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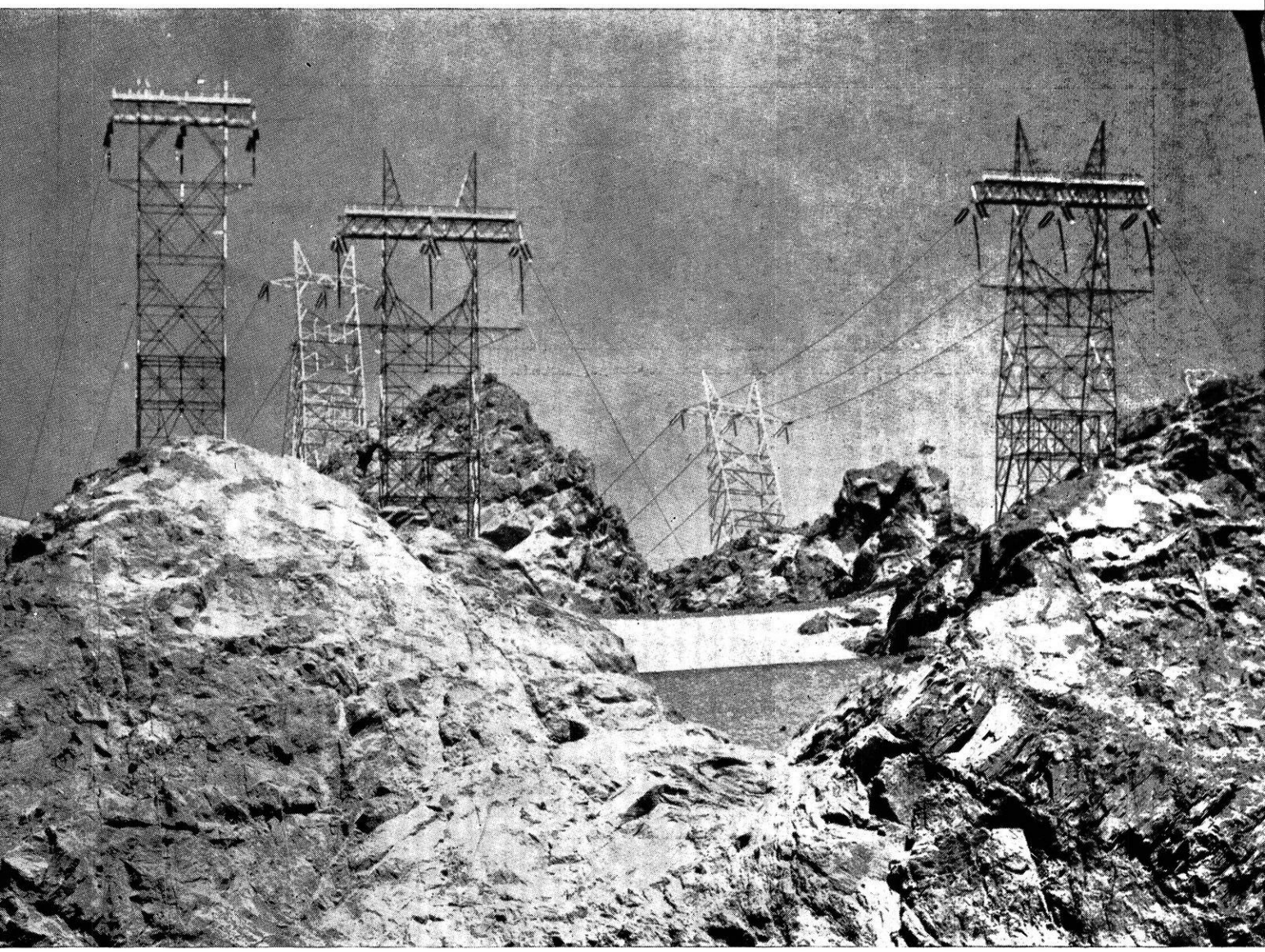
WISCONSIN ENGINEER

May, 1945



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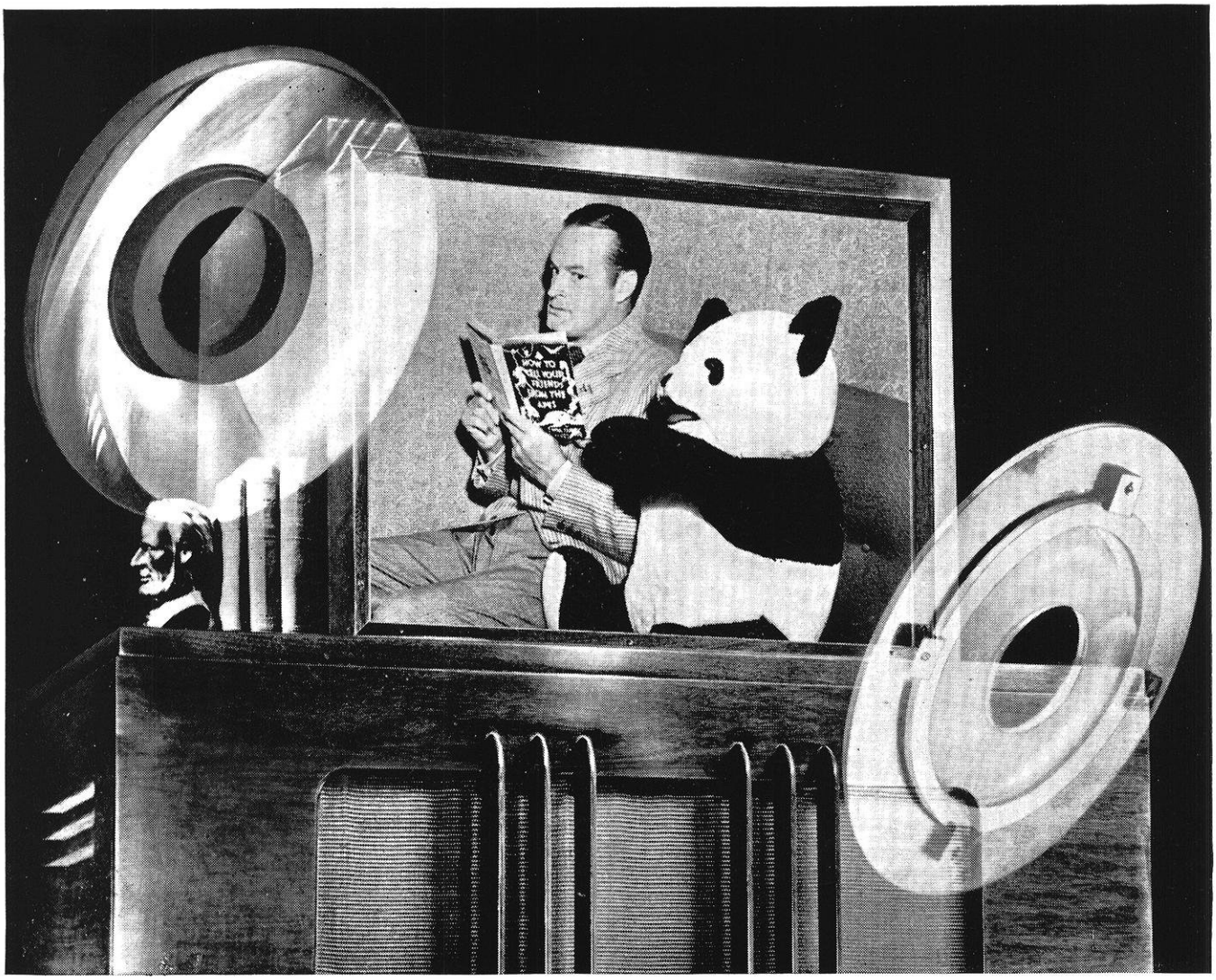


RCA Laboratories model with an 18 by 24-inch screen showing how Bob Hope may appear on future home television.

New Projection Television - Bob Hope's face "big as life"

Can you picture Bob Hope on television . . . seeing his face *big as life*—right in your own living room?

Well, you will—for now, thanks to RCA research, all limitations on the size of home television screens have been removed.

RCA Projection Television sets can have 18 by 24-inch pictures, or for that matter, pictures as large as the screen in a "movie" theater!

When you tune in an NBC television broadcast you'll almost think the actors are in the same room with you—and trust NBC, America's No. 1 network in sound broadcasting, to bring you the best in television entertainment.

This revolutionary improvement was achieved in RCA Laboratories by development of an entirely new reflector and lens, shown in phantom above. This lens, of inexpensive plastic, is 8 times as efficient for the purpose as the finest optical lens.

When you buy an RCA radio, phonograph or television receiver—or any other RCA product—you receive the benefit of the latest research development of RCA Laboratories. It is this *plus value* which is your assurance of lasting satisfaction.

The widespread public recognition of this plus value has given to RCA world leadership in the radio, phonograph, television and electronic art.

Dr. D. W. Epstein with a projection television tube, reflector and lens unit. Here the image on the end of the tube hits the reflector, is corrected by the lens, projected to the screen, then enlarged . . . making possible larger and clearer television than ever before.

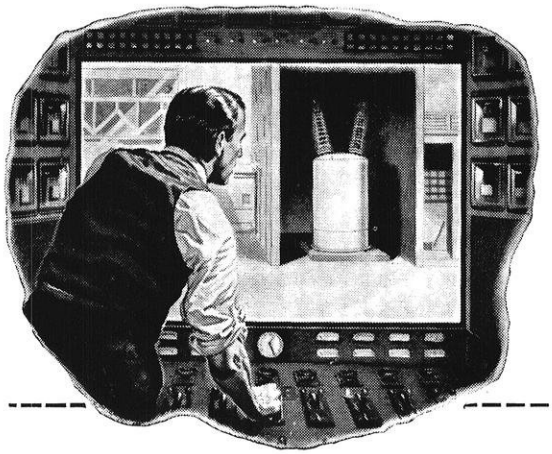
RADIO CORPORATION of AMERICA

PIONEERS IN PROGRESS

RCA

In a field hospital, a SURGEON uses a new x-ray machine that marks the exact location of the bullet, speeds life-saving behind the battle line.

. . . the name on the X-RAY MACHINE is Westinghouse.



In a laboratory an ENGINEER uses the instantaneous power of 75,000 thunderbolts to test giant circuit breakers that protect America's power systems.

. . . the name on the CIRCUIT BREAKER is Westinghouse.

In his tent a SOLDIER uses a bug bomb to destroy insect life – safeguarding health and increasing comfort in tropical jungles.

. . . the name on the BUG BOMB is Westinghouse.

In a war plant a WORKER uses an electromagnetic device to detect flaws in heat-treated bearing races – keeping our combat vehicles rolling on to victory.

. . . the name on the ELECTROMAGNETIC DEVICE is Westinghouse.

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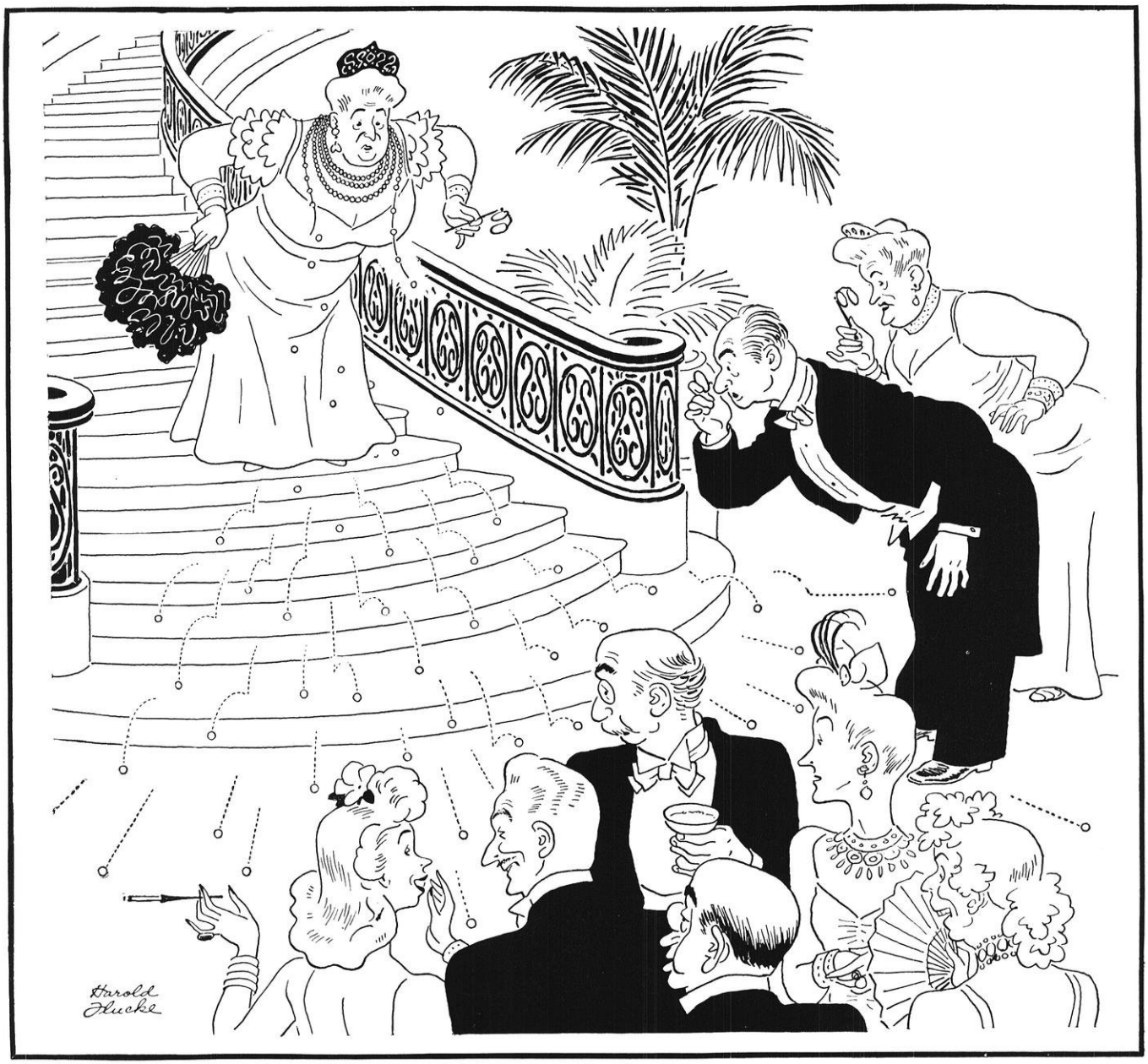
TOMORROW—New processes and new materials...created under the stress of war . . . will mean better and longer-lasting Westinghouse products for a world at peace.

