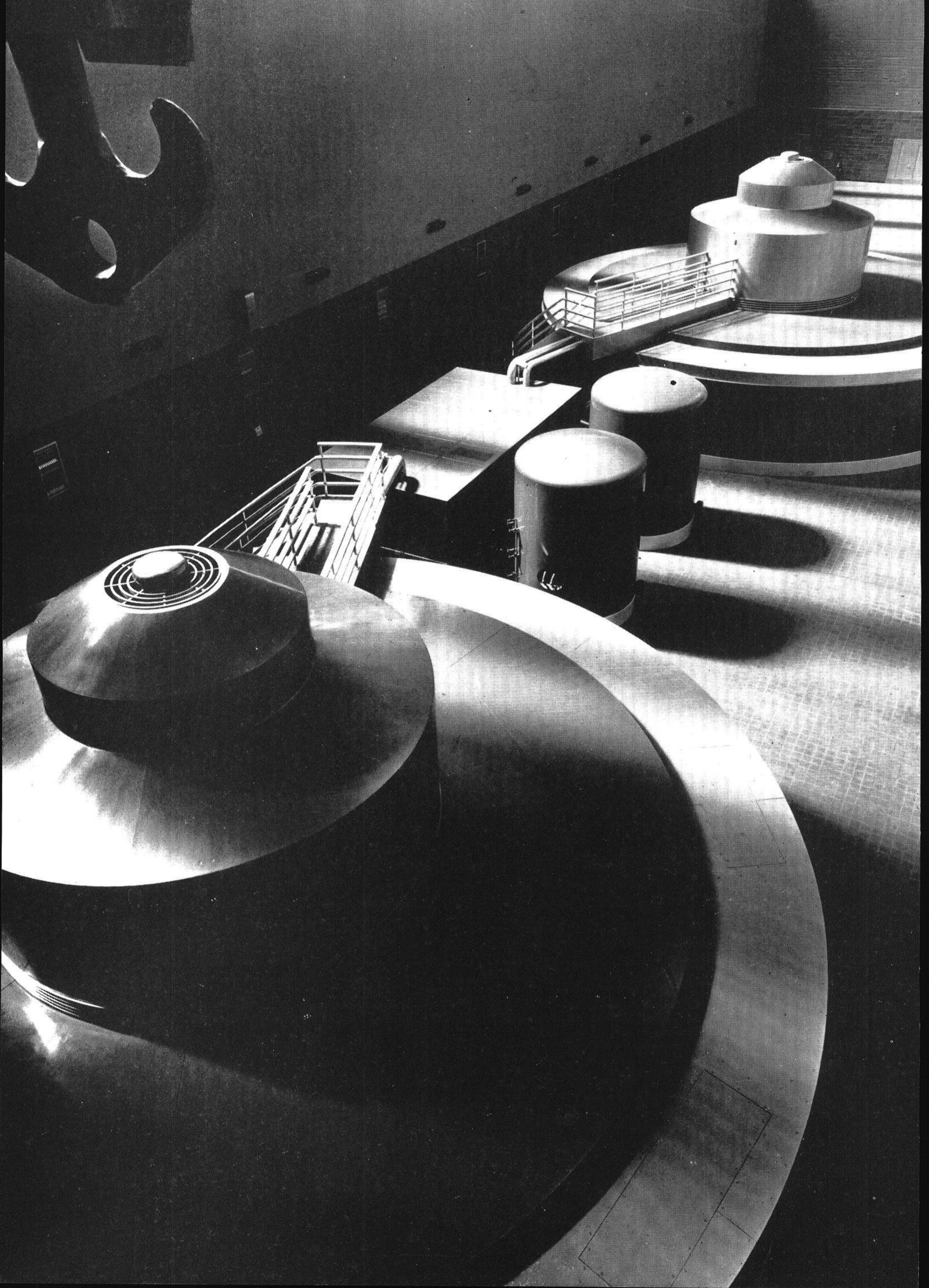
BETTER HEALTH! Pure calcium metal is used as a drying and purifying agent in the manufacture of certain new disease-fighting drugs.

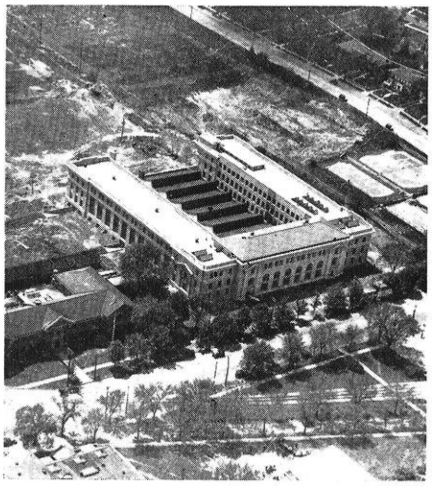


CHEMICAL HELPER! Calcium is necessary in making a number of rare metals—many of which heretofore were unavailable commercially—and all of which are vital.

METAL-SAVER! In the melting of copper scrap for use in certain types of electrical equipment, calcium is used as a purifier and a restorer of electrical conductivity.

BUY UNITED STATES WAR BONDS AND STAMPS





History, Labs, Faculty . . .

MECHANICAL ENGINEERING

by Arne V. Larson, m'43

Mechanical Engineering is one of the oldest branches of the College of Engineering at this institution. It was one of the four original courses at the time the College was established in 1870. Instruction in this course together with that in Civil, Mining, and Metallurgical courses was carried on for the first seven years in Bascom Hall, at that time known as University Hall and the only building on the campus that had class rooms.

History

The completion of old Science Hall in 1877 provided space for recitation and drafting rooms on the upper floor. One room in the basement was equipped for an engineering laboratory and machine shop. The laboratory was used for tests on steam units, on hydraulic machinery, and materials of construction. In 1884, old Science Hall burned and most of the equipment was destroyed.

During 1887 and 1888, there was considerable building activity on the campus. The present Science Hall together with the present Chemical Engineering Building (then called the Chemistry Building), the present Mining Engineering Building (then the Heating Plant), and the Machine Shop were all constructed during this period. Science Hall provided rooms on the first floor for recitation, lectures, and drafting, while the entire north wing basement was used for an engineering laboratory for classes in steam engineering, hydraulics, and materials testing. All mechanical shop practice, such as machine work, carpentry, patternmaking, and foundry work, was carried on in the Machine Shop. In 1894, the Machine Shop was enlarged not only to provide more space for the increased enrollment but also to provide room for the Testing Laboratory, which was transferred from Science Hall. The Electrical Laboratory, which had previously occupied part of the first floor and basement in the south wing of Science Hall, was also transferred to its present location at that time. Up to this time, Electrical Engineering had been a part of the Physics Department.

Construction of Engineering Buildings

The year 1900 marks the completion of the present Education-Engineering Building (then known as the main Engineering Building). This building provided space for lecture, recitation, drafting, and classrooms for all branches of engineering, together with space for the Steam Laboratory and the Materials Testing Laboratory. In 1910, the building was enlarged by the addition of the northwest wing and a small addition at the rear of the Steam Laboratory.

Throughout the entire history of the Engineering College, the enrollment increased faster than space was provided to care for the larger classes. Additional buildings came at such great intervals of time that the expansion could relieve only a few of the departments. The Shop Laboratories, already cramped for space, were further reduced in 1910 by the necessity for giving space to the Department of Manual Arts. Unsuccessful attempts were made to secure funds for enlarging the shops at this time, and the carpentry shop was moved to the Service Building.

Between the years 1910 and 1931, the only addition of space that the Engineering College received was the Randall Shop Building, constructed in 1920.

Increases in enrollment in mechanical and other engineering courses have caused considerable over-crowding in all laboratories. Moreover, modern development of power and manufacturing machinery has required an expansion of laboratory space in order to include new types of machines. Many new fields of endeavor such as Heating and Ventilation, and Aeronautics have demanded space.

In 1927, a realization of the needs of the Engineering College led to the appropriation by the State Legislature of $577,000 for a Mechanical Engineering Building. The completion of the building provided for the departments of Mechanical Engineering and relieved the cramped condition of a few of the other departments of engineering. This new building was ready for use in 1931.

Laboratories

The steam and internal-combustion engine laboratory extends two stories in height and conforms with modern power plant design. There is a long open condenser pit, a traveling crane, and other modern facilities. All of the equipment of the laboratory is specially arranged for experimental work, and for demonstration of the principles discussed in the classroom. A means of supplying loads for each of the engines is provided. On many of the engines a simple friction brake is used, while for high-speed units either electric generators or water dynamometers are used. The steam driven units are supplied with condensers in order that the exhaust steam may be weighed.

