

POPULAR MECHANICS

MAGAZINE



WRITTEN SO YOU CAN UNDERSTAND IT

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**THE B-32—OUR NEWEST
SUPERBOMBER—Page 12**

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War machines that save lives



In no other war, and in no other country, have greater precautions been taken by military leaders and industry to safeguard the lives of fighting men.

Artificial fog to conceal troop movements... Electric blankets to protect wounded airmen... Solar searchlights to improve chances of rescue for shipwrecked men... These are just a few of the war machines that *save* lives—in which G-E research and engineering played a part. *General Electric Company, Schenectady, N. Y.*



Stealing the enemy's eyes. Our soldiers carry their "fog" with them, mobile smoke generators that blanket battle areas in dense white mist. New U. S. smoke machine uses a

new principle of smoke generation worked out in the General Electric Research Laboratory by Dr. Irving Langmuir. These machines have saved many American lives.



Solar searchlight designed by General Electric, in cooperation with National Bureau of Standards, gives flyers and sailors adrift at sea a way to signal rescuers as far away as ten miles. Most important problem was to find a method of aiming mirror so pilot of plane would catch reflection of the sun.



Diagnosing flyers' troubles. Photos of subjects in high-altitude test chamber, taken with G-E x-ray equipment, show formation of tiny gaseous bubbles in tissues and joints, a condition described as more painful than rheumatism. X-ray studies like this help answer what happens in high-altitude flights.



Blanket saves flyers' lives. In high-altitude bombers, wounded airmen need emergency protection against freezing cold. Now General Electric is supplying the Army Air Forces with electrically heated "casualty blankets" that automatically maintain a protective warmth in temperatures as low as 60 below zero.

★
Hear the G-E radio programs: *The G-E All-girl Orchestra*, Sunday 10 p. m. EWT, NBC—*The World Today news*, Monday through Friday 6:45 p. m. EWT, CBS—*The G-E House Party*, Monday through Friday 10:00 p. m. EWT, CBS.

FOR VICTORY BUY AND HOLD WAR BONDS

GENERAL ELECTRIC

This One



EHZL-KOE-97F9

1A

SEPTEMBER, 1945



THE BIRD WITH THE 16-MILE TAIL

The wire you see with the parachute on the end of it is a telephone wire, being payed out from a C-47 cargo plane.

Bell Telephone Laboratories, working with the Air Technical Service Command of the Army Air Forces, developed this idea. It will save precious lives and time on the battlefield.

A soldier throws out a parachute with the wire and a weight attached. The weight drops the line to the target area. From then on, through a tube thrust out of the doorway of the plane, the wire thrums out steadily—sixteen miles of it can be laid in 6 2/3 minutes. Isolated patrols can be linked quickly with headquarters. Jungles and mountain ranges

no longer need be obstacles to communication.

This is in sharp contrast to the old, dangerous way. The laying of wire through swamps and over mountains often meant the transporting of coils on the backs of men crawling through jungle vegetation, and in the line of sniper fire. It is reported that in one sector of the Asiatic theater alone, 41 men were killed or wounded in a single wire-laying mission.

Bell Telephone Laboratories is handling more than 1200 development projects for the Army and the Navy. When the war is over, the Laboratories goes back to its regular job—helping the Bell System bring you the finest telephone service in the world.



BELL TELEPHONE LABORATORIES Exploring and inventing, devising

and perfecting for the Armed Forces at war and for continued improvements and economies in telephone service.

Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

Next Month

IF ANYONE has a bigger house-cleaning job than the American railroads, let him stand and beseech your sympathy. Last year the major lines spent well over a billion dollars for maintenance, and had they not supplemented pick-and-shovel gangs with mechanical section hands the steel roads would have disintegrated by now under the pounding of war traffic. One clever device you may have missed is the vacuum cleaner for track ballast. "Workin' on the Railroad" is brought up to date in an October feature.

THE commander of a Yankee submarine had just been dealt a bridge hand when a Jap ship was sighted. "Nobody touch this hand!" he ordered as he rushed to the periscope. Two torpedoes smacked into the 10,000-ton transport. The commander went back and made a grand slam. That's one of the yarns in next month's "Grand Slam in Subs."

CONDUCTING your own scientific research with a homemade telescope is not only instructive but it's fun. An article in the Craftsman section next month tells you how to build your own telescope at a cost for the lens of as little as a dollar, or a really good terrestrial model for five dollars or less.

THE earth's crust has sunk five inches under the 40 billion tons of water backed up by Boulder Dam. Man's tampering with Nature has strange effects. How they are forecast by engineers with scale models is told next month.

SCIENCE will be the umpire at sports events of tomorrow, predicts an October story suggesting automatic starters for races and new uses for television, radar and the electric eye.

Volume 84 SEPTEMBER, 1945 Number 3

Managing Editor.....Roderick M. Grant
Assistant Managing Editor.....Wayne Whittaker
Associate Editor, Shop Notes and Crafts.....James R. Ward
Radio and Electronics Editor.....Frank L. Brittin
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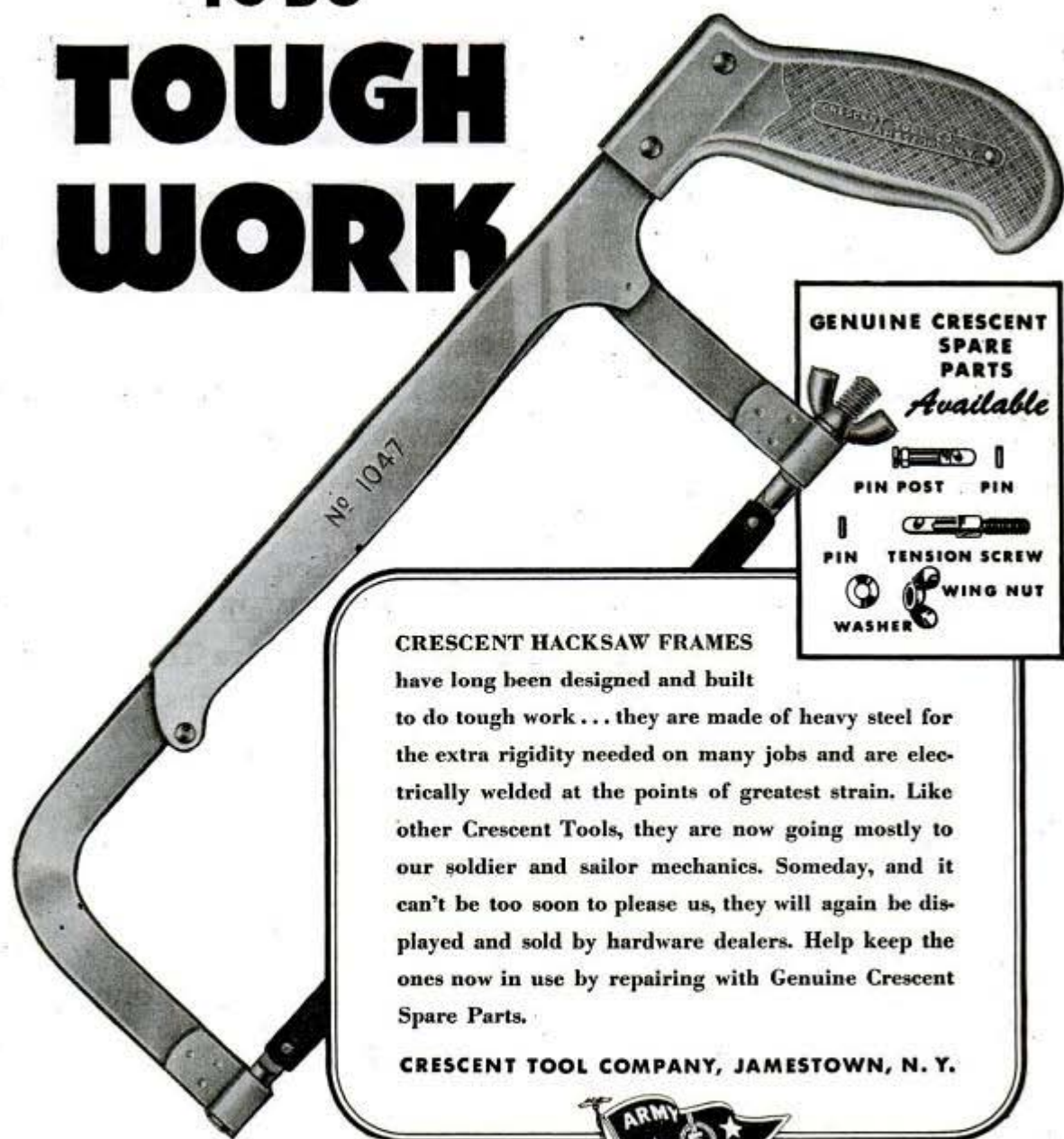
Other items, and manufacturers of available products described, are listed on pages 8A and 10A

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TO DO

TOUGH WORK



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PIN TENSION SCREW

 
WASHER WING NUT

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have long been designed and built to do tough work . . . they are made of heavy steel for the extra rigidity needed on many jobs and are electrically welded at the points of greatest strain. Like other Crescent Tools, they are now going mostly to our soldier and sailor mechanics. Someday, and it can't be too soon to please us, they will again be displayed and sold by hardware dealers. Help keep the ones now in use by repairing with Genuine Crescent Spare Parts.

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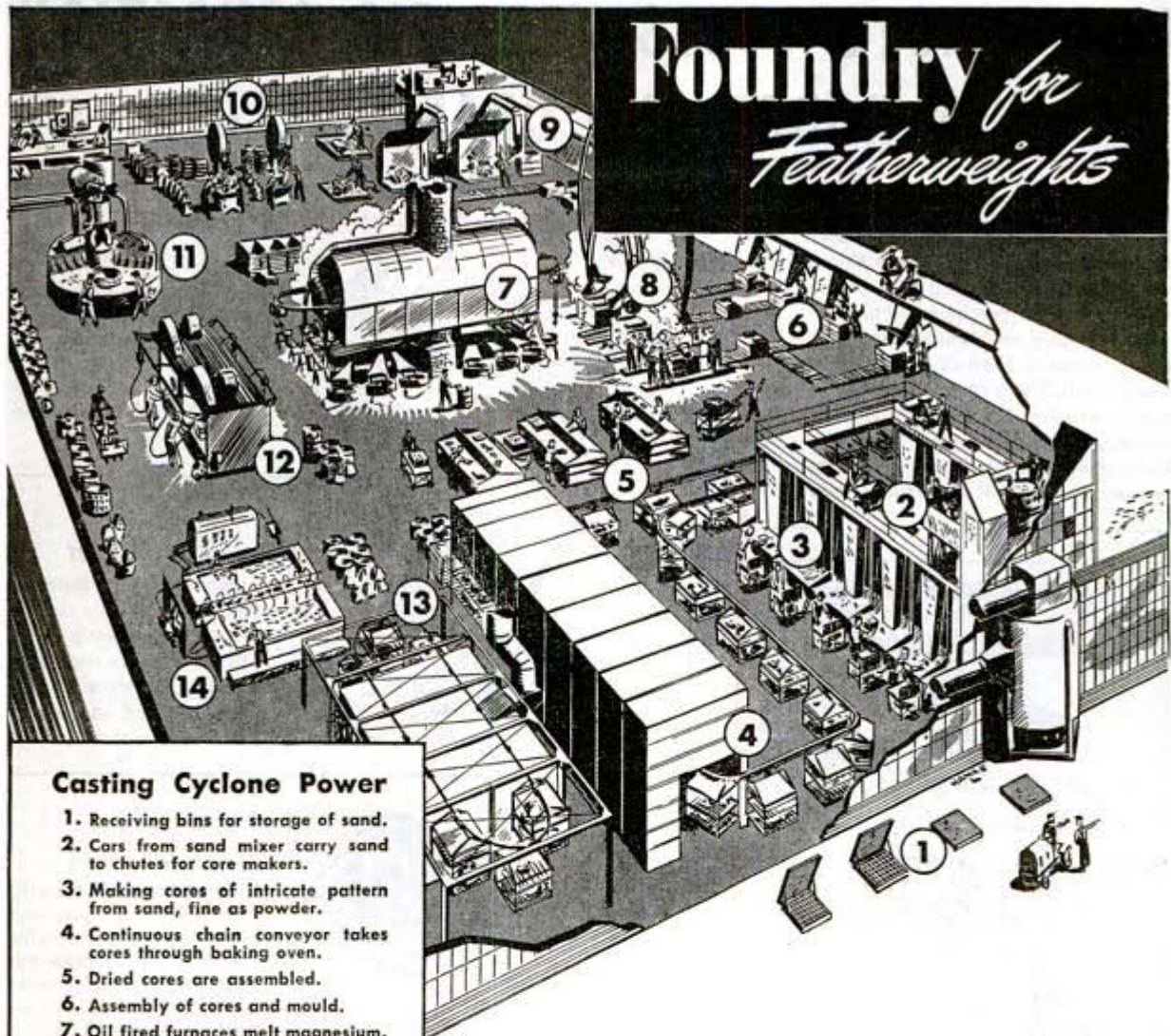


CRESCENT TOOLS

Give Wings to Work



Foundry for Featherweights



Casting Cyclone Power

1. Receiving bins for storage of sand.
2. Cars from sand mixer carry sand to chutes for core makers.
3. Making cores of intricate pattern from sand, fine as powder.
4. Continuous chain conveyor takes cores through baking oven.
5. Dried cores are assembled.
6. Assembly of cores and mould.
7. Oil fired furnaces melt magnesium, kept covered with "flux" of borax and sulphur to prevent burning.
8. Pouring molten magnesium at exactly controlled temperatures.
9. Shake out screens remove casting, also sand for reclaiming.
10. Saw cuts excess metal from casting.
11. Sand blasting, casting inspection.
12. Burring and grinding rough spots and inspection.
13. Conveyor takes castings through heat treating furnace.
14. Compressed air test under water checks any possible flaws and cracks.

Magnesium is a metal one third lighter than aluminum, strong as iron. In this Wright Aeronautical foundry, it is melted and cast into parts for Wright Cyclone aircraft engines.

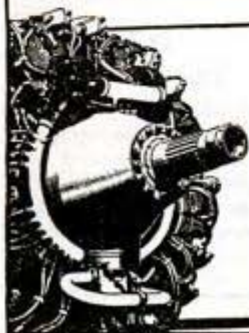
On a bomber powered by four Wright Cyclones, use of magnesium saves enough weight to add two extra gunners, or 75 more incendiary bombs, or two additional barrels of gasoline for more range.

A pioneer in casting magnesium, Wright Aeronautical uses this metal as one more means of adding speed, range and load to planes by building powerful engines without dragging weight.

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WRIGHT

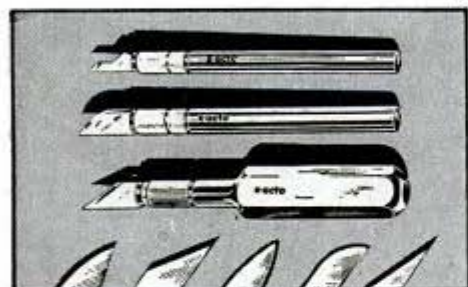
AIRCRAFT ENGINES

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Aeromodelers' indispensable. Cuts straight, square, strips; thin or heavy stock. Movable guide regulates width. Use with X-acto knife. Pays off on a single job. \$1.00 (without knife).



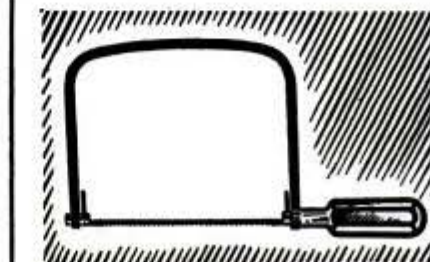
The X-acto Planer

Cuts like a charm. So easy to handle. A real precision tool, shaped like a tank, fits the hand. High-temper surgical steel single-bevel blade. The craftsman's delight. Complete \$1.00.



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The X-acto Hobbycrafters' Saw

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Say you saw it in Popular Mechanics!



WHITE COLLAR or OVERALLS—



Which will YOU wear after the war?

HUNDREDS of thousands of white collar workers have put on war overalls for the duration. Millions of both white collar and overall workers have put on uniforms. Hosts of home women are patriotically taking jobs.

After the war, millions will be coming back from army, navy and air force to civilian jobs; great war materials factories will be re-converting to civilian production; old peace-time functions of business will be springing up—where will you fit in the situation?

If you are wise, you will look ahead and prepare. You will not wait on chance. You will analyze the probable conditions in peace employment, decide where your likes and aptitudes fit best, and get ready. You will decide whether your best opportunities lie in production or office or store. You will determine whether you wish to work for someone else or develop a business of your own. You will train now to be above the average and, therefore, surer to get the opportunity you want after the armistice.

Nor will you wait very long. Nobody knows when this war will end or how soon this problem will hit you in the face.

We Can Help You Decide

If you have some question either about postwar opportunities or about your own fitness for some particular one, probably we can help you. In our 36 years, over one million adults have enrolled for our training, we have built training courses for many

major fields of commerce and industry, and we have gathered a wealth of information about job opportunities and requirements. That information is at your service.

We Can Help You Prepare

And when you have decided what field of work offers most to you for a life career, we can help you prepare for it—quickly, economically, thoroughly, in your spare time and without any interference with your present work—if it is in the list below. A 48-page booklet on the field of your choice, discussing the field and our training for it, has been prepared to help answer your questions. The coupon below or your letter will bring it to you, without cost or obligation.

Do not delay. Whether the war lasts six months or three years, now is the time to make sure your preparation for postwar success shall not be "too little and too late."

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I want to pick my career for after the war and get ready for it now. Send me your free booklet on the field I have checked below and full information about your training in that field.

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PYROIL COMPANY

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City or Town..... State.....

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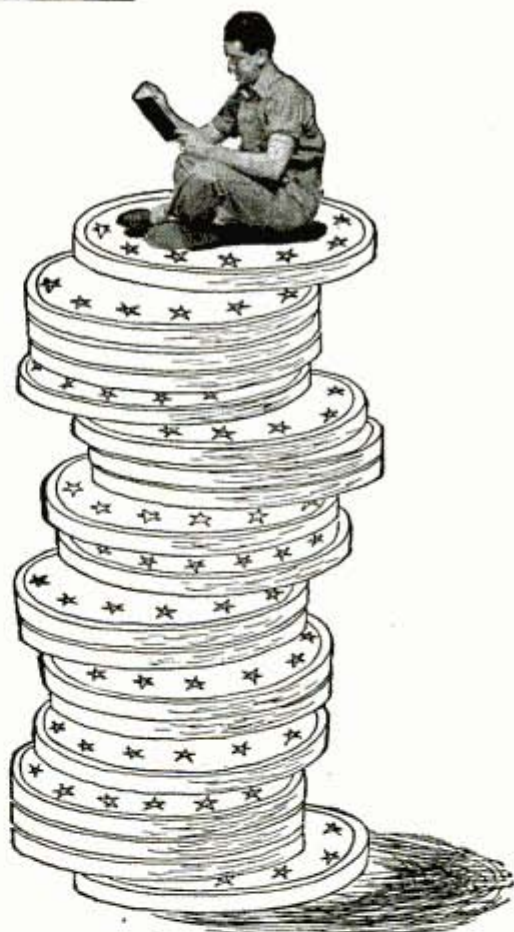
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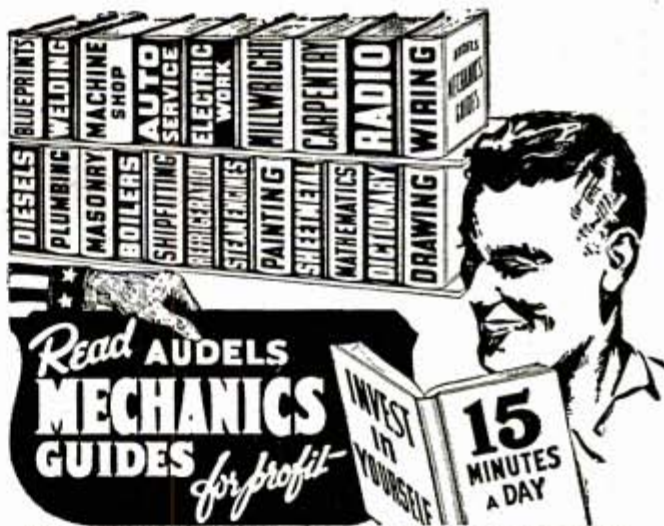
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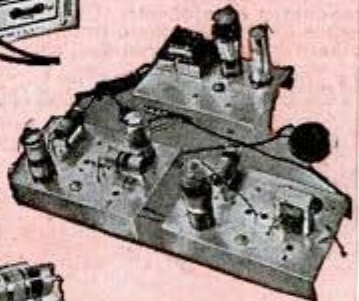
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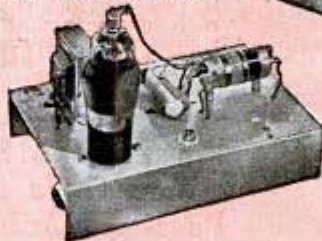
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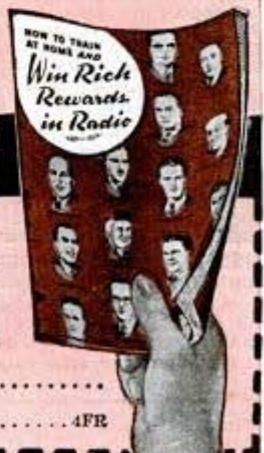
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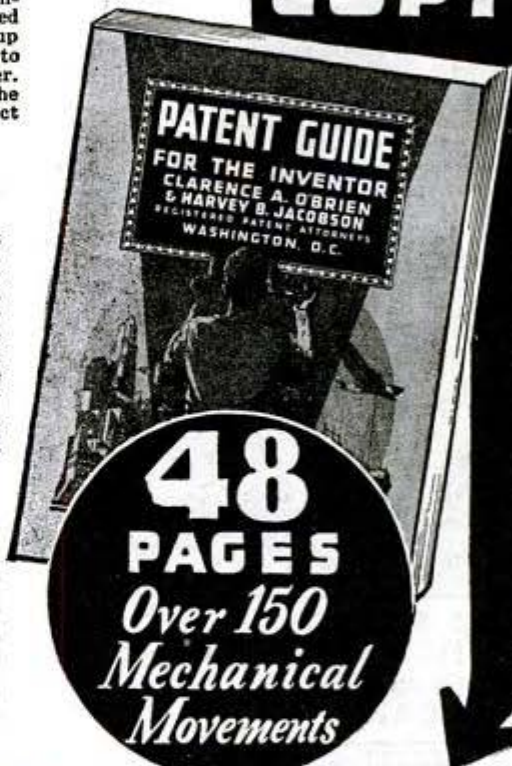
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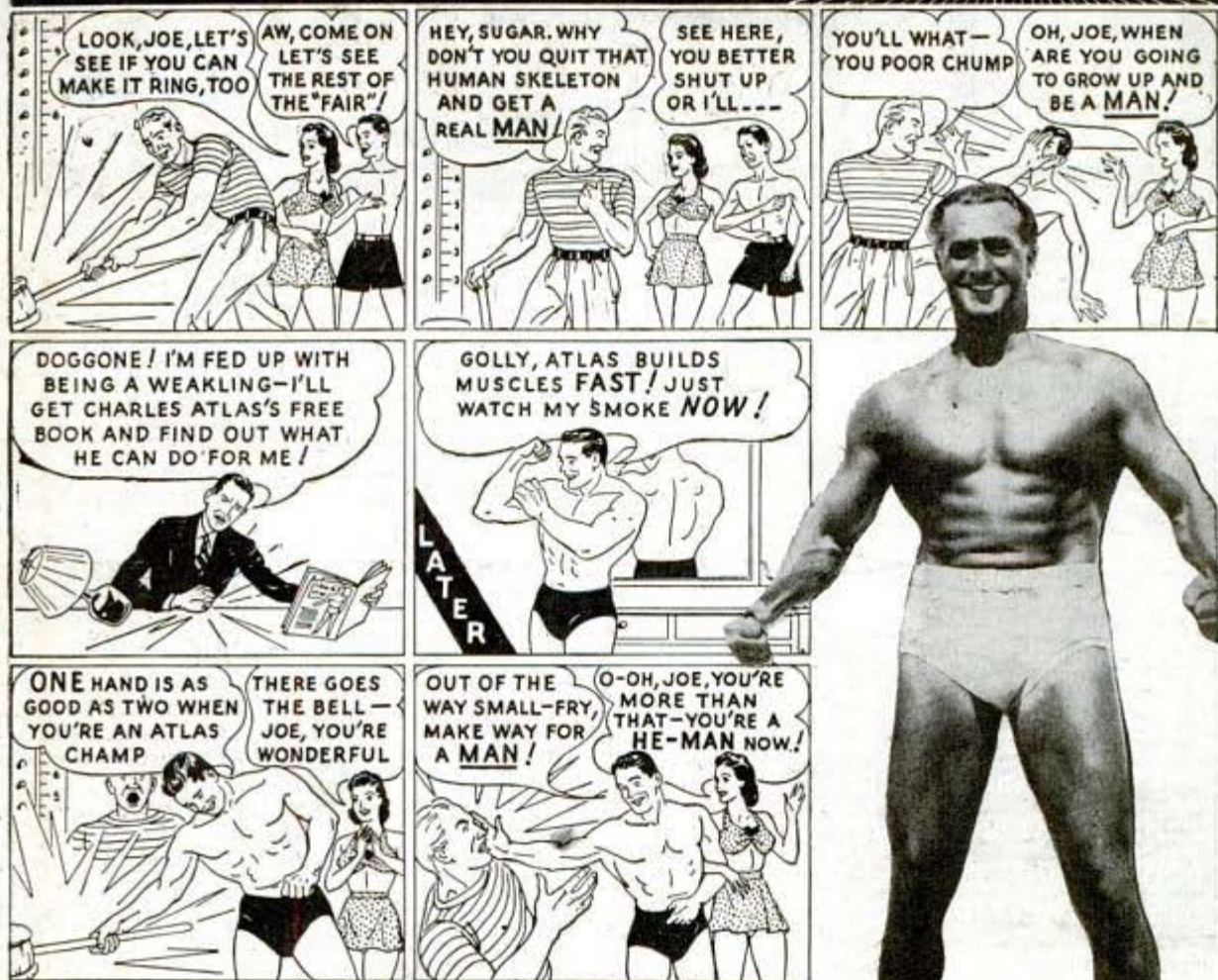
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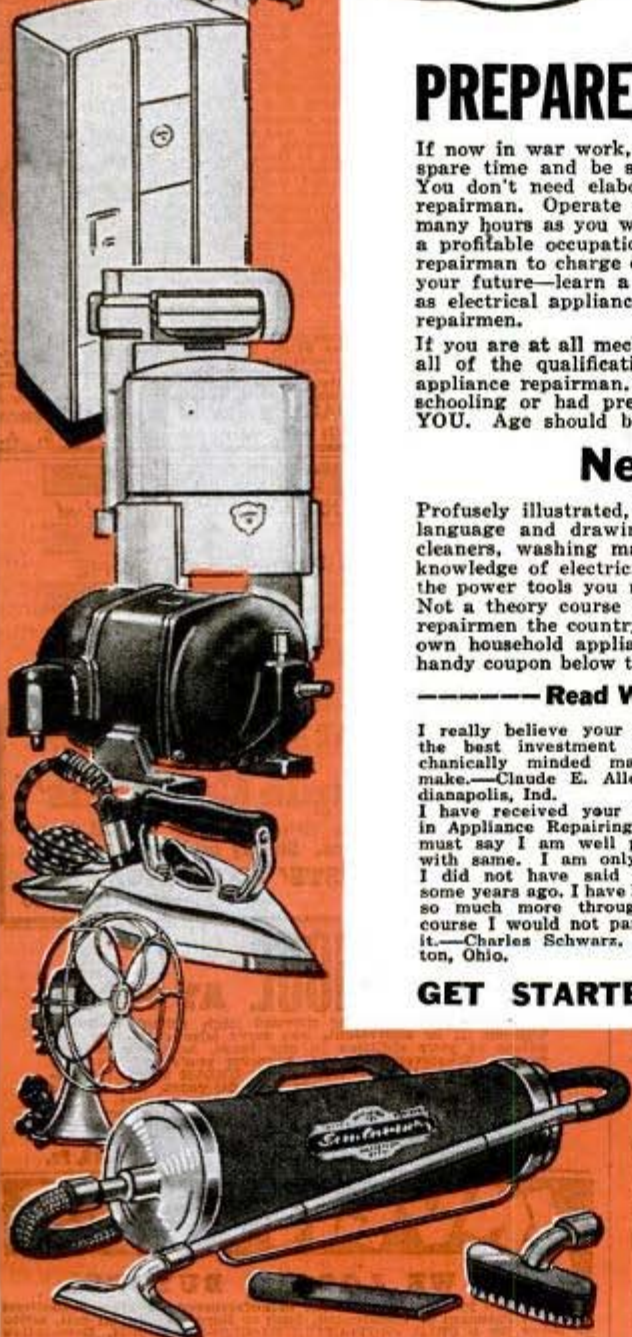
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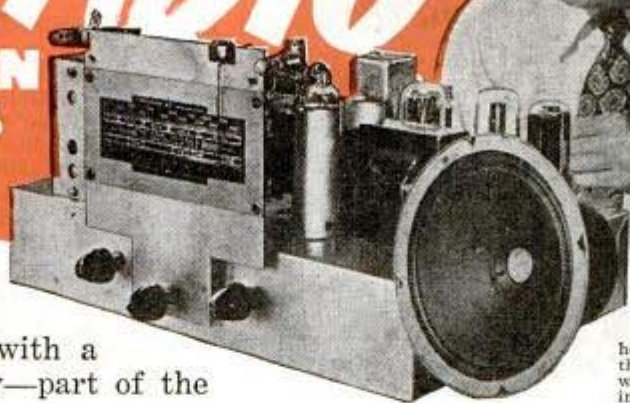
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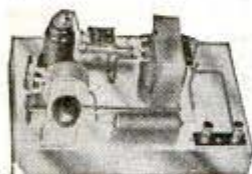
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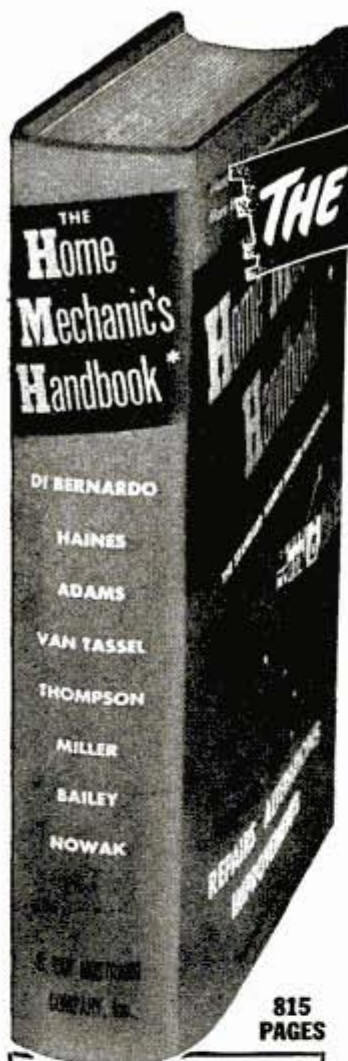
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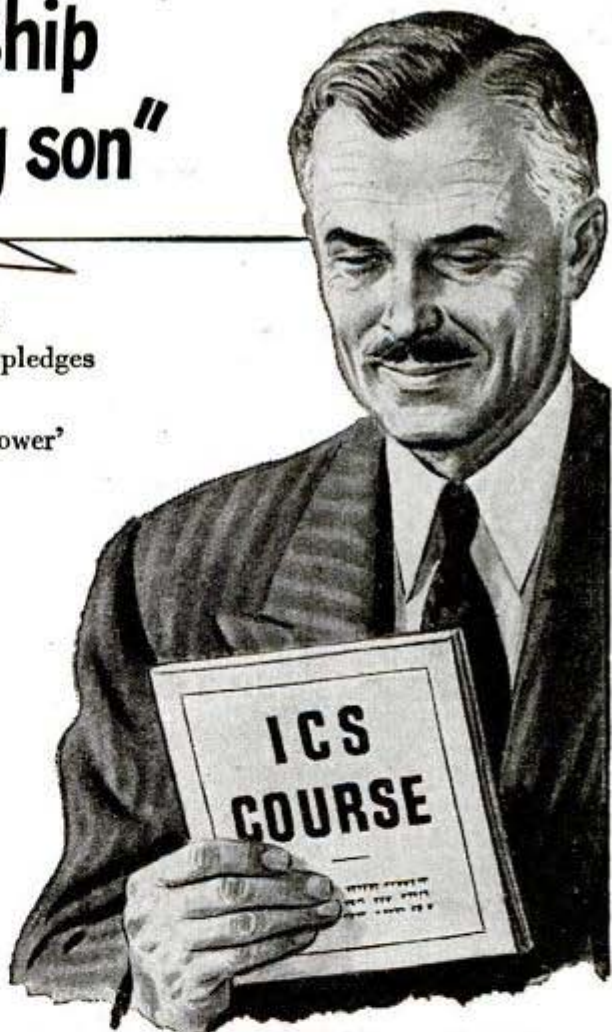
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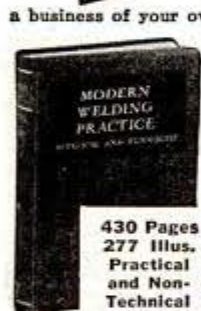
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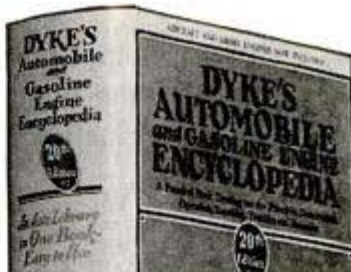