Tune in: JOHN CHARLES THOMAS—Sunday 2:30 pm, EWT, NBC. TED MALONE—Mon. Tues. Wed. Evening, Blue Network



Nothing Rolls Like a Ball . . .

. . . but Mrs. J. Woofington Smith-Smythe wishes she hadn't had to demonstrate it in just that way. Especially since that fundamental fact *is* being demonstrated in *thousands* of ways in every phase of war and industry.

For the *ball* bearing carries the loads on *free-rolling* steel balls—making possible the higher speeds, heavier loads and rigidity essential to the latest developments in war and industry.

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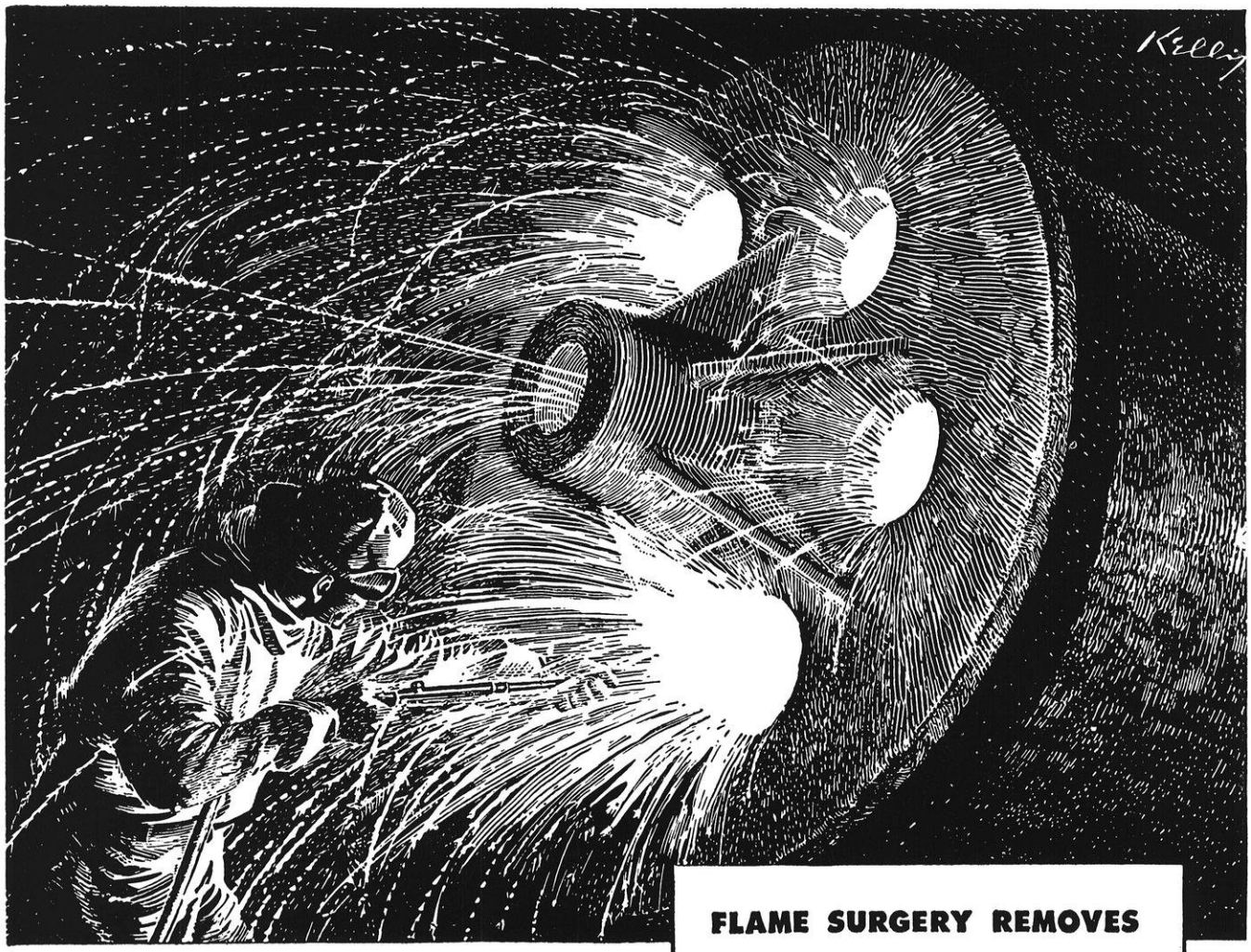

FLAME SURGERY REMOVES THREE-TON TUMOR FROM IRON INVALID

A LARGE chunk of metal, containing a mixture of coke and sand formed inside this huge drum casting when the hot metal accidentally broke through the sand during the pouring operation. This "tumor"—about two feet in diameter and five feet long—was too big to be removed through the openings in the end of the drum. The casting—costing in the neighborhood of $1500—was too valuable to be scrapped.

So a member of Air Reduction's Applied Engineering staff was called into consultation. He studied the case and prescribed cutting the tumor into pieces small enough for removal with the oxygen lance—an instrument which cuts through heavy thicknesses of metal with a jet of oxygen.

The treatment was followed; the "operation" was completed successfully in forty hours and the $1500 patient went right to work at its appointed task.

The oxygen lance is one of scores of Airco products for the shaping, joining and treating of metals with the oxyacetylene flame and electric arc. Many of these products were developed by Air Reduction for use in new and improved processes which have grown out of Airco's extensive research activities.

Through these products, through this research and through its field engineering service, Air Reduction has rendered important aid to many manufacturers in their wartime task of producing the tools of victory.

For additional information on Airco oxyacetylene flame processes and their many applications in war and peacetime industry, write for a free copy of the interesting publication "Airco in the News". Address your request to Dept. CP, Air Reduction, 60 East 42nd Street, New York 17, N.Y.

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In This Issue . . .

COVER:

Transmission towers of Boulder Dam . . . Courtesy General Electric.

FRONTISPIECE:

WITCHES' BREW: *These hooded welders appear to be concocting some brew in a great cauldron. In reality, they are fabricating an end bell for a Westinghouse generator . . . Courtesy Westinghouse.*

It's All In The Engineering World

—June Hartnell, e'46

SUCH common, matter-of-fact occurrences as a dirty ring found in the bathtub (and just when you wanted that bath), a cake rising from just a little dough put into the pan, a little bit of sticky, gummy liquid sticking two pieces of china or bits of wood together seem so common that only a passing thought is given to them. Yet each is important; each plays its part in this modern scientific world.

As an example, consider that ring around the bathtub. In reality it is a ring of scum caused by large soap consumption necessitated by the presence of hard water which requires a large amount of soap to produce a satisfactory lather. The hardness of water can be expressed by the amount of soap solution needed to form a suds. Hardness can be of two kinds: temporary hardness and permanent hardness. The first can be illustrated by the scale formed on the inside of a tea kettle. This is temporary hardness because it can be removed by boiling. (That is, of course, if you can boil water without burning it.) Permanent hardness, however, presents another problem, because it can't be removed unless it is chemically treated or distilled. The ring around the bathtub is the interacting of the soap with both kinds of hardness.

Hardness is due to the presence of chemical salts in solution. Some of these do not interfere with the formation of lather and will not form a precipitate such as this scum when mixed with soaps. Analyses have shown that the objectionable salts in natural waters are those of magnesium and calcium. To illustrate this, take some Epsom salts (magnesium sulfate) and dissolve in some water. It will take much more soap to produce a lather here than in the absence of the Epsom salts.

As an illustration of the precipitate caused with a calcium salt,

$$CaCl_2 + 2\ C_{17}H_{35}COONa = (C_{17}H_{35}COO)_2Ca + 2\ NaCl.$$

Ordinary soap is not a pure compound, but is largely a mixture of the sodium salts of oleic, palmitic, and stearic acids. The precipitate which forms is a mixture of the calcium stearates, and the other products of the reaction are sodium salts left in solution and producing no effect on the lather-forming properties.

One common method of softening the water for household use is by the use of zeolites and permutit. Zeolites occur in nature and are sodium aluminum silicates such as $NaAlSiO_4$, permutit being essentially the same. Then water containing calcium or magnesium salt on passing through this material reacts as follows:

$$CaSO_4 + 2\ NaAlSiO_4 = Na_2SO_4 + Ca(AlSiO_4)_2$$

The sodium is replaced by the calcium ions.

The main idea behind the softening of water is to replace the calcium and magnesium salts with sodium salts. Washing soda (sodium carbonate) could be used, but the calcium and magnesium precipitate as carbonates and in laundering clothes will leave a grayish tint (Tattletale Gray — don't let your sheets have that grayish appearance) that naturally is objectionable. Sodium metaphosphate, recently developed forms no precipitate and is much more acceptable. (It will leave your sheets and pillow cases shining white, fellows. See your grocer today.)

The choice then is up to you! It is between the use of some cheap chemical that will remove both temporary and permanent hardness or the use of excessive amounts of soap and the resulting ring around the bathtub.

And then, have you thought about eating glue? That is, beside that that is on envelopes. Of course, you say it would probably stick going down and although no one has probably ever intentionally eaten glue, everyone has eaten foods which from a chemical viewpoint behave much like glue.

These foods are called colloids and are called that because when dissolved in water they wouldn't pass through a membrane. And the word colloid comes from the Greek word "colla" which means glue. Here's some of those foods in the glue family: whipped cream, mayonnaise salad dressing, jelly, milk.

Closely related to this is the souring of milk, really part of colloidal behavior. Milk can really be considered as an emulsion of oil or fat in water. And this emulsion is stabilized by another colloidal substance which coats them and has an attraction for the solvent. This protective skin is a protein, casein. In water, these proteins give up electrically charged particles depending on the alkalinity or acidity of the water. In milk, this charge is negative. It is this charge which causes repelsion and keeps the particles apart. The souring of milk occurs when bacteria in the milk act on the lactose and produce acidity in the milk. This acid breaks the protective skin by eliminating the

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Amateur Weather Forecasting

A Westinghouse Talent Search Essay

—Wayland Evan Noland

METEOROLOGY is "the branch of physics treating of the atmosphere and its phenomena, especially of its variations of heat and moisture, of its winds, storms, etc." The practical application of meteorology is weather forecasting.

Mournful blasts of the fog whistles sound at regular intervals as a Coast Guard-manned troop transport feels its way through the outer anchorage of an East Coast port. Fog is just one of the weather conditions which vitally affect shipping.

For six years I have been interested in weather forecasting. I have issued daily forecasts for three years, including a summer each at Trout Lake, Wisconsin, and Exeter, New Hampshire, and the rest of the time at home in Madison, Wisconsin. My daily forecast would be issued every afternoon for the following thirty-six hours.

The problems of an amateur weather forecaster are different from those of a professional. The amateur must rely on his experience and on local weather conditions. Such instruments as the hygrometer and barometer are of little value to the amateur except for short-term forecasts. The saying, "The barometer is an instrument to tell what kind of weather we're having," is true for the amateur. The value of the barometer to the professional is that it indicates weather conditions at distant stations, especially to the west where most of our weather comes from. From the overall picture thus obtained the professional forecaster can judge what kind of weather to expect.

The amateur must know three things to make a forecast: wind direction, cloud conditions, and past behavior of the weather in his area. The thermometer is also necessary to forecast exact temperatures.

Wind direction can best be determined by observing smoke from a tall smokestack or by observing a weather vane placed high enough to be unaffected by winds deflected by obstacles on the ground. Bending of trees and the drift of low clouds also indicate wind direction. Smoke is best as it indicates approximate velocity and is affected by breezes too weak to turn a weather vane. Knowledge of wind direction is important in forecasting the approach of high and low pressure areas.

Cloud forms are also important. An amateur should know the ten cloud forms recognized by the International Meteorological Committee and described in the **International Cloud Atlas.** He should also know what kind of weather the various forms portend. I have found it generally true that higher clouds such as cirrus give the earliest warning of an approaching storm. Each cloud form has its own significance in forecasting.

