

POPULAR MECHANICS MAGAZINE

A detailed illustration of a biplane flying over a landscape. The biplane is olive drab with a blue and white star insignia on the tail. Two pilots are visible in the cockpit. A soldier in a helmet and uniform stands on the ground in the foreground, holding a long wooden pole. The background shows a landscape with trees, a small building, and hills under a blue sky with clouds.

APRIL
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SEE PAGE 16

ENGINEERING THE IMPOSSIBLE

By Brig. Gen. F. O. Carroll, USAF



*Northrop Black Widow
Night Fighter*

PRESTIGE ESTABLISHED IN THOUSANDS

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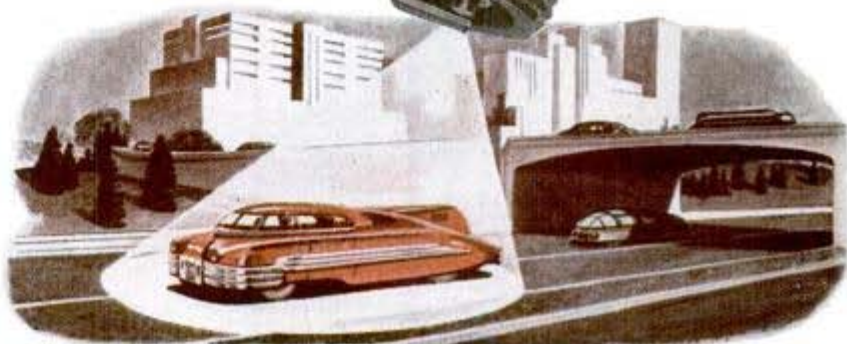
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New lamp kills germs . . . Germ-laden air is purified by the new G-E germicidal lamp. It is already at work in hospitals, in battlefield operating rooms. Tried in a school classroom during a measles epidemic, only one-fourth as many children contracted measles, as compared with unprotected classrooms.



LAMPS that kill germs . . . X rays to guide the surgeon's fingers . . . air-conditioned operating rooms . . . The pictures you see here are typical of things accomplished for you by G-E research and engineering.



Seeing the invisible . . . The electron microscope, more powerful than ordinary microscopes, gives doctors a new tool to fight disease. Here is the germ, *Bacillus subtilis*, magnified about 4,000 times. G-E engineers are working to make available a *portable* electron microscope for industry.



Mirror of D-Day injury! A mine shattered Seaman Brazinski's boat on D-Day, blew him 20 feet in air. Rescued by an LST, rushed to England, X rays quickly defined his thigh injury, permitted accurate setting. Portable G-E X-ray machines at St. Albans Naval Hospital, L. I., regularly check his progress. Through the skill of doctors 97 per cent of the wounded in this war are saved. The modern form of X-ray tube was invented by Dr. W. D. Coolidge, G-E scientist. X-ray units built by the G.E. X-Ray Corp. are at battlefronts the world over.



Helps treat infantile Paralysis . . . Doctors wanted hot packs to relieve pain and reduce muscular spasms, but such steam packs tended to burn. G-E workers put together a machine for hospital use that produces heated packs that even at 180° F. will not burn the patient's skin.



Helping the sick get well is only one of the contributions of General Electric. From the research and engineering in G.E.'s laboratories come products to make your work easier, your home brighter, creating new comforts, better jobs. General Electric Company, Schenectady, N. Y.

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 4:00 p. m. EWT, CBS.

FOR VICTORY—BUY AND HOLD WAR BONDS

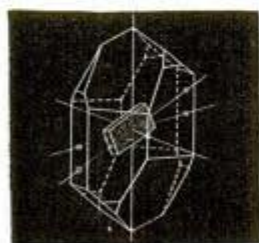
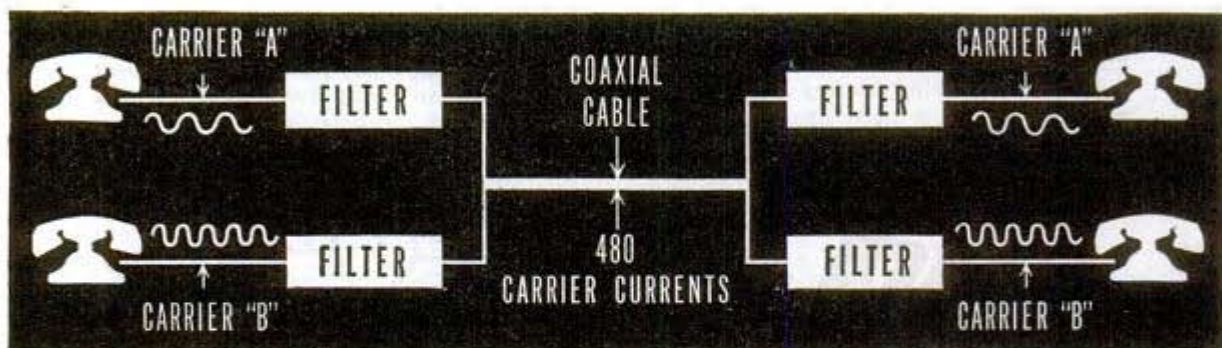
GENERAL  ELECTRIC

952-624-211





Crystal gateways for your voice



Four hundred and eighty telephone conversations over a coaxial cable was one of the last peacetime achievements of Bell Telephone Laboratories. In this multi-channel telephone system, each conversation is transported

by its own carrier current. At each end of the line are crystal gateways; each opens in response to its own particular "carrier" with the message it transports. In telephone terminology, these gateways are filters.

The ultra-selective characteristic of these filters is made possible by piezo-electric quartz plates, cut in a special manner from the mother

crystal, and mounted in vacuum. Each set of plates is precisely adjusted so that the filter responds only to the frequency of its assigned channel, rejecting all others. In the coaxial terminal equipment, such crystal gates sort out messages for delivery to their four hundred and eighty individual destinations.

In recent years, Bell Telephone Laboratories research has provided the Armed Forces with many types of electrical equipment in which frequency is controlled by quartz crystals. Notable is the tank radio set which enables a tank crew to communicate over any one of 80 different transmission frequency channels by simply plugging in the appropriate crystal. The future holds rich possibilities for the use of quartz crystals in Bell System telephone service.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for our Armed Forces at war and for continued improvements and economies in telephone service.



Popular Mechanics Magazine

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H. H. WINDSOR, Founder

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

Next Month

MILLIONS of Americans have seen Bert Brandt's war pictures, many of them taken under fire at the front. Once behind the German lines, he dived into a fox-hole on top of two Nazis who got up and yelled: "Kamerad!" He was with the doughboys at Anzio, Cassino, Normandy and Aachen. His invasion photos were first to reach the U. S. When Brandt was back here recently on a short vacation he took time out to write up a few of his most exciting experiences for our May issue.

HERE'S a challenge to anglers who banged their depleted fishing tackle boxes shut on the 1945 season. With a little ingenuity you can make those old plugs, flies and hooks like new. A well known sports editor tells exactly how to go about it in a May feature. He also tells how to snagproof a line with a piece of screen door spring.

WHEN our invasion forces pounce on an enemy beach the operation is nothing short of organized chaos. Invasion craft disgorge an avalanche of men, machines and guns. How the beachmaster keeps things moving on a split-second schedule gives an insight into amphibious warfare.

TORRENTS of rain, mud, malaria and Japs were only a few of the obstacles encountered by U. S. Army engineers who built the Ledo Road across the jungles and mountains of North Burma. The story of the "road that couldn't be built" should make all Americans proud.

IF YOU want to go exploring with a camera, a new world awaits you right in your backyard. This world is peopled with common insects offering intriguing picture possibilities. "Mr. Bug Sits for His Picture" is a May feature.

APRIL, 1945

| Volume 83 | APRIL, 1945 | Number 4 |
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| Managing Editor..... | Roderick M. Grant | |
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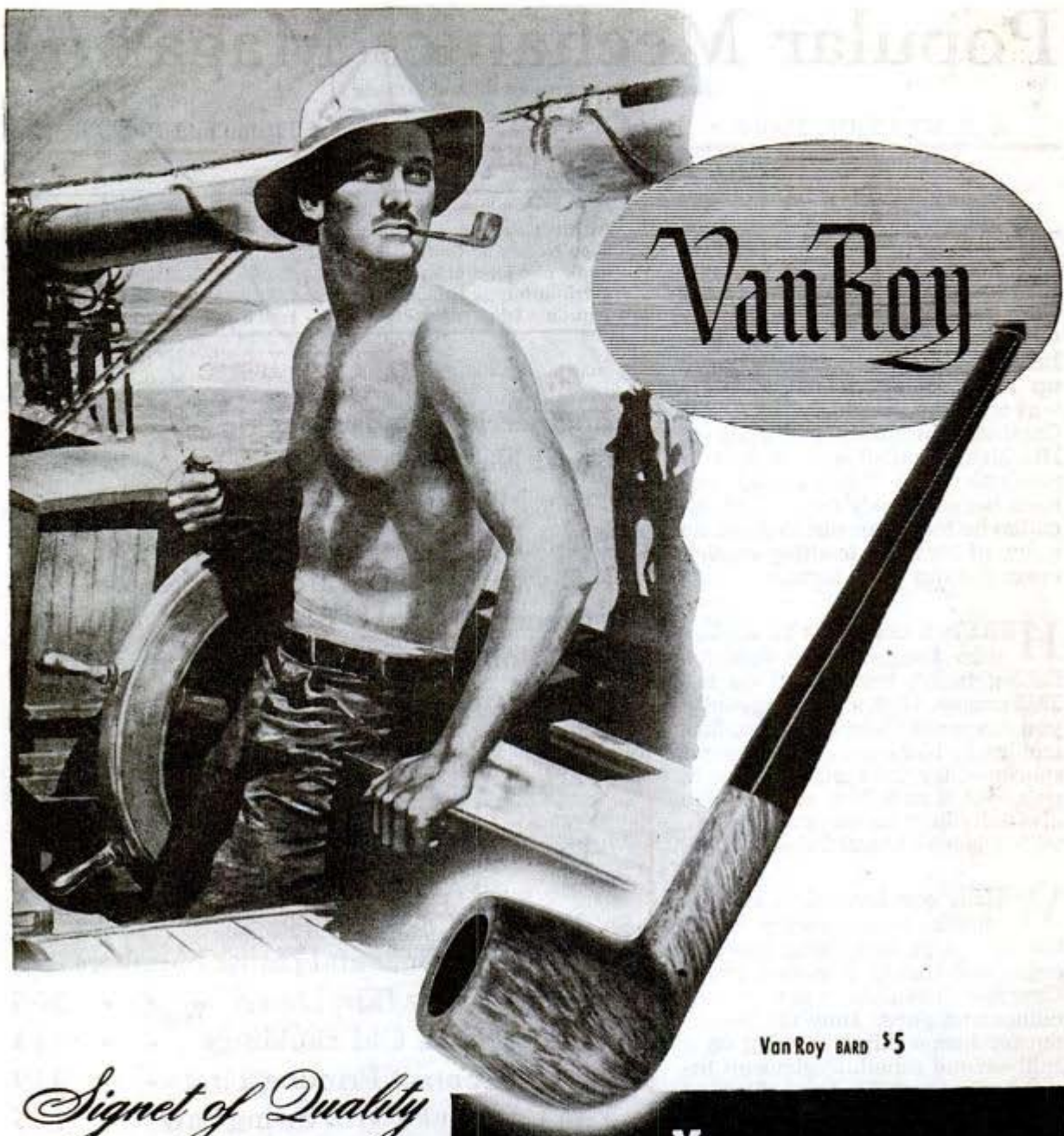
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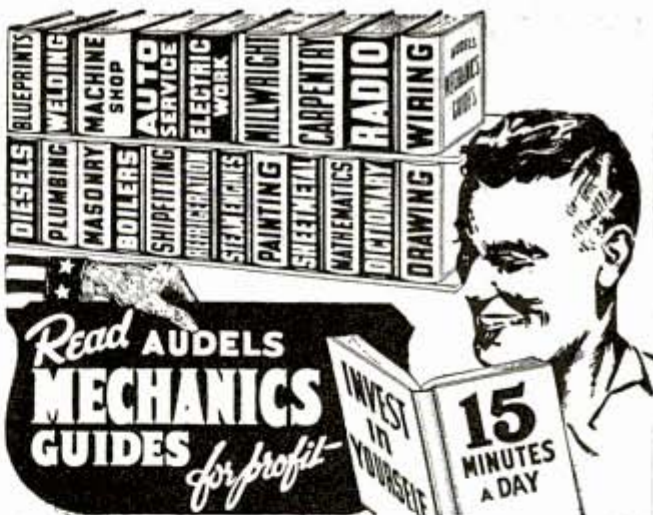
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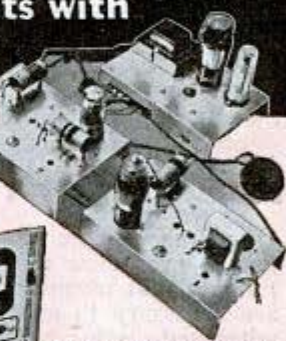


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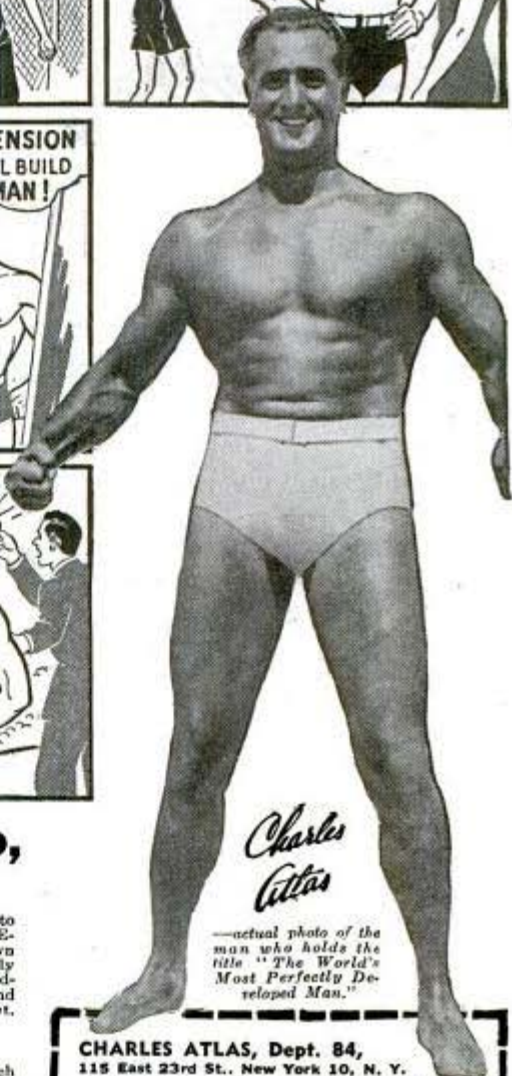
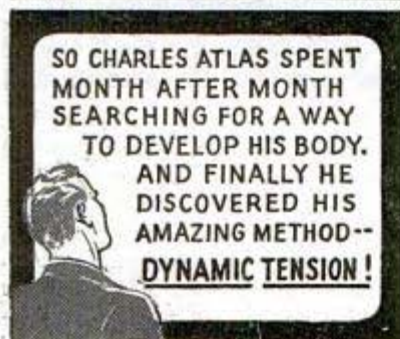
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By S. T. CHRISTENSEN

the "Fix-it Man"

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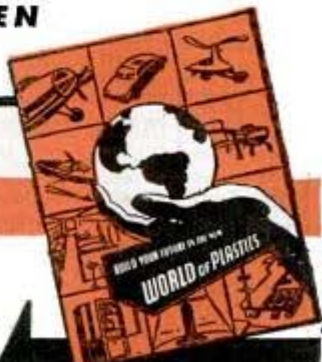
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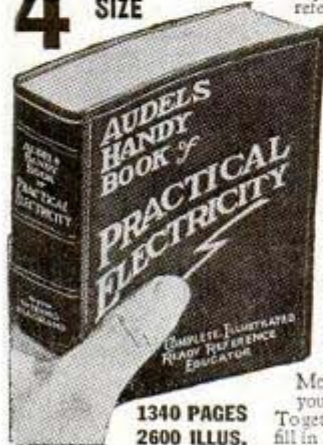
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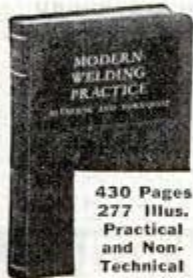
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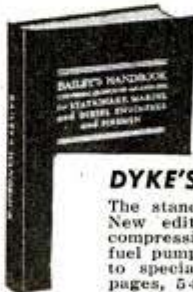
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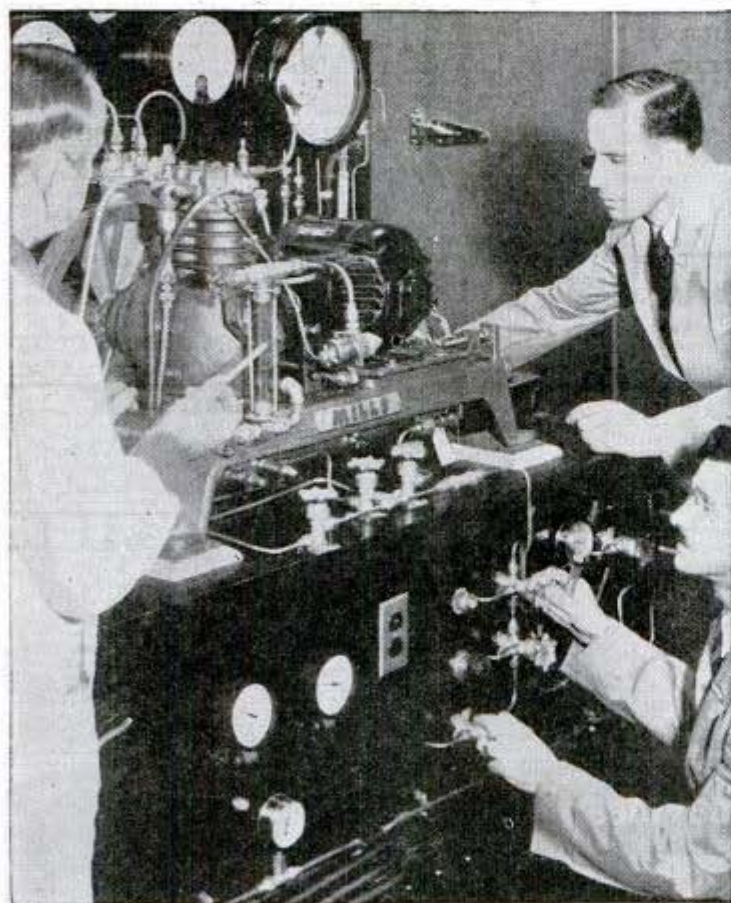
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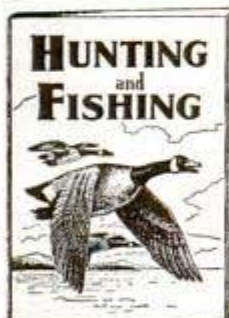
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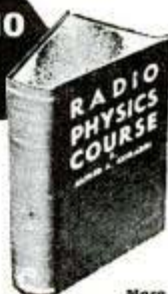
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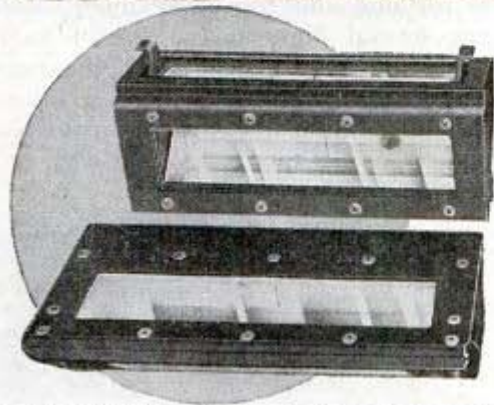
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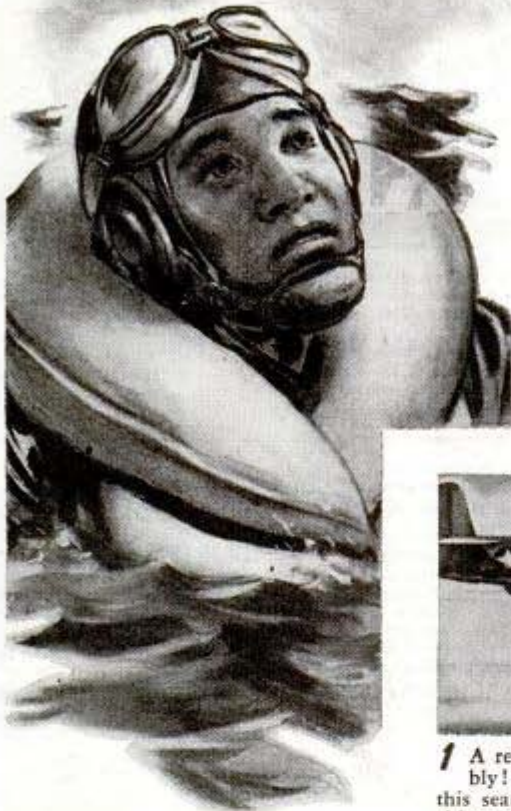
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5 The outboard is mounted. Ample fuel is provided to swiftly power a good distance from enemy coast. Then motor can be quickly replaced with a collapsible rudder for use with sail.



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EVINRUDE

OUTBOARD MOTORS

BUY MORE WAR BONDS — AND HOLD THEM!

Popular Mechanics Magazine

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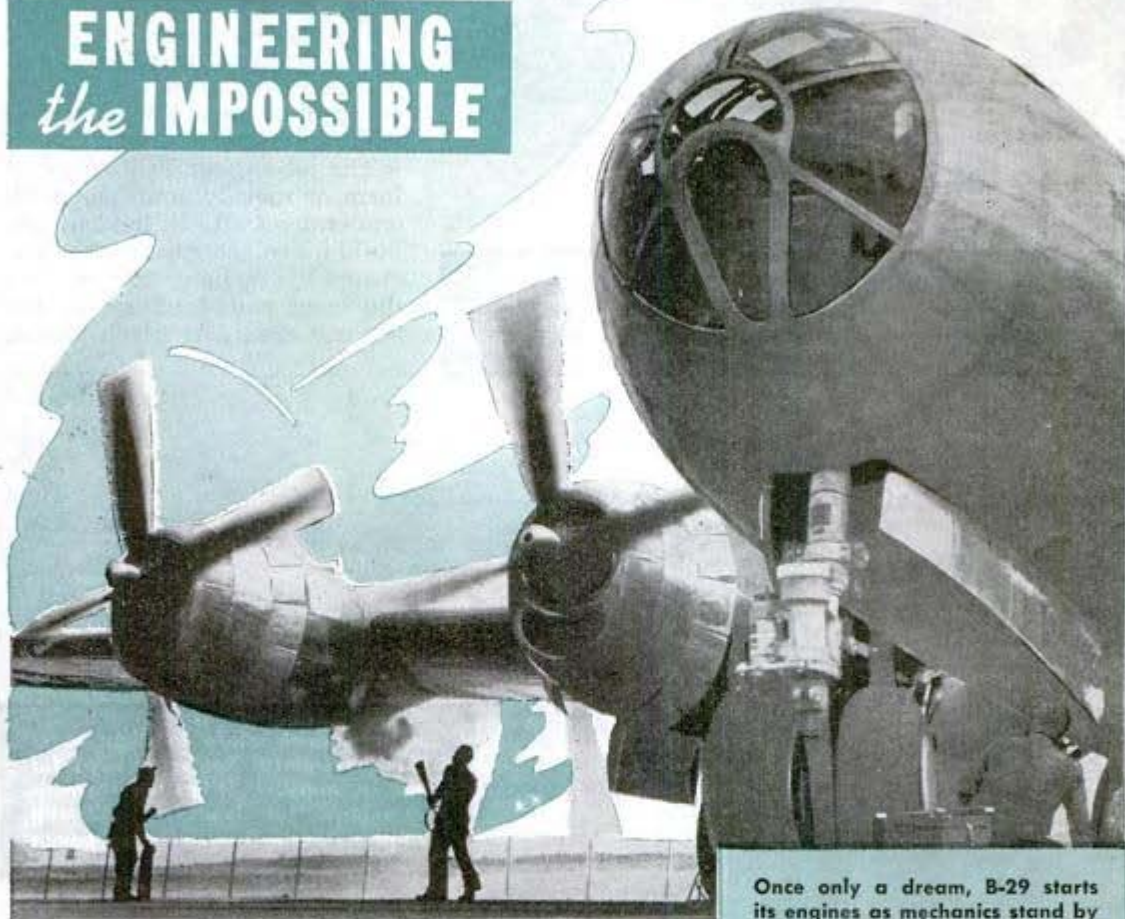
WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 83

APRIL, 1945

No. 4

ENGINEERING *the* IMPOSSIBLE



Once only a dream, B-29 starts its engines as mechanics stand by with fire extinguishers. Below, a B-25 electric upper gun turret

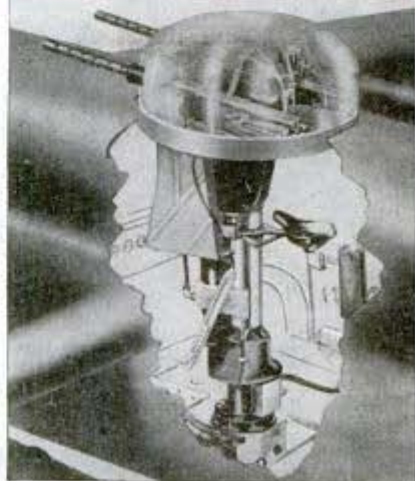
By Brigadier General F. O. Carroll

Chief, Engineering Division, Air Technical Service Command, AAF

WHEN an important development is invented in military aviation it seldom is ready for immediate use because of lack of proper materials or design. But three or four years later, engineers and chemists have supplied everything needed to use the invention to advantage.

Thus we may visualize almost every important development as a number on a giant wheel that makes a complete revolution every three or four years. The first time a number comes around, it is practically useless, but the next turn usually makes it a winner because science has brought the invention to a state of practical application. Sometimes, of course, it may take longer.

For example, principles of the jet propulsion engine were worked out by Frank Whittle, now acting Air





Air Technical Service Command photo

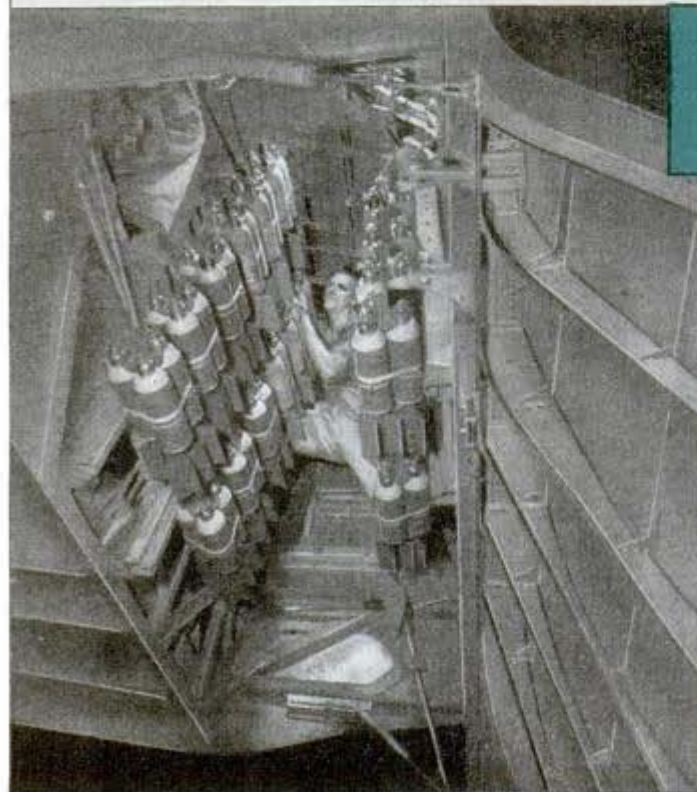
Checking rocket gun installations on a P-47 Thunderbolt. Rockets (foreground) are more potent than a 75-mm. shell and are aimed like machine guns in wing. Tubes are plastic

Commodore of the Royal Air Force, many years before metals could be found to withstand such an engine's terrific internal heat. The first experimental aircraft employing Whittle's engine was flown in 1941. Today aviation science makes possible jet engines of far greater horsepower than ever dreamed of in gasoline engines. Jet propelled fighter planes are being built for our own air forces, and it seems certain that the greatest application of jet propulsion will come after the war.

The jet engine, in its crudest form, is merely a tin can with one end cut off. In the can you build a fire. Burned gases generated by the flame escape from the open end, tending to give the can a slight push ahead.

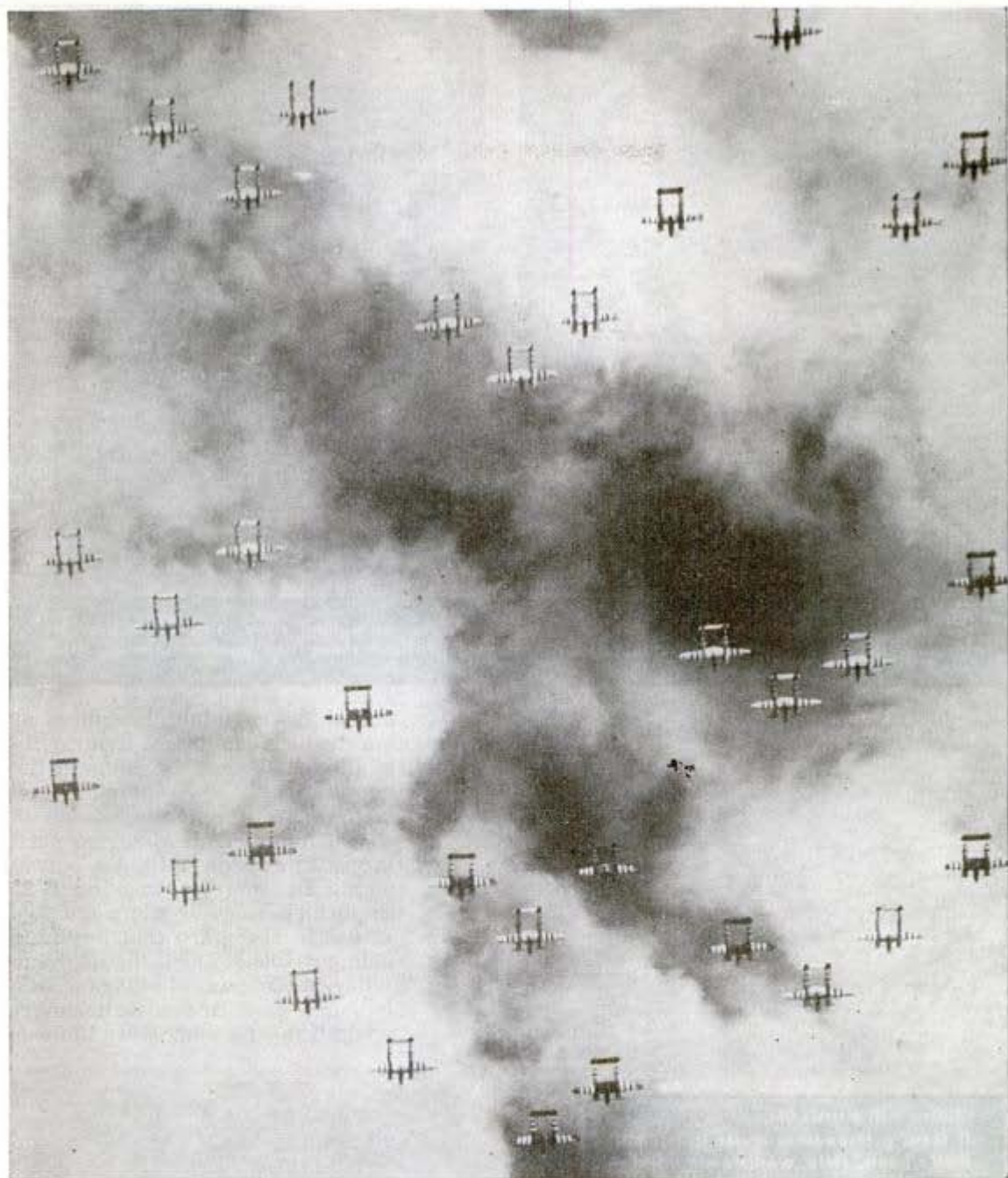


Jet propulsion plane in flight looks like conventional fighter except for lack of propeller. It has two thermal-jet engines. Left, loading a B-17 with 20-pound cluster (fragmentation) bombs



Adding a few cans and forcing the hot gas to escape through a small exhaust nozzle increases the push until it is sufficient to take an airplane off the ground and maintain it in flight. It should be possible to add a propeller to a shaft which would be turned by the hot air as it escapes, producing a combination propeller-and-jet-driven airplane. The propeller would be of advantage at low altitudes, the jet at high altitudes; the combination would be useful in launching aircraft with heavy loads.

Military demands have brought into reality many developments that might have taken years in peacetime. When this war began, we felt few air-



All these P-38s are photo ships, snapped from above. Science has boosted their speed to 425 miles per hour

craft could fly the Atlantic and the Pacific with loads great enough to warrant the attempt. But to meet urgent overseas needs, our bombing planes, then our cargo planes, and finally our fighter planes began to make long overwater flights. Today hundreds of aircraft fly to all parts of the world loaded with men, guns, ammunition and materiel.