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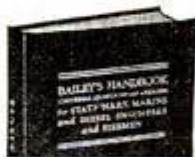
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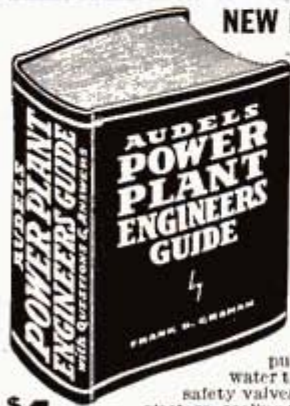
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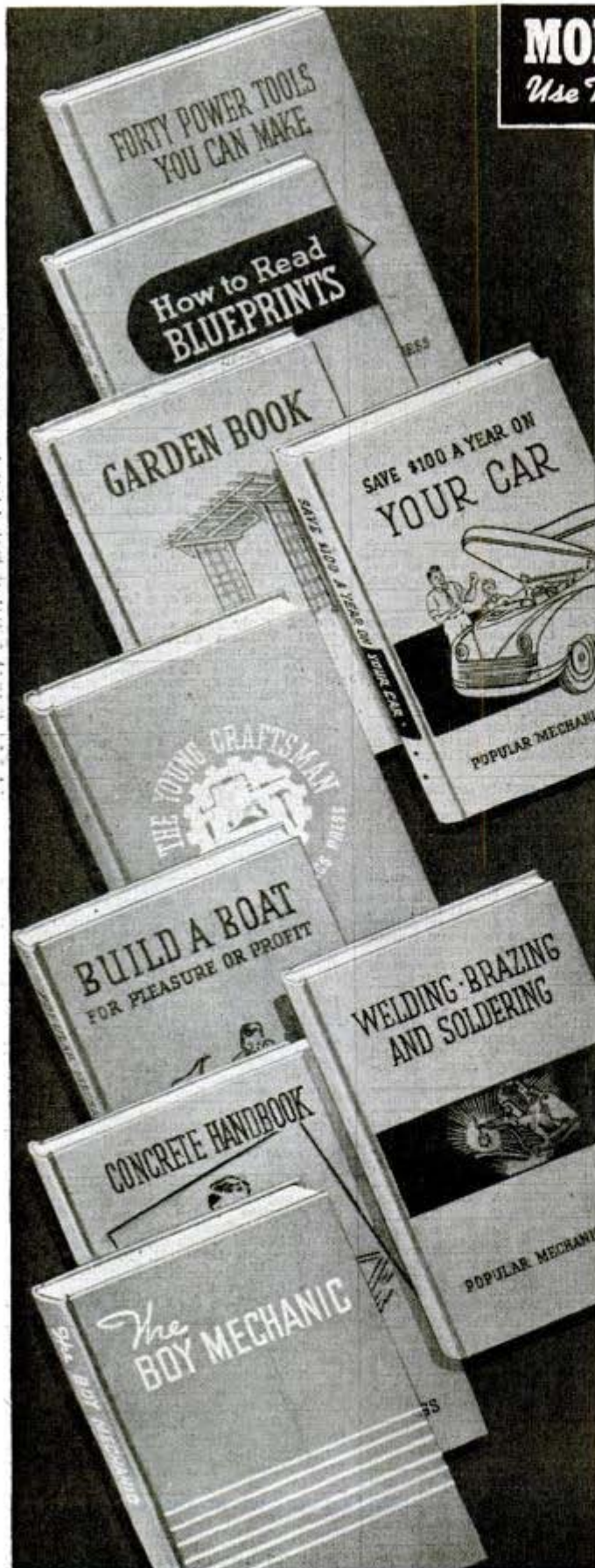
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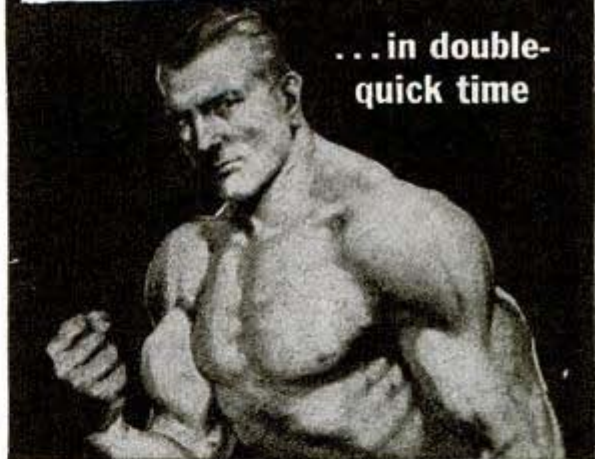
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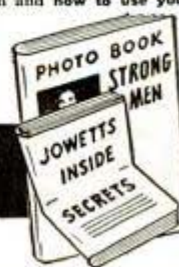
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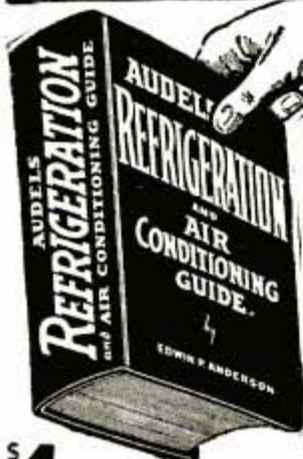
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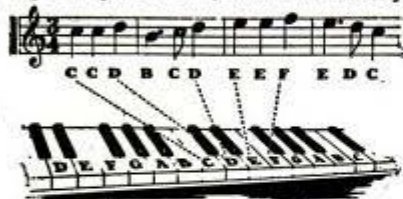
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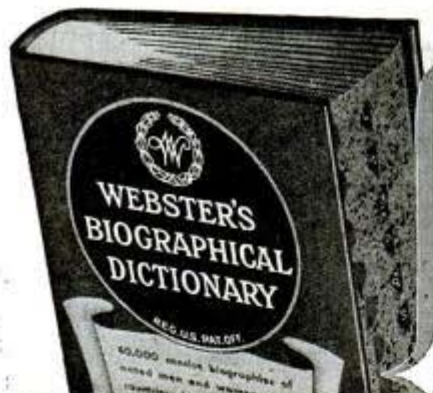
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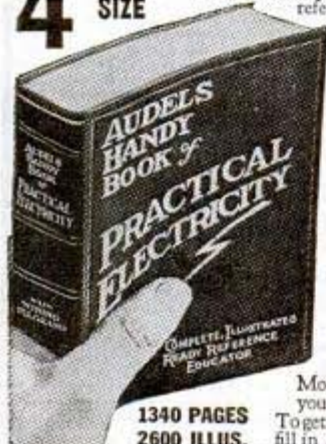
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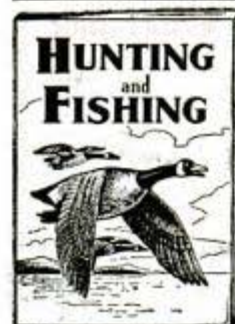
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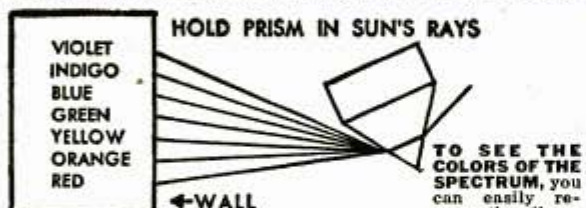


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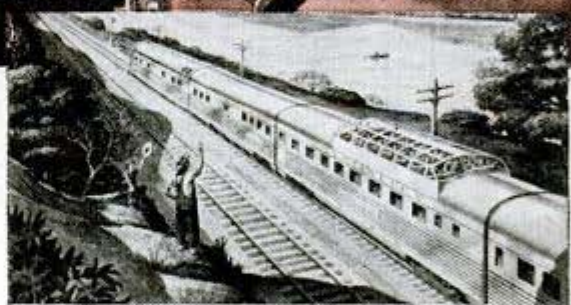
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AN ENTIRELY *New Idea*
IN TRAIN TRAVEL
OFFERS YOU A
PENTHOUSE VIEW



• It's here—our first "penthouse" railway car! An innovation which adds an entirely new perspective to train travel. In this new type car, 24 passengers are seated in the *Vista-Dome*, a laminated, heat and ray-resisting glass penthouse replacing a section of the roof and providing an unobstructed view in all directions. Deep-cushioned seats and modern air-conditioning afford complete comfort.

This unique car is a streamlined, stainless steel Burlington Zephyr coach, remodeled to include the penthouse feature of General Motors' newly-designed "Astra-Liner," and providing six more seats than before. Wartime demands for materials prevented constructing

a completely new car. Consequently, certain refinements and conveniences anticipated for future cars have been omitted.

The first *Vista-Dome* car is now in service. It is being operated in various Burlington trains, affording many travelers an opportunity to enjoy this dramatic innovation. If the traveling public likes the *Vista-Dome* idea, and if this new type car proves itself in operation, the Burlington plans a fleet of these cars for the future—a fleet which will give Burlington travelers new scenic thrills from the luxurious quarters of a "penthouse on wheels."

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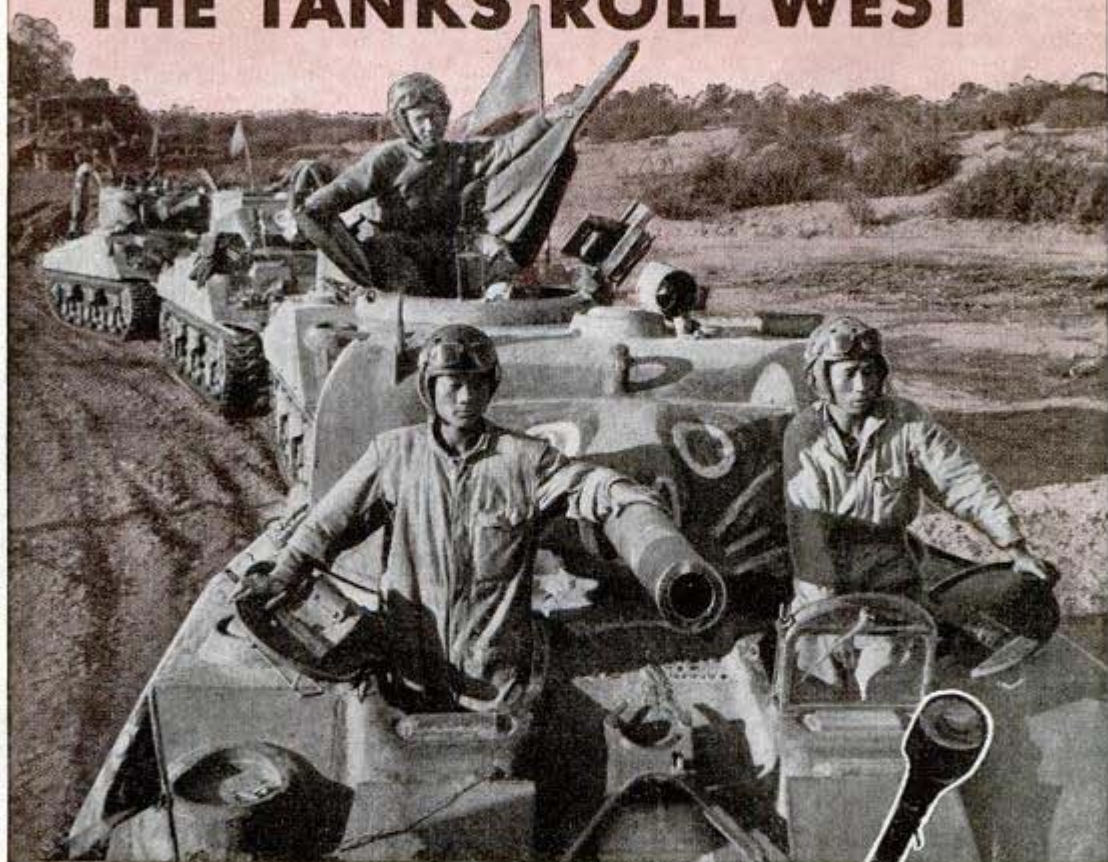
WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 84

SEPTEMBER, 1945

No. 3

THE TANKS ROLL WEST



Signal Corps photos
Manned by Chinese crews, American light tanks roll into Burma. Below, 45-ton General Pershing with 90-mm. high-velocity gun

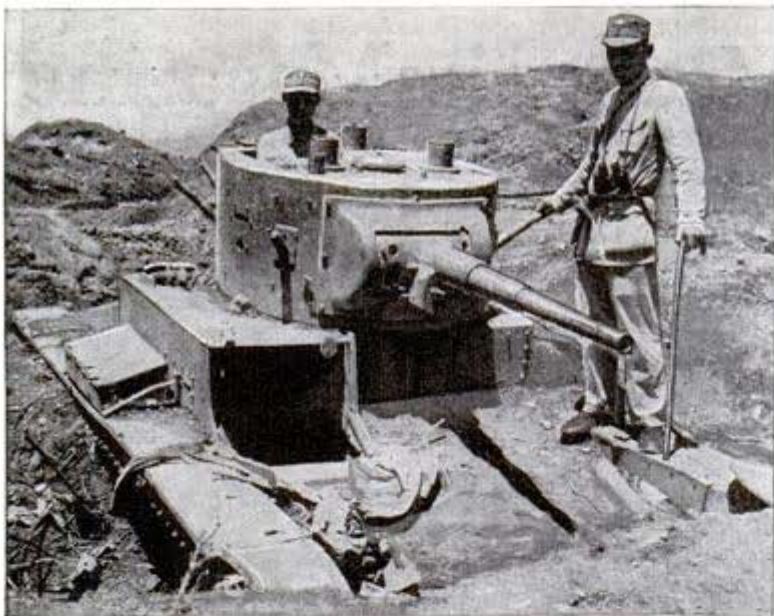
By
Staff Sgt. John L. Kent

THE Japs are in for a few surprises when our armored forces get rolling in the Pacific. Our Army intends to show them the latest in mobile tank warfare, guaranteed to make them lose more than their "face." Soon they will be introduced to a new trinity of armored destruction — "General Pershing," "General Chaffee" and the "Locust." These are the nicknames of our newest tanks, the M-26, the M-24

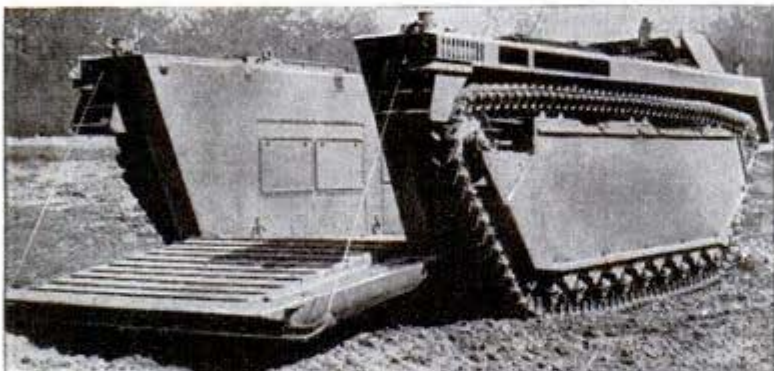


SEPTEMBER, 1945

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Above, light Jap tank with 37-mm. cannon was dug in and used as pillbox



Borg-Warner photo

LVT Beachbuster with ramp lowered has Hydra-Matic drive which shifts transmission automatically to desired gear ratio; it is powered by two Cadillac engines. Below, crew takes breather as tank plows through mud



and the airborne M-22.

By a trick of fate, mobile tank warfare in the European phase of World War II ended where it began some 500 years ago—in Bohemia, land of the Czechs. Mobility and firepower, the essence of tank warfare, began when Jan Zizka, the blind Hussite leader of the Czechs, mounted a cannon on a two-wheeled wagon back in the 15th century. This mobility was brought to perfection by Hitler. Then came Patton.

One captured German general inquired whether the Americans had perhaps adopted the methods of the German tank expert, Heinz Guderian. He was assured that General George S. Patton, Jr., had his own type of armored razzle-dazzle.

But while the tanks were helping shorten the war in Europe, there was criticism of our tanks occasioned by comparison with German armor. Commentators and analysts, many of whom still

misunderstand our tank situation, had compared our Sherman tanks with the Nazis' Royal Tiger or the Russian Stalin. The statistics they marshalled were indisputable! On graphs, charts and pictures, our heavy tank—the General Sherman—looked weak. Why didn't we have a larger tank?

The situation became such that finally a long letter from General Patton to General Thomas P. Handy, the Army's Deputy Chief of Staff, was published. He wrote in part: "It is patent that if a Tiger tank with an enormous thickness of armor were put at one end of a village street and engaged in a fight with a Mark IV tank (General Sherman) at the other end, the Mark IV would not last. However, the great mobility of the Mark IV tank usually enables it to circumvent the slow and unwieldy Tigers and attack them from the rear. Had the armored divisions which accompanied the Third Army across France been equipped with Tiger tanks, the road losses would have been 100 percent by the time we reached the Moselle River. As it was, the road losses on our long-lived tanks were negligible."

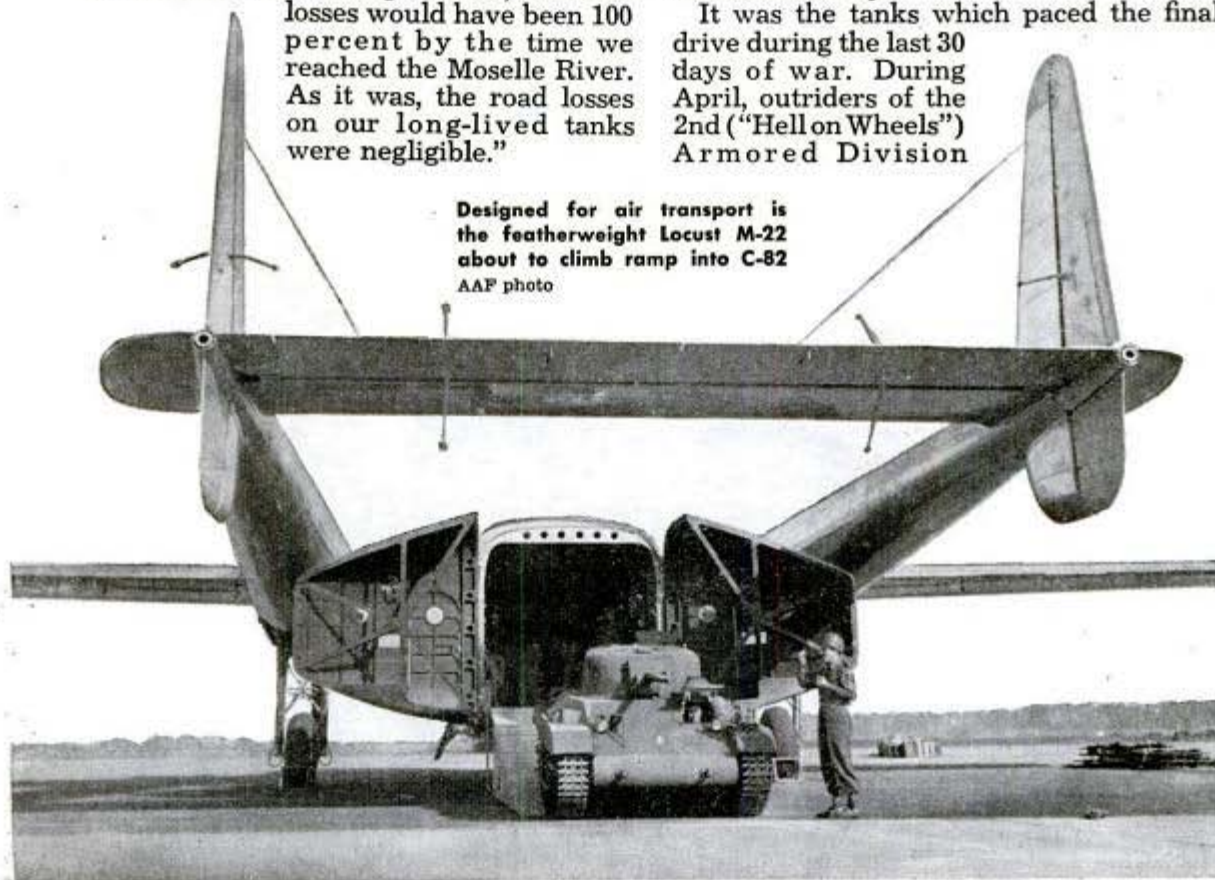


This new light tank—M-24 General Chaffee—will be rolling into Tokyo

The answer, then, was simple. Our Army has not seen fit to approve a larger tank, although tanks as heavy as 60 tons were built more than three years ago for experimental purposes. Our Army's traditional concept of tank warfare has been that there should be three types of tanks: Light, medium and heavy.

It was the tanks which paced the final drive during the last 30 days of war. During April, outriders of the 2nd ("Hell on Wheels") Armored Division

Designed for air transport is the featherweight Locust M-22 about to climb ramp into C-82
AAF photo





Caring for wounded tank men in advance units is major problem; medics rehearse transfer of men to Weasel

raced 55 miles in one day to reach the Elbe River, where they secured intact one of the important bridges for the use of the Ninth Army.

In another sector, the First Army was using the new M-26 tanks for the first time. The M-26 or General Pershing weighs more than 45 tons, upward of 20 tons more than the General Sherman. It has much heavier armor plate, and mounts a 90-mm. high-velocity gun instead of the 75 or 76-mm. in the Sherman.

Major General J. Lawton Collins, commanding the 7th Corps, who rode in one of the new tanks, said it was apparently as easy to drive and shift gears as in an automobile. It is more maneuverable and can move over soft ground which would bog a Sherman. This is due to its wider tread, so wide, in fact, that engineers' bridges had to be widened to accommodate it. A distinguishing feature, in addition to its low silhouette, are the six dual, independently sprung road wheels which support the tank.

This 60-ton U. S. Army tank was built for experimental purposes. Big tanks sacrifice maneuverability for armor



Armored warfare presents special problems for supply and medical evacuation. In Europe at times our tanks would lose contact with the supply columns speeding behind them and the tank men would subsist on emergency rations. Gasoline presented an enormous problem, as tank engines consume it in astronomical quantities. General Patton solved this problem on occasions by having trucks race ahead and deposit caches of gasoline along the proposed route of tanks.

The problem of getting wounded men out of tanks and back to medical facilities has been solved. One of the pioneer units, the 47th Medical Battalion, Armored, in nearly five years of experimenting has just about set the pattern for armored medical units. When this unit was activated at Fort Knox, Ky., in July 1940 as part of the 1st Armored Division, the unit was handed a new, major problem in warfare: how to render medical support to the fast rolling tank men.

The battalion's first goal was to get its surgeons and their operating tables on



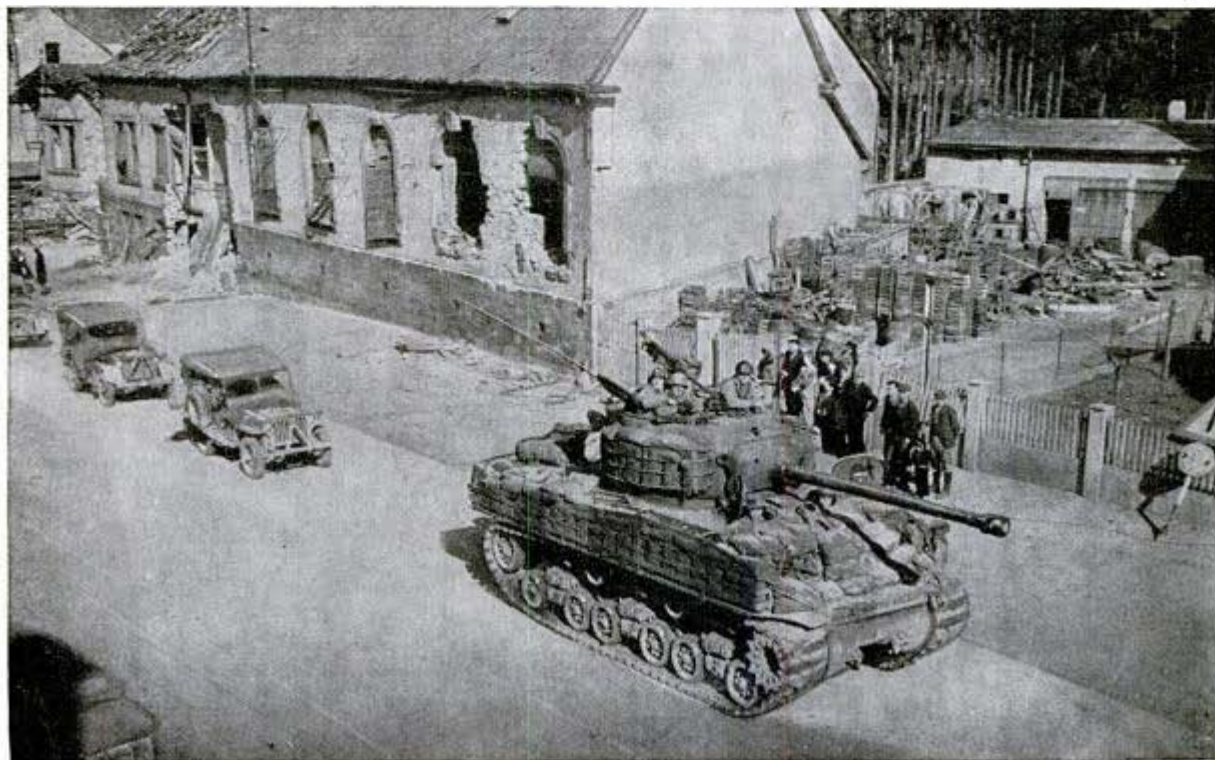
Signal Corps photo

U. S. Army engineer guides tank driver onto newly built pontoon bridge

wheels. In the Louisiana and Carolina maneuvers of 1940 and 1941, 47th Battalion medics came up with their first innovation—surgical trucks. Tested and modified in North Africa and Italy, these trucks are now the key equipment around which all armored medical battalions are organized. Each company of a battalion has two of these trucks. Twenty minutes after one of these big vans pulls into a new area, it is in operation. Surgeons can handle three

(Continued to page 160)

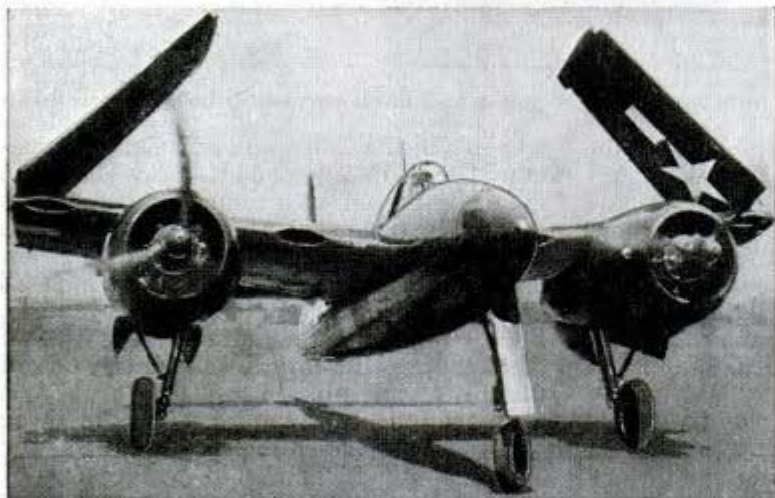
Packed with sandbags, an M-4 Sherman tank leads vanguard of American troops through European village





Navy's Tigercat Hits 425 M.P.H. With 2 Engines

Bigger by half than the Hellcat, the new Grumman F7F Tigercat is the Navy's first twin-engine fighter plane. Its two 2100-horsepower engines have more than twice the horsepower of the Hellcat. Most powerful fighter and fighter-bomber ever made for the Navy, the Tigercat can do 425 miles per hour at its critical altitude, and is faster at sea level than anything the Japs have. This gives us a vital advantage against sneak attacks at low levels, for which the Japs have demonstrated a fondness in operations in the Pacific. Wings of the Tigercat can be folded for carrier operations or to permit greater utilization of space in land bases. A tip to the Nips: Don't fool with a Tigercat.



This is the Navy's twin-engine Tigercat in air and with its wings folded

Britain's Double-Deck Airliner Carries 70 Passengers

Powered by four Bristol Centaurus engines of more than 2500 horsepower each, the Shetland Flying Boat is Britain's largest aircraft yet to fly. With a loaded weight of 130,000 pounds, a wing span of 150 feet and an overall length of 110 feet, the Shetland was planned for world-wide patrol and reconnaissance duties. It has a maximum speed of 267 miles an hour and, cru-

ing at 184 miles an hour, will carry a payload of 7620 pounds for a range of 4650 statute miles, distance from London to Bombay. Seventy passengers and a crew of 11 can be carried on the plane's two decks, with three main compartments, a promenade and a kitchen. Two generators provide power for lighting, cooking, refrigeration and air conditioning.



Flown Into Net, Airplane Drops Without Injury

British engineers recently tested the ability of one light plane to "take it" by flying the craft into a vertical net. Space was left for the propeller so the full impact was taken by the wings. The plane, a Miles M.38 Messenger, originally designed for war duties, dropped to the ground undamaged. Another test withstood by the sturdy plane was a takeoff in which two rockets literally threw it into the air. The Messenger is expected to be a favorite with British flyers after the war. It takes off in



60 yards, has a top speed of 120 miles an hour, a stalling speed of 28, and carries four. It is powered by a 140-horsepower engine.

Postwar Plane for Sportsmen Has a 25-Foot Wing Span



feet. It has a wing span of 25 feet, an overall length of 18 feet, and a height of only 63 inches. Tests show that it can climb at 750 feet per minute. Fuel capacity is 10 gallons, which gives a cruising range of 275 miles. It has a top speed of 125 miles an hour. All instruments are shock mounted according to Army standards to provide longer life and more

Designed for the sportsman pilot who may want to come down in a convenient field, the "Skyhopper" can take off in 400

accurate readings and all movable control surfaces are balanced to prevent vibration. The craft will sell for approximately \$1000.

Family Model of "Flying Jeep" Accommodates 4 Persons

Nonstop weekend trips of 580 miles can be made with the Stinson Voyager-125, a four-place passenger plane. This is a post-war model of the L-5 "Flying Jeep" used by the Army for artillery spotting, reconnaissance and other important jobs on the war fronts. The Voyager has a top speed of 128 miles an hour, can climb 670 feet per minute and stay aloft five hours. It takes off in 550 feet at sea level and lands in 280 feet. In addition to the pilot, three passengers and full

fuel load, it will carry 131 pounds of baggage. Cruising speed is 116 miles per hour and service ceiling is 13,800 feet.