Wind direction and cloud forms indicate little without the knowledge gained by observation and study of local climatology. And acquaintance with the causes of weather change is valuable to the amateur forecaster. Wind, precipitation, and temperature changes are caused by high and low pressure areas which result from the convergence of cold and warm air masses.

After observing the weather for several years, I am convinced that cirrus clouds are usually the first sign of an approaching low pressure area, or cyclone, as it is often called. Usually they come from the southwest, west, or northwest.

When they come from the southwest, the wind may be expected to become northeast and to back toward the north and northwest as the center of the cyclone passes to the south of the observer. Light precipitation and cold, cloudy weather may be expected.

When the cirrus comes from the west the wind may be expected to become east. Much precipitation and strong winds may be expected because the center of the cyclone will pass close to the observer. The wind will either back

or veer to the west depending on whether the center of the cyclone passes to the north or south of the observer.

When the cirrus comes from the northwest the wind may be expected to become southeast and veer to the northwest as the center of the cyclone passes to the north of the observer. Considerable precipitation and warm weather may be expected, followed by much colder weather when the cold front, indicated by the northwest wind, arrives.

Unfortunately, no rule is infallible in specific instances. The forecaster must, therefore, rely upon experience he has gained from previous observations. Such common expressions as "Mackerel scales and mares' tails make lofty ships carry low sails" and "Thunder in the morning, sailors take warning" are based on the experiences of many people and are very often true. It is, therefore, essential for an observer to have a reservoir of previous observation and study to rely upon in making forecasts.

In the actual preparation of the forecast the amateur should consider the interests of those for whom he is forecasting. Most people want to know whether it will rain or snow, what the temperature will be, and whether the sun will shine. The forecast should be comprehensive, unambiguous, and short enough to be easily remembered, for instance:

"Much colder tonight. Minimum 5° below. Continued cold and clear with minimum tomorrow night at 12° below."

The reason for a study of amateur weather forecasting is twofold: it is a very interesting and practical subject.

The study of the causes of wind, rain, and temperature changes are of interest to anyone because they have such a profound influence on his life.

Amateur weather forecasting is the first step in becoming a professional meteorologist. The amateur weather forecaster has an advantage over one who has not previously studied the weather because he already understands the basic principles of meteorology. Although meteorology has not always been a profitable vocation, it is rapidly becoming so since meteorology has been recognized as one of the most important sciences. There is much research to be done in meteorology, especially in the behavior of the upper atmosphere and the effect of sunspots on the weather.

As an avocation, meteorology will continue to be of interest and personal benefit and will aid young people in becoming professional meteorologists.

Meteorology has much to offer to the progress of civilization. As aviation becomes more important, so will meteorology increase in importance. Safety in the air is dependent upon accurate weather information. It may be found that long-range weather forecasts can be made from sunspot cycles, giving even more adequate warning to farmers of frosts, droughts, and destructive storms. It is obvious, therefore, that meteorology is destined to become ever more important.

—Courtesy Science Service

—Cuts Courtesy Coast Guard

WINTER SEAS—Forewarning of storms is valuable not only to farmers and aviators but also to ships at sea. Here a rough riding Coast Guard 63 footer cuts through a mighty wave during gruelling air-sea rescue tests in the North Atlantic.

Women In Medical Research

—Ruth Hilda Niles

A Westinghouse Talent Search Essay

THE world of today is a world of science, and one of the most important phases of science is medical research. Right now the United States Government is sending out an urgent call for young women workers in every sphere of scientific activity. Several of the country's greatest scientists have stated that the present war will be won in the research laboratories of the United States. It is for this reason that I, a high school senior, am considering medical research in my proposed science project. Being confined by the many limits imposed by a small town school, I have been unable to carry on any extensive laboratory projects as are possible in a larger institution.

Naturally this pressing need for women in science is a result of the war and it is our duty to do something about it. However, there are many more reasons for my interest in this line of work in addition to patriotic motives. I believe it is one profession that is never lacking in new interest. There is never a time when one would feel that he had done all that could be done, discovered all that could be known, or reached the point where there was no longer any room for further advancement.

This call is often for research workers to study and improve methods of destruction. Better, faster, and more horrible wholesale means of killing are the order of the day. However, in my opinion, the purpose of saving lives and relieving suffering is fully as vital as learning new ways of administering death in great doses. When there is more pain and more lives are being lost in the world now than ever before, what is as important as the advancement of life-saving and pain-relieving agencies? Won't we win the war just as quickly by saving our own men as by killing the enemy? Therefore, I say that America needs toilers for life as much as and more than toilers for death and destruction.

There is unlimited opportunity for progress in the study, improvement, and communization of the newly discovered weapons against disease and infection.

Let us take for an example one of the most interesting and beneficial of all new medical discoveries—penicillin. Penicillin, or technically speaking, **Penicilliumnotatum,** was discovered quite by accident by Dr. Alexander Fleming when this unknown agent ruined his culture of staphylococci at the University of London in 1929. Unfortunately, its development, perfection and the great business of making it available for all will not come by any miracle out of the sky. It has been found that not all of the powdery yellow-brown stuff from bread and cheese mold is equally capable of killing the harmful bacteria. It will take time and work to discover by the old trial-and-error method how and why this is true. It is the aim of the authorities to make penicillin available for civilian use after the war.

Miss Galina Mouromseff, bacteriologist, is shown removing a rack of virus tubes in preparation for an ultraviolet exposure.

—Courtesy Westinghouse

First, of course, the armed forces need all that can be produced by the present method. The sulfa drugs have been used by our fighting men for some time but many people suffer unpleasant after-effects from the sulfas. That penicillin doesn't cause any such reaction in the body is another reason why it must be developed.

Now we have found that one does not need to fear that penicillin will harm him but the question is raised—what can penicillin do? It has proved to be most efficient in the treatment of some of the most dreaded diseases to which the human body is subject. Pneumonia, gonorrhea, syphilis, blood poisoning, streptococcus infection and infection in open wounds all have bowed before their master,

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Planning a War Plant

—John E. Lough, m'47

THE government wants a new plant to produce materials for war. It must be placed in a locality that can supply the manpower without crippling the manufacturing of other important war products in that area. It must be built where the transportation problem will not overburden any already congested transportation services and where electrical power is available. The new plant must be managed by capable men whose absence from any other businesses would not hinder the war effort. This plant must be built as swiftly as possible and contain every modern facility for production efficiency.

This is the problem that has been solved many times since the war began. The government picks the area for the proposed location and asks a company whose efficiency and cooperation have been proven to undertake to plan the new factory. If the plans are accepted in Washington the factory will be under the management of this company.

The project we are interested in is planning the factory to house the equipment of manufacture. To best illustrate the procedure that is generally followed in the planning of a government-controlled plant we will take an actual case, the manufacturing of the forged aluminum cylinder head, and follow it through. Although the steps of planning may vary in complexity and sequence for different products, the trend of the procedure followed is the same. This is the actual method that was followed in laying out a plant to produce finished cylinder heads.

The first thing done was to survey the land and make a set of drawings of the area including the surrounding buildings, railroad, roads and power lines. Then three representatives were sent to a plant producing the forged cylinder head. One of the men collected data concerning the receiving, handling, shipping and storage of parts that compose the head. Another collected blue prints of all the machines used in machining the parts and the equipment needed in the inspection departments. The third engineer studied the methods of handling the cylinder heads in the heat treating and paint departments. This was the beginning of the big job, the layout of general areas for each department and then the layout of the departments in detail.

The general areas of the departments having been determined, drawings were made of four or five proposed buildings. A plan drawing of the approved building chosen from the proposed drawings was laid on a layout board. Then templates of the plan view of the machines to be placed in each department in the building were cut out of light weight cardboard. The templates were made to the same scale as the layout drawing of the building. A notation consisting of the name of the machine or equipment represented, its serial number and, if it had a motor, the horsepower of the moter was printed on each template. The cardboard out of which the templates were cut was of different colors following a code depending upon the type of machine or equipment. Buff was used for partitions; yellow for new equipment; red for ovens and heat treating furnaces; and brown for storage equipment like shelves and racks. After the departments were laid out the templates were pinned in place with tacks of different colors which followed another code. An example is the use of an orange pin or tack for new machinery and a red one for old machinery. Colored string is often used to denote lines of conveyors and routes of operations on the layout board.

The job of laying out the individual departments was given to an engineer thoroughly acquainted with the equipment, the problems and the requirements of the department. For final layouts of some departments the engineer held consultations with other experts. The man responsible for a department may work for days without any appreciable results; but eventually the department will be put in an acceptable form on the layout board. To find the most efficient and final position for a template in a department involved numerous trials in which the templates of the machines, equipment and sometimes building partitions and entire departments were shifted around in a seemingly aimless pattern. The group of men setting up the plant layout work cooperatively in planning the individual departments that make up the plant. Although one man may not be responsible for more than one or possibly two departments the dependent association of the numerous departments in the plant make close cooperation necessary in planning.

The locations of the roads, ramps, truck transport docks, railroad docks and railroad spurs on the outside of the building offer a major problem that must be solved. Another problem to be worked out before any efficient manufacturing can be done is the handling of materials. This includes all storage before and after each separate department, the disposal of scrap from machining areas, the moving of all materials within the building and outside the building. When material arrives on a receiving department dock it must be stored; before it is worked on in any department it must be stored; after the cycle of operations

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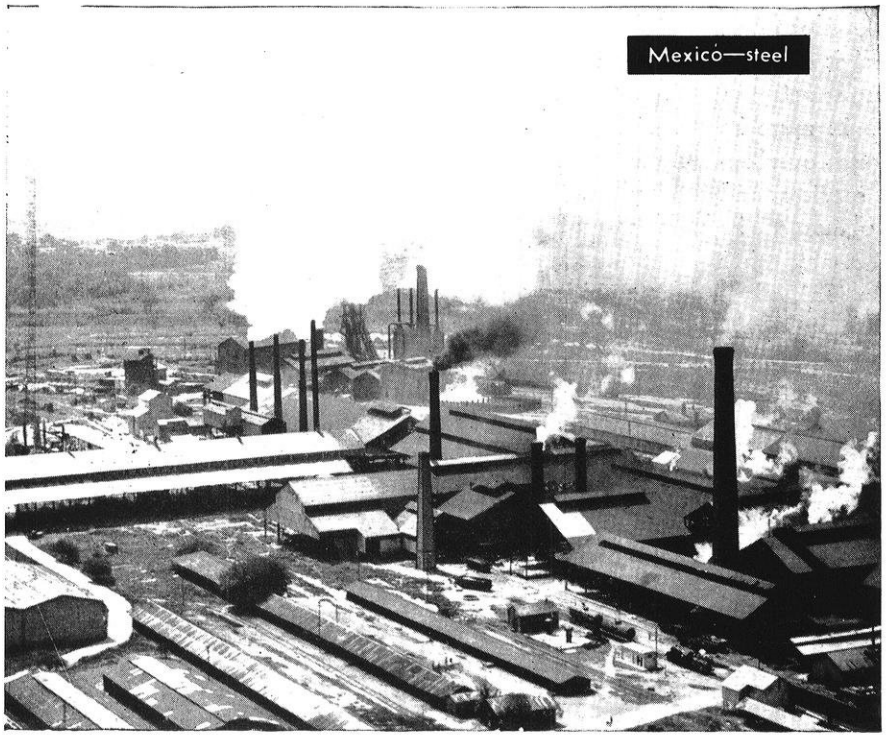
Thought Much About


Mexico—steel


Brazil—transportation

TODAY Latin America is closely linked to the United States by the common ideal of freedom. But Nature has also linked the countries together with physical ties. And today these two links are working together, building up a third — economic solidarity.

When the war first broke out, the Americas found themselves without many vital engineering materials vital to industry. Many of these were present in the Latin Americas, but they hadn't been built up. With the threat of the Axis, the countries had to look to each other for assistance. Even then, though, it was not a new idea; it was one for which some far-sighted Americans had worked hard and long. The dream has not been fulfilled to nth degree, but it is reaching out and causing much political unity among groups of nations.

Through the products of engineering, international services, and contacts of engineering companies and agencies, the Latin Americas are being aided in the building up of their natural resources.

There are twenty independent nations in Latin America, not including the United States. In Central America there are Costa Rica, El Salvador, Mexico, Nicaragua, Guatemala, Panama, and Honduras. Cuba, Haiti, and Dominican Republic are the three island countries. The other ten—Argentina, Brazil, Colombia, Venezuela, Paraguay, Uraguay, Chile, Peru, Bolivia, and Ecuador—are the republics of South America. Together these twenty nations have a combined area of over 8,000,000 square miles and a population of about 125,000,000 people. They, before the war, depended on the production of other countries. For instance, in 1940,

Latin America?

—June Hartnell, e'46

before production was restricted, they imported about thirty million dollars worth of electrical goods alone from the United States.

What is happening today to the Latin Americas might be compared to that in the United States before and during the industrial expansion. Before the war, the Latin Americas had been chiefly concerned with agriculture and mining; now the transition is being towards industry.