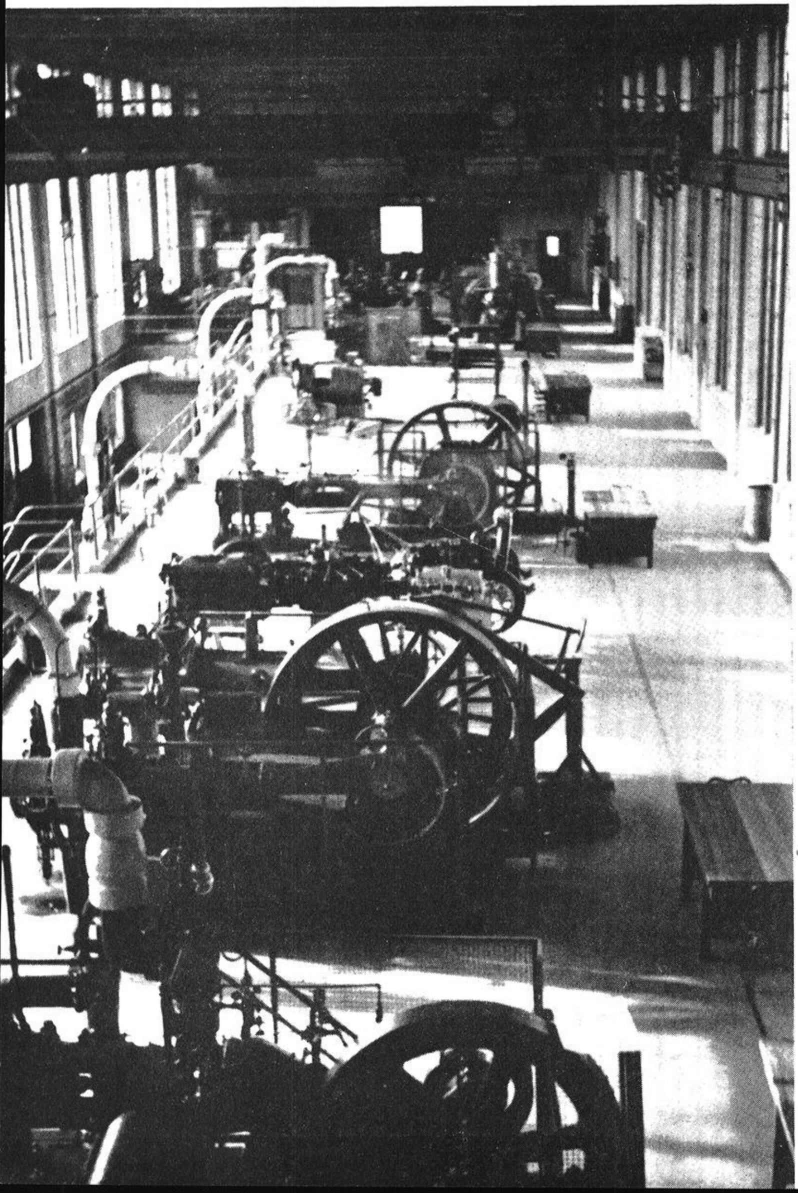
Steam Engines

The more important steam driven units are a 25-kilowatt Curtis turbine, a 25-horsepower simple Corliss steam engine, and a complete refrigeration plant. The main unit of the refrigeration plant is a 15-ton direct-connected Corliss engine-driven ammonia compressor. Also, this plant includes a double-pipe ammonia condenser and a double-pipe brine cooler besides some automatic control equipment. A 50-horsepower cross-compound poppet-valve steam engine is fitted with steam jacketed receiver and cylinders. Tests can be made with either superheated or saturated steam, condensing or non-condensing, with or without steam in the steam jackets and with or without reheating between cylinders. This furnishes a means for studying the effect of such conditions upon steam consumption. Moreover, the speed of the unit may be varied from 90 to 125 revolutions per minute, while the cut-off has a range of automatic variation between 0 and 95 per cent of the stroke.

A 50-horsepower compound steam engine is directly connected to a two-stage air compressor. The engine is equipped with a Meyer valve gear and operates a condenser. The base of the unit contains an intercoller for the air and a receiver for the steam end. An orifice is used for measuring the quantity of air compressed.

Equipment is arranged for determining the accuracy of steam metering devices. Steam flows through an electric flow meter, a balance type of mechanical flow meter, a Pitot tube, a Venturi meter, and several orifices and nozzles. By condensing and weighing the steam, a calibration may be obtained for each method of measurement.

View of the Steam & Gas lab from secondary floor balcony in the east wing of the M. E. building.



Heating Plant

The University Central Heating Plant is used in addition to actual laboratory equipment. The boiler house of the University which furnishes steam for all the buildings of the institution, both for heating and for power purposes, has a normal capacity of 5528 boiler horsepower. It is equipped with special testing apparatus so that experimental work may be carried on relating to the economy of boilers under various service conditions.

Internal Combustion

The internal combustion engines range in size up to a 50-horsepower full Diesel type engine. This is a vertical single cylinder unit, and is a modern piece of equipment. It is a two-stroke cycle engine of the solid injection type, and it will operate on a wide range of fuel oils. There is a 25-horsepower semi-Diesel engine besides some smaller units which will operate on crude oil or kerosene.

The high-speed internal combustion engine laboratory is located in the basement at the rear of the east wing of the building. Special testing devices are available for testing marine, airplane, automobile, and truck motors. A small single-cylinder Diesel engine has been constructed in order to study combustion conditions in an automotive type of Diesel engine. By means of a special three beam photo-electric tube indicator, a graphical picture of action in the combustion chamber is obtained.

Oil Testing

The oil testing laboratory is located on the balcony at the rear of the main laboratory. Its equipment consists of viscosimeters for determining the viscosity of oils at different temperatures, and apparatus for determining the flash, fire, and pour points. A colorimeter, a centrifuge, and a frigistat have recently been added to the equipment. Most of the State oil tests are performed in this complete and modern laboratory. A fume hood and exhaust blower have been installed so that oil tests may be carried out conveniently and accurately. Many oils are tested both in the oil test laboratory and in actual service in connection with engine tests.

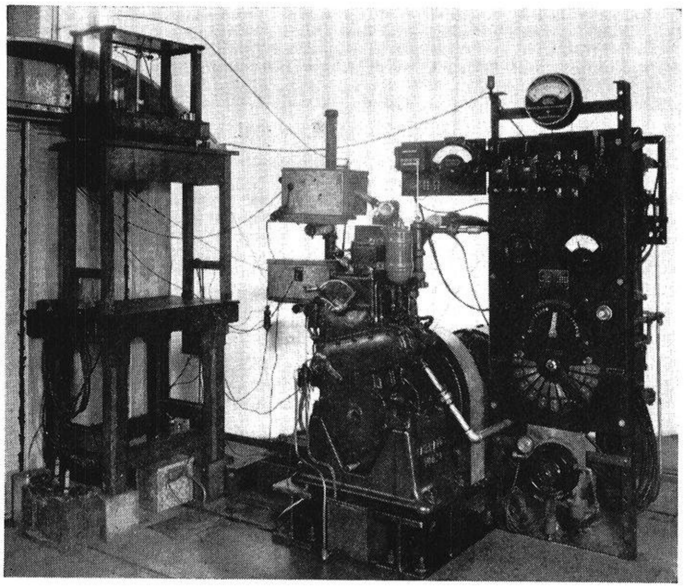
Boiler Efficiency

The boiler efficiency testing laboratory is located between the Steam Engine Laboratory and the Heating and Ventilating Laboratory. Thus it serves as a testing place for both power and heating plant type of boilers. Efficiency tests can be run on these boilers with a variety of fuels and types of firing. Boiler feed pumps and vacuum heating plant pumps are arranged for test purposes.

The calibration laboratory is located on the balcony at the front of the main laboratory. In this laboratory, there are deadweight gauge testers, vacuum pumps with mercury columns, and a fluid pressure scale with which gauges and indicators can be tested to pressure of 25,000 pounds per square inch. Steam drums are used for calibrating inside spring indicators under working conditions.

Multi-Fuel Engines

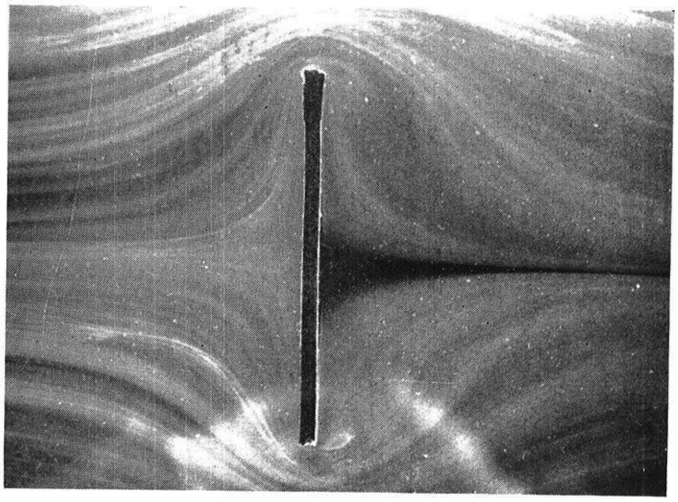
Students perform efficiency tests on a 40-horsepower city gas engine. A 20-horsepower engine which was built especially for test purposes can be fitted with a variety of heads, vaporizers, valves, governors, and auxiliary equipment. This permits testing the same engine with city gas, producer gas, gasoline, kerosene, alcohol, or other liquid fuels as desired. Floor slots have been provided for setting machinery in this portion of the laboratory so that engines may be quickly set up for temporary test work. Several manufacturers loan engines and other apparatus to the department for special test projects and experimental study.



Single gasoline engine ready for a test run

Heating, Ventilating, and Refrigeration

The Heating, Ventilating, and Refrigerating Laboratory is located in the single-story high ceilinged central wing of the building. An air conditioner in this laboratory is set up for washing, cooling, humidifying, and dehumidifying the air for the auditorium. A modern type of dust determinator is used in connection with air testing. An extensive arrangement is installed for determing the infiltration of air around doors and windows under various conditions of wind pressure. Types of windows, metal weather stripping, and many types of wall construction are problems under investigation. Unit heaters and ventilators are arranged for efficiency and rating tests. Several ventilating fans and blowers are available for test purposes.



Air flow analysis in Heating & Ventilating lab, the light flow lines are titanium oxide smoke.

Machine Design

The Machine Design Laboratory is located in the basement in the front portion of the building. The equipment includes a best testing machine, several forms of transmission dynamometers, and apparatus for testing hoists and screw jacks. Also, there are means for determining the relative efficiency of various forms of shaft bearings.

The work in gas and fuel analysis is given under the direction of the Chemical Engineering Department, and in their laboratories. The equipment there available provides excellent opportunities for study of the method of gas and fuel analysis and the determination of heating values of fuels. Also, some time is given to the study of boiler feed-water treatment.

Faculty

The Chairman of the Department of Mechanical Engineering is Prof. L. A. Wilson, the well known gentleman who impresses the principles of thermodynamics upon Junior and Senior Engineers.

Prof. P. H. "Pat" Hyland heads the Machine Design Department as well as teaches the Juniors and Seniors the elements of Machine Design. He also gives the course "Power Plant Design" to Senior engineers.

Another well-known character to Mechanical Engineers is Prof. L. E. A. Kelso, who terrorizes both Juniors and Seniors with his specialty of A.C. and D.C. electrical machinery. Electrical Engineering is taught to the mechanicals by Prof. G. F. Tracy and Prof. L. C. Larson also.

Prof. G. L. "Gus" Larson is the specialist on Heating and Ventilating. Air-conditioning and refrigeration are also taught by this well-liked professor.

Profs. D. W. Nelson, E. T. Hansen, N. S. Sherwood, "Bill" Feiereisen, and P. S. Meyers, are connected with the Steam and Gas Laboratory.

Besides these, many others in the Department of Mechanical Engineering are bending every effort to impress knowledge into the minds of the young engineers who are so urgently needed to aid the present war-effort.

A Weapon for War and a Tool for Peace . . .

Gliders For Victory

by Reino J. Salmi, m'44

In their successful invasion of Crete, the German army demonstrated to the world a new technique in modern military invasion. Scores of large troop carrying gliders brought men and materials to the island which was soon in the hands of the invaders. This was not the first time, however, that the Germans had benefited from the use of gliders. The formidable Luftwaffe had been made possible by the large number of German youths who had been taught the fundamentals of flying in small sport gliders.

The United States has by no means been asleep in the development of a glider force for its army. Several months before the attack on Pearl Harbor, Lt. Gen. H. H. Arnold, commander of the U. S. Army Air Forces, announced that we would build a glider force second to none. We are now well under way in the mass production of these motorless craft for our armed forces.