How can our aircraft make ocean flights for which they were never intended? The answer is simple: first, the airplanes were so sturdy that they could take tremendous overloads. -Second, we demanded and got

vastly more horsepower out of our engines, while calling on manufacturers to produce power plants with still greater horsepower. Aircraft with a gross weight of 50,000 pounds began taking off with loads some 15,000 pounds greater; aircraft with larger gross weights were designed, and today we may predict superplanes of about 250,000 pounds gross weight—and not too far in the future.

The engines have kept pace, increasing from about 800 or 900 horsepower to above 3,000. A laboratory at Wright Field, Ohio, seat of America's military air power, al-



Airman (left) can quickly release steel and canvas flak vest by pulling strap attached to shoulder lacing. Right, inertia brake testing machine at Wright Field slams tire against spinning steel



Courtesy Bell Aircraft Corp.

It takes a three-story tower to put on B-29's boots. Here, workers are installing de-icer boot on vertical stabilizer. Right, lethal nose of a B-25 bomber

ent objective might be stated as an airplane capable of flying non-stop once around the earth at the equator with a 20 percent fuel reserve, or a potential range of 30,000 miles. Of course, no such aircraft has been built, nor is it in sight. But neither was the B-29 Superfortress a few years ago. We refuse to recognize that anything is impossible. "The difficult we do today, the impossible takes a little longer"—but not much longer when it means shortening the war

ready is capable of testing engines up to 8,000 horsepower to altitudes of 30,000 feet. And these are gasoline engines. Jet engines may reach the superpower stage first.

Engineers of the Army Air Forces, in coordination with airplane and engine manufacturers, constantly study the possibilities of aviation. One group burns the midnight oil on the subject of larger aircraft, always seeking greater range and greater load. The pres-

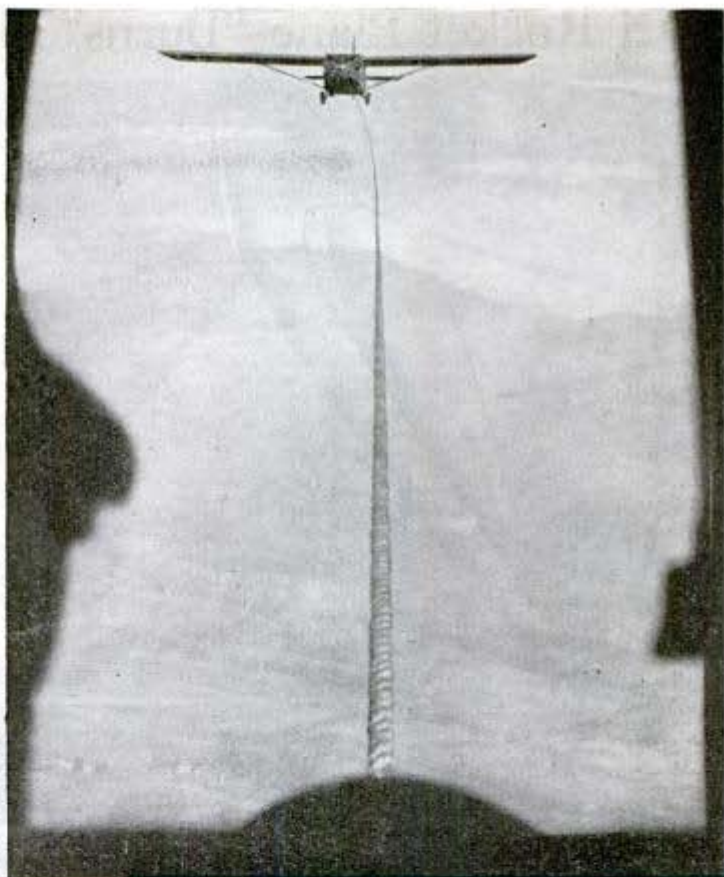


and saving our fighters' lives.

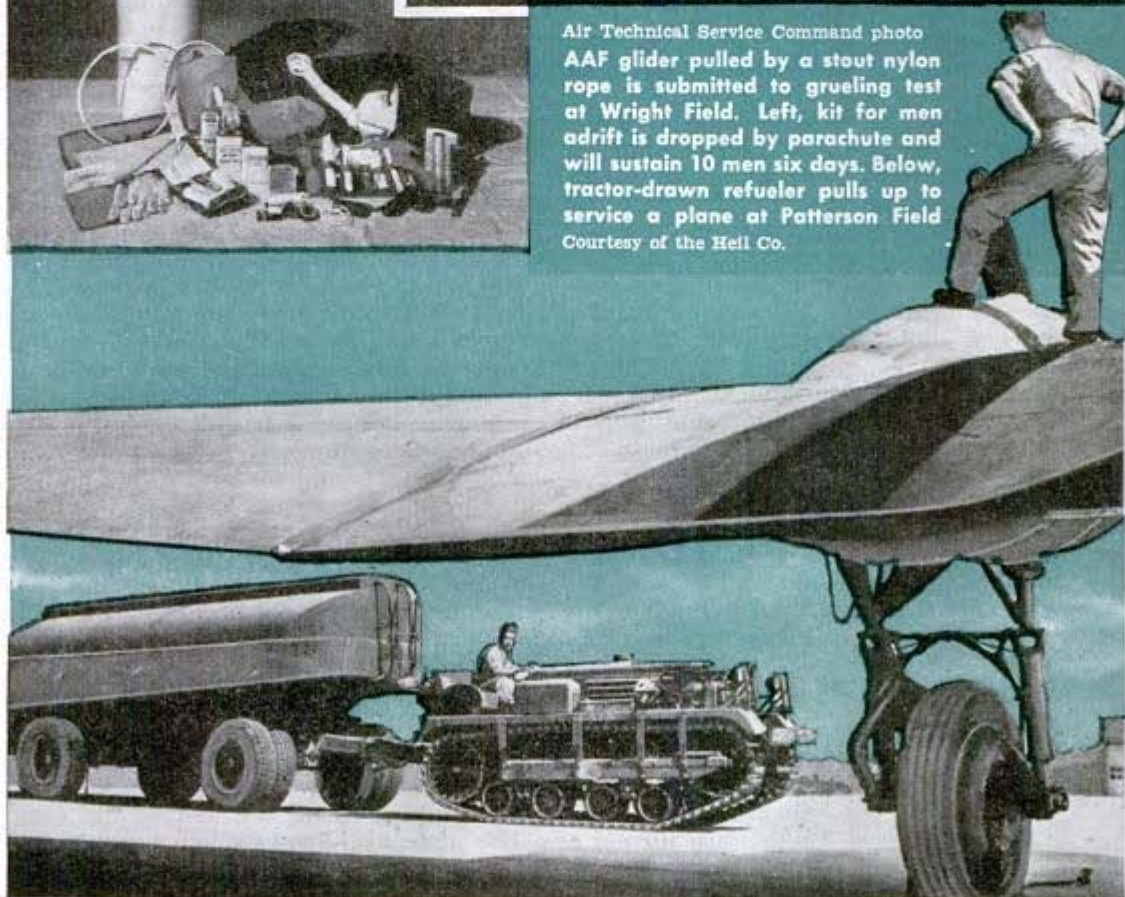
In one laboratory at Wright Field we have a group of young scientists and engineers who work under orders never to have a practical idea. We want them to dream, to work on projects utterly fantastic today but which probably will develop into practical aircraft, engines and equipment of tomorrow. Some designs "dreamed up" four or five years ago will begin to come off the aircraft production line soon—amazing looking ships that no one would have believed capable of flight a decade ago.

Yes, the dreamers are constantly at work. I can look back a quarter of a century, when it was considered impossible to build an airplane

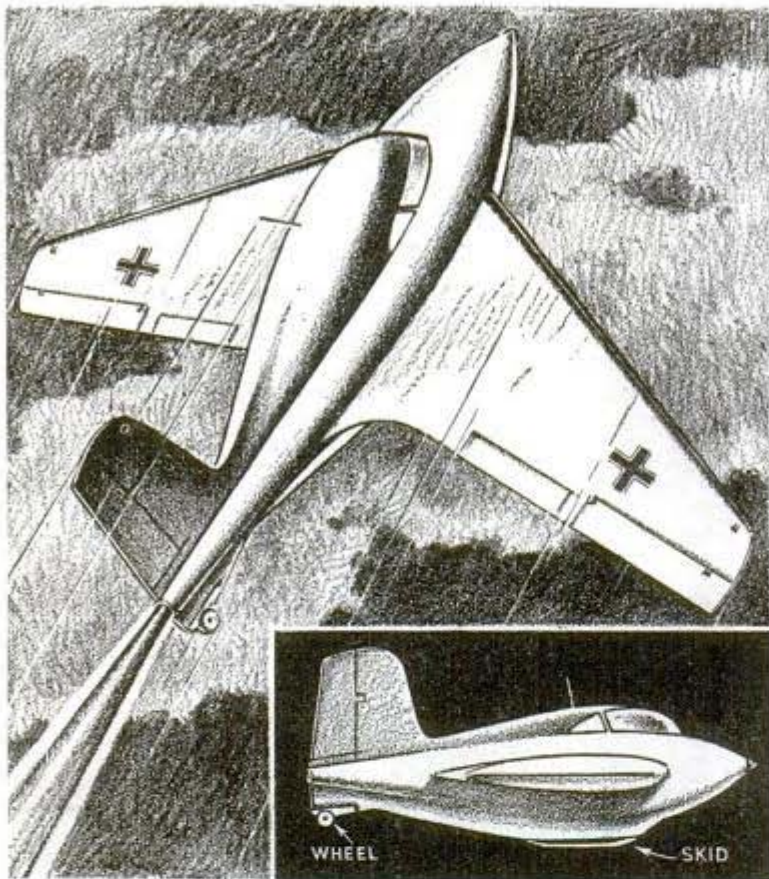
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Air Technical Service Command photo AAF glider pulled by a stout nylon rope is submitted to grueling test at Wright Field. Left, kit for men adrift is dropped by parachute and will sustain 10 men six days. Below, tractor-drawn refueler pulls up to service a plane at Patterson Field. Courtesy of the Hell Co.



Nazi Rocket Plane "Burns" Sky at 600 M.P.H.

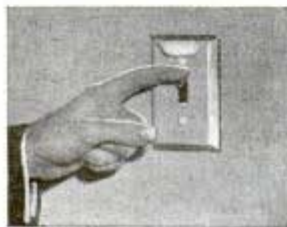


Ours Is Faster

Heralded as the fastest fighter plane in the world, the AAF's new jet-propelled P-80 Shooting Star is reported to have a top speed of about 800 miles an hour. The P-80, which is already in production at five aircraft plants, was developed by the Lockheed Aircraft Corporation in co-operation with the AAF and RAF. The propellerless fighter's electric turbo-jet engine is said to be the world's most powerful aircraft motor, and its range is equal to that of any pursuit ship. Rate and angle of climb are reported "superlative." The Army announced its first jet plane, the P-59 Airacomet, will be used as a trainer.

Reputed to be the fastest plane in combat today is the German Messerschmitt Me-163, whose single rocket power unit near the rear of the fuselage drives it at about 600 miles per hour. Burning a special fuel believed to be liquid oxygen, hydrogen peroxide and calcium permanganate, the plane is capable of staying in the air for only about seven to 10 minutes, though this can be extended by gliding. The Me-163 climbs almost vertically at a rate of about 10,000 feet a minute and drops its landing gear immediately after takeoff, landing on the tail wheel and a belly skid. The British have conceded it is faster than their own jet fighter, the twin-engine Gloster Meteor, which has been in action since last summer. The Meteor's speed is a secret but since it has knocked down a "substantial number" of robot bombs it

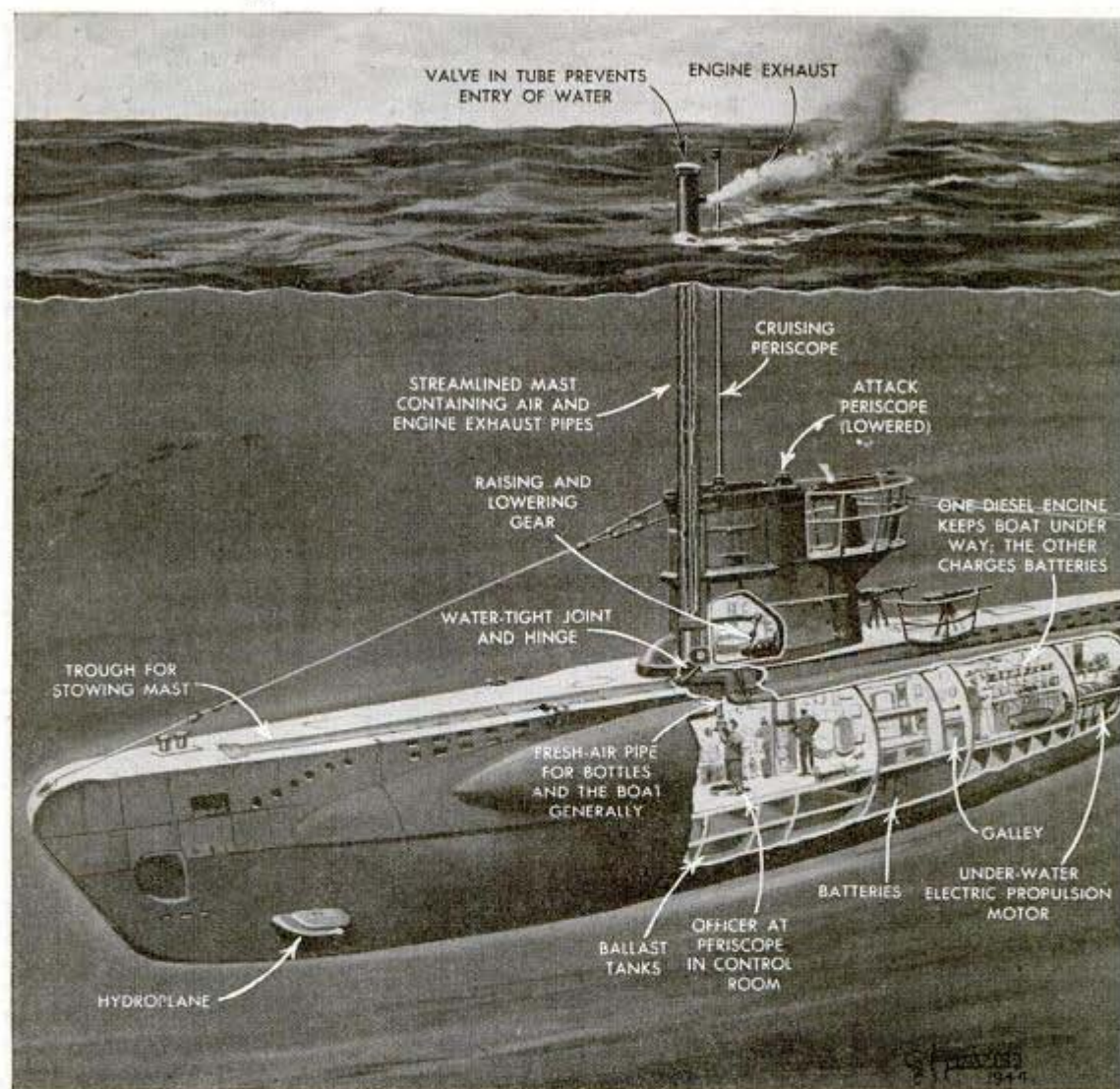
must be capable of more than 500 miles an hour. The Air Ministry says it has a second jet-propelled fighter in an advanced stage of development. The Me-262 and Heinkel He-280, Nazi jet fighters, are powered with two axial-flow turbo units, operating like the U. S. Army Air Forces' Airacomet. They burn low-cost fuel mixed with oxygen from the air. The Me-262, believed to be good for more than 500 miles an hour, has four cannon and room for bombs under its wings. It uses a tricycle landing gear and includes a device by which the cockpit canopy, pilot's seat and the pilot himself can be catapulted completely clear of the plane merely by pressing a button should it be necessary to bail out. The slightly slower He-280 has dual rudders and fins and elliptical wings with pointed tips similar to other Heinkel ships.



Lighted Switch Goes Out When Lights Come On

There's no excuse for groping or stumbling about in a dark room if you have an automatic safety plate attached to your wall light switches. The plate has a tiny, shielded electric light that glows in the darkness and goes off the instant the room lights are turned on. The plate also shows when porch, basement or other remote lights have been left burning. The glow of the plate is not bright enough to disturb sleepers.

"Iron Lung" Lets U-Boat Breathe Under Water



This artist's conception of the U-boat "breathing" tube was drawn for Illustrated London News by G. H. Davis

By breathing through an "iron lung" which resembles an oversized periscope, U-boats remain submerged for long periods in areas where they would be detected if they surfaced. The device, which is known as the Schnorkel Spirall to the Germans and the "Snort" to the British Royal Navy, is a streamlined tube which is projected above the water. The fresh air taken in through the pipes replaces the stale air circulating in the submarine, replenishes

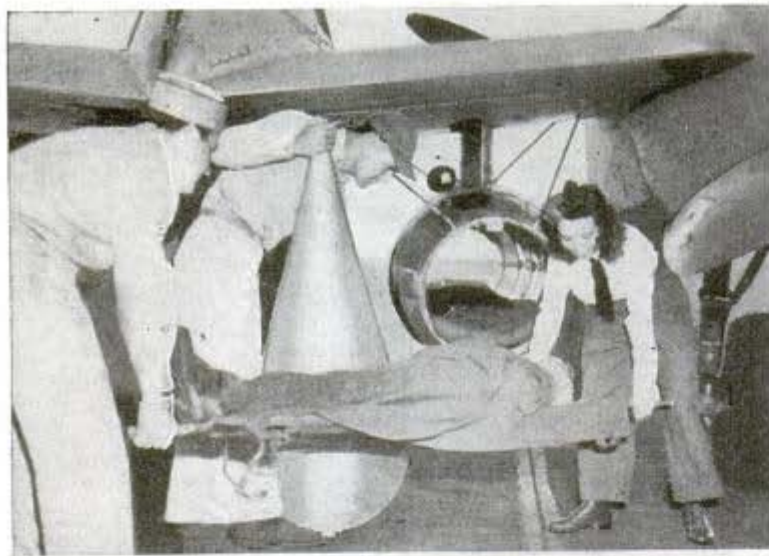
the compressed air used for blowing the ballast tanks, and recharges the batteries used in underwater cruising. The pipes exhale the exhaust of the Diesel motors working when the U-boat is submerged, and inhale fresh air. When the enemy appears, the "Snort" is lowered, the Diesels are stopped and the electric motors take over as the craft dives. The Germans claim the device has enabled the U-boats to remain under water for 30 consecutive days.

Lubricating Oil Made Sludgeproof by Adding Selenium Compound

Lubricating oils can be improved by a new treatment with compounds of selenium, the Battelle Memorial Institute at Columbus, O., has found. Selenium, a non-metallic chemical of the sulfur-tellurium group, is added to lubricating oils to prevent their tendency to oxidize and form

sludge and gummy resins in engines. A film of selenium-treated oil will support increased pressure between bearing surfaces. Selenium is also used in radio and electronic equipment, toning photographic prints, making free machining alloys, and barnacle-proofing ship hulls.

Wounded Ride Inside Gas Tank of P-38 Fighter



With casualties resting inside its fuel tank and tail section, the P-38 fighter plane becomes the world's fastest ambulance. The stretcher patient is pushed into the 12-foot gas container and locked in place. A Plexiglas nose affords a wide range of vision and the tank is equipped with two portholes, air vents, and a set of earphones. As many as four men per trip can be carried by each fighter equipped with "passenger tanks," and the ship's maneuverability is not affected by the load.

Magnet Hangs in Air Over Frigid Plate

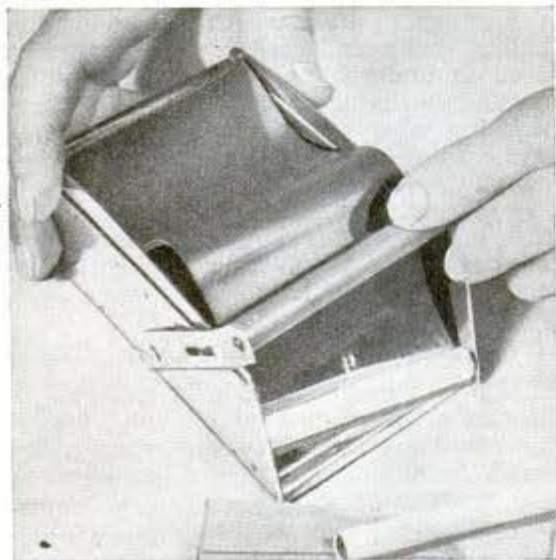
When Russian scientists tossed a tiny ferromagnetic magnet on a lead plate cooled to 269 degrees below zero Centigrade, approximately four degrees above absolute zero, it bounced into the air and remained floating without visible means of support until the temperature of the plate rose three degrees, whereupon it settled on the plate's surface. Their explanation was that the magnet itself created the power



that held it aloft, since its magnetic field set up incessant induction currents in the lead, which in turn repelled the magnet.

Hand Roller Makes Cigarettes Firmly Packed and Sealed

Cigarette smokers can "roll their own" with a hand roller that requires no skill to operate. This machine, designed to ease the cigarette shortage by encouraging home manufacture, produces firmly packed and sealed cigarettes on the first attempt. It consists of a small metal box with a fabric-covered roller on top. The operator fills a pocket in the fabric with enough tobacco for one cigarette, inserts a cigarette paper under the roller with the moistened edge up, and pulls the handle of the roller across the box. The finished cigarette rolls down a chute at one end of the box.



CORAL NEST FOR THE SUPERFORTS



Cutting up a coral mountain on Saipan, engineers get prized construction material for B-29 bases. Above, bulldozer pushes coral to waiting trucks. Below, Superfort soars from smooth coral runway
AAP photos



THE 804th Engineer Aviation Battalion was ready for its toughest assignment when the last bulldozer was shoved aboard an LST whose blunt prow was turned toward Saipan in the Jap-held Marianas Islands. Even the outfit's tough preparatory hurdles at Canton Island, Christmas Island, Baker, Makin and the Hawaiian Islands—tests of construction skill and combat courage—were sophomore stuff compared with what faced the aviation engineers on Saipan.

Saipan, the plans said, was to be the first island in the Pacific from which the thundering fleets of B-29 Superfortresses could smash at the heart of Japan. More than

that, it was to be the first attempt at building, under enemy fire, a first class airdrome capable of handling the largest bombers of the Army Air Forces. And this future nest of the Superforts was, at the time, May 27, 1944, still one of the virtually impregnable bastions of the Jap inner circle of island defenses.

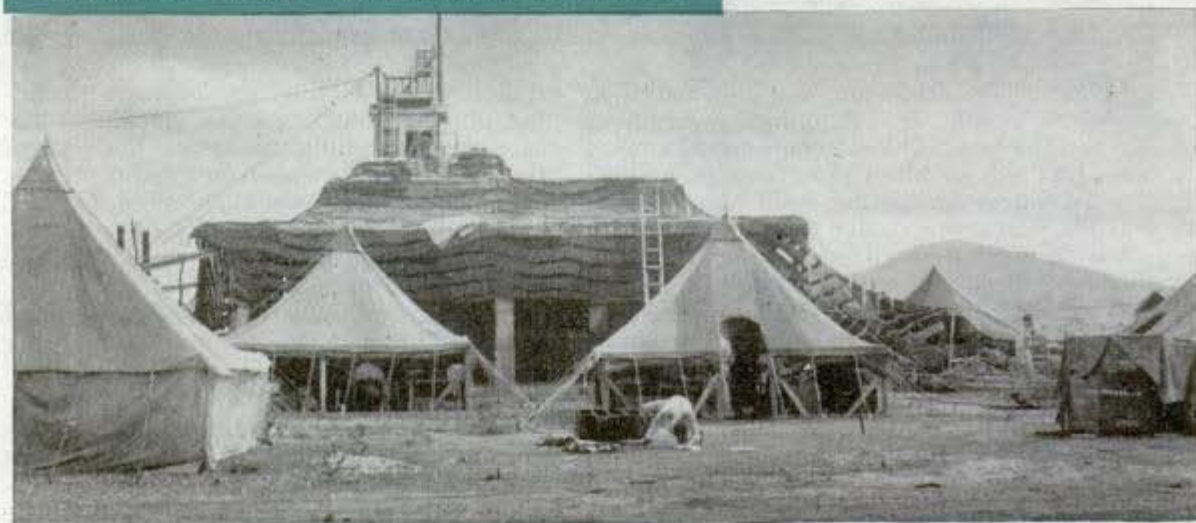
The three weeks previous to sailing had been solid drudgery and muscle-cramping fatigue 24 hours around the clock until all equipment had been overhauled and readied for action. All the motors were water-proofed with compound; exhaust pipes were raised above the cabs to insure operation of the tractors, bulldozers and all the



There's plenty of room for the tail gunner on the Boeing B-29. He cleans his own windows so no Tojos can sneak up unseen



Destination Formosa! Above are 500-pound demolition bombs which B-29 will carry to advanced base for raid on Formosa. Below, quarters of fighter group on Isley Airfield, Saipan



other aviation engineer paraphernalia even if it became totally submerged in the last wild dash for the beaches of Saipan.

Then came loading orders. Equipment and vehicles were measured to the tenth of a foot, and a diagram was prepared whereby every square inch of shipping space was utilized. In addition to all the battalion's rolling stock, 200 tons of pierced plank landing mat was carried, and one tank complete with connecting lines, fittings and dispensing units was stowed away for immediate fueling needs after the landing. Every item and every engineer was aboard after 72 hours of continuous back-breaking labor.

The voyage to Saipan was uneventful, but as the convoy swung in toward land on June 16—D-day plus one—a heavy barrage was laid down on the LSTs by Jap 120-mm. coastal guns. The convoy moved out of range before being bracketed, however, and anchored that afternoon off the coast of Charan-Kanoa. During the evening the battalion received a second reception in the form of a bombing and strafing attack by Jap aircraft which lasted two hours. Aslito airfield, the ultimate destination, still was in Jap hands, so the convoy weighed anchor and orbited in the vicinity of Saipan until June 20, when the airfield fell



Superfortress gets its first engine change at 20th Air Force headquarters on Saipan Island

to American troops. Then the aviation engineers swung into action.

A survey and reconnaissance party was sent to the field to map the area and locate sites for two parallel 8,500-foot airstrips. The remainder of the battalion began unloading across a wide coral reef and up a steep coastal bluff. In making a road across the coral reef, which surrounded the island, coral heads had to be dozed down and in some cases blasted to permit the passage of the heavy equipment and vehicles. A road was cut through the 40-foot high bluff at the landing point, which required the blasting and moving of several thousand yards of rock. The path in had to be carefully reconnoitered as the floor was pock-marked with depressions and shell holes, and at high tide the water was over a man's head.

On D plus six a platoon of men and one grader arrived at Aslito Airfield and began shaping up the badly battered Jap runway and taxiways, clearing shrapnel and filling shell holes. A captured Jap roller was repaired and pressed into operation compacting filled shell holes. The remainder of the battalion arrived the following day with more equipment. The aviation engineers immediately dug in and began laying the pierced plank as an extension to the existing 3,700-foot Jap runway. Eight hundred

feet of plank, 150 feet wide, were placed and in operation on D plus 10. This included clearing an additional 400 feet and the construction of two 75-foot shoulders.

On D plus nine the survey section completed a topographic map of the area and had established lines and grades for the first runway which was to be 8,500 feet long by 500 feet wide. Work on this project began immediately. Simultaneously, a platoon from Company "A" began erecting a "tank farm" which was in operation on D plus 12. A platoon from Company "C" erected one tank to act as a drain and storage bin for a Japanese aviation gas system



Saipan "traffic cop" controls more than 100 ten-wheel trucks on coral run. One truck passes him every 20 seconds, day and night



Ground crew on Saipan watches a B-29 take off for Tokyo from 8,500-foot coral runway built in 117 days

found intact near the runway. This system had a capacity of 45,000 gallons and was used to fuel the fighter planes then on the field. A platoon from Company "B" began laying a pipe line and pumping system from the ocean to the airfield as a source of water for compaction of the runway. All material for this project, pipe, wire, generator and Diesel engine, was salvaged from Japanese installations captured on the island.

The gasoline tanks had been prefabricated, but had to be bolted into place, with the lower sections partially underground. The fuel was to be piped in from tankers offshore and distributed to the various tanks of the "farm," which covered several acres. This dispersion of tanks was necessary, for if one were hit by a Jap bomb, it could be cut off from the others without losing the entire fuel supply.

The runways were to be 30 inches thick—strong enough to withstand the constant crushing jolts of airplanes that weighed more than 100,000 pounds. They were to have a crushed coral base, with a three-inch layer of asphalt-concrete mix on top, much like an ordinary black-top highway.

On D plus 12 work was temporarily halted, as the Japs, who had been cut off on Nafutan Point, broke through the infantry lines and made one of their notorious charges, equipped with everything from hand axes to automatic weapons. The battalion took up battle stations with Headquarters and Service Company in bivouac area defense, while the lettered companies swept the adjacent fields and hills free of Jap snipers.

One of the aviation engineers and several score of the enemy were killed in this operation. As soon as the area was "deloused," the battalion continued construction on its various projects.

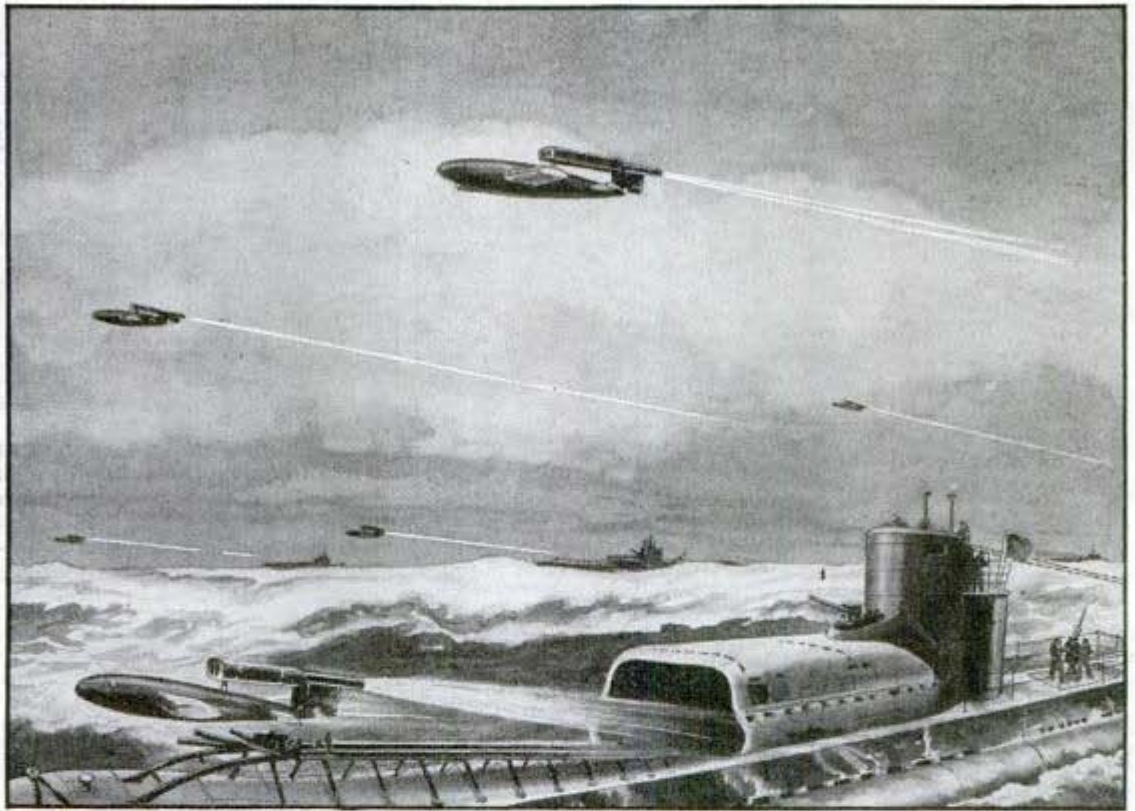
Once the location for the airfield was staked out, nothing remained for the battalion but a lot of hard work. That was the story, day in and day out, week after week. Coral pits and borrow pits were opened and used up, and new ones were started to furnish materials for the heavy fills. Earthmoving equipment labored, broke down, and was repaired

(Continued to page 158)



Trucks are lined up to move a mountain of crushed white coral to surface runway on Saipan

Ramp on Sub Deck Could Launch Robot Attack



From Drawing by Montague Black

Engineers have conceived how undersea boats could be altered to launch flying bombs from a ramp on the deck. Coming in close to shore, they could carry two or

four bombs, launch them quickly after surfacing, and then dive immediately. A smaller bomb than the 4,000-pound V-1 probably would be used.

Swivel Stool With Touch Control Adjusts to Any Position

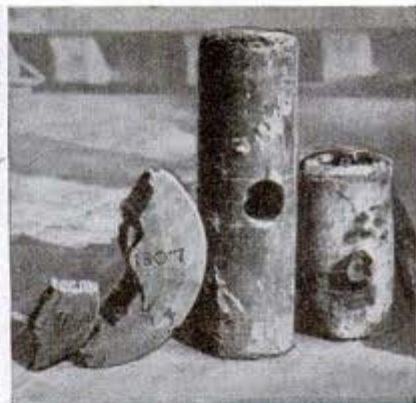
Excessive fatigue at the work bench, machine and assembly line can be minimized by using a streamlined swivel stool that is fully adjustable in any direction. The seat is controlled by a ring underneath. Without getting up, the worker can place his hand on the "wheel" and change the tilt or height of the seat by pressing the ring upward with the fingertips.

