Fall 10-1942

Volume 52 - Issue 3 - October, 1942

Rose Technic Staff
Rose-Hulman Institute of Technology

ROSE TECHNIC

OCTOBER 1942

MEMBER OF
ECMA

Word has been received that any changes in engineering programs which may follow the lowering of the age for military service will undoubtedly conform to the three, sixteen-week term plan. This division of the year is already in force at Rose and any adjustments which may be required will therefore produce little disturbance.

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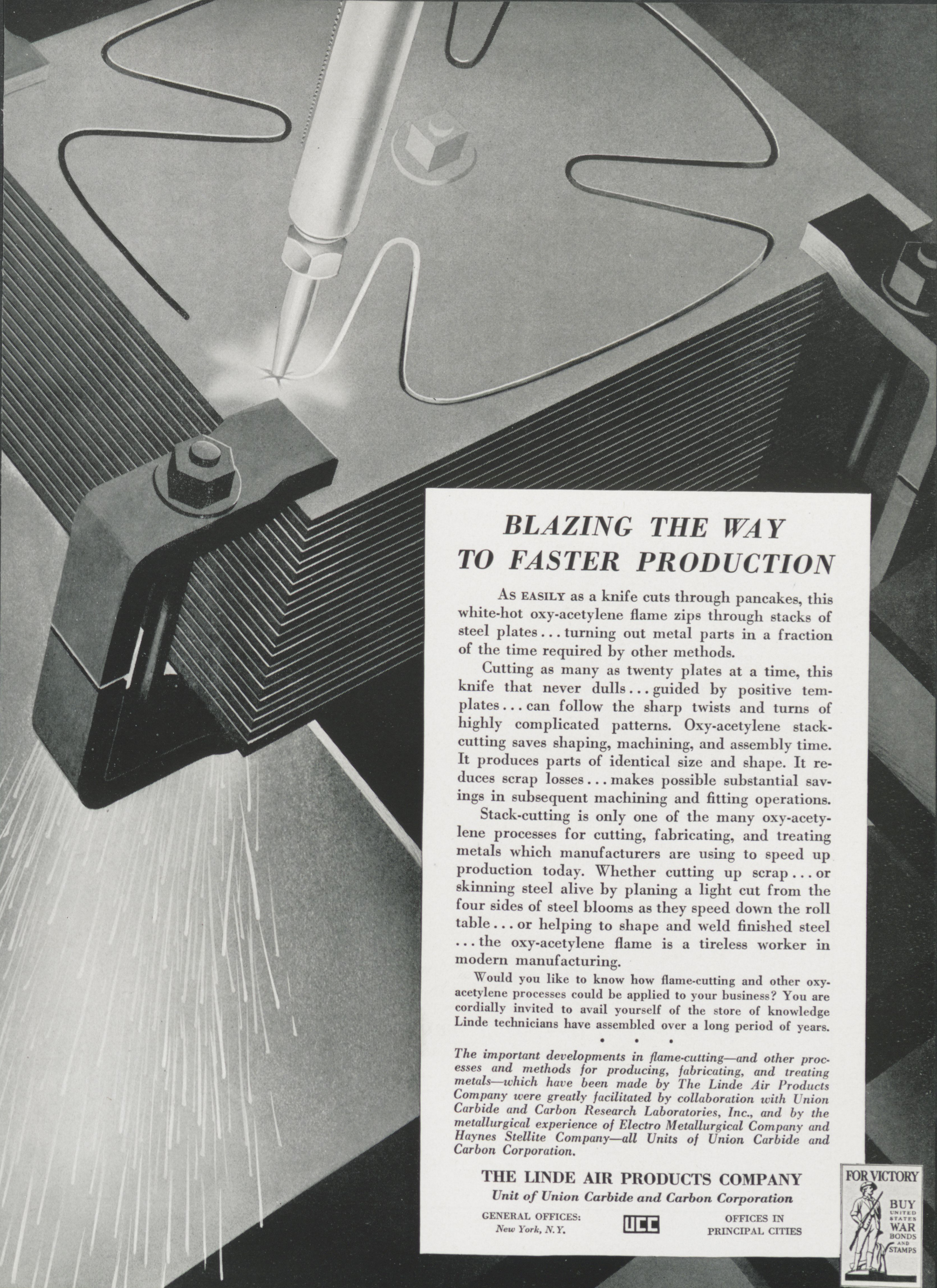

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ROSE TECHNIC

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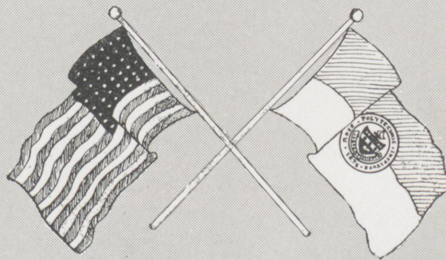

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—Courtesy of Westinghouse

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One of the world's largest shovels operating in a strip-mine only a few miles from Rose. Photo by Davis

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Rain Gages and the Collection of Rainfall Data

By ARTHUR JOHNSON, Jr., c.e., '42

A thorough knowledge of rainfall over a definite area is of great importance to water power engineers. The measurements of rain fall are taken by rain gages and this article by Mr. Johnson explains the method of measurement and a few of the difficulties encountered in this work.

ABOUT three-fourths of the earth's surface is water, from which evaporation is constantly taking place. Water in the form of vapor rises constantly from the seas. It is distributed by the winds in very unequal amounts throughout the land, falls in the form of rain or snow, and, gathering into streams, pursues its course toward the sea.

Many of the streams that are flowing toward the sea are desired to be utilized for the production of power. Water power depends primarily on the flow of the stream that is being considered for power purposes and on the head that can be developed and utilized at the site proposed for the power plant. Both head and flow are essential for the development of water power, but both are variable quantities which are seldom constant for two consecutive days at any point in any stream. These variations radically affect the power that can be economically developed from a stream at any locality. The accurate determination of both head and flow therefore becomes very important in considering water power installations and hence should receive careful consideration of the engineer. The neglect of proper consideration of either or both of these factors has frequently been fatal to the complete success of water power projects.

The quantity of water flowing in a stream at any time, which is more briefly termed "stream flow" or "run-off," depends primarily on rainfall. Although other elements and conditions also influence the run-off, a relationship can be calculated between the rainfall and the corresponding stream flow.

Observations of stream flow are quite limited both in time and geographical extent, while the observations of rainfall have extended over a long period of time and the points of observation are geographically widely distributed. If, therefore, it is possible to trace such relationships between the flow of streams and the rainfall so that the water power engineer can calculate the flow even approximately, the value of the establishment of rain gages is readily understood.

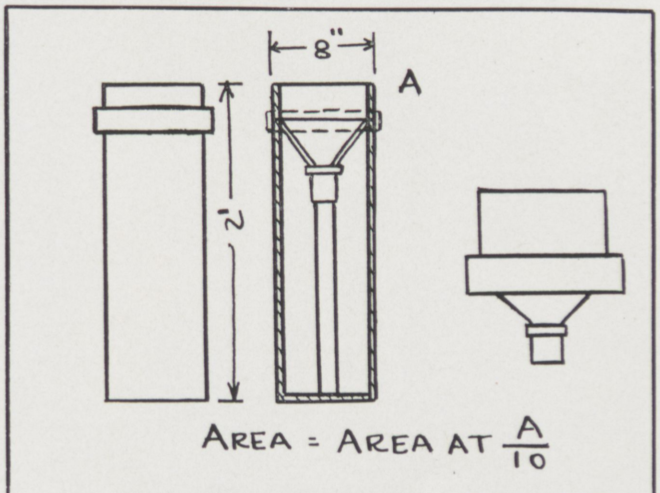
Establishment of Rain Gages

The greater portion of data upon precipitation is obtained and the results published by the United States Weather Bureau. There are several thousand regular so-called cooperative observer stations where daily observations of precipitation, temperature, and weather conditions are noted and over one hundred regular stations from which telegraphic reports are made daily.

Description of Gages

A rain gage for measuring precipitation consists of a collecting cylinder which exposes a circular surface for collecting the rainfall and a storage vessel in which the water is retained until measured. The standard rain gage of the United States Weather Bureau, in most common use, consists of a receiver, an overflow cylinder, and a measuring tube. In this rain gage the exposed receiver area is eight inches in diameter and is connected by means of a reducing funnel with the measuring tube, which has an inside area of cross section of one-tenth of the area of the surface of the receiver. The measured depth of water in this tube is, therefore, ten times the depth of precipitation. When used as a snow gage, the funnel and the measuring tube should be removed and the overflow cylinder used to catch the snow. This snow should then be melted, poured into the measuring tube, and measured with a stick. The readings from rain and snow gages are taken daily and at the beginning and ending of each storm.

The size of the exposed receiver seems to have some effect upon the amount of precipitation collected by the gage. For example, of four 3-inch cups and one 8-inch one, in use on Mount Washington, the average total amount collected by the 3-inch cups in one year was 46.26 inches,



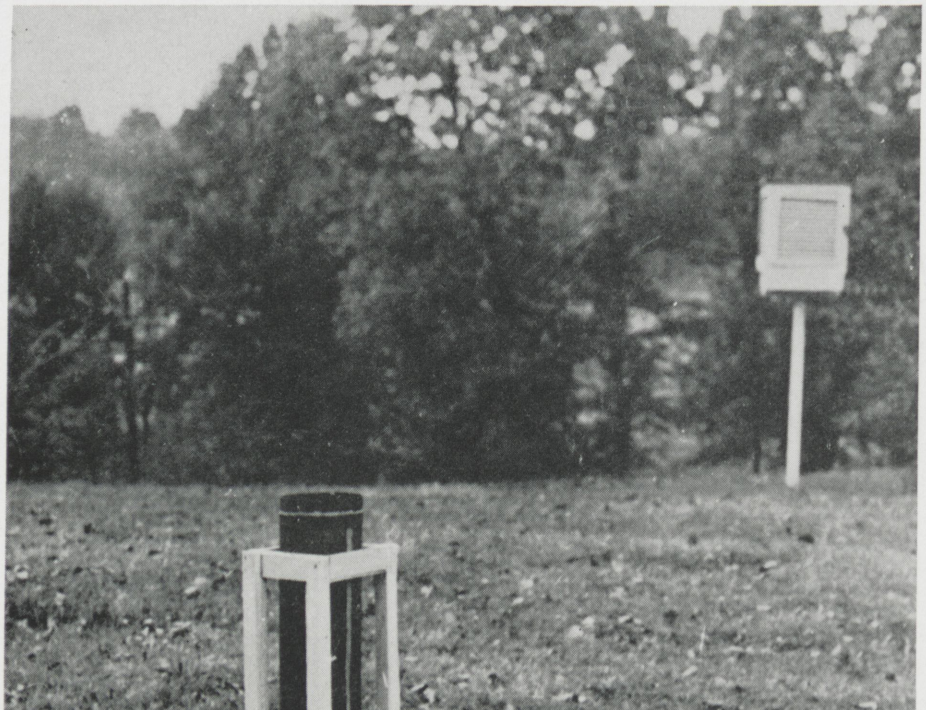
while that recorded by the 8-inch cup was 58.70 inches. It is probable that the larger the receiver the more accurate the results.

Location of Gages

Rain gages should be placed in suitable locations and as such frequent intervals that their records will give an accurate measurement of the precipitation over any area for which the rainfall is desired. If it were known just which were the proper locations and at what intervals the gages should be spaced, providing the funds were available, the measuring of the real rainfall would be a comparatively simple matter. It is doubtful, however, if there exists an authority competent to state how many gages are required and where they shall be located to measure the true rainfall over a specific area.

Perhaps the problem of rain gage location could best be solved by taking affirmative action on the question asked by one resident of an agricultural community in the upper Tennessee Basin. Upon agreeing to act as an observer for one of the Tennessee Valley Authority rain gages in that area, this man asked, "Are you going to give one of these to every farmer?" Farms in that area being small, to locate a rain gage on every farm would in all probability assure them being close enough together to make it logical to assume that the rainfall varied between them as a straight line function. If this were done and the gages maintained for a sufficient number of years to determine which gages furnish data representative of the entire area, the other gages could then be removed. These remaining gages could be said to be in the proper locations and properly spaced to give a measure of the rainfall over the area.

The establishment of such an enormous number of rain gages would involve so great an expenditure of money that it would hardly be economically feasible. Consequently the number of installations must be limited to considerably less than that suggested and the proper locations determined in some other manner.



A rain gage and thermometer house on the Rose Campus illustrates a typical location.

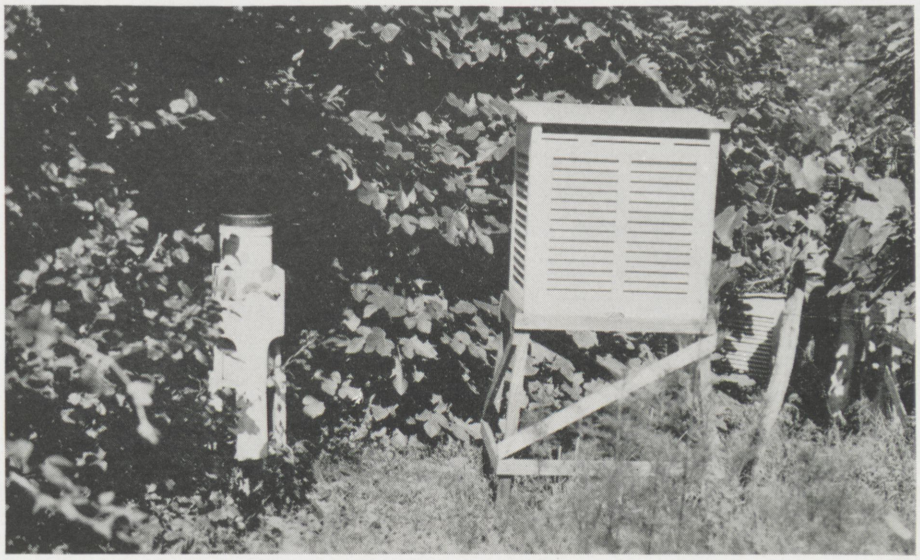
The selection of rain gage sites can probably best be done by making preliminary studies in the office and altering the office selections to fit field conditions. The office studies generally consist of plotting the proposed location on the best maps available. Field examinations are then made of most of the proposed sites before any of the gages are established. This is done so that if any of the proposed sites are found inaccessible or otherwise impractical and it is found necessary to move any one gage any great distance from the point originally selected, the surrounding proposed sites can be easily changed to better conform to the new location.

The accessibility of the site, the availability of a satisfactory observer, and the topography of the available locations must be considered in the field studies. If the site is accessible, the possibility of obtaining a satisfactory observer becomes the next consideration. Quite often this is the most difficult of the three conditions to meet.