Perhaps the war opened the eyes of the Latin Americas; the realization of their dependency on other nations for supplies and goods was forced upon them; but also the realization of the possible potentialities in their own borders. A good example of this is the case of iron ore. Except as a medium of exchange, iron ore was of little value to them. Now they are mining their iron ore and sending it to their own steel mills for conversion into usable and needed materials.

In many essential commodities, Latin America could exceed the production of foreign countries. There is iron in Brazil, nickel in Cuba, tin in Bolivia, copper in Peru, meat and textiles in Argentina, oil and minerals in Mexico, more oil in Venezuela, nitrates in Chile. Electricity is as essential and as vital to the development of these natural resources as is water to the growth of a plant. International aid and collaboration can and is speeding the introduction of new skills and techniques needed to build, operate, and work the industries already established and being established.

The fact that all the Latin Americas are joined together now either with broken diplomatic relations or actually at war is bonding

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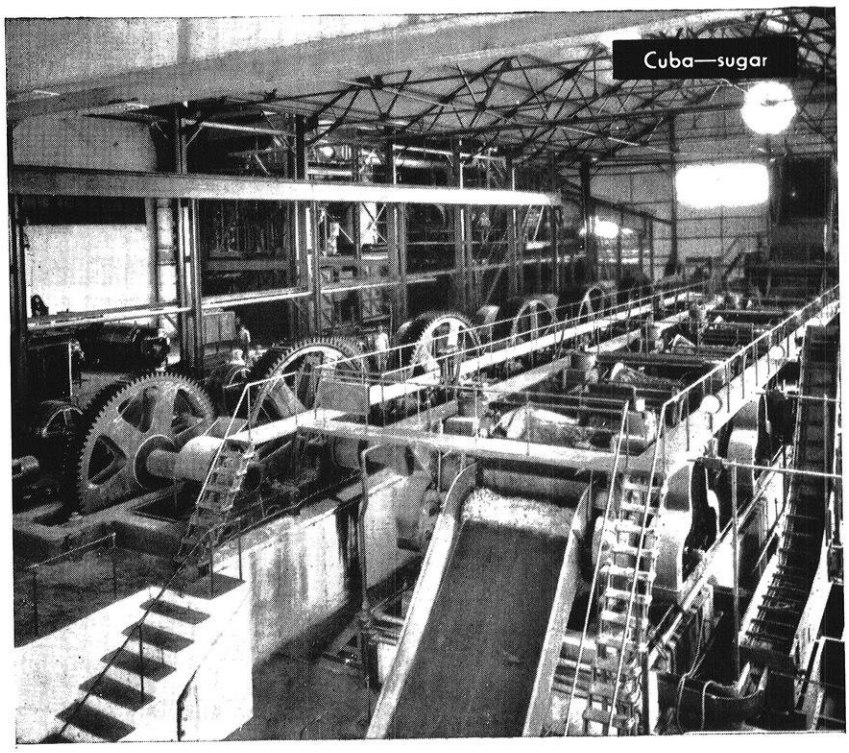


Cuba—sugar

Argentina—power generation

Expansion Valve Control of Refrigeration Systems

—*Gene Daniels, e'46*

CONTROL devices generally employed in refrigeration systems today include expansion valves, high and low pressure floats, and capillary tubes. With the increased use of hermetically sealed domestic units, float and capillary controls have particularly come into favor because of their low cost and adaptability to quantity production. They have their disadvantages, however; high pressure floats require that the total amount of refrigerant charge be kept constant within certain limits, too great a charge resulting in excessively high pressures. Capillary tubes are rather susceptible to clogging from dirt or sludge in the system and are rarely used for capacities over 1/4 ton (one ton of refrigeration is the heat required to melt one ton of ice per day).

The most versatile controls are the expansion valves. The two kinds of expansion valves which can be depended upon to give efficient control of systems ranging from 1/6 ton household boxes to 50 ton air conditioning jobs are the constant pressure or automatic valve and the constant superheat or thermostatic valve. Both are essentially the same in fundamental principle; a needle fitting tightly in an orifice, the stroke of the needle and, therefore, the effective area of the orifice being determined by an equilibrium of forces on the two sides of a gas-tight beryllium-copper or stainless steel diaphragm.

The Thermostatic Valve

This valve keeps the suction end of the evaporator at some pre-determined temperature, the superheat, above that corresponding to the pressure at its (the expansion valve) outlet. It is accomplished by having one of the forces above the diaphragm due to the pressure of some refrigerant charged in a feeler bulb connected to the head of the valve by three or four feet of capillary tubing. When the bulb is securely clamped to the suction end of the evaporator and perhaps insulated to reduce the effect of ampient temperature, the force above the diaphragm is the sum of the force of the loading spring and that due to the pressure of the bulb charge, now at the same temperature as the end of the evaporator. Underneath the diaphragm, the forces are due to the adjusting spring and the evaporator pressure. The thermostatic valve shown in Figure 1 has an adjusting spring at the bottom with which its superheat may be varied from about 0 to 30 degrees. Some valves are factory set and sealed at a superheat of 10 degrees, which has been found to give satisfactory performance when used on the average application.

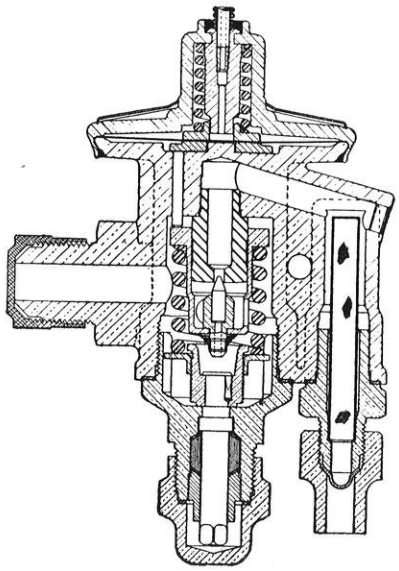


FIG. 1
Cross-Section of a Typical Thermostatic Valve

Figure 2 shows how a system equipped with a thermostatic expansion valve is operated by a pressure switch; when the pressure in the system rises sufficiently to close the contacts, the compressor starts and the pressure is reduced. The force underneath the diaphragm is thereby reduced, opening the valve and allowing refrigerant to flow into the system. When the feeler bulb is cooled, it begins to throttle the valve. Gradually the suction pressure is reduced and the pressure switch kicks out, completing the cycle. The pressure at which evaporation takes place in a thermostatic system is determined by the capacity of the condensing unit used and the load on the evaporator.

(continued on page 29)

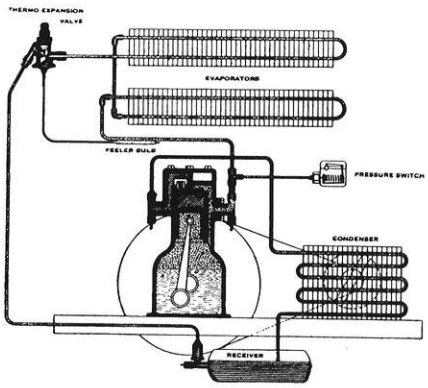
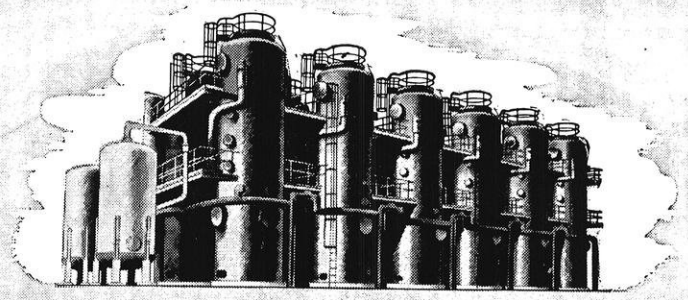


FIG. 2
Thermostatic Valve Application

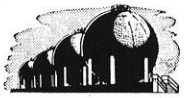


UNION CARBIDE *AGAIN* REPORTS

on the production of

BUTADIENE

for the Government's Synthetic Rubber Program



ONE OF THE MOST IMPORTANT factors in the Government's rubber program is the production of GR-S type synthetic rubber.

The basic chemical in this rubber is Butadiene, which can be made from alcohol or hydrocarbon materials.

The Government's original plan provided that about one third of the required Butadiene would be made by CARBIDE AND CARBON CHEMICALS CORPORATION'S alcohol process.

In 1943, their first year of operation, however, the plants using this process produced over 75 per cent of all Butadiene made for GR-S type synthetic rubber.

In 1944, the second year, these plants produced about 64 per cent of all Butadiene necessary for military and essential civilian rubber. This was true despite the fact that good progress had been made in the production of Butadiene by other processes.

THE RECORD

The first tank-car load of Butadiene was shipped from the Government's Carbide-built, Carbide-operated plant at Institute, West Virginia a little over two years ago.

This was just five months after the famous Baruch Committee Report pointed out this nation's desperate need for rubber—and approved Carbide's butadiene alcohol process, originally selected by Rubber Reserve Company, as one of the solutions.

In its first year the Institute plant, with a rated capacity of 80,000 tons per year, produced enough Butadiene for more than 90,000 long tons of synthetic rubber.

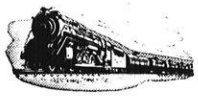
Two more great plants using Carbide's alcohol process—and built from the blueprints of the Institute plant—are in full production. One of these, with an annual rated capacity of 80,000 tons of Butadiene is located at Kobuta, Pennsylvania and is operated for the Government by another important chemical company.

The second, with a rated capacity of 60,000 tons a year, is operated for the Government by Carbide at Louisville, Kentucky—making the total rated capacity of the two huge plants now operated by Carbide 140,000 tons a year.

In 1944, the production of Butadiene from the three plants using the alcohol process totaled 361,000 tons—representing operation at over 164 per cent of rated capacity. An even higher rate is expected in 1945.

* * * * *

Before Pearl Harbor, the United States was a "have not" nation with respect to rubber. Now, thanks to American research, engineering and production skill, our country can take its place as a dominant factor among the great rubber producing nations of the world.



▼

Business men, technicians, teachers, and others are invited to send for the book P5 "Butadiene and Styrene for Buna S Synthetic Rubber from Grain Alcohol," which explains what these plants do, and what their place is in the Government's rubber program.

SEPTEMBER 10, 1942

"Of all the critical and strategic materials, rubber is the one which presents the greatest threat to the safety of our nation, and to the Allied Cause.... We find the situation to be so dangerous that unless corrective measures are taken immediately the country will face both a military and a civilian collapse."

—Report of the Rubber Survey Committee (Baruch Committee).

AUGUST 31, 1944

"Undoubtedly the outstanding achievement of your company has been the development of your process for the production of Butadiene from alcohol. With a rather meager background of experimental work, your engineers were able to design and construct commercial units for the production of Butadiene. In an exceedingly short time, the operation of this equipment at capacities up to 200 per cent of rating has been largely responsible for our present safe situation with respect to rubber supplies..."

—Letter from Rubber Director Bradley Dewey to CARBIDE AND CARBON CHEMICALS CORPORATION

The material herein has been reviewed and passed by the Rubber Reserve Company, the Defense Plant Corporation, and the War Department.

BUY UNITED STATES WAR BONDS AND STAMPS

UNION CARBIDE AND CARBON CORPORATION

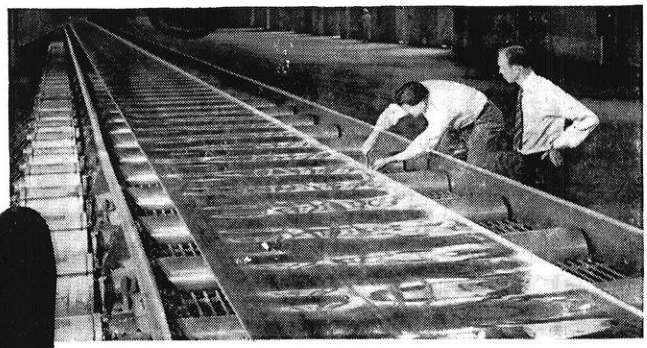
30 East 42nd Street UCC New York 17, N. Y.

Principal Units in the United States and their Products

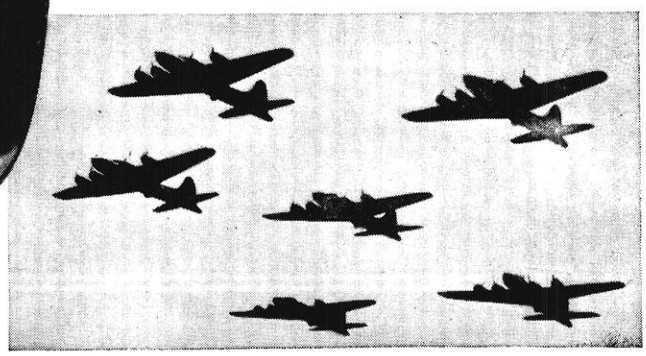
ALLOYS AND METALS—Electro Metallurgical Company, Haynes Stellite Company, Kemet Laboratories Company, Inc., United States Vanadium Corporation
CHEMICALS—Carbide and Carbon Chemicals Corporation **PLASTICS**—Bakelite Corporation **ELECTRODES, CARBONS & BATTERIES**—National Carbon Company, Inc.
INDUSTRIAL GASES AND CARBIDE—The Linde Air Products Company, The Oxweld Railroad Service Company, The Prest-O-Lite Company, Inc.