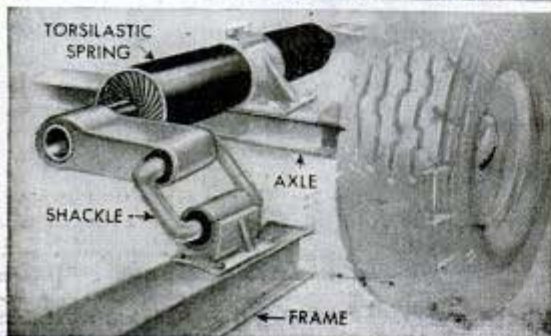
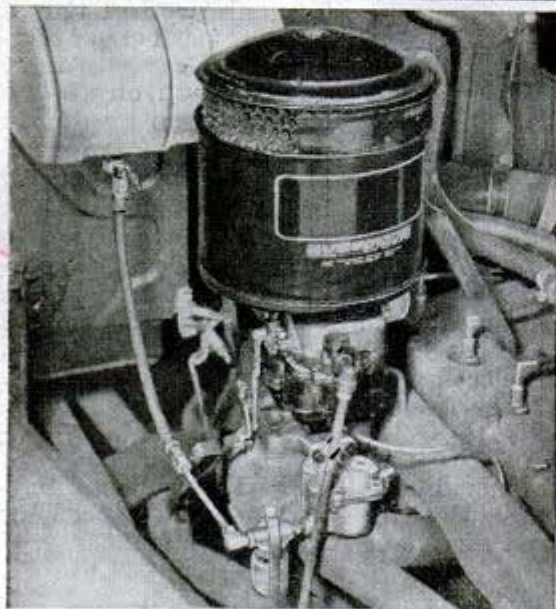
HEADED FOR THE HIGHWAY



↑ Features of the 1946 Lincoln include a hydraulic system to raise and lower windows, bigger oil pump for better lubrication, smart grille and fog lights

← Foot pedal of new Zenith auto radio control changes stations and volume, mutes receiver when desired. It will be available on Ford, Lincoln, Nash, Hudson

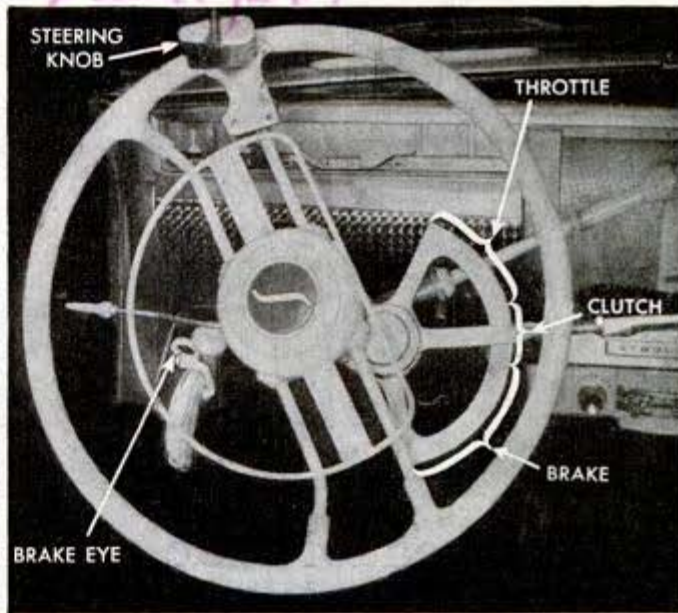
Alcohol-water injector, left center, can improve gasoline of lower rating by 10 octane numbers. Half-and-half solution is injected as coolant into intake



← Torsilastic spring of rubber bonded to steel outer shell and central shaft provides all springing action by twisting in rubber. No lubrication is needed
B. P. Goodrich photo

*Thompson Products Co.
2196 Elm Street
St. Louis, Mo.*

*Quaker Automobile Assoc.
Penna. Ave. of 17th
Wash. D.C.*



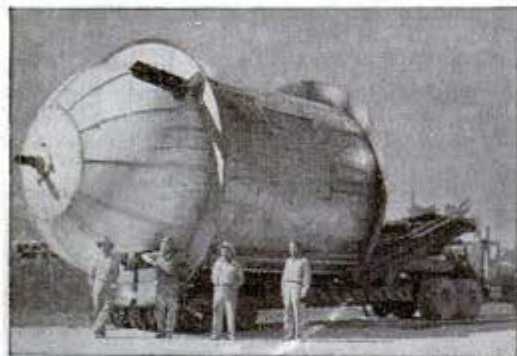
Automatic devices to make driving safe for GIs who have lost limbs have been worked out by auto makers and Army, made available to entire industry. Mike Daugherty, who lost a leg on Guadalcanal, tries out devices as applied to a Studebaker. Retarded, steering column lever disengages clutch and applies brakes; advanced, lever engages clutch and opens throttle. Eye for hook is on brake handle. Steering knob swivels with wheel



First hand-made model of the 1946 Mercury embodies many mechanical and styling improvements. A grille of die-cast vertical louvers extends across the front. Instrument panel features better visibility with easier-to-read pointers. Tri-alloy bearings, improved oil pump, 4-ring aluminum pistons are among mechanical changes



Tank Taken for Ride



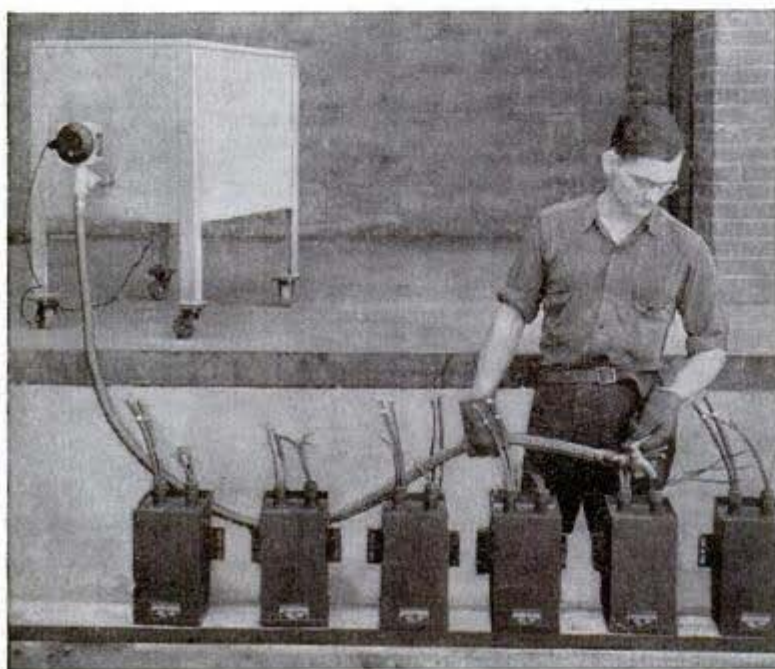
Four men working with block and tackle recently lowered a 60,000-pound water tank, standing 65 feet high on its tower, moved it 200 miles by truck and raised the tank again to its original height. First, four heavy timbers about 32 feet long were placed upright and connected to form a square support about the base of the tower. Block and tackle were fastened to the tower 25 feet above the ground and the legs were disconnected below that point. Then the entire tower was lowered 25 feet. Two repetitions of this operation brought the tank to the ground and it was rolled onto a truck for the trip from Casa Grande, Ariz., to Agua Prieta, Sonora, Mexico.

Hose Within Hose Keeps Melted Compound Flowing to Transformers

Potting compound for filling transformers is premelted in a tank and conveyed in liquid form by means of metallic hoses. A

small hose heated by resistance wires running through it is enclosed in a larger hose and the liquid flows between the two hoses.

Heat is controlled by a variable thermostat on the tank.



Bad News for Insects — Find Super-DDT

Discovery of a synthetic compound deadlier to insects than DDT is reported by British chemists. Called Gammexane or 666, the super-DDT is chemically the gamma isomer of benzene hexachloride, and is not particularly close to DDT in structural chemistry. Tests showed it to be the deadliest weevil poison ever tested by the British. Half the concentration required in a DDT solution killed flies. Length of its effectiveness is unknown.

Colored Tabs Posted Over Umpire's Chair Tell Tennis Score

Bright colored markers mounted above the umpire's chair kept the spectators informed of the match score throughout the playing of the National Clay Courts Championships at the River Forest, Ill., Tennis Club. Devised by a club member, the ingenious visual scorer consisted of a T-shaped mount made of ordinary pipe. Yellow tabs of metal tubing, pressed flat and perforated for hanging on hooks, indicated the game score of the set in progress, and if the games passed 10-all a blue marker was suspended to indicate 10. Red markers fixed on pegs above told the score in sets. At the umpire's feet a placard gave the names of the players on each side. In the photograph, the set score is two-all and the umpire is removing the game markers at the completion of a 6-2 set. When these visual scorers are used the umpire need not repeatedly call out the score.



75-mm. Guns Fired in Giant Vacuum Jug Get Substratosphere Test

Artillery for superbombers and high altitude fighters is to be given a substratosphere test in a 50-foot steel vacuum jug. The unique firing chamber duplicates atmospheric changes encountered by a plane during a 5000-foot-per-minute climb up to 50,000 feet, where the temperature is about 70 below zero. Under these conditions Army experts study the effect on the speed of shells and firing mechanism of 75-mm. aircraft cannon. The range of the chamber

is only 27 feet compared to the previous shortest firing range of 300 feet for heavy caliber guns. The forward end of the chamber holds 20 tons of sand with a steel armor plate backstop. During tests the shells plow 10 feet through the sand and strike the armor plate with enough power theoretically to hurl a one-pound projectile 680 miles. This chamber was designed for the proving ground at Aberdeen, Md., by the York Corporation, York, Pa.



Service Station on Wheels For Industrial Plants

Only 21 inches wide, a compact lubricating cart for use in industrial plants is virtually a service station on wheels. Designed for operation by one man, it is pushed like a perambulator and can be maneuvered easily between rows of machines in a plant where space is limited. The cart carries many types of lubricants as well as a variety of pumps, oilcans, handguns and other tools. One model has a portable pump which is capable of developing 7000 pounds pressure per square inch.



Twin bomb bays of the B-32, arranged in tandem, are shown here with doors open. The tail rises 32 feet high in taxiing position



HERE'S THE B-32 - OUR NEWEST SUPERBOMBER

By Wayne Whittaker

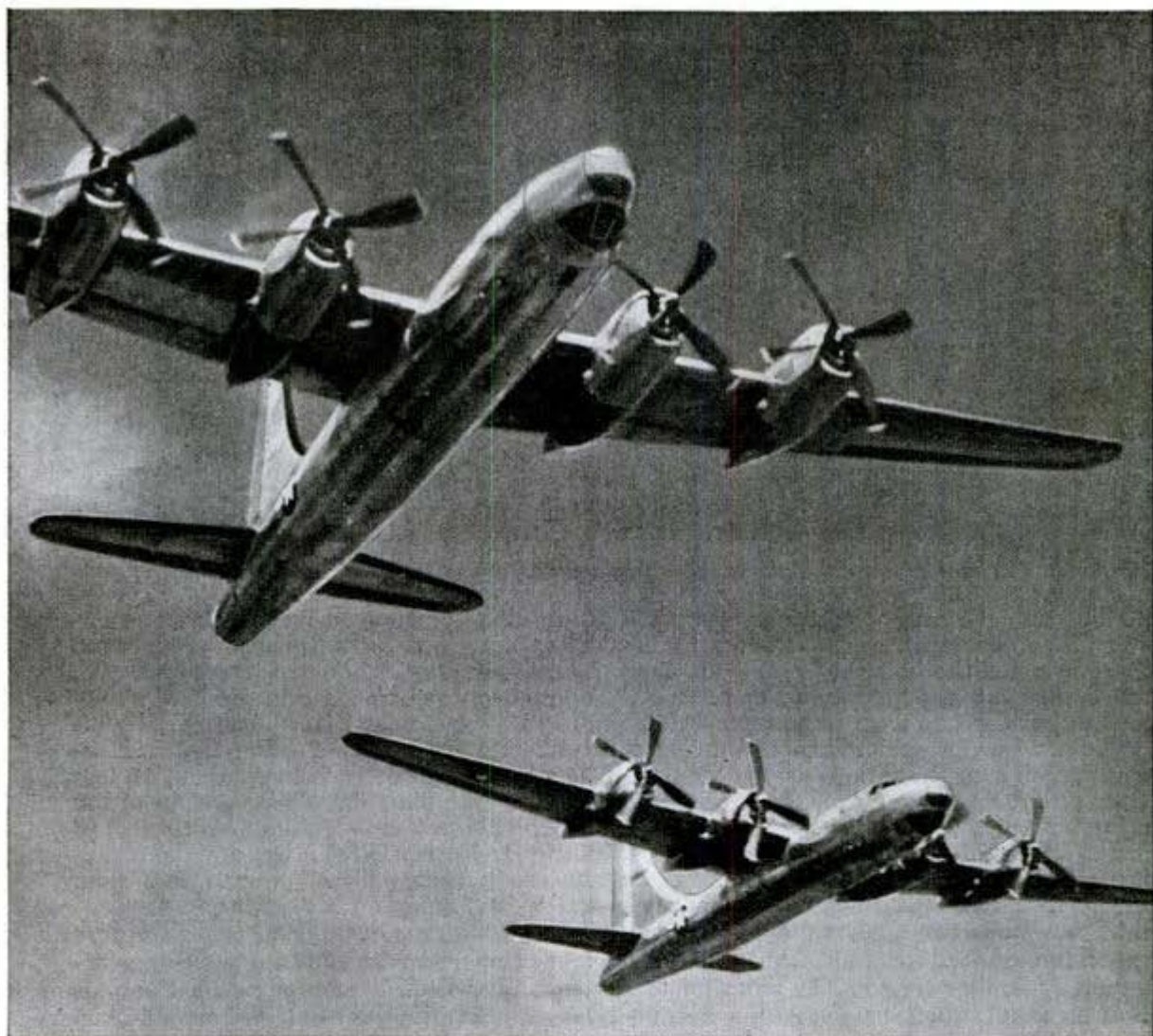
WITH flying suit zipped up and parachute harness snapped on, you step from the "ready" room into the hot Texas sunshine at the Fort Worth Army Air Field. On the flight line before you, with its four powerful engines idling, is Uncle Sam's new superbomber, the B-32, designed and built by Consolidated-Vultee.

As you pause at a respectful distance, you remember the words spoken a few minutes before by Lt. Gen. Barton K. Yount:

"The B-32 will help us knock out the Japs just twice as quick."

The first thing that catches

POPULAR MECHANICS



Liberator-type twin tails, pressurized cabin and remote-control guns were abandoned in production model B-32

your eye about the B-32 is its lofty single-fin tail which rises to a height of 32 feet two inches. It is the bomber's most distinctive exterior feature and will always make it easy to identify.

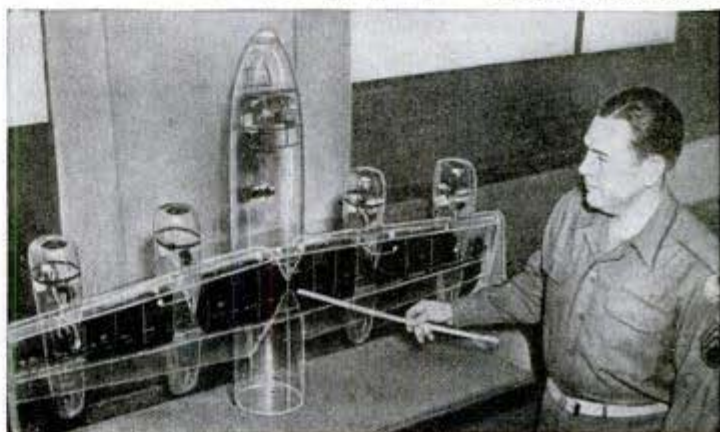
"There's a tale behind that tail," says the flight officer who is assigned to fly with you. "The B-32 started life with a twin tail similar to Consolidated's B-24 Liberator. It was changed on the third experimental model to achieve less drag and greater stability. About the same time they also lopped off the pressurized cabin and remote gun control."

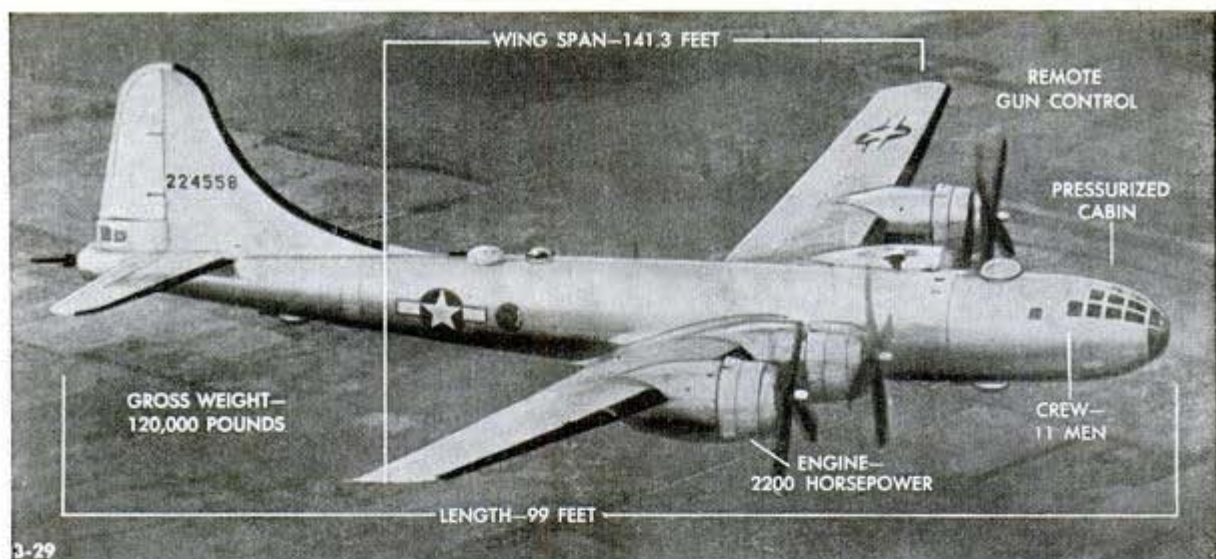
The abandonment of these two outstanding features of the famed Boeing B-29, our first "superheavy," called for some explaining. It was soon forthcoming:

"You see the B-29 was de-

signed with one eye on European conditions and one on the Pacific. At that time missions were flown for considerable distances over enemy territory. As we have pushed the Japs back and acquired new bases such as Iwo Jima, that no longer

Instructor traces fuel and oil system in plastic model of big bomber





This is the B-29, first of our superheavies, with characteristics shown for comparison with B-32, opposite

holds true. We can now safely approach Japan at moderate altitudes, climb up over the target for the bombing run, and after the bombs are dropped come back down for most of the trip back to home base.

"Even with a pressurized cabin we would use oxygen over the target—so why bother with pressurization at all? As for giving up remote gun control, tests on the combat model of the B-32 showed more accurate fire control with individual turrets."

The B-32 and B-29 have their likes and unlikes. Both are said to have similar speed (announced for the B-29 as 350 miles an hour), similar range (3600 miles for the B-29), about the same service ceiling (35,000 feet for the B-29) and similar bomb load. The B-29 has a maximum capacity of 10 tons of bombs, but on most missions over Japan the average has been about seven.

Both superbombers are powered with

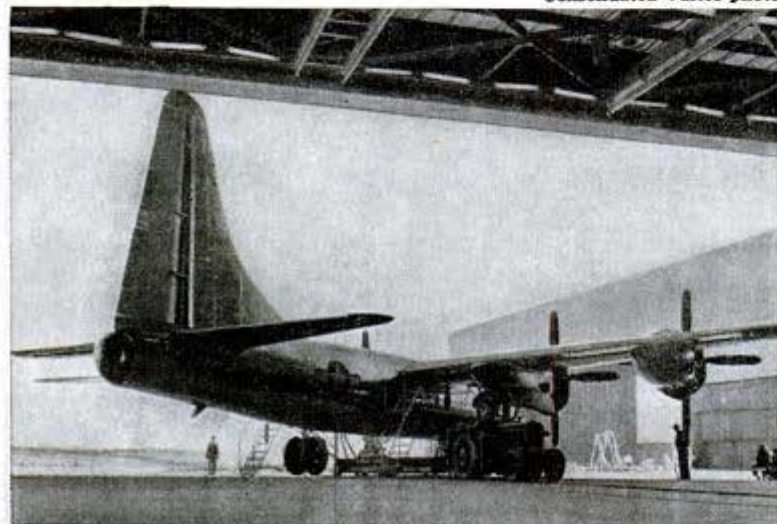
four 2200-horsepower Wright Cyclone engines equipped with turbosuperchargers. These 18-cylinder engines are air-cooled, double-row radial. Span of the B-32's low-drag Davis wing is 135 feet compared with 141.3 feet for the B-29. The B-32's fuselage is 83 feet one inch long, about 16 feet shorter than the B-29. Gross weight of the B-32, including crew (eight men compared with 11 on the B-29), fuel and bombs is 100,000 pounds—20,000 pounds less than the B-29.

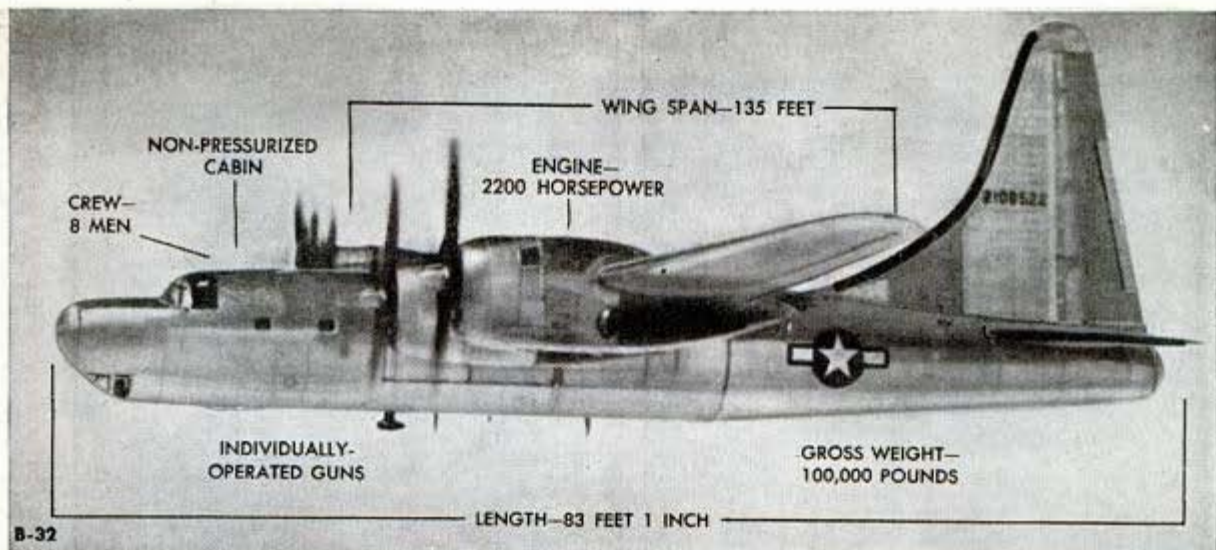
The wing area of the B-32 is 1422 square feet compared with 1739 for the Superfortress. The B-32 wing weighs 1000 pounds less than it did on the original model. Part of this weight saving was due to redesigning to make use of artificially aged and stretched aluminum alloy.

The flight officer leads the way toward the open bomb bay doors. After a glance at the dual wheels of the tricycle landing gear, you climb a short steel ladder onto the bomb bay catwalk and proceed forward into the cockpit. To the left is the navigator's table and across the way a cot on which are piled the chest-type parachutes that can be snapped to your harness in a jiffy.

"Not much chance you'll have to use this chute," says the f.o., "but if anything should happen all you have to do is step out on the catwalk, hold your head down and fall forward." He grinned. "Simple."

Tail barely clearing the hangar door, a "32" emerges from assembly line
Consolidated-Vultee photo





Recessed pilot cockpit and lofty tail are distinguishing features of Consolidated-Vultee's new bomber

You look about the roomy cockpit. Pilot and copilot are in their conventional positions, but between them is a station for the engineer. He sits on the floor between the two pilots, his feet resting on one of the steps leading down to the bombardier's compartment in the nose. The engineer's job is similar to that of the enlisted aerial engineer, or "flying crew chief," on a B-24 or B-17. He does not have the cruise-control responsibility of the B-29 flight engineer who occupies a station back of the copilot with an instrument console of his own.

All flight instruments on the B-32 are on one large panel before the three-man flying team. These three key men receive their B-32 transition training together.

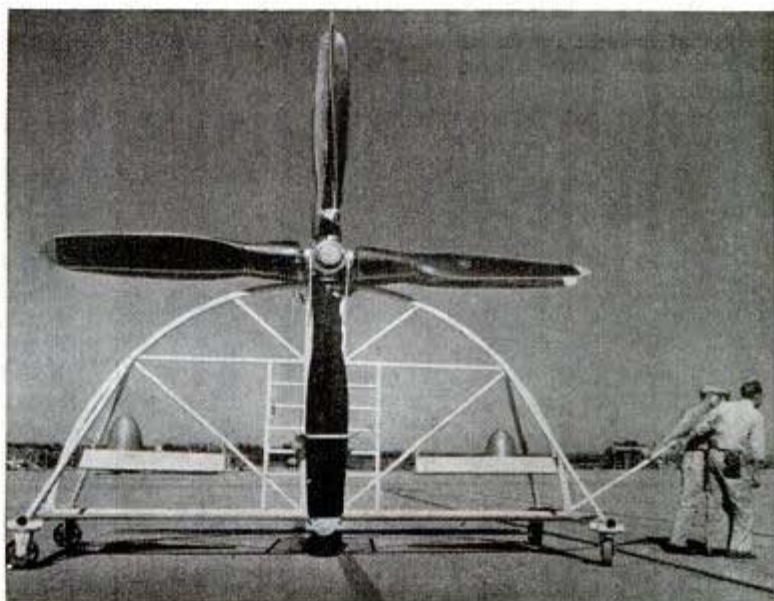
As the big bomber taxis across the field getting ready for the takeoff, you glance across the runways to the mile-long Consolidated plant where the bombers are rolling off the assembly lines. The pilot "revs" up each engine, and the bomber trembles and tries to pull away. The B-32's four-bladed Curtiss propellers are 16 feet eight inches in diameter, the largest on any land plane in mass production. You watch the pilot set a single control which synchronizes all four engines by altering the propeller blade angles. This control maintains synchronization through various flight conditions and saves the pilot the headache of manually adjusting separate controls.

The copilot holds a check list in his hand as he speaks into the interphone. There are 75 items to be checked before takeoff. After the last one is checked, the bomber surges forward with a tremendous roar and in less than 30 seconds you and 50 tons of bomber are in the air.

Although the giant B-32 seemed to take off without effort, you are told that 160 gallons of high octane gasoline were consumed in taxiing and taking off. It requires 190 gallons to lift a B-32 to 10,000 feet. These factors, and many others, are carefully weighed by the crew when planning a long mission. They must carry adequate fuel for emergencies such as the loss of one engine; the bomber consumes 15 percent more gasoline on only three engines. Un-

(Continued to page 158)

Two of the B-32's 16 foot 8 inch reversible pitch propellers ride to work

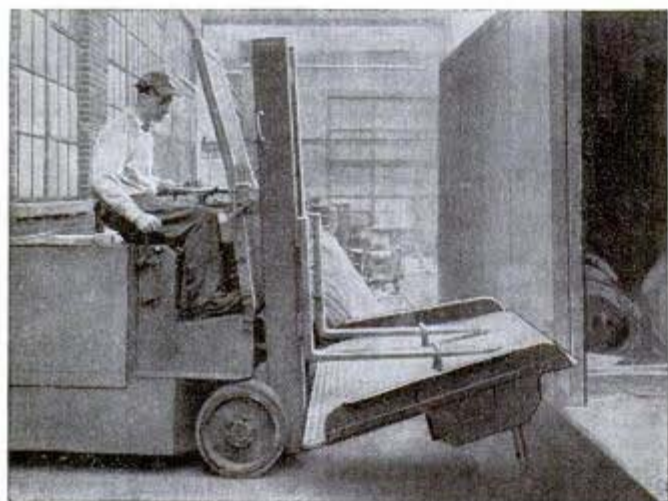




Sawdust Retread Is Nonskid

Tires made with ordinary sawdust may eliminate the bothersome wintertime job of putting on chains if the invention of two Morgantown, W. Va., brothers proves successful. With a special remilling process the sawdust is worked into the retread camelback, which is applied to the tire in the same way as ordinary camelback to provide an abrasive tread. In tests before representatives of leading rubber companies the inventors ran an automobile up a snow and ice-covered 12-percent grade, stopped the car, started it again and finally backed the car up the grade. The rubber companies are making their own tests, not only for nonskid qualities, but to see if the sawdust also increases mileage.

Milling machine (top, left) softens camelback and works in sawdust, then tubing machine (top, right) heats and extrudes camelback to desired width and thickness, after which it is applied as usual (right)



Portable Freight-Car Ramp Supports 15,000 Pounds

Gaps between loading platforms and freight cars can be bridged with a portable nonskid ramp which is moved with a fork truck. It spans any gap between five and 46 inches and carries loads up to 15,000 pounds. Lift handles slide down flush with the riding surface when not in use. Shock plates absorb impact and transmit it to stringer plates which prevent truck and load from running off the sides. Ends of the stringers are set back and rounded off to permit the truck to turn sharp corners.



HOME WORKSHOP SANDING KIT TURNS OUT MANY SHAPES



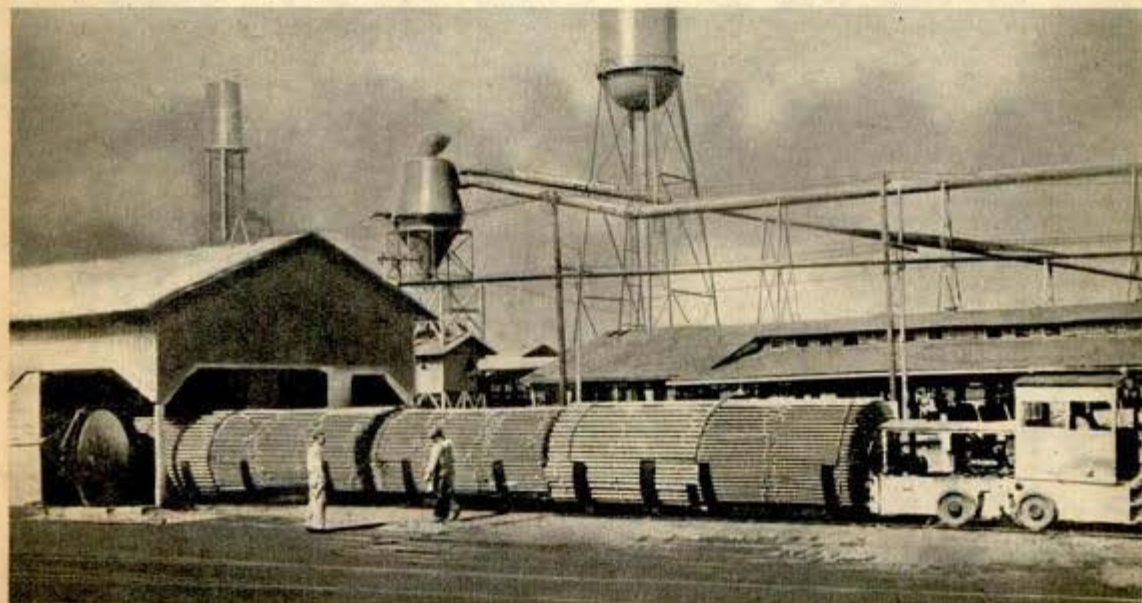
Sanding disks, drums, blocks and compound shapes for use on a workshop lathe, saw or grinder head may be coated with abrasive quickly and easily with a can of water-soluble, quick-drying cement and abrasive in various grits. Such sanding shapes are invaluable in working on irregular surfaces which flat sandpaper can't cover. To coat a desired shape, first make sure it is clean and dry, then apply a full

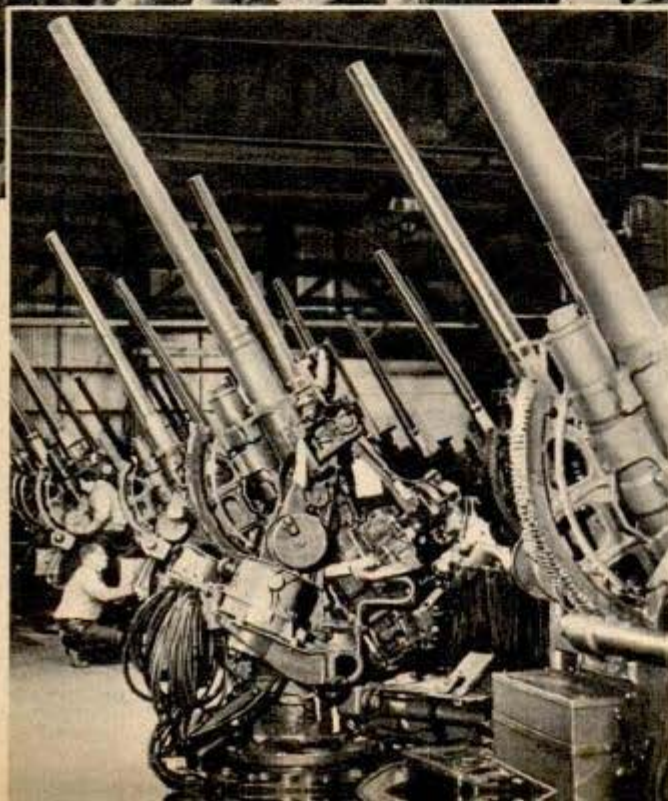
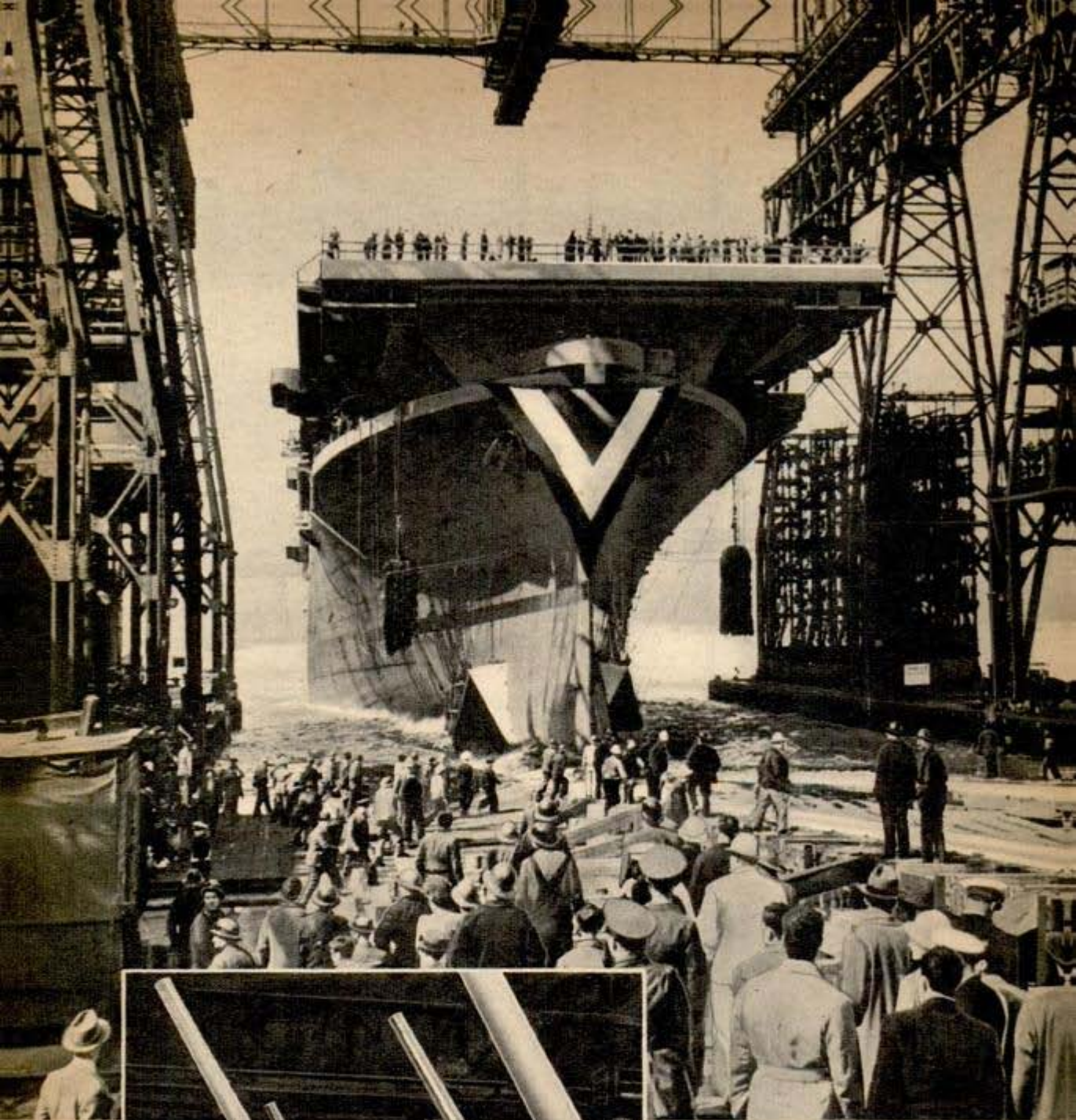
coat of cement with a small, clean paint brush. Pour the abrasive on immediately and shake off the excess grit by tapping the shape lightly on the corner. Apply a second cement coating 20 or 30 minutes later, directly over the abrasive, and pour on more abrasive, shaking off the excess as before. Allow the finished shape to dry overnight. When the abrasive becomes badly worn, the shape may be recoated.