Color Code to Brand Hazards Proposed for Plant Safety

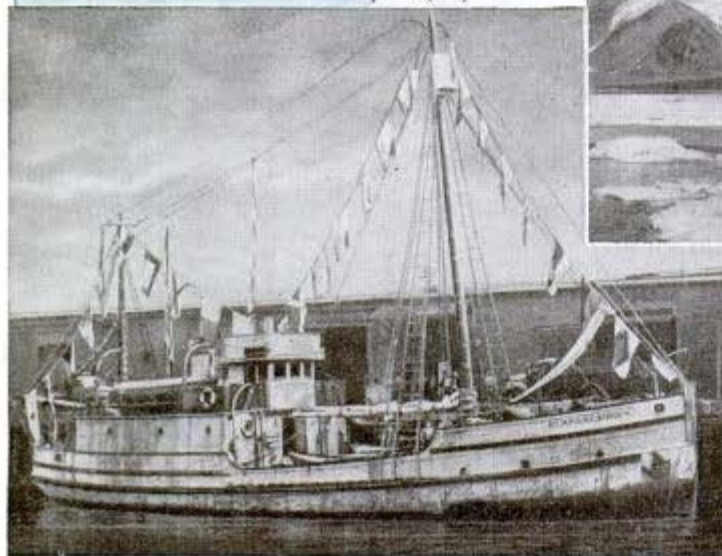
Workers moving from one plant to another would not be confused by lack of uniformity in colored warnings for physical hazards if the safety color code of the American Standards Association were adopted. The code designates red for fire protection equipment, danger signs and stop buttons; yellow for caution and physical hazards; green for safety, first-aid kits and starting buttons, and black, white or a combination of the two for housekeeping, sanitation and traffic markings.



86-Day Trip Opens Up the Northwest Passage



Crew of schooner *St. Roch*, left, at Vancouver after 86-day trip through Northwest Passage. Skipper Larsen at extreme left. Above, broken pulleys and mallet heads, relics of earlier tragic trips, found during voyage



Map shows route of 80-ton schooner, first to make voyage in one season through Northwest Passage. At left is the ship, Royal Canadian Mounted Police vessel especially built for bucking ice floes, such as the ones pictured above, which she met off a Canadian Arctic Island. The trip of the *St. Roch* proves that route through Passage is suitable for use in summer, Larsen declares

OPEN for business from July to October. Tourists invited. The Northwest Passage."

Don't be surprised if some day such a notice appears in the travel advertisements. Hendrik Hudson and countless other explorers were right after all. The Northwest Passage has at last been put to use after more than four centuries of heartbreak and disappointment.

Leading the way is the Royal Canadian Mounted Police schooner St. Roch, first vessel to travel the route in one season. The 80-ton St. Roch crossed the top of North America, from Sydney, N. S., to Vancouver, B. C., in 86 days. Along the way she picked up relics of earlier ill-fated expeditions, including British foodstuffs nearly 100 years old.

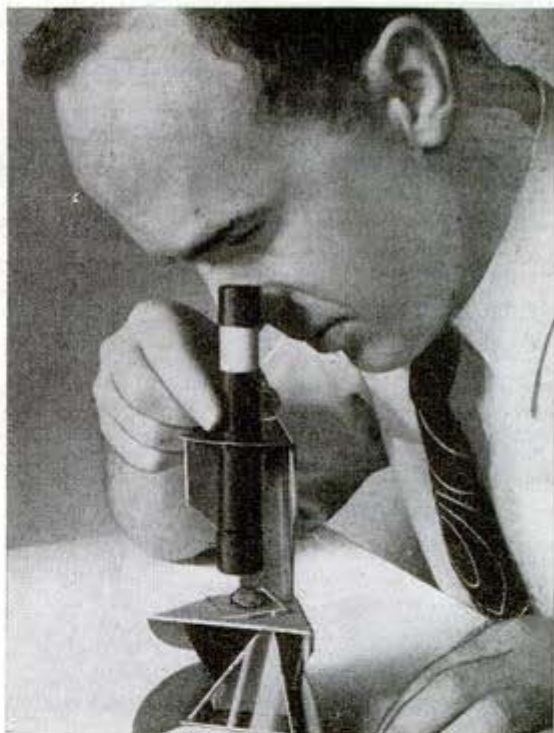
"The route through the Northwest Passage is suitable for summer traffic by wooden vessels," declares Sub-Inspector Henry Larsen, skipper of the St. Roch. Such traffic is expected to open up new fur posts, with small wooden schooners patterned after the St. Roch servicing the Eskimo hunters. The Diesel-powered St. Roch was built to buck ice floes. She is timbered two-thirds more heavily than normal. Timber is sheathed with copper and over the copper is a layer of Australian iron bark, best wood to withstand the grind of northern ice.

The St. Roch carried fuel and food to last three years, should she be caught by ice. Northward from Sydney, she skirted Labrador under the watchful eyes of the Royal Canadian Air Force coastal patrol. At Baffin Island she stopped to take aboard Eskimos and dogs to help in case of a forced winter stopover. Past Baffin Island, the schooner turned west into Lancaster Sound and traveled ice-packed waters into Barrow Strait. Swinging southward between Banks and Victoria Islands, the St. Roch entered Amundsen Gulf and left the Eskimos on the Arctic mainland.

Lookouts guided the schooner through the ice pack skirting the coast of Alaska into Bering Strait, thence to Vancouver, which the St. Roch reached in October.

Not only is the ship the first to travel the Passage in one season, but she also is the first to make the trip both ways. She left Vancouver for Halifax in 1940, but spent two winters locked in the ice and the voyage took 28 months. Norwegian explorer Roald Amundsen made the first trip through the Passage, sailing west in his ship Gjoa in 1903. It took him three years.

Toy Microscope of Cardboard Can Be Operated by Child



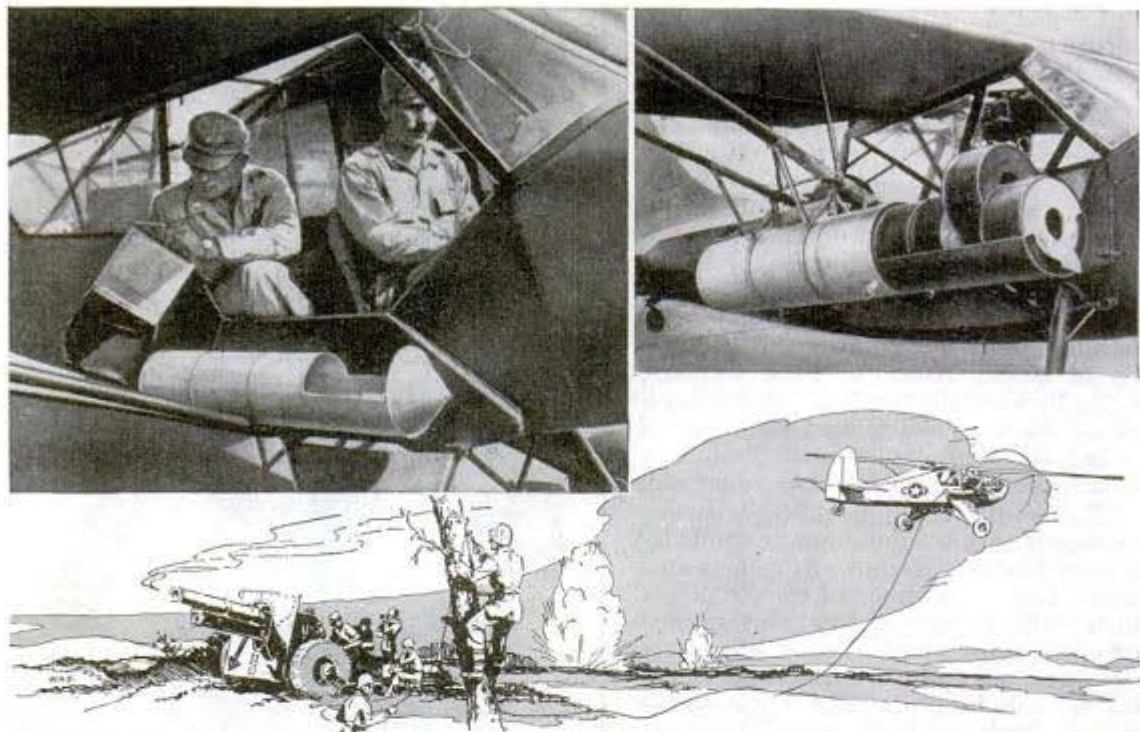
Equipped with a glass slide and a reflector at its base, a cardboard microscope can be easily operated by a child. A sliding adjustment aids focusing the lens on objects such as plant life, bugs and fingerprints.

"Alphabet Sticks" for Decoding Unscramble Message in Jiffy

Code messages are quickly read with a sliding scale arrangement devised by the FBI. The scale has rows of lettered "alphabet sticks" that slide. Letters of the coded message are arranged horizontally across the top and the proper words are obtained by reading across the alphabet sticks.



"Flying Jeeps" Skim Obstacles in Laying Wires



Equipment used in laying wire by plane, above. Flyer at left holds phone unit which is attached to end of wire and dropped by parachute. Wire unreels from the cylinder attached to struts. Reels in place at right

Difficulties met in laying telephone wire across hills, valleys and streams for quick battle communications are being brushed aside by the use of light "grasshopper" planes as wire layers. Wire is wound carefully in binder twine fashion, so it will pay out from the center of the reel without tangling or binding, and with little friction. Reels are placed in a cylindrical container 40 inches long and eight inches in diameter, fastened to the wing struts of the plane. A cylinder will hold four reels spliced together to make $1\frac{1}{2}$ miles of wire and extra rolls permit laying three to five miles of wire in a flight. Skimming the ground at 200 to 250 feet, the plane flies over a desired terminal of the line and drops a parachute bearing a telephone unit, to which the leading end of the wire is fastened. The wire then unreels as the plane proceeds at 65 to 70 miles an hour. Both ends of the wire are marked with bright colors so they may be located easily. Experience shows the line is best laid from forward positions to the rear. Patrols cut off from communications may be swiftly reached by this method.

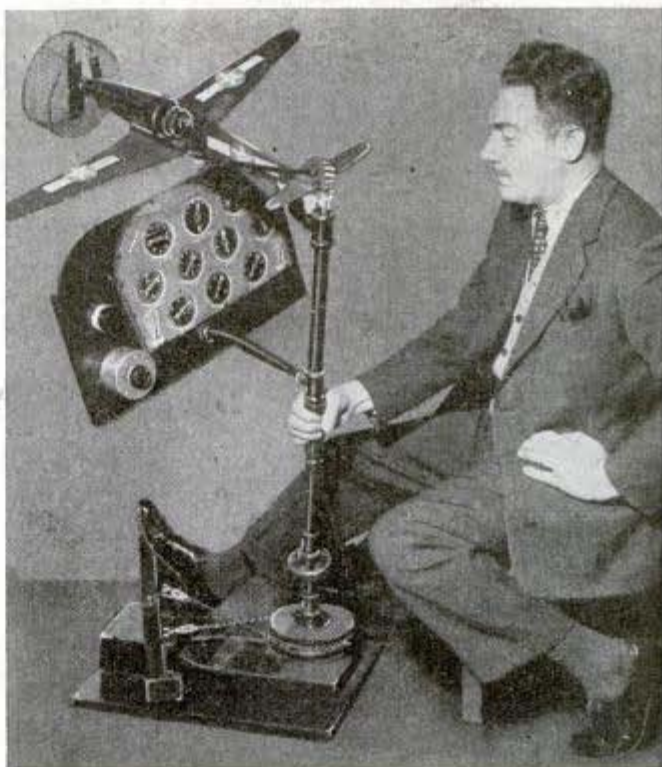
Another system of wire-laying by plane employs a regulation spool fitted to a reel which is attached to lift struts of the light craft. The Army has been using as much as 235,000 miles of wire a month for communications, despite the diversified role played by radio in the war. Frequently it is found advisable to use telephone communications systems in operations where radio might disclose positions to the enemy.



It's not all done with wings, this wire party in New Georgian jungle testifies

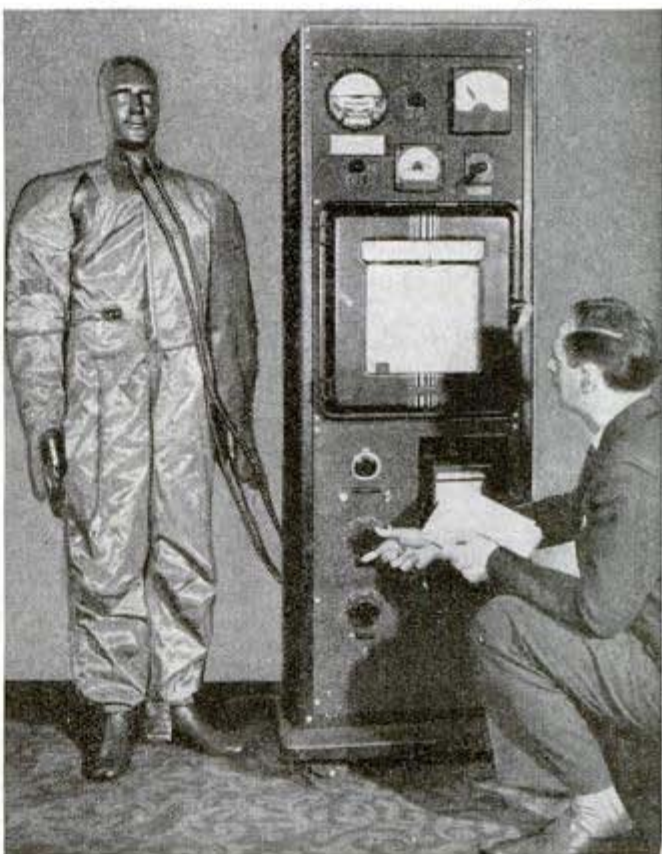
Preflight Trainer Can Be Built at Home for \$10

Plans are available for building at home a preflight "trainer," designed by a New York high school teacher, from simple plumbing and hardware parts, an old automobile universal joint, a toy motor, wood, wire and other easily accessible material. The student sits on a stool in back of a stick to which is attached a model plane, while his feet control a rudder bar attached to the base of the stick by a chain. The ailerons, tail and elevators move automatically with the movement of stick and rudder, just as in a real plane. Directly in front of the stool, also attached to the stick, is a plastic instrument panel board with photographically accurate dial surfaces. The movable needle dial arrows on the face of each instrument can be regulated to simulate any flight change. The inventor, in offering his plans, claims the trainer can be built for about \$10, which includes the cost of the panel board. He says it is successful as a shop project.

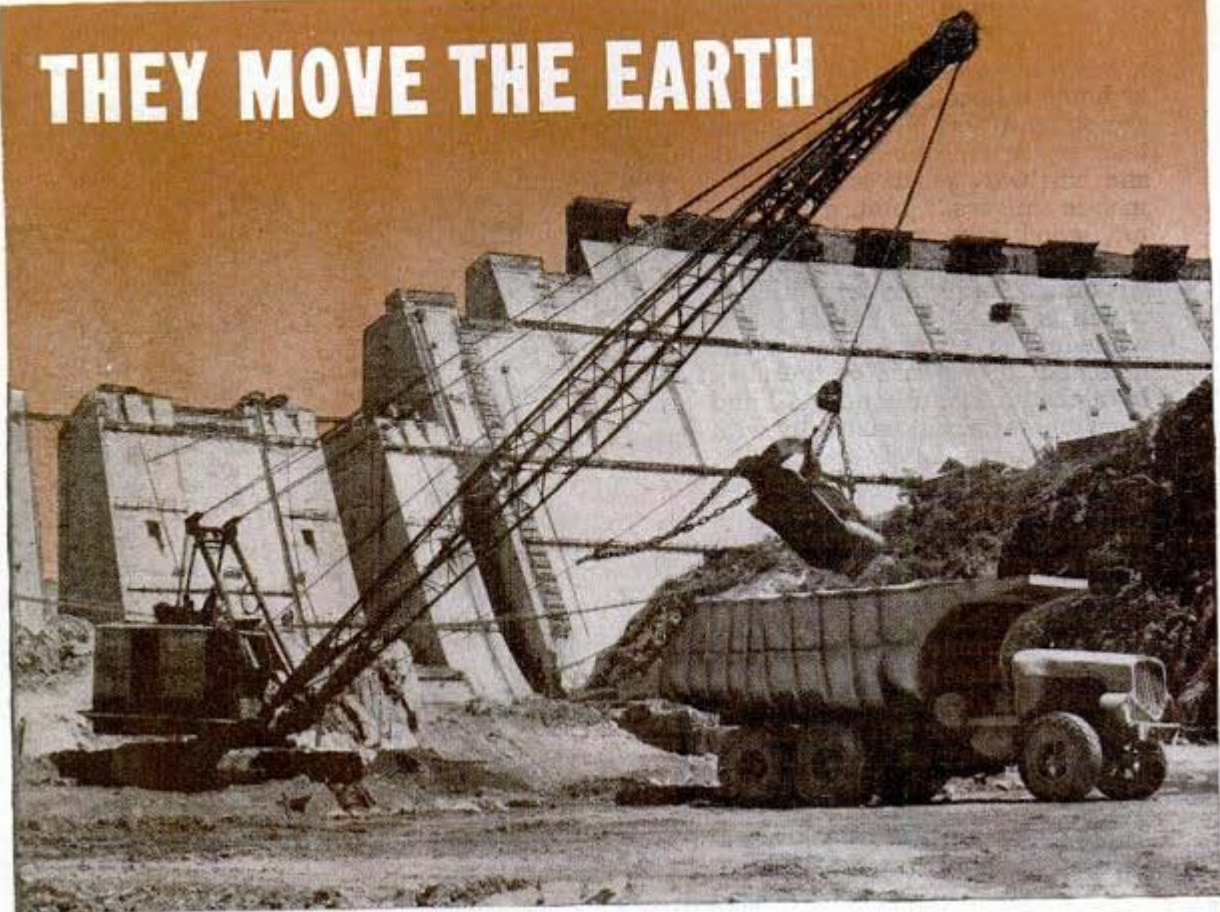


Copper Man "Suffers" for Flyers in Warm Clothing Tests

Discomfort ordinarily heaped on volunteer human "guinea pigs" now is endured stoically by General Electric's life-size Copper Man. This scientifically rigged dummy, who represents the average dimensions of American flyers, is 5 feet 10½ inches tall and has a copper "skin" one-sixteenth inch thick. By means of electric wires connecting head, torso, hands and feet, he can be made to reproduce the human temperature system. Clothed in electrically warmed suits and blankets of varying thicknesses designed for possible use by airmen in below-zero cold, his reactions are recorded on a machine to which he is attached. Testers can vary his body temperature at will in order to examine clothing under almost any given condition. In addition, he is not subject to injury, frostbite or respiratory difficulties incurred by men, whose reactions are sometimes modified by eating or sleeping just before the tests. The Copper Man has a "brother" working at the Wright Field, O., Aero-Medical Laboratory.



THEY MOVE THE EARTH



"There'll be some changes made," hum busy earthmovers. Above, gouging out the earth at Shasta Dam. Below, sign tells a power shovel's story



ONE NIGHT late last summer the residents of a village in southwestern England were terrified by a curtain of fire half a mile long moving in their direction. At first they thought it was a new and horrible weapon introduced by Hitler in the wake of his buzzbombs.

Actually, an enemy air raider had dropped a bomb on a hidden gasoline dump containing thousands of gallons. A flaming torrent rushed from the dump at the rate of a thousand feet a minute, rolled down a hill and into a stream that led directly into the village.

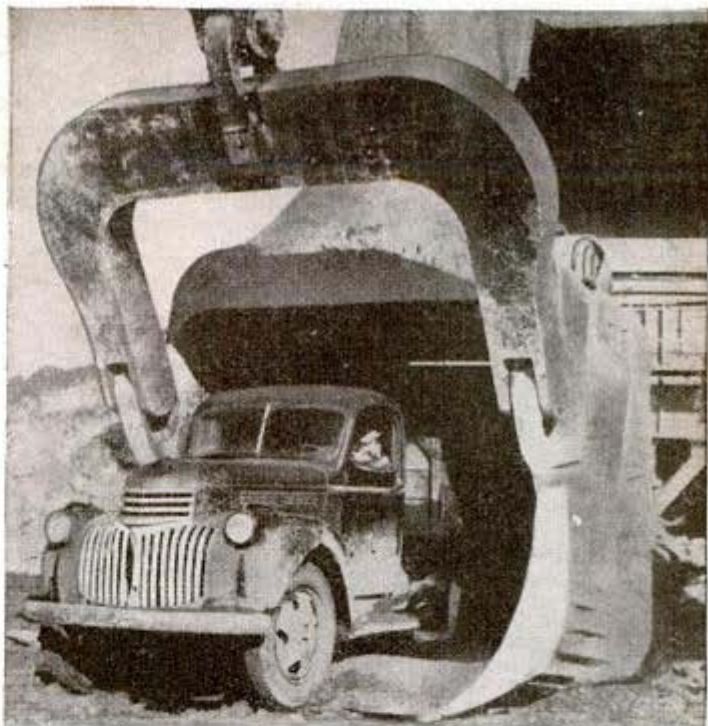
While the villagers prepared to flee and firemen were turned back by the intense heat of the flaming stream, a modern Lochinvar riding a dirt-tossing steel steed came to the rescue. The Yank

driver of an American bulldozer saved the village by pushing enough earth into the stream to dam the channel until the fire burned out.

When a slow-moving bulldozer, or any other nonspectacular piece of earthmoving machinery, makes the headlines these days, it is like a turtle carrying off the blue ribbon at a greyhound exhibition. However, in both war and peace, the big machines that shove the earth around have a tremendous effect upon man's welfare.

Every year millions of cubic feet of earth, gravel and rock are moved by the machines that range from giant bulldozers and thousand-ton electric shovels to the smallest scraper or drag line.

They scoop out dirt for the foundations of homes and fac-

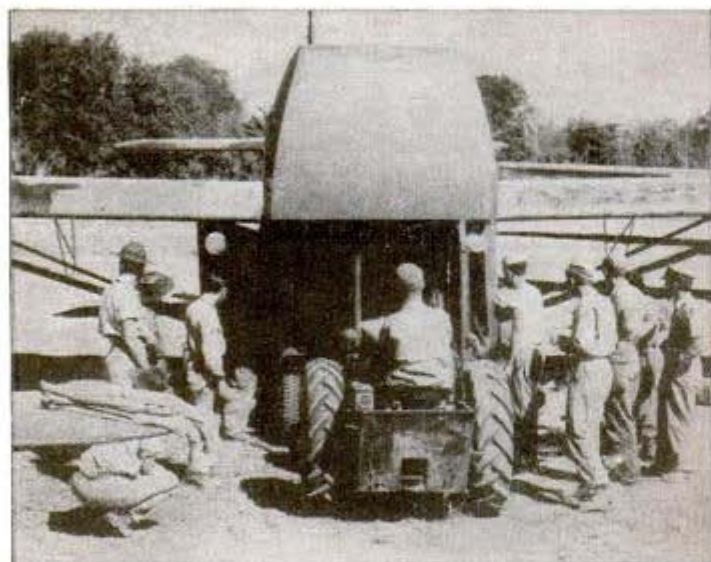


Above, largest power shovel takes 52½ tons in a mammoth bite. Below, trailbuilder helps rebuild Nazi-wrecked bridge in day
Signal Corps photo





When airport building boomed after landings in North Africa, the bulldozers found plenty to do. Above, "Cat" throws up a revetment



AAP photo
Above, loading a tractor aboard a glider for Air Commando Force operations in Burma. Below, "Cat" with scraper widens banks for rebalasting along Duluth branch line of Great Northern Railroad



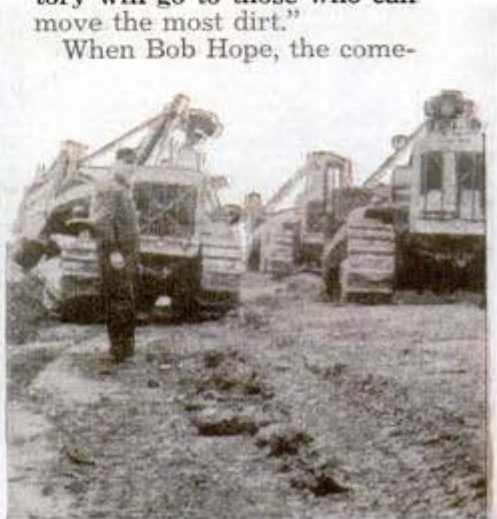
ories. They build the great earthfill dams and levees, the roads and landing fields. They dredge channels to make shallow streams navigable, and heap up earth to guard against erosion. They remove topsoil and rock for the strip-mining of coal, dig ditches for the laying of oil pipe line, and help build railroads. They perform miracles on beachheads so troops and supplies can be landed, and clear paths for advancing infantry and mechanized weapons.

Earthmoving machines even engage in active combat. During the assault on Treasury Island in the Solomons, a bulldozer pushed over an enemy pillbox, burying 12 Japs and destroying two machine guns and a 90-mm. gun.

The war has dramatized the use of earthmoving machinery as never before. The German and Japanese armies have concentrated on the development of guns, tanks and planes. The British concentrated on weapons. The United States Army, while not neglecting the primary tools of warfare, was the first to adopt heavy construction equipment as standard military issue. All the others followed suit.

This equipment is often responsible for the rapid advance of an army on land and in the air. Shortly before the invasion of Normandy, an American general said: "Victory will go to those who can move the most dirt."

When Bob Hope, the come-



dian, returned from a tour of battle fronts he expressed amazement at the amount of "farm machinery" he saw there. This "farm machinery" consisted of earthmovers. The most versatile of these is the bulldozer with its many variations.

To a construction engineer, a bulldozer is a steel scraper attached to a crawler-type tractor. The "dozer" family includes the beachdozer (with armored cab for operation under fire), angledozer, treedozer and, newest of all, the tankdozer. The latter, a bulldozer blade mounted on the front of a General Sherman tank, was used to break through the hedgerows in Normandy. The blade is



U. S. Navy photo

Above, unloading a tractor at Pago Pago for use of navy detachment. Below, General Sherman tank in France sports a new type pusher blade



hydraulically operated and can be jettisoned in about 10 seconds to free the tank for fighting.

One revolutionary development, which may have far-reaching effects on postwar construction projects in remote places, was the adaptation of earthmoving equipment to air transport. Airborne engineers demanded the impossible and got it—construction equipment that could be moved by air in one piece. When you land behind enemy lines, as our airborne troops did in Burma, Normandy, Holland and other places,

Tractor "train" moves the earth in laying groundwork for 170-mile arsenal railway





Ditch-digging, too. Preliminary to deepening ditch, this Austin-Western moves windrow from shoulder line

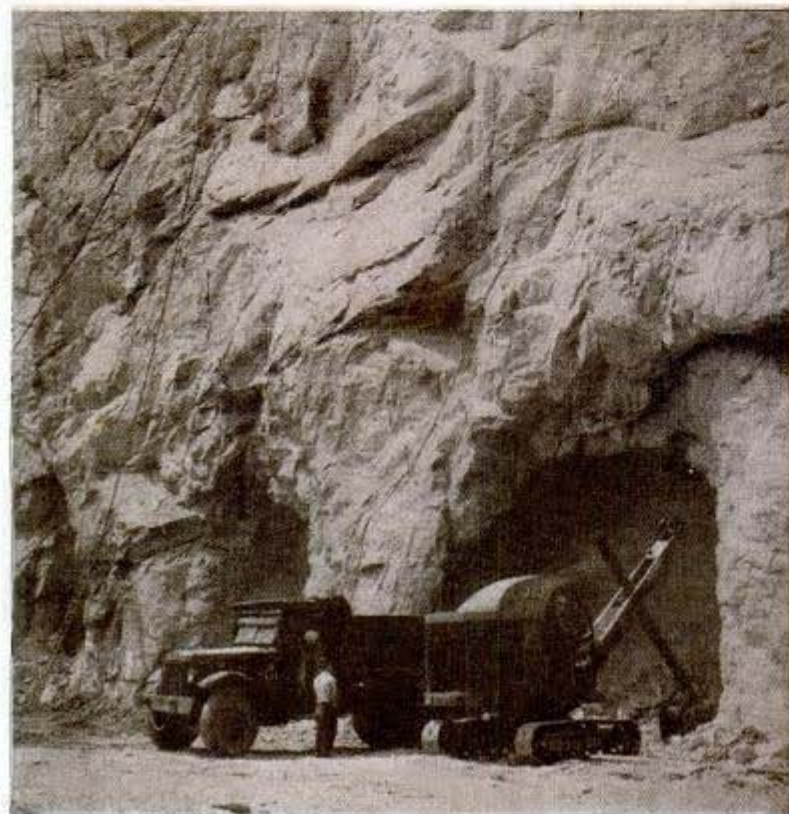
there is no time to set up an assembly shop. So they can be reinforced, the troops must build landing strips in a hurry.

The special machines, each deserving a distinguished flying medal of some kind, include a 20-horsepower crawler tractor, 23-horsepower rubber-tired tractor, 1½-

yard scraper, ½-ton two-wheel dump tractor, 1-ton cargo trailer, small smooth roller to which lugs may be added to make it a sheepsfoot, midget grader pulled by a jeep, ½-ton truck, trailer-mounted asphalt kettle, towed roofer, soil-stabilization mixer, tractor-drawn mower (for cutting head-high jungle grass), and a ½-kilowatt electric power plant.

The earthmoving and grading machinery assigned to each airborne battalion includes nine ½-yard carrying scrapers, 17 half-ton dump trailers, 19 23-horsepower bulldozers, two ½-yard shovels, and seven 6½-foot towed graders.

Sometimes, as in the glider operations of Col. Philip Cochran's Air Commando Forces in Burma, only a fraction of this equipment can be carried. When Col. Cochran's men took off for central Burma they carried only four tractors, one grader, two scrapers and a jeep. One tractor and a scraper were lost in glider crashes, but with the remaining equip-



Power shovel digs out rock for tunnel to Grand Coulee Dam

ment the men were able to construct a transport plane landing strip in less than 24 hours.

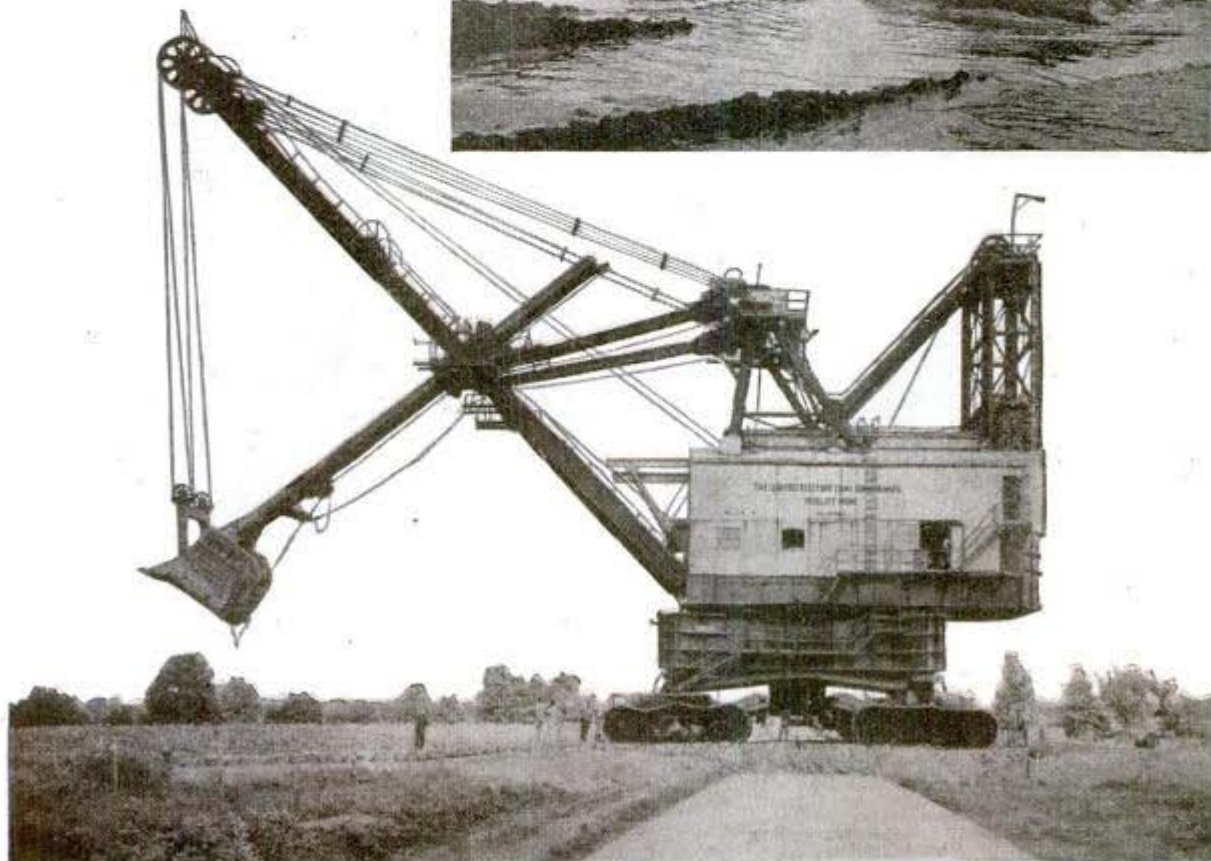
The Navy, too, is performing sensational feats with earthmoving machines, not only in the routine construction of amphibious bases, but in the building of airstrips, roads, and the occasional "stretching" of an island. When an LST (Landing Ship, Tanks, which gobs have nicknamed "Last Slow Target") was grounded 60 feet off shore at an advanced base in the Pacific, the Seabees "stretched" the island to reach the craft. They built a causeway of coral sand and quickly unloaded 40 tons of materiel, 2,800 drums of gasoline and other valuable cargo.