U.S. War Birds—

"Rivers" of aluminum, → magnesium, other vital war metals flow off U. S. production lines speeded by Allis-Chalmers Mercury Arc Rectifiers. Big boost for U. S. airpower!



'ave after Wave → U.S. warplanes now attack ir enemies—thanks to a ntiful aluminum supply!



Amazing story of a "laboratory curiosity" that became an Industrial Giant!

ONE OF THE GREAT miracles of this war—the rapid expansion of U.S. airpower—was performed with the help of a huge electronic device—the *Allis-Chalmers Mercury Arc Rectifier!*

First introduced to America in practicable form by Allis-Chalmers, the Mercury Arc Rectifier provided—in the nick of time—a fast, easy way to convert alternating to direct current for mass production of aluminum and magnesium for warplanes.

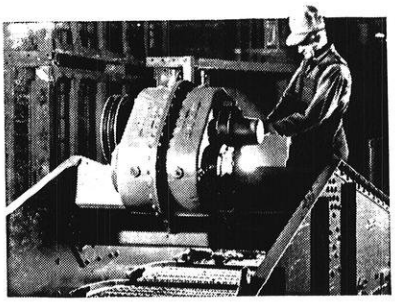
After war, the Mercury Arc Rectifier—*plus the other 1600 Allis-Chalmers products*—will help speed production of many things America needs and wants . . . will work for better peace-time living!

VICTORY NEWS

Better Pulpwood, More of It—With Less Manpower! Important help in reducing serious manpower shortages in the nation's pulp and paper industry is Allis-Chalmers' new Streambarker...a machine which removes bark from pulpwood logs quickly, thoroughly, economically by means of water under high pressure.

Streambarker does away with hand cleaning of wood, eliminates pulp loss from "brooming" of log ends, produces cleaner wood for pulp than is possible with older type barkers.

More Help for "Sink-Float" Plants: To facilitate wet screening and dewatering, Allis-Chalmers has designed a new End-Tension Deck for Low-Head Vibrating Screens.



New deck construction assures uniform depth of product and maximum use of screen surface for more efficient operation. Write for Bulletin B-6321.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

TUNE IN THE BOSTON SYMPHONY—

Allis-Chalmers' coast-to-coast radio program dedicated to the men and women of American Industry!

Hear the World's Finest Music by the World's Finest Concert Orchestra with Serge Koussevitzky conducting. Over the Blue Network, every Saturday, 8:30—9:30 P.M. (E.W.T.)

FOR VICTORY
Buy United States War Bonds

HALMERS

SUPPLYING THE WORLD'S LARGEST LINE OF MAJOR INDUSTRIAL EQUIPMENT

FLOUR AND SAW MILL EQUIPMENT

CHEMICAL PROCESS EQUIPMENT

CRUSHING, CEMENT & MINING MACHINERY

BOILER FEED WATER SERVICE

POWER FARMING MACHINERY

INDUSTRIAL TRACTORS & ROAD MACHINERY

Frequency Modulation

—Don Brewer, ee'46

THE term frequency modulation or FM is coming into more general use daily. Frequency modulation is a new type of high-fidelity radio transmission which may some day replace the present amplitude modulated form of transmission.

FM was invented by Major Edwin H. Armstrong, Professor of Electrical Engineering at Columbia University. It was patented in 1933 and in 1935 it was out of the experimental stage. The original purpose of the invention was not to eliminate static but to increase the possible number of stations that could operate and to put the ultra-high frequency range into practical use.

Through tests made from the top of the Empire State Building, it was found that more than one station could operate on the same or adjacent frequency band without interference or distortion provided one signal is at least twice as strong as any of the others. It was also found that reception was crystal clear and free from both atmospheric and man made noises.

The first FM station was an amateur station, W2AG, owned by C. R. Runyon of Yonkers, N. Y. A short time later a high powered station, W2XMN, was completed by Major Armstrong at Alpine, N. J. No wire line facilities were required to transmit the programs from the studio to the transmitter. The relay was accomplished by transmission of a low powered signal from the studio which was picked up and rebroadcast at high power at the transmitter.

The ordinary amplitude modulation receiver reproduces a range of 30 to 5,000 cycles out of the audible range of 30 to 15,000 cycles and thereby cuts out many musical overtones. This is why a radio "sounds like a radio." By FM the entire audio range can be reproduced with negligible distortion. For example, the Milwaukee Journal's FM station, WMFM, transmits with a modulation characteristic of a frequency response that is flat from 30 to 15,000 cycles with a variation of plus or minus ½ decibel. Distortion is less than 1% over the entire frequency range. This station operates at 50 kilowatts input to the transmission and the antenna radiates about 40 kilowatts.

The transmitted amplitude modulated wave is slightly distorted by a power supply hum causing a slight carrier hiss in the receiver. Since static is of the same character as the received signal, this is also reproduced in the receiver. The FM receiver picks up these distortions but the limiter tube cuts down the wave so that it has constant amplitude and all forms of amplitude modulation are eliminated before demodulation.

There has been considerable controversy over the practicability of FM. It has been argued that if FM were applied to the ultra-high frequency range it would also be free from noise and have the same high audio frequency response. It is true that atmospherics do not bother the ultra-high frequencies but many noises from man-made appliances extend into this range. It was also claimed that its range was limited to the horizon and would require the construction of many high cost transmitters. The rapid expansion of FM in the past few years seems to bear out the fact that the cost is not prohibitive.

The telephone business is now making extensive plans for both wire line and radio relay facilities for FM. They will make a nation-wide FM network possible. Many police and sheriffs' departments are already making use of FM facilities and there are good prospects of its use in the aircraft industry. FM is now being used for television sound channels and sight channel relaying. If present FM channels tend to become crowded it is probable that the higher frequencies in the micro-wave region will be put into use to provide again as many channels as are now used in radio.

AIEE—

A meeting was held on Friday, May 11. A movie, "Alcan Highway," was shown. Nomination of officers was held. On June 1, the following were elected:

President: Gerald Keppert

Secretary-Treasurer: Eugene Daniels

Polygon Board: Keppert, Gabriels

U. S. Marine Corps Photo

Combat wire moving up in a hurry!

Every unit ties in by telephone to report on contact between companies, and to discuss the next move. That means combat telephone wires must be laid down with every forward push. And communications crews must work continuously repairing breaks in lines torn by tanks and amphibians and blasted by artillery and mortars. Our Armed Forces still have urgent need for huge quantities of communications equipment of all kinds. That's why there is a wait for home telephone service.

BELL TELEPHONE SYSTEM

"Service to the Nation in Peace and War"

Alumni Notes

—Ralph Watson, m&m'46

EDITOR'S NOTE: Because some people seemed disturbed about the apparently hap-hazard form this column has exhibited in the last few issues, an explanation is due. Alumni are indexed first by year of graduation, then alphabetically; the most recent graduates last. We hope this method will help you to find your classmates' names more easily, but your criticism is invited.

•

Mining and Metallurgicals

SWANSON, DARWIN, '40, is now a Major flying with the AAF in Italy. He took part in the strategic bombing of Austria and the Ploesti oil fields.

LYONS, EUGENE (PAT), '43, has received his commission as Lieutenant (j.g.) USNR, and reported to the Norfolk Navy Yard for further training. He is expecting sea duty in the near future. We expect him to build a record at sea as excellent as he did on the gridiron.

•

Electricals

HUBBARD, EDWIN P., '07, died at the Veterans' Hospital in Milwaukee on March 13, following a long illness.

VEA, OLAF F., '36, has been placed in charge of a newly created Marketing and Promotion Section of General Electric's Motor division. He has been with the company since 1936.

RUNSTROM, GEORGE A., '41, Lt. (j.g.) USNR, has been assigned to testing of mines and torpedoes at the Solomons, Md., testing grounds. Mrs. Runstrom, the former Josephine Aspenleiter of Mount Vernon, N. Y., recently presented him with a new daughter, Martha Jo.

NESVIG, LT. ELLIOTT, USA, is in the Canal Zone.

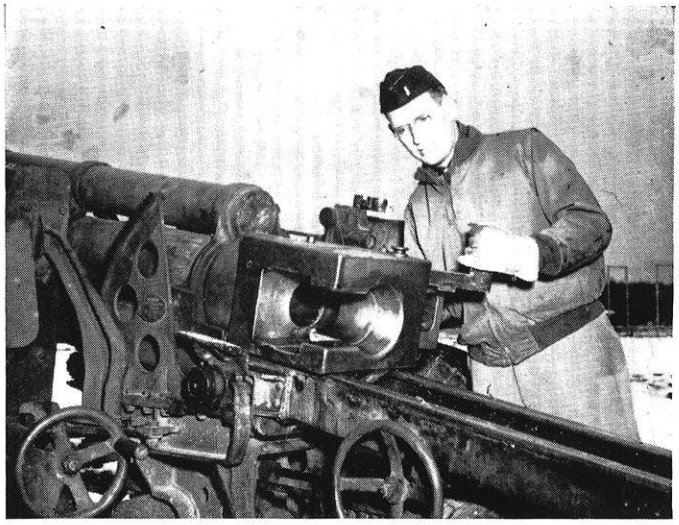
NETTESHEIM, LT. HENRY, USA, of the army signal corps is stationed at Allbrook Field in the Canal Zone.

LAMB, EARL R., is stationed at Navy Pier, Chicago, studying radio. He has applied for transfer to V-7, officer's training. He reports that the following men are also in radio training at Chicago: **HAL BOETTCHER, CLYDE MEERDINK, RUSS VANDERMUS, JACK DOYLE, DICK MILLER, CLARENCE RIEDERER, NORMAN KOHLHARDT, JOHN TANGHE,** and **BOB LAWRENCE.**

•

Mechanicals

WARREN, GLENN B., '19, has charge of General Electric's expanding Turbine Department. The thesis he presented for his degree dealing with gas turbines has recently been reviewed by a large manufacturer.



Lt. George M. Kuetemeyer

HANSON, EARL P., '22, will be with the American Embassy at Monrovia, Liberia, as head of a U. S. mission for the next two years. While at the University he assisted in establishing the radio station WHA, "the oldest station in the nation," on this campus. He was also its first broadcaster. Later he was radio man with Admiral Richard Byrd at Little America in the Antarctic.

IMMERFALL, RAY, '40, is in the engineering department of the Wright Aeronautical Corp., Patterson, N. J.

KUETEMEYER, LT. GEORGE M., '41, is assigned as Development Officer working on howitzer ammunition at the world's largest ordnance research and development center, the army's Aberdeen Proving Ground, Md.

WAGNER, CAPT. WALTER J., '41, risked his life to save a B-24 Liberator bomber from destruction. At his 15th AAF base in Italy a fuel truck caught afire while refueling the bomber. Capt. Wagner moved the flaming truck to a safe distance.

LIVERMORE, DONALD F., '43, is with the General Electric Co. at Schenectady. His engagement to Miss Elizabeth Scott of Schenectady has been announced.

PETERSON, GARFIELD E., '43, was reported killed in Europe last February.

ENGLE, ENS. D. G., '44, is Assistant Engineer on the U.S.S. Valencia.

LANGRILL, ENS. WILLIAM, '44, has been ordered to the U.S.S. Tazwell as Assistant Engineer.

DE PATRE, ENS. FRANK, '44, is serving as Assistant Engineer on the U.S.S. Independence.

Chemicals

FOURNESS, CHARLES A. (BERT), '14, has been with the Kimberly-Clark Co. since his graduation. He recently wrote an article in the plant paper, "Where the Creped Wadding Staff Fits In," one of a series pointing out the basic functions of various plant departments.

HAINES, FRED W., '20, has been elected vice president of the Cleaver-Brooks Co. of Milwaukee.

DAMON, GLENN H., Ph.D. '32, has taken a position with the Carbide and Carbon Chemicals Corp.

WILLIAMS, GORDON C., Ph.D. '35, is taking consulting work as well as continuing in his position as assistant professor of Chemical Engineering at the University of Louisville.

HOIBERG, ARNOLD J., Ph.D. '37, is with the Loin Oil Refining Co., El Dorado, Ark.

SCHULEIN, JOSEPH, '38, electrochemical consultant and instructor in Chemical Engineering at Oregon State College, recently wrote a thought provoking article on the economic status of Chemical Engineers. It has been published by several local sections of the A.Ch.S. and has aroused much comment.

ACKERMAN, DAL V., '41, with the Du Pont Co. since graduation, has been assigned to powder production at Carney's Point Works, N. J., as shift supervisor.

HADDOCK, GORDON W., '43, is with the National Advisory Committee for Aeronautics at Cleveland, Ohio.

(continued on page 22)

ALUMNI NOTES . . .

(continued from page 20)

HOEKSTRA, IRENUS A., '43, is a research engineer with the Niagara Alkali Co., Niagara Falls, N. Y.

OTTERSON, EDWARD (BUZZ), '43, is working on the development and production of a new type of dry cell for the RMR Corp. here in Madison.

WALSTAD, JUSTIN, '43, is a radio technician in the navy and is also assigned to the RMR Corp.

JACOBSON, WILLIAM, '44, formerly associate editor of the ENGINEER, was recently commissioned at the U. S. Naval Academy. Ensign Jacobson has been assigned to radar training at Bowdoin and M.I.T.