Tent Poles Get Salt Treatment to Resist Rot and Vermin in the Tropics

Tropical termites and fungi that once played havoc with tent poles at the Navy's advance base shelters are thwarted by U. S. chemists. The poles are soaked in a special salt solution which is not only unpalatable to termites but wards off fungi. One wood-preserving company alone has produced more than a million feet of tent poles for use in the South Pacific. Canvas and tent ropes are similarly treated.

table to termites but wards off fungi. One wood-preserving company alone has produced more than a million feet of tent poles for use in the South Pacific. Canvas and tent ropes are similarly treated.





The
**COLOSSUS
OF
BROOKLYN**



U. S. Navy photos

Here are some of the 70,000 workers at the New York Navy Yard in Brooklyn. Above, women welders at work on flight deck. Page opposite shows launching of carrier Bon Homme Richard, and gun inspection

are used for such purposes as storage. Sixteen shipyards in three states operate under the navy yard's jurisdiction. More than 700 companies, each with subcontractors, some as far west as Gary, Ind., make parts for its ships.

What the navy yard manufactures is principally trouble for the nation's enemies. In 1944 it performed repairs, alterations and other services on 1616 ships, 833 of which went into drydock. In addition the field service division handled 1517 vessels built in private yards, fitting them out or providing alterations. Also, merchant ships totaling 7286 paid service calls at the yard.

While repairing and altering at the above rate, the yard has built and sent to sea during the present expansion program the greatest warships that have ever wet their hulls. These include the 45,000-ton superbattleships Missouri, North Carolina and Iowa and the 27,000-ton Essex type aircraft carriers Bennington and Bon Homme Richard. Just a few months ago, from the six-story depth of one of the yard's huge construction drydocks emerged the greatest airplane carrier ever built, the 45,000-ton USS Franklin D. Roosevelt.

Some of the problems which the yard, under Rear Admiral Freeland A. Daubin,

UNCLE SAM decided back in 1801 to build a navy yard convenient to the promising little settlement of New York. After shopping around he invested five dollars in a 42-acre piece of land on the Brooklyn waterfront.

Today, colossal is the only word to describe the operations of the New York Navy Yard at Brooklyn. The 70,000 employees of this largest navy yard in the world form a community about as large as Schenectady, N. Y., or Topeka, Kan.

The original 42 acres on the East River near Brooklyn Bridge have grown to 290. Four annexes raise this total to 788 acres. Eighty more locations, mostly in Brooklyn,



Workmen polish up a 16-inch rifle before 175-ton crane hoists it aboard the 45,000-ton battleship Iowa

commandant, and Rear Admiral Sherman S. Kennedy, general manager, has solved are examples of Yankee ingenuity on a gigantic scale.

There was the time two 280-foot, 1300-ton destroyer escorts limped into the yard. The stern of one was badly damaged. The midsection of the other had been blown out, but bow and stern were okay.

The two vessels were set in a construction drydock side by side. The two stern sections were cut from the two ships so that the good section could be transferred from the vessel damaged amidship. The 200-ton undamaged section was cradled in steel and concrete. Wooden skids were built between the two destroyer escorts and greased. A block and tackle arrangement at the bottom of the drydock reached

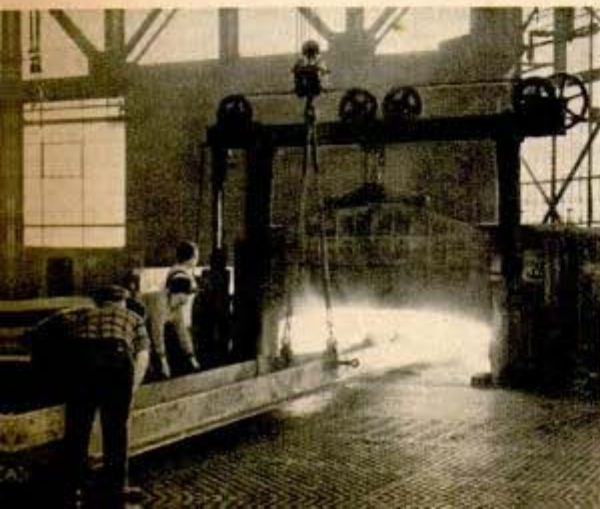
to the top. A second block and tackle at this point led to a great crane.

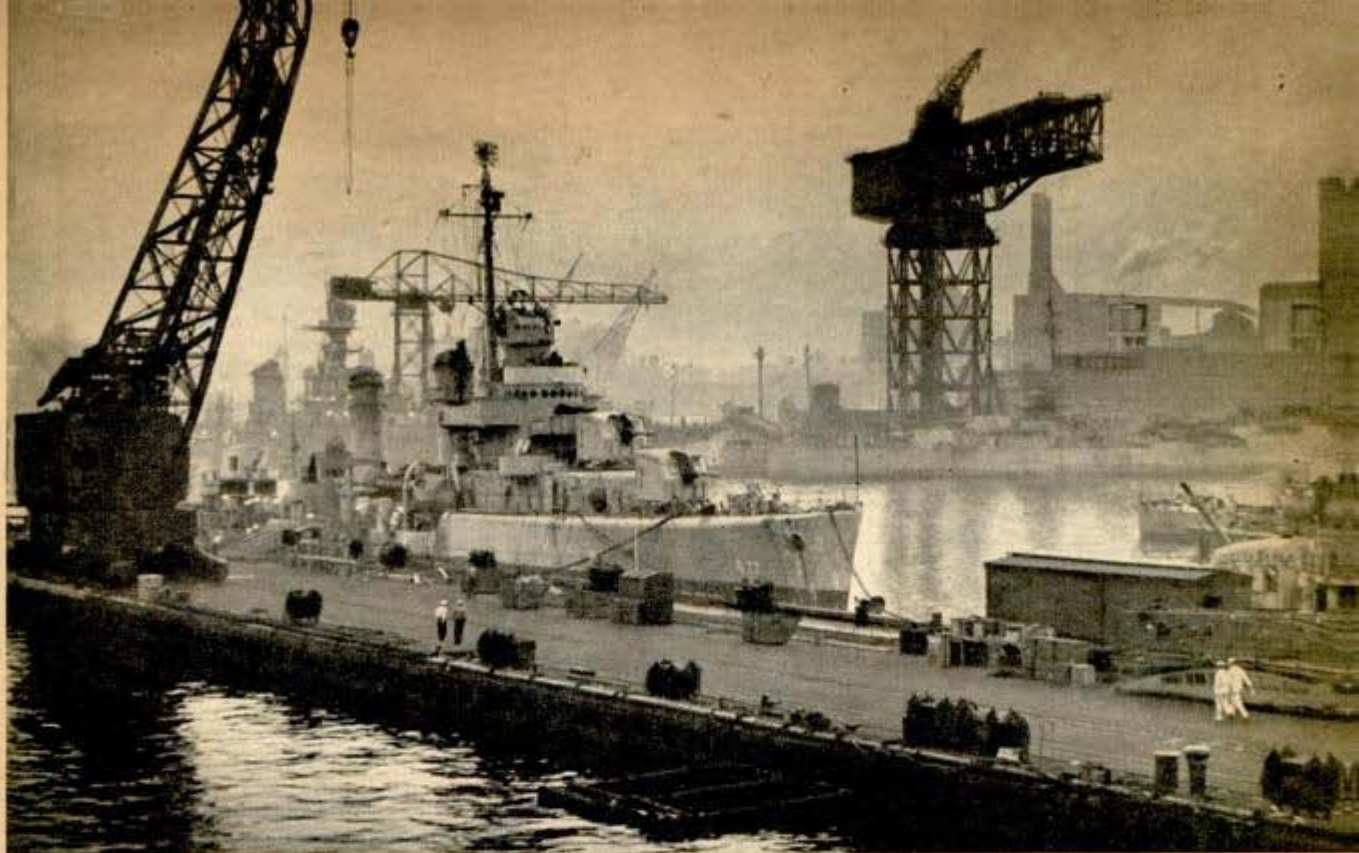
The crane lifted, the good stern edged sideways until it replaced the amputated stern. The great job, which was something like sewing a giant tip on the finger of a gargantuan glove, was completed in 21 days. The new ship, a combination of two badly damaged ones, was soon back at sea.

Another remarkable job was performed on a destroyer which was towed in with the entire middle section damaged beyond repair. Cutting away the center of the ship, with the exception of enough deck for workmen to pass between bow and stern sections, the navy yard built in a new center and the nation had another seaworthy ship instead of a hopeless heap of scrap.

One of the most difficult jobs ever tackled

Below at left, one of the yard's blast furnaces receives piece of structural steel. Right, flag-makers' loft





Heavy dockside crane swings into position alongside destroyer; in left background is big hammerhead crane

was to repair the stern of a warship after a collision with another vessel. The fantail area was not only a jumble of twisted bunks and equipment, but was filled with gasoline and oil fumes, highly explosive and deadly to workmen. Quantities of powder and other explosives had been released into the damaged section by the crash.

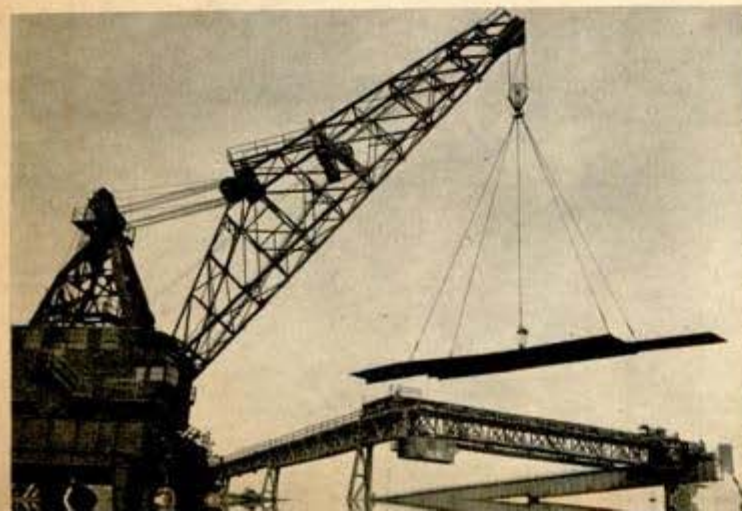
The problem was handled first by berthing the tinder box at a safe dock and calling fire fighting equipment. Powerful streams of water were hosed into the section until gasoline, oil and other explosives were washed out. Experts in diving costumes and others in gas masks tackled the wreckage by hand, using hack saws and cold chisels. Finally the ship was drydocked without hazard.

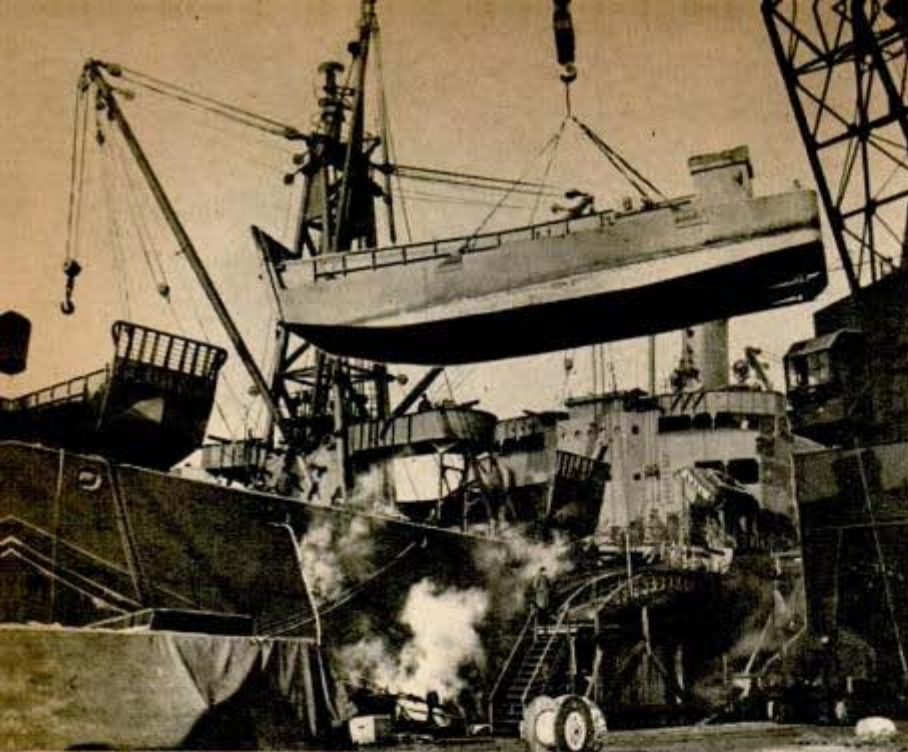
Incredible as it seems, even in these mod-

ern days of fabrication, the yard has a stock of bows, or forward sections, for the most numerous classes of destroyers and destroyer escorts. In common with all ships which travel the sea, the bow sections are most often damaged by collision with other ships, docks and various obstructions. When a ship of this class comes in with severe damage it is often drydocked, the damaged area cut away and a new nose is fitted on. "Plastic surgery" goes to sea with the result that the damaged vessel is in fighting trim again in a couple of weeks.

All jobs of this magnitude go into the repair drydocks which, along with construction drydocks, have reached the peak of efficiency in the New York Navy Yard. Great pits, lined with concrete and reinforced, they are approximately as deep as

Below at left, huge section of steel keel about to be lowered into drydock. Right, girl at engraving machine





Landing craft is loaded aboard attack transport with big dockside crane

a six-story building is high and their floors are big enough for a football game with room to spare for the spectators.

On repair jobs ingenuity and the rush of activity at the yard combine to save time and put ships back at sea in record time. Whenever possible, four or five ships are lined up and floated in, the end of the drydock is closed and water is pumped out. Repair crews numbering into the hundreds swarm onto the various vessels. Work is scheduled so all the vessels are finished about the same time.

Often several large warships, too wide to be placed parallel in a repair drydock, are fitted in by placing the narrow bow of one

where is the art of below-surface construction brought to greater efficiency than it is here in Brooklyn.

So huge are these concrete ditches that the gates which hold back the water while ships are being built are virtual ships themselves. They are steel caissons which can be floated away and moved at will by tug power.

Floated into place, they are sunk into the mouth of the dock by permitting them to fill with water. Once they have formed a "stopper" for the mouth of the drydock, the dock is emptied and construction is begun. When the ship is finished, the caisson is pumped dry, whereupon it floats to

Below at left, workmen building wood pattern for steel gear which will be made for fighting ship. Right, rivet is driven home in deck; it is one of hundreds of thousands of many sizes used in ship building



the surface. It is hauled off by a tug and the completed war vessel leaves the flooded dock under its own power.

Construction drydocks cost more to construct than building ways because of the extent of excavation necessary and the reinforcement of bottom and walls. However, in the long run the method is cheaper and faster. When a ship is being designed for construction on a slanted building way, every angle under calculation must be modified to care for this slant. Construction on the horizontal bottom of a drydock eliminates these laborious calculations.

Another advantage of "ditch" construction is that leaks can be discovered and corrected, trim and balance of a craft checked and motive power tested as soon as the dock is flooded. Any developments needing correction can be handled merely by emptying the drydock. Still another advantage of the construction drydock is that it serves as a repair dock instead of being out of commission on occasions when no vessels are being built.

To move huge warship parts around the navy yard a network of railroad tracks supports one of the greatest collection of huge portable cranes in existence. Most of these cranes will lift 300,000 pounds with ease and place a section into the designated spot with exact precision. The cranes not only serve to move guns and fabricated parts onto ships being built, repaired or modified, but they do such odd jobs as loading 100-ton landing craft onto larger ships.

In addition, the yard boasts a gigantic ham-



Famed 45,000-ton battleship Missouri hits water. Below, yard officer uses gas-saving motorbike in inspection tour of sprawling N. Y. Navy Yard





Repair job for navy yard—stern of cruiser *Marblehead* caught direct bomb hit in Battle of Java Sea. Note bulging afterdeck

merhead crane, so-called because it resembles a hammer with the vertical section simulating the handle. The crane will handle up to 900,000 pounds and it can sling a 200-ton tug, a 16-inch gun or a 150-ton turret section as a routine job.

The 50 miles of railroad track which criss-cross the yard near Brooklyn Bridge do more than move cranes. They transport the 150 navy yard freight cars, hauled by electric and Diesel locomotives, and even include a classification yard. Despite the congested location of the yard, which has

more skyscrapers within rifle shot than any other such establishment in the world, no civilian railroad connects directly with the navy yard railroad. Every car which comes into the area is brought in by car float or car ferry.

In addition to the huge waterborne traffic, 150,000 automobiles and trucks enter the navy yard every day.

Figures dealing with yard operation are gigantic by any measure. The stock pile of material on hand has an average value of \$180,000,000. More than 25,000 phone calls a day keep its 1575 telephones busy.

The monthly payroll runs \$15,000,000 and to facilitate the cashing of up to \$600,000 in payroll checks per day a branch bank is operated within the yard. The building floor area is 6,500,000 feet.

Paved roads total 22 miles. Forty restaurants do a \$3,500,000 business yearly.

Salvage alone gives another idea of the magnitude of the operation. In an average year 105,400,000 pounds of iron and steel scrap are collected along with 7,656,000 pounds of nonferrous scrap. The paper scrap item hits the 3,200,000-pound mark and 825,000 pounds of rags are collected, so that nothing valuable is wasted.

More than \$300,000 a year will be saved by a new oxygen carrying pipe line 10 miles in length with 700 outlets for welding and flame-cutting.

Roughly speaking, the working force of the yard is divided 20,000 on new construction, 20,000 on repairs, 10,000 on manufacture of parts, etc., and 20,000 on maintenance, utilities, transportation, clerical work and various minor classifications. Keeping this huge force at top speed during the war has been an inspiring and gratifying task, according to Rear Admiral Kennedy.

"The lights have never been turned off and the telephones have never stopped ringing a minute since the war started," he says. "Nor has the fighting spirit of our huge army of workers flagged in their battle to get ships in shipshape condition to the fighting fronts. We have hit our completion dates with 100 percent efficiency under our slogan, 'service to the fleet.'"

After trip half way around the world, damaged cruiser shown at top of page ties up at N. Y. Navy Yard in Brooklyn for repairs





Westinghouse photos

FM permits direct communication between engine cab below and yard office above or dispatcher at right



FM Speeds Train Orders

Static-free radio communication is achieved between yard office and switch engines with the first adaptation of frequency modulation radio to railroads. Mobile FM radio sets maintain constant communication between crews and yard office over the Westinghouse Company's 25 miles of switchtracks in Pittsburgh. The system consists of one stationary transmitter and installations on five locomotives. The FM broadcasts are said to be heard with great clarity.



Goggles for Amphibious Troops Help Gauge Depth of Water

Sun goggles recently issued to Army and Navy men have Polaroid lenses which assist in amphibious operations by transmitting true colors. The lenses show the color of water at a depth of two feet as white, at six feet as yellow, at eight feet light green, at 10 feet dark green and at 20 feet black. The lenses, made of a new type of light-polarizing plastic material which is neutral in shade, are also useful in identifying airplanes and signals where colors are involved. They transmit 12 percent of visible light, one third that of ordinary sun glass lenses. The shatterproof goggles protect the eyes against glare, wind and dust. They permit 180-degree normal vision while the eyes are looking directly ahead.

Although a twin-engine plane burning 87-octane fuel can climb at the rate of 1000 feet per minute, 100-octane increases the rate to 1400 feet per minute.





Army Air Forces photos

Dummy Airplanes Fool Enemy's Aerial Spies



Dummy air bases complete with landing strip and all facilities now can be constructed in record time by American aviation engineers, who have concentrated efforts

on ease and rapidity of handling. Made of target cloth, wood and wire, with parts hinged for compact folding, a dummy P-51 can be unloaded and set up in seven minutes by a crew of five. An entire squadron can be folded and hauled away in two 2½-ton trucks. In erecting a camouflage installation bulldozers first scrape out the major strip just deeply enough to show from the air. Bamboo or tree trunks provide an operations tower and simulated bivouac areas indicate personnel activity. Trucks are run into a clear area to leave tire tracks that spell "ack-ack" to photo intelligence men. Fake radio

traffic soon attracts enemy monitors. Supplemented by occasional flights by genuine aircraft these air bases defy detection by enemy photo reconnaissance planes.



Electrical "Manicurist" for Home

You can give yourself a speedy, professional manicure in your own home by using an electrical plastic "pencil" provided with buffer, file, cuticle pusher and brush attachments. It is claimed that the robot manicurist files the nails so smooth that they will not snag the sheerest hose. Powered by a 1/200 horsepower motor and easy to operate, the machine prevents hangnails and, with the buffer attachment, massages hands and finger joints.

Successful firing of blood plasma in artillery shells to isolated Allied troops before the Nazi collapse is reported in the Marine Corps Gazette. Instead of one transfusion for every five wounded, as estimated, a transfusion was required for every two wounded, battle records showed.

HELICOPTERS

“—With the Greatest of Ease” →

Hoping to become the first “human helicopter,” Horace T. Pentecost, Seattle engineer, designed the small rotary wing with air-cooled two-cylinder engine which is strapped to his back. Unit weighs about 90 pounds. He holds the flight control stick in his right hand and throttle in his left. A certificate of air worthiness granted by the Civil Aeronautics Authority enables the inventor to carry out the necessary flight experiments by which he expects to perfect the revolutionary personal helicopter



← Mayor on the Air

With a wave of the hand, Mayor Fiorello H. LaGuardia of New York becomes the first American mayor to ride in a helicopter, a two-place experimental Bell model. The mayor said his ride satisfied him that rotary wing aircraft would assume an important role in postwar aviation



Two sets of three blades each overlap as they rotate in opposite directions in the AAF XR-8 Helicopter built by the Kellett Aircraft Corporation. Action of the blades shown below is something like that of an egg beater. The design eliminates necessity of a tail rotor for counteracting torque and reduces drag and power transmission requirements, according to the manufacturer.

Egg Beater

In flight the “egg beater” helicopter is highly maneuverable and has all conventional helicopter characteristics. The XR-8 fuselage is 22 feet 7 inches long, the rotor span 40 feet and the blade area 84.5 square feet. It has a gross weight of 2975 pounds and is powered by a 245-horsepower air-cooled engine. Its maker emphasizes that it is a military experimental design



RADIO PILOTS YOUR POSTWAR



APLICATION of radio equipment to wartime aviation has been given a tremendous boost by Army Air Forces experimentation and research, just as military necessity has spurred practical development of many other techniques.

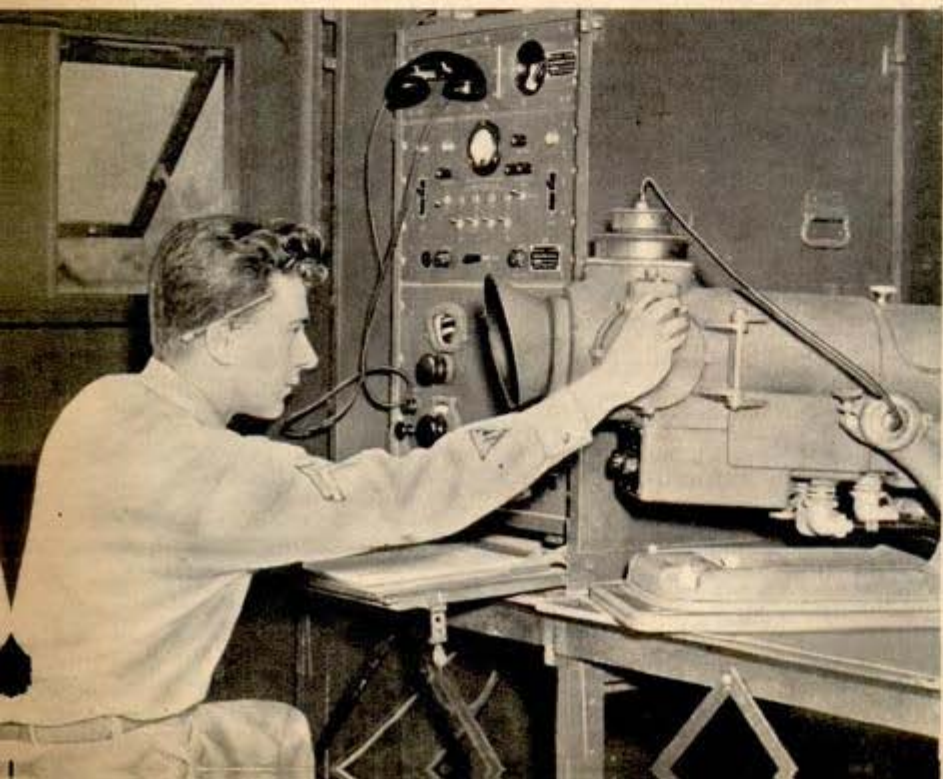
Consider a suppositional flight by a globe-girdling plane such as the cargo version of the B-29. Before takeoff, radio-range has reported on weather conditions that may be encountered. New electronics equipment is able to detect severe thunderstorms up to 100 miles away and weak cumulo-nimbus clouds to at least 50 miles. This information, plus a knowledge of

Plane is poised for landing approach by instruments. Localized transmitter in background and mobile set, above, send beams aligned with runway's center line

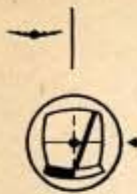
weather characteristics in a particular area, allows for adequate warning of impending meteorological disturbances, especially valuable in flights over the Pacific. No observation stations are available there and treacherous, turbulent areas and quickly changing frontal cumulus constantly jeopardize air operations. With data thus collected, radio is then put into effect to communicate forecasts and reports to all airports in the airways system, using point-to-point and air-to-ground circuits.

At takeoff time, improved radiophones enable tower operators to keep in two-way touch with pilots, issuing instructions and transmitting last-minute information. If other planes take to the sky at the same time, air-to-air communication between planes may be accomplished automatically without fading at altitude or increasing in audio output on descent. Frequencies are preset on the ground and the radio operator simply selects the channel he desires to use; the receiver

Direction-finder operator takes bearing on plane signal. Cathode ray tube projects pointer on glass rimmed by compass scale



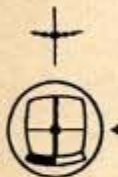
AIRLINER



Needle of glide path indicator always points in direction plane must be flown to approach glide path. With craft at left of signal, instrument in cockpit points to right



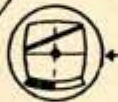
With plane approaching beam from right, glide path indicator needle shows corrective action should be taken toward left



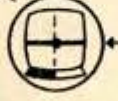
With plane on beam, vertical and horizontal needles line up to show proper approach is being made



With plane above beam, needle tells pilot he must lower ship



Plane is flying below glide path, and needle shows pilot must raise his craft



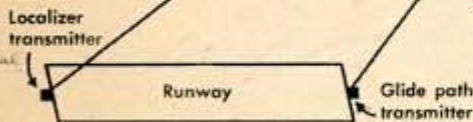
Coming in for safe landing through darkness or overcast, glide path indicator shows plane is descending at correct approach angle to runway

Localizer transmitter projects two tone-modulated radio patterns which intersect to provide pilot with a centerline to runway from as far as 75 miles at 8000 feet

With localizer beam bracketed, pilot flies along until he intersects glide path at approximately 2500 feet, about 13 miles from field

Plane's radio operator sends signals by hand key to get a position fix, soon available through direction finding net

automatically picks out the frequency and tunes it in without any dial-twisting. If pilot or copilot must communicate with the navigator or the radioman, increased sensitivity of his interphone amplifier will compensate for low microphone output in upper air, and its three-step volume control will modulate the increased power output capacity



Glide path transmitter provides signal to keep pilot on correct angle of descent after entering approach path





Arrow points to fork-type antenna which receives localizer landing beam

of the amplifier to overcome the reduced sensitivity of headsets in high flying. In the new "lip" microphone all unwanted sounds and noises are cancelled out by the acoustics of the design. It is so constructed that sounds enter either front or back and noises originating at a distance affect both sides of the diaphragm at once, resulting in no movement. Weighing less than two ounces, this small microphone can be worn under a respirator.

With the plane leveled off at a selected altitude for flight to its destination, scores of radio navigational aids are available to guide the craft along its route. At present,

also be employed to determine precise position, with a radio transmitter on the ground sending a modulated wave of a given length to the aircraft in flight from which it is retransmitted to the ground on a different wave length by a receiver-transmitter called a telesonde. The interference of the two waves is indicated on the ground by an oscilloscope and gives the distance, which may be read directly from a quadrant.

The principles and practices of the fighter control system—developed to a high degree of efficiency during war—undoubtedly will be used to monitor commercial aircraft. At remote outposts throughout the world, including mid-ocean "artificial islands," transmitters will be set up to provide navigational aids to sea-spanning airliners. Should a pilot want a bearing, his radio operator advises an airways station, which alerts all direction-finding stations within the control net. The airliner operator then sends his identification signal and any other required signal at established intervals, while each DF station

Ground station operators keep in constant touch with plane, supplying navigational aids

POPULAR MECHANICS



takes a directional bearing on these signals and transmits it to the central station. All bearings are evaluated there and the plane's position at the time the signals were received is radioed to the craft. The pilot flies a set heading during this period and upon receipt of the bearing adds the distance traveled within the time of three to four minutes to establish his correct position. In this connection, radio set SCR-291 may prove extremely valuable in furnishing accurate bearings for planes on world-wide air routes. The equipment includes a radio receiver, a loop or Adcock-type antenna array and a cathode ray tube and motor-driven goniometer which provide instantaneous bearings. The plane operator tunes the signal in, reads the visual trace pattern, determines the true direction by pressing a switch and enters his findings on a chart for evaluation into a fix. A control network of several of these DF stations and a master station can cover an operational area 1000 miles in diameter.

To increase efficiency, the latest type of very-high-frequency vertical antennas will be used. Formed of streamlined cypresswood with a metal plating, they can withstand icing and acceleration loads, reduce drag, neutralize the effect of precipitation static and pick up and radiate low-frequency waves more effectively. To eliminate undesirable sounds, a "probe antenna" locates sources of noise in loose metal or electrical connections, faulty ignition and elsewhere, and dampens out the interference. Precipitation static, caused by the passage of rain, snow, ice or dust over the metal skin of the plane, often making radio reception impossible, also is reduced considerably by a dry-type discharger riveted to the skin, which emits accumulated charges constantly.

In event of a forced landing at sea, the chances of quick rescue are greatly heightened by radio devices. A portable transmitter is parachuted into the water and begins to send repetitive distress signals as soon as the radio marker buoy strikes the surface. The signal is sent out continuously for 12 hours, and ships and planes can be guided to the survivors by radio compasses. For life rafts, the Corner Reflector has been developed, a lightweight collapsible set of intersecting surfaces made of metallized cloth or screen-like material on an aluminum frame which reinforces the raft's "Gibson Girl" radio signal.