The accurate measurement of rainfall at any point is largely dependent upon the exposure of the gage and its location with respect to surrounding objects. In spite of the fact that at many of the principal stations of the United States Weather Bureau the rain gages are located on buildings, it is generally conceded that locations on the ground are more desirable. A gage near the edge of a roof, on the windward side of a building, shows less rainfall than one in the center of the roof. The vertical ascending currents along the side of the fall extend slightly above the level of the roof, and part of the rain is carried away from the gage. In the center of a large, flat roof, 60 feet square, the rainfall collected by a gage does not differ materially from that collected at the level of the ground. A gage on a plane with a tight board fence 3 feet high around it at a distance of 3 feet will collect

6 per cent more rain than if there were no fence. These differences are due entirely to wind currents.

Since the value of the precipitation records depends so greatly upon the proper exposure, particular care should be taken in selecting a place for the location of the gage, and every care should be taken to protect it from molestation. If possible, a position should be chosen in some open lot, unobstructed by large trees or buildings. Low bushes and fences or walls that break the force of the win in the vicinity of the gage are beneficial, if located at a distance not less than the height of the object. Locations where the wind has a clear sweep across the gage produce the same wind effects on the gage that are obtained by locating the gage on the roof of a building. In selecting a side for a rain gage, it is well to consider changes that may take place in the surrounding vegetation within the next few years. A site selected in the fall or winter months may look altogether different when the foliage appears on the trees and bushes the next summer.



An improperly located rain gage and thermometer house that would register incorrect data.

Inspection of Gages

Too much consideration cannot be given to the proper inspection and maintenance of rain gages. This should be done in the spring of each year. The spring season is specified because, if the observer has been careless with the gage during the winter season, there is a possibility that the gage may have been subjected to freezing temperatures while it contained water, resulting in leaks in the gage. Then too, the worst conditions of overhanging foliage will appear in the spring and early summer seasons. It apparently is hopeless to try to rely upon the observers to keep the vegetation from growing up around the gage to such an extent that the collector no longer contains a fair catch of rainfall. At a voluntary station in Bakersfield, California, the rain gage was almost completely sheltered from the rain by drooping trees above the gage. The results from this station, however, were regularly published by the Weather Bureau month after month. At a station in Tennessee it was found that an apple tree had grown up alongside of the gage so close that the branches of the tree were hanging completely over the gage and stuck out two or three feet on the other side.

It is doubtful if engineers using rainfall data would place much faith in its accuracy if they could visit some of the stations furnishing the data. Stations will be kept in good condition only if frequent inspections are made. The expenditure necessary to make these inspections would be well worth while if the importance of accurate reports is considered.

Instruction of Gage Observers

After the rain gage is established an observer must be found to read the gage. Instructing rainfall observers is usually a very difficult task. In localities where the observers have had little education, the task is especially difficult. One instructor for the Tennessee Valley Authority at first had trouble in using a diplomatic method in finding out whether a prospective observer could read and write. He finally settled upon asking the following question: "Can you fill out a Sears Roebuck Order Blank?" Sometimes the native would answer that his wife, son, or daughter did most of the family ordering and writing. This was a cue for the instructor to change over to another member of the family, and some families had as many as thirteen children.

After finding a prospective observer who can read and write, the instructor must then carefully explain how to measure the rainfall in the gage with a scale that is graduated in decimals. About the only way found to solve this problem has been to call one inch of rainfall, as measured in the measuring tube of a standard gage, one dollar of rain and then explain that each 0.01 of an inch is to one inch as a penny is to a dollar. Even a person with little education usually understands this explanation.

A time record of the start and finish of storms is usually difficult to obtain. Many rural families have only one clock and no watches. The one clock is apt to be from thirty minutes to an hour off from the correct time of day. The best plan found has been to have only the more intelligent observers record the times of start and finish of the storms and let the remainder of them record only the amounts of precipitation. With a few key stations recording times, the path of a storm could be traced across an area.

A Second Answer to the Submarine Menace

By WILLIAM H. PLENGE, sophomore, e.e.

Following his article on Liberty ships in the preceding issue, Mr. Plenge presents another possible answer to the submarine menace. He offers the facts concerning the construction and practicability of a fleet of huge freight-carrying airplanes and asks the reader to form his own opinion of the plan.

IN order to answer the submarine question, some Washington authorities have suggested constructing a fleet of cargo planes even if it means reducing our present ship and combat plane program. Henry Kaiser, of whom we talked last issue, together with Howard Hughes, famous air craft designer, went to Washington, fought for and secured a contract for two cargo ships of the Navy's "Mars" class and returned to the comparative safety of the Kaiser Shipbuilding Company to begin work. With them went the blessings and admiration of many farsighted Army and Navy officers who for a year have been fighting for some better method to supply our far-flung battle fronts.

Never before has a suggestion caused such a disturbance in the halls of Congress. Everyone in the country seems to have taken sides. In Congress, the cargo ship faction won out for only a small contract was given to Kaiser. Two planes are hardly enough to determine whether or not mass production of huge air freighters is feasible or even possible. Nevertheless, the greater part of the American public is not going to dismiss the idea of huge air fleets so easily for they have seen what the Axis has been doing the past three years with air-borne troops supplied with air-borne equipment.

In the last issue of the *Technic* the case for the cargo ship was presented. In this article, the possibilities of air freighters will be discussed; it is up to the reader to form his own opinion.

In the President's January war program, of 185,000 aircraft to be produced in 1942-1943, between five and ten thousand were to be troop and cargo carriers. This is a decided change from the original 50,000 plane order; at that time only 2% were cargo and troop planes; moreover these were intended only for short, light hauls and carried an A-10 priority as do aluminum scrap and truck repair parts.

Now the cargo planes have been placed alongside the four-engine bomber in priority rating. The rapid rise has been spectacular considering that the only persons fighting for the cause were airline owners already under suspicion of furthering their own interests. Even now the big fight is for the control of this cargo fleet. Both the Army and Navy lay claim to it, along with the WPB and airline companies, the latter looking into the future and realizing their very existence is at stake.

It is generally conceded that the plane is definitely inferior to the ship on the cost-per-ton-per-mile basis. But in a war first cost does not matter. What does matter is that materials must be transported to the place where they are needed when they are needed.

A tragic but graphic illustration of the inferiority of the ocean ship in this time element is shown in the case of Singapore. The nine convoys that arrived just in time to be captured by the Japanese had to be assembled in India and Australia.

Taking the average eight-knot speed of ocean convoy, this means that the English had to anticipate the Japanese movements five months in advance. In other words, England would have had to prepare for these convoys long before war was even declared upon Japan.

The Germans, on the other hand, at 150 miles per hour with air transportation have been able to take Norway, Crete, Greece, and Libya with comparative ease.

It is 4,100 miles and 37 days from the United States to England, 7,400 miles and two months to Australia, and 14,300 miles and five months to India. By air, assuming the use of carriers and constant flight, it is twenty hours to England; two days to Australia; 10,800 miles and three and one-half days to India.

Our Air Corps maintenance job is much more difficult than in England where often the planes are based next door to the plants that produce them. The advantage of this is evident in Burma where 100 A.V.G. fighters were grounded for lack of solenoid controls for the guns or in the Middle East where one-fifth the Allied Air force was out of action for lack of spare parts.

If not by air freighter, another means must be invented to end the inefficiency presented by a 300-mile-per-hour striking force kept in the air by an eight-knot supply line.

Let us take a sample movement of 150,000 troops, about 10 divisions, from San Francisco to Hawaii, a distance of 2500 miles, and let us suppose that they must be there in six days.

By sea it would take fifty C I transports, making 18.4 miles per hour with 3000 troops each. By air it would take 150 planes, making 220 miles per hour with 167 men and averaging one round trip per day.

The troop carrier for this job is not yet in mass production but will weigh 140,000 lbs. gross weight or two and two-thirds times as much as the C-54.

	Ships	*Airplanes*
Number required	50	150
Cost per Unit	$1,800,000	$650,000
Total Cost	$90,000,000	$97,000,000
Wt. raw materials per unit	3,977 T	36.6 T
Total Wt. raw materials	190,000 T	5,500 T
Fabricating man hours per Lb.	.19	2.5
Total man hours for task force	60,000,000	27,000,000
Per pound cost	$0.22	$8.80

These figures are based upon a 100-ship order. Douglas engineers say that with a 1000-ship contract, the per pound cost could be dropped to $5.00. Even so, in these times, the amount of raw materials consumed for the sea transports is staggering. These figures do not take into consideration the amount of steel and man-hours of naval convoy that must also go along to minimize the U-boat toll.

However, not all is so rosy with the cargo plane situation. First, there is the pilot shortage; second, the problem of maintenance of supplies and gasoline thousands of miles from civilization; third, supplying the ground forces needed to maintain landing fields.

There is also the possibility of long range Axis interceptors preying upon the isolated air fields and planes, but England and Germany have both shown that aerial blockade is impossible. In the way of supply routes, Alaska and the West Coast of Africa become increasingly important. To lose either would mean as much to aerial transportation, as the loss of Suez would to naval power.

The aircraft now in production can carry five tons over the existing air route; to fly an additional 500 miles inland to new bases would mean 3000 more pounds of gasoline or a decrease of 30% of the payload. The loss of Abadan on the Persian Gulf, would mean the loss of the last source of high octane gasoline in the Eastern Hemisphere. To see what this would mean, the cargo plane consumes four and a half tons of gasoline to carry five tons of payload. Without refueling service, such a trip to Calcutta would be impossible since the plane could not carry enough gas for a round trip.

Our cargo plane foundation is weak. It consists of only 165 commercial planes, plus a few converted flying boats. Until late this spring, there were only 19 aircraft capable of making the Brazil-Africa hop other than long range bombers. These bombers are poor substitutes because they are built for heavy, concentrated loads and not with wide, heavily reinforced floors necessary for cargo storage.

The Army now has in production several types of planes to meet the varied shipping problems presented by our farflung fronts.

The first is the C S 4, for long range over-water flights. It is the military version of the Commercial D C 4, a four-engined plane of about 31 tons gross weight. Second, for the long-range over-water route there is the slightly larger C 69 which is the military version of the Lockheed Constellation designed by Howard Hughes. Both planes double as troop ships and cargo carriers and will carry the burden of the long ocean hops.

The shorter overland hauls will go to the C 46 and C 47. The C 47 is the familiar Douglas DC 3 airliner with all the passenger facilities removed and wide doors, heavy floor beams and folding seats installed. It is the American "Junkers", and has a short-range of 1,000—1,500 miles, a speed of 155-160 miles per hour and a payload of four and a half tons.

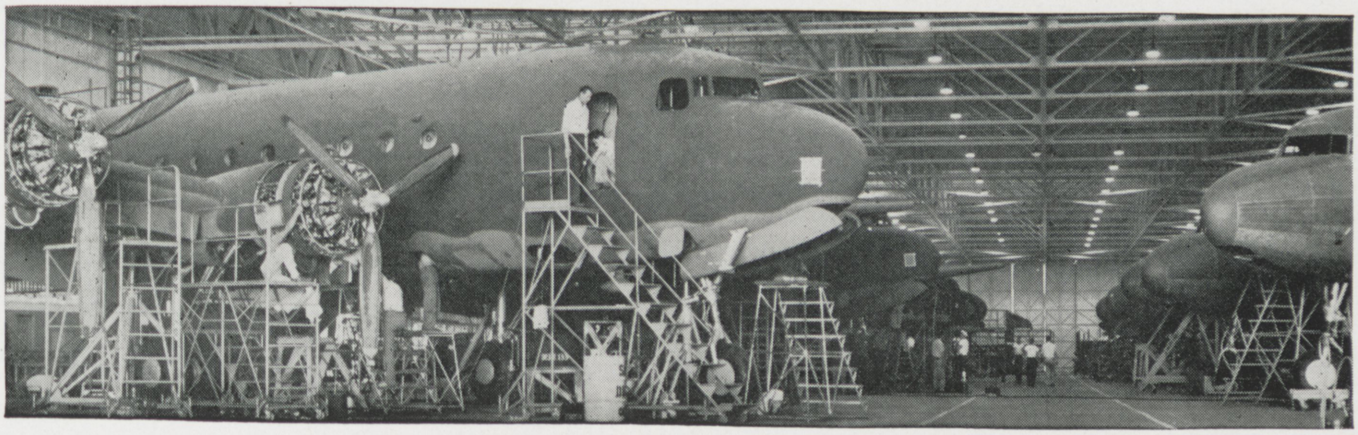
The Curtis Wright C-46 is slightly heavier and faster and carries eight tons. Both are combination troop and cargo carriers and will be used to shuttle cargoes to the larger ships.

Far larger planes are visualized; Loening forsees a 450-ton giant and Glenn Martin promises a 125-ton ship. An increase of 70 tons on a D C-7 would jump its effectiveness over two and a half times, not taking into consideration the lowering of the ratio of crew to cargo volume or ground service to cargo volume.

Gliders and cargo planes made of non-critical materials are two other possibilities for cargo-craft. Curtiss Wright is working on a plastic-wood plane with a 600 mile range at 175 miles per hour with a payload of six tons. Budd has similar contracts for a stainless steel affair of about the same weight and range.

The glider plan has been ballyhooed

(*Continued on Page* 29)



Cut Courtesy of Aviation

The modern assembly-line method of manufacturing war planes indicates that huge cargo fleets to aid the merchant marine are not impossible.

The Engineer's Top

By J. H. VANDER VEER, Jr., m.e., '42

The gyroscope is one of the very important elements in the operation of several essential war machines. Mr. Vander Veer explains the theory of the "engineer's top" and illustrates its use as a gyrocompass.

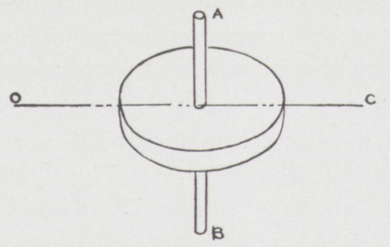


FIGURE I

THE word gyroscope was coined by Foucault (1851) and means, etymologically, to see rotation. It means simply any body exhibiting or showing rotation. In other words, a gyroscope is a rotating mass. We live in a world of gyroscopes; everywhere there is rotary motion. The wheels of a moving bicycle are rotating masses, and it is their gyroscopic action which keeps the rider upright by his control of the steering wheel. A rotating motor is a gyroscope, as is the earth itself.

It is only in the last two decades that gyroscopes have been employed in operative devices for indicating the vertical and horizontal, as well as the meridian, and that they have come into use for steering torpedoes and ships and for stabilizing marine and air craft. The development of high speed machinery has brought to light unsuspected gyroscopic effects in rotating shafts, wheels, and propellers.