PUFAHL, ALBERT E., Ph.D. '44, has been doing development work with the Carbide and Carbon Chemicals Corp. at South Charleston, W. Va.

WILKE, CHARLES R., Ph.D. '44, is assistant Plant Process Engineer for the Union Oil Co. of California.

DONAHOE, ROBERT J., who was called into service at the end of his freshman year, has been reported missing in action in Germany.

GRIFFITH, LT. ROBERT L., of hospital entertainment fame, is home on furlough from Italy. He will report to Miami, Fla., for reassignment.

McNALL, ENS. PRESTON E. (SANDY), son of Prof. P. E. McNall, is with the Seabees in the Pacific. He was recently commissioned at Camp Endicott, R. I.

SCHINASI, SEYMOUR B., sophomore here in 1942-43, was reported killed in action in Germany on March 2.

●

Civils

BOND, COL. AUBREY H., c'17, has been in Puerto Rico since May, 1944, in charge of design, maintenance, and construction of all military structures, airfields, and utilities from Cuba to French Guiana. He has been with the Corps of Engineers, USA, since shortly after his graduation.

HUNTZICHER, PAUL, c'19, died of a heart attack in February in Denver, where he was an engineer with A. R. Wilfley & Sons.

FIELD, GEORGE H., c'25, has been appointed head of the Bureau of Community Facilities of the Federal Works Agency. He had been FWA regional director for a group of five states in the Middle West.

HARMS, LAYTON R., c'25, sales engineer for Worden-Allen Company, has been elected president of the Builders' Exchange of Milwaukee.

JOHNSON, WAYNE W., c'37, engineer with the Madison Metropolitan Sewerage District, announces the arrival of Wayne Junior on April 10.

VIEREG, DONALD A., c'38, is captain and engineer officer in the 410th light bombardment group, 9th AAF, on the Western Front in Europe.

VON GUNTEN, GLENN H., c'38, is structural designer with the U. S. Engineers at the Baltimore office.

YERGES, LYLE F., c'38, has been discharged from the army because of a back injury incurred while in training for a commission, and has returned to the U. S. Gypsum Company at Chicago, as manager of the acoustical department.

WILKE, RICHARD W., c'43, is a lieutenant with the 1062 Engineer Forestry Rgt., APO 350, N. Y.

Sophomore Honors

Dean Johnson recently announced the awarding of the following Sophomore honors:

HIGH HONORS

Chemical Engineering:

Fischer, Edwin F. 2.676

Electrical Engineering:

Hartnel, June 2.873
Laubenstein, Richard A. 2.731
Bunn, George B. 2.743

Mechanical Engineering:

Hlavka, George E. 2.928
Allison, Dean M. 2.731
Hyzer, Donald V. 2.597

HONORS

Chemical Engineering:

Smythe, Lowell J. 2.636

Civil Engineering:

West, Robert P. 2.375

Electrical Engineering:

Miller, Robert F. 2.515
Jordan, Howard E. 2.493
Gausewitz, Richard L. 2.366
Teuscher, John 2.225
Green, Donald G. 2.182

Mechanical Engineering:

Marichal, Robert R. 2.549
Heinrich, Richard L. 2.534
Clayton, Robert T. 2.479
Smith, Mildred 2.420
Hunsaker, Oral K. 2.379
Smith, Bruce C. 2.338
Matthews, Eugene R. 2.329

These honors were for the 1944 March, July, and November terms.

"And It Comes Out Here"

Short Circuits

—Fran Tennis
Bob Clayton *me'46s*

A pinch of salt can be greatly improved by the addition of a stein of beer.

•

"But, Papa, if God makes some girls brunettes, and makes some girls blondes, who makes the red-headed girls?"

"You know?" replied the Papa absently, "I've often wondered."

•

Did you hear about the little moron who transferred from O. U. to A. & M. and raised the I. Q. of both colleges?

•

Wisconsin U. Lecturer: "Here's an argument from nature. If I lead a donkey to a pail of water and to a pail of beer, which will he drink?"

Student: "The water."

Lecturer: "Right. Why?"

Student: "Well, don't you like beer?"

•

Of all the fishes in the seas,
My favorite is the bass.
He climbs up into sea-weed trees,
And slides down on his hands and knees.

•

A violinist entered a little music shop in London.

"I want an E-string, if you please."

Nervously producing a box from behind the counter, the cockney clerk said, "Would you mind pickin' one out for yourself. Y'know, I 'ardly can tell the 'e's from the she's."

•

Pastor: "Are you troubled with improper thoughts?"

Sinner: "Naw, I rather enjoy 'em."

•

Englishman: "I say, what are they doing?"

American: "They're dancing."

Englishman: "They get married later, don't they?"

•

A genealogist was employed by Mrs. Newrish, to work out an impressive family tree for her. The only ancestor on record turned out to be noteworthy by virtue of having been electrocuted for a crime.

After some thought, the genealogist finally reported to his employer that her ancestor had "occupied the chair of applied electricity at one of our better-known public institutions."

Sat., 8 a.m.: Willoughby: "When the room settles down I will begin my lecture."

Rickner's bright boy: "Why not try a Bromo?"

•

"So I says to her, please honey, don't be difficult, one obstacle course in a week is enough for me."

•

A fellow lawyer we know has a broken arm which he received fighting for a woman's honor—it seems that she wanted to keep it.

•

Civilian: "How perfectly splendid to think you're one of our heroes who went over there to die for your country."

Salty: "Like hell I did, ma'm! I went over there to make some other guy die for his."

•

Found: Woman's bag left in my parked car. If owner will pay for this advertisement she can have it. If she will tell my wife how bag happened to be there, I'll pay cost of advertisement. Telephone Jefferson 8800—the quicker the better.

•

Soph: "Why is it that gentlemen prefer blondes?"

Frosh: "I'll bite; why is it?"

Soph: "Where there's light, there's heat."

•

Co-ed to Roommate: "I don't care much for that engineer you have been dating lately. He whistles dirty songs."

•

A college student is one who enters his alma mater as a freshman, dressed in green, and emerges as a senior in black. The intermediate process of decay is known as a college education.

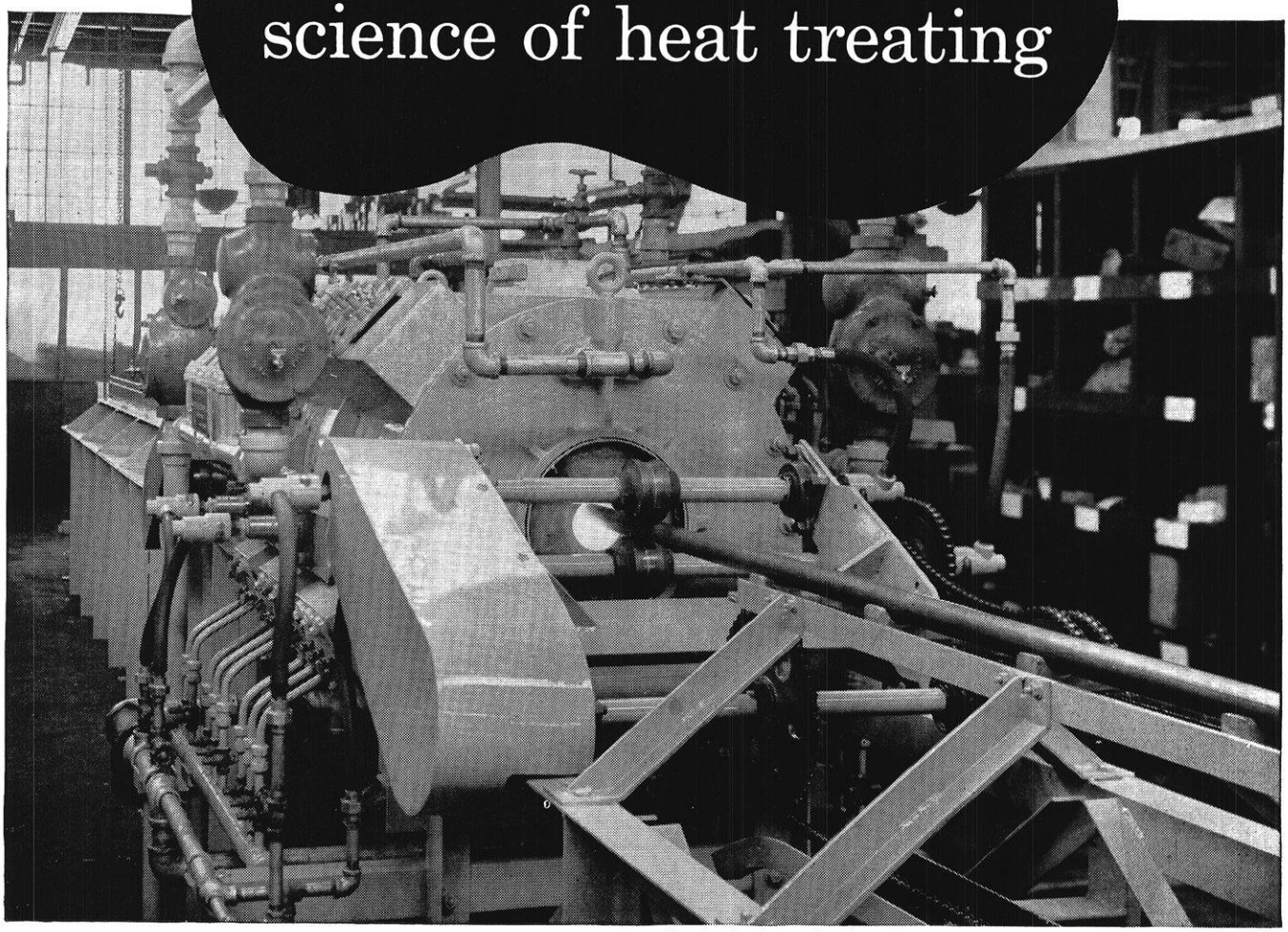
•

The big day was on. The wonderful, gigantic bridge was being formally opened. At the height of the festivities when thousands of people had thronged onto the bridge, the center span—with a crash heard for miles—fell into the bay, a mass of twisted girders and human bodies. The frenzied mayor, seeing the engineer, dashed up to him. "Look what you have done."

The engineer, scratching his ear, replied, "I told Creech that decimal point was in the wrong place."

(more — can you find it?)

How Gas advances the science of heat treating



Gas-fired rod annealing furnace; photo courtesy of Selas Corporation of America

Research in Gas application, through the ceaseless study and experiment of equipment manufacturers, independent laboratories and the facilities of the American Gas Association, is constantly producing improvements and new departures in the application of heat, industrially.

For example, heat treating of metal rods in batch furnaces has certain disadvantages, particularly that of uneven heating throughout the bundle of rods. A group of engineers recently perfected a continuous-flow type Gas-fired furnace with a ceramic heating unit capable of intense, focussed heat, and closely fitted to the shape of the work in progress.

There are many advantages to this new Gas technique for annealing. For instance, one inch rod stock passing through a six foot furnace of the new type can be heated and quenched at a rate of 12 feet per minute, no section of the metal remaining under heat more than thirty seconds—against 2½ hours in a batch furnace. Furthermore, better uniformity of heating is achieved; scaling, distortion, decarburization are minimized. Floor space of the new furnace is 24 square feet against several hundred feet for the older type. Over-all costs are also considerably reduced.

Local Gas Companies help make these new benefits of Gas and Gas Equipment available to industry through the services of skilled Industrial Gas Engineers, who are available for consultation without obligation.

BUY WAR BONDS—HELP SPEED VICTORY!

AMERICAN GAS ASSOCIATION
INDUSTRIAL AND COMMERCIAL GAS SECTION
420 LEXINGTON AVENUE, NEW YORK 17, N.Y.

THE TREND IS TO GAS

FOR ALL
INDUSTRIAL HEATING

Preparation — Exams

WOMEN IN MEDICAL RESEARCH . . .

(continued from page 10)

penicillin. The ability to cure just one of these cancers to mankind would be enough to show that it is worthy of study.

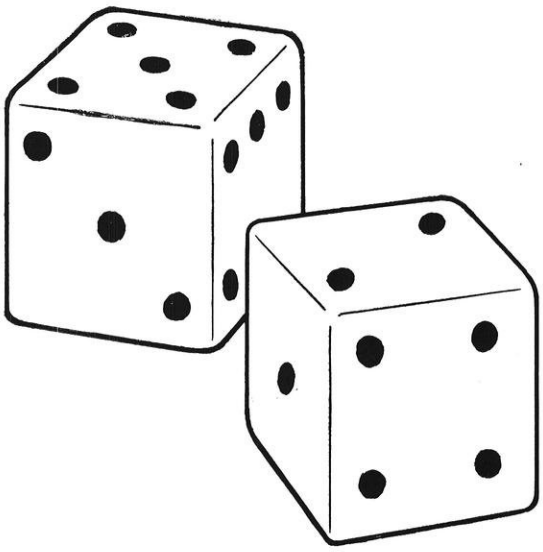
Another valuable property of penicillin is the fact that it comes from a source that is cheap and plentiful. There will be no danger of its becoming scarce as has happened in the case of quinine. We need not worry about the enemy buying or capturing all sources of its supply because bread and cheese will continue to form mold as long as there is life on the earth to use it.