The Seabees have built scores of coral landing strips from Guadalcanal

Below, a 1,400-ton coal stripper moves along a corduroy road



Yoke of giant earthmover, above, frames land levelers busy in Iceland. Below, bulldozers scrape Alaskan inlet to obtain sand fill for runway





Bucyrus-Erie Co. photo

Above, two-wheel scraper dumps backward, thus letting tractor remain on solid ground. Right, tractor hauls cable-laying roofer. Below, power shovel loads carryall at fill stockpile on Boise project. Conveyor belt runs up hillside



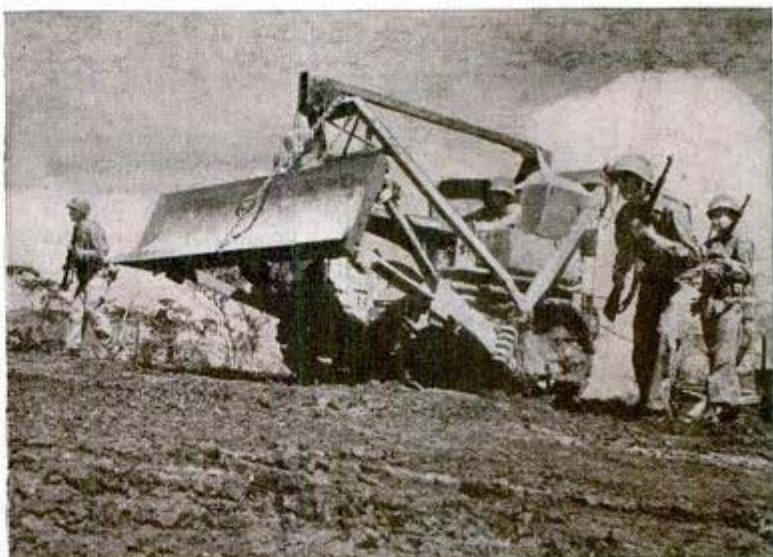
to Saipan. Some strips are made of living coral dredged from the sea with power shovels, carryalls and drag lines. Living coral, which must be doused frequently with salt water to keep it alive, has great cohesive qualities and forms an excellent hard-topped runway.

One of the most difficult and least known of the Seabees' earthmoving projects was the construction of Maracas Road through the mountainous jungles of Trinidad. This seven-and-a-half-mile road literally was cut out of the sides of mountains at perilous heights with bulldozers, shovels and dynamite. Hampered by landslides (19 in one day) and tor-

rential rains, the troops worked night and day to complete the road in seven months. Some 1,150,000 cubic yards of rock, out of an excavation total of 1,320,000 cubic yards, were moved during the construction. There is no fill along the entire length of the road.

Formerly, the only access to the Maracas Bay area was by water. The bulldozers and shovels had to be brought in by barge, and before the first bulldozer could be landed the Seabees had to build a ramp of sand by hand. Weary Seabees almost kissed the first bulldozer to lumber ashore. The bulldozers widened a six-foot right-of-way blasted through the mountains and made way for the shovels that sidecast the rock and earth. One bulldozer went over a cliff, but it was recovered and repaired in the two repair shops that worked around the clock.

Far less dramatic, but just as important, are earthmoving projects on the home



Armored bulldozer moves with bodyguard at Munda airfield in Solomons

front. Construction of the Anderson Ranch Dam on the Boise River in Idaho, halted by a War Production Board order in 1942, has been resumed.

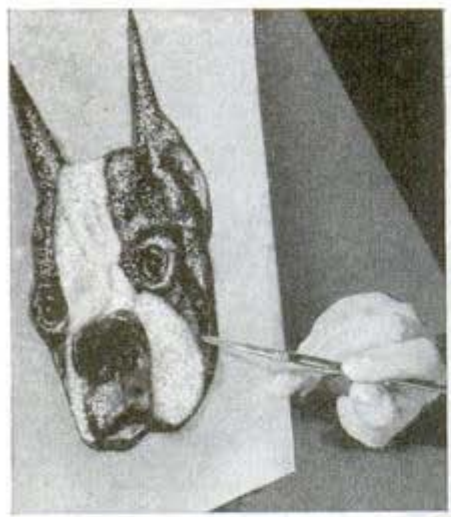
When this giant structure is completed in 1946 it will be the highest earthfill dam (465 feet) in the world. The dam will contain 8,800,000 cubic yards of earth and rock,

(Continued to page 150)

Seabees fight a winter war with tractors and graders grinding away at rocky soil to build Aleutian bases



Plastic Powder "Builds" Picture From Tracing



After outline of picture is made and coated with adhesive, artist applies the plastic powder. Finished picture (left) is tinted with water colors



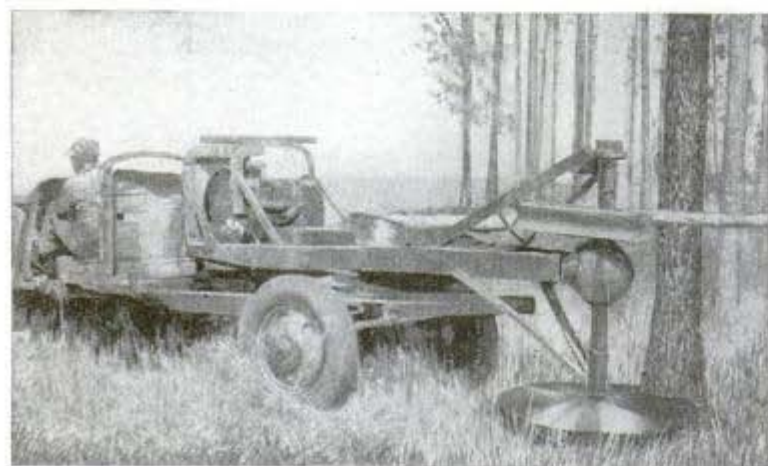
Homemade art is produced in the form of pictures in relief with a special plastic powder and adhesive base. The picture can be started from a tracing, free hand outline, newspaper picture or photographic print. After applying the adhesive base, the white powder is sifted on to build up the picture in third dimension. When the powder dries it can be tinted with water colors to produce pictures for framing, show cards or greeting cards. Designs can also be built up on cloth for neckties or tablecloths, according to Nick Nichols, Chicago cartoonist, who developed this form of "plastic art." Kits containing the powder, adhesive and full directions are available for the amateur or professional artist. No special training is required, and pleasing results can be obtained by the amateur.

Automatic Valve Seals Battery in Dogfight to Keep Acid From Spilling

Banking and flying upside down during aerial combat are less dangerous for American pilots because of the development of a valve vent which seals battery cells automatically when the plane is out of its normal position. Though it allows perfect

functioning of the battery, the valve closes to eliminate the danger of spilling corrosive acid, opening again the instant the plane returns to a position where the acid cannot escape. Accumulated gases are thus allowed to exhaust without loss of vital acid.

Saw Cuts Tree at Ground Level to Eliminate Costly Stump Removal



Provoked by the slow and costly process of stump removal, two Floridians built a homemade saw which cuts trees flush with the ground. It consists of a truck chassis with an engine and special framework mounted on the rear. A 36-inch saw is mounted horizontally so the blade can be swung against the trunk of a tree at ground level. The saw is lifted clear of the ground when moving from tree to tree.

AIR SCHOOL AT THE FRONT

By

Thomas A. Tobias

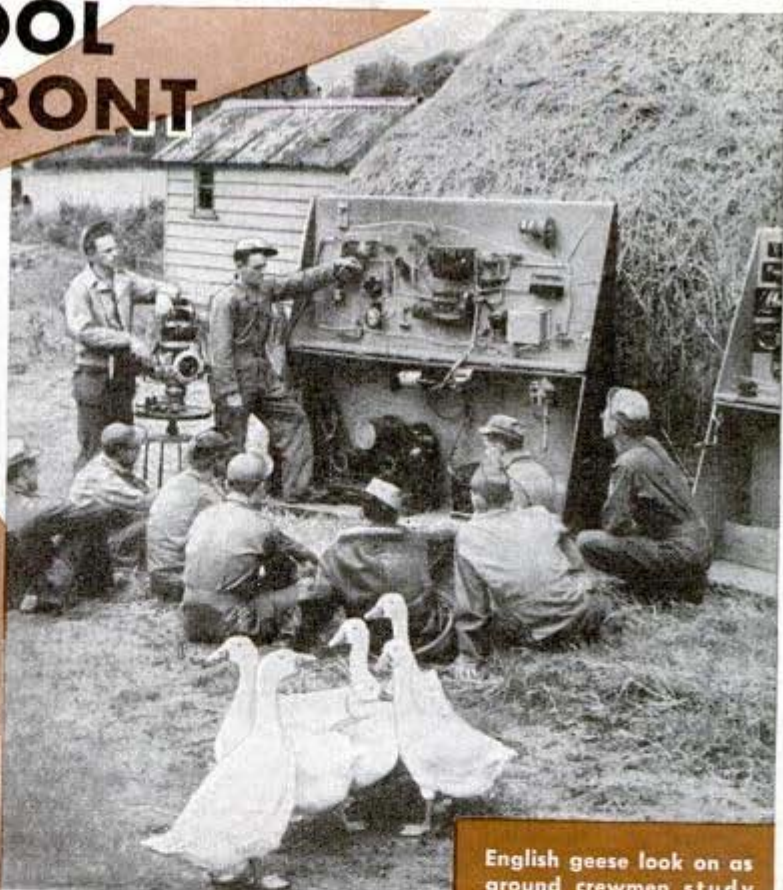
Major, Army Air Forces

TO COPE with the rapidly changing conditions of a global air war, American airplanes are constantly undergoing modifications and improvements. Designers and manufacturers no longer merely meet aircraft needs, but frequently anticipate technical and tactical requirements.

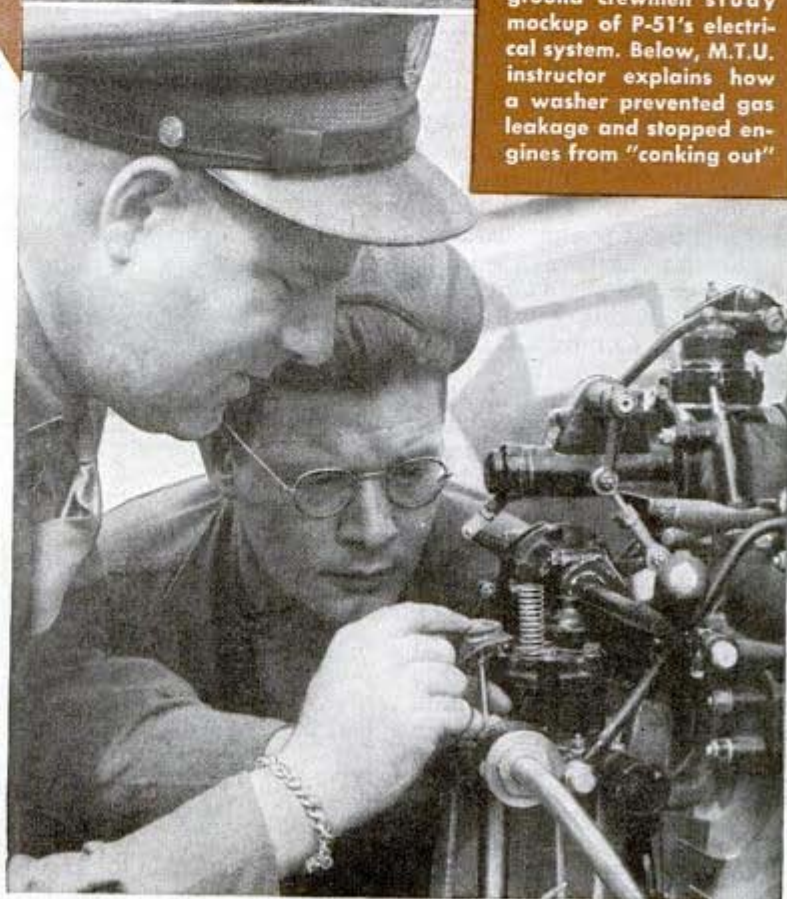
Such changes mean that pilots, air crews and maintenance men—who were experts when graduated by the Army Air Forces' Training Command and AAF schools—now are employing new, unfamiliar equipment.

Sending them back to the United States for technical or flying training on the new type aircraft usually is out of the question. It would mean grounding squadrons that must carry the fight to the enemy.

In peacetime, it was up to flying and ground personnel, as individuals, to familiarize themselves with new equipment as best they could. But early in 1942 the United States was engaged in a globe-girdling war, and the situation became alarming. The Army Air Forces were growing to fabulous proportions. A new type of fighter plane presented crucial operational and maintenance problems far from the factory. Plane improvements developed so speedily that they threatened to make back numbers of the most recent technical and flying school graduates.



English geese look on as ground crewmen study mockup of P-51's electrical system. Below, M.T.U. instructor explains how a washer prevented gas leakage and stopped engines from "conking out"





Unit hydraulics instructor uses mockup to explain the new emergency landing gear on Mustang to pilots

Why not take the classroom to the students for refresher courses? At a conference in Los Angeles with aircraft and engine manufacturers, a high-ranking Air Corps general came up with that suggestion. Lt. Col. Thomas E. O'Connell developed the idea and has built the program to its present importance at Brig. Gen. Albert L. Sneed's AAF Western Technical Training Command headquarters in Denver.

The first Mobile Training Unit, on an advanced fighter-type aircraft, moved into action July 2, 1942. The idea then was to review technical subjects for AAF men headed overseas, and to pass on to them newest maintenance and operational methods. After a few stops at fields in this country, the tremendous value of the training became apparent, and requests for the new service swamped M.T.U. headquarters.

Today, the big AAF Train-

ing Command project encircles the earth, holding classes in every theater of operations. More than 140 units are now in operation. The units travel in five-ton tractor-trailers or in cargo-type aircraft.



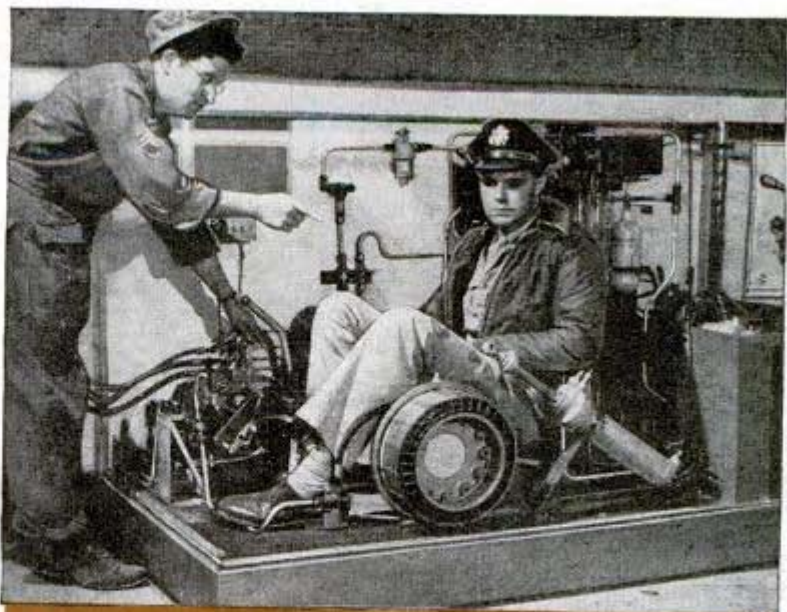
Mockup shows just how B-24 instruments work

Instructional aids are the most vivid conceivable. In addition to training films, charts, graphs and latest tech orders, the trailers carry mock-ups and cutaways of a plane's complete mechanism. They are actual working models, from which a student can see at a glance exactly what is taking place.

These working models include mockups of the following systems: Electrical, hydraulic, oxygen, instruments, fuel, oil, electronic turbo-supercharger control, coolant (on liquid cooled engines only), deicing, anti-icing, automatic pilot, armament, radio, bombsight, turret and propeller. Also included is a cutaway engine operated by a small electric motor.

The instructors, all enlisted men, are the brain trusters of the AAF's aircraft specialists. Hand-picked at M.T.U. headquarters and trained before they are sent on the road, they are qualified because of their ability to teach, their personality, military bearing, personal habits and, above all, because of their knowledge of their subjects.

Every few months, the instructors themselves



Pilot at English base is shown proper use of landing gear selector valve handle on an A-26 mockup. Below, Mobile Unit instructor explains operation of generator switches on electrical mockup of an A-26

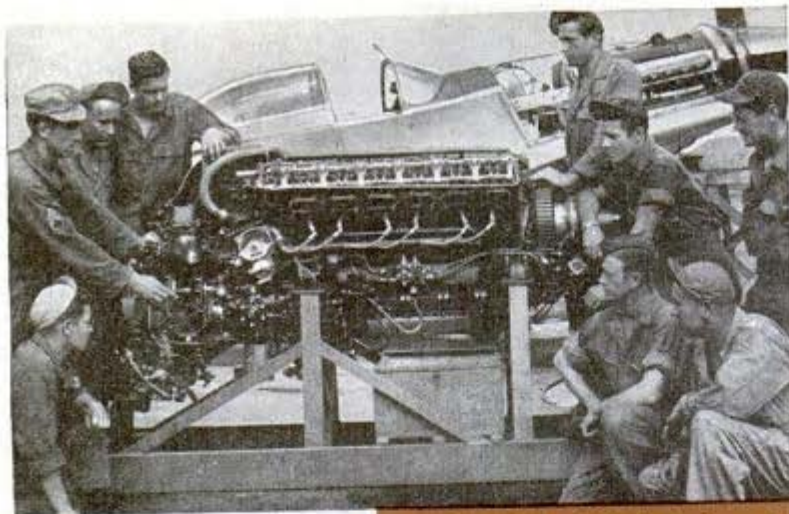


Below, in shadow of "Flak Alley Lil," crew chiefs get latest dope on servicing B-17 oxygen system



are sent to technical schools or factories for postgraduate courses and to obtain the latest information on important aircraft changes. There are seven to 12 instructors with each unit. Each operates as a separate military outfit with an officer in charge.

Units prefer to hold classes in a building that has been set aside for them, but often find that impossible because they now follow our advancing air forces so closely. The first unit to land in France, a



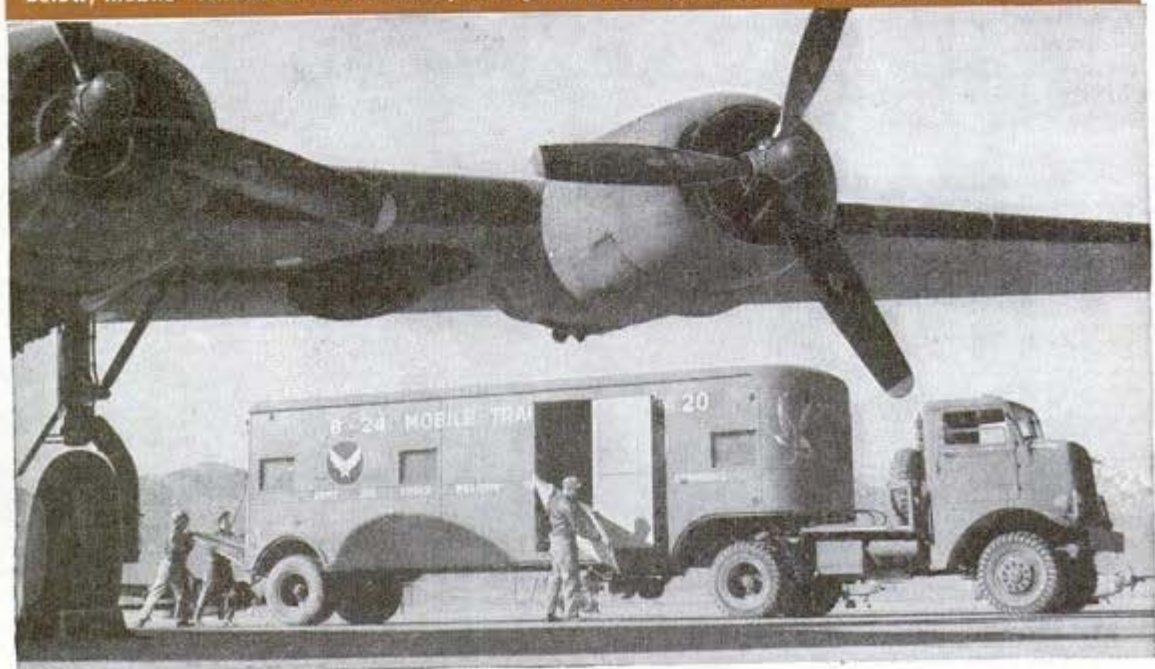
Mobile Training Unit instructor at airfield in England shows mechanics how to service a P-51 supercharger. Below, explaining action of distributor valve on A-26 propeller mockup

few weeks after the actual invasion, set up its school in a Normandy cow pasture, and the instructors had to sleep in foxholes. As the air forces moved forward, classes were held in bomb-battered barracks where tattered Nazi flags still decked the walls.

The weeks preceding D-Day saw large-scale conversions among fighter and bomber groups in Great Britain. There, many group commanders said, the M.T.U.'s hit the peak of usefulness.



Below, mobile "schoolroom" is driven up to flight line to explain latest improvements on B-24 to crew



A unit headed by Capt. Juel G. Droubay, for example, was assigned to three squadrons of pilots and maintenance men who were converting from the P-39 to the P-38. The unit had to teach all phases of the P-38. Classes were held from 8 a.m. until 10 p.m., seven days a week, for nearly a month. The group commander told the captain his men would have been "almost useless" in the coming invasion without the training.

M.T.U. has established itself as one of the armed forces' chief agencies for saving property and lives. Incidents such as the one related by Sgt. Harold J. Foss, a P-47 crew chief and instructor, are occurring daily overseas, M.T.U. case histories show. At a base in England recently, Foss heard about a series of crackup landings by fighter pilots who had returned from missions over Germany with bullet-riddled hydraulic systems. Many, though unscathed in battle,

were coming "home" to be injured on their landing strips because of flap and landing gear failures.

"When their flaps didn't work under the plane's power, the pilots had assumed that all their hydraulic fluid had drained away," Foss recalled. "They didn't know that on the new P-47 the hydraulic tank held a little fluid that has to be pumped out by hand. It's enough to work the flaps, but the system had been improved after the pilots left school. They didn't know about it."

Foss stressed the point in classes, and the long series of misfortunes came to an end. A few days later Lieut. Leroy Higginbotham, a P-47 pilot, approached Foss on the field. Although he had made an apparently normal landing, his face was bloodless and showed intense strain.

"I want to thank you, Sergeant," he said, a quiver in his voice. "On my last mission, my hydraulic system was shot to pieces. Your hand-pump trick has saved my life."

Ground crews have a similar affection for M.T.U. men—but in their case it's created by maintenance short cuts. Instructors deal extensively in timesaving procedures that take a lot of drudgery out of a ground crewman's life.

As long as there is a war in Europe, Warrant Officer Herbert G. Watson, assistant liaison officer on an A-20 unit, will be a hero to thousands of aircraft mechanics. He developed a method whereby the ignition harness on an A-20 can be changed without removing the engine, as had been standard practice. Ordinarily, four men required four days to change a harness. The Watson method requires only four hours for two men to do the job. The man-hours saved to date cannot be estimated, but in the French campaign two out of every 60 bombers returning from a mission had shot-damaged harness that had to be replaced.

A third M.T.U. specialty is trouble shooting. It's fun for the inquisitive minds of the instructors. At a British base not long ago, Pvt. Gerald S. Horwitz, an instruments instructor, heard pilots complain about fuel gauges giving false readings. They were sure inferior gauges caused the trouble, but Horwitz found it in the rubber fuel

Rescue Truck for Land or Water Hauls Wounded on Trailer



Equipped with a trailer for carrying litters of wounded, an experimental model of an all-steel 7-passenger amphibious rescue truck has been developed by the Crosley Corporation. The vehicle, which looks like a wheeled rowboat, has tracks for land and a propeller for water. Powered with a four-cylinder, 45-horsepower gasoline motor, the craft is propelled by the rear two wheels. It was designed especially for use in swampland.

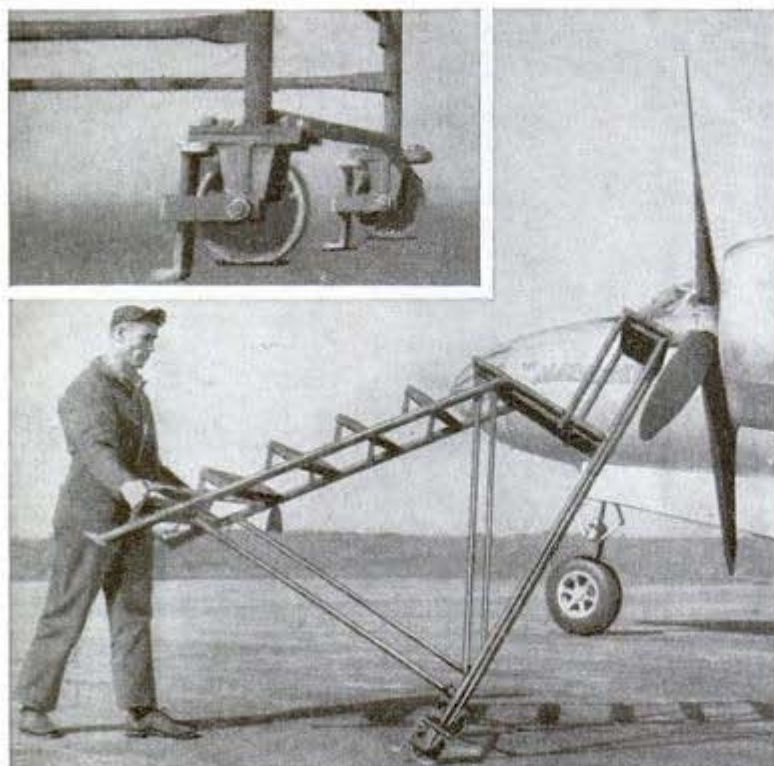
tanks. Broken wooden struts were pressing against the sides of the tanks, holding the floats in one position regardless of the amount of fuel.

At another base in England, an M.T.U. outfit found an operational bottleneck—the fighter unit couldn't get immediate replacements of gyro air filters. An M.T.U. handy man rigged up a spray gun, filled it with 100-octane gasoline and cleaned discarded filters. It worked.

There are always "bugs" in a new plane; M.T.U.'s are deadly exterminators.

(Continued to page 148)

Jacked-Up Mobile Stepladder Avoids Creeping



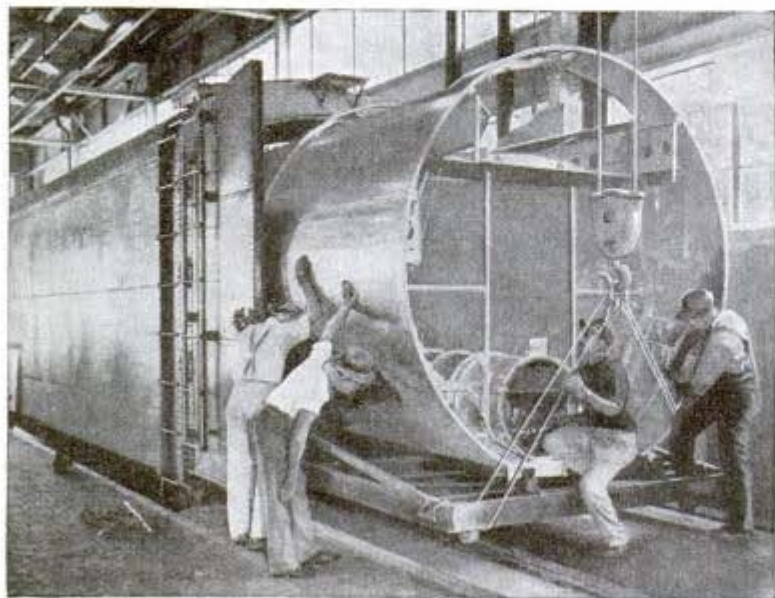
Metal brackets which "jack up" mobile stepladder platforms while they are upright safeguard ground crews against the "creeping ladder" hazard. The conventional ladder, with wheels on the two back legs to permit easy movement, is provided with two brackets rigidly attached to the back legs just in back of the wheels and extending lower than the wheels. Thus the wheels are lifted off the ground when the ladder is in working position, preventing it from rolling; yet when the front of the ladder is picked up, it rolls back on the wheels and is as easily moved as the older types. Hand-operated spring stops previously used were not always positive and were sometimes forgotten.

Electronic Guide Speeds Cutters That Shape Huge Plane Propellers

With the aid of an "electronic brain," giant propellers can be machined 700 per cent faster than ever before. A "tracer" automatically guides two sharp cutting tools over the surfaces of the propeller model to be cut and in two days completes the job that used to require two weeks.

Prior to this time milling machines shaved the flat sides but the convex sides had to be ground and chipped by hand. The propeller cutter now cuts both sides of a propeller at the same time and is accurate to within $\frac{1}{100}$ inch. All hand work is eliminated except a minimum of finish grinding.

Super-Boxcar for Superfortress Links Assembly Plants



To accommodate B-29 assemblies at the Glenn L. Martin-Nebraska plant, the Burlington Railroad prepared 69 special freight cars which are 12 inches wider and 19 inches higher than the standard variety. Previously they had raised the roofs of 60 box cars 26 inches to make them big enough to handle plane parts. Superfortress assemblies are hauled to the plant from Detroit and Akron; motors come from Chicago, propellers from Cleveland, and other materials and parts from various parts of the nation.

By Jack Stanfield

Society of 16-mm. Cinemaphotographers

GOOD LIGHTING will do more than any other one thing to give your home movies a professional touch.

With proper lighting you can obtain the brilliance and depth that Hollywood achieves in its pictures, no matter whether you are filming simple everyday scenes at home or are shooting an actual rehearsed production. With lights, too, you can control the interest of your audience and focus attention where you want it.

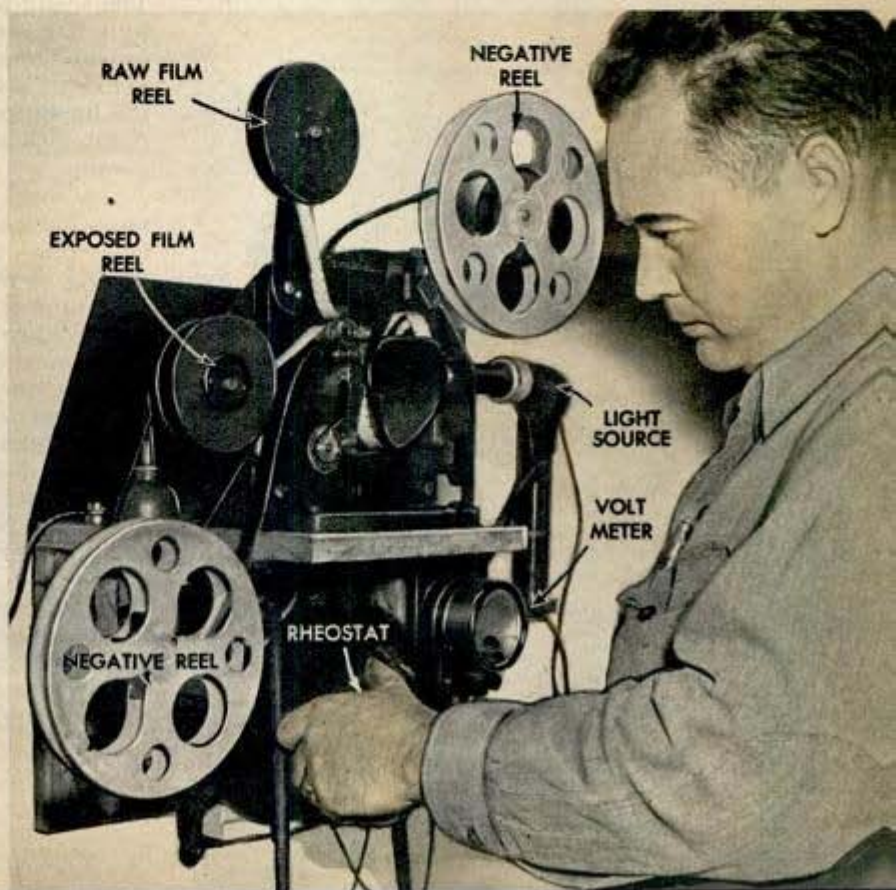
After all, your 8 or 16-mm. camera is no toy. It is a simplified, streamlined version of the full-sized motion picture camera. Within its limitations it can produce pictures that compare in excellence with those made by a \$16,000 professional camera. But you must help it along with proper lighting, just as they do in Hollywood.

This applies to outdoor scenes as well as indoor shots. The best way to avoid black shadows on faces in bright sunlight is to use reflectors or flood lamps. A pair of flat cardboard or plywood reflecting surfaces, one 18 by 24 inches for close-ups and general use, and one 30 by 40 inches for general scenes, will wash out the harsh shadows of a bright day. The reflectors should be coated with aluminum paint if you are using ortho film, or with gold paint for panchromatic film.