The common understanding of the gyroscope is embodied in a mechanism consisting of a wheel and axle supported in gimbal rings so that it can be given rotation with its axis set in any desired direction. This is the toy and demonstration model that, with some variations, has been in existence for the last hundred years. As the mathematicians began to understand the theory of the gyroscope, it grew from a child's toy to the very complex mechanisms in use today. These include the gyrocompass, gyrostabilizor, gyropilot, turn and bank indicator, torpedo control, naval fire control, and the roll and pitch recorder for ships.

History

In 1810 one of the first gyroscopes was constructed by Bohnenberger. It was similar to the ones made today with the exception that the flywheel was a solid spheroid instead of the conventional flywheel design. In 1836 Edward Land presented a paper before the Royal Scottish Society of Arts in which he suggested an experiment to prove the earth rotated on a fixed axis. His paper outlined the use of a gyroscope for the purpose. If the gyroscope could be kept running at its speed long enough, the axis would appear to move when actually the earth was the moving element. Foucault carried this experiment out on a practical basis in 1852.

In 1886 Admiral Fleuriais of the French Navy was the first to embody the idea of the gyroscopic horizon in a practical instrument. At about the same time Sir Henry Bessemer constructed a cabin on a ship, swung on fore and aft trunnions, to which was attached a heavy rotating flywheel. His idea was that the gyroscope would maintain its plane, thus keeping the cabin on an even keel when the ship rolled. The idea was fundamentally unsound as will be shown later, but it was the forerunner of Schlick's Stabilizator.

However, it was not until the latter part of the nineteenth century that the first practical gyroscope was introduced. This one had an electrically-driven rotor and was designed by G. M. Hopkins in 1878. In 1911 the first gyrocompass completed its tests on board a vessel of the United States Navy. Because it was located at the geometric center of the ship, it was found to make an ideal base for graphic course recorders and turret gun control in azimuth, a most important factor in accurate gun fire control. The various ramifications of this control in use today are beyond the scope of this paper.

Theory and Marine Applications

The gyroscope consists of a heavy flywheel mounted on an axle pivoted in supporting rings, or gimbals. For convenience the gimbals will be omitted and the gyroscope represented as shown in Fig. I.

The angular momentum w of a rotating body is dependent on the weight of the body, the square of its distance from the center of rotation, and the speed of rotation. All known gyroscopic phenomena and the application of the principles involved

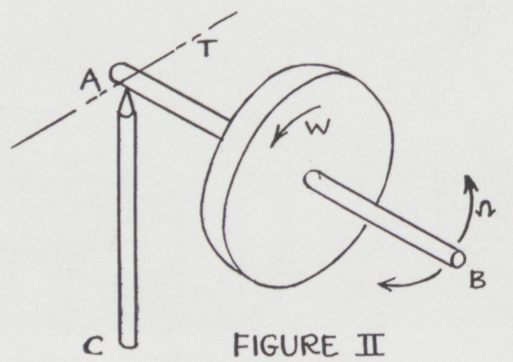


FIGURE II

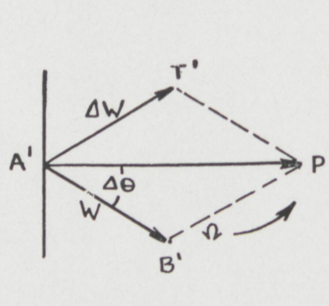


FIGURE III

are dependent upon two principles of the elementary gyroscope. These are rigidity in space, called gyroscopic inertia, and precession. Axis AB Fig. I is the axis of symmetry and the axis about which gyroscopic action takes place. Axis OC is the axis of spin of the gyroscope and is known as the axis of precession.

Precession is defined in the *Encyclopedia Britanica* as follows:

> When a gyroscope is subjected to a force which tends to alter the direction of its axle in space, the force meets with great resistance, and the gyrowheel will turn about an axis at right angles to the axis about which the force was applied, the movement being such as to place the plane and direction of spinning rotation of the wheel coincident with the plane and direction of the force by the shortest path.

Precession can be readily illustrated by a simple experiment. The flywheel of a gyroscope is placed in a set of gimbal rings so that motion about each of the three perpendicular axes is permissible. The flywheel is then set to rotating with its principal axis horizontal, and a constant vertical force is applied at one end. The flywheel and axle will then move in a horizontal plane about the central vertical axis at a constant velocity of rotation. This is the phenomenon known as precession. Precession will cease as soon as the weight is removed.

When the flywheel is set to rotating, the direction of the axis remains constant unless acted upon by some external torque. This is known as the First Law of Angular Motion. The Second Law of Angular Motion is equally important and states that a body subjected to an unbalanced force will be accelerated angularly, and the acceleration produced will be proportional to, and in the same direction as, the torque, and further, the acceleration will be inversely proportional to the moment of inertia of the body about its axis of rotation.

It will be convenient in the following discussion to represent angular velocity and torque by vector lines in a diagram. The angular velocity of a rotating wheel is represented by an axial line having a length drawn to a suitable scale, and its direction in the same direction as a righthand screw would advance if turned in the same direction in which the body rotates. The torque is represented by a line drawn in the direction of the axis of the torque to a suitable scale.

Figure II shows the rotating gyroscope and Fig. III indicates the various vectors. The line A′B′ in Fig. III represents the angular velocity w of of the wheel at an instant. The unbalanced torque of the earth on the wheel and axle is about axis AT Fig. II. The effect of this unbalanced torque during a short time interval is to set up an additional angular velocity $\triangle$w about axis AT which is represented in the vector diagram as A′T′. The resultant of these two velocities will be line A′P′. Therefore, *the effect of the unbalanced torque T is to cause the axis of spin to sweep around AC in the direction of the arrow* Θ. It would then appear as though the motion of precession were one of small steps. Actually the process is one of infinitesimally small angular shifts, thus producing a uniform veocity of precession.

The torque required to produce precessiona motion is derived from the Second Law of Angular Motion and may be stated in the form $T=I\Sigma$ where T is the torque, I is the moment of inertia, and Σ is the angular acceleration. Referring to Fig. III, the line A′B′ represents the angular velocity w of the wheel, and the line A′T′ represents the angular velocity Δw of the motion produced by the pull of the earth. For small increments then, A′P′=w and $\triangle\Theta=\frac{\triangle w.}{w}$ The angular velocity of precession Ω is equal to the time rate of change of the angle $\triangle\Theta$ or $\Omega=\frac{\triangle\Theta.}{\triangle t}$ Substituting for $\triangle\Theta$ gives the equation $\Omega=\frac{\triangle\Theta}{\triangle t}=\frac{\triangle w}{w\triangle t}=\frac{\Sigma}{w}$ where Σ is the angular acceleration $\frac{\triangle w}{\triangle t}$ of the end of the line A'B' involved in the continual change of direction of the axis A′P′. Using these values in the equation $T=I\Sigma$ gives the result $T=Iw\Omega$. This is the fundamental gyroscopic equation. The above derivation has been based upon that given by Franklin and MacNutt. Another derivation is given in the form $\triangle\varphi=$

(*Continued on Page* 30)

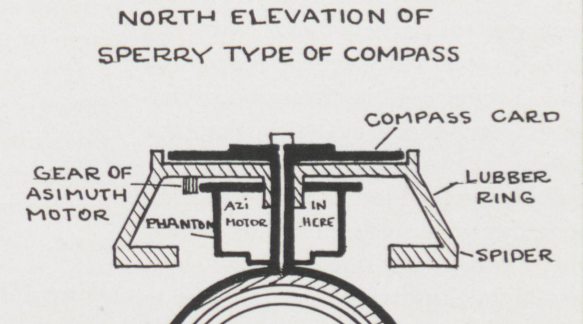


FIGURE IV

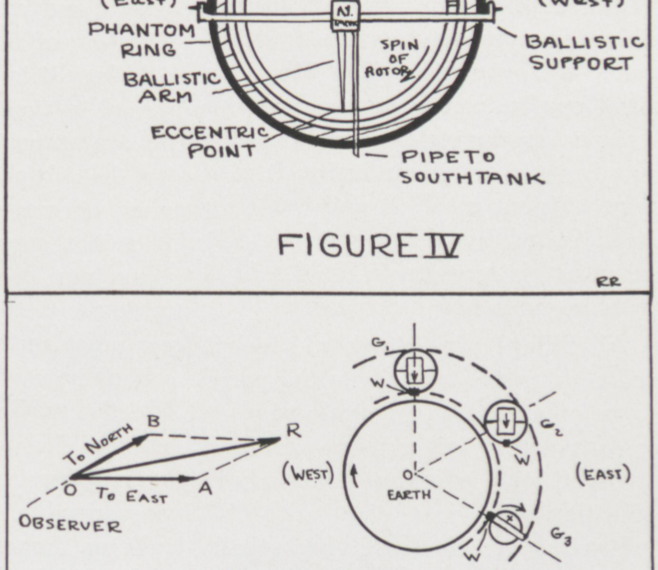


FIGURE V

Editorials

Physication

Recent football results seem to point to another successful year of football at Rose. It seems, however, that fewer candidates are trying for positions on the team than in previous years. Reserve strength is at a low ebb on this year's squad. Several reasons might be cited for this unfortunate situation. The war probably has pointed its finger at all sports. The summer term produced finals at a time when football training was starting and thus interfered with student time for study.

Whatever the reason may be, all physically capable young men at Rose who are interested in any sport should report for practice. Physical fitness is a "must" for this day and age. The army and navy urge all reserves to participate in athletics so as to condition themselves for the armed forces. It is through participation in school athletics that the college man at Rose has a chance to build himself physically. Engineering provides an ample amount of mental exercise but very little physical exercise. School athletics is an answer to this problem.

The Germans and Japanese are great believers in physical fitness. The Japanese are excellent swimmers and wrestlers. The Germans have emphasized body exercise and gymnastics during the years Hitler has been building his army. It is a very efficient machine and can only be defeated by a superior one. It remains for America to build such a machine in a few short years.

All college students should feel it their duty to participate in some form of athletics. Physical exercise is far from being a waste of time. A sound mind in an unsound body is of little use.

Rose offers football, basketball, tennis, and track. These sports cover nearly every season and, consequently, offer a chance for the student to exercise the year around.

Along with the body building, which comes as a result of any sport, comes the teaching of how to work successfully with fellow men. The knack of being able to cooperate toward a common goal without arousing jealousy is possessed by few people. The army and navy need such individuals to act as officers. Rose offers you this along with your college education.

It is quite possible that with a few reserves this season on the football and basketball teams, Coach Brown will not have to shed "crocodile tears" as he usually does. A heavy or a rough game that would tire the first few men on this year's Rose team, would probably succeed in ending our winning streak extending over two years.

If you are at all athletically inclined or feel the need for a good workout, report to the practice field or court and get busy. Let's keep our record one of the best in the state.

War Effort

We as students preparing for engineering are allowed to remain in school and complete our education. Too few of us realize what a great privilege it is to be allowed to go to school in times like these. We must do our utmost to prepare ourselves for the job ahead. Winning the war must be our sole aim and purpose. It is not easy to remain in school when our brothers and friends are taking an active part in the war, but we must realize that by staying in school now we will be much more effective when we do go into active service. We can aid the war effort by helping the authorities in every way possible. In a recent release to colleges James M. Landis, Director of Civilian Defense, outlines the need for help in certain fields. Colleges are already training workers in the many phases of war work. Rose, with its excellent short engineering courses, has not lagged behind. Our faculty labors day and night to win the war. In spite of what the colleges are already doing there is a need for specialists to train civilians in home defense. Director Landis wants students who are qualified to help with this work. The following are wanted: engineers to advise on planning and selection of air raid shelters; designers to advise on camouflage; electrical engineers and physicists as advisers on the control of illumination during blackouts and dimouts; chemists and sanitary engineers to assist in detecting gases in foods, water, and air, and to advise on decontamination after a gas attack; and physicists, chemists, engineers, and medical experts to study the effects of high explosives on buildings and people.

Do You Know That—

Latest Washington figures show that college enrollment has fallen off at least 10 per cent; the final figure may prove to be much higher. Nobody knows yet exactly how drastic the drop.

War needs for technical and professional men have probably kept enrollment in such courses at a relatively high level. However, the liberal arts curricula have taken a kick in the face which is "somewhat disturbing."

What's the answer? Apparently there isn't any while the war lasts. And it's a moot question whether an answer should be sought before the war's end.

Manpower Commissioner McNutt has said that "nonessential courses we have come to regard as essential to a classical education must be replaced. This war demands chemists, engineers, doctors, experts in nutrition, public health and agriculture."

Research and Development

Edited by ROBERT W. HODGERS, senior, e.e.

Non-Bounce Contacts

Since in conventional contacts no means is provided for the absorption of the kinetic energy of the moving contact, bouncing results. Even though the control current may not be completely interrupted, its magnitude is always reduced by the bouncing. If the current is large enough, a path for the current is provided by the arc established during the first rebound even though the contacts continue to separate. Thus in slow speed induction relays the effect of bouncing is negligible. On the other hand, in high-speed carrier-current relays the current in some elements is so small that it cannot form an arc and the current is interrupted momentarily by even a slight separation of the contact surface. Yet for satisfactory carrier-current operation the relays must work rapidly and either remain positively closed or fully opened. The contact action must be complete in one or two cycles. The higher the speed of relay mechanism, the greater the necessity of chatterless operation.

In order to assure chatterless operation a moving contact consisting of a hollow metal shell partially filled with small grains of tungsten is used. When the contact arm starts to move, the tungsten powder stays in the rear of the shell or capsule. When the contact strikes the stationary element, the powder is thrown to the front end of the shell. In doing so the grains tumble and slide over each other, absorbing the kinetic energy released by the impact. The result is that the circuit is made without any tendency for the contact to separate.

The material for the powder is important. It must be as dense as possible so that the particles have high inertia as they slide over each other. The individual grains must be rough to create intergrain friction, and hard to avoid wear. Of all the metallic elements, tungsten meets these diverse requirements best.

Obviously tungsten-powder damping is not restricted to contacts. Many mechanisms that are subject to shock or to excessive vibrations can be equipped with dampers or shock absorbers filled with tungsten-powder. For example, some single phase generators and some moving armatures in relays are equipped with tungsten-powder dampers.