A few months ago an incident occurred which very nearly became a subject of nation-wide controversy. A young child needed penicillin treatments to save her life. As the government has complete control of its distribution and use it was impossible for the family or doctor of the child to obtain any for her use. Almost immediately after the plea was made for the release of enough of this drug to save her, newspaper editors all over the country began to take sides in the matter. Some stated that the government was neglecting to give the civilian population proper attention, while others argued that the armed services should come first. Then came the big question—which should be saved first, one of the young men of the present generation, or a child, a potential leader of the coming generation? Yes, it is a hard question, but with the young women now in high school lies the ability to make such a question unnecessary and not even worthy of mention. Studying the eccentricities and irregularities of this sought-after drug will make it possible for it to be produced on such a large scale that it will be available for everyone.

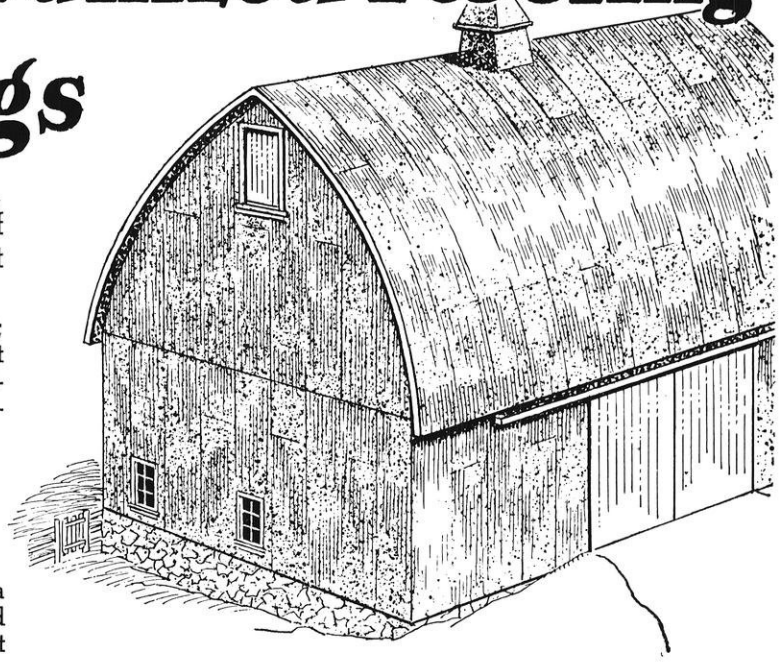
It is not known how it is that penicillin is able to do all the wonderful things it does, but it has been found that it is a complex chemical. There is a hope, remote perhaps, but nonetheless a hope, that there is a way in which it can be made artificially. This will be no simple task but if it is possible, it would be worth all the labor and expense necessary. Synthesis is a marvelous science that America is just beginning to realize. With the right kind of trained workers in large enough numbers, it may be that penicillin can be made in great enough quantity, that is, can be released for civilian use before the war is over.

And how is this going to be done?

It can and will be done by the young women and the few remaining men in the high schools today and the colleges tomorrow. Saving life is far more important than destroying it. Let us hope that soon more and more people will come to realize this. Then it will be that we shall go ahead and delve deep into the wonders of science and find more ways of relieving the world of pain.



It's GOOD LUCK *to have Galvanized Roofing on Buildings*



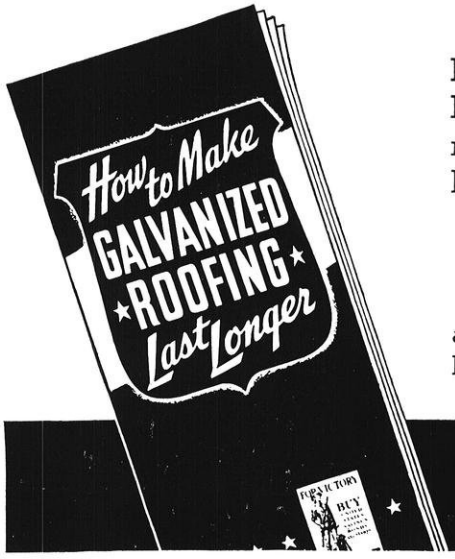
For in these days of material scarcities, galvanized roofing can be taken care of by simple, easy means and made to last a lifetime.

Galvanized roofing is zinc-coated roofing; and the U. S. Bureau of Standards states that zinc is "by far the best" protective metallic coating for iron or steel! Zinc in the form of galvanizing provides double protection:

First, by simple coverage, with a sheath of rust-resistant metal.

Second, by electro-chemical action or "sacrificial corrosion."

Galvanized roofing is used on more than a third of all the farm buildings in the United States — which proves that farmers are smart judges of roofing value!



Take Care Of It!

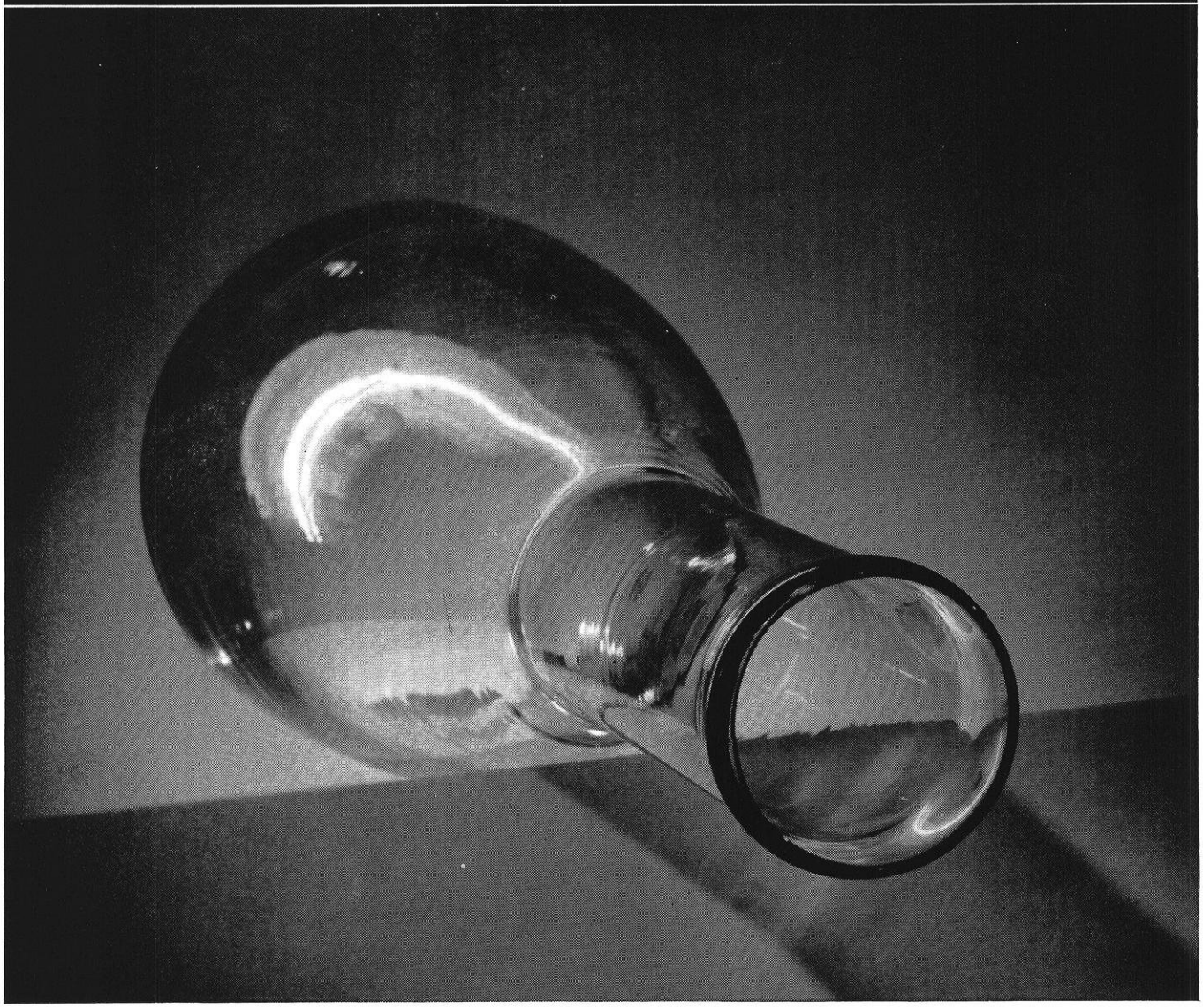
It's just good business to take good care of galvanized roofing. It is so easy to do it, too, that there's no excuse for neglect. With reasonable care, galvanized roofing can be made to give a lifetime of satisfactory service. Get a copy of the free booklet

"How to Make Galvanized Roofing Last Longer"

and the few simple steps to take will be made completely clear. The booklet is valuable. It's free—write for it today.

American Zinc Institute
INCORPORATED
60 East 42nd Street, New York 17, N.Y.

How many lives is a glass bulb worth?



NO, it isn't a gun or a new-style bomb. It's just about all we can show you of a special glass radio bulb that is a part of our secret military apparatus.

At one stage in the war a high-ranking officer stated that a bulb of this type was so valuable and effective that he would risk the lives of five soldiers to keep it in operation. That's something to think about. And it's one reason why you find Corning men and women today striving to surpass quality standards that are already exacting.

This bulb is made of a special glass to very strict requirements. And so are most of the articles Corning is making for the Army and Navy and other services. They cover a wide range—from airplane wingtip lights to giant field marking beacon lenses. From laboratory ware for hospitals to optical glass for gunsights. From tough glass messware to thimblesize tubes for field radios.

And these are but a few of hundreds of items that Corning is making for the military services in addition to glassware for industries that supply chemicals and clothing, food, powder, rubber, and gasoline! In these fields and in many others Corning's deep knowledge of glass and glassmaking has made it possible to put this fairly plentiful material to work, not merely as a substitute, but as a new material capable of standing on its own feet and delivering better service in many instances than the one it replaces. Keep this in mind when the peacetime developments you will be working on, reach the blueprint stage—glass is amazingly versatile in the hands of people who know glass. And Corning has spent nearly a century getting acquainted with it. So, when you get to those blueprints, write us. Corning Glass Works, Corning, New York.

CORNING
means
Research in Glass

REFRIGERATION . . .

(continued from page 14)

The Automatic Valve

Here, the forces in balance are the atmospheric pressure and a stiff adjustable spring above the diaphragm and those due to system pressure and a balancing spring underneath. The valve is set at a pressure slightly higher than that required for operation by turning the adjusting knob, thus compressing the adjusting spring. A differential of two or three pounds below this opening pressure may be necessary to disturb the spring forces enough to obtain the required valve stroke (.008 to .016 approx.) depending on the sensitivity.

In operation, when the thermostat has become warm enough to close the contact in the control switch, the compressor starts lowering the pressure in the evaporator. The force below the diaphragm is therefore decreased and the valve opens, allowing refrigerant to flow into the evaporator.

Any tendency for pressure change is counteracted by a repositioning of the needle. With this type of valve, the capacity of the condensing unit and the load on the coil determines the amount of superheat that the gas picks up in the coil. Objectionable frost-back may be eliminated by operating the valve at a lower pressure. This has the effect of decreasing machine capacity since the lower pressure gas is less dense so fewer pounds of refrigerant per minute will be circulated through the system.

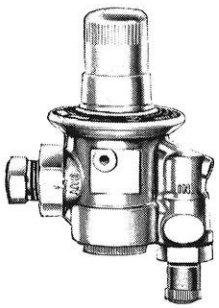


FIG. 3
Automatic Expansion Valve

The design of these valves presents numerous problems to the engineer. Since the pressure-temperature relations are different for all refrigerants, valves must be designed accordingly using different spring stiffnesses and bulb charges. The thermostatic valve shown is "cross charged"; freon-12 valves have bulbs charged with methyl chloride, methyl chloride valves with sulfur dioxide, and sulfur dioxide valves are charged with isobutane. (Due to the characteristics of sulfur dioxide and isobutane, it has been found that no loading spring is needed in sulfur valves.) Valve head, bulb, and charge volumes must be determined so that some liquid remains in the bulb at all times or the valve will lose control, at the same time keeping bulb size and charge to a minimum for quick response. The needle must seal off on the off cycle to prevent the leakage of refrigerant into the evaporator. All internal parts must be made of materials selected to withstand wear and the corroding action of the refrigerant for which it is designed. The valve bodies must be forgings or good quality gas-tight castings; pressures up to 200 psi may be encountered with freon-22 (monochlorodifluoromethane), a fairly new refrigerant especially adapted for low temperature work. Needle hunting and valve friction must be small. This is especially important on pressures at controlled applications where a needle hunt might momentarily reduce the pressure below cut-off. Orifice size, needle angle, valve sensitivity, and diaphragm snap (the diaphragm exerts a force, too) are other worries.

New difficulties are bound to arise, even in a product that has been sold by the thousands for years. In refrigeration, they are best solved by design and development engineers well grounded in fluid flow, thermodynamics, and heat transmission, and with fifty or sixty years' practical experience working in complete harmony (the engineers). A little refereeing by the chief engineer who has his mind on costs and production doesn't hurt either.

—Cuts Courtesy Automatic Products Co., Milwaukee

ENGINEERING WORLD . . .