The leading manufacturer of gliders in the United States is the Laister-Kauffmann Aircraft corporation. It began a year and a half ago when Murray Whitehead and John R. Kauffman, who were trying to speed up the development of a light plane designed by Whitehead, met Jack Laister, who had been building gliders since he was fifteen and now had an invitation from the Army Air Corps to submit a design for a two place training glider. The company, which resulted from their meeting, has already outgrown one plant and has taken over a large arena which had formerly held flower exhibits, dog shows and such.

Some of the parts of the small craft are sub-contracted, but the main parts, the wings and fuselage, are made in the plant. The fuselage frames are made from lengths of steel tubing which is fashioned into small sub-assemblies, which are welded into larger assemblies until the fuselage is finally done. The wings and tail surfaces are made mainly of three-ply spruce plywood, which is shaped into hundreds of rigid parts that make up the wing and tail assemblies.

The hundreds of parts that make up the Laister-Kauffman glider are made as carefully as those of the finest pursuit plane. The glider is fabric covered except for the leading edge of the wing which is covered with plywood. The main parts of the glider are assembled one by one until the control cables; wing, elevator and rudder "tabs", small control surfaces used to trim the ship in flight; wing and tail running lights; radio; control instruments; seats; landing wheel (just one) and plastic cockpit hood are finally in place. The completed glider weighs just 450 pounds of which only 150 pounds is steel tubing.

Testing

The small ships are given a rigorous test by the chief pilot. It is towed to an altitude of 4000 feet by a tow plane, and the glider pilot then cuts loose. Test maneuvers include spins, stalls, dives, sharp banks and side slips. When the glider is picked up by the tow plane, an ingenius tow reel takes up the shock.

When the glider has passed its final inspection, it is loaded onto its custom built trailer ready for delivery. The wing halves and horizontal tail surfaces are removable so that the glider takes very little space when transported or stored. A trained crew is capable of removing the glider from the trailer, assembling the wings, fuselage

Fig. 1. Taking off into the wind at the start of a training flight.

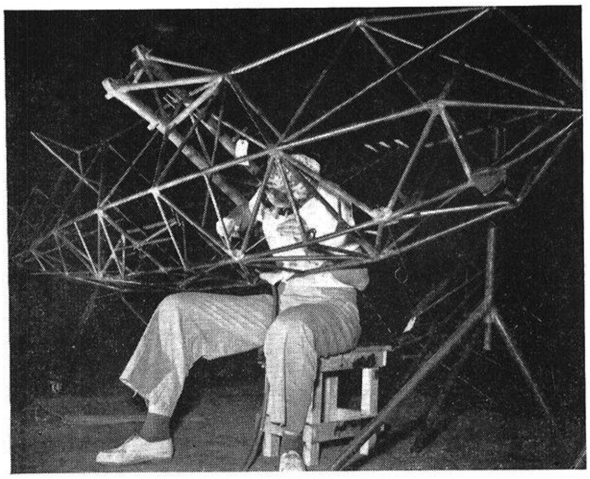


Fig. 2. Steel construction.
—Courtesy Monsanto Magazine

and horizontal tail surfaces and having the craft ready for flight in fifteen minutes.

Why Use Gliders?

The reason for the use of gliders is based on the principle that it is easier and more efficient to tow a load than to carry it. In Crete and North Africa the Germans used two types of gliders. One capable of carrying 23 fully equipped soldiers and 2 pilots or a freight load of 5300 pounds, and the other could carry 10 troops and one pilot or a freight load of 2800 pounds. They were towed by a Junkers three-engine plane which had a cruising speed of 146 miles per hour, a range of 650 miles and a pay load of 4200 pounds when using 60% of the available horsepower. It consumed 120 gallons of fuel per hour or 4 pounds per mile.

Using these figures, with a range of 500 miles, a cruising speed of 146 miles per hour, a gas consumption of 120 gallons per hour, a crew of 600 pounds and 400 pounds of miscellaneous equipment, we have a total of 15,300 pounds. Subtracting this from a gross weight of 22,000 pounds, a weight of 6700 pounds is left for freight and gasoline. Subtracting 2000 pounds of fuel leaves a net freight load of 4700 pounds. In the same way, a net freight load of 5700 pounds results for a trip of 250 miles.

The adding of a tow glider such as the Gotha 242, which is of only moderately clean design, will not reduce the cruising speed to less than 115 miles per hour. The Gotha 242 carries a load of 5300 pounds. The fuel consumption for the combination now becomes a 5.1 pounds per mile. On the 500 mile basis (with the glider in tow) the plane will use 2540 pounds of fuel and will carry a freight load of 4150 pounds. This makes the total load carried 9450 pounds. On the 250 mile basis, the plane will use 1270 pounds of fuel and will carry 5430 pounds of freight. Adding this to the 5300 pounds carried by the glider makes a total of 10,730 pounds.

The resulting gain from the use of the tow glider made it possible to carry 4750 pounds more on the 500 mile trip and 5030 pounds more on the 250 mile trip.

Looking at the entire question from another viewpoint, the tow-glider has no apparent advantage from the standpoint of carrying larger loads. By carrying overloads, an airplane of such size as was used by the Germans to tow their gliders, may be overloaded so as to make the wing loading as high as 30 pounds per square foot and the power loading up to 12 pounds per horsepower. Using the wing area and horsepower information on the Junkers, the gross load may be run up to 29,000 pounds. This of course necessitates the use of higher angle of attack in flying and therefore causes more wing drag. The cruising speed will not, however, go below 141 miles per hour at 60% horsepower. By the same reasoning as was used earlier, the net weight of freight for a trip of 500 miles becomes 11,500 pounds and 12,550 pounds for the 250 mile trip. This seems to cancel the advantage that was achieved by the use of a tow-glider.

The advantages in the use of tow-gliders for military and for commercial purposes are not quite the same and should be considered separately.

In contrast to power planes, gliders can land on a very small field and can make a much smoother landing than a power plane. Troop carrying gliders can therefore be used to land in any small field that is most convenient for the invasion plans. Once the landing has been accomplished, the pilot of the glider does not have to worry about getting out of the field with his ship as an airplane pilot would, since the cost of these troop carrying gliders is small enough to make them expendable. If the invasion

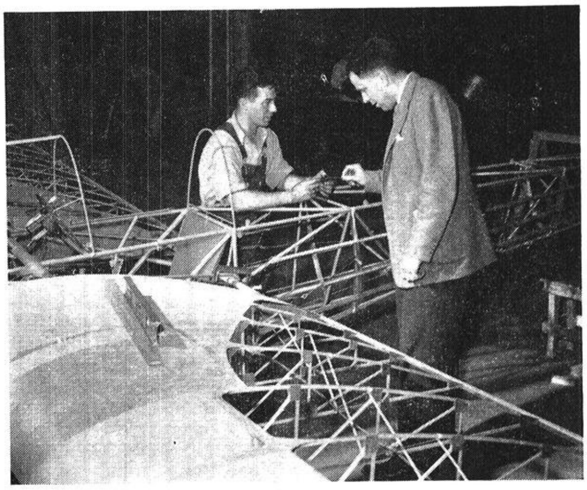


Fig. 3. View showing almost completed framework.
—Courtesy Monsanto Magazine

proceeds successfully, the gliders will be recovered with little damage from landing in a strange field. A heavily loaded airplane needs a long smooth runway to take off, while a glider which is picked up by an airplane in flight needs hardly any field at all. However, the use of troop carrying gliders assumes that the invading forces have local air superiority at least while the gliders are being towed, for they would be very vulnerable to enemy fighter planes.

Airplanes have not been used to carry freight and passengers on trips that would require the airplane to stop at each city to dispose of its cargo, because the plane would be required to land, unload its freight, take on new

(continued on page 20)

One of History's Great Engineers . . .

Isaac Newton

by Fred Engler, c'45

Illustrated Courtesy Scripta Mathematics

Today, the world is engaged in a bloody war. Machines of war are born from practical science. Let us, therefore, go back and examine the life history of a man whose fundamental laws of physics and mathematics gave to us these useful machines of peace and war.

Sir Isaac Newton, an Englishman honored for his many discoveries of many important laws of science, was born of humble parents on Christmas day, 1642, in Lincolnshire, England. During his grammar school days, he was much more interested in mechanical devices than he was in studying his lessons. In his early youth he invented many useful devices, some of which can be seen to this very day.

His first teachers were nothing more than grooms or gamekeepers, and naturally during the course of years he adopted their habits of drink. Newton, as a boy, would not have been much different from the rest of us, for he acquired such a diction of abusive language and a dry tongue that he reminds one of a modern college student.

At the tender age of fourteen, he gave up school to assist his mother in the management of her farm. However, books so interested Newton that it was decided to send him on to school. Accordingly, he was admitted to Trinity College at Cambridge in 1661. Here he began a career which revealed his exceptional powers in mathematics and physics.

Newton had such a craving for books, and he carried out so many original ideas in school that he had little time to engage in sports or outside activities. His schoolmates played constant pranks on him, and in general he was considered quite queer. Once when his tutor announced that he was to give lectures on Kepler's "Optics," Newton obtained a copy of this book and read it at home. When the lectures began, his tutor was surprised to learn

that his pupil had already mastered the subject.

Newton was very fortunate in having such a fine teacher as Isaac Barrow, one of the foremost mathematicians of the day. As a result Newton mastered not only the ancient works of Euclid and Archimedes, but also the new analytical geometry of Descartes. Early in 1665 Newton received his B.A. Then he began to do original work, and during the next two years he announced the discovery of the binomial theorem, the method of tangents, and other important mathematical principles.

In 1665 the Great Plague swept over London. Even schools had to be closed, and all students fled to comparative safety. During this interval, Newton did much studying. No less than three major strongholds of scientific truth were assailed and subjugated by the onslaught of his gigantic intellect.

Newton's contributions to the theory of light were of hardly less importance than his others. By admitting a beam of light into a darkened room so that the beam passed through a prism, he showed that white light is a combination of the seven rainbow colors: red, orange, yellow, green, blue, indigo, and violet. In 1704 his results were published and made known to the world in his book entitled "Opticks." During this time he also made a study of telescopes. Five hundred years before, Galileo had invented the telescope. When a beam of light came through Galileo's telescope, it blurred the image due to the fact that the white light dispersed upon passing through the prism into primary colors of the spectrum. Newton therefore set about to invent a telescope which would work under any condition. His result was the reflecting type of telescope that has proved so successful in modern science and astronomy.

After the plague had retreated from London, Newton returned to his old home. It was at this stage of his life that the flame of love kindled in his heart. His eyes beheld the beauty that marked a Miss Storey, one of the sweetest of Irish roses. However, the flame soon died, and she married another. Never again were women to come into the heart or life of Newton.

In 1672 Newton was elected to membership in the Royal Society. After the flight of James II, Newton became a member of Parliament, holding his seat until the year 1690. In 1696 he became Warden of the Men; and three years later he was appointed Master of the Mint, at the huge salary of twenty thousand pounds per year.