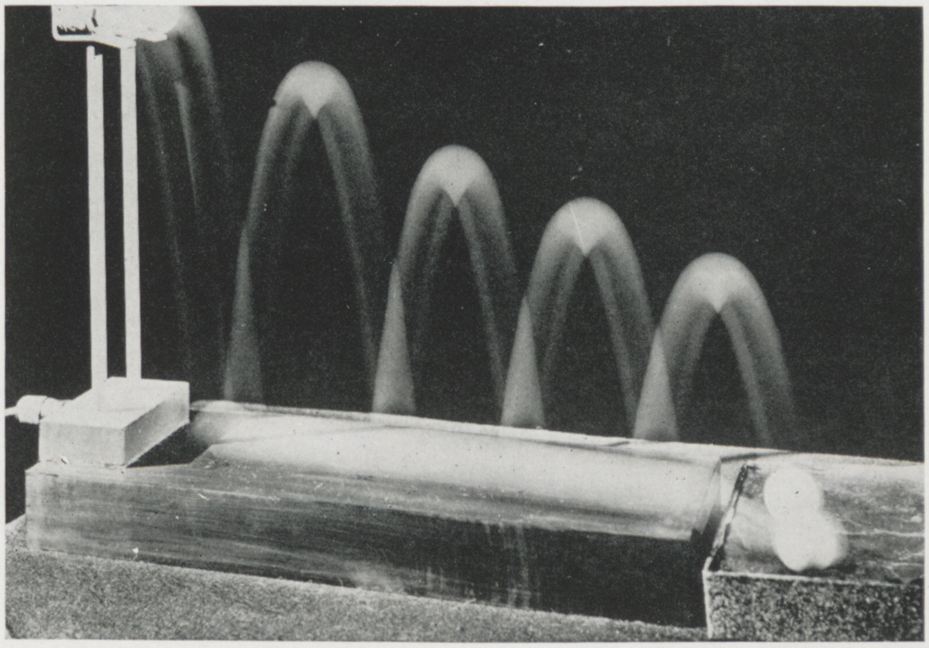
Portable X-ray Unit

A portable X-ray unit has been designed by Tom Triplett of the Triplett and Barton Laboratories at Lockheed Aircraft Corporation for facilitating the task of maintenance and servicing of aircraft in the field. A complete diagnosis of possible structural weaknesses can be made by the ground crews within 15 minutes after the plane has landed by using this X-ray laboratory mounted on a trailer. By this diagnosis it can be determined whether the plane must be grounded for repairs due to faults which are not visible to the eye, or whether it is in condition to continue in action.

After taking the X-ray exposures, the operator develops the negatives in the dark room within the trailer. Twelve minutes later the diagnosis can be made as to acceptability or rejectability of the suspected parts.

The unit is completely self-contained with power supplied by the towing truck and weighs 4,000 pounds. It is 13 ft. 4 in. long. It has a normal ground-cruising speed of about 45 mph, and when equipped with dual wheels, it is able to travel over rough country. When the unit is installed in the hanger for routine work, the wheels are removed, but only 15 minutes are required to prepare it for action.

In order to enable the unit to reach all vital parts of an airplane without dismantling the plane, the unit is equipped with a 350-degree rotating action yoke with boom and mechanism having a 16 inch stroke and a



Courtesy Westinghouse

Difference in the bounce characteristics of a hardened-steel ball and tungsten-filled ball illustrates the principle of non-bounce contacts.

6 ft. up-and-down motion. The hoist is fully hydraulic and control of the X-ray machine is automatic, being operated by one man. The machine is turned on by the operator for a set exposure and automatically turns itself off at the end of the designated time. As large as 14 x 17 inch X-ray plates may be taken with the unit.

Electronic Ore Separator

An experimental electronic ore separator has developed for concentrating the metallic ore containing tin and other war metals from low grade deposits. Promising results have been obtained with a low grade ore sample from a tin deposit in a southern state containing one percent tin. After separation by this device, a concentration of metallic ore containing about 70% tin was yielded. In order for the separator to sort dry mixtures of two materials, one must be a fair insulator and the other must have appreciable conductivity. The principle of separation is similar to the attraction of iron filings to an ordinary magnet except that the attraction of the separator is electro-static instead of electro-magnetic. After the ore has been ground to the fineness of sand, it is allowed to trickle through a trough and fall into a rotating drum. In this drum they receive high voltage electrical charges of 12,000 volts from a series of fine wires mounted a short distance from the drum surface. The electrical charges seep through the metallic particles, which are good conductors of electricity, onto the metal drum, thus after losing their charge the metal particles fall off before the drum has made one half turn. During the second half revolution the poorer conducting sand and rock particles which retained their charge and were held to the drum are pulled by a series of positively charged wires.

Plywood Bomber

In order to train bomber crews—pilots, co-pilot, bombardier, navigator-radio operator, camera man and machine gunner, as an integral unit, the new training bomber Fairchild AT-13 has been built. The craft is of Duramold plastic bonded plywood construction throughout except for engine mounts and supporting members for bomb racks, gun fittings, camera mounts and other equipment.

Wings are of conventional two-spar and rib construction, with plastic bonded plywood skin. The skin is of sufficient thickness and rigidity to maintain its true curve under high speeds with less than the usual amount of stiffening members. The aft portion of the fuselage is true monocoque construction, with all stresses being taken by the smooth skin without the use of longerons or lateral stiffeners.

The bomber's wing span is 52 feet 6 inches, length is 37 feet, 7⅜ inches, and overall height is 13 feet. It is the first trainer of the type to be designed with tricycle landing gear similar to that found on tactical types now in use in the Army Air Forces.

Performance data are restricted except that it is "in the 200 mph category." Two Pratt and Whitney Wasp engines supply the power.

Plastics in War Service

This is a total war—a war that is passing up plush-time gadgets and plastic trinkets. Plastics have thrown aside civil duties and gone to war—the plastic orchid boxes or minnow traps are now windows in a bombadier's bay or the goggles on the nose of a desert tank driver. Synthetic resins or plastics are in the thick of things alongside of other chemicals.

The best contributions offered by Monsanto to this war program are the Resinox phenolic compounds. They are in the electrical system of aircraft, trucks, jeeps, reconnaissance cars, tanks, ships, and radios. Gun stocks proposed for submachine guns, fuses for high explosive shells, aircraft pulleys, submarine periscope housings, portable field generators, use high impact type of Resinox.

Another Monsanto plastic in the service is Lustron polystyrene. Bell aircobras, radio masts, portholes in temporary army barracks, battery cases, and individual hypodermics for the soldiers are a few of its applications.

Lenses of civilian and combat type gas masks are made of fibestos

Courtesy Westinghouse

An experimental electronic ore separator.

molding compounds. Transparent sheeting is used in the glider units. An American trooper on desert duty is supplied with six Vuepak plastic eyeshields to protect him from sand and desert glare. If scratched or damaged, the eyeshield is replaced with a new one.

These are only a few of the various applications in which plastics are used, thus insuring the necessary safety and preparedness for our American troops.

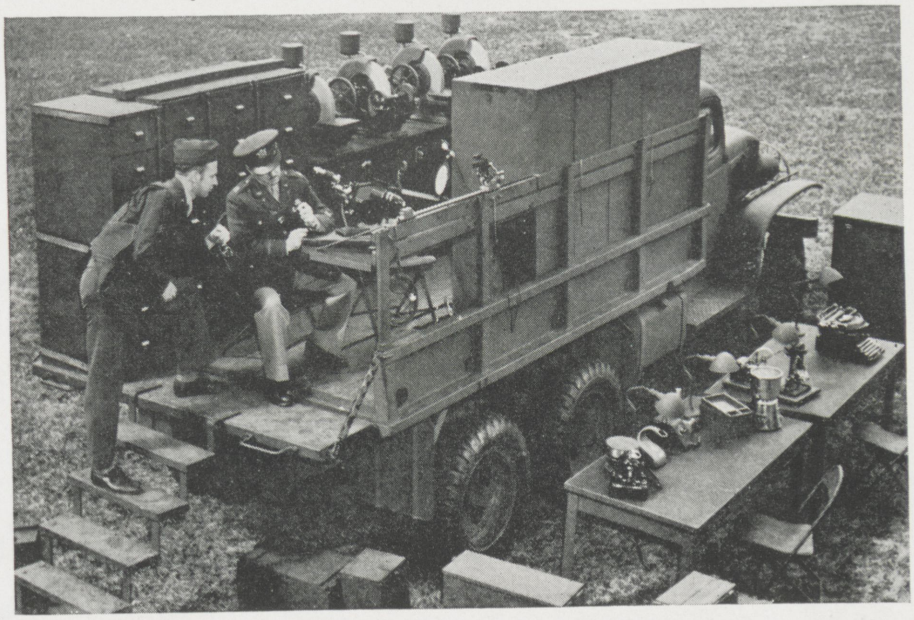
New Tools From Old

The Automotive companies have greatly accelerated their salvage and conservation activities since the huge production of war equipment has caused a heavy drain on supplies of metals. For instance, the shortage of cutting tools, which is far more serious than most people realize, has led to development of reclaiming methods that in peace time would be prohibitive in cost.

It now takes two months to replace an ordinary tap, of the type which could once be found at the five and ten cent store. Milling cutters require six months in which to be replaced, and to obtain such a part as a taper reamer for one standard type machine tool requires nine months, therefore, since monetary savings are relatively unimportant when values are measured in terms of life and death as they are in wartime, the salvaging of worn-out tools now on hand becomes a definitely sound practice.

The method of restoring a worn-out form tool, as illustrated above, costs more than it would to replace with a new tool, but through use of such methods, thousands of pounds of cobalt steel are being saved. Left to right, the photo shows: (1) the original new tool; (2) the same tool worn out and in normal times, ready for discard; (3) annealed and forged, the tool is restored; (4) machining, heating and quenching produce a new tool; (5) grinding, the final step, restores polished surfaces.

Mobile optical shops: Another vital use of motor trucks in wartime.



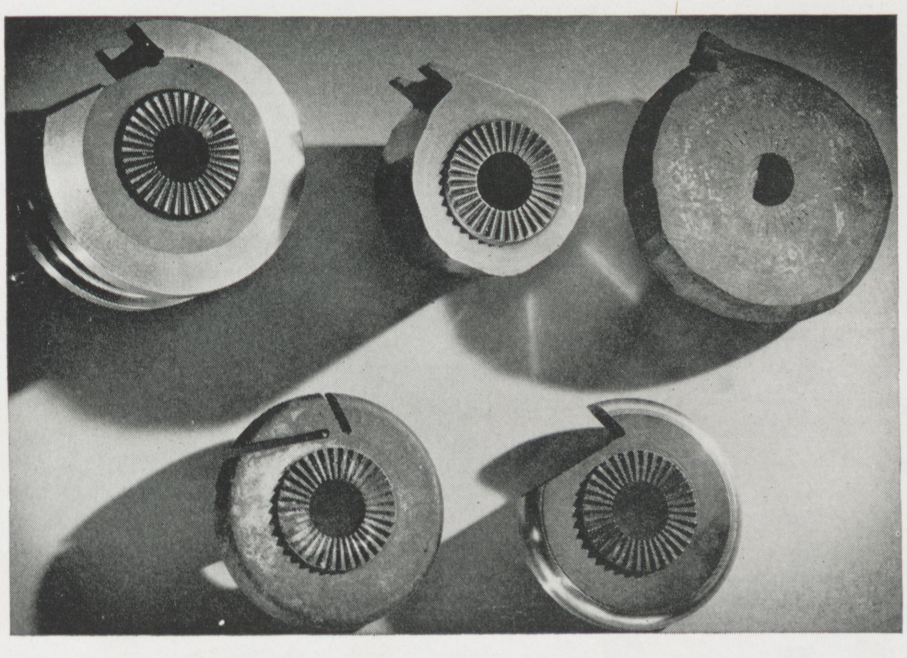
Courtesy of Automotive War Production

Mobile Optical Repair Shops

In World War I, the loss or breakage of glasses was a serious matter in the A.E.F. The army's only optical shop was a stationary one in a Paris suburb, therefore, a soldier whose glasses were lost or broken was a casualty until his loss could be taken care of through long and circuitous regulation procedure.

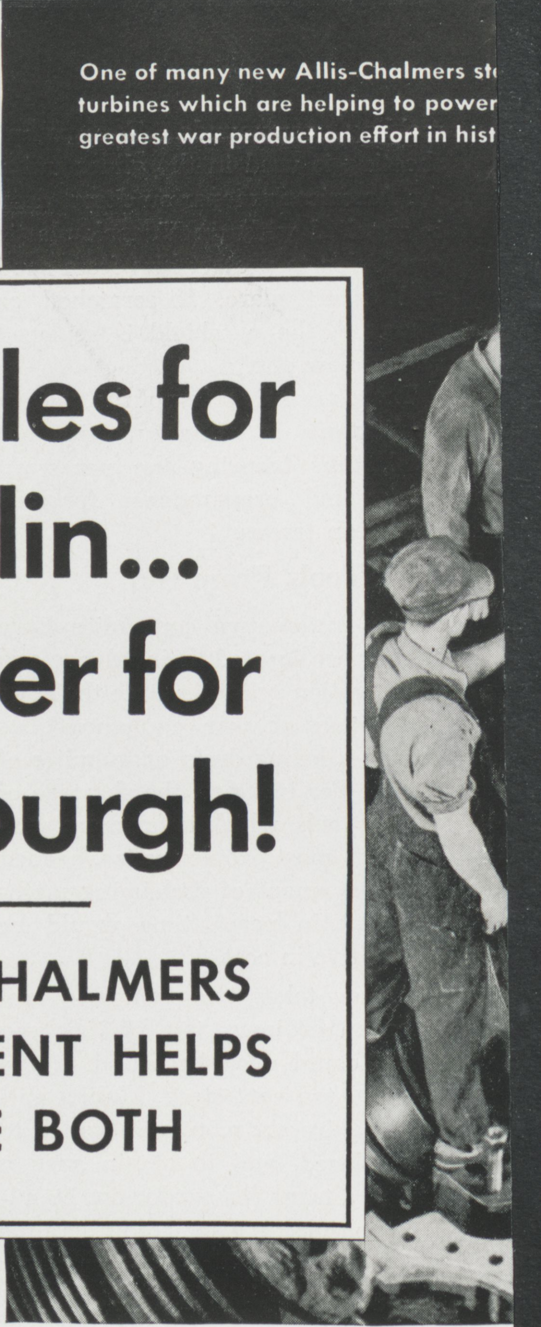
Since about 15 per cent of the men wear glasses in the present war, truck-mounted units designed at the request of the surgeon-general's office, containing optical machinery, 36,000 lenses, 8,400 frames, 600 pairs of extra temples, and 1,200 spectacle cases are now attached to United States Field Armies.

With this equipment 120 single lenses can be edged and mounted daily. It is estimated that each such mobile optical unit can take care of the average requirement of a field army of 300,000 men. Since each soldier has his prescription attached to his service record at headquarters his emergency needs can be taken care of immediately after he reports them, thus eliminating the delay caused by regulation procedures.



Courtesy Automotive War Production

Conversion of an old tool for war production work shown by stages.



One of many new Allis-Chalmers st
turbines which are helping to power
greatest war production effort in hist

Bundles for Berlin... Power for Pittsburgh!

ALLIS-CHALMERS EQUIPMENT HELPS MAKE BOTH

Ore for Giant Aerial Torpedoes and bombs is mined with Allis-Chalmers equipment.