Assuming that all has gone well, however, the plane would continue on its course, guided at all times by a chain of radio-range stations stretching at inter-

(Continued to page 150)



With metal pegs for direction finder stations and cords showing bearings, board charts plane position



Static discharge tube, above, reduces interference in plane radio. Probe antenna in lieutenant's left hand, below, spots electrical leaks affecting radio



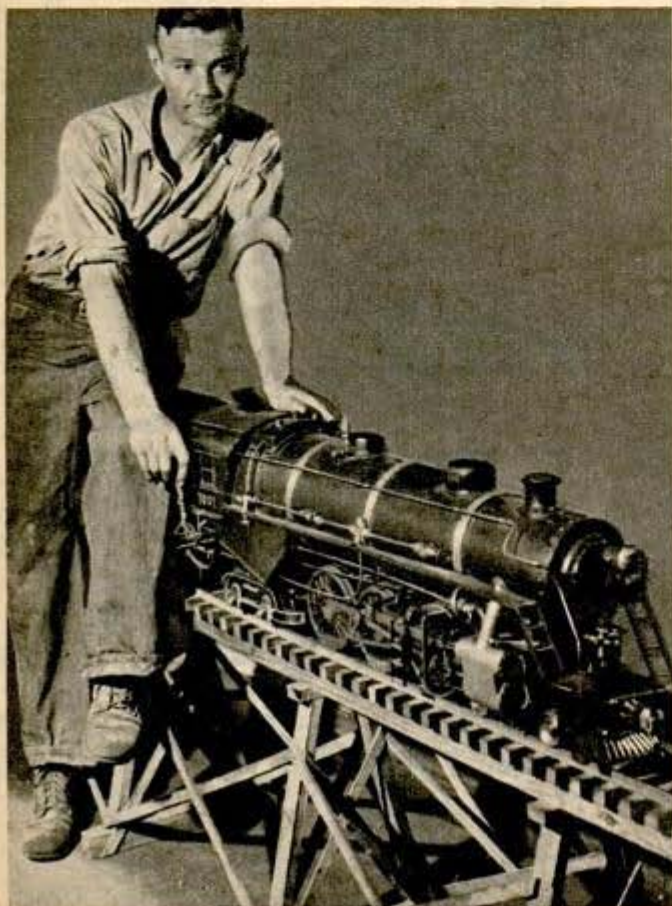


Skeg strengthens skiff, easily lifted by one person



48-Pound Plywood Skiff

Construction principles of wooden bombers are applied to a new seven-foot plywood skiff weighing 48 pounds which can carry four persons or 750 pounds. Shell planking is $\frac{7}{32}$ inch thick and consists of three plies of wood veneer, laminated with plastic adhesive, baked and molded under heat and pressure. Skeg keel, transom and seats also are of birch and maple veneers left over from manufacture of huge wooden flying boats. Already available to hunters, fishermen and yachtsmen, the skiff's stern is strengthened to permit the use of an outboard motor.



Miniature Steam Engine Hauls 1500-Pound Load

Complete in detail down to tiny workable brass-handled throttles, a model locomotive fashioned by Daniel Boone VII, a mountain blacksmith near Burnsville, Ky., can pull 1500 pounds. Powered by steam, the engine weighs over 200 pounds and runs on an aluminum track. It is made entirely of metal. Boone can ride down the length of the track which he has laid on a trestle in his shop. He spent six years building the miniature.

Non-Spatter Welding Film Cuts Part Cleaning Time

To reduce the adherence of welding spatter to metal and reduce cleaning time, a new liquid can be sprayed or painted on a job. Welding can proceed after application of the film, whether it is dry or still wet, and priming coats of paint may be applied over the film. One application is effective for multiple-pass welding, the manufacturer reports.

AROUND THE WORLD IN 30 MINUTES ...

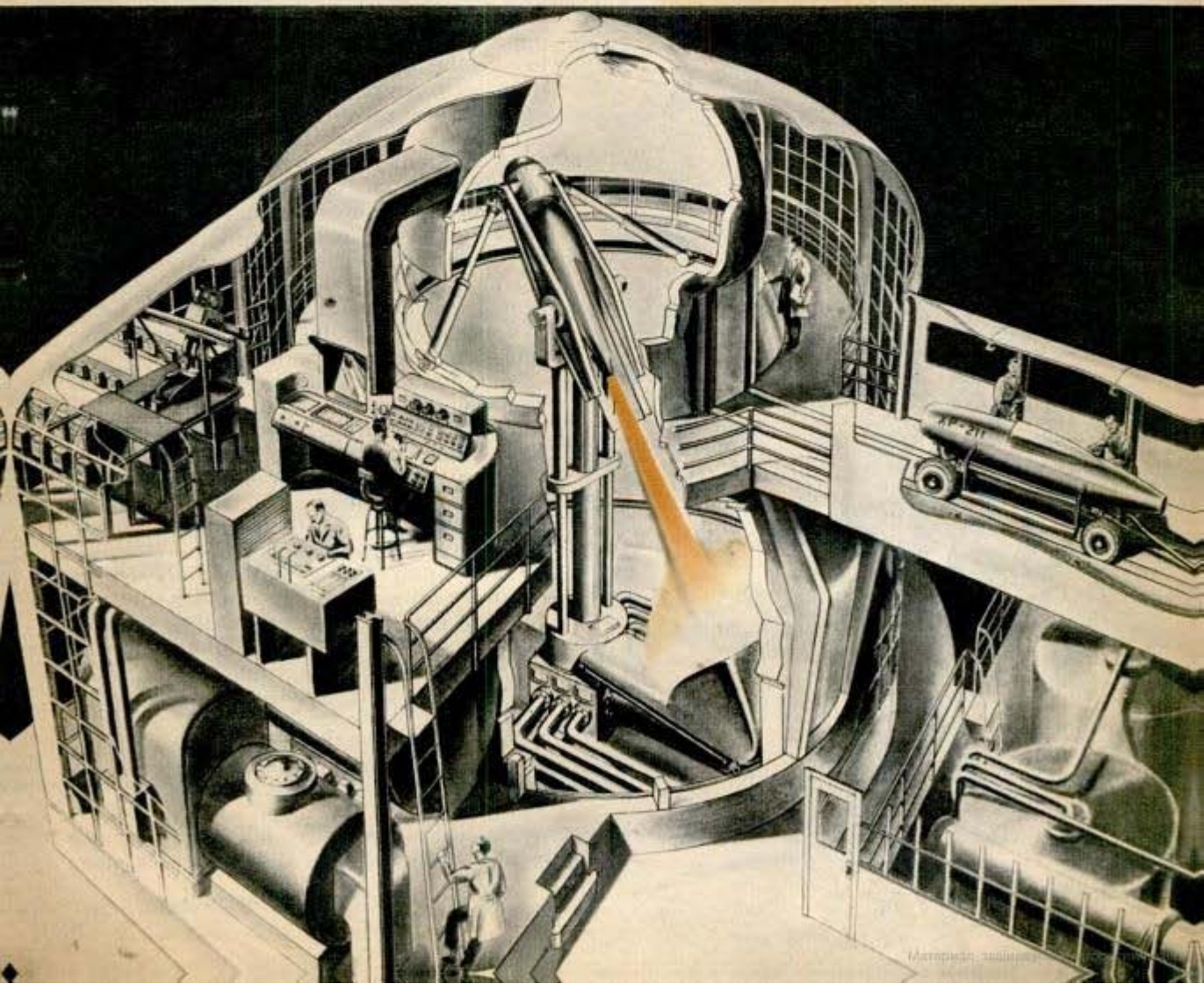
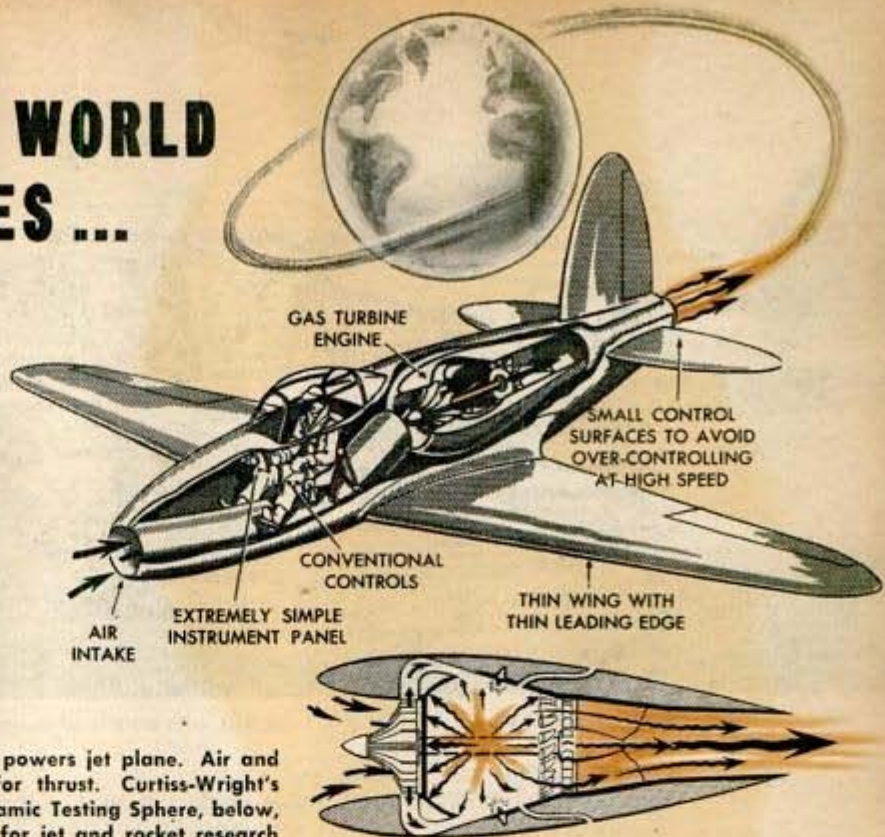
By
Thomas E. Stimson, Jr.

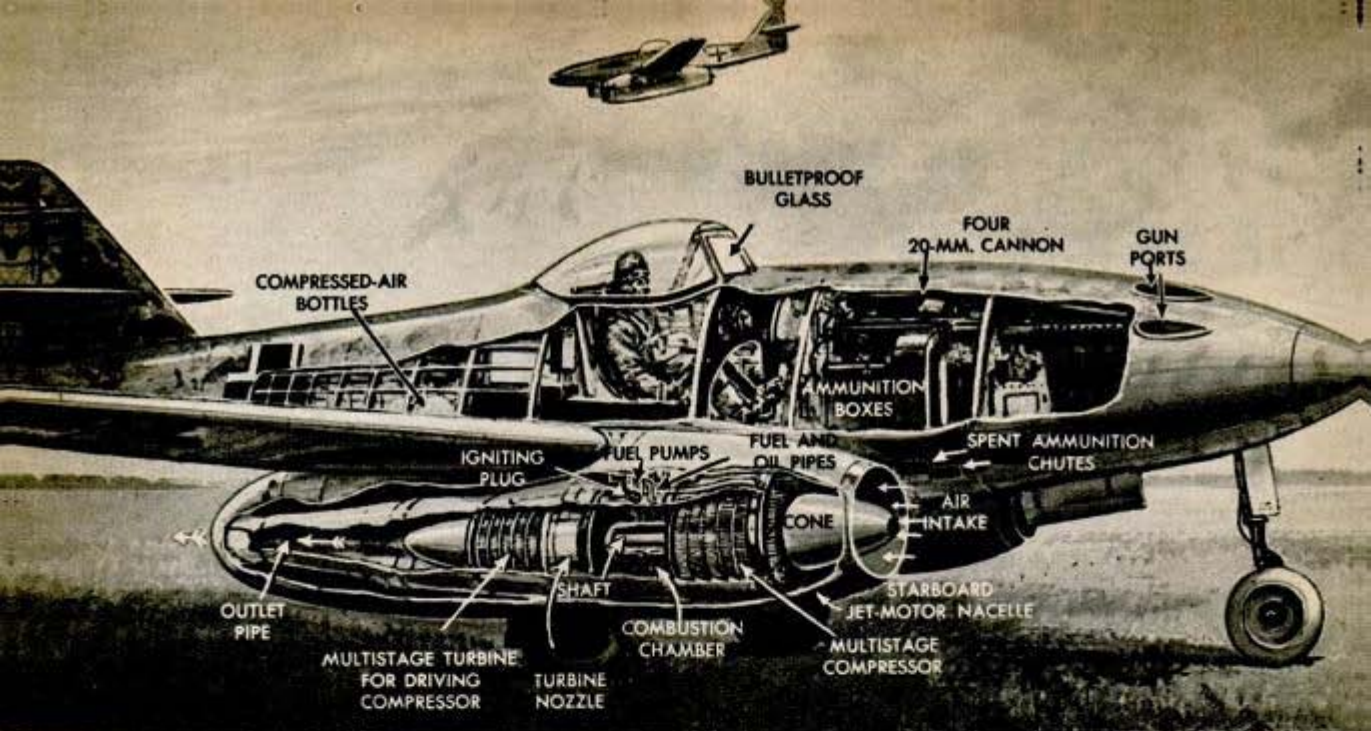
AVIATION designers are looking forward to creating within the "visible future" a rocket ship that would fly at the rate of 100,000 miles per hour.

At least, states Hall Hibbard, vice-president and chief engineer of Lockheed Aircraft Corporation, the basic principles of such a space ship are understood

Gas turbine engine like that at right powers jet plane. Air and fuel ignite in combustion chamber for thrust. Curtiss-Wright's Peter Rossman conceived the Aerodynamic Testing Sphere, below, and Tethered Flight Tunnel, page 35, for jet and rocket research

Drawing courtesy of Industrial Aviation





This is the German twin-engined jet plane ME-262 with details of major parts. It attained 500 to 600 m.p.h.

and the problems that remain are minor in comparison to the ones already solved.

It is conceivable that such an airplane, moving outside the atmosphere, could fly all the way around the world in half an hour. Provided that it could carry enough fuel and a livable atmosphere for its occu-

pants, it could travel to the moon, around it and return to earth between daybreak and dark.

The swiftest vehicle in the world today is our P-80 Shooting Star, Lockheed's jet propulsion aircraft that gets its thrust from a gas turbine. It is a transitional type between the aircraft that get their power from reciprocating engines and the rocket craft of the future.

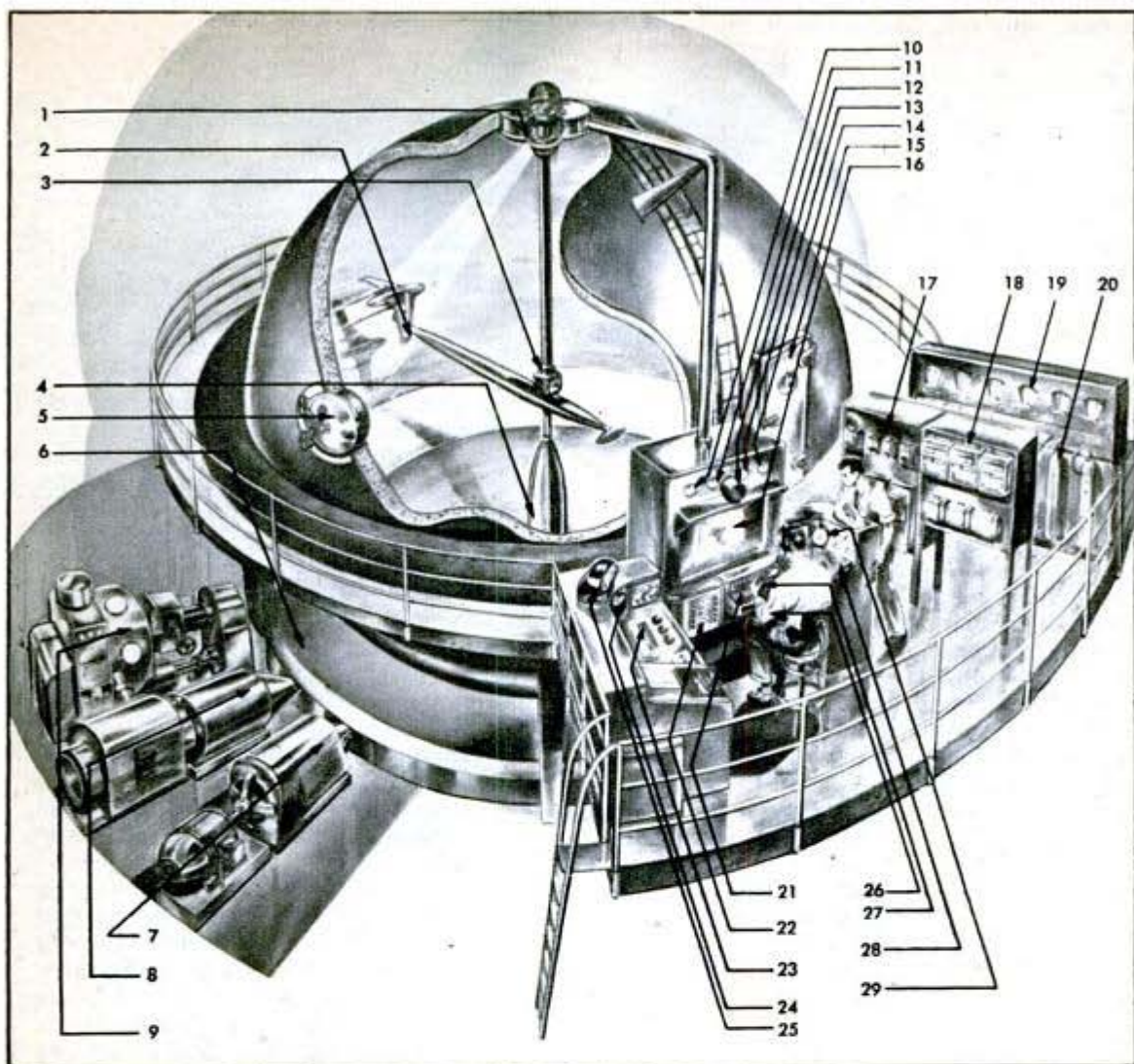
The P-80 wing has a knife-like leading edge and other aerodynamic innovations that master the problems encountered when the speed of sound is approached or surpassed. The pressurized cabin is unique among production fighters.

Small and light, the Shooting Star is extremely maneuverable through use of a hydraulic aileron boost and electrically operated flaps, and can carry heavy loads of ammunition, photographic equipment, bombs and fuel. Ceiling of the P-80 is well above that of propeller driven airplanes. The engine can be completely replaced in 15 minutes. There is no engine torque or vibration. The General Electric jet engine (gas turbine) is installed in the fuselage between the cockpit and tail.

Our atmosphere is both handy and a handicap for aviation. It provides the oxygen that gas turbines and gasoline engines must have to burn their fuel and it also supports the airplane itself. At the same time it contains an arbitrary speed barrier at about 750 miles per hour and an absolute speed limit at about 1500 miles per hour. Beyond that a human being would be burned to a crisp.

Jet flyer inflates "G" suit. This will inflate itself automatically in fast dives and stop pilot blackouts

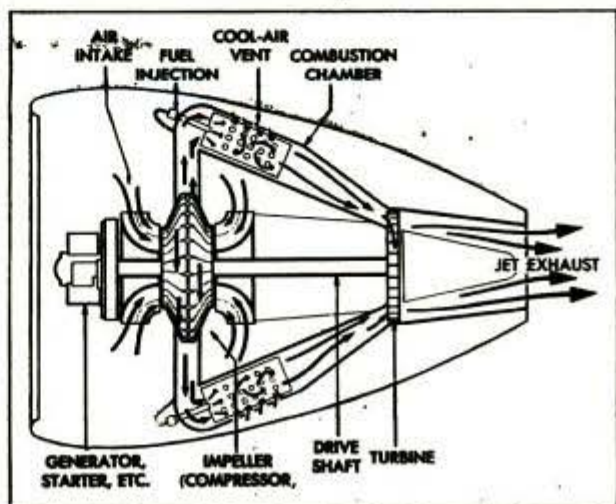




Drawing courtesy of Industrial Aviation

Here's key to operation of Tethered Flight Tunnel: 1, spotlight to light jet model for television pickup synchronized with model under test; 2, twin-jet model mounted on its center of gravity; 3, television scanning unit; 4, base containing bearings and fuel injection pipes; 5, emergency hatch; 6, countersunk concrete base containing explosion bulkhead, air ports, conduits; 7, heating unit to raise temperatures and dehumidify sphere; 8, extreme cold chamber of cooling system; 9, main power installation, gas engine of 300 hp.; 10, dial to show r.p.m. of "swing arm"; 11, dial showing bank of model; 12, oscillograph; 13, dial showing rate of flow of propulsive gases or liquids; 14, dial showing drag as created by "swing arm"; 15, self-sealing main entrance; 16, television screen; 17, transformers; 18, automatic devices recording temperature, humidity and air pressures; 19, weighing scale to check weights of propulsive gases or liquids; 20, tanks of fuels for rocket or jet pressure; 21, fuel speed controls; 22, multiple control box with signal lights; 23, combination machine that records all data shown on dials on each side of oscillograph screen; 24, clock with stop and recording attachment; 25, remote controls and dials; 26, operator at master control station; 27, rheostat wheel to control revolving "swing arm"; 28, main switch; 29, dial showing the thrust energy developed by jet model tested

Basic principles of GE's new Turbo Jet, which drives the Shooting Star, are illustrated in drawing below



Whoosh! And this B-25 gets away to a flying start with help of rockets



The 750-mile-per-hour speed-of-sound mark is a barrier because at that speed a projectile such as an aircraft sets up a shock wave that increases its drag materially. A lot of power, possibly gravitational power, will be needed to break through that barrier. An airplane trying to fly past the speed of sound may be able to accelerate by going into a dive, getting an extra boost from gravity and passing on to the higher speeds at which drag is less. Research in ballistics indicates drag or air resistance is less at 1000 or 1200 miles per hour than at 750 miles per hour.

Aircraft engineers are whittling away at the speed-of-sound barrier all the time and are just about ready to punch through it. Then they will encounter another serious problem, the unavoidable fact that heat is created at high speed because of friction with the atmosphere.

Already, in aircraft that are slower than Lockheed's P-80, heating troubles due to

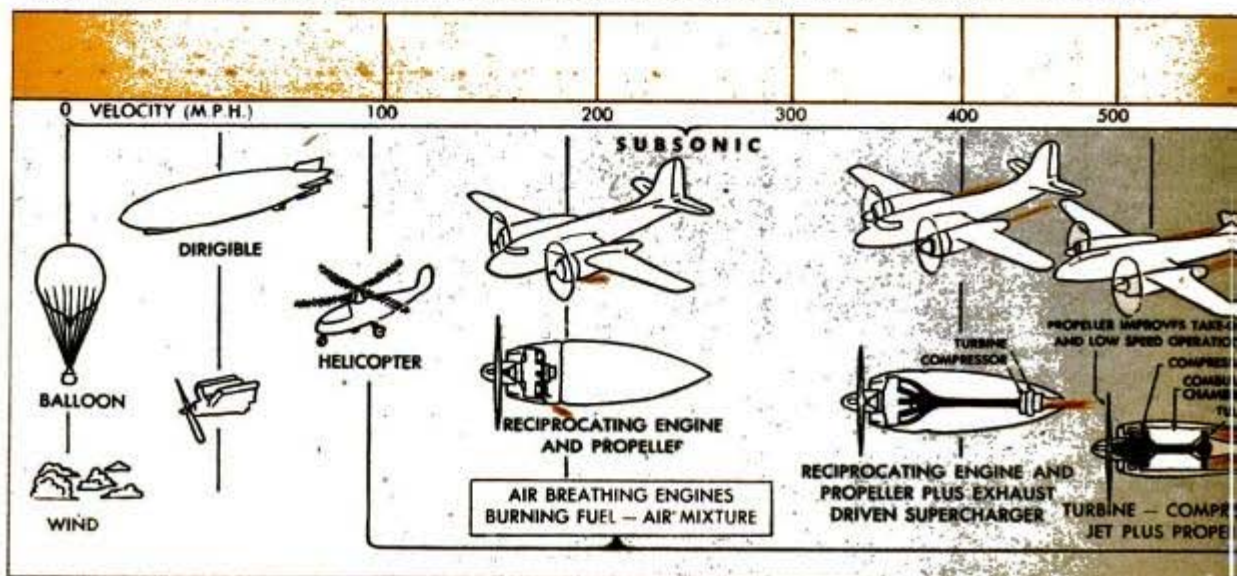
friction plus heat caused by the compression of ventilation air are a matter of concern. Some kind of refrigeration system appears necessary for any low-altitude airplane to fly, say, at 1000 miles per hour.

To fly faster than the 1500-mile limit fixed for moderate altitudes, it will be necessary to climb out of the atmosphere into space, above the friction of the earth's envelope. A cruising altitude of 100 miles above sea level would eliminate all frictional heat problems.

Oxygen doesn't exist at that altitude, so the gas turbine power plant would be useless. Oxygen or some other oxidizer would have to be carried as part of the fuel supply, using jet propulsion of the true rocket type.

The present main obstacle to space flying is the inefficiency of rocket fuels. Liquid oxygen and gasoline are used up so rapidly that not enough can be carried for protracted flights. The German rocket plane ME-163 ran out of fuel after 15 minutes of powered flight. This plane had no ceiling in the usual sense and could climb until its fuel was exhausted. With a slightly greater fuel capacity and a pressurized cabin it could be flown out beyond the atmosphere.

Below is the Speed Spectrum, showing the average possible top speeds of various known and future aircraft



Research on better rocket fuels is under way. Possibly within 10 years an improved fuel will be developed, the engineers suggest, that will permit the building of a practical space ship.

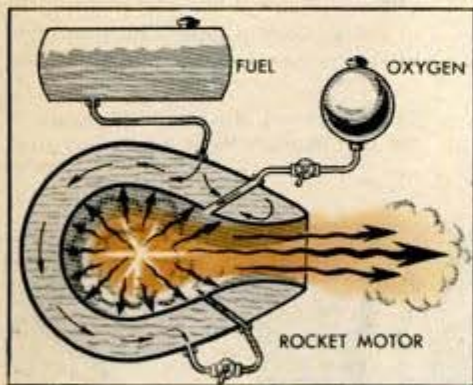
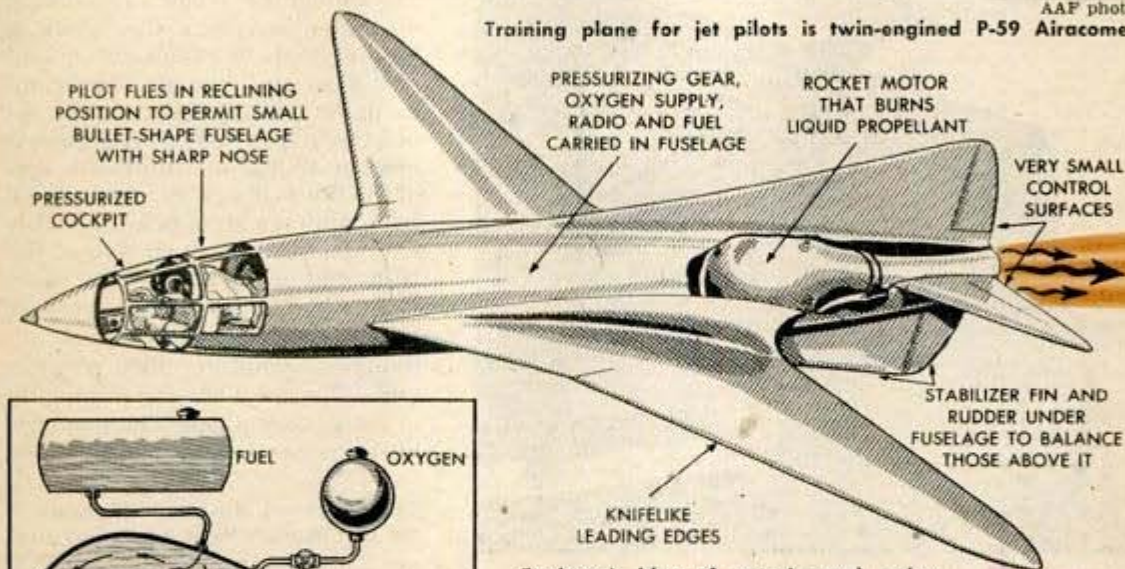
What will this ship look like?

It will compare pretty closely with present airplane shapes, modified for high speed, Mr. Hibbard believes. Its fuselage will have a long pointed nose. A wing and conventional control surfaces with sharp leading edges will provide lift and maneuverability for taking off and for climbing through



AAF photo

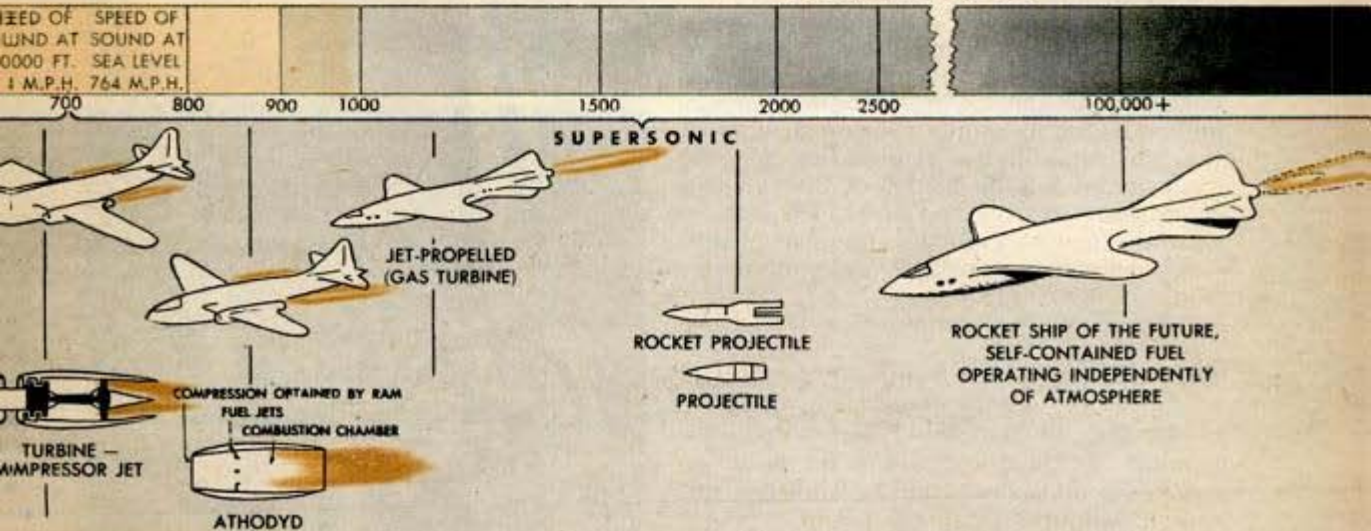
Training plane for jet pilots is twin-engined P-59 Airacomet



Engineer's idea of experimental rocket plane. Left, principles of rocket motor

the atmosphere. The wing and tail group will be necessary also during descents and landings. Rudder and elevators would be useless at high cruising altitudes, and all steering would be done by the directable jet nozzle.

(Continued to page 156)

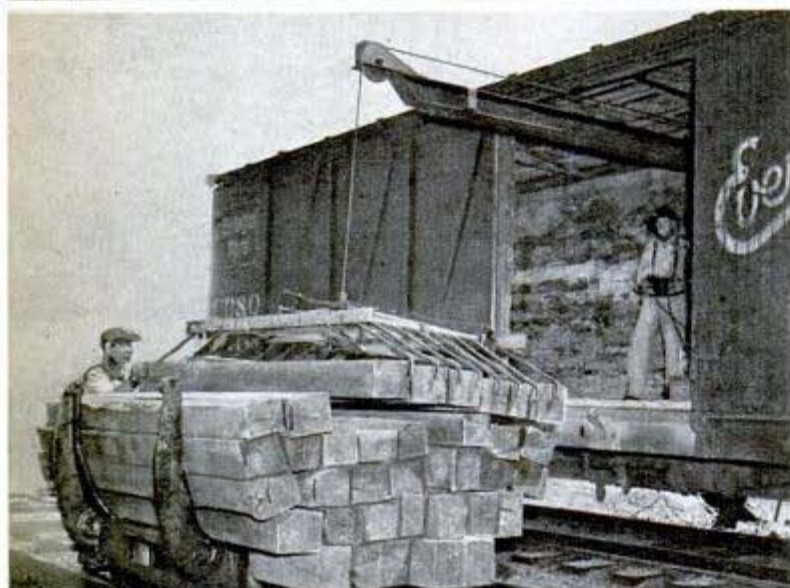


Adapted from Douglas Aircraft Flight Spectrum



Steel Fingers Unload Railroad Cross Ties

Manpower shortages and an arduous physical task were eased at the same time by development of a mechanical unloader for railroad cross ties, tested successfully at the Southern Wood Preserving Company's plant at East Point, Ga. The electrically operated mechanism is mounted on a horizontal steel boom which is pivotally supported on a steel frame. The frame rests on a concrete foundation at one side of the unloading track. Revolving on roller bearings, the boom is long enough to reach either end of the car and is racked back and forth on roller bearings by an electric motor drive. A separate electric motor on the outer end of the boom operates a rope drum from which a steel hoisting cable extends out over a sheave at the front end of the boom. The cable is attached to a multiple cross tie hook or grapple which picks up five ties, weighing 1500 pounds, and releases them automatically at the proper place. The machine also can be used to load boxcars.



Grapple at end of boom picks up ties in car and deposits them on waiting truck

Rotary Snowplow Cuts Grass With Simple Attachment

Using an assortment of materials, Arthur A. Schwartz, Bell Aircraft engineer, built a rotary snowplow for clearing his walks which he converts to a lawn mower in summer by the addition of a simple attachment. Materials for the hybrid device cost him \$12 and included an electric motor, a garbage pail for the scoop, a length of stovepipe, a frying pan for a housing to support the spinning blades, two pulley wheels, scrap metal for the blades of the fan and some assorted nuts and bolts. He plans a gasoline powered model for use where electrical connections are not available.