If you are working near an electrical outlet it may be simpler to use flood lamps instead of reflecting surfaces. Flood lamps will produce beautiful results out of

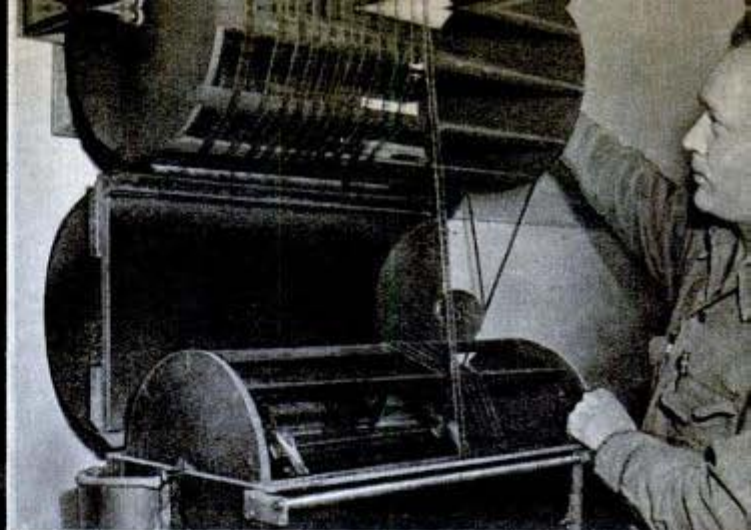


Photoflood lamp is positioned for an outdoor motion picture to lighten the shadows caused by bright sunlight. Below, parts of a movie projector are rigged up for printing extra copies of home movies





Hollywood technician uses 5,000-watt bulb in front of shallow reflecting surface to give soft lighting. Below, home movie screen is mounted behind draperies



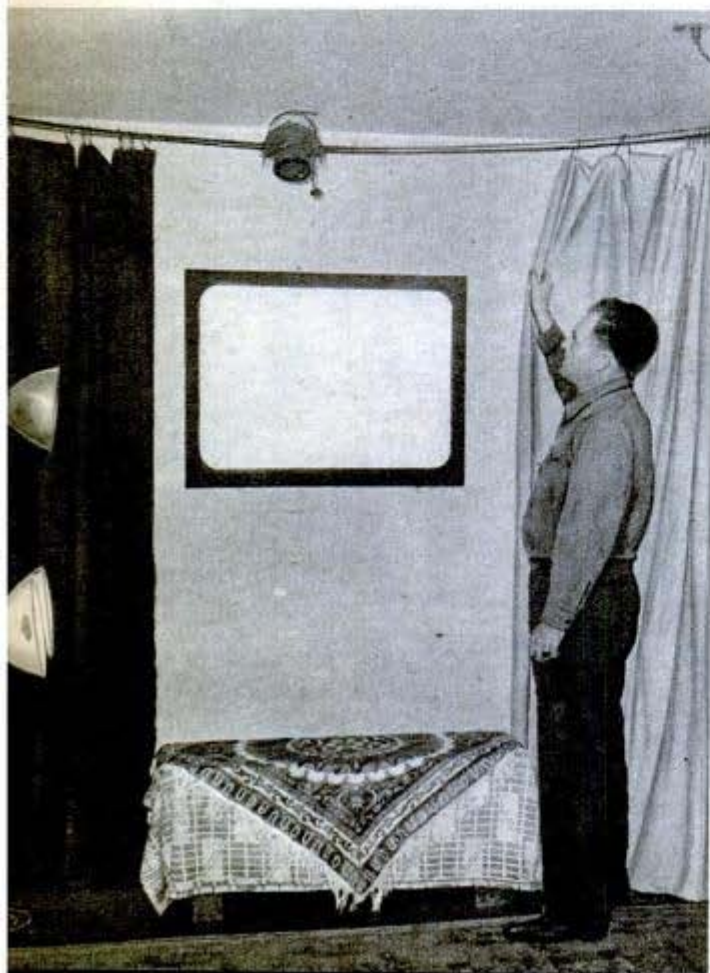
Simple tank and reel which make it easier to develop 8 and 16-mm. motion picture film in your home

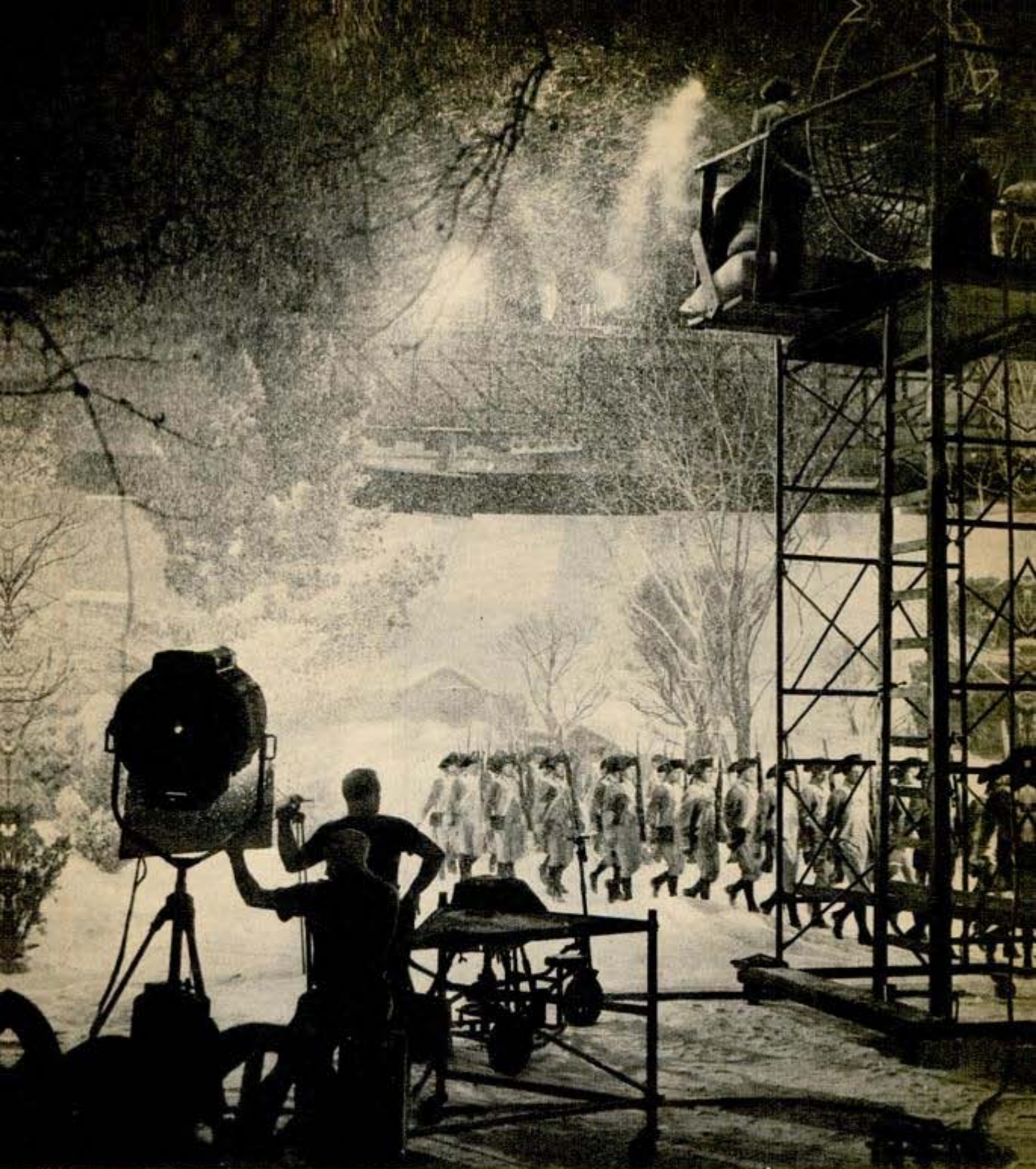
doors. Still photographers have been using flash bulbs outside for years. Place the flood lamps so that they will cut into the shadows but don't light faces too brightly with them. Incidentally, always use a deep sunshade on your lens when shooting toward the sun. You can make a good one out of cardboard, painted black inside to kill reflections.

A common scene in almost every home movie library shows a couple of friends or relatives sitting on the lawn with a dense mass of shrubbery in the background. The shrubbery looked perfectly natural when the shot was made but it comes out a dismal black on the screen. The scene would be improved many times by using reflectors or flood lamps to lighten up the shrubbery, thus balancing the picture. This lighting should be close to the background, out of camera range, and pointed so as to illuminate the background evenly.

Use your floods or reflectors to illuminate leaves and the trunks of trees in close-ups. You will be surprised at the feeling of depth that results. In shooting close-ups of people indoors or out you can get extra relief and help make them stand out from the background by using a backlight behind them, pointed so that it outlines hair and shoulders. Backlights, of course, must not be visible to the camera.

Out of doors you use the sun as the main light source; indoors you need a similar key light. Normally, this should be placed several feet to one side and several feet above the camera and should not be changed or moved while you are shooting from that point. One flood lamp or several of them close together will serve, depending on how much main light you need for a good exposure.





Twentieth Century-Fox

Costumes, artificial snow and props would be useless in this professional shot without the special lighting

To this you add auxiliary lighting to lighten up shadows and give a sense of roundness and three dimensions. One or more soft floods directed onto the scene from the side opposite the main key light and placed at camera height is enough auxiliary light for semiclose-ups.

The background of any interior, even if it is no more than a bare wall, needs special

lighting. Another soft flood or two, mounted high and aimed somewhat downward, fairly close to the background and out of camera range, will do the trick. This background lighting increases the third dimensional illusion.

The basic lighting outlined above is of the high key type. It is a broad, bright illumination with faint shadows that is suitable



A 16-mm. camera contrasted with the huge \$16,000 type used in Hollywood. At right, phonograph synchronizes with film which is projected to mirror (lower left) that reflects it to the screen above

for most interiors and that fits the mood of comedy scenes and musicals. Low key lighting is of the opposite type. One harsh key light and practically no illumination in the shadows is just the thing for spooky or mystery scenes.

It's bad to pour a lot of raw light on a person's face in a close-up. The harsh details are unflattering. To get a more pleasing effect attach a scrim in front of the main flood. This is merely a piece of muslin or other thin cloth stretched across a wire frame that is mounted an inch or two in front

of the flood reflector. You can make your own. The scrim breaks up the bright rays but still provides brilliance.

Always remember that people will grow brighter as they walk toward an offstage light. To keep the lighting uniform, you should have such a light slowly turned to one side as an actor approaches it.

Part of the craftsmanship of a professional cameraman consists of doing little things that help an audience to grasp unconsciously the feeling or significance of an action. An actor who is leaving the scene through an open door, for instance, can be lighted brightly until he disappears if his exit is to be emphasized. But for an ordinary departure you should help the actor out of the scene by fading the light away from him as he leaves. The audience automatically loses interest in him, unaware that the cameraman skilfully diverted its attention.





For indoor lighting amateur uses a specially wound transformer to double output of photo-floods. Right, scrim softens light for close-ups



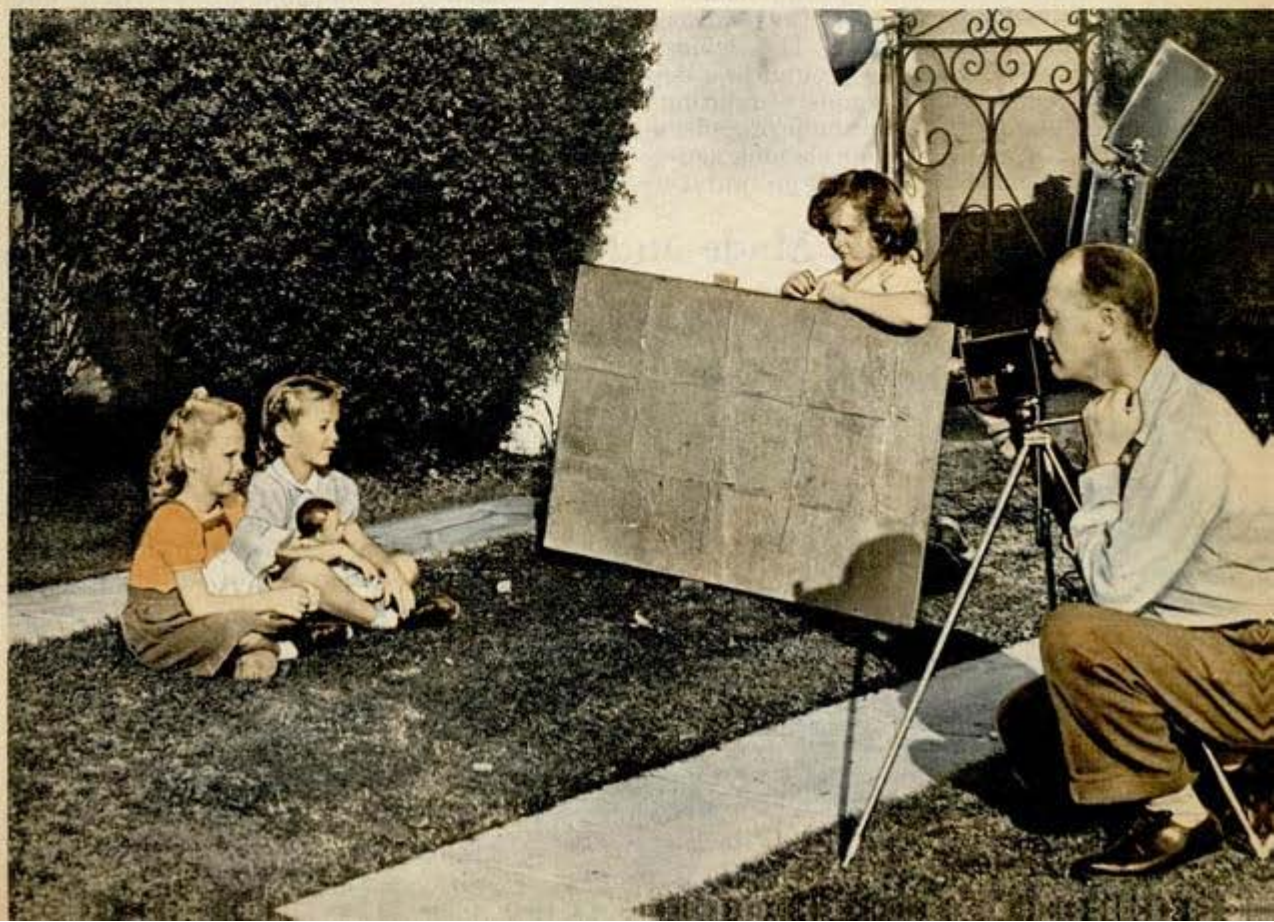
For a close-up showing speech or a grin, you need a spotlight fitted with front flaps—called “barn doors” in the studios—that can be swung together until only a thin slit of light is emitted, if necessary. With this local light added to the general illumination you can emphasize any part of the features. Overlighting, however, causes chalky overexposure.

Another way to control attention is by focus. Attention automatically goes to that part of the scene which is in sharp focus. Hollywood cameramen frequently work with an almost wide open lens to throw out

of focus deliberately those parts of a scene that aren't important to the action. They change focus frequently from one person to another during conversation so that the audience is unconsciously carried along.

Proper movie make-up goes hand in hand with good lighting. It need not be
(Continued to page 152)

A reflector board kills shadows over face outdoors. Flood lamp behind board lights up background shrubbery



Rototiller Plows, Disks, Harrows in One Trip



Left, Rototiller making soil "cement." Above, it churns earth into even seed bed

Plowing, disking and harrowing all are accomplished in one operation with a Rototiller, a versatile farm machine which Graham-Paige Motors Corporation will produce after the war. The device thoroughly crumbles the ground to a depth of 12 inches or less by means of rotating tines, or edged tools, which help propel the machine forward by their clawing action. On a single trip over a plot of ground it creates

a deep, serrated seed bed, in which there are no hard lumps to check root growth, and with fertilizer and humus mixed in uniformly. In addition, the Rototiller can be adapted to other uses. A roller fastened behind the revolving tines compacts the soil as desired. With furrowing and covering attachments, crops like potatoes can be planted in one operation. A field mower attachment, connected to the front, cuts underbrush, weeds or grass. There are other attachments for snow plowing, trenching, cultivating and hilling. It will also churn dry cement into the soil and mix it thoroughly. The mixture then is sprinkled, retilled and rolled to form "soil cement," a hard surface similar to pavement.

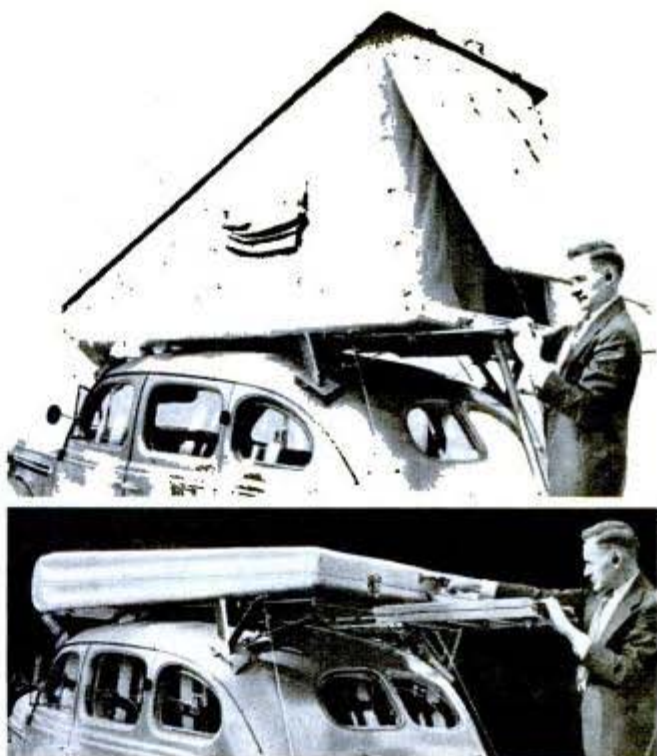
Oil Containers Made and Filled at 70 Quarts a Minute



Paper cartons are made, filled with lubricating oil and sealed at the rate of 70 quarts a minute with a high speed packaging machine at Paulsboro, N. J. The machine is set up in combination with standard paper working equipment to complete the process from fabricating the container to filling and sealing it. The paper working equipment takes ordinary board paper in roll form and, with adhesive, spirally winds it into cylinders open at each end. The cylinders are fed into the oil packaging machine, filled, capped and sealed at a speed of 70 per minute.

Folding Canvas Bedroom Carried on Top of Car

Searching for convenient hotels or tourist cabins on overnight automobile trips is a thing of the past for Earl Jimmes, a Milwaukee, Wis., tool designer, who has just patented a collapsible double berth for the roof of his car. The portable bedroom looks like an enormous plywood suitcase, fastened to the top of the car. When the hinged roof of the compartment is raised, it forms a triangular berth with canvas sides, and includes screened windows, a comfortable mattress and electric light. It takes Jimmes only 60 seconds to set up and climb a little ladder, open a lock on the "suitcase," push up the bedroom "roof," brace it, climb in and zip down the door. The berth, which is only 14 inches higher than the car when closed, can be lifted off with a small rope hoist. It weighs 225 pounds but its inventor hopes to produce roof berths out of aluminum which weigh about 100 pounds.



Dual Engines on Heavy Trucks Prove More Economical Than One

Tests during the last 15 years show that dual-engine trucks are efficient and economical, Ralph M. Werner of United Parcel Service reported to the Society of Automotive Engineers. The two engines may be used simultaneously or only when extra

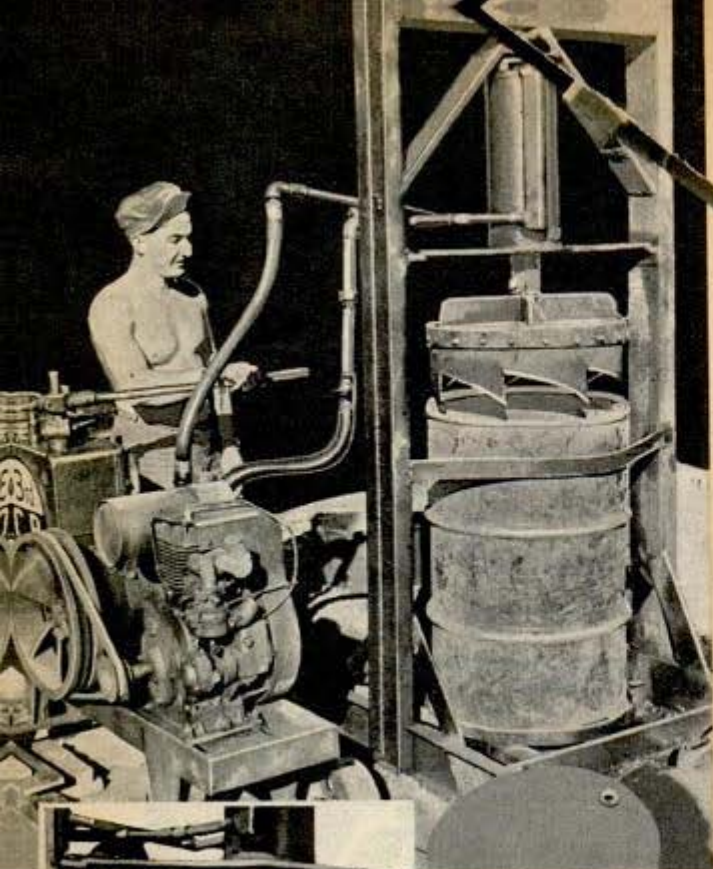
power is required in hill climbing or heavy snow. Two 100-horsepower truck engines will cost 30 percent less to build and operate than one 200-horsepower engine, he said, adding that in a complete installation the saving might be 50 percent.

Yank-Devised Press Saves 'Frozen' Tires

Known as the "mechanical life saver" of rubber, a trouble-shooting tire press has been devised by Lt. Carmelo Palermo of the motor pool repair shop, 6th Ferrying Group, Long Beach, Calif. Palermo constructed the press from salvaged airplane struts, a pump, and gasoline tanks from a scooter. It saves the tire bead from damage when the tire is taken off the wheel and easily removes tires which have become frozen or rusted to the wheel and cannot be removed by hand. Adjustable to almost any size tire, the press conserves by one third the heavy-duty tires so acutely needed in combat zones and is expected to save the group approximately 1,440 work hours a year.



Clever, These



Jumbo can-opener built by Pacific Seabees rips ends off empty gasoline drums in less than one minute and exerts "500-housewife" pressure. Its principle is hydraulic, 1½ h.p. motor powering oil pump. Above, start, left, the finish—lid off

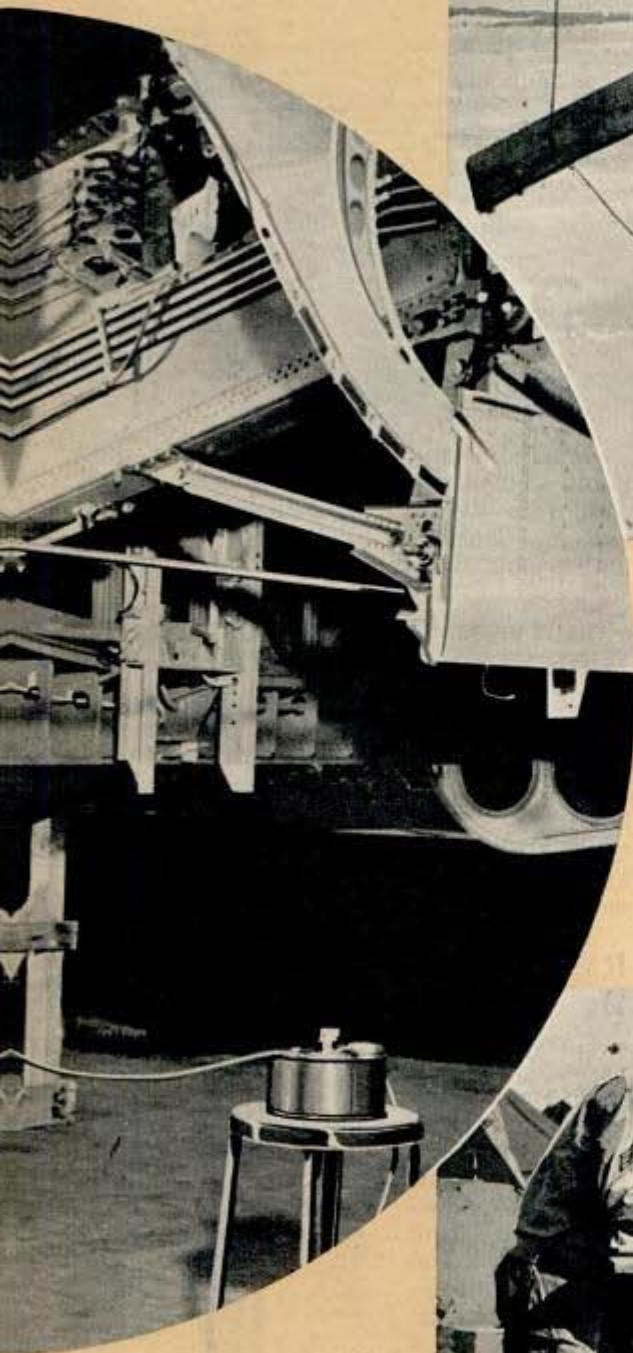
Below, foolproof guard of Plexiglas invented by civilian in Arizona AAF shop keeps fingers out of a metal shearer



Rivetscope 110 inches long, above, carries view of Glenn Martin aircraft inspectors into dark recesses of wings whose rivets formerly had to be checked by X-ray. Scope has ⅝-inch outside diameter, contains 20 lenses, and is electrically operated



Yankees



No laundry headaches vexed Aleutians unit after private devised windmill washer with a chain and sprocket to run paddles, above. Versatile fuel drum finds still another use as base for windmill

With hydraulic jack adapter, right, used at Cochran Field, Ga., tail wheels speedily are raised for tire changes and repairs



Now we've a jeep saw mill! In Italy, the little vehicle of many uses is put to work with a belt around a front wheel powering a buzz saw. Right, logs are cut for hospital



APRIL, 1945

Flood Rescue Scow Has Only Five-Inch Draft



Drawing only five inches of water and powered with heavy duty outboard motors, a shallow draft scow-bowed boat is being tested for speed and maneuverability as a flood rescue craft by the Coast Guard. Fifty of these boats are being built for use

on flooded inland waterways. Each is capable of transporting 24 persons or a like weight in livestock or household goods, and has lockers containing life jackets, flares, tools, first-aid kits and other items.

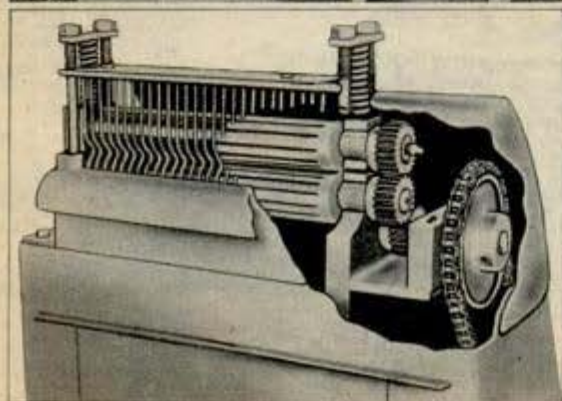
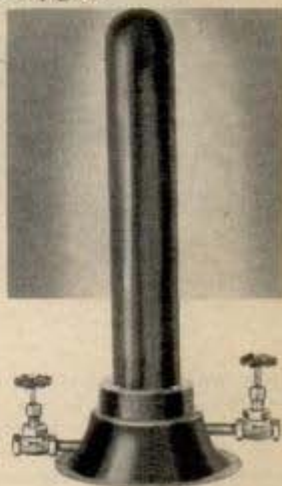


Poultry Stripper Pulls Quills With "Marcelling" Action

Mechanically removing all quills, a poultry stripper performs the work of three men. The wing stripper consists of two power-driven rolls, each having a series of horizontal grooves, so arranged that the quills are withdrawn evenly and completely. The machine develops a "marcelling" action which does not injure the flesh.

Rare Metal Purifies Gases By Absorbing Oxygen

Gases of extremely high purity can be obtained with a purifier which uses the precious but unrestricted metal, palladium, as a catalyst. The palladium operates at room temperature in a compact metal cylinder provided with intake and outlet valves through which the gas is passed.



Its efficiency in removing oxygen from such gases as hydrogen, nitrogen, argon and neon will make it important in the manufacture of radio and radar tubes and in the heat treatment of alloys. A portable analyzer now being perfected as an adjunct will indicate continuously the hydrogen or oxygen impurity.

Navy Sends "SOS" To Inventors

Twenty-five problems have stumped the U. S. Navy, which is passing them along to American inventors. They range from a shoe sole that won't slip on wet decks to an improved twin-triode vacuum tube. Some of the problems to be solved include a method for welding thin aluminum sheet, a coating that will make tents rotproof in the tropics, a way to prevent cracks from spreading in steel without riveting and caulking, and a method for dropping cargo from planes without using parachutes. Others are a simple radio antenna about 300 feet high that can be put up without steeple-jack work, a lightweight beach marker light, a portable fire extinguisher for electrical equipment, an improved drum-type lens that spreads a flat circle of light in all directions, and various waterproof items which include telephone jacks. The Navy would also like to find an efficient knapsack sprayer for mosquitoes and a device for detecting gasoline vapors in enclosed spaces. The National Inventors Council, Department of Commerce, Washington 25, D. C., will furnish full details on specifications for these needed inventions.

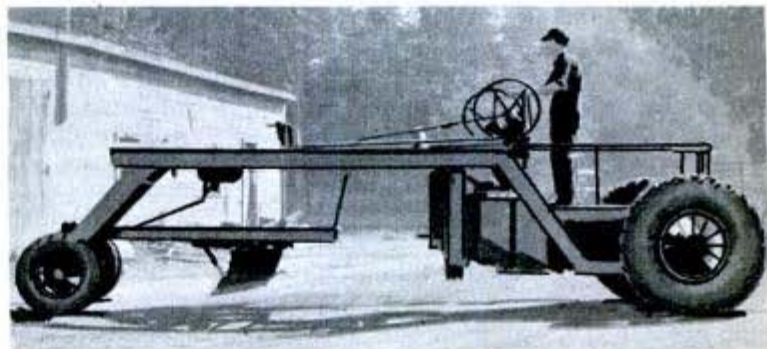
Electronic Heater Mends Auto Tires With More Durable Patches



To save much of the time required by conventional steam vulcanizing, the Air Technical Service Command mends damaged truck tires with electronic heating methods. Because heat is developed in all sections of the rubber at the same time, the finished patch has superior characteristics and there is no danger of overbaking the surface in order to reach internal layers. High frequency energy for the vulcanizer is supplied by an electronic heater developed by the North American Philips Co., Inc., New York City.

Road Grader Made From Junk for Only \$354

Three employees of the Michigan City, Ind., street department rigged up a road grader entirely from salvaged materials. The motor and back wheels came from a discarded tractor, the control wheels and rods from a bulldozer bought at a junk yard, and the "I" beams for the framework and a few other parts were picked up around town. The operator's platform at the rear was made of old planking, nailed together with discarded spikes. The grader, which took four months of spare time to put together, cost \$354.60 to make. A new one would have cost \$5,000.



"BOSUN - PASS THE WORD!"



Piping aboard King George VI of Britain is part of the day's work for USS Augusta's bosun, above. The Indianapolis' bosun knows his ropes, below

By
Grace and Knickerbaker Davis

IN VIVID reports of correspondents assigned to task forces in the theaters of war, you've probably read about boatswains' calls resounding over ships' loudspeakers before, during and after action. Perhaps you've visited war craft in port and cocked an inquisitive landlubber's ear at a medley of falsetto peeps, squeals, warbles and blasts. What you heard wasn't the gibberish of a whistle gone haywire. It was a boatswain's mate "passing the word," piping calls for execution of orders.

A bosun's mate (the Navy clips the pronunciation) is a petty officer, with responsibilities depending upon his classification, of the Navy's oldest "specialist rating." The oddly shaped silver pipe he wears on a braided lanyard is even older (it traces back to the time of the Crusades), and its form and use are exactly the same as when it shrilled above creaks of a gale-tossed frigate.

Although vastly more complicated today, a bosun's duties are basically the same as when his lusty bellows sent pigtailed tars scurrying aloft to trim sail or replace canvas and gear shattered by enemy round shot and grape.

With the passing of "wooden ships and

POPULAR MECHANICS



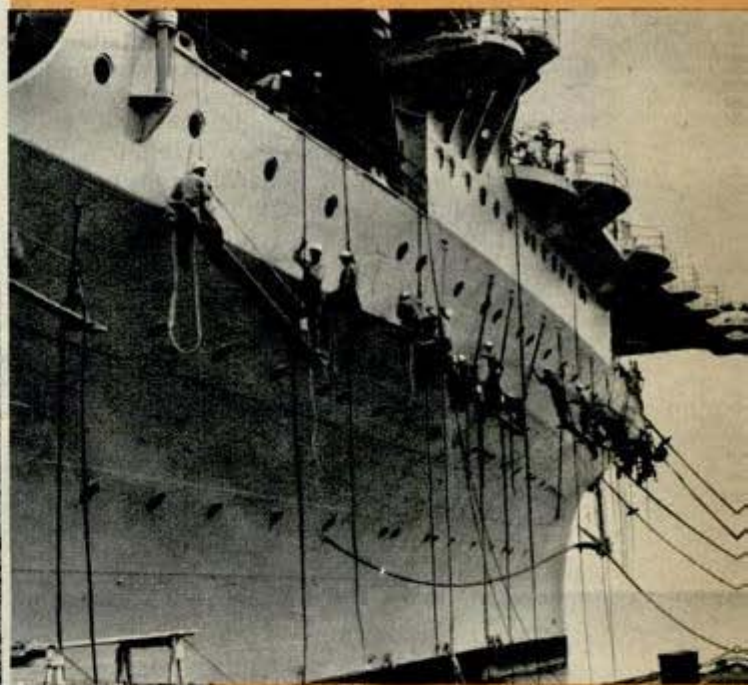
iron men" went the burly, tattooed, cutlass-swinging bosun who "started" laggard seamen with a taste of "colt" (the rope-end coiled handily within a bosun's stiff-brimmed hat), and who also laid the lashes of dreaded cat-o'-nine-tails on naked backs of culprits. But the rating still carries on with a will other traditional naval customs and usages.