(continued on page 21)

The Burp Number or

Why Engineers Drink Beer

by Jerry Beyer, ch'44

The West has been the colorful setting of numerous stories of doubtful origin. Isolated desert valleys and lonely mountain retreats offer a locale which might be characteristic of Arizona, Utah, or any Western state. The place is never firmly established in these stories; the chain of events is stretched at the discretion of the author. "Once upon a time" permits the tall story writer to roam at will. But set the scene more exactly, limit the locale, and then—you'll still find incredulous, supernatural events going on!

Along the southern side of sloping Winnebago Street, for instance, in the small town of Milwaukee, Wisconsin, is a little establishment which makes quite a business out of bottled goods. Their trade-mark—a colored ribbon, —is known throughout the country as a symbol of fine flavor and quality. And the success of the entire company is traceable to a certain day in early spring when. . .

Enzymes

Knowledge about enzymes is still extremely limited, but the ordinary proteolytic enzymes have been used for years in the metamorphosis of protein into the more soluble, palatable forms sold as beer. As Herr Schultz once told me, "A beer is as good as the enzymes it's made from!"

At the south end of the brew house an abnormal abundance of bubbles might have been observed rising in the mash tub. A slight leak in one of the agitator motors had allowed a drop of No. 40 oil to fall into the tub. Continued use of the motor without proper lubrication had caused deposition of carbon and an increase in the free acid, which, on striking the malt and water, reacted to give an unsaturated carbogen of the enigmatic series.

Now this carbogen was most unusual in several respects. Because of its uniqueness it could find no mate but had to be content to run around with normal little female proteolytic enzymes when their mates were off to a convention or on a spree. As a result of these abnormal relationships there were produced members of a rare species of enigmatic enzymes. And these children of the unusual carbogen inherited from their father the rare facility of increasing the radioactive emission of Y rays with a consequent decrease in the burp number of the beer.

Most confusing of all was the manner in which these enigmatic enzymes defied all methods of chemical analysis. Professor Ztagar, with his bevy of sensitive potentiometers, milivoltmeters and pyrometers, was unable to establish its presence; Professor Resier even with his oxygen bombs, viscometers and complete gas analysis, could not tell one enzyme from another; Professor Eklawak was at a loss to find a suitable septum or solvent for separation in his filter presses or diffusion batteries.

But the search still went on . . . And one night in the local haven for thirsty souls a most breathtaking event took place! A young man with a slide rule slung from his belt put his foot on the brass rail and, in full view of a dozen sober witnesses, downed ten 12 oz. glasses of beer without experiencing a single erruption of gas! Here,

indeed, was the only living human being that had a conclusive test for that delicate, refined beer with the lower burp number. The man-marvel told the gaping bystanders that the empirical test of drinking ten consecutive glasses was unnecessary, and that by a consideration of the action of circularly-polarized light on beer it was possible to establish within 1% accuracy, the absolute burp number of beer.

And now extensive research continues in the field of the identification of enigmatic enzymes, as evidenced by the young men with slide rules slung at their belts, with their feet on the rail, in the local havens for thirsty souls, enthusiastically downing glasses of amber fluid in an untiring search for the beer with the lower burp number!

Seeing's Not Believing . . .

OPTICAL ILLUSION

by Frank McStay, e'43

The engineer knows from his experiments that one can not rely very much upon the senses of touch, sight, hearing, taste and smell when he would make accurate observations. Of all our sense organs our eyes make the least number of mistakes. Yet at times even our eyes are unreliable. The purpose of this article is to present a few examples of the types of errors the human eye makes and also to give an explanation of the cause of error in each case.

The eye as an optical instrument is far from perfect, at least when its parts are considered individually. A famous optician made the observation that if a person were sold an optical instrument with as many defects as the human eye, he would be perfectly justified in taking the instrument back to the man who made the instrument and give him a tongue-lashing. This statement was made only for effect, of course, for all scientists are in agreement that the eye when considered as a whole is a marvelous instrument, the operation of which is not completely known to man even today. For instance we don't know exactly what causes the sensation of color, in fact, we are in disagreement over exactly what causes the sensation of sight itself, whether it is electro-chemical in nature or purely electrical.

The optical illusions taken up in this article have been divided according to their causes of which there are four basic ones.

1. Something happens to the light which the eye does not discern.
2. Another sense or other senses "bias" the "report" made by the eye.
3. Physical failure of the eye itself.
4. Mental standards derived from experience influence the "report" made by the eye.

It would be possible to combine groups two and four under a single heading since the causes of both are psychological in nature.

Misinterpretation

As an example of the type where other senses bias the report of the eye to the brain, consider the case where an auto stops on a curve of a modern highway. The occupants sometimes receive the illusion that all objects inside the curve are tilted toward them and those outside the curve are tilted away from them. This is bcause the senses are not fully aware of the inclined position of the body. The same situation has been known to develop when one has been riding on a train for some time when the train suddenly stops. The apparent direction of the force of gravity as the train comes to a stop deceives the sense of touch which in turn makes objects seem to tilt back toward the direction from which the train came.

Another example of misinterpretation by the brain is the illusion which the motorist sometimes receives when driving in mountainous regions. When driving toward the mountain he often underestimates the slopes he climbs and overestimates those he runs down. When driving in a direction away from a mountain the opposite effect is true. The error here is due simply to misinterpretation of what the eyes see.

False Sensation

There are times when the eye itself must bear the blame for giving a false sensation to the brain. For instance, in the field of vision of each eye there is a "hole" in which the eye fails to detect anything. The reason for this is because of the blind spot on the retina of each eye. The retina is the part of the eye that produces the sensation of light. The blind spot is seen in Figure 1 to be at the junction of the nerve canal from the brain with the eyeball. This spot is blind because it has no retina.

Draw a dot about 3/8 inch in diameter on a piece of white paper and close one eye. Stare straight ahead and move the dot to the right or left, and you will find that at a certain point the dot disappears. This is because the

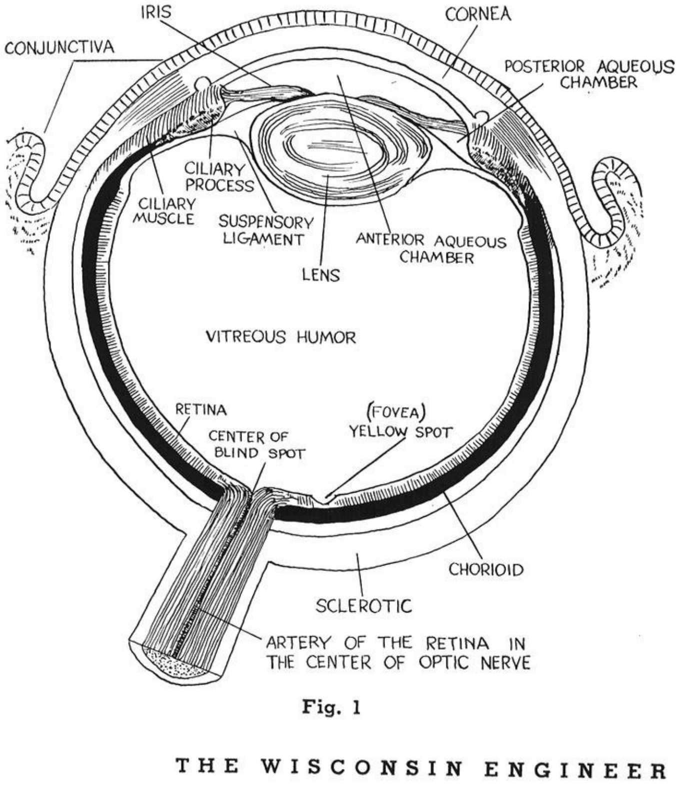


Fig. 1

ray of light reflected from the dot is being received on the blind spot.

Then there is also the phenomenon called the fatigue of the retina of the eye. If we look at a bright surface the whole of the retina is subject to a definite amount of fatigue which doesn't occur when looking at a dull object. The retina is more sensitive when looking at a dark surface and any object put in front of a dark background seems to be brighter than otherwise. Also owing to the slight involuntary rotations of the eyeball previously mentioned, a dark object seems surrounded by a light rim and vice versa.

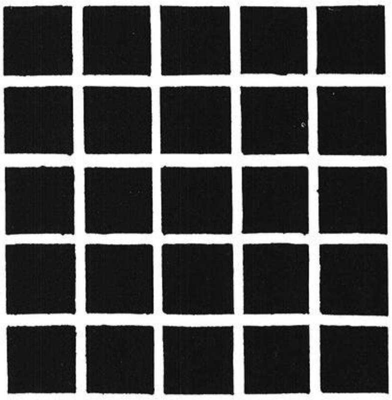


Fig.2.

In Figure 2 it is noticed that one suffers the optical illusions of flickering shadows where the white lanes meet. This is explained by the fatigue of the retina. A point in a white lane away from an intersection is surrounded by more black than a point at an intersection, therefore since a part surrounded by black seems brighter, we get an illusion of darkness in the parts not surrounded by so much black.

Fatigue of the retina occurs as far as colors are concerned also. If one were to stare at a large red object for a minute or two, and then transfer the gaze to a white sheet, the sheet will not appear white, rather it will appear the complement of the original color. This is probably due to the fact that the nerves sensitive to that one color have been tired so it is absent in the white.

The phenomenon known as persistence of vision is also caused by the failure of the eye itself to make an accurate observation. An impression made upon the retina continues to be registered for a fraction of a second after the cause has ceased to act. Tyndall demonstrated this effect in a very simple way. A lantern projects a cone of light and a white stick is made to cross the cone quickly as if it were a sword slashing the light. The watching eye does not see the stick as it cuts through, it sees a white disc. The eye sees the stick in all its positions at the same moment. This explains the illusion of no motion an electrical engineer receives when he watches the field structure of a synchronous motor under load by means of a stroboscope or the illusion of movement one receives in motion pictures.

An individual observes movement at a distant point by unconsciously using stationary points for reference. If there are no stationary points to use as a guide he judges the movement, unconsciously of course, by the muscles of his eye. If they feel at rest and his vision reports movement then the sensation is that of the object being looked at moving. Being unaware that our eye continually performs little involuntary movements, we naturally ascribe displacements of the image over our retina to corresponding displacements of the source of light. Thus the eye itself is once again seen to be the cause of a false sensation. This type of an illusion often occurs when watching a distant airplane. If watched intently the airplane seems to move spasmodically.

Psychological Effect

We now take up another division of optical illusions as they have been grouped in this paper: Optical illusions caused by a mental standard which has been established by the individual's experience.