Junk-built snowplow (right) doubles as lawn mower

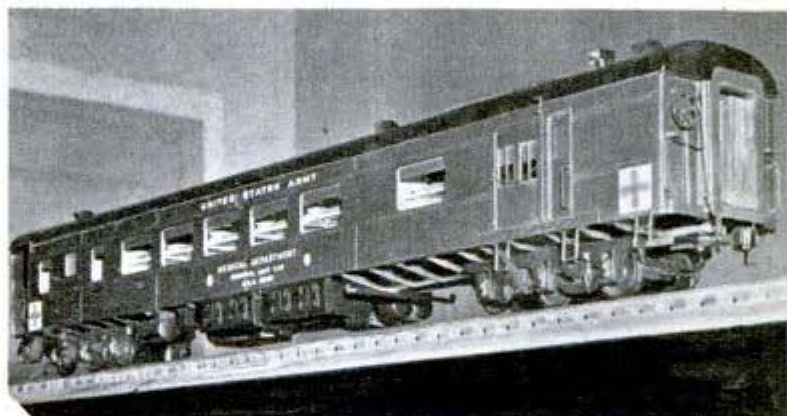
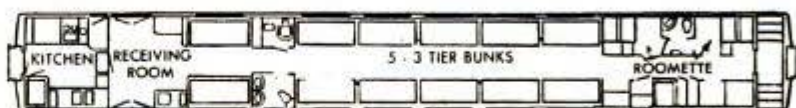
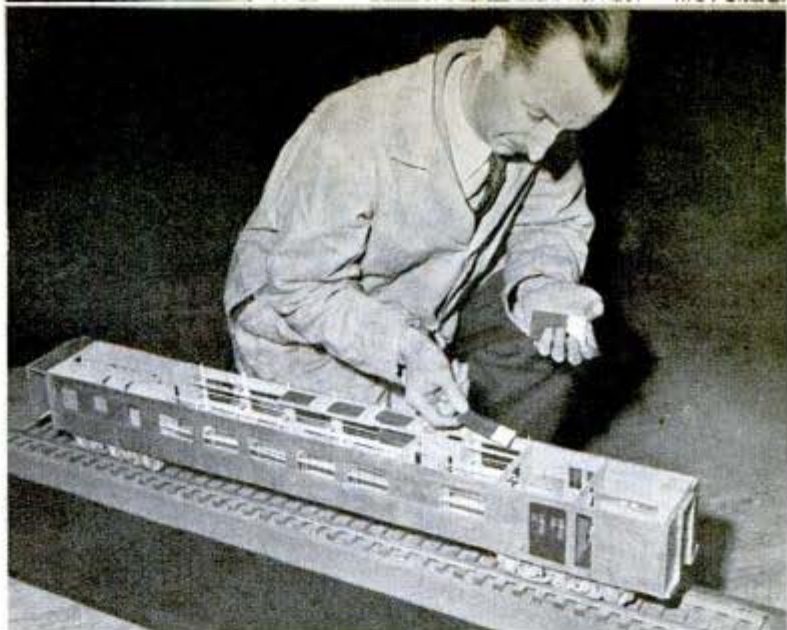
☐ Manganese, which frequently is used to toughen steel, also is essential in the diets of rabbits, chickens and other animals to maintain fertility and insure the development of sound bones, the Agricultural Research Administration has found.



Hospital Cars Have Kitchens And Pharmacies

Streamlined 85-foot hospital unit cars, 10 feet longer than previous hospital cars, provide the utmost comfort in rail transportation for wounded soldiers returning to the United States. Accommodating 38 patients and attending personnel, the new cars are fitted with two rows of triple-tier beds, a complete kitchen, pharmacy, receiving room, two roomettes for serious cases, a shower and air conditioning and automatic heat control equipment. Built by the American Car & Foundry Company, 200 of the new cars are being placed in service. An exact model of the car, on a scale of $\frac{1}{2}$ inch to a foot, was built by Boucher and is complete down to bunks that can be dropped to provide seats for patients able to walk.

Model of hospital unit car made by Boucher contains everything in original, even carpet on floor



Electric Gauge for Tool Holes Gives Instant Readings



Equipped with an electric gauging head, an instrument called a "hole checker" gives precision measurements of the internal di-

mensions of tools. Quick, positive readings are given by electrical magnification which causes instantaneous action of the indicator hand. The "hole checker" is for use in the tool room or gauge laboratory for checking master and working ring gauges, setting snap and length gauges and checking tools and other high precision work. Range is from .37 inch to 12 inches in diameter and $\frac{1}{16}$ inch to $1\frac{1}{2}$ inches in depth.

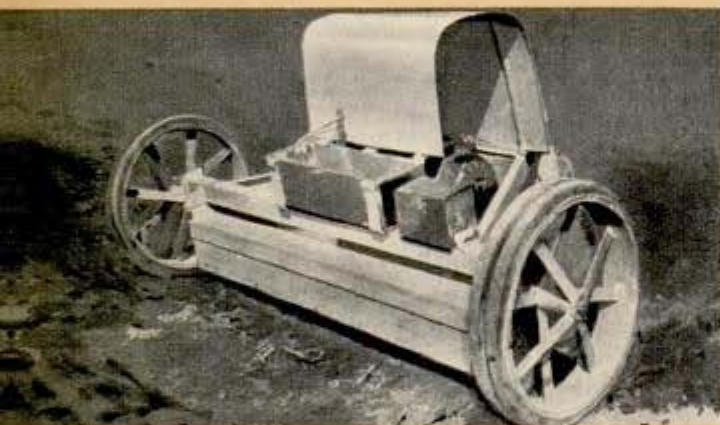
Patents Available for Licensing Listed in Official Gazette

Small manufacturers seeking new articles to make after the war will find a helpful list of available patents in the Official Gazette of the Patent Office. This list, which has been appearing for several weeks in the Gazette, includes a simple description of the article. Any patent owner who wishes to license or sell his invention may write to the patent office, attaching a printed copy of his patent and giving its number.



Clever, These Yankees!

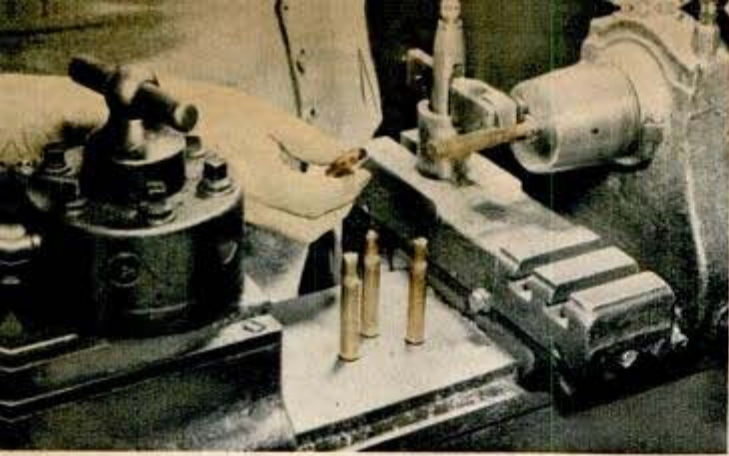
Working at the flame-hardening turntable he developed in the Bell Bomber Plant at Marietta, Ga., Garland W. Hudgins shows how he keeps his work constantly before him by merely turning the table. To speed the work further, dies can be set down and clamped in place with single operation



Signal Corps photo
Magnetic broom at left is hauled over Army runways in Hawaii to pick up nails. Below, Pvt. Maurice Upp of Kansas City, Mo., gives demonstration with his \$30,000 toaster. He built it of wrecked Liberator bomber parts that originally cost that amount. It puts toast on "production line"

↓ Heater for ambulance planes, built by Army Air Corps mechanics, uses aircraft engine preheater





Winchester Repeating Arms Co. photo
Millions of slightly imperfect cartridge cases are saved from scrap pile by device which presses them against roller. It was invented by Fred Masotta, New Haven, Conn., war worker at right, who is shown inspecting cases which will be corrected



Lt. Walter Moore of Baker, Ore., lets go with a swan song for Hirohito played on banjo made appropriately enough from a wrecked Jap Zero. Tuning pegs on the instrument are Jap .25-caliber cartridges

Right, souvenir of the European campaign is this cyanide furnace built by two GIs from German food cylinders dropped by parachute. It was used at airbase for case-hardening tools and parts in cyanide bath





Air Technical Service Command photo

MINERAL JUNGLE This photograph, which at first glance might appear to be an aerial view of jungle warfare, actually is a photomicrograph, made with the aid of polarized light, of an organic lead salt. Magnification is approximately 200 diameters. Pictures of this type are used by the photographic engineering branch at Wright Field, Ohio, for identification or microanalysis



PORTABLE WALLS in standardized sections convert unused buildings into offices. Asbestos and cement compressed into durable, smooth-surfaced sheets form the walls, which are fireproof and ratproof. Erected

on rails placed along the outline of the desired space, they are fastened to elbows by any regular maintenance crew. When no longer needed, the offices may be dismantled and the walls stored for future use

HOMECOMING IN STYLE



This B-17, before conversion into transport to bring GIs home from Italy, weighed 68,000 pounds loaded



Mechanics remove top turret, above. Engineer-gunner who had station becomes airline "hostess," serving food to returning GIs. Right, out come the chin turret and its twin machine guns. New surface skin will patch up the openings. Fort carries 15 men and crew of five in speed and comfort of any modern passenger airliner. With load, it now weighs in at a mere 57,000 pounds

GI luxury airliners are bringing home in style returnees from the U. S. 5th Army, which endured so much in the Italian campaign. Two 15th Air Force bomber groups, the 436th and 483rd, converted their Fortresses into passenger-carrying craft and emerged as an air transport line capable of returning 20,000 soldiers a month. Both groups have enviable battle and efficiency records. Only expert radio operators, navigators and pilots with more than 500 hours' flying time are assigned to the airliners.

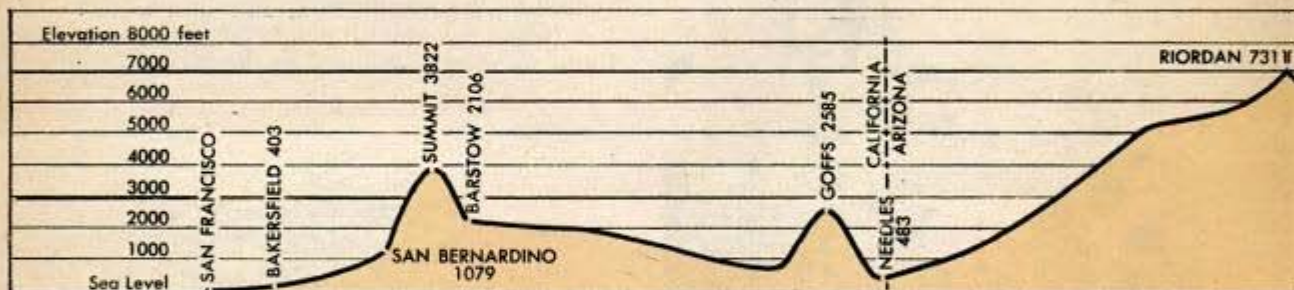


THE NAVAJOS CALL IT "LIGHTNING WAGON"

By
Roderick M. Grant

FOUR YEARS AGO, when the first big Diesel-electric freight locomotive in its fancy blue jacket rumbled through Winslow, Ariz., with only a brief pause for station identification, Winslow was a cowtown of 3500, shopping center for Navajos and Hopis and jumping-off place for tourists who had read the ads about the Painted Desert and Petrified Forest.

A reconditioned cylinder liner goes back to work in Diesel freighter in Winslow shops. Below, profile of mountain lines of Santa Fe railway on which Diesel-electrics predominate; four of fleet are shown at bottom

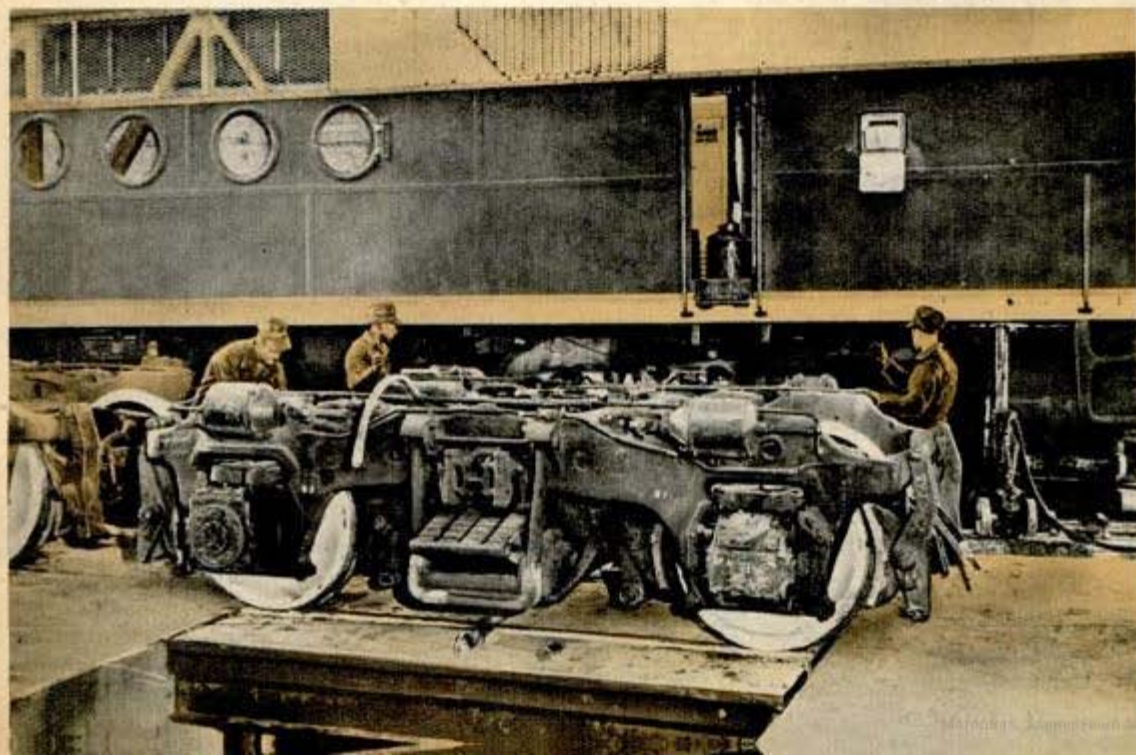


Since then Winslow has doubled its human population and filled its roundhouses to overflowing. It has become an important railroad town, with a train arriving or leaving every 12 minutes around the clock. It is home to a fleet of 68 main line Diesel-electric freight engines—probably 78 by the time you read this—hauling 2300 cars of freight in and out of the Winslow yards every 24 hours. The Santa Fe railway calls this the "Diesel Capital of the World." Some of our Navy bases might dispute the title; but upwards of 400,000 Diesel horsepower are stabled in the Santa Fe's Winslow yards.

Quite probably the Santa Fe would be suffering acute traffic pains today had the railroad not begun in early 1941 to acquire these 5400-horsepower streamline giants from Electro-Motive Division of General Motors Corporation at a continuous rate of about three four-unit locomotives every two months. The war has multiplied the passenger and freight loads to the aircraft factories and shipyards and military establishments on the Pacific coast and to the California ports of embarkation, and a new peak is approaching as the Army and Navy transfer their forces and materiel from Europe to the Japanese theater. True, the Santa Fe's fleet of steam locomotives knew their way around the 451 miles of mountain curves and steep grades and blistering



At the Winslow sanding tower the four sand boxes on each engine unit are filled. Below, a new truck is rolled on transfer table under Diesel locomotive. Substitution of a new truck is accomplished in 1½ to 2 hours





On the wash rack at Winslow a high-pressure steam-operated jet washes grease and dirt from a Diesel engine's trucks

desert between Winslow and Barstow, Calif., but it took two steam engines, and often three, to haul a heavy freight train up to the 3000 and 7000-foot passes of California and Arizona. One of these Diesels can tow 3500 tons imperturbably up the same grades without a pause to gulp water, without a halt on the downgrade to cool burning brakes.

On these rugged 451 miles west of Winslow the 60-mile-an-hour freight Diesels and the 100-mile-an-hour streamliners that pull the "Super-Chief" from Los Angeles

to Chicago in 41 $\frac{3}{4}$ hours meet their severest tests. From Winslow westward they climb steeply to the rarefied atmosphere of Riordan, 7311 feet above sea level, Diesel engines purring as smoothly in the zero weather of the Arizona mountains as in the semitropic warmth of Needles, Calif., at nearly sea level. Eastward from San Bernardino the rails climb 2750 feet in 25 miles to the Cajon pass, a grade of better than 2 percent. The Diesels take in stride the extremes of temperature and pressure and grade.

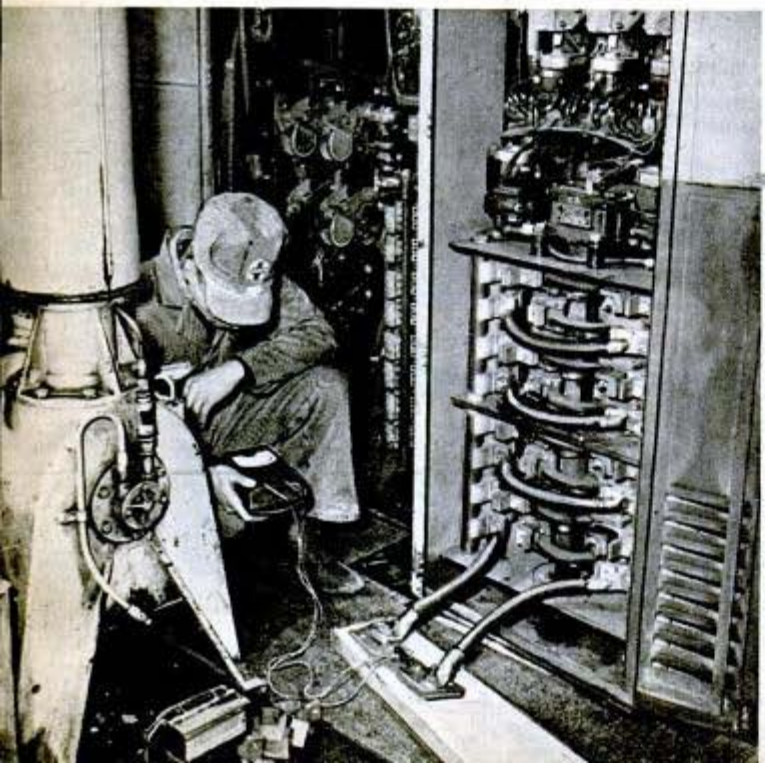
The debate between advocates of Diesel and steam power has only just begun—and into it must come the proponents of electric, steam turbine and turbine-electric locomotives. It is easy for Diesel adherents to claim economy in fuel and maintenance costs, but fuel costs vary according to many factors—inherent efficiency, price, cost of hauling, availability for work. The Diesel need burn no fuel during "standby" time and on the Santa Fe it has the high average of

working 91.5 percent of the total hours in the month. As to maintenance, a true account will have to be based on more years of Diesel-electric experience than have yet run out. The life span of a locomotive is unknown.

Maintenance problems are relatively simple. One obvious advantage of the multiple-unit Diesel over steam is that if one engine is disabled the ailing unit is simply cut out of the circuit and running repairs effected while the freight keeps rolling on its remaining 4050 horsepower. When an iron horse of the steam variety breaks down it may block traffic until the veterinarian comes.

Whatever the merits of the Diesel in the all-over transportation picture, it has performed to the eminent satisfaction of the Santa Fe on its particular territory. For one thing, it has virtually eliminated a fairly colossal water-hauling problem in the waterless regions of the southwest. Some towns along the railroad depend entirely on the Santa Fe for water supplies and when the insatiably thirsty steam locomotive prevailed on the Arizona lines it was necessary to haul a million gallons of water per day in tank cars to Ash Fork, Ariz., alone. The Diesels drink only enough to cool

Such ailments as low oil pressure, improper loading of main generator, etc., are tested with roundhouse unit that reproduces full load conditions as encountered on the road



themselves, and with traffic three times as heavy today Ash Fork needs only 360,000 gallons of water.

The Diesels also excel in downhill travel. Coming down the mountain into Ash Fork or San Bernardino the trains used to grind to a stop with smoke pouring from overheated brake shoes and wheels. Every 10 or 12 miles on the downgrade it was necessary to stop and let the air brakes cool. Just the other day the engineer of a Diesel-electric released his air brakes at Supai for the tortuous 23-mile ride to Ash Fork, 1800 feet lower. In all that distance, with 2300 tons of freight behind him, he applied the air brakes just 20 times, a few seconds at a time. The brake shoes were cool when the train pulled into Ash Fork. The Diesel's electric retarding brake had done the work.

This dynamic brake turns the traction motors into generators, the resistance thus set up acting as a brake on the locomotive. The current generated is dissipated as heat through grids on the roof. As much as 4300 horsepower is generated and thrown away and no one has thought of any better use for the waste current than to make toast on the rooftop grids. The problem bothers no one, for the electric brake pays its way liberally in running time saved and reduced wear on all brakes. Just a hint of the saving in wheel wear alone is evident in the tabulation of 11,000 pairs of car wheels changed due to wear in 1942, when the fleet of Diesel-electrics with dynamic brakes was just beginning; in 1943 only 4000 pairs were changed.



More than 2600 lubricating oil filters are used each month

Most of the work on the Diesels is centered in the railroad shops at Winslow, which have been turned into a "superservice" station for "Lightning Wagons"—the name given by the Indians when the first of the freight Diesels came west in '41. Navajos, Hopis, Lagunas, Mexicans, Spaniards and Nordics perform the superservice.

A locomotive requiring no repairs spends eight minutes at the fuel rack filling her 5000-gallon oil tanks, moves on to the sand tower where four boxes on each engine unit are refilled, travels to the wash rack for a steam and oil bath, takes on radiator

A four-unit freighter spends eight minutes at the fuel racks filling its 5000-gallon tanks with Diesel oil





Winslow's fuel pumps can deliver 500 gallons a minute

water, undergoes routine inspection and is back on the main line in 90 minutes, ready to haul another string of freight cars west.

Each Diesel unit requires 250 gallons of distilled water for its cooling system and the Winslow shop distills 23,000 gallons a day. Each engine uses 190 gallons of lubricating oil in its crankcase, which is drained every 20,000 miles. Drained oil is sent to a reclamation plant and 80 percent of the original volume is reclaimed and used again.

After every 2000 miles the locomotive goes into the shop for inspection and servicing which become more comprehensive with each 2000-mile step. The check sheet includes such items as inspection of pistons and crankcases, air compressors and fire extinguishers; engine air filters are cleaned, fan bearings and generator belts checked. The cooling system is completely inspected. Electrical inspectors go over traction motors, brushes, main and auxiliary generators, batteries, driving controls and instruments, headlights and interior lights, wiring and electrical cabinets. Engines are run under load for an operating test. Viscosity of oil in the Diesel engines is checked and other lubricating jobs performed.

At 4000 and 6000 miles every engine undergoes an additional routine, and another special servicing is prescribed at monthly intervals. In one recent month 588 Diesel-electric locomotives went through Winslow's "super-service" station in an average of 5 hours and 43 minutes each. The average "turn-around" time for a steam engine is about 11 hours.

The big Diesels do their heavy chores with little interruption at the rate of 10,000 miles a month; some of the four-year-olds have passed the half-million-mile post.

Three of the outdoor service tracks have lighted pits. The 200-foot platforms just fit a four-unit Diesel



Most of the engineers of this Dieselized line are very happy in the upholstered arm chairs of their streamline cabs. Of course, wherever railroaders swap yarns there will be engineers who snort at the pretty Diesels with their drawing-room luxuries; for them, the hand at the steam throttle, the grimy cab, the brute power of the old iron horse, the rhythmic thrust of the steel driving rods leave nothing to be desired.

But the men who direct the fleet are so imbued with the Diesel spirit they dream it, literally.

One of the Santa Fe mechanical chiefs was on an inspection trip not long ago. In the middle of the night he burst into the room of a division officer and woke him.

"What have we got a steam engine on here for?" he demanded.

His victim sleepily protested that the Diesel was still up ahead.

"No sir," exclaimed the motive power chief, "the whistle of the steam engine wakened me and I got up and dressed and went forward. Sure enough, I saw the steam engine myself. What's wrong with the Diesel?"

The division officer got out of bed and quieted the boss. He was walking in his sleep. It was all a bad dream. The Diesel was up there, pulling the load.

Houses Carried in Planes Forecast for After War

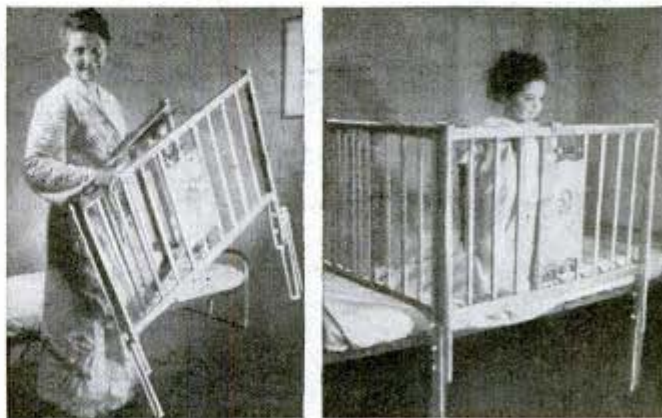
Perfection of a portable hospital shelter which can be transported by air points the way to postwar air transport of prefabricated houses and small buildings for remote areas. The hospital shelter weighs 3700 pounds, takes only two thirds the cargo space of a C-47 airplane and can be erected by four men in two hours. Adequate ventilation is stressed in design of a shelter for use in tropical climates and insulation is emphasized in one designed for the Arctic. Each unit has two rooms, one 16 by 16 feet and the other eight feet-square. There are electrical connections and a stovepipe outlet. Each room has an outside door. Developed by the Equipment Branch and Aero Medical Laboratory of the Air Technical Service Command, each unit can accommodate 12 patients on litters.

Upright Freezer for the Kitchen




Upright quick-freezers occupying no more floor space than an ordinary refrigerator and with the same "reach-in" convenience will be manufactured when priorities are lifted. Designed for use by the housewife, each cabinet will have one compartment for storage at zero temperature and another for freezing at 10 to 20 degrees below zero.

Folding Bedguard Makes Crib of Daybed



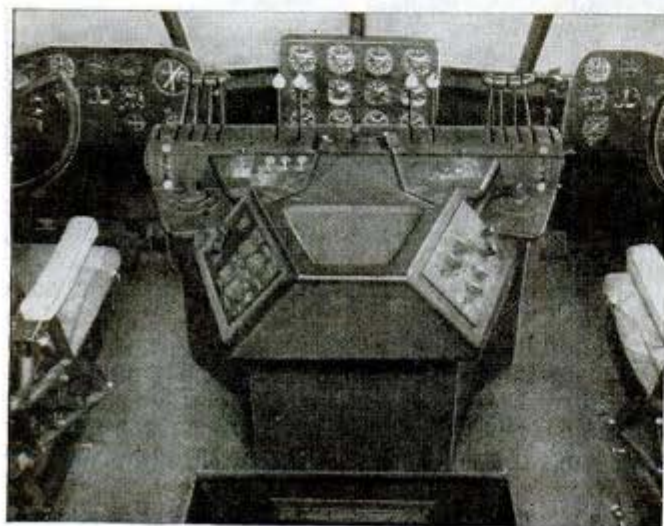
Baby can have a room of his own even in the tiniest quarters with the newly patented bedguard, two slotted walls hinged together at right angles, which converts a daybed couch or single bed into a crib. The side traversing the bed adjusts to fit the width; legs adjust for various heights. The guard is held rigidly to the bed by the crosspiece and hinged corner and may be folded for easy storage and transportation. Rubber tips prevent the legs from slipping. As a child grows older, the bedguard may be placed to allow him to climb in and out yet keep him from rolling out at night.



Look quickly—for tomorrow this giant, which must be seen to be believed, may be dwarfed by its own children. It could ferry the Navy's 70-ton Mars in its hold!



Hughes Aircraft photos
Engineer studies model of 225-ton "Hercules," mounted on supports on which hull will float into water. Below, mockup of the control cabin, pilot's seat at left and copilot's at right



MOST fabulous airplane ever built, the \$22,000,000 Hughes "Hercules" all-wood flying boat that could transport 400 soldiers and all their equipment across the Atlantic between dawn and dusk, is scheduled to make its test flights this winter.

This mammoth airplane weighs some 225 tons loaded for takeoff. Its full-cantilever wing is 320 feet long and has as much area as two ordinary residential lots. Its horizontal tail surfaces alone are three times the area of a standard two-engined airliner's wing.

The flying boat is powered by

GARGANTUA OF THE SKIES



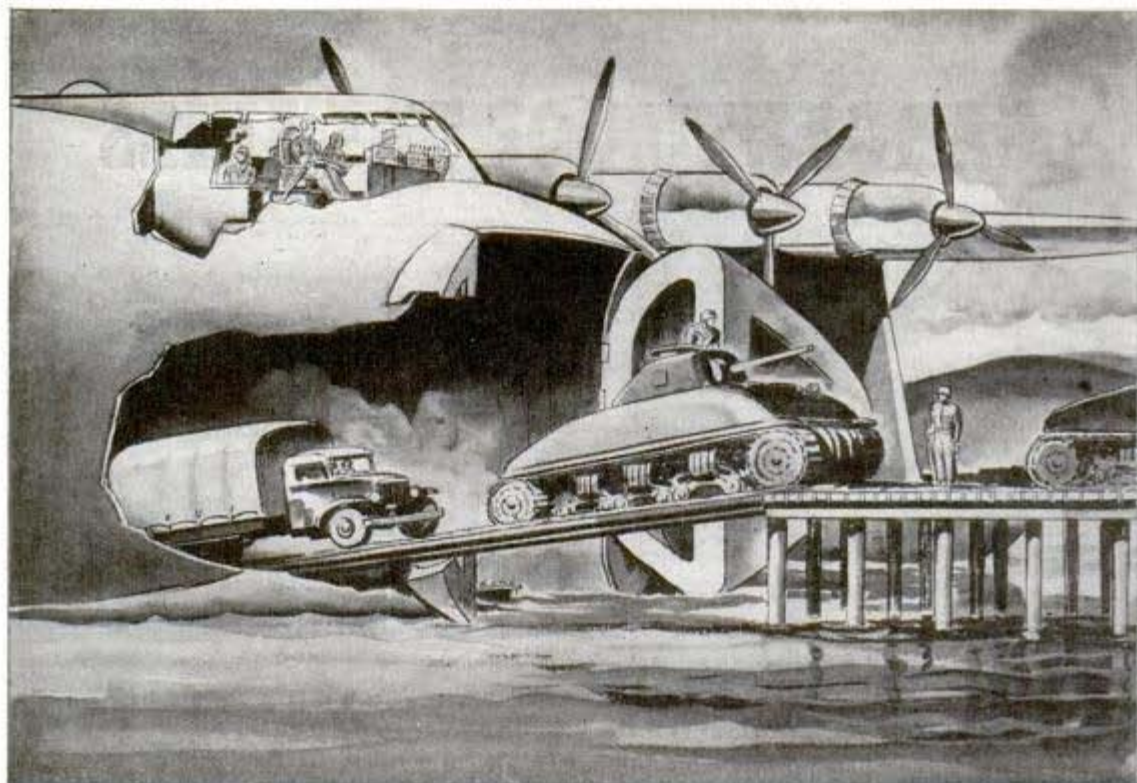
eight Pratt & Whitney "Wasp Major" barrel engines of new design that can develop a total of 28,000 horsepower, equivalent to the power plants of 11 ocean-going Liberty ships. Its fuel tanks can hold 42 tons of gasoline, sufficient for 5000 miles of flight while carrying a 65-ton payload. The 70-ton "Mars," the largest flying boat in the world until now, could be disassembled and carried as cargo by the new giant, with a partial fuel load.

Those are only a few of the breath-taking facts about the "Hercules." Its fuselage is 220 feet long. The pilot and copilot sit at the front of a flight compartment that is larger than an ordinary living room, 28 feet

above the waterline. The plane's tail fin is 52 feet tall and its top is 85 feet above the keel. Either of the streamlined wing floats is the size of a 20-passenger lifeboat.

There are 11 feet of headroom inside the wing at the root, and flight mechanics can walk through the wing to any of the engines, then crawl on hands and knees to the wing tips themselves. The wing has a designed deflection allowance of nine feet up or down at its tips, a total flexibility of 18 feet. There is an acre of skin in the wing, a total of two and a half acres of skin surface for the entire airplane. It will require a mile run for its takeoff.