"A. HITLER, BERLIN, GERMANY"
That's what we'd like to label just one of th
thousands of tons of ore which Allis-Chalmer
equipment is helping to mine and turn int
aerial torpedoes and bombs!

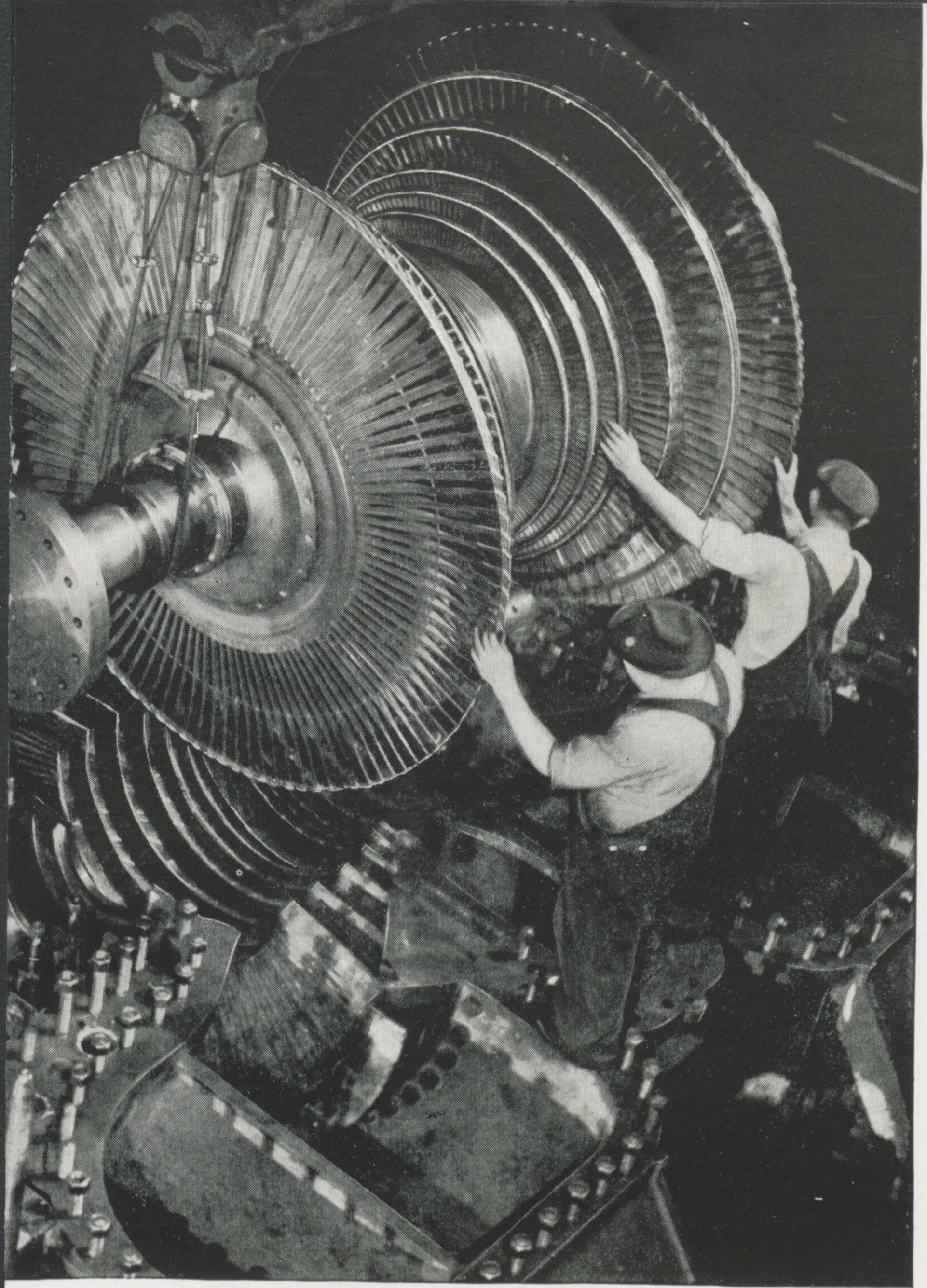
And that turbine above is another Allis
Chalmers product that will soon be turnin
out trouble for Hitler—supplying power t
great war plants—helping to make America'
soldiers the best equipped in the world.

These are just two examples of how thou

ALLIS-CHALMERS · A-C · MILWAUKEE

ALLIS-CH

OFFERS EVERY MANUFACTURER EQUIPMENT AND ENGINEERING

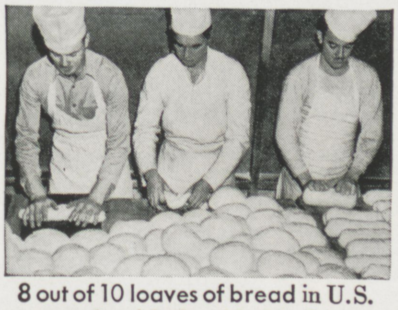


…ands of Allis-Chalmers people are fighting …he Axis—are *working for Victory!*

Over 1,600 Allis-Chalmers products are …orking in the Battle of Production. And our …ooperative Engineering service is helping …akers *produce more*—not just with new ma…hines, but with *machines now on hand!*

This production experience will be of added …alue when the war is over. We work for …ictory—we plan for Peace!

…LLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.



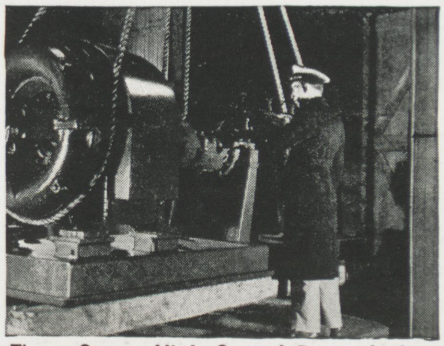
8 out of 10 loaves of bread in U.S. are made with the aid of A-C farm and flour mill equipment.

VICTORY NEWS

Washington, D. C. — Keels for more than 140 "Liberty" ships have been laid and more than 60 ships have been launched from ways which did not even exist before 1941. Original schedules have already been more than doubled.

To set the fastest shipbuilding record in history, mass production principles are used. More than 500 makers are feeding parts to Liberty ways.

From Allis-Chalmers, one of the most important of the contributing firms, comes products ranging from machine-gun cooling pumps to propulsion shafting.



Three-Stage High Speed Pump is inspected as it leaves A-C shops for a military destination. Equipment includes Allis-Chalmers motors and switchgear.

Milwaukee, Wis. — Mosquito boats no longer have to use their motors to recharge their batteries—small Allis-Chalmers rectifier units now do this job.

This unit is the newest means of obtaining nominal d.c. current from existing a.c. power lines. It eliminates need for keeping ships motors running for battery charging on shore. It also aids coast defense by helping to supply power for shore searchlights.

Industrial plants are also using the new unit to supply small amounts of d.c. for individual drives on planers and other machines, in laboratories for testing purposes, and in tool rooms.

FOR VICTORY
Buy United States War Bonds

…ALMERS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

…ERATION TO HELP INCREASE PRODUCTION IN THESE FIELDS…

FLOUR AND SAW MILL EQUIPMENT

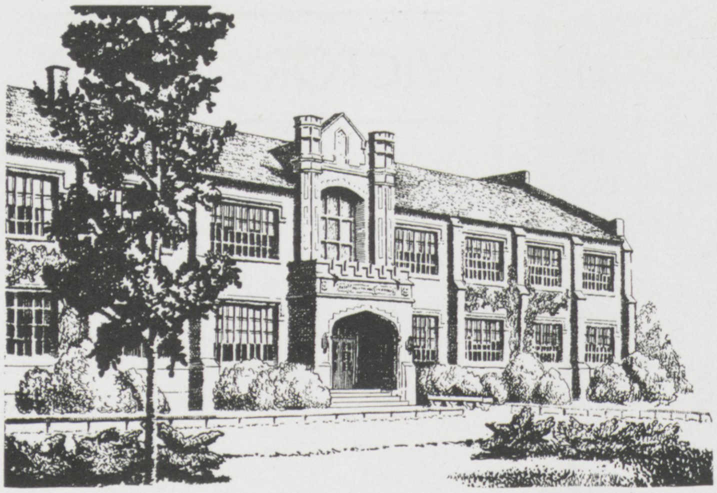
CHEMICAL PROCESS EQUIPMENT

CRUSHING, CEMENT & MINING MACHINERY

BOILER FEED WATER SERVICE

POWER FARMING MACHINERY

INDUSTRIAL TRACTORS & ROAD MACHINERY



Campus Survey

Edited by CHARLES W. NEWLIN, sophomore, c.e.

A. S. C. E.

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

Friday afternoon, September 18, the members of the Rose chapter of A.S.C.E. enjoyed a field inspection trip through the Terre Haute Ordnance Depot on North Fruitridge Avenue. The group was accompanied by Lieutenant Colonel Noyes, Captain Bennett, and Professor Hutchins of the Civil Engineering Department.

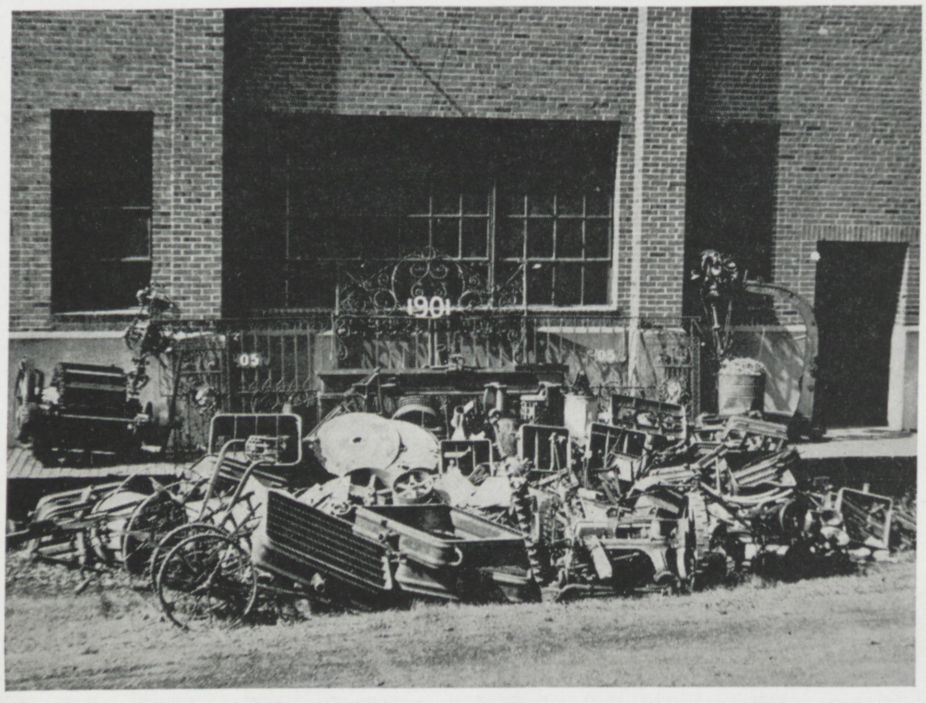
The purpose of the trip was to acquaint the men with the engineering aspects of the construction and road building being conducted at the plant and see in actual operation machinery and construction principles which they have learned in their classwork and in former meetings of the A.S.C.E.

The trip began at the south entrance of the plant where rails were being laid for a spur railroad to bring in material for storage. Of interest were the oil-composition unloading docks, which, although not constructed of the most durable weight-supporting materials, have thus far proved to be capable of serving the purpose very well. These surfaces, which must support heavily-loaded trucks, should be very satisfactory as their use will not be permanent enough to warrant concrete construction.

A 1,000,000 gallon water reservoir has just been constructed to hold a reserve supply of water for the plant. The huge reservoir is situated on high ground in the area and upon the completion of the plant will furnish enough water to meet any emergency which might arise. A pump has been placed on the city water main near the plant which will increase the pressure of the water in the pipes before it reaches the depot. All excess water which is not used by the many buildings on the project will be pumped into the reservoir. When the reservoir is filled the pump will automatically shut off and all water that is used will be obtained from the reservoir until the level of the water becomes low. The pump will then again go into operation. The reservoir is shallow with a funnel-shaped bottom. With such a construction the level of the water will descend very slowly thereby keeping a nearly constant head.

The group visited the huge warehouses. These warehouses are divided into several sections one acre square. The sections are separated by a fireproof wall extending four feet above the roofs of the buildings. In case of a fire these walls will prevent the flames from spreading to other parts of the building thus protecting against any great disaster. The floors are made of a rapid-drying cement which when nearly hard is coated with a protecting fluid that takes the place of the straw that is commonly used. When the concrete is dry, it is left with a shiny finish.

The water mains throughout the



The Rose scrap drive refreshed memories of the old Alumni.

project are laid in narrow trenches dug by a mechanical trench digging machine. This machine is of the rotary type with large scoops on an endless belt. It moves with a constant speed and daily it is digging many hundreds of feet of trench.

This inspection trip was the first meeting that has been held by the Rose Chapter this school year and proved a great success. The students were astounded at the great size of the project and at the rapidity with which the many warehouses are being constructed. If this depot is an example of the war industries that are cropping up over the United States, we may feel with assurance that industry will not lag during this war.

R-Men's Dance

Besides providing thrills and entertainment on the playing field for Rose sports enthusiasts, the R-Men's Association proved itself very capable as host for a "Sweater Dance" in the Rose gym on Saturday, September 26.

The time for the occasion was very appropriately planned, for Rose had just a few hours before emerged a 41-7 victor over Evansville College and the gay spirit which prevailed among the large crowd assured the letter men that their dance was a great success.

This was the second such dance given this year by the R-Men, and it proved very successful.

It is planned that the proceeds from these dances be used toward purchasing film to bring Rose athletic contests to the screen through action pictures taken at the home games.

Rose Battalion at Work

The world conflict has brought about many changes in the everyday life at Rose. These changes are evident in the policies of the military department. The class room discussions and drills twice weekly have been altered slightly to present to the students the more practical problems presented by actual warfare.

Since drill must be held in-doors during the bad weather of winter months, two drill periods have been held each week during the first semester while the weather was warm and the time of the second semester is to be devoted entirely to classroom studies.

These drills included hikes and practical problems, as well as the manual-of-arms and usual company and platoon drills. The portions of the drill which have not been included in the drills of the past included a hike taken by the entire battalion, interior guard duty, a four-mile hike, and a combat problem by each platoon. A combined two-hour hike and combat problem which involved the entire Rose battalion concluded the summer drills. This last problem presented many tactical problems to the R.O.T.C. students. Four of the group were chosen to represent Japanese snipers and were given Garands and blanks with which to impede the march of the battalion. After the loss of several men the snipers were finally overcome and the battalion was able to contine its march.