One of the most famous illusions is the apparent enlargement of the moon at the horizon. It's difficult to believe that when it rises just above distant trees and buildings, that it is no larger than when overhead. Artists usually paint the sun or moon many times too large relative to the rest of the landscape in a picture because of this illusion. The reason for this is that we are influenced by our mental standards. We see clouds floating toward the horizon and shrinking in their apparent dimensions as they do so. An airplane seemingly becomes smaller and smaller as it moves away. The difference between the case of the airplane and cloud, and that of the moon is that the angle subtended by the plane and the cloud decreases continually while that subtended by the moon remains constant. If an airplane were seen rising above a distant village on a far horizon which would have the same apparent size as overhead, it would seem larger than the village.

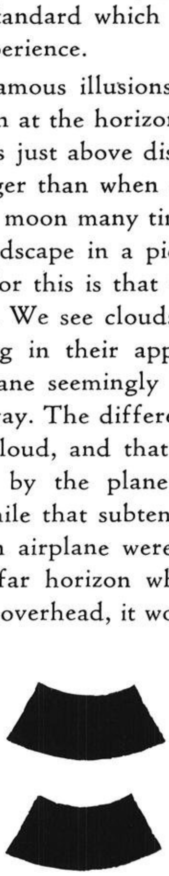


Fig. 3.

Another illusion of the same type is shown in Figure 3. In this figure, both objects are exactly the same size, in spite of the fact that the upper one seems much larger. The seeming difference is due to the fact that when the eyes move up they tend to follow a direction parallel to the edges, which makes the top figure appear to be larger.

Other illusions of the same type are shown in Figures 4 and 5. In Figure 4 "BC" lies in a larger parallelogram than "AB." And in the case of "AB" one's eyes do not take the trouble, in a quick glance, to follow "AB" to its ends whereas they do in the case of "BC". The com-

(continued on page 22)

The stories of the lives of

ST. PAT

FOUR GOO

The civils' hope . . .

BILL O'BRIEN

The A.S.C.E.'s candidate for St. Pat is Bill O'Brien. "As any fool kin plainly see," Bill O'Brien is a 100% Irishman—he's as Irish as Mulligan stew.

Bill is a senior in Civil Engineering and an old-time St. Pat parader. He went to Madison West High School and remembers the brawls from the vantage point of being in

the middle of them. He recalls vividly the fire-hose fights, rotten eggs, ripped off trousers and broken windows. The fact that the parades turned into brawls is the reason they aren't held any more. Besides throwing tomatoes, Bill played high-school basketball.

A cadet captain in R.O.T.C., O'Brien cannot grow a beard due to military restrictions. He will be in the army by June, and perhaps before. Because he and most of the rest of the seniors have not been to summer camp, he will go to a training camp for a while before getting his commission.

During summers he has worked on the road. Two summers were spent as general handy-man for a contractor and one as an inspector for the Highway commission. Last summer he was a party chief at the airport.

Extra-curricular activities include the Society of American Military Engineers (a society including both army and navy engineers) of which he is secretary. He also engaged in intramural sports.

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The M.E.'s pride . . .

BILL CUNNINGHAM

The A.S.M.E. and S.A.E. teamed up and elected one candidate. It seems the handicap on sales was so heavy for the mechanicals that they wouldn't have a chance if the two societies were divided so they combined and appointed a senior mechanical from Kenosha, Bill Cunningham.

Bill is about 99½% Irish with red hair and, what's more important, red whiskers. At the time of this interview, the whiskers were already quite long, and if he stays

away from explosive cigars and faulty gas stoves, he stands a good chance to win the beard contest.

He is one of the few candidates of late years to have participated in the old St. Pat's parades. He started in 1938, which was the year of the last parade. He claims i was a quiet parade and very un eventful, but what is quiet to a Irishman is not always considere quiet by everyone else. The Dean of the Engineering College and La School had signed a peace pact tha year which had a retarding effec on the rioting.

Bill stayed out of school one yea and worked at the Dynamatic Cor poration of Kenosha, where he als worked in the summers and ever other vacation. He has been activ in extra-curricular activities. He i a member of Triangle, and was vice president of it last semester. He ha won minor and major letters i baseball, being varsity catcher in hi sophomore and junior years. H claims that his beard won't bothe the catcher's mask when he goes ou for early practice this spring. He' had try-outs with both the Brewer and the White Sox, but decided t let the pro go in favor of inter-col legiate baseball. In spite of his ac tivities, he has managed to main tain a "B" average for his fou years.

Bill's staff will consist of seve sub-chairmen: Rene Gehl, Bob Ne son, Roman Pitzen, Jerry Bauer, Bo Jirucha, Bob Lanz, and Clarenc Possell. The sub-chairmen are re sponsible to Bill and they hav ticket-salesmen responsible to them

DO

ST. P

Winne

GREAT HALL . . .

NDIDATES

AND TRUE

'he chem's choice . . .

ELMER MERTZ

Elmer O'Mertz, the Chemical En-ineer's candidate, has been chosen y them in hopes of giving them wo St. Pats in a row. He is a wor-ny man to succeed their winner of ıst year, for back in Sheboygan ie only reason he entered high :hool was the fact that he was ex-elled from seventh grade for not aving. While there he partici-ated in football, basketball, track, ramatics, and debating, and was ept off the swimming team only y the school's lack of lifeguards, nce he couldn't swim.

Elmer is a man of the world, and as had experience in many fields. His knowledge of the present battle f production is enhanced by indus-ial work for the largest company f its kind in the world, the Garton oy Company, where he helped in-ugurate the first assembly line for icycles by putting on their left edals. He has traveled extensively, aving toured the country via side-oor Pullman (boxcars to you). His appreciation of our country's atural resources is due greatly to is experience as a lumberjack in a CC camp. His clear perception of onstruction problems was gained s a carpenter's helper at Truax ield. And last, but not least, his

ET

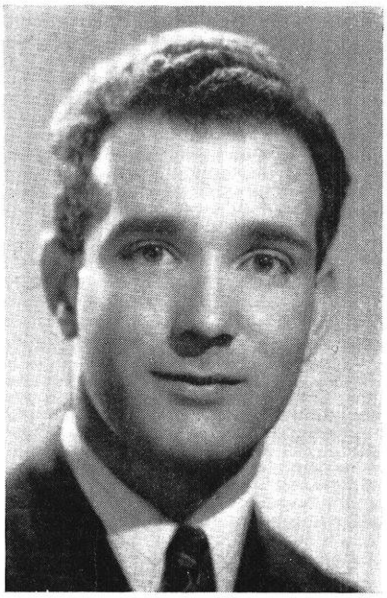
BALL

owned

. . . FRIDAY, MARCH 19

appreciation of the finer things of life was acquired during work in an ice cream factory, which he had to quit because his increasing weight made it impossible for him to get in the place.

Here at school Elmer has worked his way, but still has been able to keep up with his studies and other things. His brilliant scholastic record is highlighted by his average of over a hundred for last semester's physical chemistry exams. His hobbies are Edith, photography, Edith, music, Edith, stamp collecting, Edith, Edith, etc.



Incidentally, he is taking the Marriage and Family course with Miss Edith Halverson, his fiancee. He will enter development research work with the Shell Oil Company after his graduation next September.

If Elmer is elected as St. Pat, he promises to reign in a manner befitting the honor of the patron saint of all engineers.

The E.E.'s man . . .

JOHN CREMER

The fourth candidate to be considered is the white hope of the E. E.'s, John Cremer, a junior from LaCrosse. John attended LaCrosse State Teachers' College for two years before he came here, taking the special science course offered by them so he was able to transfer a good many credits to Wisconsin.

Outdoor activities of all kinds appeal to him. He and a friend made a two weeks' canoe trip to Canada one summer, and they didn't see another person for nine days.

He spent one year at the Elgin Watch Company school to learn watchmaking and is now a licensed watchmaker, entitled to practice anywhere in the country. He expects this training to be handy in his chosen profession of aircraft instruments.

Cremer is 99¾% Irish and his middle name (so they say) is "Blarney." He owns a dandy Irish setter (100% Irish) which he considered bringing up to keep the lawyers' goat company, which he keeps tied up in the basement.

The A.I.E.E. is backing him completely, even to the extent that most of the electricals are growing beards or side-burns. There is more chin-foliage per square foot of floor space in the KHK house than anywhere else in Madison.

ALUMNI NOTES

by Glenn Jacobson, ch'45

Miners and Metallurgists

GOODIER, WILLIAM, '41, an ensign in the Navy, was married to Mary Louise Law on February 13, 1943, at Bremerton, Washington.

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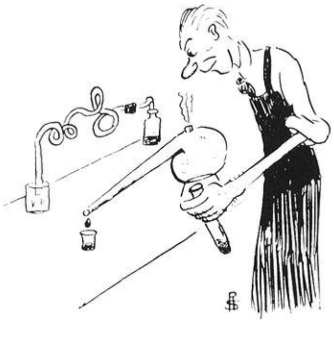
Chemicals

KEHL, GEORGE L., '34, MS (met) '37, of Coumbia University, has just pubished the second edition of his book "Principles of Metallographic Laboratory Practice."

SCHUELER, LOUIS E., '40, has been promoted to the rank of captain in the Chemical Warfare Service. Schueler, who is stationed in England, reports that he spends most of his time in chemical plants which are engaged in the manufacture of war materials.



LITTLE, JAMES C., '41, formerly with the American Steel and Wire Co. of Waukegan, Illinois, was called into service with the engineering ground crew of the Army Air Force.

ROEBUCK, JOHN, '41, was married to Esther Uranga on December 26, 1942, at Berkeley, California. The couple have taken up residence at Richmond, California.

VETTER, EDWARD R., '42, an ensign in the Navy, was married on February 13, 1943, to Betty Hotchkiss of Milwaukee. Vetter, who was in training at Hollywood, Florida, is now stationed at Washington, D. C.

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Civils

COX, GLEN N., Ph.D. '28, professor of mechanics and hydraulics at Louisiana State University, is the author of a new text, "Engineering Mechanics," published by Van Nostrand.

GELBACH, WARREN A., '07, who has been in private practice as a structural engineer in Chicago, had charge of the structural engineering for the Pantex Ordnance Plant, which is now in operation. At present he is at Houma, Louisiana, assisting on the structural work for a naval air base.

JESSUP, WALTER E., '12, has been called to active service with the rank of major. He is assigned to the office of Chief of Engineers at Washington, D. C.

STIVERS, CHARLES P., '13, is a brigadier general and is with General MacArthur in Australia. As assistant chief of staff at Manila, he served there until the last torpedo boats left for Australia.

KUNESH, JOSEPH F., '14, director of the Territorial Planning Board at Honolulu and president of the Wisconsin Alumni Association of Hawaii, last October represented the University of Wisconsin at the inauguration of Gregg M. Sinclair as president of the University of Hawaii.

BRAGG, KENDALL B., '15, is a captain in the U. S. Navy and is public works officer in charge of construction for the 9th Naval District, Great Lakes.