The "Veer!" of the bosun's pipe still brings sailors on the run to form a lane at a gangway's head when rank comes aboard ship. This honor originated, Navy folk say with a grin, not only as deferential welcome but also to lend a hand to portly dignitaries apt to roll with the ship. The full scale rise and fall of "piping the side" continues until the visitor has faced aft to salute the taffrail's colors and has taken the salute of the spyglass-toting officer-of-the-deck.

During this war bosun's mates of United States fighting craft have paid such honors to plenty of visiting foreign potentates in addition to our own. None, however, is believed to have matched the record of Mississippi-born, veteran Chief Boatswain's Mate Sam Franks of the USS Augusta. He "piped the side" when President Roosevelt, Prime Minister Churchill and their aides came on board to make



Here is a bosun and his pipe. Changing position of hand over hole in bowl of the pipe varies its notes



Above, bosuns oversee paint job on the Ranger; left, sprucing up a gig



history with the Atlantic Charter. Later, Franks piped aboard Britain's King George VI. Scores of other notables have heard his pipe as they mounted the cruiser's gangway, among them Madame Chiang Kai-shek and the other Soong sisters, and Manuel Quezon, late president of the Philippines.



Piped to topside duty by bosun's call of "Sweepers!" members of broom brigade shoulder "arms" and set out for day's chore aboard a flattop

Bosun's mates and their pipes are still as indispensable to working and fighting rough-and-tumble destroyers, hard-hitting light and heavy cruisers, plane-laden flat-tops and towering battlewagons as they were to the wooden ships of a century ago. Over the public address systems of task forces, the bosun pipes "All hands!" as the preliminary of general emergency orders such as: "All hands clear ship for action!" "All hands man your battle stations!" "All hands provide and equip for abandon ship!" "All hands overboard!" And the pipe's "Attention!" prefaces all battle orders directing specific ship's divisions, such as crews manning antiaircraft batteries, damage control parties and other emergency specialists called to cope with fire, collision, and hits of enemy shells, bombs or torpedoes.

Then there are scores of routine calls

Right, coxswain pipes crew to attention over ship's loudspeakers. Below, bosuns inspect anchor chains



sounded by the bosun. Among them, "Up all idlers!" and "All hands trice your bunks!" have replaced the early days' "Rise and shine!" "Show a leg!" "Lash and stow!"

Two other traditional calls still prefaced by the bosun's pipe are: "Light ship! The smoking lamp is lighted on all weather decks!" and "Darken ship! The smoking lamp is out on all weather decks!" These designate smoking periods, and are carry-overs from days when tars lit blackened clays at a smoking lamp and doused them when it was

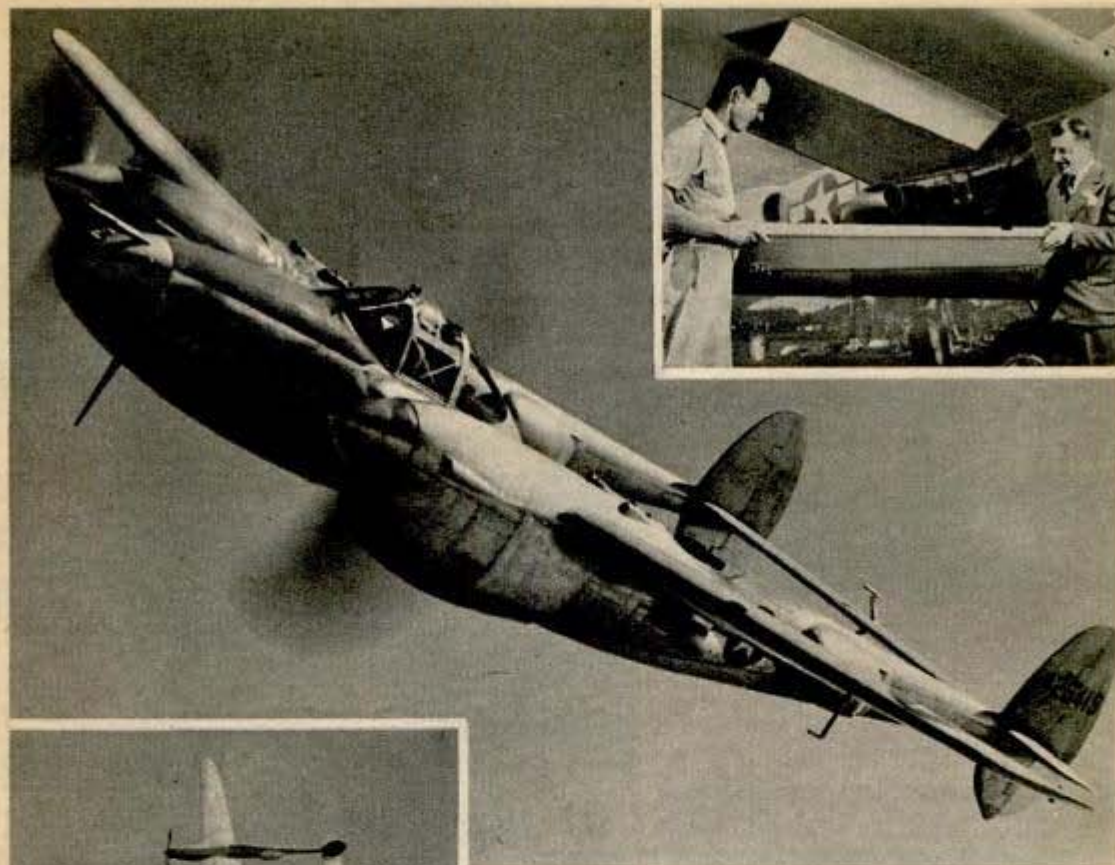
extinguished. The pipe also sets first, mid and morning watches.

Many of the pipe's calls used under sail have, naturally, become obsolete. But plenty of salty ones remain. Its piercing "Stand by!" still sends men to tackles. "Lay up!" sends them aloft. "Lay out!" to man yards, booms

(Continued to page 152)

POPULAR MECHANICS

Wing Flaps on P-38L Add to Speed and Control



New 425-m.p.h. Lightning has increased range, bomb load and rate of climb. Dive flaps (top) give pilot full control in power dives. Left, executing steep bank on only one motor

Speed of the new model P-38L has been boosted to 425 m.p.h. and more by modifications of design, most important being special wing flaps which control air flow under the wings and eliminate air turbulence encountered as planes approach the speed of sound. The flaps are operated by electric motors and controlled by a button on the pilot's wheel. Hydraulic boosters give the pilot the strength of ten men in working his controls. The P-38L has 50 percent more bomb capacity than former models. Its ceiling is 40,000 feet and range 1,700-1,800 miles. With drop tanks maximum range is 3,000 miles. Two new turbo-superchargers greatly increase the rate of climb.

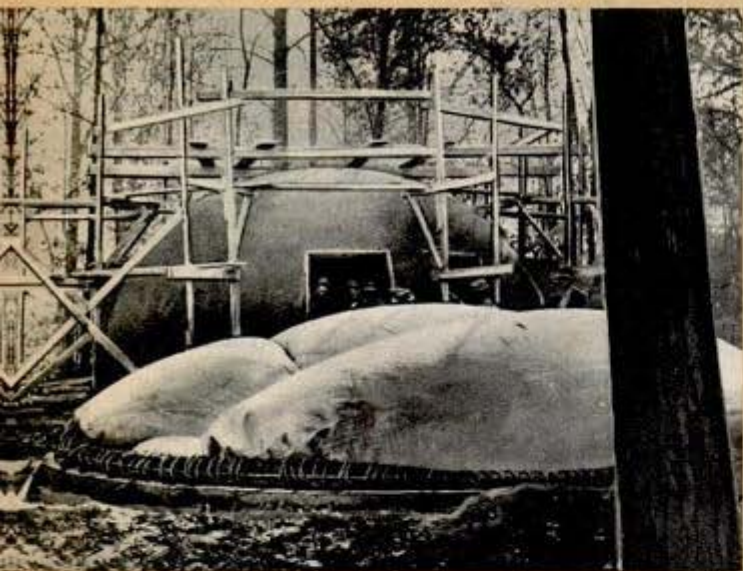
Television Movies With Color Are Mapped Out for British in Decade

Great Britain will have television movies in color within 10 years if a technical development program of the British film industry succeeds. The 10-year plan calls for full development of the color film at the end of the first four years, and practical realization of commercial high-definition, large-screen television in two more years, plus a method of providing and distributing

television programs of special events. Two more years are expected to bring large-scale television in color, and the last two years a practical solution of stereoscopic projection.

Deaf workers in a Louisville plant are protected from cranes and shop traffic by wearing red caps to warn fellow workmen.

BLOWN-UP HOUSE

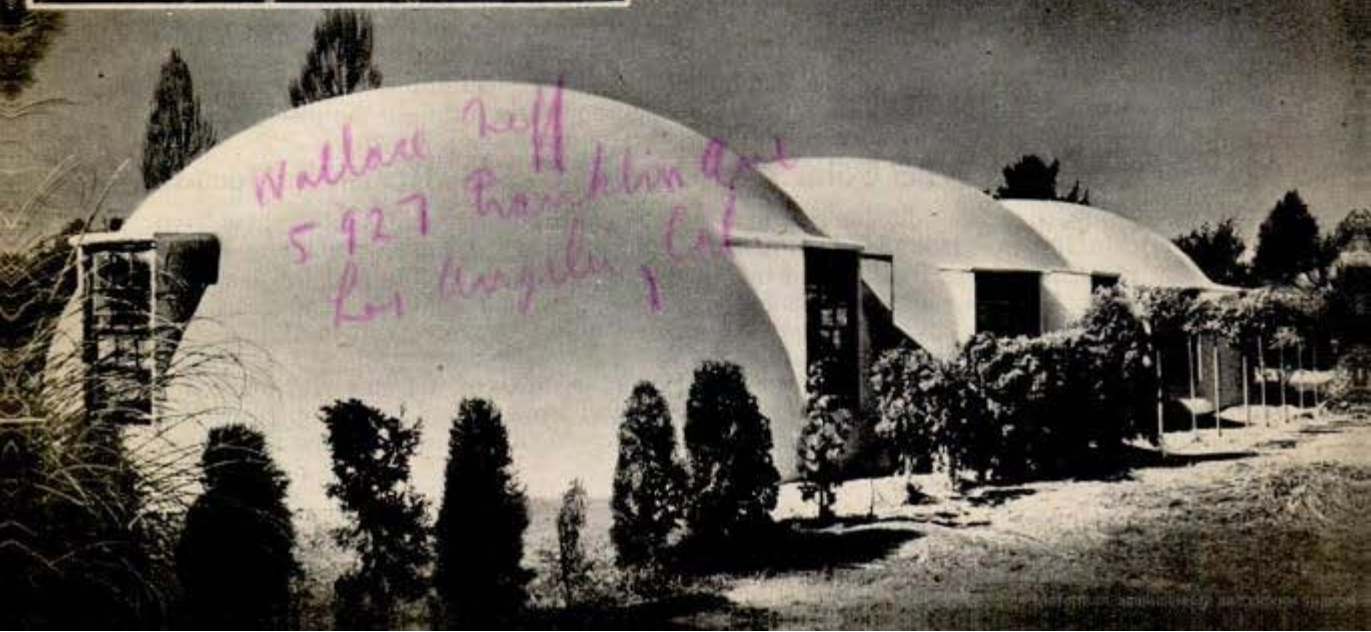


Here is interior of a balloon-type or "bubble house" in Litchfield Park, Ariz. Style is adaptable for terminals, hospitals and schools

Buildings are blown up, not constructed in the ordinary sense, by Wallace Neff, Los Angeles, Calif., architect. A balloon is inflated (above) so that concrete and insulating materials can be shot over the form by air pressure. When they harden, form is removed



Left, concrete is sprayed on a balloon, which was inflated with an air pressure of $1\frac{1}{2}$ ounces per square inch. The new engineering building at Loyola University in Los Angeles is shown from the inside (above) and outside (below)
Photos by Maynard L. Parker



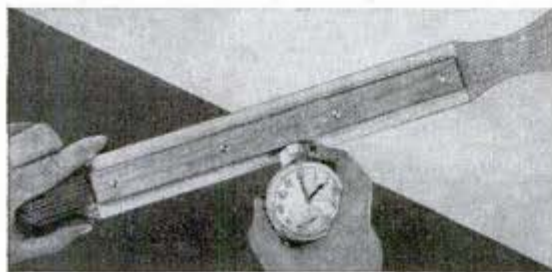
Cargo Version of B-29 Paces Postwar Planes



Postwar air travelers can have breakfast in New York and lunch in Los Angeles if future transports keep the pace set by the C-97 cargo version of the B-29 Superfortress. This plane recently broke all cross-continental speed records by flying from Seattle to Washington, D. C., in six hours, four minutes and 33 seconds. The former record was six hours, 31 minutes and 30 seconds set by a Mustang fighter plane. The double-deck C-97 has 10,000 cubic feet of cargo space in its enlarged fuselage, and the doors are large enough for light tanks and trucks. The plane is 110 feet four inches in length, 12 feet longer than the B-29. Aside from the fuselage, the plane is almost identical with the B-29 and surpasses all Army transports in range, speed and size. Its maximum flying speed is said to be well over 300 miles an hour.



"Paddle" Winder for Watches Does the Job in Only Two Seconds



It took a special paddle to "lick" the job of winding the hundreds of watches tested daily by the U. S. Naval Observatory and Hamilton Watch Company. The foot-long paddle is faced with a tough strip of resilient material that is said to be 30 times as longlasting as rubber. A watch can be wound in two seconds simply by whisking the winding crown across the surface of the paddle.

A BILLION "HORSES" ON OUR SIDE

By John Waring, Jr.

IN THE dynamics of warfare, the side which hurls the greatest amount of metal and explosives against its enemy wins the battles. The more you hurl, the farther and the faster, the more energy is needed. In all wars up to modern times this energy was supplied by the one-tenth horsepower in each soldier's muscles. The present war is the first technological conflict in history.

Our soldiers, sailors, and flyers would have among them only 1,150,000 horsepower—if they were fighting in the armies of Caesar, Napoleon or George Washington. They wouldn't stand a chance against the mechanized strength of the Axis . . . so we're having to overpower the enemy with over a billion horsepower!

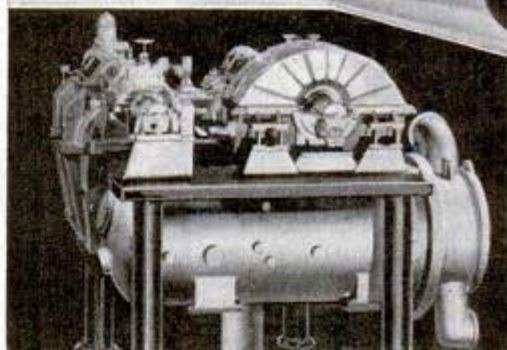
Here are estimates—based on official data—of America's armed might in terms of mechanical horsepower installed and available at the end of 1944:

| | |
|------------------------------|--------------------------|
| Aircraft..... | 712,500,000 hp. |
| Trucks and combat vehicles.. | 300,000,000 hp. |
| Naval vessels..... | 96,000,000 hp. |
| Tanks | 22,700,000 hp. |
| Merchant marine..... | 15,274,000 hp. |
| Total..... | 1,146,474,000 hp. |

Every plane, every truck and car, every tank, and every vessel requires at least one engine . . . automotive plants alone have delivered 3,100,000 engines for vehicles, aircraft, PT boats and landing craft.

When it comes to the power part of firepower, we are more than a match for the enemy, from simple gunpowder and TNT to the new secret RDX and Pentolite high explosives. We are manufacturing explosives of all kinds at the rate of 250,000,000 pounds monthly. The Army's 8-inch gun uses 90 pounds in a single charge.

Chief source of our war energy, however, is the exploding of gasoline and oil in the engines that power our planes, ships, and fighting vehicles. Our petroleum needs



U. S. Maritime Commission photo

Model of turbine engine for a Victory ship represents seagoing horsepower, and shell cases (top), U. S. firepower





Courtesy General Motors

Crawler tractors with cranes (above left) lined up for shipment overseas. Above, inspecting a new 18-cylinder aircraft engine

It takes horsepower by the million to maintain air supremacy with our super planes which include the A-26 Invader (above), newest AAF attack bomber. Below, International Harvester trucks on way to front, and 155-mm. gun



AAF photos

Ground crew sees that engines deliver maximum power

are 80 times that of World War I—when it was said that “the Allies floated to victory on a sea of oil.”

To deliver one ton of bombs to enemy targets, three tons of high-octane gasoline are burned in a bomber's engines. Up to mid-November of 1944, the Army Air Forces had flown 1,500,251 combat sorties since Pearl Harbor. The 1942 daily average was only seven. In 1943 it jumped to 1,000 trips a day, and last year it was 3,500 sorties per day. On every mission each plane, on the average, takes off with about 875 gallons of fuel.

Supply just one gallon of gasoline to a 1,000-

Right, soldiers of 9th Air Force filling field of gas cans for delivery at front. Below, B-17 changes “horses”



plane bomber fleet and it could travel a distance of only five feet! A heavy bomber uses one gallon in traveling one mile, but we have to send up thousands of bombers on missions covering thousands of miles. An armored division will move just 21 feet on a single gallon of gasoline, but a General Sherman tank will travel $\frac{3}{4}$ mile with the same amount of fuel.

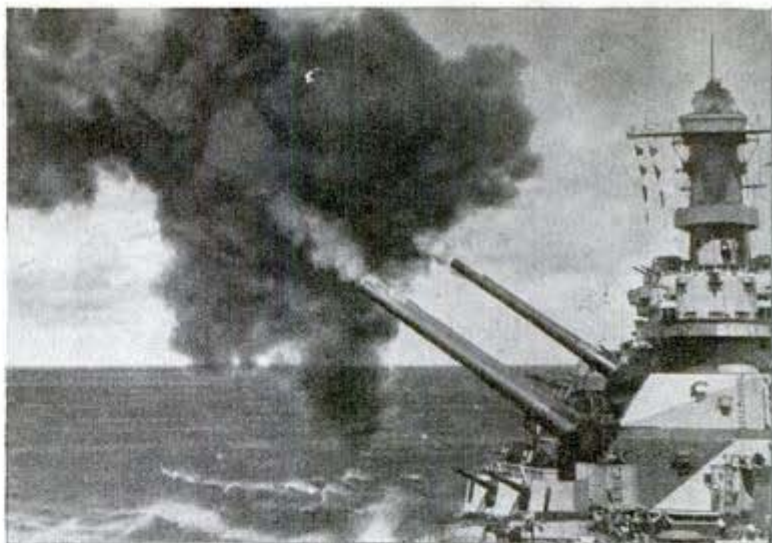
To power our tanks, planes and ships at the highest rates of hit-and-run speed, liquid fuels are



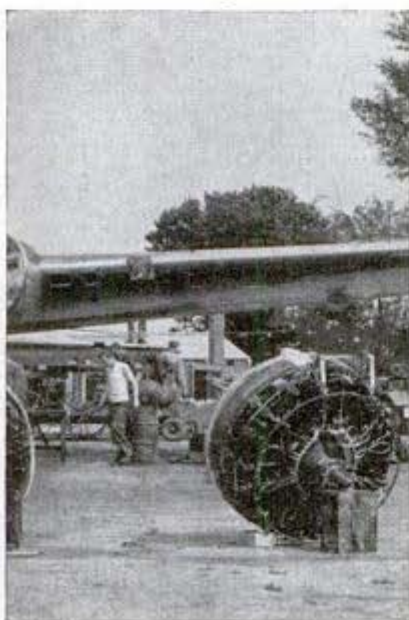
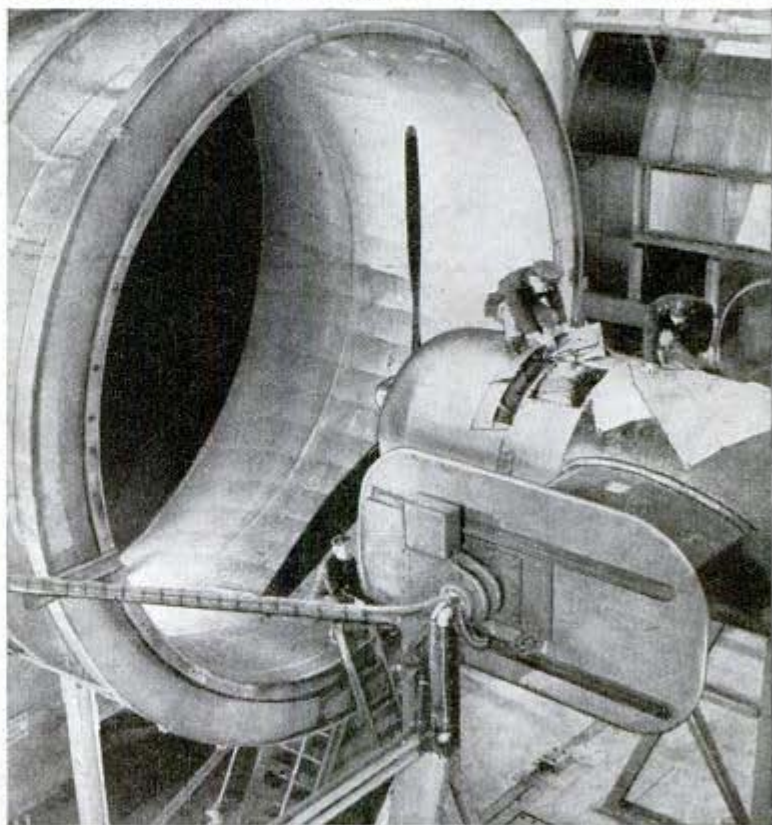
consumed in tremendous quantities. The armed forces use nearly 2,000,000 barrels of gasoline and oil every 24 hours. This includes 500,000 barrels of high-octane gas.

In the great Meuse-Argonne battle of 1918, our AEF fired an average of 90,000 rounds of shells daily, delivering more tonnage of ammunition in 47 days than the Northern Army fired during the entire Civil War. Scheduled needs for November, 1944, on the western European front were reported as averaging 200,000 rounds of artillery ammunition plus 70,000 rounds of mortar ammunition daily. This did not include ammunition for the air forces. In a 24-hour full-scale barrage, a U. S. mechanized field army can fire 20,000 tons of ammunition from its heavy guns.

The American Revolution was fought with cannon having a range of one mile. Our Army's 155-mm. "Long Tom" gun knocked out a German battery in Tunisia that was 14 miles away. Last summer these guns, referred to by German soldiers as "Zauber-



The USS Iowa speaks as tons of hot steel hurtle through the sky toward a target miles away over Pacific horizon. Below, preparing engine for test against 400-mile-an-hour winds in 20-foot tunnel at Wright Field



feuer" (fire magic) figured heavily in capturing Cherbourg.

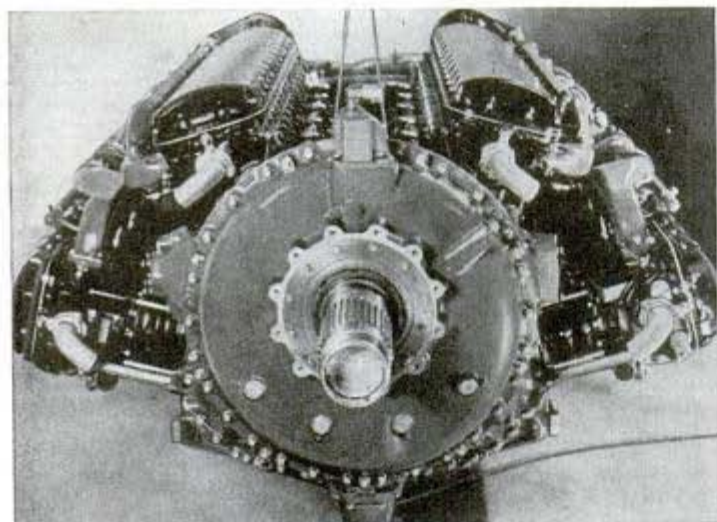
Our newest artillery piece, the 8-inch (200-mm.) gun, hurls a 240-pound shell a distance of 20 miles. However, the 16-inch coastal rifle can send a 2,340-pound shell 31 miles.

Artillery today needs more than firepower. A new element—airpower—requires that the guns themselves be capable of quick getaway. This means they must be towed by massive "prime movers" which require more engines.

Gen John Ziska, the Bohemian patriot who fought Germany and Hungary 70 years before Columbus discovered



Rocket-firing Typhoon of the RAF is fitted with long range fuel tanks. These hard-hitting planes helped blast path for infantry



This 3,000-horsepower Allison engine is said to be the most powerful aircraft engine in the world. Below, the new M-36 tank destroyer mounts a 90-mm. cannon in heavy turret on the hull of an M-4



America, was the first to use mobile firepower. He mounted cannon on horse-drawn carts. It would take far more than a couple of "war horses" to move our newest mobile weapon—the M-18 Hellcat. After shelling an enemy position seven miles away with its 76-mm. cannon, the five-man crew can start up its 485-horsepower gasoline engine and within an hour the 19-ton vehicle can be 55 miles away.

The ultimate in mobile weapons is the tank. Its four-man crew possesses the firepower of 40 riflemen, and can travel 10 times as fast.

Airpower has given firepower a new dimension: "vertical warfare." Thirteen Thunderbolt fighter planes have a greater firepower than all the machine guns of a German infantry regiment, and thirteen Airacobras have as much firepower as all the anti-tank guns in that regiment.

During World War I the U. S. Army's bombers dropped only 137 tons of explosives on Germany. In November, 1944, the USAAF bombed Germany with 55,700 tons of explosives and metal from the air. Between August, 1942, and December, 1944, our aircraft hit Germany with 442,000 tons of bombs.

In World War I only 155 combat planes were delivered to the U. S. Navy. Today it has upward of 35,575 planes. Our Navy's newest fighter planes can fire in one minute nearly six times the projectiles handled by 1940 models.

The Jap fleet learned about the firepower of our light cruisers the hard way. These cruisers can fire a dozen 5-inch shells per minute per gun at a target 10 miles away, or as far as six miles in the sky.

Many of the war machines that are delivering more than a billion horsepower to our fighting forces today will be obsolete in a few years. Jet engines, rockets, supersonics, electronics, and improved explosives will release untold amounts of energy in the future for war—or peace.

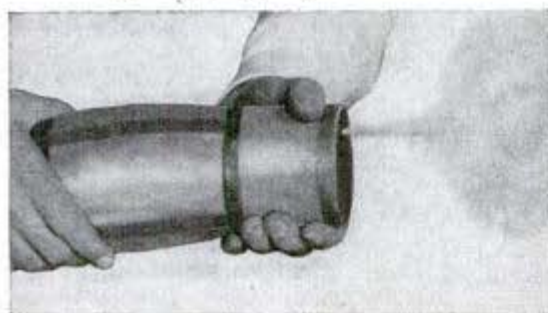
"Balloon" Provides Fresh Water for Castaways on Raft

By using floating solar stills formed like balloons or plastic envelopes, Air Force castaways can distill enough drinking water from the sea to keep them alive for weeks. First, a sponge-covered plastic screen stretched through the center of the still is saturated with two quarts of sea water. Then the envelope is inflated by lung power, tilted to drain excess sea water from the sponge, placed on the water and tied to the raft. About 90 percent of the sun's rays can pass through the plastic transparency of the envelope, and the water-soaked sponge absorbs the sun's heat. The heat evaporates the water, which passes off as vapor, leaving the sea salt in the sponge. On the cooler envelope of the still the vapor condenses into fresh water, which runs down to the



reservoir at the bottom of the still. The Air Force plans to use six stills for each multiplace raft, which will assure each man at least a pint of water per day.

Dusting Bag Sprays Insecticide on Plants When Bottom Is Squeezed



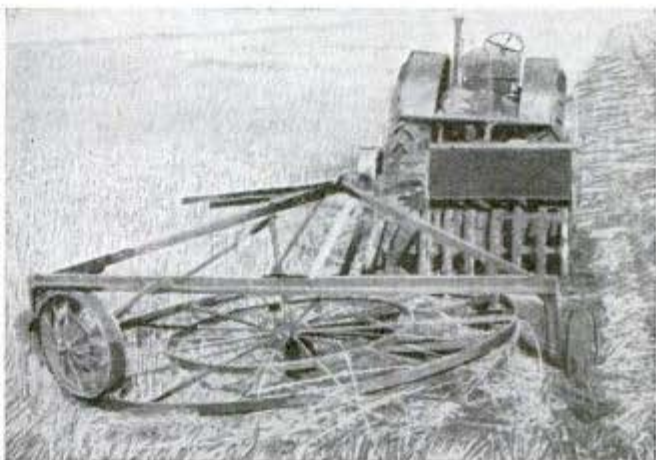
No additional sprayer or duster need be used with a one-pound insecticide bag which itself can be used as an efficient duster. When the bottom of the bag is squeezed, the container spreads the powder in an even film without wastage. This method keeps the insecticide off the user's clothes. Better control of insects is claimed with the device, since the bag permits the dusting of both the underside and the top of plant leaves.

Mulcher Rakes Straw and Strews It Over Plowed Soil

Soil preservation has been simplified by Carl Schultz, Upham, N. D., farmer, and his son, Alfred, who invented a mechanical mulcher which rakes up straw, leafage, or fiber from unplowed soil and distributes it over the surface of the newly plowed ground. The machine's main element is a large wheel with long teeth like those of a harrow. The wheel is tilted from its horizontal position and combs the ground on one side only, with the forward movement rotating it. Attached to a plow, the mulcher rakes up the material on one side and strews it evenly on the plowed side. The diameter of the wheel is twice the width of the plow strip. The mulcher's operation assists in controlling wind erosion on light soil, breaking up the eroding effects of rain, helping to increase intake of water into the soil and reducing

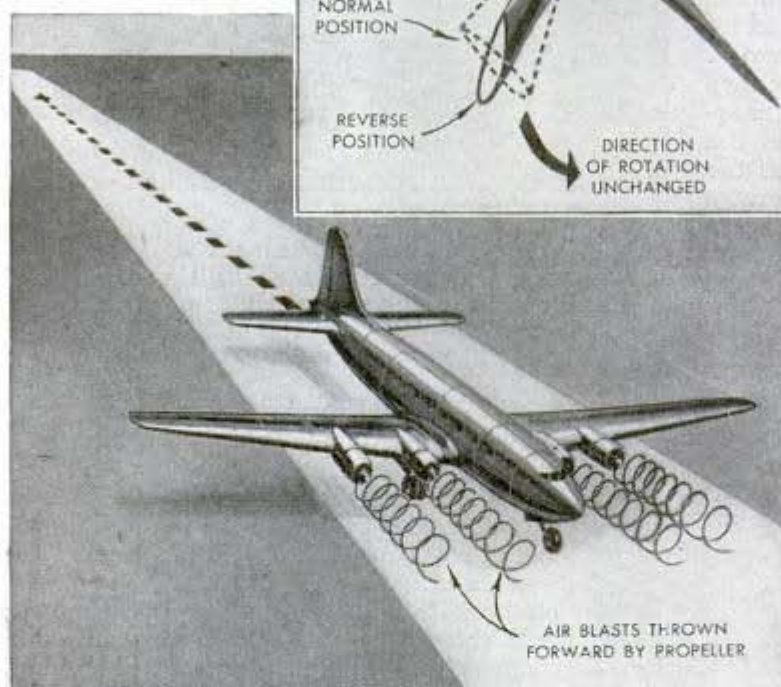
evaporation of the soil moisture by the protective blanket of straw spread over the land immediately after it is plowed.

Mulcher follows pony press drill hitched to tractor and covers seeded ground with protective mulch



Propeller 'Brakes' Halve Bomber's Landing Run

By changing pitch of propeller blades, air blast is thrown forward to create braking effect. This reduces diving speed or shortens landing run



By changing the pitch of propeller blades, a blast of air is thrown forward which acts as an "air brake" for heavy aircraft. Aerodynamic braking, developed by Curtiss-Wright Corporation, is accomplished without reversing the rotational direction of the propeller. Tests reveal that the propellers in reverse pitch can stop a plane in one half its normal landing run. On a four-engine plane, the reverse thrust from two propellers was found to be as effective as the application of wheel brakes, besides giving smoother deceleration. In a vertical dive, the propeller can slow a P-47 Thunderbolt down to 250 miles an hour. Aerodynamic braking is expected to aid in the development of high speed postwar transports, since reverse thrust propellers will reduce the size and weight of wheel brakes.

Gas Mask for War Dogs at Front Fits Snugly Over Nose

If the enemy uses gas, war dogs of the U. S. Army can go about their business of patrol with a special gas mask recently adopted by the Chemical Warfare Service. The mask, which weighs only two pounds, is the result of considerable research to find a mask that would fit 97 percent of the war dogs. It fits snugly over canine noses and affords protection against chlorine, phosgene and other choking gases.