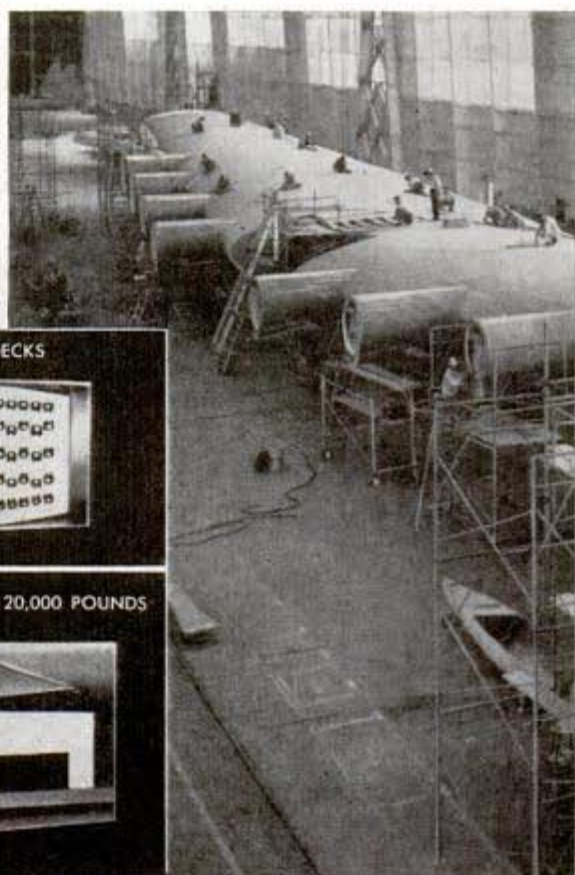
Conceived as a long range military trans-



port in 1942 by Henry J. Kaiser and Howard Hughes, the plane was financed principally by the Defense Plant Corporation and has been built by the Hughes Aircraft Company in Culver City, Calif. Exterior shape above the water line was designed by Mr. Hughes, with Ray Hopper the chief designer for the entire project. The total cost of the first plane, estimated at \$22,000,000, includes the plant at which it was built, an assembly and testing site on the ocean, and considerable preliminary research and testing. The "Hercules" is insured for \$4,500,000.

This is how "Hercules" would discharge tanks from bow doors like LST. Below, workers completing all-wood wing, which is 320 feet long

Cargo arrangements below are possible in Gargantua of the air if used in military transport. Craft could carry 400 soldiers and equipment across Atlantic in daylight



SEATING ARRANGEMENT FOR 400 TROOPS ON TWO DECKS



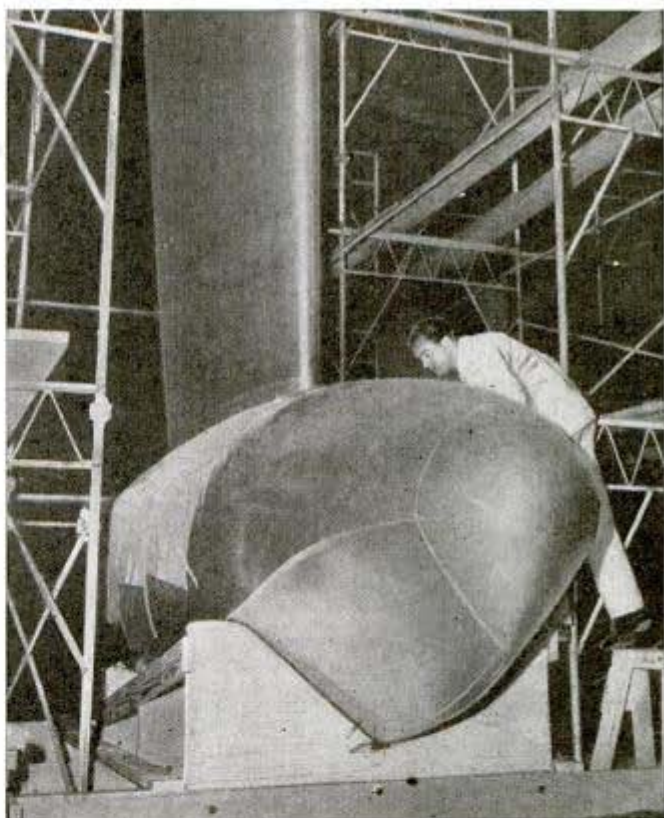
3 LIGHT TANKS, AMMUNITION AND EQUIPMENT TOTAL WEIGHT 120,000 POUNDS



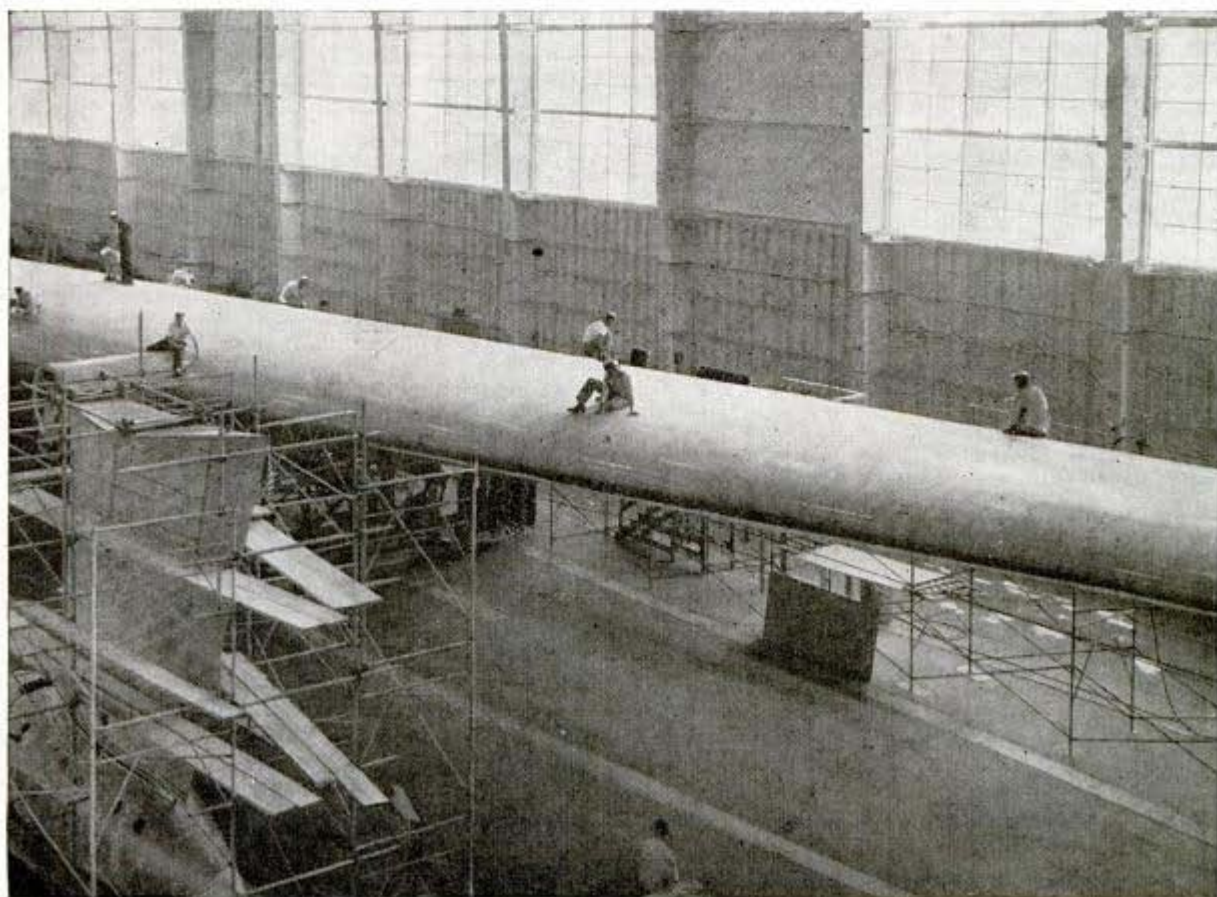
Decision to build the plane of wood was necessitated by the scarcity of aircraft metals when it was designed. Aside from the engines, instruments, control systems, control surface hinges and a tubular bracing system inside the leading edge of the wing, there is hardly a pound of metal on board. Even the engine mounts are of strong plywood. There are no nails or screws in the entire structure, although five tons of nails were used in the nailing strips during construction. Then each nail was withdrawn.

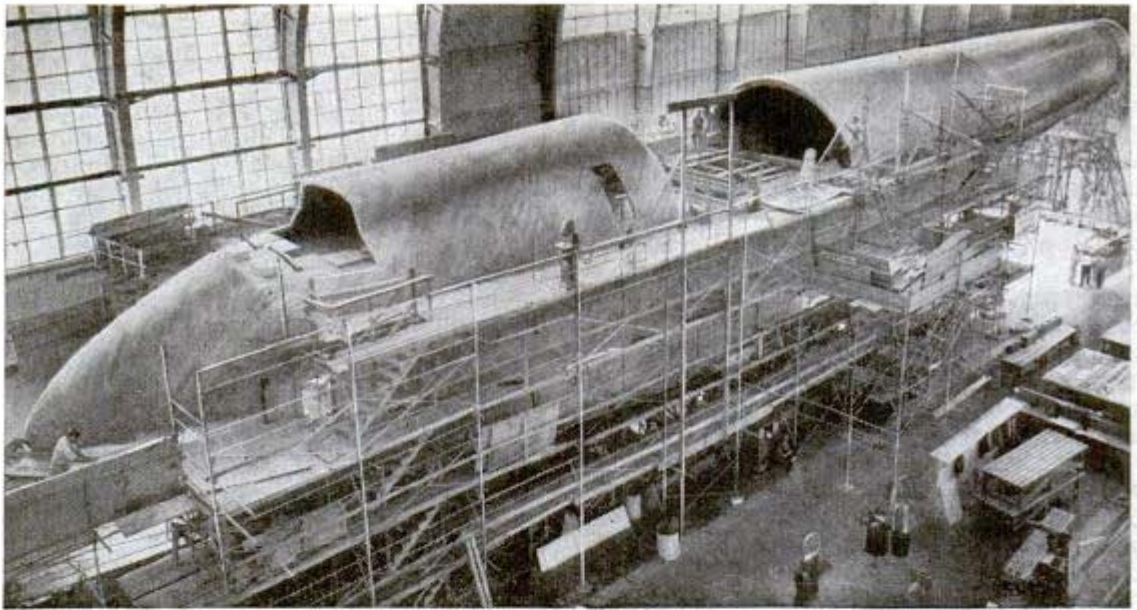
To provide the best strength-weight ratio, all structural members and the skin are built up as plywoods and veneers, the individual plies ranging from $\frac{1}{64}$ of an inch to $\frac{1}{8}$ of an inch in thickness. The plane's main hull longeron, 10 by 10 inches in cross section and 100 feet long, is built up from such plies.

Construction woods include spruce, birch, maple, poplar and mahogany. Construction of the plane actually began in the forests themselves, for individual trees were carefully selected and cut

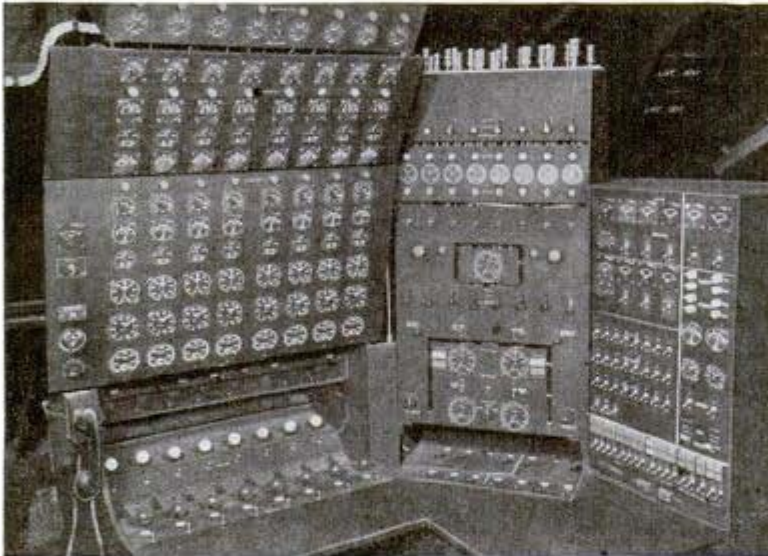


Finished wing float of wood, with strut, above, has an aluminumized surface. One of two, it's as large as 20-passenger lifeboat

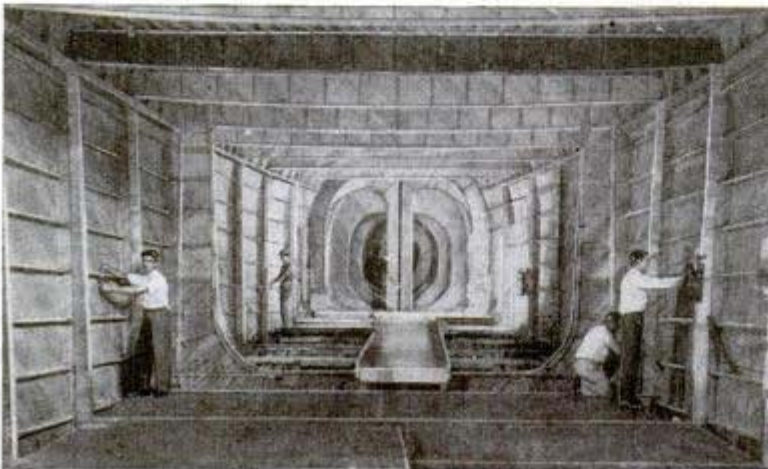




Hull under construction towers above four floors of scaffolding. It is 220 feet long. Open area showing amidship will receive the giant wing



Engine control panels in mockup of engineer's station. Below, cargo hold looking toward bow doors; beneath are 14 thousand-gallon fuel tanks



down, the stripping of the bark and the veneering of the wood was carefully watched, and the shipments were guarded against damage all the way to the plant.

The veneers were put together with a thermo-setting formaldehyde type of glue, the forming being completed in presses and in a huge autoclave chamber inside of which heat and pressure could be applied. All exterior surfaces are finished with a coat of wood filler, a coat of sealer, a .002-inch thick sheet of tissue paper, two coats of clear spar varnish, and a final coat of aluminized spar varnish. These coats furnish protection against moisture and the sun's rays. The finished "Hercules" is considered to be one of the finest examples of woodworkers' craftsmanship in the world.

The plane was built inside a huge wooden hangar equal in size to the area of two large aircraft carriers. Temperature and humidity in the hangar were rigidly controlled.

Planned as a cargo carrier, the fuselage contains a large cargo hold that is

(Continued to page 158)

Navy Feeds "Bean Soup" to Fires to Quench Them Swiftly

More than 4,000,000 gallons of bean soup have been made for the Navy since the start of the war and no sailor has eaten a spoonful. In concentrated form, made from soybeans, it's mixed with water and air under pressure to form a smothering blanket of foam for fire fighting aboard ship. The soup comes in cans for quick handling. When connected to water and air supply the soup combines to pour a stream of snowlike chemical from a hose. This forms a six to eight-inch blanket separating the flame from the combustible agent. Air is excluded and flames are extinguished in 30 seconds. Flight and hangar



decks of the carrier Enterprise, soaked with gasoline, burned furiously after a bomb hit, but the flames were extinguished in a minute by the chemical blanket.

Parachutes Drop Trench Digger to Cut Off Forest Fires



Smoke jumpers who parachute from planes of the United States Forest Service to fight forest fires with mechanized equip-

ment now use a portable motor-powered trencher to keep flames from spreading. Packed in two parachute units, the trencher is dropped with the jumpers, who can have it in action in 10 minutes. Powered by a small outboard or aircraft motor, the beater head cuts a shallow trench 12 to 15 inches wide around the fire line, doing the work of 25 men with grub hoes and shovels. Centrifugal force is utilized in the beater head, which is a series of forged iron picks in three sections of three picks each. Each pick operates as a separate unit, with pendulum action providing resiliency to prevent a pick from snapping when it hits an obstacle. The head chews up roots and small timber, tossing debris 15 to 18 feet to the side. The trencher operates easily over rough forest terrain.

Drum of Gasoline Freezes Solid in the World's Coldest Rooms

Aircraft engines for Army planes are tested in the world's coldest laboratory at Wright Field. A temperature of 110 degrees below zero is maintained in four large steel-walled chambers. At this temperature Army research workers can freeze a drum of ordinary gasoline solid. The laboratory was built for testing every piece of equipment that helps start an aircraft engine. Heat from the engines, once they are started, is carried away by fans. The two largest chambers are 36 by 16 feet, and it

takes 16 hours to drop the temperature to 110 degrees below zero, according to engineers of the York Corporation, York, Pa., who built the equipment. Workers in the chambers wear electrically heated suits.

IF YOU WANT TO BUY IT—

Write to the manufacturer or distributor listed in the Where-to-Buy-It index to learn more about commercially available products described in this magazine. Say You Saw It in Popular Mechanics

HOW TO BEAT THE JUNGLE



All the tribulations of jungle life are at the disposal of student officers of AAF's Tactical Center, Orlando, Fla., when they arrive on Hypoluxa Island, south of West Palm Beach. There, in six days, groups of 15 to 50 airmen learn how to construct shelters, forage for food and all the procedures of emergency navigation and signaling. Bamboo raft above keeps guns and machetes dry as class crosses tricky mangrove swamp. Right, correct way to break open coconut, bringing it down on sharp pointed stick which pierces husk



Shelter at left was built on Hypoluxa by jungle survival students. It's constructed with cabbage palm leaves laid shingle fashion to make shelter waterproof. Direction of prevailing winds must be considered when building such a lean-to. Other lessons in jungle survival include improvising ropes by twisting bark, climbing coconut trees, telling directions without a compass, the fine art of shaving without a razor and washing clothes in salt water. Sea shells or sliver of bamboo are used to do the tonsorial job

Taught to search for unfamiliar foods of tropics, flyer eats off plate made from banana leaf. Bill of fare consists of soup made from mussels, a boiled palm cabbage, sea purslane or pigweed, fruits such as custard apples, tamarinds, wild grapes, beach plums, plus a lot of meat dishes, such as squirrel, the marsh rabbit, 'coons. Below, chute serves as hammock and insect bar



Airmen below on semitropical Hypoluxo have learned to build jungle sleeping quarters and are enjoying the fruit of their labor. Mattress is constructed of palm leaves and canvas is stretched between branches. Landing on island, students wear usual flying clothes and only equipment is machete, web belt, mosquito net and insect repellent. They learn the hard way, never to forget

AAF Tactical Center photos

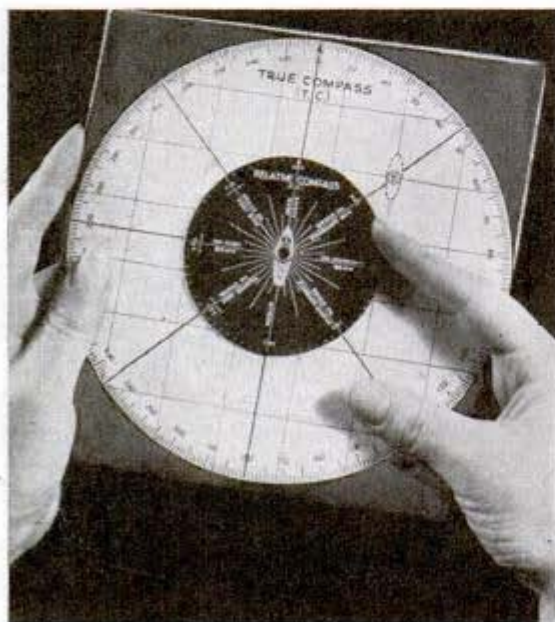




Collector "Paints" With Stamps

Not for this stamp collector are the conventional rows on rows of the album. He paints pictures with his stamps and mighty fine ones, too, art experts declare. Harry Storms, New York artist, chops up his canceled stamps into bits of confetti and with the aid of tweezers and a little glue produces brilliant landscapes and portraits. Art patrons have bought many of his masterpieces in the past 10 years. Many persons who have seen his work send him packets of stamps with the hope he'll use them in future works. Storms has been teaching wounded soldiers his method and hospitals find it effective in soothing war-torn nerves.

Compass Dial Trains Navy Men to Visualize Navigation



Navy trainees are provided with a small dial which has a relative compass superimposed on a true compass to help them understand simple bearing and maneuver-

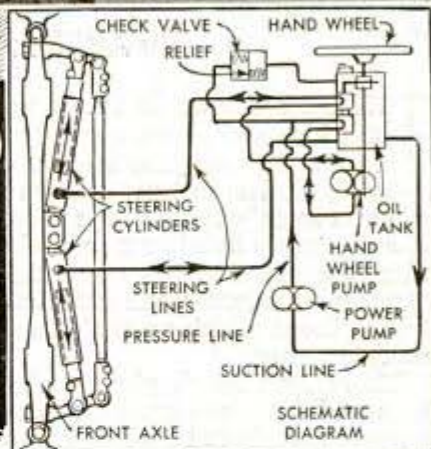
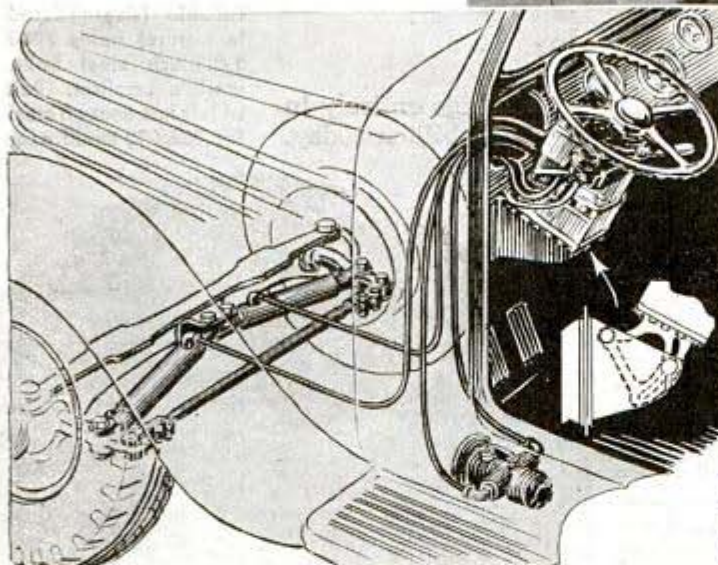
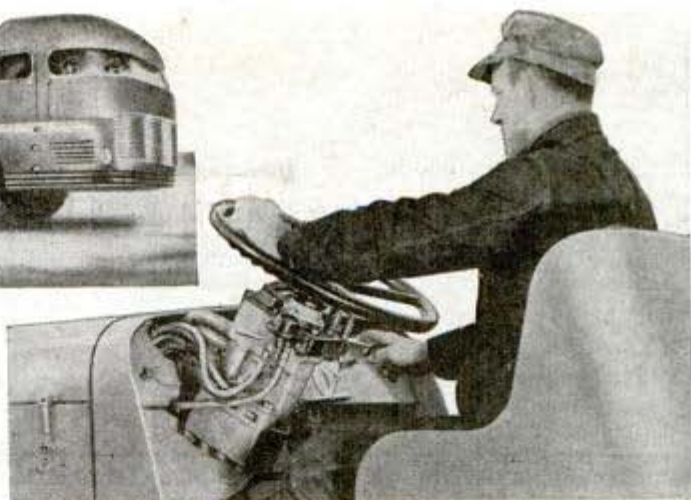
ing problems. True north is located at the top of the true compass. The problems are explained on the back of the dial, which is used as a visual aid in seamanship, navigation and ordnance classes. To solve the problems, the student cuts out the silhouettes of ships drawn on the corners of the dial and places them according to instructions. For example, he is told to turn the guide ship which is centered on the dial so that it is set on a specified course. The position of another ship is also given. Then, by reading clockwise on the dials, the student is able to determine both true and relative bearings of the secondary ship.

Accurate Color Printing Sure With Voltage Stabilizer

Constant voltages required for accurate photoprinting of color values are maintained by a General Electric voltage stabilizer in use at Ansco's San Francisco laboratories. Plugged into a 115-volt outlet, the stabilizer provides a constant power supply for the photo-enlarger lamp, regardless of line voltage fluctuations.



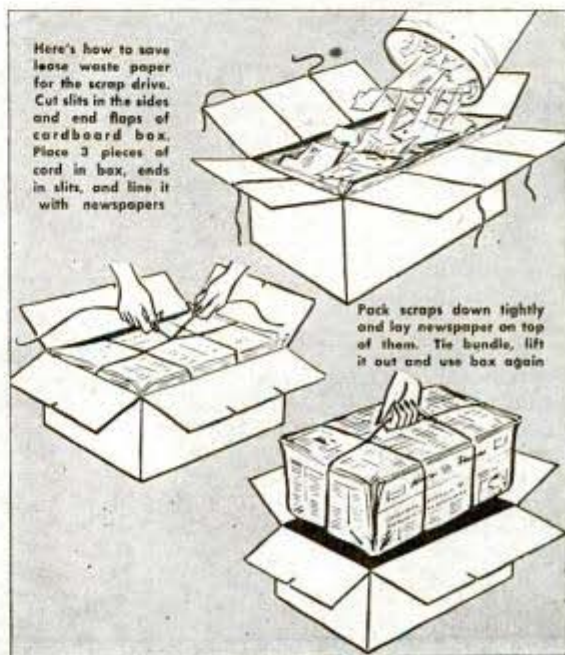
HYDRAULICS PERMIT FINGERTIP STEERING OF CARGO CARRIERS



Schematic diagram and drawing indicate how steering wheel controls hydraulic pressure on individual wheel cylinders

Fingertip control for huge earth moving and cargo carrying vehicles using big single tires is provided by a constant ratio hydraulic steering mechanism soon to be offered as a postwar product. The system has no mechanical connections between steering wheel and axles. Impetus is transmitted to cylinders through flexible ducts or hoses. The steering head, to which the steering wheel is attached, contains a steering drive, metering pump, steering, relief and check valves, and an oil reservoir. Oil is drawn from the reservoir through a suction line to an engine driven hydraulic pump. The steering wheel serves merely as the hydraulic control valve for the power steer. When the wheel is turned to the right, the pump forces oil into the left-hand cylinder, causing right-hand steering movement. Pressure is on the right-hand cylinder for a left-hand turn. Front wheels of the vehicle remain in a locked position until the steering wheel is turned. A constant ratio between steering wheel and front wheel movement is provided by the metering pump.

WRAP WASTE PAPER EASILY



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BEARINGS BY THE BILLION



Ball & Roller Bearing Information Center photo

By William E. Taylor

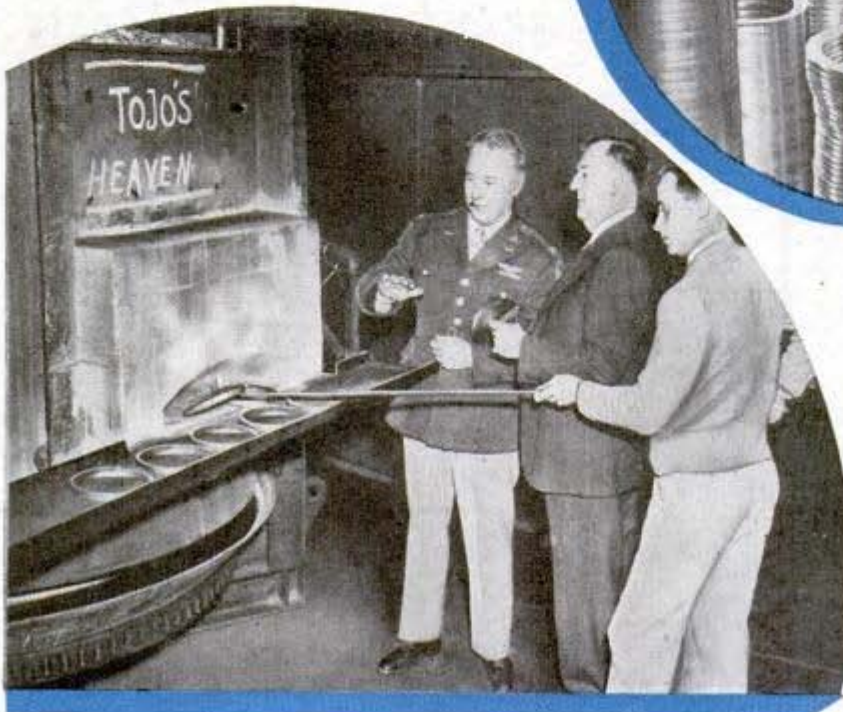
THOUGH the world seems to have lost its bearings entirely in the last few years, actually it has them by the billion today. When the last Jap has surrendered and industry begins to turn out the mechanical marvels that promise to revolutionize our everyday living, we won't be able to turn around without encountering the "tremendous trifle," the antifriction bearing, without which no nation can have a modern army.

There isn't much glamor about bearings and little has been said about their magnificent share in the march to victory. Without antifriction bearings, our B-29s wouldn't be bombing Tokyo at will. Our mechanized equipment couldn't have rolled across Germany to cut Naziland to

Thimble (size reduced in picture) holds 3000 1/25-inch steel balls, world's smallest. Ball at left has enough steel for 156,600 small ones



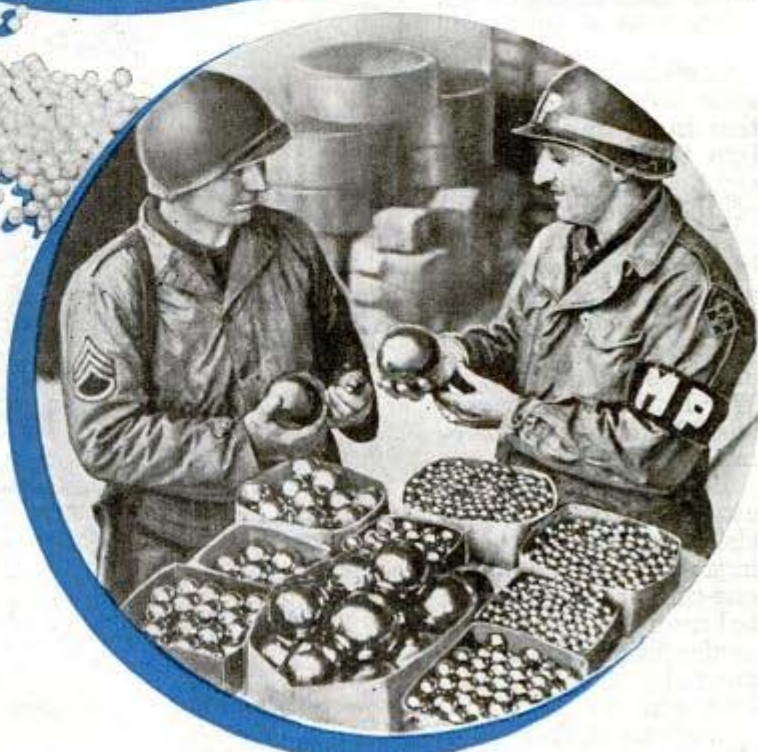
Rings for propeller bearings of airplanes, made by the millions in plant in Chicago, undergo the scrutiny of Colonel R. L. Finkenstaedt, chief of Midcentral District, ATSC



"Tojo's Heaven" operates at 2080 degrees to heat-treat bearing rings for the Superforts. Worker shows how ring is taken from oven upon attaining the proper hardness



Steel balls roll out of 3500-degree oven in American factory



Yanks examine bearings of various sizes in factory captured in Germany

ribbons. Our battleships could not lay down the barrages that precede the taking of vital islands in the Pacific.

"Bearings are the life blood of the Army Air Forces," says the Air Technical Service Command. Crippling of German war production began with the bombing of Schweinfurt, heart of the Nazi bearing industry, in 1943. Now the AAF is giving the same treatment to bearing centers in Japan.

Today our ball and roller bearing industry is manufacturing more than 30 million bearings a month for the armed forces. AAF requirements alone in 1945 call for 100 million complete bearings, plus 35 million balls and 25 million rollers. There are 3500 antifriction bearings in the B-29 Superfortress. The electric turbosupercharg-

er, which gives American flyers a priceless margin of altitude over the enemy, was made possible by bearings. Bearings operating at minus 70 degrees Fahrenheit to plus 350 degrees permit the supercharger to attain more than 35,000 r.p.m.



Girl in 10-ton bearing for gun turrets holds a $\frac{3}{8}$ -inch ball

The smallest bearing ever built, 2.7 millimeters in diameter, goes into the Norden bombsight. It contains three of the world's smallest steel balls, each $\frac{1}{25}$ inch in diameter, smaller than a pinhead. Seven thousand fit into a tablespoon. Produced only 10 months after we entered World War II, this bearing surpassed German achievements that took 35 years.

Bearing manufacture attains the peak of precision in aircraft bearings mass produced with one-millionth of an inch tolerances. All flight navigation instruments contain ball or roller bearings.

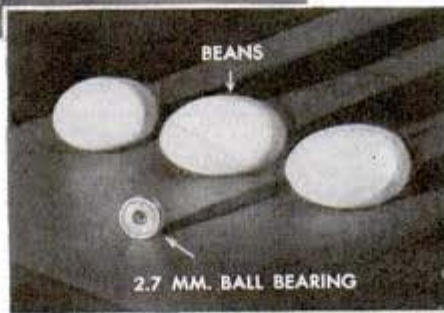
Workers on fine precision bearings wear kid gloves, lintproof gowns and caps. Stethoscopes and hypodermic syringes are as common as in a hospital—the stethoscopes used to detect sound imperfections and

the syringes to place a single drop of oil on tiny bearings. Plants are dustproof and air-conditioned and a constant temperature is maintained in precision rooms.

A step-by-step journey sponsored by the ATSC through roller bearing, ball bearing and ball manufacturing plants in Chicago, one of our three bearing centers, gives a fascinating picture of a precision industry at work.

In the Aetna Ball & Roller Bearing Company plant is produced a propeller blade retention roller bearing which makes it possible to adjust the blade's pitch under enormous centrifugal pressure created by the propeller revolving at high speed. The rings holding the rollers, called raceways or races, are $7\frac{1}{4}$ inches in diameter, and the bearing is built to withstand 170,000-pound pressures.