BIRD, LT. COL. BYRON, '15, is chief of the Engineering Division of the U. S. Engineer Office at Washington, D. C.

UTEGAARD, THOMAS, '17, construction engineer with Consolidated Water Power & Paper Co. at Wisconsin Rapids, has been commissioned a lieutenant commander in the USNR.

SCHMIDT, EUGENE A., '25, is a lieutenant, USNR, at Allen Field, Norfolk.

LIDICKER, WILLIAM Z., '27, has returned from Panama and is now at Galveston, Texas, on government work.

BLIFFERT, WESLEY P., '29, engineer with the Tews Lime and Cement Co. of Milwaukee, is a lieutenant (jg) in the Civil Engineer Corps of the USNR.

COX, MARVIN E., '30, is a lieutenant in training at an officers' school at Miami Beach, Florida.

STAEFFLER, MAJOR RICHARD P., '31, is commanding officer of the Badger Ordnance Works at Merrimac.

SENN, CHARLES L., '32, who has been with the Milwaukee Board of Health, has been appointed public health engineer for Los Angeles.

WILDE, WALTER E., '32, is overseas as a Pfc.

DE YOUNG, CAPT. KENNETH C., '33, is area engineer at the Kingsbury Ordnance plant at La Porte, Indiana.

HARBECK, G. EARL, '34, who has been with the USGS for some years, is a first lieutenant in the Marine Corps.

MAERSCH, JOHN M., '34, is a lieutenant in the Signal Corps, Army Air Forces, in England.

CARDINAL, ALTON L., '35, is a lieutenant with the 339th Engineer Battalion.

GRADT, EUGENE W., '35, is with the Sea Bees, USNR.

LA CHAPPELLE, H. A., '35, is an ensign at the Naval Air Station, Elizabeth City, N. J.

OLSTAD, ORVILLE A., '35, is a lieutenant in the Navy Air Force at San Juan, P. R.

WERNISH, GEORGE, '35, is a lieutenant (jg) in the Navy, stationed at the Bureau of Yards and Docks at Washington, D. C.

KESTER, WILLIAM H., '36, who is with the American Bridge Co., was married on August 22 to Betty Zufall of Ambridge.

MATTHIAS, CARL D., '36, is a lieutenant with the U. S. Engineers at Camp Claiborne, Louisiana.

HOGANSON, CAPT. L. O., '37, is in command of the 234th Signals Operation Company at the Presidio, San Francisco.

WILSON, FRANCISS C., '37, was married on December 12 to Grace Lewis Markham of Milwaukee. Ensign Wilson is supervisor of shipbuilding in one of the yards at Wilmington, Delaware.

CAPE, FREDERICK A., '39, is engineer for a syndicate of contractors engaged in heavy construction at the Panama Canal Zone.

HILGENDORF, LT. DANIEL D., '39, is overseas with an engineer battalion.

KLIEGER, PAUL, '39, is Pfc, 771st M. P. Bn., Co. B, at Fort Ord, California.

LEHMANN, KENNETH F., '39, announces the arrival of a son, Scott Kenneth, on November 28, at Balboa, Canal Zone. Lehmann is an assistant engineer (civil) in the Public Works Department of the Navy.

Battle without headlines!

The men and women of Bell Telephone Laboratories are directing their energy these days to developing new and better communication equipment so vital in today's swift-moving global war.

Peacetime developments, pioneered by Bell Laboratories, are seeing action on every front. Many of their war-time achievements should prove stepping stones to progress in the coming days of victory and peace.

Service to the Nation—in war or peace, that's the one ideal of Bell System people.

WAR CALLS COME FIRST!

AMERICAN TELEPHONE & TELEGRAPH CO.
BELL SYSTEM
AND ASSOCIATED COMPANIES

Here and There . . .

On The Campus

with Bill Haas, c'45

A.S.C.E.

The local chapter of the A.S.C.E. met February 24th at the Hydraulics Lab. The principle business was discussion of the plans for the A.S.C.E. Yearbook. The Yearbook Committee presented the general outline of the Yearbook to the members. The men on this committee are Ed Korpady, chairman, Jack Scholbe, Roy Ericksen, Ed Kloman, Charles Naeser, Elroy Spitzer, and Bob Miller.

Bill O'Brien accepted as the A.S.C.E. candidate for St. Pat. A committee was appointed to make and post signs advertising the meetings of the Chapter. A suggestion that the various engineering societies organize a league of softball teams, with equipment to be furnished by Polygon Board, was favorably received.

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A.S.M.E.

"A force of American air bombers and British fighting aircraft as guards can bring a smashing end to the war," stated Colonel Fay Dice, who is in charge of Truax field radio instruction, before members of A.S.M.E., S. A. E., A.I.E.E., and the Madison Technical Club at Music Hall on Wednesday, February 24.

Colonel Dice spoke in place of W. B. Stout, president of Stout Research, Inc., of Dearborn, Michigan. Mr. Stout was unable to arrive in Madison to speak as originally scheduled because of bad flying conditions.

Colonel Dice's subject was "The Importance of Airpower in the Present War." Before going into the main subject, the speaker outlined the reasons for our entering the war, the course of the struggle up to and including the entrance of the United States, and the preparations we have made to wage an offensive war. He said, "Germany could be pounded out of the war if the Allies would take to the air and strike at Germany's heart until the heart is stopped. Americans can feel encouraged because of the national resources and the mass production facilities we possess and in the faith in an educated youth."

Colonel Dice explained the vital part air forces play in modern war and stated that no major victory is possible without an air force. He showed how the navy had lost its former offensive position but added that an effective blockade of enemy nations can be possible by means of airplanes, particularly bombers. In closing Col. Dice emphasized five "musts" for American action: cooperation with the Allies, placing campaigns in the hands of capable strategists, unified commands in each theater of war, effective air power, and "an aggressive way of thinking that has in it no worry about giving up."

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ENGINEER BANQUET

On Wednesday evening, February 24, the ENGINEER had its annual banquet. Members of the Editorial and Business staffs, with Directors and guests of the ENGINEER, were served at 6:15 in the Round Table Room of the Union.

"Ceegars" were distributed, and Virginia Morrick and Mildred Bowar, Dean Johnson's secretaries, startled more than a few persons by calmly dipping into the box as it was passed around. (We heard since that they eventually wound up in Prof. Van Hagan's possession.)

Jerry Baird, retiring Editor of the ENGINEER, now acting in an advisory capacity on the staff, acted as toastmaster. The members of the Board of Directors who were introduced included W. K. Neill, advisor, L. C. Larson, P. H. Hyland, R. A. Ragatz and L. F. Van Hagan. Prof. Van Hagan, introduced as "the grandpappy of the ENGINEER," gave a brief, interesting account of life on the campus in 1918, and emphasized the difficulties the ENGINEER staff overcame in publishing the magazine under wartime conditions. It may be of interest to mention that the upper third of the engineers in school at that time were allowed by the War Department to finish their courses. The magazine staff at that time was largely in uniform.

The honored guests introduced at the banquet were Prof. F. E. Volk, librarian of the Engineering library, Mrs. Donald Niles, Miss Virginia Morrick and Miss Mildred Bowar, secretaries to Dean Johnson, and Miss Ruth Yaeger and Mr. Mike Harris of the Daily Cardinal.

The speaker of the evening was Mr. Guy W. Tanner, manager of the Campus Publishing Co. He spoke on the subject of post-war planning, emphasizing the importance of the human touch in business relations by citing several conclusive illustrations.

Jerry Baird also introduced several staff members, including Donald Niles, editor; William Jacobson, associate editor; John Caldwell, business manager; Don Caldwell, circulation; Arne V. Larson, Alumni Notes; Dick Roth, Static; Bob Daane, cartoons; Wilbur M. Haas, Campus Notes; Doug Bainbridge; and Gordon Erspamer.

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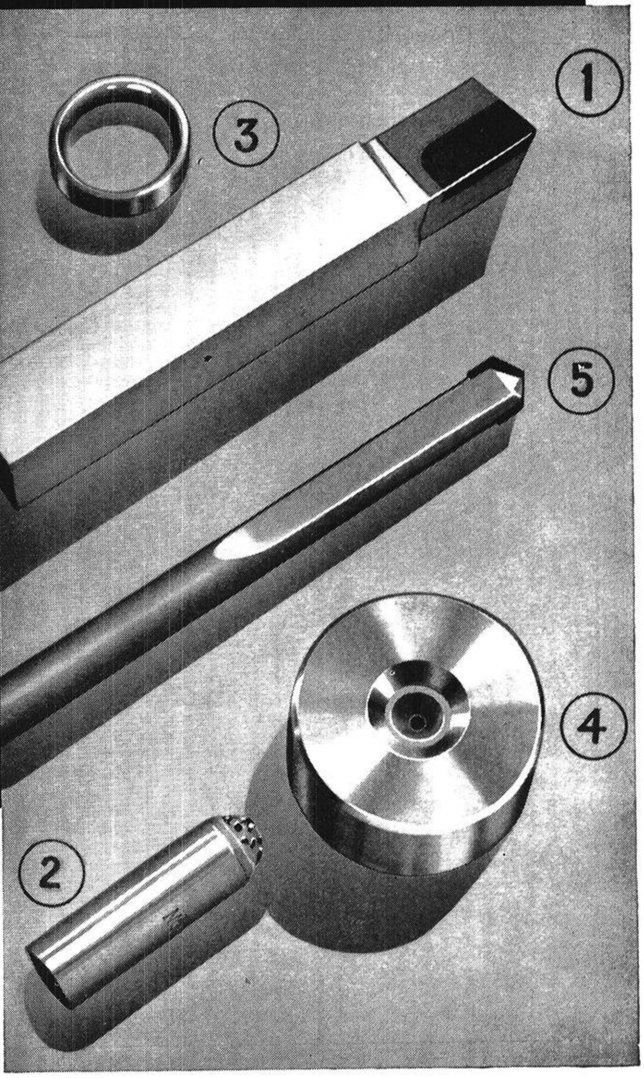
WRITING CONTEST

To stimulate further student interest in magazine article writing, the Wisconsin Engineer announces

(continued on page 28)

These are the 5 WAYS in which industry is stepping up WAR PRODUCTION With Carbides



1. Cutting Metals Faster! . . . Carbide tools commonly double the volume of metal removed per hour. Cut wide range of material, from "tough" armor plate to "soft" plastics. Continuous or interrupted cuts. Adaptable to most old machines, as well as new.

2. Dressing Grinding Wheels Easier! . . . Diamond-Impregnated Carboloy dressers make diamonds do a full day's work every day! No time out for remounting. No lost diamonds. No "pampering" temperamental stones. Diamonds held permanently in place. Used in 3 sizes for wheels up to 42″ diameter.