Company C demontrated the formal guard mount to the other two companies. This ceremony is held to impress embryonic soldiers of the importance of guard duty and is now being executed by American troops all over the world. Every movement was done exactly as is done in the regular army and seemed to bring the men of Rose nearer to actual army life.

New Officer at Rose

War situations have again altered the faculty personnel at Rose, this time in the military department. Early this month, Lt. Robert H. Colwell, a Rose graduate with the class of 1940 who has been with the Army Engineers since shortly after graduation, was transferred to Rose from Camp Banding, Florida, where he has been stationed with a light ponton company for over a year. He will trade positions with Capt. Bennett, who has been an instructor in the military department for the past two years, having arrived at Rose in June, 1940. This will be the first troop command experience for the Captain, who spent several years in the administrative department of the Civilian Conservation Corps after his graduation from Rose in 1936.

Although Lt. Colwell will be warmly welcomed at Rose, the loss of Capt. Bennett will be sincerely felt in the military department and among students of military science. His knowledge of military tactics and organization plus his ability to teach the latter have been of great

(*Continued on Page* 28)

Our new faculty members—Messrs. Schull, Stuart, Fairbanks, and Straw.

Cross Section

Howard Heinz Irvin—a quiet and sincere senior of the chemical engineering department. Howard was born in Munich, Germany, on November 18, 1918 just one week after the signing of the armistice of World War I. From the above statement it is easy to imagine that he has experienced an interesting life.

Howard was reared in Munich. He attended four years grade school, six years high school, and one semester in a technical school before starting to work in Munich. Irvin worked three years in Germany as an auto mechanic and then in 1938 decided to come to the United States. He left for England at the time Chamberlin was in Munich discussing the invasion of Czechoslovakia, the same time that Hitler started his persecution of the Jews. While in England, Howard stated that gas masks were issued to the civilians indicating the unrest that was present even at that time.

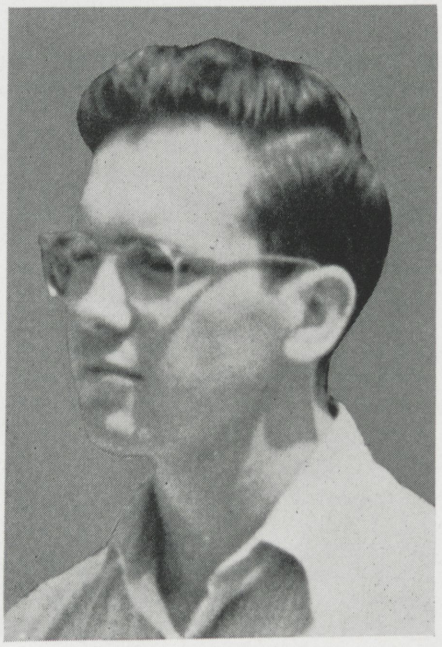
Upon arrival in the United States in October 1938, Irvin stopped in Virginia on a tobacco plantation. He drove a tractor for almost a year and then came to Rose in September 1939. Irvin received a scholarship through the International Student Service.

Howard learned English in high school and has very little difficulty in picking up the American version. His father was placed in a concentration camp only four weeks after Howard sailed and was not released until two months later. His parents now live in Massachusetts.

Irvin says he misses the ski trips that he and many of his fellow students made to the German mountains, quite different from the flat country at Rose. He is well pleased, however, with the American system of education that is so completely opposite from the politically influenced type of socialist Germany.

This is the second of a series of articles relating past experiences and future outlooks of two Rose seniors It is interesting to note how the war has affected the lives of these embryo engineers of the chemical department.

Howard H. Irvin



Joseph J. O'Connell

Joseph J. O'Connell — another senior struggling along the rocky road to become a chemical engineer. Joe first saw the light of day through the good old Terre Haute smog on November 8, 1921. "J. J." attended the Terre Haute schools except for two years of his grade school education when he lived at Effingham, Illinois. He graduated from Wiley high school as an average student, a letterman in football, and advertising manager of the year book.

Joe spent many of his summers at the lakes of northern Indiana and in later years worked during vacations. He was employed on the bottling crew of the Coca Cola Co. of Terre Haute for one summer and the next summer worked at the Jefferson Proving Grounds near Madison, Indiana. O'Connell has worked Saturdays in a haberdashery for the past four years.

Joe is now vice-president of the senior class, president of the "R" Men's association, and is business manager of the Modulus. He plays end on the football team and has earned two letters.

O'Connell is now enlisted in the Air Corp Engineers and will probably be stationed at Chanute Field some time between graduation and March 19, 1943. After advanced training he will be eligible for a second lieutenant's commission.

Before the war Joe had planned to attend a law school after graduation from Rose to receive a well-rounded education that would fit him for administrative work. He still plans to attend law school but now it will have to come after the war. Joe desires a position that will allow traveling to different countries and he hopes some day to settle on the west coast.

O'Connell's main hobby is golf. He says he will rent one good set of Sammy Snead's for the duration.

How YOU can help her speed vital war calls

WHEN you're about to telephone, remember that the wires — especially Long Distance circuits — are busier now than ever before, with war calls. We can't build new equipment to carry the load because the materials we need are going into ships and planes and shells.

Here's how *you* can help to keep the lines open for war calls. Unless your message is really urgent, please don't use Long Distance service. But if you must, please make your calls as short as you can. Thanks! — we know you'll be glad to help!

WAR CALLS COME FIRST!

AMERICAN TELEPHONE & TELEGRAPH CO. BELL SYSTEM AND ASSOCIATED COMPANIES

Alumni News

Edited by W. ALAN WINSLOW, junior, ch.e.

A Letter From An Alumnus Overseas

I hardly know where to start, so much has happened since you last heard from me. We finally landed after a quick trip, saw some beautiful hilly country, typical quaint towns with their interesting natives and their accents, took a long ride on a funny little train with entirely different seating arrangement in their coaches. All of which, you have read about and seen in the movies.

What a reception we had when we alighted from the train! I never dreamed of anything like it! Our reception here was better than anything you could offer, even at a political rally. We marched to our new quarters through the streets, led by a band peculiar to this part of the country. That was the first time any of us had heard anything like it, and did we appreciate it! Such hospitality and courtesy I have never seen.

Our outfit was very lucky to land in such favorable quarters. We have large airy barracks for the men, and then I have a table, chest of three drawers, with mirror, and clothes hooks. To top it all off, new shower rooms are being built, also, wet and dry "canteens", dayroom, and even a little N. C. O. Club. Hope the priorities don't stop the building program.

We have a special job cut out for us, and when our equipment arrives, it means 24 hours a day, 7 days a week, "and make it snappy". Well, that's what we're here for. I only hope we can get some leave now and then because there are so many things to see of such great historical interest. I only wish I had time to tell you the things I have seen and heard, and what a great experience this is. Too bad that I can't keep a diary, matter of regulation, you know.

I am really enjoying myself immensely. In fact, I consider myself very lucky to be in such a set-up.

The Grads Advance

'30 John J. O'Mara, who was graduated from the Architectural Engineering Department at Rose, is now teaching civil engineering at Cooper Union, New York. O'Mara was formerly the Field Engineer with the Vigo County Surveyor.

'32 Bertram M. Menden, C.E., is now in New York as the manager of the New York District Office of The Trane Company. Formerly Menden was the regional engineer of the Airtemp Division of Chrysler Corporation in Detroit, Michigan.

'34 H. Loren Thompson, C.E., is the Assistant Professor of Civil Engineering at Northwestern University. Thompson was formerly the Assistant Professor of Civil Engineering at the University of Idaho, Moscow, Idaho.

'36 E. Kendrick Newton, C.E., is working as a plant engineer for the Evansville Ordnance Plant, Evansville, Indiana. Previously Newton had been with the State Highway Commission.

'41 Gene F. McConnell, M.E., is now employed in the engineering department at the Wright Aeronautical Corporation. Prior to his employment at the Wright Aeronautical Corporation, he was a student in the experimental department of the Allison Division of General Motors Corporation, Indianapolis, Indiana.

Charles S. Meurer, C.E., is now working on the production of Curtiss "Helldiver" dive bombers and "Seagull" scouting planes in the engineering department at the Curtiss-Wright Corporation in Columbus, Ohio. Meurer formerly worked as a junior sanitary engineer for the State of Indiana.

In The Service

Hal H. Dronberger, '22, is now a Lieutenant (junior grade) in the United States Naval Reserve, and is stationed at Beaumont, Texas.

Captain E. J. Ducey, C.E., is with the Operations Training Section in the Office of Chief Engineers, Washington, D. C.

Paul H. Sawyers, '32, is the Field Engineer for runways and storm drainage at the United States Naval Reserve Aviation Base in Glenview, Ill.

George Owen Howson, '32, is a Lieutenant in the United States Naval Reserve Air Transport Squadron VR-3, Kansas City, Kansas.

James F. Guyman, '33, has been promoted to the rank of Captain. Guyman is stationed at Camp Forrest, Tennessee.

Harold Reintjes, '35, has been transferred to the Chemical Warfare Service and is to attend Massachusetts Institute of Technology for further training.

Nelson B. Trusler, '35, is in the signal corps school at Fort Monmouth, New Jersey.

Raymond J. Harrod, '36, is attending the Introduction School at the Naval Training Station, Newport, Rhode Island.

Ensign Charles G. Fuller, '39, has been graduated from the naval academy training course. Fuller is to go to Cornell for a diesel engine course.

Lieutenant George W. Smith, '39, is now stationed in the Air Corps Advanced Flying School at Lubbock Field, Lubbock, Texas.

Ensign Luther L. Yaeger has been graduated from the naval academy training course. Yaeger is to report at the University of Illinois for a course in diesel engines.

Edwin A. Martin, ex-'43, is now in the United States Coast Guard and is stationed at Astoria, Oregon.

(Continued on Page 28)

Campus Sports

Edited by RAYMOND KOPAN, junior, e.e.

The Engineers began the 1942 football season with a bang by inflicting a crushing 41 to 7 defeat upon the Evansville Aces. Ed McGovern and Francis Hillenbrand led the attack with a number of dazzling runs that kept Evansville on the defensive most of the game.

Rose Tech, defending Indiana Conference champion, appeared on the field for its first contest of the season with a light and fast ball team. The backfield had only one regular, Ed McGovern, returning to play, and the Rose line showed up with only four of last year's mainstays. Hillenbrand, however, provided an added threat to the Rose opponents with uncanny ability to elude would-be tacklers.

A few minutes after the opening kickoff found Rose threatening for a touchdown when McGovern scooted around the left tackle and sprinted 25 yards to the Aces' 20-yard line. After trying three times to break through the Evansville line Hillenbrand cut outside the left end and carried the ball to within five yards of the goal. Kenny Allison scored on the second play and McGovern kicked through the uprights for the extra point. Hamby kicked off for the Aces and the ball went out of bounds on Rose 26-yard line. Price carried the pigskin for a nine-yard gain and followed with a line plunge that made a first and ten for Rose. McGovern broke loose for his second long run of the game and ran 35 yards before he was forced out of bounds by Hobart on the Evansville 25-yard line. A 15-yard penalty set the Engineers back but Price and McGovern advanced the ball steadily till Hillenbrand raced across the goal for Rose's second score. McGovern converted to make the score 14 to 0.

The Engineers wasted no time in scoring another touchdown after recovering an attempted lateral from Duvall to Galloway on the Aces 35-yard line. Hillenbrand broke through most of the Evansville team on a remarkable run to place the ball on the five yard line. McGovern scored on an end sweep and followed with the kick for the extra point.

Late in the half, Evansville took the offensive with an aerial attack that netted a touchdown. The three effective plays were long passes from the hands of halfback Duvall; the first received by Deller, the second by Morneweg and the third to Galloway. The touchdown was made by Galloway after he slid along the sidelines to execute a sleeper play. Rose blocked Duvall's placement attempt, but Morneweg grabbed the loose pigskin and raced over the goal. The gun went off at half time with Rose leading by a 21 to 7 margin.

An early threat of another touchdown by the Enigneers was blasted when Allison fumbled the ball, but possession of the ball was soon regained only to lose it again on an intercepted pass. After the interception the Aces marched down the field to the Rose 29-yard stripe where the Engineers took the ball. Hillenbrand shortly broke loose for a 26-yard dash to the 13-yard line. McGovern broke around the left to cross the goal for his second touchdown of the day.

After the third Rose touchdown Coach Brown gave nearly every man on the Rose bench a chance to perform in final period, but before the final gun two more Engineer touchdowns rolled across the goal line. McGovern threw a shovel pass to Ellsworth who carried the ball to enemy 15 and Hillenbrand made the goal on his third attempt. Kadel's

(*Continued on Page* 26)

The Freshmen salaam to Rosie at the half.

McGovern out on his own.

Fraternity Notes

Alpha Tau Omega

The Gamma Gamma chapter of Alpha Tau Omega has been bustling with activity the past couple of weeks in preparation for the coming rush season. Improvements and repairs on the house were the main objectives with the painting of the house as the biggest accomplishment. The outside paint job on the house was done by hired painters but the members spent evenings and Saturdays cleaning and scraping the boards in preparation for the painters. The game room in the basement has been scrubbed down and a fresh coat of paint added to its walls. Numerous other improvements were made and as a finishing touch the inside of the house was completely cleaned.

Sunday, October 11, the chapter attended the Central Presbyterian Church in continuance of the monthly practice. The Rev. Goodpasture delivered an inspiring sermon that was enjoyed by all who were present.

All A T O members in province XVII were happy to hear the good news that Province Chief Jake Maehling has returned from the hospital. Jake has spent many weeks on a hospital bed recovering from an injury received in an automobile accident, but now he is convalescing at his home.

Sigma Nu

The months of September and October proved to be extremely active ones for the Beta Upsilon chapter of Sigma Nu. With the advent of Rose's first football victory, the chapter held a buffet supper in honor of the occasion. Special guests at this affair were Brothers Kadel, Mitchell, Warrick, and Woolsey who played important roles in the smashing victory over Evansville College. The Sigs and their dates enjoyed games and stunts at the chapter house and then all went out in a body to the R-Men's dance held in the gymnasium at Rose.

The fine fall weather of the following week proved too tempting for study. As a pleasant diversion the chapter held a hayride at New Goshen. Two wagons were well filled, and the party enjoyed a moonlight ride along the famous banks of the Wabash. A huge bonfire welcomed the return of the wagons and everyone became busily engaged appeasing the hunger of the "inner man." In the dying embers of the bonfire, marshmallows were toasted and fraternity songs were sung. Mr. and Mrs. White and Mr. and Mrs. Schull graciously acted as chaperons for this affair.