DDT Mixed in Paint Kills Flies After Two Months on Wall

DDT, the potent insecticide developed for use in the tropics by the armed forces, is deadly to flies and mosquitoes when mixed with an oil-bound water paint. In tests conducted by two British chemists, walls coated with paint containing 5 percent DDT killed flies after two months. So far, experiments in mixing the insecticide with ordinary oil paints and varnishes have not been successful.



"Mickey" Tube Gives Movie of Invisible Target



BOMBARDIER WATCHES INDISTINCT
IMAGE OF TARGET ON SCREEN

One of the cherished secrets of the American and Royal Air Forces is the method by which bombardiers find invisible targets through a heavy overcast. Enough has been told now to indicate that this electronic eye developed from a marriage of radar and television: the bomb aimer, watching the face of a cathode ray tube—"gen box" to the RAF, "Mickey" to the Yanks—sees the general outlines of the hidden target sketched by the radio signals beamed downward from the transmitter and echoed back to the tube in the little black box. Since these signals travel at the speed of light, the faint image is virtually an instantaneous motion picture of the target area. The bombardier can recognize his particular objective by its shadowy shape on the fluorescent screen. Meanwhile the attacking bombers are hidden from defending fighter planes and from anti-aircraft batteries, which can only throw up a barrage against the unseen "heavies" with the directive aid of the enemy version of radar detectors.

ELECTRONIC BEAM TRAVELS
THROUGH CLOUD AND IS
ECHOED FROM TARGET TO
CATHODE RAY TUBE IN PLANE



GIVE IT THE WORKS!

By
Allen Warren Elliott

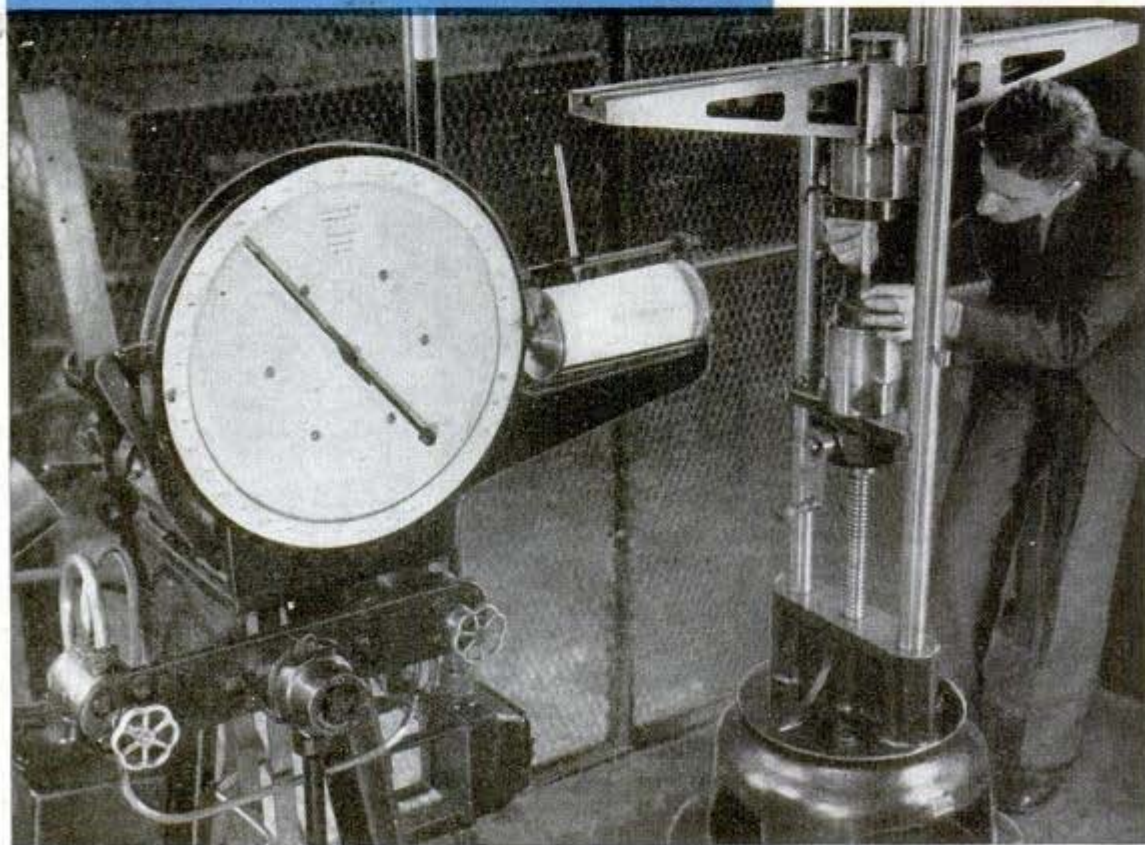
UNCLE Sam leads the world in output of quality goods because hundreds of thousands of individual products, parts and accessories are deliberately destroyed in industrial laboratories every year. Only the fit are allowed to survive.

The war, demanding higher standards of perfection, has stepped up the weeding out of materials by tests to the point of "destruction unlimited"—just to make sure the final product won't fail under extra hard wear and tear. This is expected to make peacetime products much more efficient and durable than they were before the war.

For example, one of the first trucks destined for the axle-deep mire in Europe was taken into a man-made mud hole to

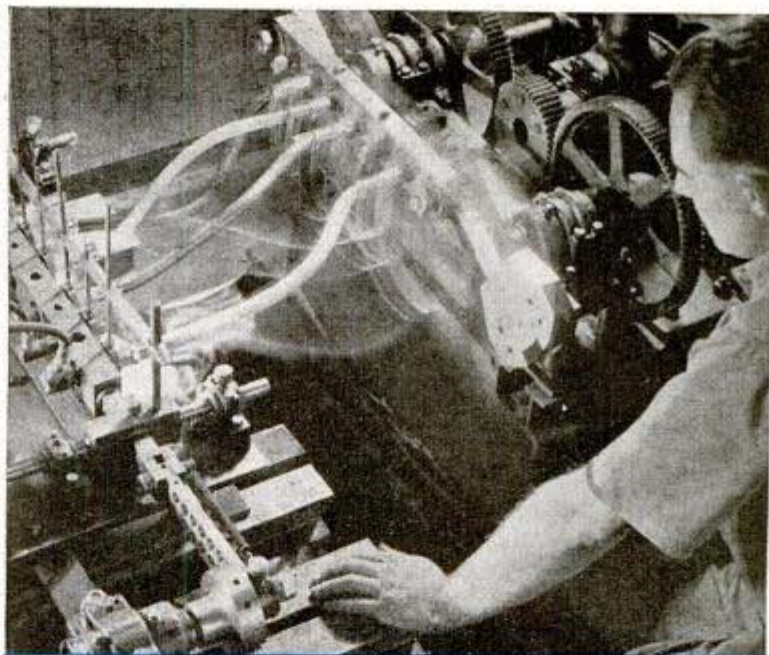


This instrument tells exactly how much pressure an airplane window can withstand in stratosphere. Below, Western Electric engineer tests a sample of brass sheet for tensile strength and elongation



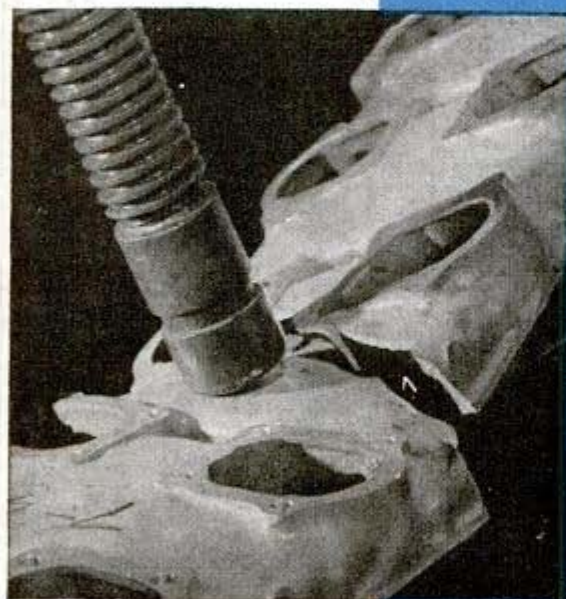
grind the life out of its gears and transmission until something cracked. In such cases the initial truck may be worn and strained until it is a wreck, but the rest of the trucks to come off the line will be perfect. Trucks also are crashed over man-made "stones" of concrete or sped over corduroy roads which rattle them inside out.

Tractors which will plow the desert in Africa or the beaches of a Pacific isle are shipped by the Caterpillar Tractor Company to American deserts and beaches to be tested for the effects of abrasive dust and grit.



"Years" of wear are put on hose assembly (above) in a few hours. Left, a cam box cover is cracked so fracture can be studied by Ranger Aircraft engineers. Below, testing metal for aircraft at sub-zero temperature

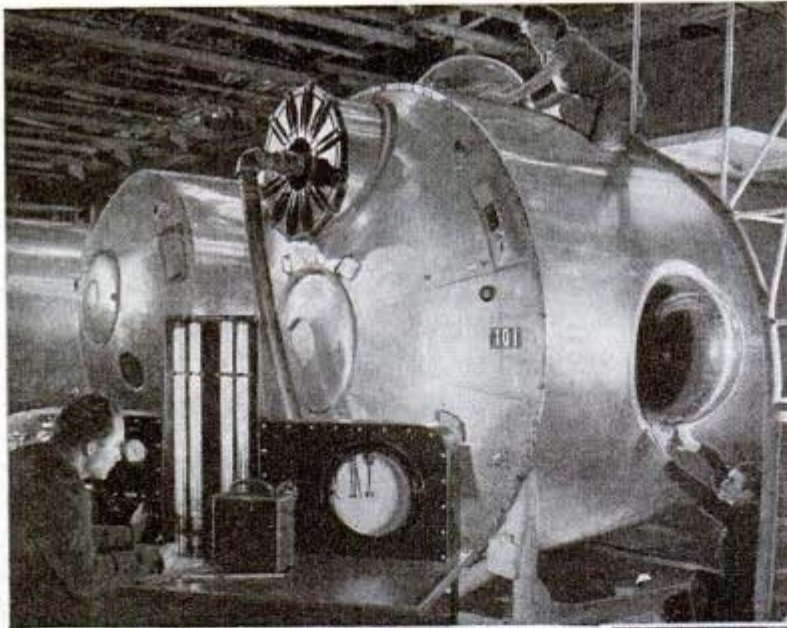
Photo courtesy Vultee Aircraft Corp.



Airplane engines which must perform in the stratosphere are frozen into hoary blocks of icy metal in refrigerated test chambers of the Naval Air Experimental Station, then pounded, strained, started cold, overheated, frozen again and so on. If anything goes wrong with the test motor, the part is discarded and replaced and the test begins all over again.

Tires for military use, and new synthetic types which will become in-

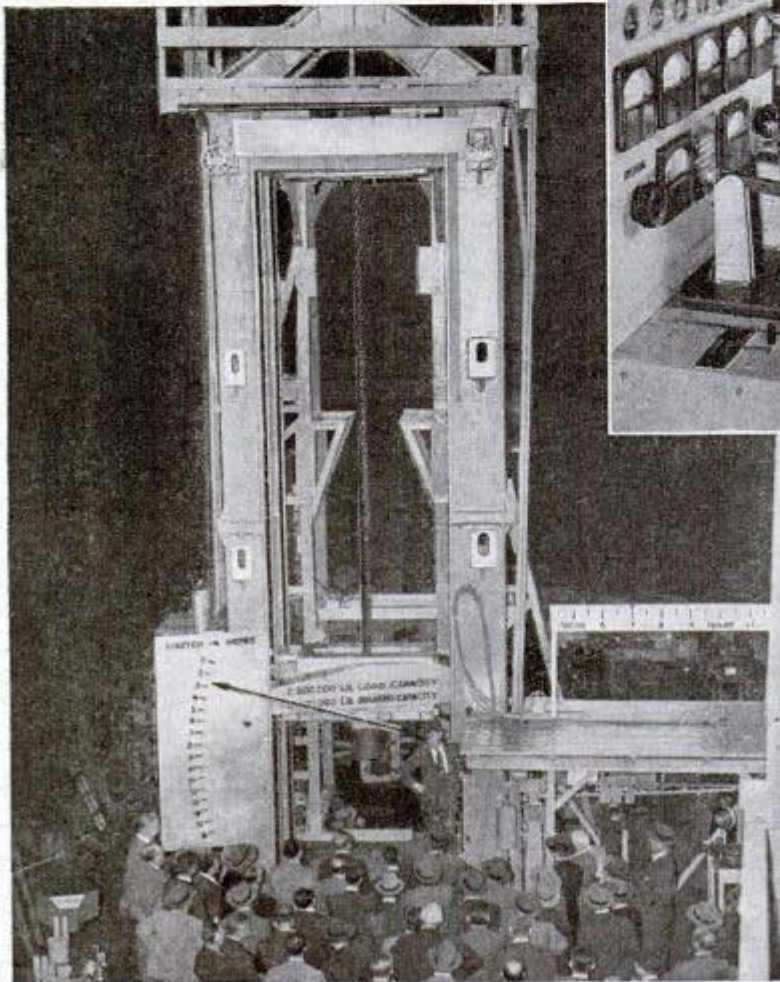




Rear cabin section of a B-29 is given exacting pressure tests to make sure it is airtight. At right, the "trolley car test"; radio tubes which amplify sounds several hundred times are tested by checking performances against meter readings. Below, big steel wire rope assembled in a test machine, ready to be broken

creasingly available to civilians, undergo destruction tests in the broiling Arizona sun, where they pound pavements hour upon hour, are rolled against tire testing abrasion machines and exposed to the weather.

To make the tests tough, Goodyear Tire and Rubber Company overloads undersized tires and runs them 24 hours a day, six days a week, on trucks with special permission to travel above speed limits.



No product is so completely destroyed in testing as glass and few products are so extensively tested. This is particularly true of shatterproof, safety or bullet-resistant types. Steel weights are dropped on tough glass or panes laminated with plastic at Libbey-Owens-Ford laboratories. They crack, cloud up, bend, but do not splinter.

When destruction tests at Libbey-Owens-Ford and Pittsburgh

Plate Glass Company have proved glass will take the force out of a bullet, this type goes into war-planes. It will be used in doors, furniture, autos, planes, trains, buses and utensils after the war.

Seeking a birdproof windshield, du Pont fired fowl at the assemblies at speeds up to 300 miles an hour. The windshields broke, but the fragments adhered to the plastic.

Bausch & Lomb and American Optical Company, producers of safety goggles, drop steel balls on safety glass, shoot metal pellets at it, drop it on concrete and try almost any sensible test to make certain that the glass will withstand concussion.

Owens-Corning Fiberglas Corporation has just established a new testing laboratory equipped for torture tests to gather and collate data on the peculiar properties of glass fibers which have only recently come into widespread use as reinforcement for plastics in making parts for structural purposes in aircraft. The testing laboratory determines the physical properties of pure plastics as well as those of Fiberglas-plastic combinations. Because of the fineness of the fibers, it is necessary to magnify some of them 1,000 times to determine their diameters. These tests will indicate post-war uses of the glass that looks like thread.

Glasslike plastics undergo the same kind of ordeals. The steel ball torture test is

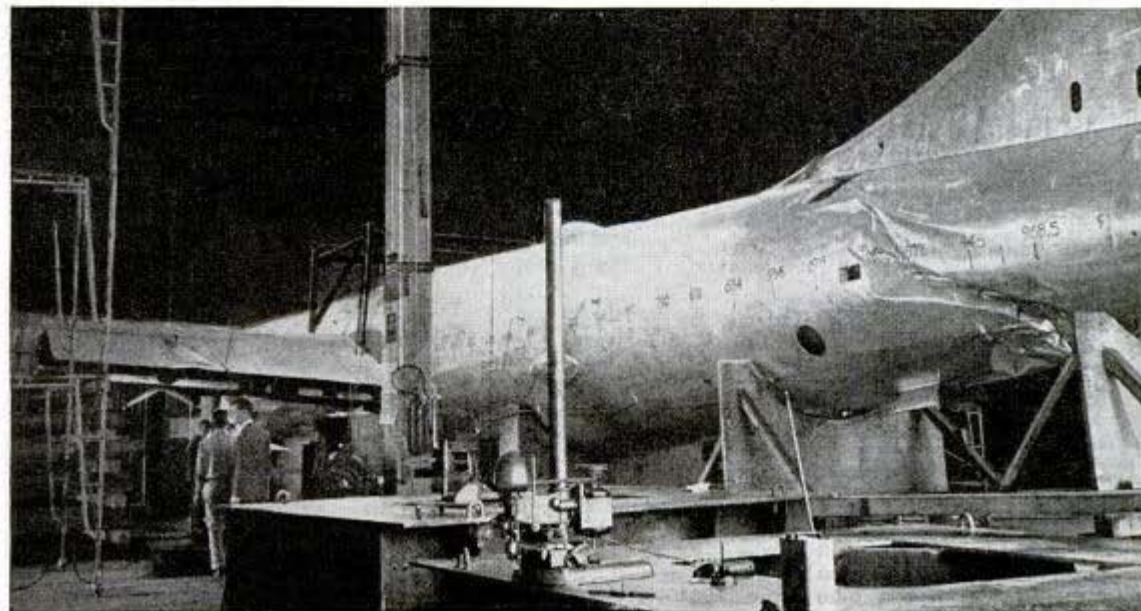


Steel balls are dropped repeatedly on Plexiglas panel to see if it is tough enough to be installed as a blister in bomber

used extensively on Rohm & Haas Plexiglas, which forms bomber noses and blisters. Sixty-below-zero rooms are also used for cold tests of Plexiglas.

Among the metals, no product gets such a going-over as ball bearings. At New De-

This B-29 was deliberately destroyed in a specially made building to check engineering strength calculations





Liberator bomber's brakes are tested at 65 degrees below zero

parture Division of General Motors, steel balls intended for bearings are placed on top of one another in sets of threes. Tremendous weight is applied by a hydraulic ram until one or more of the spheres is crushed. In other tests, ball bearings are burned out because of a lack of lubrication.

Another wartime development in metals was put to substantial test when a super-strength aluminum alloy, developed by Aluminum Company of America after 18 years of research, withstood a compression yield strength stress of 67,000 pounds to the square inch. Eight airplane manufacturers thereupon requested the alloy, which is known as 75S. It is composed 90 percent of aluminum, plus zinc and magnesium.

Destruction testing of alloys, including aluminum, provides considerable research in a special laboratory of Servel, Inc. Engineered to provide sturdy parts for the

Military car flounders through mud at a proving ground to see what punishment it can take

world's fastest fighter planes, the alloys will be used in "the kitchen of the future" being designed for the postwar home.

Bell Telephone scientists never stop testing the cradle phone. One novel machine operates day and night, lifting handsets from their cradles and dropping them back at a rate of 46 times a minute. This compares the strength of various materials proposed for use in the body of the telephone, as well as the durability of different types of springs.

Standard Oil has a roaring laboratory which will burn a lot of fuel and lubricants but eventually will save a lot more. Called a "half-million-dollar crystal ball" through which engineers and chemists may look deeply into the future of superpower from gasoline, it is the first full-scale aircraft engine test stand designed for research on aviation fuels and lubricants rather than the motor.

A 240-ton block of concrete serves as an anchor. A deafening aircraft engine of the 400-mile-per-hour type is hitched to the concrete block while scores of instruments give data on the power and performance of superfuels, including triptane. Some of these new fuels are now made only in laboratories and in such small quantity that actual flight test would be impractical. The test stand is helping to solve the problem of aviation engine knock, the chief limiting factor in aviation fuel performance today.

In the operation of a 1,500-horsepower engine on the test stand, flight conditions are simulated. Huge blowers supply a cooling air stream. Temperatures on and in the engine can be automatically recorded



from 48 points within a minute. Because of the intensity of sound produced by the engine, no one can remain in the test stand room while an engine is in operation.

Wholesale destruction is effected in war-plane plant laboratories, where wings are loaded until they collapse, fuselages are blown up until they burst and nearly every possible crisis met by a plane is visited on new parts.

Boeing Aircraft Company uses a "scientific shooting gallery" walled like a fortress, where B-17 and B-29 guns are given destruction tests. A 20-mm. cannon shell is fired into a box containing 1,000 rounds of .50-caliber machine gun ammunition. The fireworks are terrific, but when they subside, engineers can tell whether plywood, plastic or metal ammunition containers stand up best after a direct hit. To find the ideal mounting device for aircraft guns, Boeing men run tests on all types of guns.

One big problem in a plane is recoil, which is measured by the ballistic pendulum, a swing hanging from the ceiling of the range, on the seat of which the gun to be tested is mounted. Beneath the seat and attached to it is a wheel, which rides along a curved, calibrated track. The gun is fired by remote control and recoil causes it to swing in an arc. The distance the swing moves back and forth is measured by the distance the wheel travels along the track.

A jiglike structure is used so that a gun can be mounted in different ways, simulating actual aircraft installations. The twisting tendencies of the gun during firing, caused by the bullet as it travels down the barrel, can be measured in this apparatus.

Speed of bullets traveling down the range is measured by a chronograph consisting of two screens through which the bullet must pass after it is fired, and a drum on which tape rotates. As the bullet passes through each screen an electric circuit marks the tape. Knowing the distance between the two screens and the speed of the tape, the speed of the bullet can be determined.

In the engineering test laboratory at Consolidated Vultee Aircraft Corporation's Fort Worth division, every structural part and each item of equipment that goes into the mighty Liberator is subjected to grueling tests much more punishing than actual combat. The test lab personnel make their own rain, sunshine, snow, sleet, ice, wind, and sand and dust storms. One machine swirls a man-made dust storm at 1,500 feet per minute against Liberator parts to determine their vulnerability to desert dust and sand storms. Hottest spot in the test lab is the heat test oven where B-24 parts are tested at temperatures up to 400 degrees. The most torrid spot on earth cannot compare with this man-made hotbox.

Pram Wheels Turn Corners To Give Baby Jarless Ride



Tilting the baby carriage to make right-angle turns is unnecessary with a carriage which turns corners automatically. Instead of forcing down the handle of the buggy to swing it around a corner, you merely guide the handle sidewise with the fingertips. Front and rear wheels then turn in the proper direction. Center suspension springs absorb vibration.

In other parts of the laboratory, fatigue testers are bending, pulling and mashing every part of the Liberator structure. To prove that a wing section can stand the gaff, 600,000 pounds of pressure is applied at various portions of the assembly. Pressure greater than that of a power dive is applied to the parts. A diminutive young lady, utilizing a specially designed machine, spends the day hurling cannon balls at various gauge aluminum to ascertain the impact resistance of the metal.

They call these test laboratory technicians "men from Missouri" because they have to be shown. However, to them goes a great deal of credit for the warming message, "All of our aircraft returned."

Chilled Water Refrigerates Dam To Prevent Concrete Flaws



Refrigerating $4\frac{1}{2}$ million tons of concrete daily—that's the job undertaken by engineers to keep the Fontana Dam's face

from cracking. Ordinarily millions of small cracks and flaws would appear in the towering walls of the dam over a period of years as the chemical heat in the mass of concrete cooled off. Such heat may rise as high as 30 degrees above the surrounding temperature and may take 50 years to subside. Artificial chilling cuts this cooling time to two or three years. The cooling is done by pumping an average of nearly 4,000 gallons of chilled water a minute through miles of lateral one-inch piping across the face of the dam walls, from the ground to the top of the 480-foot spillways. Interior concrete temperatures are continually measured by inserting thermometers into pipes imbedded in the walls at intervals, enabling the engineers to vary the flow of cool water to various sections to keep a constant balance. Fontana, which will supply power to five aluminum plants in the area, rises approximately 1,500 feet above the mouth of the Little Tennessee

River. It will increase power production in the Little Tennessee watershed by two billion kilowatt hours annually.

Towers to Relay Radio and Television Shows Designed for Postwar

Electronic relay towers which will make it possible for FM radio and television programs and automatic radio and typewriter messages to be relayed through the air are being planned for the postwar era. A model of such a tower has been built by the General Electric Company and the International Business Machines Corporation.

Planes Built Only of Magnesium Predicted for Near Future

Airplanes made entirely of magnesium are a possibility for the near future, as a result of the success in using all-magnesium wings on Navy training planes, according to J. C. Mathes of the Dow Chemical Company. The use of magnesium alloys has increased so much that the average fighter plane now utilizes about a half ton of the metal. Since magnesium is one third lighter than aluminum, Mathes explained, all-magnesium planes would be notably lighter and therefore make air transportation more economical by carrying bigger payloads without increasing operating costs. Mathes said many Navy pilots told him that the all-magnesium wings, which have been used since early in 1943, impart better flying characteristics to the plane.



WATCH OVER GREENLAND



By E. M. Van Duzer

SINCE its establishment in 1790 the United States Coast Guard has accepted tough assignments in its stride, but even hardened old timers in the service blinked when the Coast Guard was ordered to set up the Greenland Patrol on a year 'round basis.

That "year 'round basis" was the payoff. In other Arctic patrols—notably the Bering Sea Patrol in Alaska and the Ice Patrol in the North Atlantic—the Coast Guard had pulled out of the areas about September to avoid being frozen in for the winter, and returned in June.

The strategic importance of Greenland, however, made an all-year guard imperative. It was too inviting a hop-off point for a possible invasion of North America. A weather base of prime importance, too, it was anticipated that the Germans would try to establish weather reporting and radio bases there.

Coast Guardsmen wade across melting ice, right, in their hunt for Nazi radio-weather bases. Below, capture of the last German outpost

Eyes of Coast Guard Greenland Patrol, planes keep watch for intruders





This Nazi trawler, trapped between grinding ice floes, was found on Greenland's east coast. Piles of arms and supplies were confiscated

One of the first to realize the strategic importance of Greenland was Rear Admiral Ed (Iceberg) Smith, veteran Coast Guard authority on Arctic areas. After two cruises to Greenland aboard the cutter *Northland*, he immediately laid out a plan for patrolling its waters and shores, especially the vulnerable northeast coast. The United States Navy told him tersely to go ahead, and Rear Admiral Smith became

The Germans began trying to establish weather bases early in 1941. The comparatively few intruders found an ally in the terrible Arctic weather and the great expanse of rocky land that offered cover.

With characteristic determination, the Coast Guard kept at its task, and the battle against the Germans—the farthest north fought in this war—came to a climax late last year when the cutters *Eastwind* and

Southwind, new ships on their maiden voyages, closed in on a new 180-foot Nazi armed trawler, also on her maiden voyage. They took the vessel with her crew of 20 men and officers.

The events leading up to the capture had all the drama of a movie thriller. Back in 1941, the *Northland* made the first American capture of Nazis with the taking of the ship *Busko*. In 1943 the *Northland* again helped in the destruction of a Nazi base on Sabine Island, south of Greenland.

Then on September 1, 1944, the *Northland* spotted a German armed trawler weaving through the ice off Great Koldewey Island. She loomed dimly in the early



Left, combat cutter blasts passage on icy stretch of Greenland Patrol

Arctic dawn only 7½ miles away, but separated from the Northland by ice floes. A twisting 70-mile chase began.

The enemy vessel was faster, and managed to keep an average distance of 10,000 yards, which was extreme range for the American's guns. The Northland banged away at the trawler every time she appeared between the floes.

It looked as if the slower Northland were going to lose the German, but suddenly the trawler altered her course sharply to avoid ice. Dodging big chunks of ice like a fullback ducking through a rival line, the Northland outmaneuvered the German and pulled within dangerously close range. Her shells began to fall near the trawler.

Just when it seemed that the German was going to break into clear water, she stopped. Her crew hastily took to the



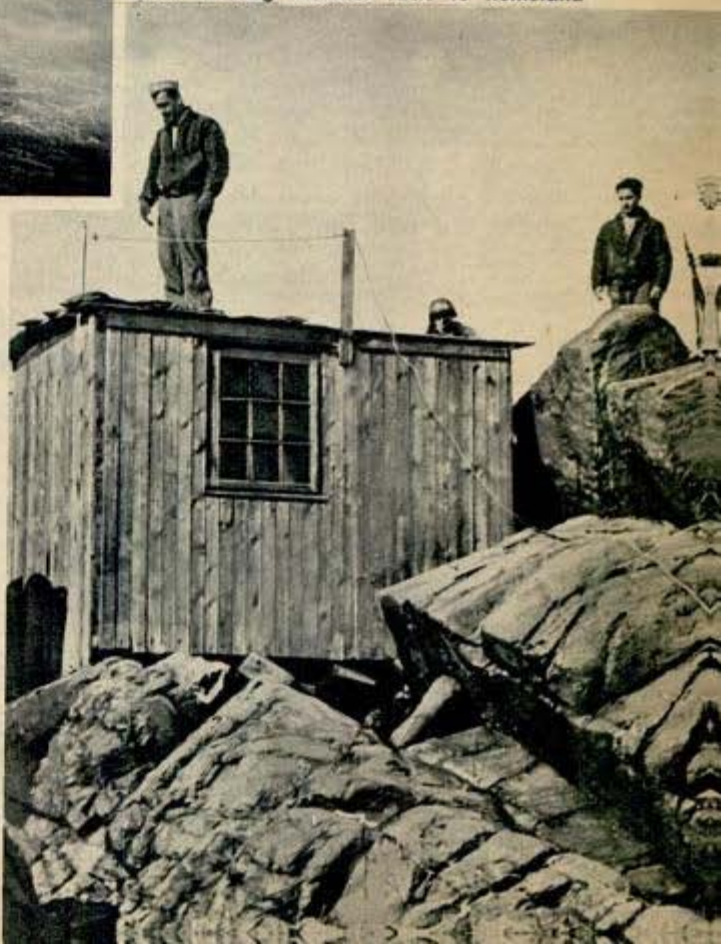
Above, clearing away shell cases after cutter fired 90 rounds in chasing Nazi trawler. Crew scuttled German ship. Left, cutter Eastwind, its rudder visible, keeps rendezvous in hunt that captured another Nazi weather ship. From crude shack below, found deserted by landing force, Nazis had been sending weather facts to homeland



lifeboats. In a few seconds two great explosions ripped the trawler. The Nazis had enough—so they scuttled their ship.

The three lifeboats, with 28 officers and men, pulled over to the Northland and surrendered. Their commander dramatically handed his sword to Lieutenant Commander R. W. Butcher of Jamaica Plains, Mass., skipper of the Northland. The sword now hangs in the wardroom.

Throughout the chase, another Coast Guard cutter, the *Storis*, had been trying to get near the scene of action. Suddenly she heard a roar, and a German Focke-Wulf twin-engined bomber hove into sight. Guns of the *Storis* were manned but the big bomber pulled out of range without attacking, for some unaccountable reason. It is believed that the bomber had been supplying the





Supplies taken from captured German weather base by combat cutter Eastwind are turned over to Danish Sled Patrol, above



Above and below are scenes along shore as the Eastwind gave supplies to Danish Patrol. Cutter caught 12 Nazis in raid



Nazi expeditions which tried to get a foothold in Greenland.

But the Northland's adventures were far from over, for after picking up the German prisoners she broke her rudder. For two days the crew labored to contrive a jury rig, always expecting to see the Nazi bomber come back, or another armed trawler come up. Finally the Northland limped off, screened by the Storis.

Informed of the Northland's plight at headquarters, Rear Admiral Smith put in a hurry call for the two new cutters Eastwind and Southwind. Both ships had just arrived at an East Coast port from Pacific Coast shipyards. They cast off immediately and made the emergency 3,000-mile run to Greenland at full speed. The cutter Evergreen also went along to tow the Northland back.

The speedy Eastwind arrived first at the scene of action, on September 13, and her scout plane joined other Coast Guard and Army planes which were protecting the crippled ship and searching for more Nazis.

About the first of October the German ground headquarters was located. Just before dawn the Eastwind landed two platoons of sailors on Little Koldewey Island, 800 miles south of the North Pole. Creeping up before daybreak, they stormed a Nazi radio and weather station, bagging 12 Germans and much equipment.



Spurred by this success, the search went on. On October 15, the Eastwind's plane, piloted by Ensign Joseph T. McCormack of Seattle, Wash., sighted another Nazi trawler 15 miles off Cape Borgen, Greenland. Captain Charles W. Thomas of Long Beach, Calif., commander of the task force, ordered the Eastwind and Southwind to get the vessel. Off they raced and late that night had plowed through ice fields to where the Nazi had been spotted.

Swinging their twin 5-inch deck guns on the skulking trawler, the two cutters fired salvo after salvo in the eerie Arctic night. A field of swiftly moving pack ice eventually closed in on the Nazi ship.

Her plight hopeless, the trawler finally ran up a white flag. A prize crew of 30 Coast Guardsmen and four officers was put aboard, while the enemy crew of 20 was transferred to the Eastwind. The trawler turned out to be the Externsteine, equipped with de luxe radio and communications systems.

The operations were closed with the Coast Guard complete master of the situation and prisoner of war camps fatter by 60 Jerries—all highly skilled and trained.