3. Keeping Machines Running! . . . Stopping "shut-downs" caused by excessive wear on such parts as rollers, cams, guides, gages, valves, etc., used on plant equipment. Just a small insert of carbide at the point of wear often increases life of parts up to 100 times longer. (Carboloy guide for wire stranding machine illustrated above is typical wear-resistant use.)

4. Drawing Metals! . . . Drawing, sizing, extruding metals through carbide dies provides better finish, greater accuracy, larger output, more continuous operation. Used for wire, bar, tubing, sheet metal. Widely employed for drawing cartridge cases from .30 cal. through 105 mm.

5. Installing Equipment Faster! . . . For installing new equipment, wiring and piping, or relocating present machines, carbide masonry drills drill holes 75% faster in concrete, brick, tile, porcelain, plaster.

CARBOLOY COMPANY, INC., 11179 E. 8 MILE ROAD, DETROIT, MICH.
(Sole makers of the Carboloy brand of cemented carbides)
Birmingham • Chicago • Cleveland • Los Angeles • Newark • Philidelphia • Pittsburgh • Seattle
Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

CARBOLOY CEMENTED CARBIDES
TRADEMARK
TRADEMARK
TOOLS • DIES • DRESSERS • MASONRY DRILLS • WEAR RESISTANT PARTS

(continued from page 9)

freight and then take off again every fifteen minutes or so. This would cause the airplane to defeat its own purpose, which is to make a journey between distant points in as short a time as possible.

If we take the same transport plane and have it tow a formation of four or five gliders (the number depending on the number of cities wanted to stop at), each glider loaded with freight or passengers bound for some city, as the airplane reached that city, the glider would cut loose from the formation and land while the tow plane continued on its way. When the last glider has been released the airplane would proceed to its original destination, carrying passengers who now enjoyed a fast non-stop ride.

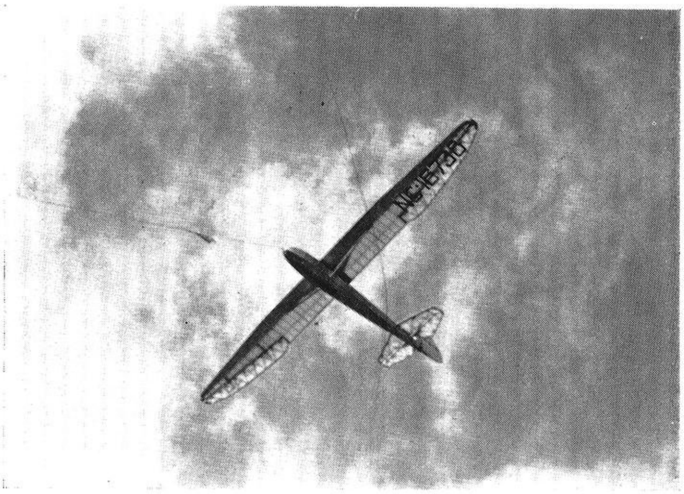


Fig. 4. "Next stop, Podunk"

Most medium sized cities do not have airports that are large enough to accommodate a large heavily loaded airliner, but they could easily provide for small airports that would be ideal for glider service.

The training of glider pilots is quite different from what one may expect. The trainees are men who are already capable of flying an airplane. The training begins with airplanes. The trainee is taken up in an airplane and the motor is suddenly cut. The pilot must then find a field and make a "dead stick" landing. This is continued with the motor being cut at different altitudes and at various distances from suitable landing fields. In this manner, the pilot becomes accustomed to gliding to any field within reach. His next ship is one of the small two place gliders. He then goes to the 9 place 74 foot span glider and finally to the 15 place 80 foot span glider. Some training is also given in the high performance sail planes to acquaint the pilot with flight in air currents.

The commercial use of gliders is a new field of aviation which remains to be fully explored. Of course there will be the usual amount of scoffing by pessimistic observers just as there was in the development of the airplane as a commercial success. But a progressive and aggressive attitude is vigorously at work to overcome any wet blankets that may be thrown on the idea, and the future of the cargo carrying glider after the war seems indeed very bright.

(continued from page 10)
At this period of history the wardenship of the mint was an important position because of the wretched condition of the English money system. For Newton's successful handling of this task he was accepted by society. At once he moved into a fashionable section of town, where he received visitors from the world over.

Thirty years before Newton had written the stupendous "Principia," in which all his theories had been compounded. This effort seemed to have burned out the flame of zeal and invention in Newton's mind. At the prime of his life, when his powers had attained their zenith, the urge to scientific production lay dead. However, success followed in his footsteps; and in 1705 he was knighted by Queen Anne. On March 20, 1727, at the ripened age of eighty-five, Newton passed into the realms of the Eternal.

Newton accomplished much during his long lifetime, but his works can be divided into six parts. They are: gravitation, mathematics, navigation, optics, physics, and astronomy. In the field of gravitation, Newton's discovery of the universal law brought order into a chaotic world. In mathematics he improved the methods of calculation and accidentally discovered the elements of calculus: the relationship between physics and mathematics. In navigation he guaranteed the movements of heavenly bodies and so led the way for modern navigation. His spectrum analysis of white light paved the way for many useful discoveries in optics and their related subjects. In physics he originated the mathematical basis for interpretation of fundamental laws. For isolated facts he substituted the rule of law. By inventing the reflector telescope the scientists of the world were able to study the stars and so gain a wider view of the universe.

The ordinary refracting telescope was satisfactory until telescopes began to get too large. To make a refracting telescope comparable in power to the almost completed 200 inch Mt. Palomar mirror would require a lens much more than 200 inches in diameter due to spherical aberration.

Out from the darkness of bygone days, the ghost of Newton comes to us. In times of war, physics and mathematics are the primary subjects which are required of any man who holds an important position in industry or the armed forces. On land, sea, and in the air, men are needed who have a basic knowledge of these fundamental subjects. We can therefore pay our respects to a man whose high intellect developed the basic laws which govern the elements of science.

As the poet Pope once said, "Nature and nature's laws lay hid in night; God said 'Let Newton Be!' And all was light."

(continued from page 13)

bined effect is that "BC" is the longer, which is just the opposite to fact. The parallel lines in Figure 5 seem non-

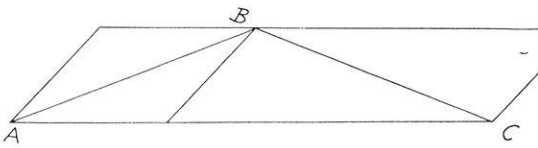


Fig. 4.

parallel to a small degree when one takes a hasty glance because all the slanting lines impress the mind more than the three parallel lines.

The "Lens" Effect

The pole used by a boatman to push his boat along looks as if it were broken just where it enters the water; this is caused by the fact that the rays of light are refracted when they go from the air into the water, or vice versa. Also for the same reason the lake or stream seems more shallow than is actually the case.

There are days when the sea looks like a huge concave dish and objects normally beyond an observer's range of vision become visible. Distant ships which to the observer's eye should have been on the horizon or beyond it, seem to sail in a valley of water. Also there are clear days when distant objects normally visible at sea disappear and the whole sea takes on the appearance of a convex surface. The reason for this is due to the lens effect of humid air. When the lower strata is cold and more dense, light is refracted around the curve of the earth and so distant points appear higher than they really are —thus the sea is cupped. When the higher strata are more dense the opposite effect takes place.

The celestial bodies appear to us slightly higher above the horizon than they really are, and this displacement increases the nearer they approach the horizon. This accounts for the flattening of the sun and the moon on the horizon. At sunset the lower edge of the sun's disc appears, on the average, 35 minutes of arc higher than it actually is, but the top edge, which is further from the horizon, only 29 minutes. As the width remains the same, it is obvious that the sun would appear more or less oval in shape, the minor axis shortened by six minutes of arc, or about 1/5 of the sun's diameter.

This phenomenon, which shows us by direct observation how the apparent rise increases towards the horizon, is simply a consequence of the increase in the density of the atmosphere in the lower layers. According as the density becomes greater, the refractive index of the air increases and the velocity of the light decreases, so that, when the light waves emitted by a star penetrate our atmosphere, they move somewhat more slowly on the side nearest to the arth and bend around gradually. The light rays, which indicate how the wave-front is propagated, curve too, therefore, and distant objects appear to be raised.

The mirage is a rather spectacular optical illusion which most people have witnessed at some time or another, frequently without realizing that they have seen a mirage. It is caused by refraction of the light rays in the atmosphere. The necessary condition for it to occur therefore, is layers of air having quite different density. This is apt to occur over any area of either land (provided the land is level) or water. When the ground or an asphalt or concrete highway is strongly heated by the rays from the sun the layers of air in contact with the heated surface may become much hotter than those at just a little greater height. This causes refraction of light causing an image to be displaced. A ship, for example, may be over the horizon, but due to refraction, a virtual image appears and seems to be much closer than the object. The effect is much the same as the one which makes the sea look cupped.

The twinkling of stars is not a phenomenon taking place on the star itself. The changes in position, twinkling, are caused by curvature of the light rays in the striae of hot and cold air, both of which are always present in the atmosphere, and especially where a warm layer of air passes over a cold layer and air waves with eddies are formed. The changes in brightness arise from the fact that at the surface of the earth the irregularly deviated rays of light are concentrated at some places and sparsely distributed at others. If the continually changing system producing this is borne along bodily by the wind, the observer will stand, now in a brightly illuminated region, now in one of less brightness.

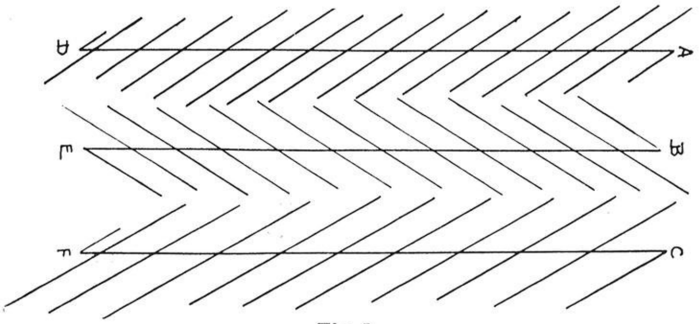


Fig. 5.

In conclusion it may be pointed out that in order to be accurate in our observation of light we should first of all be familiar with the instruments we use in observing the light, our eyes, and also light itself. For instance when looking at a fish one should realize that the location of the fish underwater is not actually where he seems to be. And in the laboratory, if an object suddenly seems to move a minute distance, there is always the possibility that the observer has merely had an optical illusion.

At the end of a paper on a subject such as this, one might make the false conclusion that the human eye is quite unreliable. This would be a gross error. On the whole, the human senses compare favorably in accuracy with most of the ordinary laboratory instruments, and, as mentioned at the beginning of the paper, of all of our sense organs, our eyes make the least mistakes. On the other hand, it is apparent from this paper that just because one sees something happen, that in itself does not necessarily prove that it actually did happen.