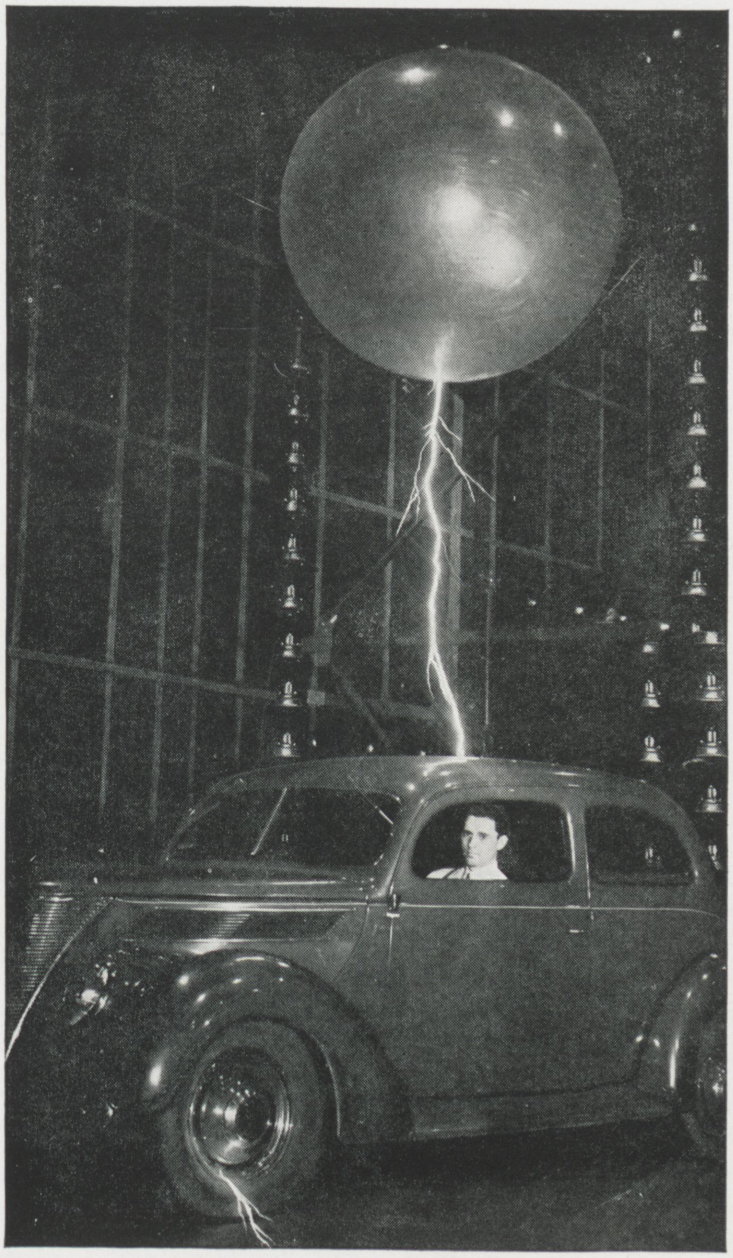
On October 5, the chapter held its second dinner meeting of the year. Immediately following this dinner, a formal initiation was held for Allen P. Smith. With the initiation of Brother Smith, the chapter is proud to announce that every member has now become active.

Lambda Chi Alpha

Lambda Chi Alpha announces the addition of four new active members to the chapter. They are: F. Richard Roesinger, Burbank, California; Francis Henry Hillenbrand, Evansville, Indiana; Daniel Peter Morisseau, Pacific, Missouri; Donald Earl Alexander, Richmond, Indiana, all sophomores. They were initiated in the wee hours of Sunday morning, September 27, after the "R" men's dance.

Saturday, September 19, the chapter sponsored a hayride and weiner roast. Although it rained all day and threatened to rain that evening, the members were convinced it wouldn't. So it didn't! A grand time was had by all and it turned out to be a swell night for a hayride. Professor and Mrs. John L. Bloxsome, and Capt.

Gilbert D. McCann, Ph.D., M.S.
...Master of Thunderbolts, too!



MODERN FARADAY CAGE. Three million volts of man-made lightning hit a car in Westinghouse High Voltage Laboratories, while Dr. Gilbert D. McCann sits safely at the wheel. Dr. McCann . . . co-inventor of the "fulchronograph" for timing and measuring the intensity of thunderbolts . . . joined Westinghouse in 1939, after receiving degrees of M.S. and Ph.D. at the California Institute of Technology.

EVERY TIME you take a breath, 175 thunderbolts crash to earth somewhere.

These lightning strokes, streaking down at 600 million miles an hour, are charged with torrents of electrical power . . . as much as 200,000 amperes, at pressures as high as 25,000,000 volts.

No wonder protection against lightning has been a major problem to utility companies . . . such a problem that, up to a few years ago, lightning frequently shut down power service to industry.

Today, a properly designed power line is not likely to be put out of service by lightning *more than once in 5 or 10 years!*

Dr. Gilbert D. McCann and Charles F. Wagner, Westinghouse engineers, have done much to make this possible through their studies of natural thunderbolts and laboratory lightning.

One of their contributions is the "fulchronograph" which automatically times natural lightning strokes and measures their intensity. Oscillographs and movie cameras also are used to photograph the celestial fireworks.

These mechanical "eyes" . . . perched high on the top of scores of tall buildings, smoke stacks, and transmission-line towers . . . are constantly collecting facts about lightning phenomena that were never known before. Facts about "cold" lightning, of terrific blasting power. Facts about "hot" lightning, the incendiary bomb of the sky.

Still further knowledge is gained from the study of *artificial lightning* . . . made in the Westinghouse High Voltage Laboratories. This man-made lightning is used to bombard insulators, lightning arresters, and other protective devices to test their efficiency.

These studies are constantly adding to the store of "know how" in the field of power transmission. As a result, Westinghouse engineers have been able to design and build lightning arresters and ground-wire systems that tame the wildest thunderbolt.

The work done by Dr. McCann is contributing mightily to America's war effort by helping to keep electric power flowing night and day to our vast war industries . . . as well as by protecting ordnance plants from destruction by lightning.

America needs scientists and engineers as never before . . . to help solve the technical problems of modern warfare and to rebuild the world when the last shot is fired.

Nearly 300 young engineering graduates joined Westinghouse last Spring to carry on this work. In the Class of '43 there will be many graduates who will have an equal chance to help win the war . . . and the peace to come . . . with Westinghouse.

Westinghouse

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURGH, PENNSYLVANIA • PLANTS IN 25 CITIES — OFFICES EVERYWHERE and Mrs. Paul D. Bennett acted as chaperons.

On September 28 an election of officers was held. The officers are as follows: President, Burton Butts; Vice President, Harmon Shaw; Secretary, Charles Baker; Treasurer, F. Richard Roesinger; Social Chairman, Francis Hillenbrand; Ritualist, Donald Alexander; House Manager, William Soudriette.

Theta Xi

The Kappa Chapter at Rose was honored with the visit of Harold P. Davison the Executive Secretary of Theta Xi, last Monday, Sept. 28. He attended dinner at the house, and later with Dr. Knight joined in the regular chapter meeting.

Mr. Davison gave a very interesting talk concerning the effects of the war on fraternity life. He also made an extensive review of the activities in other T.X. chapters throughout the country.

The chapter in the past week or so, has made an all out effort, with their noses to the grindstone, to prepare for the finals which have creeped upon us. We all know, that remaining in school is of major importance in more ways than one.

Mr. Davison presided over the installation of the new chapter officers, which was held during his stay. The new officers are: Dean Albon, President; George Blakey, Vice President; Russell Northam, Treasurer; Edward Moller and Paul Kaplan, House Manager and Assistant House Manager respectively; Corresponding Secretary, Richard Pence.

CAMPUS SPORTS

(Continued from Page 23)

conversion attempt was wide of the uprights.

Evansville began a passing attack but before any damage was done, Allen Smith intercepted a pass from Duvall and raced 50 yards for a touchdown. Smith kicked for the conversion and added another point.

Lineups and summary:

Rose Tech (41)		Evansville (7)
Ellsworth	LE	Galloway
Woolsey	LT	Grote
Warrick	LG	Fisher
Miller	C	Driggers
Hanes	RG	Sampson
Reed	RT	Bramlette
Rumbley	RE	Deller
Price	QB	Savage
McGovern	LH	Duvall
Hillenbrand	RH	Hobart
Allison	FB	Hamby

Score by periods:

Rose Tech	7	14	7	13—41
Evansville	0	7	0	0— 7

Rose vs. Wabash

Rose Tech's Fighting Engineers lost a hard-fought battle to the Little Giants of Wabash by a score of 14-13 on the latter's field. Rose was far outweighed by the Wabash team but waged a stiff battle throughout the game that was a constant threat to the Wabash victory.

Both of the Engineer's touchdowns came in the first half as a result of Ed McGovern's splendid ball carrying. Rose led at mid-game by a score of 13-7. The first score came as a result of Hillenbrand's 16-yard gain to the 51-yard stripe and a pass from Price to McGovern on the next play sent the fleet halfback across the goal line with the ball. Late in the half Rose scored again when McGovern made a sensational 89-yard return of a kickoff.

Wabash showed its power at the start of the game with big Earl Dowd charging across the Rose line for consistent gains. The Engineers braced themselves, and took the offensive, and soon had the Little Giants in their own territory. Shortly afterwards McGovern scored the first touchdown. Rose had Wabash backed against the goal with the ball on the 6-yard line with a first down and goal to go. In four attempts the Engineers were unable to cross the line, but advanced the ball to within one yard of a touchdown before losing possession. Wabash punted and Hillenbrand returned the ball to Wabash's 25-yard line. Johnson intercepted a pass from Hillenbrand to Rumbley and advanced the ball to the 45-yard line. Then came the first touchdown for the Little Giants when Fee slipped through a number of the Rose linemen and broke around end for a 55-yard dash to the goal. Kostel kicked for conversion and the score was tied at seven all. On the kickoff McGovern picked up the ball on his 11-yard line and raced through the whole Wabash team for a touchdown. McGovern made an attempt for placement but his kick hit the cross arm and bounced underneath the bar. The score at half time was 13 to 7 in Rose's favor.

The second half found play largely in Rose territory when the Little Giant's weight and reserve strength began to show effect on the Engineers. A pass from McGovern to Hillenbrand gained 20 yards to the Wabash 28-yard line, but Rose was forced to punt. Wabash gained on line plunges and then Philips took the ball for 21 yards to the Rose 30. Big Dowd carried the ball on the next play and charged across the goal line. Walker converted and the score was Wabash, 14 and Rose, 13. Rose made little gains in the remainder of the game, being on the defensive against Wabash's rushes.

Coach Brown made very few substitutions and most of the starting eleven playing the whole game. Captain Bill Rumbley and Dick Ellsworth played an exceptional game at the end positions, and the charging and tackling of substitute Bill Mitchell, playing in his first college game as tackle, was not to go unnoticed.

Lineups and summary:

Rose Poly (13)		Wabash (14)
Ellsworth	LE	Laufenburger
Reed	LT	Snyder
Warrick	LG	Ziemann
R. Mitchell	C	Powers
Hanes	RG	Hartlage
Woolsey	RT	Verzani
Rumbley	RE	O. Walker
Price	QB	Johnson
McGovern	LH	Neibur
Hillenbrand	RH	Bennington
Allison	FB	Dowd

Score by periods:

Rose Poly	7	6	0	0—13
Wabash	0	7	7	0—14

Rose Poly scoring—Touchdowns: McGovern (2). Point after touchdown: McGovern (placement).

Wabash scoring — Touchdowns: Fee, Dowd. Points ater touchdowns: Walker (2) (placements).

FLAME THROWER OF THE PRODUCTION OFFENSE

LEADING the attack on the production backlog by shaping steel and building it into ships, tanks, armored trucks any many other defense items, is industry's modern production tool — the Airco Oxyacetylene Flame. It slices its way through steel of any thickness up to 30" and more, cutting it to the desired contour with unrivalled speed and accuracy. This versatile tool flame machines metal with astonishing speed; hardens steel to any desired degree and depth; cleans metal surfaces for quicker and longer lasting paint jobs and welds metal into a homogeneous lastingly strong structure.

To assure the maximum efficiency from this modern production tool, Airco has developed a complete line of machines and apparatus. Airco has increased its manufacturing of oxygen and acetylene and distributing facilities to meet the accelerating demand. So that the Airco Oxyacetylene Flame may be used most efficiently and economically, Air Reduction offers industry the cooperation of a staff of experienced engineers, skilled in the use of this modern tool.

An interesting booklet, "Airco in the News", tells a picture of this Airco production tool and the numerous ways in which it is aiding the defense program. If you want a copy write to the Airco Public Relations Department, Room 1656, 60 E. 42nd St., New York, N. Y.

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ALUMNI NEWS

(*Continued from Page* 22)

Newlyweds

Miss Mary Alston, daughter of Mr. and Mrs. David Alston was married to Lieutenant William Lungdgren, Rose, '38, on September 23, 1942. The wedding was held at the home of the bride in Mobile, Alabama.

Mr. and Mrs. George Raymond Schwob have announced the marriage of their daughter, Margaret, to Lieutenant Robert Alfred Young, Rose, '41. The wedding took place on September 22, 1942 in New Orleans, Louisiana.

Mr. Thomas E. Jenkins announced the marriage of his niece, Jacqueline Margaret Baker, to Lieutenant Robert Dwight Phelps, Rose '41, on September 31, 1942. The wedding was held in Lexington, Kentucky.

CAMPUS SURVEY

(*Continued from Page* 19)

value to the military department.

The faculty and students join in wishing both Capt. Bennett and Lt. Colwell, the best of luck and success in their new assignments.

Freshmen Bow Down

As the football season again got underway, Rosie, the famous Rose mascot and charge of the freshman class, proudly made her presence known by rolling down the hill and travelling several times around the cinder circuit at each home game.

Rosie made her first public appearance on September 26 at the Rose-Evansville game when she was proudly escorted by about fifty freshmen who had previously taken her out of hibernation and groomed her by doctoring all dislocated joints, giving her a brand-new massage of white paint, and replacing the old "42" on her forehead with a new "Feb. '43."

At mid-game, out darted Rosie from the sidelines for three trips around the track under the power furnished by the freshmen which reached a maximum after sophomores had supplied the necessary inspiration. Then Rosie was drawn up facing the spectators while the freshmen made their traditional bows to her, each showing his true loyalty by touching his face to the very cinders. The sophomores then made certain everyone had his matches and garters. The results were very satisfactory.

Rosie is scheduled to make her next appearance the week-end of Homecoming, when she will be excorted down Wabash Avenue in the annual parade and will wind up a lusty week-end at the Rose-Earlham game the following day. For this occasion the old grads will expect to find Rosie decked out in her best regalia.