Automatic machines cut the rollers from long steel rods. Roughnesses are removed, then the rollers are heat-treated, cleaned, ground and polished. Finished rollers go



Bombsight bearing, left, is world's smallest. Magnified, it's tiny beside navy beans. Aircraft engine bearings below get final washing in oil



through an automatic size selector at the rate of 5000 per hour.

Made of high alloy steel with approximately seven per cent each of chrome and tungsten, the super-hard matched races are cut from sleeve-type forgings. First the rough sliced rings are machined, then heat treated, quenched and cooled. Grinding operations follow, with a rigid inspection to check size, parallelism and flatness. Each ring has a Magnaflex inspection in which it is demagnetized, magnetized, and dipped in a two percent iron oxide colloidal suspension which forms lines that reveal any defects—and then again demagnetized. Final grinding and polishing operations are followed by individual inspections. Races and rollers, in fact, undergo careful inspection at each stage of manufacture.

Serial numbers are etched on the races by electric pencil and the races then segregated by .0005 variations in size, matched, oiled and wrapped. Rollers are assembled in brass retainers in semicircular form, two for each bearing. The bearing—roller assembly and races—is assembled on the propeller blade during manufacture, and the races can be removed from the blade only by cutting.

More than 60,000,000 steel balls a month are produced in the plant of the Strom Steel Ball Company, with ball diameters held to tolerances of 50 millionths of an inch, approximately $\frac{1}{60}$ the diameter of a human hair. First a steel rod is heated and fed into a header, a machine which cuts off a portion of the bar, squeezes it in a die and ejects it as a rough sphere.

Next comes flashing, a rough grinding to remove gross imperfections such as the rim left around the middle of a ball. Further grinding brings the ball to approximate size. Only smaller sizes get the soft lap treatment, a polish grinding for extreme accuracy. After heat treatment for hardness, the balls are run at high speed through the multiple grooves of lapping machines.

The Ahlberg Bearing Company uses balls from Strom in its propeller thrust ball bearing assembly for Rolls Royce engines. Inner and outer races are cut roughly by automatic machines and then

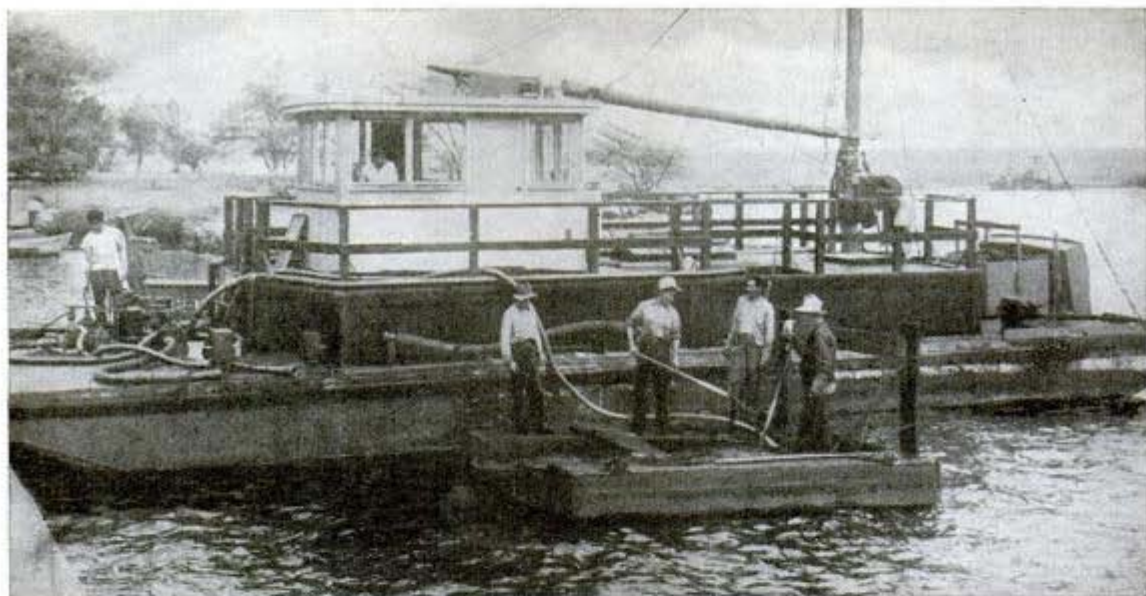
Grill on Tripod Has Own Firebox



Doubling as a refrigerator on the way to a picnic and an outdoor fireplace after you get there, an all-purpose grill is said to be a boon to picnickers. It can be used to bake, roast, boil or steam, and in addition provides hot running water from a built-in faucet. The grill is suspended from a tripod. An enameled three-gallon oven tank around the firebox can be packed with ice and food carried in the firebox itself. After the food is removed and a charcoal or wood fire built, the ice quickly becomes hot water available for coffee or other purposes. The grill can be used on a porch as well as outdoors or set in an indoor fireplace.

ground. Heat treatment is applied by a conveyor-type electric furnace which reaches 3000 degrees. After a hardness test the races go through a series of grinding operations with the grinders shaped to the contours of the grooved raceways. Diamond tools "dress" the grinders to accurate contour. A Magnaflex inspection follows. An optical comparator magnifies a bearing part 30 times and projects it onto glass for comparison with a drawing of itself, similarly enlarged.

Although the bearing industry won't be free from war production until after the defeat of the Japs, it will have a large-scale place in making a success of the postwar design for better living, since almost anything that moves moves easier on antifriction bearings. The "tremendous trifle" will be seeing you.

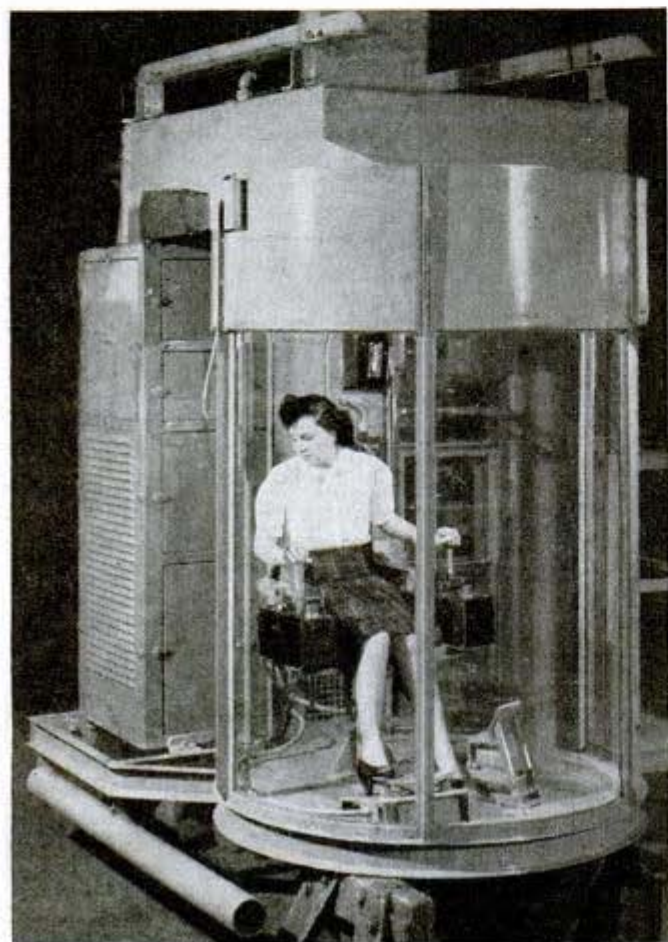


Official U. S. Navy photo

"Juicy Fleet" Skims Off Oil To Keep Pearl Harbor Safe

Dangerous fire hazards at Pearl Harbor are eliminated by the "Juicy Fleet," which skims oil from the surface of the water. Oil salvage is a by-product of the fire prevention operation and the fleet scooped

3,000,000 gallons of oil, 40 percent of which was reclaimed, from the harbor last year. Flat-bottomed boats scoop the oil scum into a large tank, the water going to the bottom and the oil passing through the reclaiming process. The fleet was developed in the navy yard after the Japs' sneak attack when oil was inches thick on the water.



Plastic Crane Cab Is Air Conditioned

As neat and streamlined as a modern showcase, a new cab for overhead cranes is a completely enclosed cage of shatterproof transparent plastic which eliminates corners and blind spots. The cab is air conditioned and its control switches are situated so that all of them can be operated easily from a sitting position. A traveling platform serves as an entrance vestibule and as a means of cleaning the exterior of the windows.

Planks Are Made From Excelsior and Cement

Excelsior made from low-grade timber is mixed with portland cement to produce a plank in a process just patented. The excelsior is immersed successively in sodium silicate and calcium chloride, which react to precipitate calcium silicate on the fibers. Common salt, produced by the reaction, is removed by washing. The excelsior then is mixed with cement, molded to dimensions, cured in a moist room and set aside to dry.

"IT'S IMPOSSIBLE BUT WE'LL TRY IT!"

PART 1



Along with his Distinguished Flying Cross and Air Medal, Lt. Peter Culbertson earned a few reprimands for such irrepressible Yankee pranks as buzzing a P-38 field with his blimp. But the impossible desert rescue he engineered has earned him forgiveness

"What in the world are you doing down there, Mr. Culbertson?" shouted an amazed member of the crew

By Thomas E. Stimson, Jr.

BLIMP Squadron X, like most other Navy units, has its own unique claims to distinction.

It has, for instance, flown its airships on convoy duty and antisubmarine patrol off the coast of southern California for more than three million miles without one injury to a crew member. It invented and uses air-sea rescue gear by which the survivors of marine disasters may be hauled up to safety from the water.

By no means the least of its distinctions, it has on its roster Lieutenant Peter Culbertson, USN.

Culbertson is the Hot-Shot Charlie of lighter-than-air, a pilot whose exploits are



Lt. Peter Culbertson at rudder wheel of his blimp →



"Oh, what a target," says gun crew, but blimp's on our side. Right, landing crew steadies big airship

the talk of blimp stations on both coasts. Such gossip results indirectly from his firm conviction that an airship is a versatile conveyance that has many more uses than its military duties suggest. For doing things with an airship that had never been done before, Culbertson has received the Distinguished Flying Cross, the Air Medal—and half a dozen official reprimands.

He is the blimp commander who, exasperated by the lofty attitude of some fighter pilots, buzzed a P-38 field with his cumbersome airship. He is the one who trailed a rope across the deck of a tuna boat with the shouted question "Got a fish to spare?" and hauled up a tuna that the fishermen tied to the line. Ten minutes later it was being cooked on the airship's electric stove.

His fellow pilots and superior officers regard Culbertson with mixed emotions. He is among the best airship pilots in the country, they agree, which is the same as the whole world in lighter-than-air operations. Usually cocky, occasionally irrepressible, he chafes under the restraint of some of the rules that govern the operation of air-

Mechanic operates engine controls inside the "car"



ships. He's inclined to the idea that all rules should contain in their language a list of exceptions. He's an "eager beaver" on patrol and likes to return home with not one pint of fuel beyond the absolute minimum that the rules say must be kept in reserve. The squadron has lumped all these characteristics into one nickname. They call him "Ace."

Today, with the discretion of 26 years and the prudence of a qualified command pilot, Ace denies that it was he who flew one of the Navy's big dirigibles under the Golden Gate Bridge. Though such a maneuver would be perfectly simple, he explains. The roadway of the bridge is 250 feet above the water and a blimp is only 65 feet high. Nothing to it.

He admits to the incident in which he fell out of his airship, catching hold with one hand in the split second before a 700-foot fall. Lighter-than-air people don't wear parachutes.

"Apparently the bomb bay doors under the ship's cabin were not quite closed," he says. "A gust of wind blew them the rest of the way open and then the wind lifted out a section of the light metal decking that covers the bomb bay. I was stepping backward in the cabin at the time and I stepped right through the hole. As I fell I grabbed at a bar in the bomb bay, caught it, and swung with most of my body hanging out in the air. The first thing I remember was one of the crew looking down at me with amazement on his face and shouting, 'What in the world are you doing down there, Mr. Culbertson?'"

The sharp shadow that a blimp throws on the water in sun or moonlight is a familiar and likewise useful image to its crew. Pilots sight on it in making time-

speed calculations. Imagine, then, the consternation of one pilot who glanced down at the water preparatory to making such a check and perceived that his shadow was double. One alongside the other, the perfect outlines of two airships were coasting over the waves.

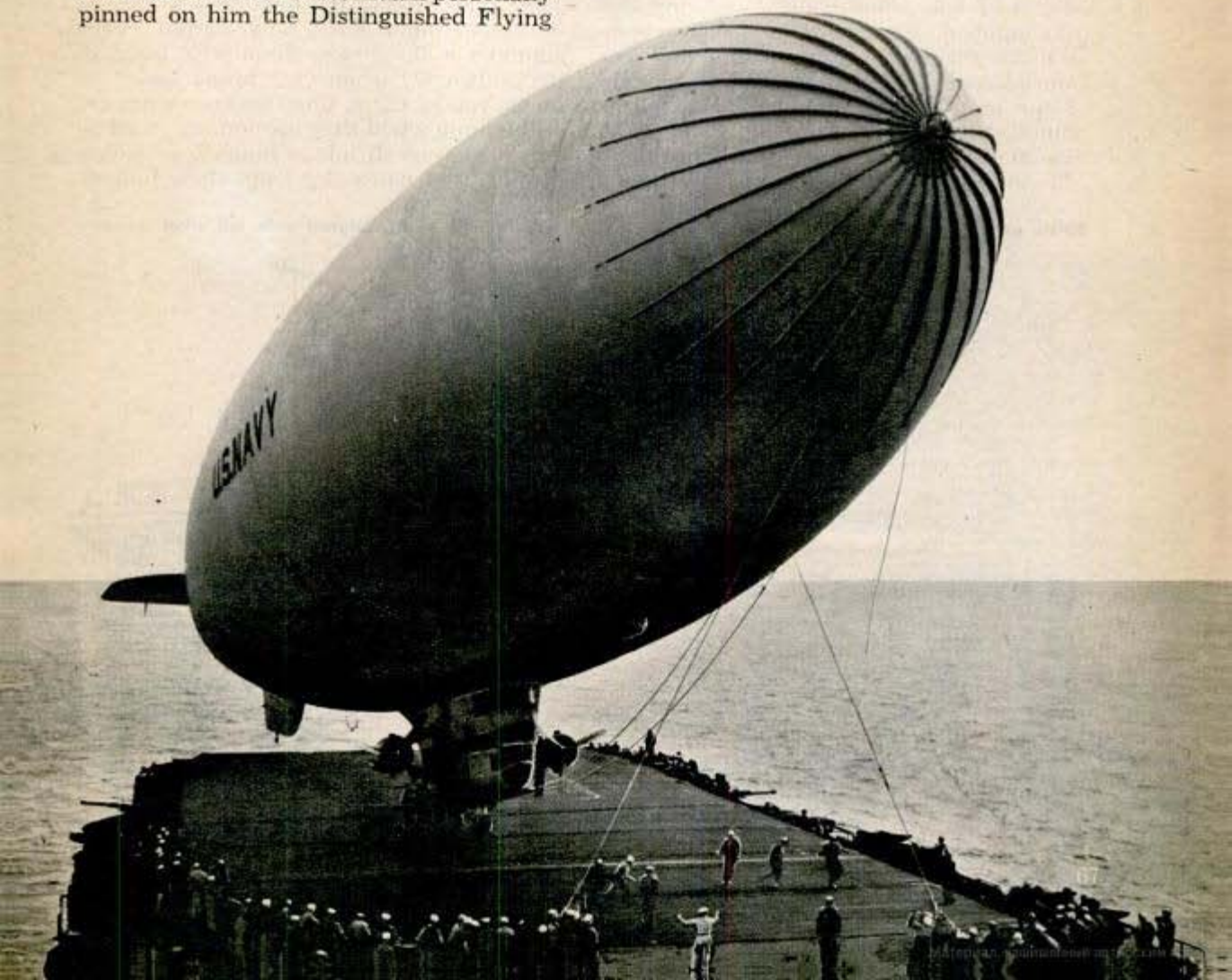
He turned his ship to the left and the two shadows moved together. He swung to the right and descended a few hundred feet. His shadow and its twin held formation. There was no meteorological explanation for such a phenomenon and so the pilot made a plausible—and accurate—guess. Culbertson had sighted him at sea, had flown over at a high altitude, and once above him had descended until he had reached a minimum safe operating distance overhead. Now he was jockeying his airship to match every move that the uncomfortable pilot below him was making.

These stories might give the impression that Culbertson is an irresponsible pilot. That isn't at all correct. Few people realize, he says, the preciseness with which an airship can be safely maneuvered.

What he did on July 2, 1944, is without parallel in air history. It was a rescue feat so daring and outstanding that Rear Admiral Charles E. Rosendahl personally pinned on him the Distinguished Flying



Navy photo
Echelon of dirigibles in sky parade. Below, blimp makes "one-point" landing on carrier deck far at sea





WAVE in control tower uses blinker lamp to give signal for takeoff

Cross. To the Ace the day was one of ordinary flying plus 15 minutes of nightmare.

That morning, over in the Imperial Valley on the other side of the coastal range, a group of Navy pilots was on a routine training flight, firing at towed targets. The engine of one plane conked out and the pilot jumped. Somehow he became twisted in the shrouds of his parachute and was injured when the 'chute jerked open. One of the crew of a companion plane parachuted down to give him help. The scene was 20 miles east of Holtville, California.

Twenty miles would be an easy distance

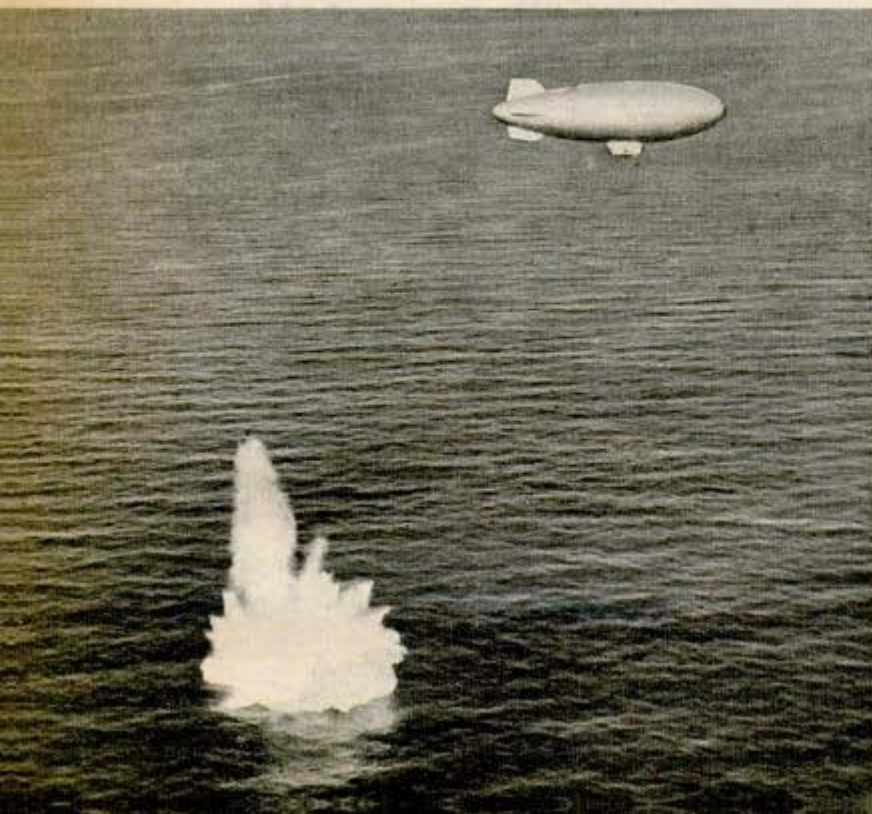
kerchief in a bucket of water, if you had the water, and flick the cloth dry with a few waves of your hand.

Men don't live for more than a few hours under those conditions unless they have adequate shade and water. Early travelers sometimes died of the heat only a mile or two from help. Even now, almost every summer, a few people die in arid areas of the southwest when cars break down on lonely roads. Often their wrist watches are still ticking when they are found. In a few hours, victims shrink so much from dehydration that rings slip from their fingers.

for a rescue party to travel under ordinary circumstances. But the two men had landed in the middle of a vast sand dune area, so soft underfoot that not even a track-type vehicle could enter it. There was no spot closer than the Holtville airport at which a rescue plane could land.

That day in Imperial, 10 miles west of Holtville, the temperature climbed to 108 degrees in the shaded Weather Bureau instrument shelter. It was hotter still on the ground at Holtville; one report was that the temperature hit 131 degrees. It probably was all of that out in the dunes. The relative humidity was 15 percent, so dry that you could dip a hand-

Below at left, geyser caused by depth charge dropped from blimp. Right, colored balls tell wind direction



Rescue parties were sent out from Holtville. The first few miles were relatively easy, then the blistering sun began to have an effect. Some of the men grew dizzy, stopped, and staggered as they went on. The water in their canteens was now almost too hot to drink.

Some of the men began to feel that unless they turned back now they wouldn't live until dark. They did turn back, all but a Navy pilot and an enlisted mechanic who were determined to find their companions. Those two trudged on. The heat warped their judgment and they wandered away from the course. Then a plane buzzed down and corrected them. It dropped more water which by now they needed badly. They were making half a mile per hour in sand up to their ankles.

Meanwhile from Holtville a call went through to the lighter-than-air station on the coast. Would it be possible for a blimp to come and land on the desert, without help of a landing crew, and rescue the men?

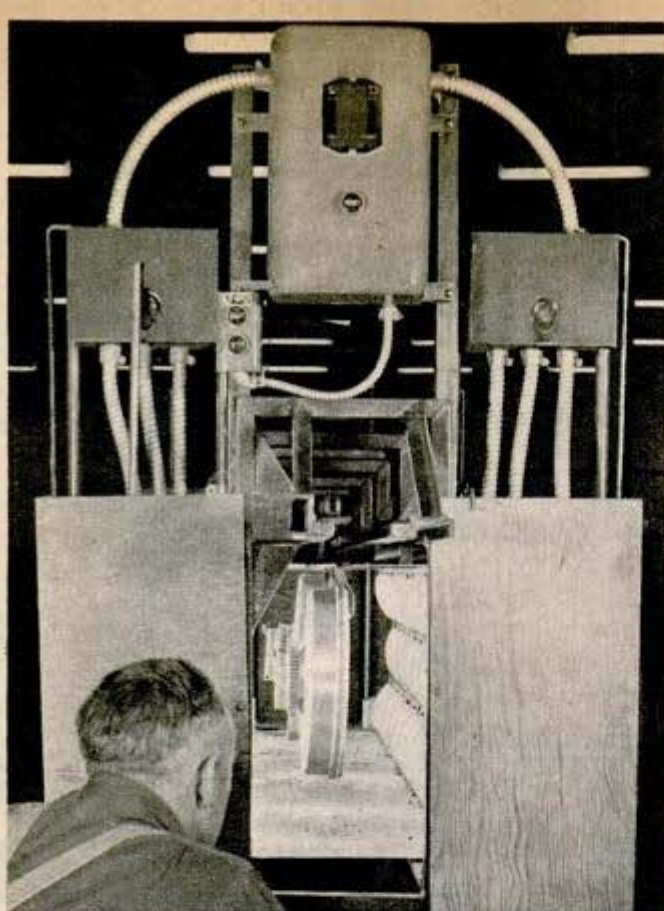
The officer who received the call shook his head. Through the window as he held the phone he was watching a blimp nose in for a landing. Forty men on the landing mat were streaming out to catch the lines and hold the ship down. That was the normal procedure. Still, there was a story that Lieutenant Culbertson had landed on an island without the help of a ground crew and had picked up a passenger.

"No," it was decided over the phone, "it's impossible, but we'll try it."

(Continued next month)

Crew prepares for feast after hauling up a tuna from fishing boat seen through window





Lamps Expand Gears For "Zero" Fit

Reduction driving gears on aircraft engines are given a "zero" fit on crankshafts by means of an infrared lamp bank at the Studebaker plant, South Bend, Ind. Near the beginning of an assembly line the tunnel-like oven heats the gear to 500 degrees. This expands the gear so that it can be installed on the crankshaft. On cooling, the metal shrinks to its normal size. The method is said to be more efficient and more economical and to avoid the noxious odor of the hot oil dip system formerly used for expansion. Although much smaller, the lamp bank is similar to those used in the quick drying of automobile paint.

Gears hung between banks of glowing infrared lamps are heated quickly to 500 degrees

Chute Combines Fun With Fire Drill

Staging a fire drill is as much fun as going to an amusement park for pupils in a school in Hindhead, England. To insure the quickest evacuation, children in classes on the third floor slide to the ground through an enclosed chute hung from the windowsill in the roof. Fellow students stationed in the school yard hold the chute taut to keep the descent from being too precipitous.

Postwar Electric Planes May Have Less Weight

Airplanes powered by electric motors driven by turbines are a postwar possibility and manufacturing costs already are being estimated, according to a report to an air transport meeting of the Society of Automotive Engineers. Preliminary engineering investigations suggest that electric planes might permit great savings in weight and power through reduced drag and more efficient propeller locations, says Austin F. Trumbull, United Air Lines representative with Douglas Aircraft.



Radio Units Are Kept in Step To Boost Overseas Wordage

Transmitting and receiving units are kept in exact electrical step with each other in the errorproof radio system of word transmission opened between the United States and Great Britain by RCA Communications, Inc. Up to 488 words a minute can be routed simultaneously in both directions on eight channels carried by terminal stations. RCA expects to handle 200,000,000 words of world-wide communications this year with the new system, compared with 63,000,000 words in 1938. Differing little in appearance from conventional apparatus, two cabinet racks, one a receiver and one a transmitter, form a unit of the multiplex radio telegraph.

Transmitting operator (upper right) sends message over multiplex distributor (right). At full capacity, unit keeps 16 operators busy receiving and sending



Student Pilots "Fly" Captive P-47 To Get Feel of Fighter

Before student pilots go aloft in a high-powered fighter they get the feel of it in a captive P-47 Thunderbolt under the watchful eyes of instructors at Seymour Johnson Field, N. C. The plane is mounted on concrete pillars in a suspended position of flight. This enables the students to start the engine and operate the flaps and retractable landing gear. The trainees practice every detail of procedure from an emergency landing to the proper fastening of shoulder harness. A complete instrument panel which is mounted in a glassed-in control booth connected with the plane gives duplicate readings of the P-47's instruments. By using a vacuum motor the instructor can transfix air speed readings to the cockpit. Among other things radio procedure is practiced thoroughly before a landing is simulated. The instructors can fake an emergency, such as falling oil pressure or a defective hydraulic system, to test the pilot's reactions.

Student pilot ascends to Captivair (left). Instructor at control board (center) slows simulated air speed and pilot lowers gear for a "landing" (top)

SCHOOL FOR



Two old-timers with track experience (left) show the young greyhound between them how to "break box" at start of race. Racing instinct of dogs is cultivated from birth, but actual training doesn't start until greyhounds are year old. At the racing kennel of Mrs. Jeanette Eagan, St. Petersburg, Fla., pups are taught to chase white cloth whenever they see it so when first simulated rabbit is dangled before them at track they will be eager to catch it. Fluttering white "rabbit" can be seen below near inside rail as greyhounds flash past. Race ends when curtain is pulled across track and rabbit disappears



Above, young greyhound "graduate" is ready to race



Left, as trainer calls, "All aboard for schooling track," dog hops into specially built trailer which contains several screened compartments with entrances on side. Note canvas curtains. Before taking him to schooling track dog has been kept on light rations to whet his appetite for illusive handkerchief rabbit



GREYHOUNDS

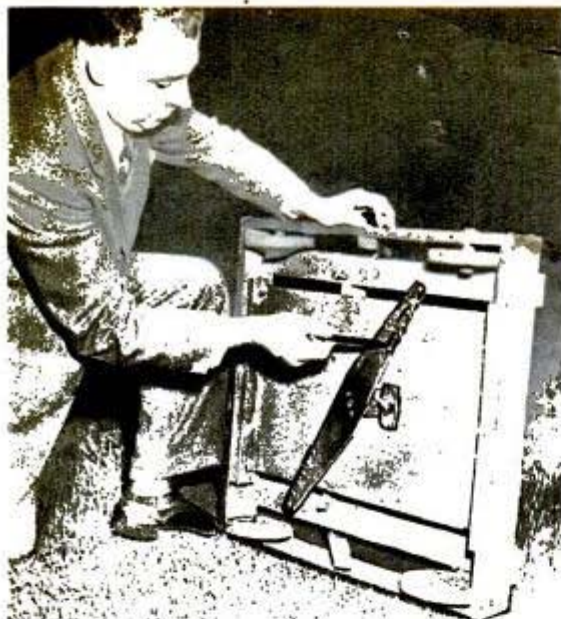


Above, greyhounds are released at training track as tantalizing "rabbit" flies by on its pulley in direct vision of the dogs. Right, tense second before release of aspiring "champs" on starting line. Below, these racing greyhounds have finished official schooling, received their Florida state certificates permitting them to enter first race and now proudly march by the judges' stand at track. They know all the tricks from breaking box to how to take curtain at finish line. They don't seem to mind not catching the "rabbit." After all, it's the race that counts!



Greyhound "student" is taught correct stance for a quick getaway. Dog is "hand spread," then released





Old Razor Blades Find Work "Shaving" Inventor's Lawn

Here's another use for old razor blades. C. D. Tuska, of Philadelphia, Pa., put them to work trimming the grass. In building his own lawn mower, he mounted a vacuum cleaner motor on a boxlike structure, attached a rotor to the shaft of the motor and fixed three razor blades on each arm. He says the blades can withstand anything except stones and heavy twigs.

Adjustable Triangle for Drawing Speeds Work of Draftsmen

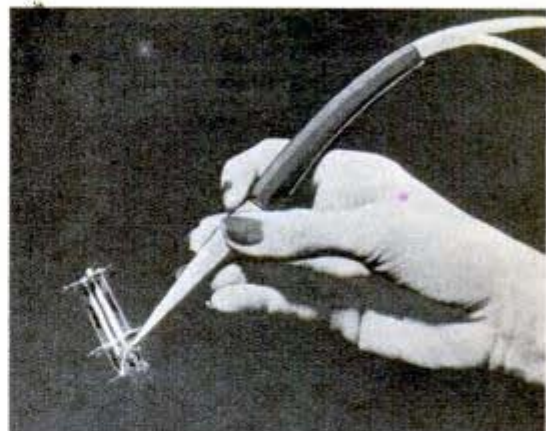
Any angle from zero to 90 degrees may be drawn quickly with the aid of an adjustable triangle made of transparent plastic. The calibrations, in half degrees, are



molded in the clear plastic and cannot become mutilated through use. A large-sized thumb screw locks the triangle securely in any set position. The three-ounce unit is only $6\frac{3}{4}$ inches wide and $7\frac{7}{16}$ inches high.

Tweezers Plugged Into Welder Pick Up Tiny Elements

Picking up, bending and welding tiny elements of a product can be accomplished easily with a pair of insulated forged copper tweezers that plug into spot welding equipment. The tweezers have plastic covered, flexible copper leads terminating in a pair of lugs which connect in place of regular welding electrodes. Capable of being



handled successfully by an inexperienced operator, the tweezers are used in making small, precise units, instruments, toys, optical goods, jewelry, household ware and luggage. Safe enough to be operated barehanded, they eliminate oxidation and produce a clean weld. They are said to be 50 percent faster than other welding electrodes and are ideal for quick successive welds on one product where space is limited. Four thousand welds an hour are possible with these tweezers, originally developed to weld tiny radio tube wires.

Impregnating wood with certain phenol compounds, especially copper-chlorophenol, repels wood-destroying termites to a certain degree, according to research done at the University of Puerto Rico.

"Vacuum Cleaner" on Tractor Harvests Seeds



To harvest ladino and white clover seeds, Michigan State College at East Lansing, Mich., uses what looks like an oversized vacuum cleaner mounted on an ordinary all-purpose tractor in its experimental fields. The machine has a grain elevator type blower operated by a belt pulley on the tractor to provide air suction. It also has a gathering unit which houses a rotating beater. Ground wheels



Vacuum harvester tosses seed into inflated sack on trailer behind. Left, the unit's "mouth"

turn the beater, after which the salvaged seed is whisked back into a large inflated sack carried on a trailer. The harvester was designed and built by members of the college's agricultural engineering and farm crops department, who say the necessary parts can be turned out in a well equipped machine shop.

Nonslip Hanger for Towels Has a Quick-Release Catch

Towels and aprons which have a habit of falling from old-fashioned racks remain securely inserted in a plastic nonslip hanger rack that has a novel locking device. The catch can be released instantly by merely lifting the towel or apron. The hook, which is available in a variety of bright colors to match the home's color scheme, can be used in kitchen, bedroom, entry hall, cupboard or closet. Although only one and three-quarter inches long the hook is ruggedly designed.

Hanger catch clamps cloth firmly so it cannot fall

20,000,000 Pictures a Month Snapped by U. S. Flyers

Members of the Army Air Forces take more than 20,000,000 pictures a month and use more photographic film, paper and equipment than any other organization in the world. One group has more than 180 cameras and averages 60 missions a day, exposing some 450,000 negatives. About 50 or 60 prints are made from many of these negatives. To conserve film and paper, technicians invented a developer to use photographic paper fogged by age.