STATIC . . .

Humor by Dick Roth, m'43
Cartoons by Bob Daane, m'43

Wednesday night, February 24, all of the members of the staff of the Wisconsin Engineer dashed home, whacked off a thre days' growth, put on clean shirts and ties, dampened a few shiny spots on their pants with a wet rag, took their slide rules off their belts, and whipped off to the Union for the annual Wisconsin Engineer banquet.

There was an awful moan from some of the scribes who hadn't eaten for a week when they saw the menu which consisted of the following tidbits:

Pickled Herring Soup
Dandelion Salad
Concrete Rolls
Mushrooms on Rhubarb
Pressure Cooked Horse Meat
Bitter Chocolate on
Impervious Barium Sulfate

Everything went smoothly until Toastmaster Jerry Baird introduced Mildred Bowar and Virginia Morick and asked them to stand up and take a bow. Arne Larsor. jabbed Pat Hyland in the ribs so hard that he almost swallowed his cigar.

A good time was had by all and it was worth a year's work just to get a crack at that delicious horse meat.

* * *

"What are you putting in your vest pocket there, Murphy?"

"That's a stick of dynamite. Every time that Riley sees me he slaps me on the chest and breaks all my cigars. The next time he does it, he's going to blow his hand off."

o o o

She was peeved and called him "Mr."
Not because he went and kr.
But because just before
As she opened wide the door,
This same Mr. Kr. Sr.

o o o

Some travelers were looking at the molten lava inside Mt. Vesuvius. An American remarked: "Looks hot as hell."

An Englishman muttered under his breath, "Those damned Americans have been everywhere."

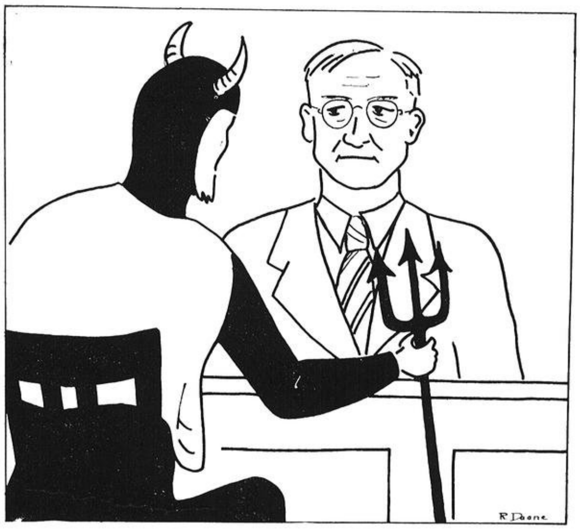
o o o

She walks with a decided jerk.

Yes, isn't he?

We have just received a definition of a dictator which we believe is right in tune with the times. Here it is:

A male puppy is the son of a female dog. A female dog is the dog-catcher's main objective. A main objective is the dream of a dictator. Therefore, dictators are male puppies. Now what did I say a male puppy was?



"Well, Gus, I have a little air-conditioning job for you."

o o o

Judge (to amateur yegg): "So they caught you with this bundle of silverware. Whom did you plunder?"

Yegg: "Two fraternity houses, your honor."

Judge (to sergeant): "Call up the downtown hotels and distribute this stuff."

o o o

There are to me two kinds of guys,
And only two that I despise:
The first, I'd really like to slam,
The one who copies my exam:
The other is the dirty skunk
Who covers his and let's me flunk.

o o o

Attention to All Chem. E's.

Cynaide solutions should always be measured out in graduates, never in pipettes. If pipettes are used, there won't be any graduates.

STATIC . . .

(continued from page 24)

The Engineer's Lament

Listen, collegians, and you shall hear
The sad, sad tale of the engineer.
All the day long he meets, in his classes,
The male of the species, no beautiful lasses.
No astonishing babes frolickin' with 'em,
Just sliding the rule of the logarithm.
The electrical men may solve a new circuit,
But the problem of women! They'll never work it.
The theory of mechanics is mastered by many.
The masters of women! Gosh, there ain't any.
The civils are always blazing new trails,
But they're not so hot at praising the frails.
A bunch of the boys are studying the mines,
And they find no faults in female designs.
The rest of the gang is messing with chemicals
Which leaves little time for testing the femmy-gals.
'Tis a bleak, dismal outlook to the engineer,
To go through school withut feminine cheer.
Can nothing be done about this deplorable state?
Ah me, no! 'Tis the engineer's fate.
Dammit!

° ° °

Then there was the freshman engineer who was so dumb he let his roommate fix him up with a blind date with Allis-Chalmers.

If all the sleepers in Professor Larson's 108 class were placed end to end . . . they would be more comfortable.

° ° °

"I shall now illustrate what I have on my mind," said the professor as he erased the board.

° ° °

Noah's ark had finally come to rest on the mountain top, and the animals were herded off, two by two. Noah remained behind, and as he stood surveying the scene, he heard a terrible sobbing. He went back to the ark and searched until he found two snakes in a corner, weeping bitterly.

"Why, what's the matter?" asked Noah.

"Alas," wailed one snake, "you told us to go and multitply, and we're only adders."

° ° °

A sentry was walking his lonely post, when suddenly he heard a noise.

"Halt!" he cried, "Who goes there?"

"Free French soldiers," came the reply.

"Advance, Free French soldiers," and they passed. A long while, and then another noise.

"Halt!" cried the sentry, "Who goes there?"

"English soldiers," was the answer.

"Advance, English soldiers," and they too were admitted. After a long pause, there was some commotion.

"Halt!" ordered the sentry, "Who goes there?"

"Who the hell wants to know," was the answer.

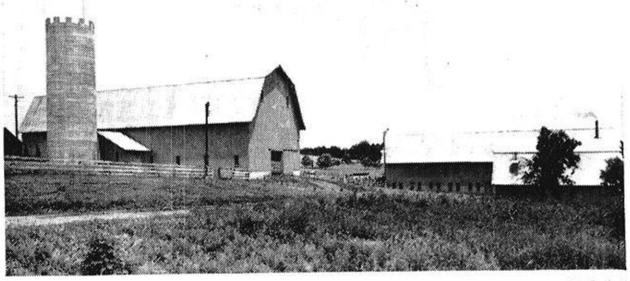
"Advance, American soldiers," said the sentry.

Combining PATRIOTISM *and* GOOD SENSE

Of course every one is willing to do without the essential materials that help win the war; everybody knows zinc and steel are among those materials. And *of course* it is just good common sense to take care of the things we have, including galvanized roofing, to make them last as long as possible and give the best service.

HOW TO CONSERVE GALVANIZED ROOFING

You'll find galvanized roofing of various types used on all kinds of structures, on farms, in industrial plants, in housing. It is a valuable material, and with proper care it can be made to last a long, long time; anyhow, until the war is over and necessary replacement material is available.



Galvanized sheets constitute one of the most popular forms of roofing for farm buildings of all kinds. Everything considered, they are also the most economical.

Do This . . .

See that all the roof supports are in good shape. If necessary renail and strengthen them, and replace broken or rotted members.

And This . . .

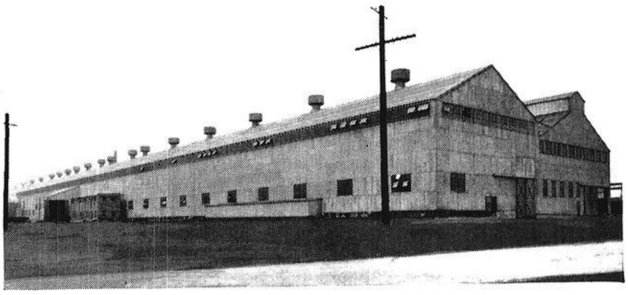
Then bring all the separate sheets into as close alignment as possible. If moisture has a tendency to creep through at the laps, lay a strand of asbestos wicking between the sheets at the laps, and renail the roofing with an approved type of zinc-coated lead-seal special roofing nail with a drive-screw shank. Stubborn lap openings can be effectively closed with hardware screws.

In industrial establishments, where efficiency and economy of materials are of prime importance, galvanized sheets are widely used for various types of structures, from modest homes for employees to the largest of manufacturing plants.

And This . . .

If any of the roofing is showing signs of rusting, paint it with two coats of metallic zinc paint, (see Federal Specifications TT-P-641) which will effectively stop the rust and prevent further injury to the roofing. In fact, the use of this remarkably good paint, which can be readily made by any paint manufacturer, will extend the life of galvanized roofing almost indefinitely.

In "How To Make Galvanized Roofing Last Longer", a booklet published by the Institute, complete and explicit directions are given for all of the above operations. Copies will be sent free upon request.



AMERICAN ZINC INSTITUTE
Incorporated
60 East 42nd Street, New York, N. Y.

CAMPUS NOTES

(continued from page 18)

its student written article contest. It is a chance for every interested student in the College of Engineering to develop and display that skill of expression which means so much in becoming a successful engineer.

The contest rules are as follows:

1. All regularly enrolled undergraduate students in the College of Engineering of the University of Wisconsin, with the exception of the editors of the Engineer, are eligible for competition.

2. The articles may be of a semi-technical or non-technical engineering nature, similar to the articles which appear in the popular engineering journals. The subject may be of the student's own choice, but it is suggested that he consult in regard to suitability with the editors of the Engineer, 356 Mechanical Engineering Building.

3. Articles should be typewritten or written neatly in ink, and preferably between 800 and 1,500 words in length. Entries should be addressed "Article Contest" and will be due in 356 Mechanical Engineering Building on or before March 31, 1943.

4. The following items will be considered in judging the article:
   (a) Reader Interest
   (b) Writing Technique
   (c) General Make-Up

The decision of the judges will be deemed final.

5. The first place award will be ten dollars in cash. Three other awards of five dollars each will be made. The winning articles will be published in the April and May issues. All entries will become the property of the Wisconsin Engineer.

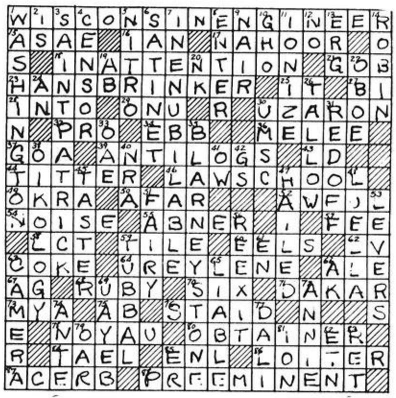
6. The judges are L. F. Van Hagan, chairman of the department of civil engineering, and F. E. Volk, librarian of the College of Engineering.

SOLUTIONS

To Last Month's Brain Twisters

•

Answer to the horse problem:
The horse travelled $1+\sqrt[3]{2}$ miles. And that's good calculating for a horse if you ask us.



If you like this kind of stuff let us know (and vice versa). We can make lots more if you want it.