(continued from page 7)

electric charge and the particles unite in clots; that is, they coagulate, characteristic of the souring of milk.

Under this subject of colloids could come an explanation of many other common, everyday chemical happenings in the food field, such as whipped cream being a colloidal system of air dispersed in a liquid; a difference between butter and cream (now we ask, what did butter look like?); why French dressing is usually prepared immediately before using. Many other things could also be mentioned.

Although at the present time, it may seem to many that all engineering is being done along the lines of research and building of war equipment and material, an important engineering field contains work in such seemingly unimportant lines as that pertaining to the science of everyday living.

He: "We're having a party tonight; won't you come along?"

She: "Oh, I can't. I haven't a thing to wear."

He: "That's all right. I'll get you a blind date."

•

"They say you can tell a girl's character by her clothes."

"Nonsense. I'm sure the girls have more character than that."

•

Prof. Mills: "Are you smoking back there?"

Mech. student: "No sir, that's just the fog I'm in."

"And believe me, you lop-sided, mutton-headed, goofus-brained set of certified rolling pins, that day has come."

LATIN-AMERICA . . .

(continued from page 13)

them closer together. And such a military alliance is having a big effect on the outcome of the war.

Friendly relations between countries is as essential to winning a war as putting an army on the field. Friendliness leads to cooperation and uniting in a common cause.

Although Latin America cannot put a big army on the field, they are making great contributions to final victory. Their navies patrol the coasts, alert for submarines. Ports are open to ships of the United Nations. Valuable, strategic air bases are available. There is also the building of the southern section of the Pan-American Highway, of greatest military and economic importance. When finished this highway will run 16,000 miles stretched from Alaska to Buenos Aires and Rio. The highway is being rushed to completion, much of the cost being financed through loans from the United States. When finished, the importance of boundaries will be minimized, east-west roads will be connected and trade and production will be facilitated.

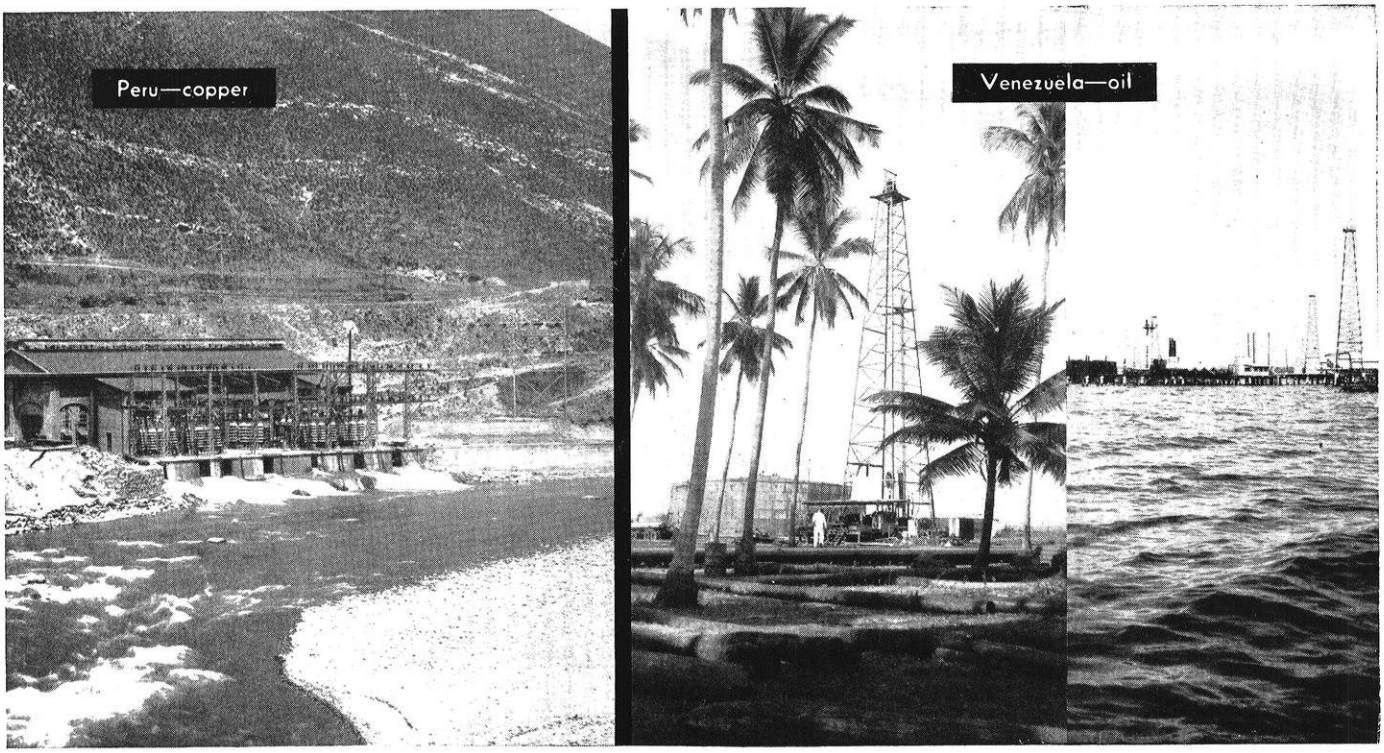
Although the war has been a big stimulus toward this economic collaboration, work toward this end began even before the war added its impetus. Perhaps the most outstanding is the Pan-American Union, created in 1890. It was established to gather, tabulate, and publish information concerning laws, customs, production, commerce, and regulations of the various countries in the Western Hemisphere. However, it has also worked on arbitration, conciliation, and the forming of closer ties between nations. Besides the Pan-American Union, there has also been the Pan-American Society, the Inter-American Relations Committee, and others.

One important part of this collaboration is the Inter-American Trade Scholarship, begun in 1941. The object of this program is to provide practical training and experience for men of the Americas who are engaged in work in those fields important to the national economies of their countries. Such a program brought not only increased national economy, but also an insight into the problems, opportunities, culture, background of the other republics. Future industrialists gained important and valuable information. Manpower reached a higher and better degree of operating efficiency. The program brought the Latin Americans to the United States, put them in industry where they "earned while they learned," and finally sent them back to their respective countries to apply the knowledge and experience gained. One such program is being carried out at General Electric, such as placing Latin Americans for practical training in electricity.

Economic development in Latin America, spurred on by the war and being tuned now for the present uses and needs of war, is carrying and should carry on in the post-war period to a higher and more glorious development of Pan-American civilization and resources.

The day will come when the Americas are closely tied together. The present war has speeded up that day. Perhaps the peace following will make it reality—a solid front of a high degree of development in education, industry, and democracy.

—Cuts Courtesy General Electric

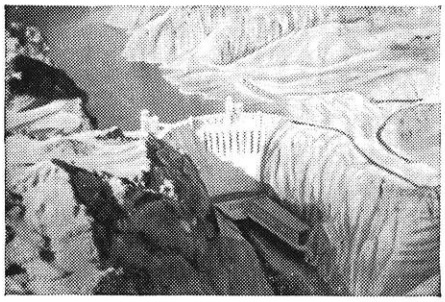


COMING YOUR WAY

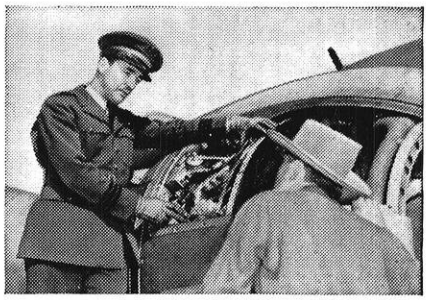
A New Kind of Horsepower is Changing Your World

This is the story of what is likely the biggest thing that has happened in our time . . . of a new kind of power spreading throughout the world . . . of a new force affecting our lives, our outlooks, and our incomes as perhaps only electricity has done since the turn of the century.

1. Under the wing of a giant Lockheed Constellation, in the shadow of one of the big ship's four Wright Cyclones, two men talk. One is a veteran airline pilot who lives and works in a world most people haven't yet begun to know or understand or even to imagine! The other, a man who has seen a whole vast western section of America change in his lifetime as if by magic!



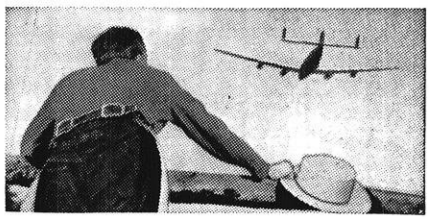
2. The Westerner operates a ranch that was literally made possible by power — electricity and irrigation from the great Boulder Dam harnessing the Colorado River. Power which made possible the conversion of millions of acres of barren wilderness into fertile ranches and farms!



3. No wonder he's eager to hear the pilot tell of a new super-power — such as that of the Wright Cyclone . . . the engine which speeds the great Boeing B-29 Superfortress across the air miles to Tokyo . . . power that makes possible a trans-Atlantic flight every 13 minutes.

4. Most efficient power plant in the world, today's Wright Cyclone packs a horsepower into less than a pound of metal. Four Cyclones develop more power than the mightiest locomotive operating in the Rocky Mountains . . . and already this new power is changing ranches and farms, business and homes . . .

5. These Cyclones help make possible the operation of U. S. transport planes over more than 110,000 miles of global air routes. For example, 1,800 cargo shipments daily leave a single U. S. airport, and millions of miles are daily flown by U. S. airlines and the Air Commands of our armed services.



6. Carrying our men, materials, ideals to the corners of the earth — breaking down barriers of distance — the Cyclone power of American aviation is changing the world you live in...right over your head!

LOOK TO THE SKY, AMERICA!

CURTISS WRIGHT

AIRPLANES • ENGINES • PROPELLERS

[AVIATION OFFERS A BRIGHT FUTURE FOR COLLEGE ENGINEERS: WRITE ENGINEERING PERSONNEL BUREAU, CURTISS-WRIGHT CORPORATION, PASSAIC, N. J.]

WAR PLANT . . .

(continued from page 11)

on the material is completed in that particular department it must be stored. If by chance the storage space is overcrowded or not large enough the production of the department suffers as does the production of the entire plant.

The overhead storage conveyor of the monorail type is a solution to both the storage problem and the materials handling problem. The flight, or overhead, conveyor is of great value in the shipping and receiving departments. A belt or chain conveyor laid under the floor was the answer to the aluminum chip problem. This endless belt or chain carried the aluminum chips from the machining areas to the chip crusher.

To obtain a high percentage of efficiency from the employees clean air is an essential factor in modern plants. The heating and air conditioning engineers in planning this factory laid out all the facilities that were required to condition the air. Large wash rooms, toilet rooms, lunch rooms and stairways were provided for on the layout board and planned well within the limits of the industrial building code of the state. The work aisles, the truck aisles and pedestrian aisles were laid out with safety as a primary factor. The offices of the inspectors, government men, and superintendents and foremen were placed in a centrally located area. The hospital rooms were also planned in this area because they would then be only a short distance from all parts of the plant. Lunch counters served by a large central kitchen were planned. A warm lunch is a step up the ladder towards top production efficiency.

The rough machining and the finish machining departments were laid out by using templates of machines that had been used for a similar purpose by a company producing cylinder heads at that time. The routes of operations for the machining and inspection departments were also obtained from this company. The paint and heat treat department engineer after studying the methods of other cylinder head manufacturers planned the cylinder paint and heat treat department using modern ovens for treating and systems of conveyors for handling and cooling. Following the same procedure the maintenance, assembly, tool crib, tool grind and inspection departments were laid out in template form on the layout board.

After all the machines and equipment had been placed on the layout board in their final positions the electrical engineer of the engineering department was able to compute the electrical power needed for the entire plant and the facilities to handle the electricity.

Some changes had to be planned in parts of the present factory outside the area to be sold to the government. The enlargement of the receiving and inspection departments to accommodate the increase of materials due to the new plant was an example of this. The change was planned with the supplementary help of the supervisors of the departments to be enlarged and rearranged. An important job that came up related to the receiving department was laying out a monorail conveyor from the receiving docks in the company's plant through two factory buildings and finally into the proposed cylinder head plant. The many problems that the conveyor offered were solved by experts on material handling within a short time.

When all the departments in the proposed plant were satisfactorily laid out on the layout board, a drawing was carefully made of the entire layout. These prints showing everything that was necessary for efficient production of the cylinder heads were sent to architectural engineering firms. This was done to obtain sets of structural drawings of the buildings that were to be built to house the manufacture of the forged aluminum cylinder head.

This method of planning a war plant is swift when compared with the painstakingly slow progress of planning in pre-war days. To a great extent cost is sacrificed to time in order to save the lives of men in combat who would be endangered by a lack of materials. This is the reason why information to increase production is often pooled between otherwise rival companies and nations in time of war. With the vast sources of improved production methods contributed by the industries of the United Nations and the unlimited financial aid of the government, miracles can be performed in planning a war plant within a short time.

MORE SHORT CIRCUITS . . .

(continued from page 24)

"We had the honor system in our school, but the faculty had to cut it out."

"Why?"

"Well, the profs had all the honor and we had all the system."

•

Visitor: "How can you tell the ganders from the geese?"

Farmer: "Oh, we never worry about that. We just turn them all out together and let them figure that out for themselves."

•

A newspaper found a man in Arkansas who lives so far back in the hills he had never seen Mrs. Roosevelt.

•

"Meet Me in St. Louis"