SUBMARINE MENACE

(Continued from Page 9)

but much has to be learned about its behavior under ice, wind, and combat conditions. Theoretically a plane can tow half its gross weight in gliders but this cuts speed almost in half. The Army has two-ton gliders on order but these are chiefly experimental.

America's contribution to the art of war is the A T C, Air Transportation Command. Held strictly under Air Force Command, it has at its head capable airline operators. Its duties are five-fold (1) Moving planes from factories to training and combat centers. (2) Control of delivery of Lend-lease aircraft. (3) Ferrying replacements to the A E F, (4) Operating all cargo and passenger lines outside the U. S., (5) Developing and maintaining airline services.

Whether the A T C will replace the commercial airlines after the war remains to be seen, but even with their pool of men and planes cut in half, the airlines are carrying more than in pre-war days.

The commercial airlines are troubled on two counts, first upon the possibility that they will be completely militarized and, second, that their pool of pilots, planes and personnel will be taken from them. It might be wise to take a lesson from the Germans and keep government control on the airlines and Army Air Corps hands off.

This is not to say that the Army is inefficient, but it is to say that a civilian board is likely to be more partial and fair to all who need air transport than would be the Army. A unified effort will be needed to win the war and this unification cannot be accomplished easily if one faction is allowed complete control over such a vital part of the war effort as the airlines.

ENGINEER'S TOP

(*Continued from Page* 11)

CwΘ by Cordeiro which takes into account the more complex forms of the gyroscope.

The use of the gyroscope for preventing the rolling of a ship at sea may now be explained. A gyroscope is mounted with its axis vertical and in the plane of the keel of the ship. Fore and aft motion is permitted by hanging the shaft from bearings at the top. The lower end of the axis is connected horizontally to a piston in a sealed cylinder filled with oil. When the ship rolls about the keel as an axis, precessional motion causes the piston to move back and forth. The hydraulic action of the oil offers great resistance to this motion, and the rolling is greatly reduced. This is the way Schlick's Stabilizator worked. Bessemer's cabin did not work because he mounted the flywheel with the axis horizontal and across the keel of the ship. Rolling caused the axis of the gyroscope to precess in a horizontal plane and had no effect on stabilizing the ship in the plane of the roll.

Having developed the theory of the gyroscope to some extent, it is now possible to enter into a slight discussion concerning the gyrocompass. The need for a north-seeking navigation instrument that would be unaffected by the magnetic currents found in iron and steel ships had become quite a problem in 1907 when the first progress was made with the Sperry and Anschuetz types.

The principal features of the Sperry compass are illustrated in Fig. IV. The axle of an electrically driven rotor is mounted horizontally in a case pivoted on horizontal trunnions carried by a vertical ring. The vertical ring is suspended from the head of the phantom by steel wire. Attached to the phantom ring are compensator masses to make the moments of inertia of case, rotor, and vertical ring equal about all axes in the plane of the supporting gimbals. This makes these axes all principal, and rotation about them will not cause rotation of the suspended system about the suspension wire.

The compass card is fixed to the phantom. Vertical pivots keep the phantom ring and the vertical ring concentric without carrying any of the suspended weight. Between the phantom and the vertical rings are electric contactors (not shown) so devised as to have current only when the two rings are out of the common plane. The current operates the azimuth motor to keep the rings coplaner. This prevents torsion in the suspension wire.

A mercury ballistic consisting of two cylindrical containers connected by a horizontal tube turns freely about the trunnions on the phantom ring. It is mounted on the transverse axis so as to tilt with the rotor axis. The ballistic arm, attached to the ballistic frame, is connected to a pivot placed eccentrically at the bottom of the case. This arm causes the damping effect that is so necessary to ship applications.

The spider is a frame supported in gimbals in a stand bolted to the deck of the ship. The lubber line on the spider is parallel to the keel of the ship and indicates the course. The phantom rests on and turns in the spider.

Some of the data for the Sperry, Mark X, gyrocompass are given in the following table.

Weight of Gyro	120 lbs.
Weight of compass complete in Binnacle	1350 lbs.
Moment of Inertia of Rotor	22.2 lbs. ft.^{2}
Lever Arm of Ballistics Container	7.25 in.
Diameter of Gyro	13.625 in.
Width of Gyro	3.5 in.
Speed of Gyro	10,000 r.p.m.
A.-C. Voltage of Supply to Gyro	105
A.-C. Amperes of Supply to Gyro	2.2
Percentage of Damping	67%
Damping Angle	1 41′
Frequency of A.-C. Supply to Gyro	350

The action of the gyroscope as a compass can be more readily explained by the use of Fig. V. The earth is viewed from a point in space beyond the south pole and is seen to revolve in a clockwise direction. G_3 is the natural position of the gyroscope, while the other two are used for explanation purposes. The arrows on the wheel in positions G_1 and G_2 indicate the direction of the wheel rim in rotation. A weight w is placed on the inner gimbal ring. This is the weight upon which the gravitational force of the earth acts and is analogous to the mercury ballistic tubes of the Sperry gyroscope.

Suppose the gyroscope to be in position G_1 with its axis arbitrarily directed east and west. The angular velocity of the rotating wheel is represented by the vector OA directed towards the east in accordance with the rules previously discussed. As the earth revolves and carries the gyroscope to position G_2, its axis will continue to point eastward, thereby bringing the weight w out of line with the earth's radius. The action of gravity tends to set up a torque producing clockwise rotation of the gyroscope about an axis perpendicular to the page. This additional angular velocity is shown as vector OB. The vector sum of these velocities is the resultant OR in the direction toward which the axis of the wheel precesses. Consequently the shaft end y will move northward (into the paper); the precessional motion occurring about axis C. When the gyroscope reaches the position G_3 the pull of the earth no longer exerts a torque upon the weight and the gimbal ring will remain in a plane with the axis of the earth. Thus the gyroscope wheel will seek a position so that its axis will point north and south, and thereafter it will maintain that plane.

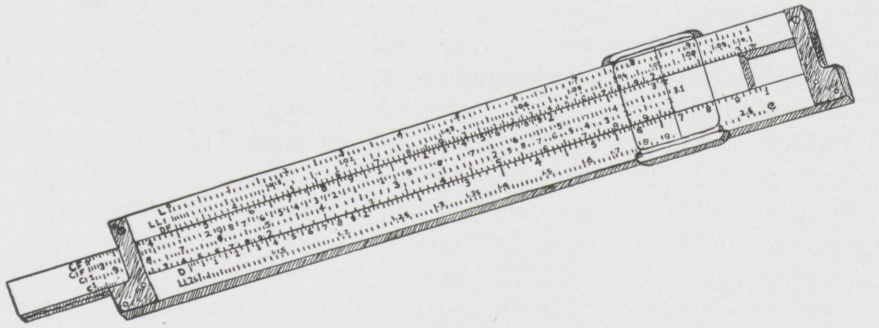
The preceding discussion assumed that the gyroscope was placed at the equator. For any other position, the axis would not remain stationary in a north-south direction, but it would oscillate about the meridian as the mean position. This is a condition that could not be permitted on shipboard; so a method of damping had to be obtained.

Damping can be confined to a small error called the latitude or damping error by putting a small weight on the north end of a right-handed spinning compass. The damping error can be corrected entirely, but it is far easier to compensate for this constant deviation by changing the lubber line of the ship.

A detailed description of damping the Anschuetz compass is given by H. Crabtree. The mathematical explanation is given by R. F. Deimel for the Sperry type.

The gyrocompass is standard equipment today on all warships and merchant vessels. The auxiliary equipment consists of bearing repeaters that can be set up in various parts of the ship to reproduce the compass indications and course recorders which automatically draw a history of the voyage showing all deviations from the course and all large applications of the rudder. These data are secured by electric pickups directly from the master gyrocompass and appears as a long regular line on a strip of paper.

In addition to the gyrocompass, compass repeaters, and course recorders, there is also a device known as the "Iron Mike". The gyropilot, briefly, is an electrical system for steering a ship without a human pilot. The directions come from a repeater compass and are transferred to the electrical steering system of the ship. The gyropilot holds the ship much closer to a prescribed course than a human could possibly hold for more than a few minutes at a time. With each deviation from its course, a ship must travel further, to maintain its straight line course, than if it were held constant. There have been curves constructed showing this comparison rather neatly.



Sly Droolings

Edited by HAROLD E. CAMPBELL, sophomore, m.e.

First Jailbird: "What they got you here for?"

Second Jailbird: "Just for rockin' my wife to sleep."

First Jailbird: "But they can't put you in here for that."

Second Jailbird: "Oh yes they can; you didn't ask me anything about the size of them rocks."

"Lizah, didya weah dem flowahs ah sent yo?"

"Ah did't weah nothin' else but, black boy."

"Lawd, Gal! Weah didja pin 'em?"

A group of local college boys were coming home from a party one night plastered to the gills. They stood out in front of the house of one of their number and called for the father.

"Will you pleash do ush a favor," asked one?

"What do you want?" replied the father.

"Will you pleash come out here and pick out Johnnie so the rest of ush can go home?"

"Pardon me, suh," asked the old pappy, "but is you the bridegroom?"

The young buck shook his head dolefully. "No suh," he replied, "ah was eliminated in the semi-finals."

"May I take you home? I like to take experienced girls home."

"I'm not experienced."

"You're not home yet."

Stranger: "How many students are there in this college?"

Prof.: "About one in every five."

Anyone can play bridge, but it takes a cannibal to throw up a hand.

Mr. Watson kissed his wife fond farewell as he was about to catch his morning bus. But due to circumstances beyond his control, he missed his first bus in five years. Thinking it would be a pleasant surprise, he tiptoes back into the kitchen and planted a tender kiss on the back of her sweet neck as she was washing the dishes.

"Good morning," she responded. "I'll have two bottles of milk and a pint of cream."

A wealthy, elderly bachelor advertised for a wife to share his estate in return for bearing him an heir. Four years passed and the villagers decided that the woman had misrepresented herself. When questioned she replied, "The old man is indeed heir minded, but he is far from being heir conditioned."

The gorgeous girl was speaking to her parents.

"Mother," she said, "do you think I should marry John? He doesn't believe in Heaven."

"Listen darling," replied her mother, "if you can't disprove that theory in your first month of married life, you're no daughter of mine."

Marketing one day when the maid was off, the lady of the house came across her servant pushing a rickety carriage containing twins.

"Why Carolyn, whose babies are those?"

"Mine," came a quick reply.

"Yours? Why I thought you told me that you were an old maid."

"Oh, I am," she confessed, "but I ain't a fussy old maid."

Then there was the guy who called his girl Carbon because her resistance went down when she warmed up.

"And where is Cadet Smith?"

"A. W. O. L."

"What do you mean by that?"

"After women or liquor."

Mr. Penny (to servant): "Please announce Mr. and Mrs. Penny and daughter."

Butler (loudly): "Three cents!"

We wonder why the iceman smiles
so,
When his glance happens to meet
The sign: "Please drive slow;
The child in the street
May be yours, you know."

Secretary: "Sorry I'm late, Mr. Smith. I'll be here bright and early tomorrow morning."

Boss: "Don't promise the impossible—just be here early."

The husband answering the phone said: "I don't know; call up the weather bureau," and hung up.

"What was that?" asked his wife.

"Some fellow asked if the coast was clear."

"Heaven's above!" exclaimed the college boy on the train as he jumped into the berth beneath the one occupied by the belle of the campus.

A man and his wife, hiking in the woods, suddenly realized they had lost their way.

Said the husband: "I wish Emily Post were here with us; I think maybe we took the wrong fork."

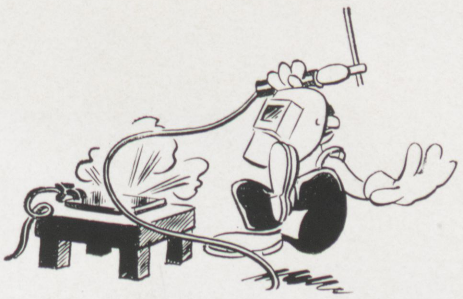
G-E Campus News

COLLECTOR

VINCENT J. SCHAEFER, of the G-E Research Laboratory, used to collect snowflakes, and because of his hobby metallurgists now have a simple method of observing details of metal structures far too fine to be seen with an ordinary microscope.

The young scientist's method of "casting" snowflakes in a film of Formvar has solved the problem of how to get a metal specimen thin enough to be examined in the electron microscope. (This device uses electrons instead of light to form the magnified images, and the electrons must pass through the specimen.)

A thin film of resin, stripped from the specimen and retaining all the details of the metal surface, can be placed in the microscope and be magnified as much as 100,000 diameters.



CALAMITY JOE

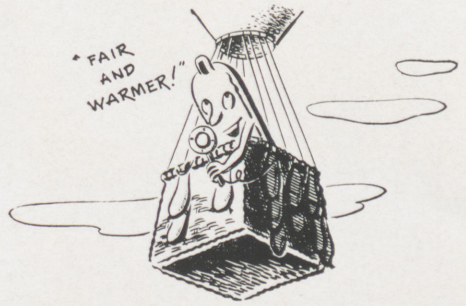
EVERYTHING happens to Joe.

And anything is likely to happen when he picks up the welder's electrode, because Joe MaGee, an animated cartoon character, doesn't know the first thing about welding. Throughout the new G-E instructional movie, "The Inside of Arc Welding," he seems to do the wrong thing.

But Joe does a good job of teaching you how *not* to strike the arc and how *not* to control the metal in the molten pool. His bungles, plus close-ups of the arcs in action, make this full-color film "one of the most helpful training aids ever offered to the welding industry."

The movie is in six parts. Each part (16 mm.) is complete in itself—a 10-minute sound production covering one particular phase of arc welding in full detail.

Organized groups may borrow the films with no charge other than transportation costs; schools and industry may buy single reels at cost—$52 each—for use in training welders. Write Campus News, General Electric, Co., Schenectady, N. Y.



SH-H-H-H-H-H!

THE one announcer in the country who can give weather forecasts over the air is a mechanical man who broadcasts from a point 12 miles up in the stratosphere, where next week's weather is in the making.

This mechanical investigator, whose heart is an electron tube, works for the U. S. Weather Bureau. He weighs only a couple of pounds and looks like a large box camera.

As a small balloon takes him up, the robot broadcasts the atmospheric conditions he finds. Tuned in with a ground receiver, the radio signals tell the temperature, wind velocity, etc. The balloon bursts at the low pressure limit (about 60,000 feet above ground), and a parachute brings the radio sonde, as it is called, down to earth.

The mechanical weatherman carries a calling card with his return address on it in case he gets lost on the way back.

GENERAL ELECTRIC

953-46-211

CLAUDETTE COLBERT is doing a grand job in the Volunteer Army Canteen Service (VACS to the boys)
☆ You should see her starring in the new Paramount Picture "PALM BEACH STORY" ☆

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