Despite its importance, wiping out of the



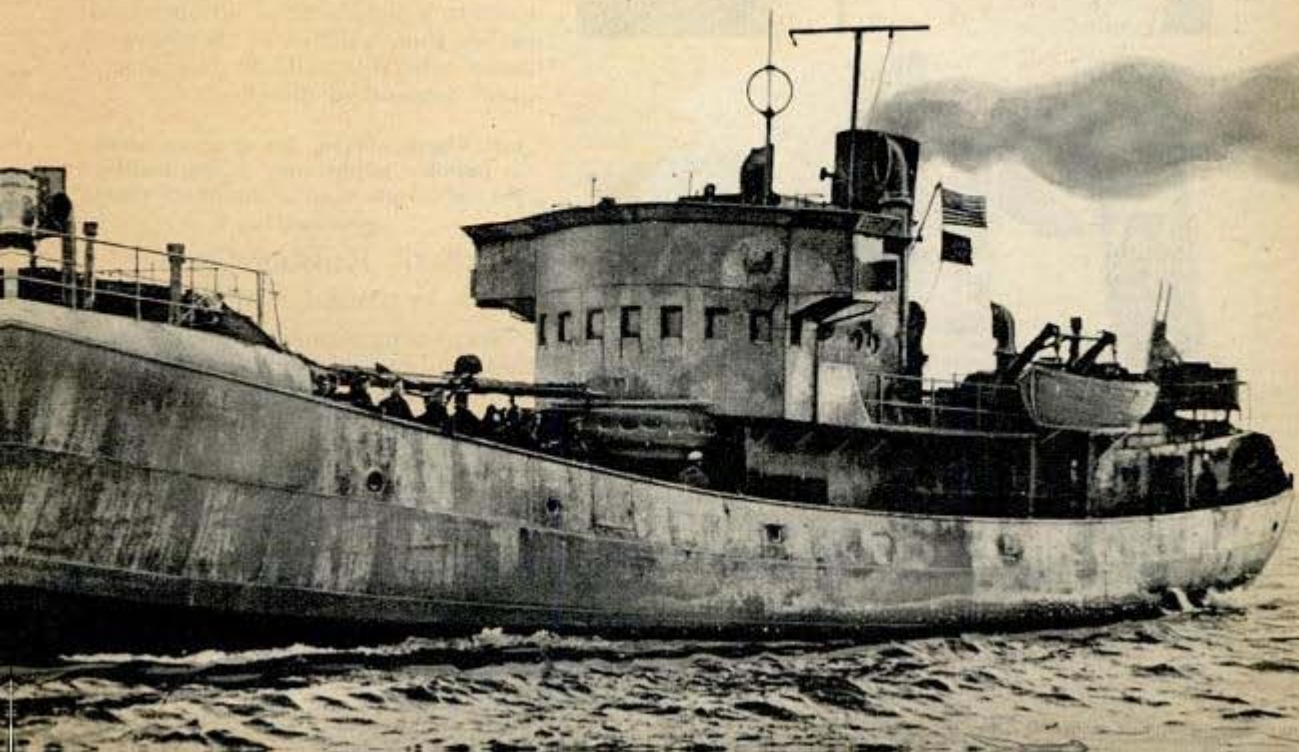
Landing party from combat cutter leaves its small boat on Greenland's rocky coast in action preliminary to wiping out of Nazi weather bases

Germans is not the greatest contribution of the Greenland Patrol to the war. Its most valuable task has been establishing and maintaining bases and routes used in ferrying thousands of planes across the Great Circle route from Canada and the United States to Great Britain. No less important have been the heroic rescues of downed Allied flyers.

Keeping bases supplied and planes flying takes the hardest work and greatest risks in a land where 100-mile-per-hour winds are usual and where cutters are away from their bases for 10-month periods instead of the usual three months.

(Continued to page 156)

Manned by prize crew of Coast Guardsmen, the German armed trawler Externsteine is brought to East Coast



Power Paint Sprayer Shoots DDT Over Lake

Mosquitoes and mosquito larvae, flies and other pests are being killed in astronomical numbers by spraying DDT, synthetic anti-insect compound, over lakes and ponds with a power paint sprayer. In one spraying test the material drifted on the wind for 600 feet before settling to the surface. The tests offer hope that general spraying of water in regions subject to malaria may bring effective control of the disease after the war.



Blood Refrigerator Rushed by Plane To Battle Zones

Whole blood, just as it comes from the donor's veins, is rushed to battle zones in a lightweight refrigerator designed for air transport. The refrigerator consists of a plywood case lined with Fiberglas insulation two inches thick and holding an ice-filled container around which glass jars of whole blood are packed. It is light enough, even when loaded, to be handled by one man. This type of blood, which loses its value in a week, reaches Army hospitals overseas within 48 hours. Regular daily shipments of the loaded refrigerators are being made from San Francisco to Pearl Harbor. Whole blood, rather than plasma, is necessary in cases where a soldier has lost a great amount of blood.

Left, above, packing jars of whole blood in portable refrigerator. Below, loading the refrigerators on a transport plane



Synthetic Rubber Gasket Seals Without Swelling

Surpassing natural rubber, a synthetic rubber gasket which does not swell is used in sealing fuel cans. Because natural rubber swells when high octane gas is in the containers, GIs find the cans hard to open under combat conditions. The synthetic rubber is inert to gasoline and oil, making it easy to open the fuel cans under all conditions.



Air Force Puts Unconventional Planes to Test

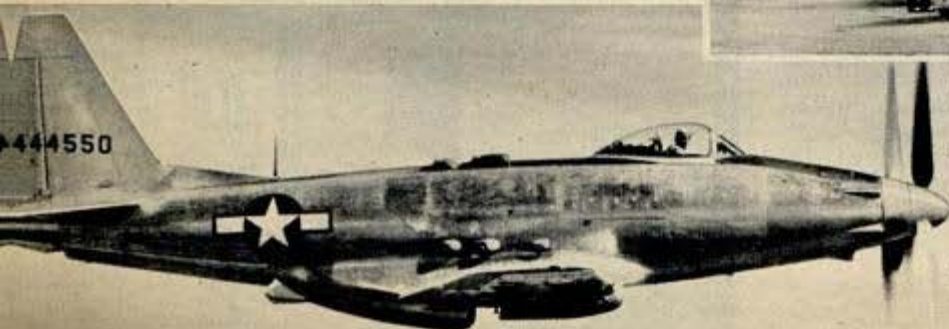
Many an experimental airplane never makes its way into the official AAF roster yet contributes to the evolution of better fighting planes. Designers defy many aeronautical conventions to see if they can produce more power, more maneuverability and greater range. Above is the XP-54, a twin-tail pusher type tried out by the Air Technical Service Command. Pilot gets into and out of plane by raising or lowering seat like an electric elevator



The XP-55 Ascender (above) seems to fly in reverse. Engine and wings are behind the pilot and elevator controls are in the nose tip. Pilot can jettison propeller before bailing out



A bat-winged, twin-engine, long range interceptor, the XP-67 (above), was used to test the flying wing theory. At right, nestling under wing of a B-29, is the XP-77, our smallest fighter plane, an all-wood midget. None of these planes has been accepted by the Army Air Forces



Left, the XP-75 is a composite fighter. It has P-40 wings, P-51 fuselage, F4U landing gear, A-24 tail. Engine back of pilot drives two 3-bladed contrarotating props
AAF photos



BLACK LIGHT BRIGHTENS TOMORROW



IN NEW YORK counterfeitters about to print 5,000,000 gasoline coupons were arrested by the Currency Protection Branch of the Office of Price Administration. "Black light" helped trap them.

On the Atlantic Coast an enemy agent, about to contact spies landed by submarine, was unmasked through a message written in an invisible chemical on the lenses of his glasses. In California aircraft factory saboteurs were discovered through employe identification systems based on the use of invisible symbols on the workers' hands.

Allied night flyers read instruments and maps without ordinary light; Army surgeons are treating severe wounds and infections with far more speed and efficiency, and at home poultry mortality is being reduced by as much as 68 percent. These seemingly unrelated achievements are linked by the one thing that makes each possible: ultraviolet radiation, called black light because most of its rays cannot be seen by the human eye.

Top, a baby giraffe afflicted with rickets is given a treatment with ultraviolet rays. Below, killing germs in a jar of water in less than a minute by inserting sun lamp





Photos courtesy New Jersey Zinc Co.

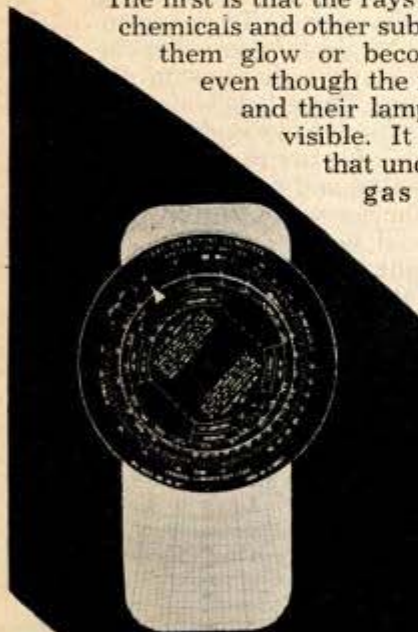
Room with fluorescent pigments in furnishings is shown under ordinary light (left) and ultraviolet light (right)

Ultraviolet rays have two major characteristics which have made them an invaluable tool of war and which promise to make black light "the rays of a thousand uses" in peacetime.

The first is that the rays activate certain chemicals and other substances, making them glow or become fluorescent, even though the rays themselves and their lamp source are invisible. It was this action that uncovered the fake gas coupons, that

trapped the bespectacled enemy agent, and that makes plane instruments and charts glow readably without telltale light to attract enemy aircraft.

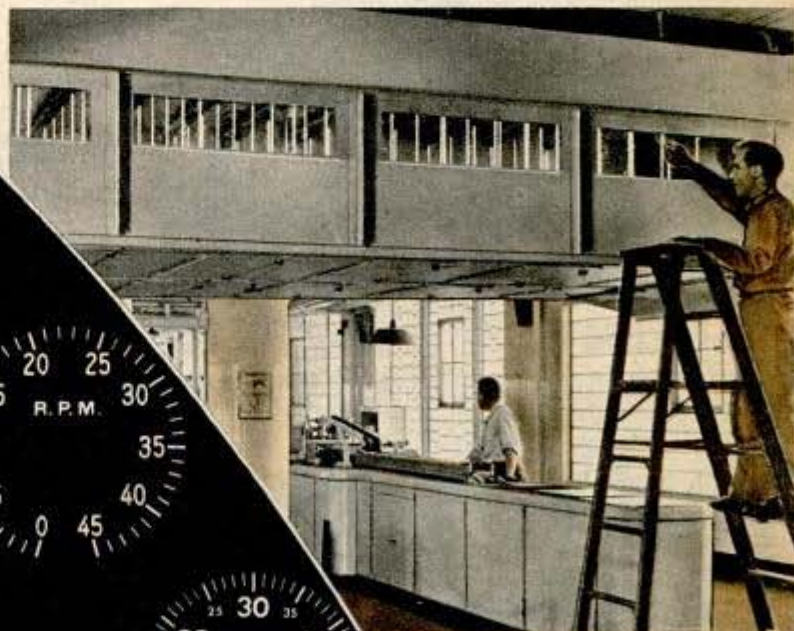
Indirectly, it was this same factor that led to the finding of the aircraft plant saboteurs. Regular workers had the identification symbol stamped on their hands with a secret chemical and were passed in and out of the gates after putting their hands under an ultraviolet ray lamp which made the symbol "light up." The agents, having no such symbol, were detected.



Dial faces, airplane instruments, warning signs and computing devices coated with fluorescent pigments are easily read under glow of black light

APRIL, 1945

WARNING
DO NOT STOP
FUEL SELECTOR
HANDLE ON
SECTOR
PRINTED RED



Westinghouse photo

Above, air duct has ultraviolet lamps to keep air in factory as sterile as possible



Left, fluorescent powders under black light shed eerie glow; right, luminous paint decorates theater

The second characteristic of ultraviolet radiation is its powerful antibacterial action and its ability to give artificial sun-tan. Because the rays activate vitamin D, they are widely employed in food processing and other places where the sunshine vitamin is desirable. In tests by Westinghouse in more than 400 hatcheries, ultraviolet radiation not only killed bacteria on newly-

hatched fowl but also supplied the vitamin D necessary to reduce mortality more than two-thirds and greatly speed up growth.

To the average individual, ultraviolet rays and black light are the same thing, which, substantially, is true. To the scientist, however, black light is "near ultraviolet" or the long wave radiations in the ultraviolet spectrum. These long waves are not harmful to the human eye and thus are particularly suitable for use in display advertising, entertaining and merchandising. Lamps emitting shorter wave lengths usually require special goggles to filter out the rays that might be optically harmful. In most cases, lamps with shorter rays are used for therapeutic purposes.

The term ultraviolet comes from the fact that these rays lie just below the range of visible light in the solar spectrum. Visible radiations are distinguished mostly by col-



Authentic OPA coupons are readily distinguished from spurious ones under lamp at left. Below is an assortment of new type ultraviolet lamps, and at the right a portable "sun lamp" for sun-tan treatments

Photo from Sun-Kraft, Inc.



ors—red, orange, yellow, green, blue and violet—but scientists measure the entire spectrum by wave lengths in terms of Angstrom units. Light is visible to the eye only from 4,000 to 7,600 Angstrom units. Above that is the infrared zone. At 4,000 units, light visible is violet, and below that level, down to 500 units, is the ultraviolet zone.

Full sunlight contains all the rays of the spectrum, but by the time it reaches the earth most of the invisible rays have been filtered out by the atmosphere, heat and other elements. The average sunlight which does reach the earth contains light ranging from 30,000 units down to slightly under 3,000 and thus contains only a small proportion of infrared and ultraviolet rays and none of the other invisible rays.

Ultraviolet ray lamps reproduce various sections of the ultraviolet ray zone in varying degrees of intensity, according to the use for which they are intended. The lamps contain special glass or, preferably, pure quartz tubes, first exhausted to a high vacuum, and then filled to the proper pressure with rare gases, such as argon, neon, helium or krypton, together with a globule of mercury. The contents of the tube are activated by high tension electrical energy, which produces the rays.

Several companies already have installed ultraviolet ray "lighthouses" in their plants to bring artificial sunshine to workers who labor overtime and can't soak up much natural sunshine. This lamp makes it possible for a dozen or more workers to absorb the ray at the same time.

Many manufacturers of clocks, radios, automobiles, home and commercial appliances are considering black light and fluorescent materials to improve the utility and appearance of their design. The Commonwealth Edison Company, Chicago, has installed a complete ultraviolet ray test laboratory to enable food processors to determine the effect of ultraviolet radiation on their products and in their plants.

Great strides have been made in the development of new fluorescent and luminescent pigments for use in paints and finishes. These pigments glow under ultraviolet rays, creating spectacular effects. Two processes utilize this principle for detecting flaws in the surfaces of products and parts made of metal and other materials. The surface is coated with a fluorescent paint, and when the paint is wiped off it remains in the cracks, revealing the defects under black light.

Fluorescent pigments are combined with plastics for greater permanency, the effect under black light being the same as with fluorescent paint.

Ultraviolet lamps are standard equip-

(Continued to page 154)

Shells Pierce Glass Plane Without Exploding



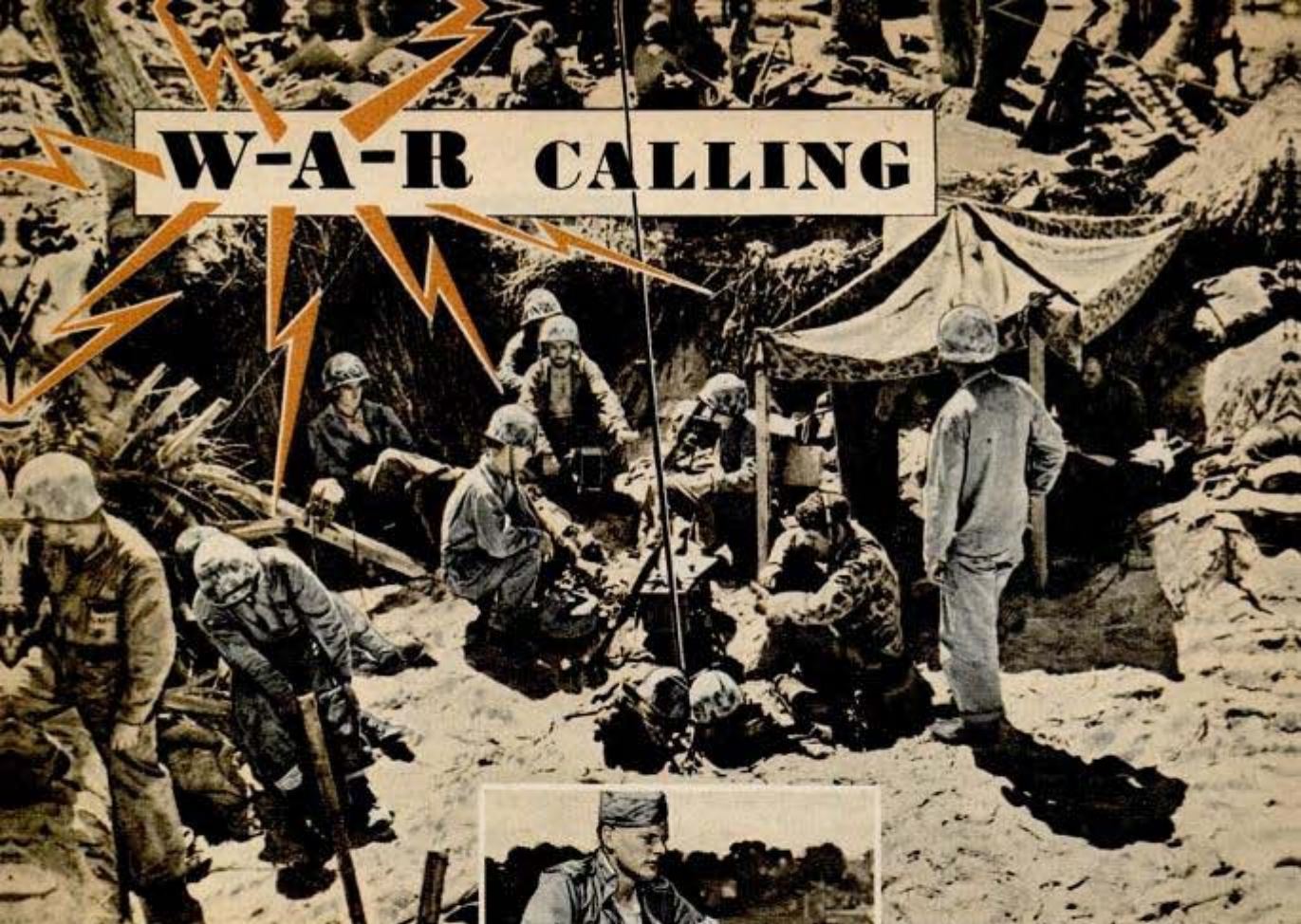
Combat planes, automobiles, boats and buildings of the future may be made of glass fiber, according to the Air Technical Service Command, which has successfully tested a plastic airplane fuselage. ATSC engineers say the glass fuselage is 50 percent stronger than metal fabrication and 80 percent stronger than a plywood fuselage, besides being much lighter and affording superior streamlining. In addition, the resin-bonded cloth doesn't "flower" under gunfire and its low density prevents high explosive shells from detonating. Plies of glass cloth laminated with the resin are laid over a mold and shaped to the desired size and thickness, then transferred to another mold and baked in an oven at 220 degrees for three hours. The rigidity of a balsa wood core between the layers of plastic eliminates the need for all stringers and the majority of bulkheads.

☐ In the last 20 years the childhood death rate for scarlet fever has declined 90 percent and all children's diseases have been reduced by 93 percent, the Metropolitan Life Insurance Company has reported.

Wrapping Up Victory

Without tropicalization treatment, equipment of all kinds vital to our fighters in the Pacific sprouts "whiskers"—fungus growth—overnight. Paper packaging preserves these precious cargoes during long sea voyages. Let's not let the lack of a scrap of paper upset our march to victory. Send your waste paper to war by turning it over to your scrap dealer or salvage committee.

W-A-R CALLING



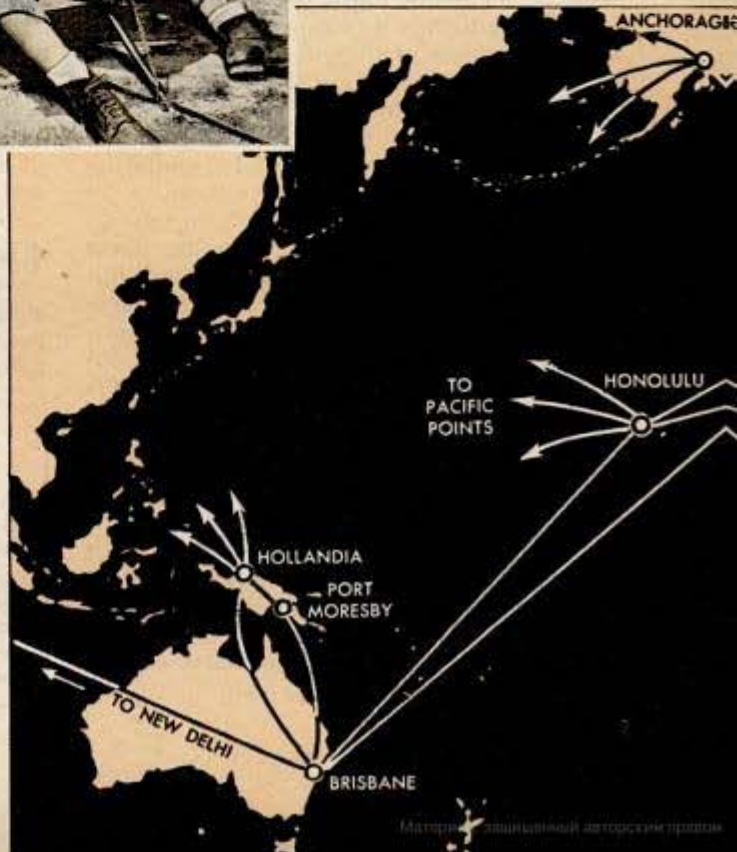
IF Dr. Mars were called in to take the pulse of the greatest war machine in history, he would be sent to one place: the War Department's Signal Center in Washington. Here is the heart of the largest radio network in the world. It is aptly called Station W-A-R.

This signal system enables the General Staff to communicate with an officer in the front lines in a few minutes, or vice versa. Many thousands of vitally important messages go crackling out over the air from W-A-R daily with eight to nine million words handled in a single day.

More than 400,000 words a day are poured out alone by the Army's super-radio station in France, which has direct hookups with W-A-R. The multiple-channel 40-kilowatt station, costing an estimated \$2,000,000, was in operation 25 days after it arrived in France in 1,000 shipping boxes.

The Signal Center, which resembles an immense central telegraph

"Nerve center" on Tarawa, above, is one of numerous battle front communications posts linked with Signal Center Station W-A-R in Washington. Left, Marine-pow-er feeds a short-wave transmitter
Marine Corps photos



office, is equipped with every modern device to speed communications. The receiving room gets the messages originating in the War Department from the code rooms, through pneumatic tubes, directly over the counter and over a local wire net.

Some of the text is "clear," which means it needn't be transmitted in code. This includes Red Cross messages and dispatches from the Office of War Information or the Army News Service for such publications as Stars and Stripes and Yank.

An ingenious two-way belt conveyor system carries the messages to the operators. These messages have priority classifications from "urgent" to "deferred." The latter may be held over night, but "operational" and "administrative" messages are on the air about nine minutes after they are received.

W-A-R is actually not one radio station but a number of one- to 40-kilowatt transmitting and receiving stations. Each transmitter, remotely controlled from the Signal Center, is lined up with a specific receiver somewhere. Each receiver—whether in London, Teheran, Delhi or on an island in the South Pacific—is the center of a small-

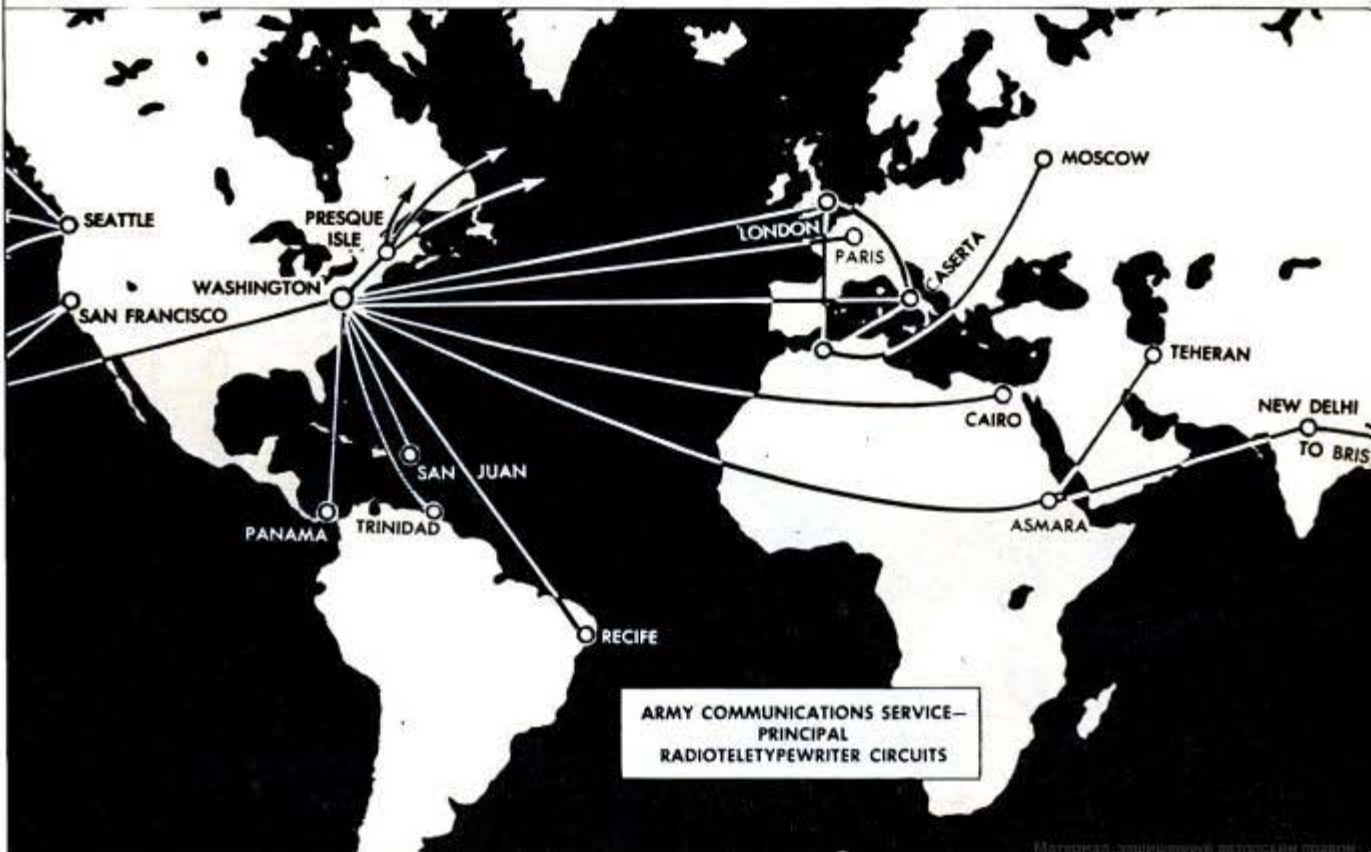


Radiophoto transmission and reception is vital Signal Center activity

er section of the network. These sections narrow down until they reach a combat unit on the battle front.

Suppose, for example, an engineering unit in the Philippines discovers that several lucky Jap hits have destroyed all of a special grease used to protect equipment from jungle dampness. The company commander learns that no more of the grease is available in that theater. He calls his signal officer, and soon a message requesting 500 pounds of the grease is on its way to the War Department via the Signal Cen-

Vast radioteletypewriter network shown on the map permits quick contact between W-A-R and combat zones



ARMY COMMUNICATIONS SERVICE—
PRINCIPAL
RADIOTELETYPEWRITER CIRCUITS



WAC operator inspects tape of Signal Center semi-automatic radio, above. Below is radio interceptor station of a signal company at work on Bougainville
Signal Corps photo

ter in Washington. Marked "priority," it clears the center in less than nine minutes after reception.

Every officer, enlisted man and WAC who handles that message from the front feels that his or her job is about as important as any in the Army. They know anything that will speed the message may mean saving the lives of many fighting men. Every lost minute is a minute gained by the enemy. Perhaps that is why errors by the alert Signal Center personnel are few and far between.

Soon after the message has reached the proper authority, an Air Transport Command plane wings west. Its high priority cargo includes 500 pounds of special grease for the engineers.

One distinguishing feature of this worldwide network is the interconnection of different circuits. If one circuit should suffer from interference, the message is quickly rerouted over another circuit route and reaches its destination with a minimum of delay. This also permits direct communication between the various theaters of war.

After the Signal Center receives a message it is put into "Army procedure" for routing either in this country or overseas. First, the message is punched out in tape form by one of a long line of especially trained operators at perforating machines. Each letter is indicated by an arrangement of holes across the narrow tape, the words averaging five characters. Pneumatic tubes



speed the perforated tape on its way to the automatic transmitters.

If a general order is being sent out, master machines can make up multiple tapes at once. Before each machine is switched into the master hookup, headings for the proper stations are punched into the tape by individual keyboards.

Many high speed machines used at the center have been specially developed. Signal Corps engineers and the best minds in the American communications industry successfully converted the overseas signal system to radio teletype. Considered the out-



Above, WACs work automatic numbering and monitoring apparatus. Left, radiophoto from France

months to permit correction of any possible garbling in transmission. Original copies of messages offered for transmission are retained for four days, then photographed on microfilm. A small cabinet holds six months' records—more than a billion words.

One compact unit developed by the Signal Corps is a miniature signal center in itself. It transmits, receives, numbers and monitors messages. Adaptable for field use, a number of them can be installed to make a sizable center.

(FRANCE) 11/6/44—AMERICAN PARATROOPERS KEEP ALERT EYE ON BUILDINGS OF ST. MERE EGLISE FOR SHNIPERS. (CARROLL, AP POOL) SIGNAL CORPS RADIO-TELEPHOTO, FROM LONDON. #754



standing achievement at the center, this has helped the same personnel of about 500 keep pace with a 150 percent increase in messages during the last year

One machine, known as an Automatic Numbering Teletype Duplex, sends and receives simultaneously; it also numbers each message before it goes on the air. The automatic numbering device alone has speeded up sending by 15 percent.

Every message that goes out is monitored, and the monitor record on perforated tape is rolled on motor-driven reels in the order of transmission. These records are kept on file for three

Enlisted personnel, right, operate one of Signal Center's tandem transmitters





Above, sergeant operates Teletype machine in Kiska message center

Recently, the Signal Center sent a message around the world in three and a half minutes, a new record. No circuits were cleared for its transmission. The four-word message originated in the Capitol. From the Signal Center, it was relayed through Asmara, Eritrea; New Delhi, India; Brisbane, Australia; then from San Francisco back to the Signal Center. The previous record was nine minutes for one word.

Another vital Signal Center activity is the transmission and reception of photographs, maps and charts by radio. This development permits publication here of photos of battle scenes on the very day they occur.

During the invasion of the Philippines,

radiophotos were flashed back to the Signal Center from a Signal Corps radio ship moored off Leyte. This was the first radio ship used in a landing operation. The pre-invasion photographs began flowing into the Signal Center at 6:30 a.m., Oct. 20, and the landing pictures followed with surprising promptness shortly thereafter.

The first photograph of Allied troops landing on French soil was distributed to picture agencies at 11:30 p.m. on D-Day. Earlier that day (5:22 a.m. EWT) a picture showing infantrymen embarking from England in a landing craft was received by radiotelephoto at the Signal Center. During the week of the invasion the center received about 600 radiotelephotos.

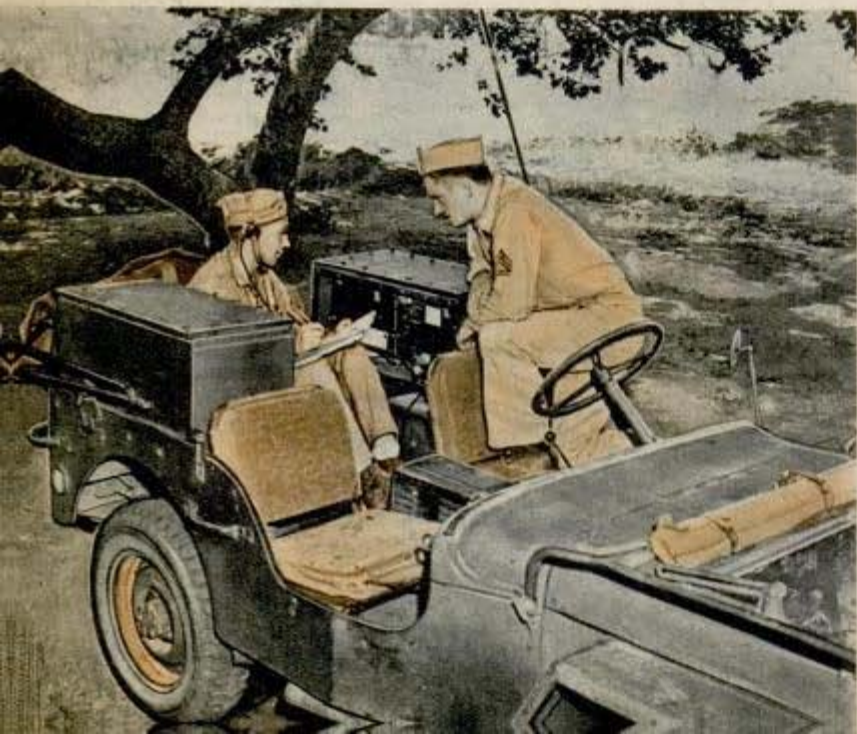
There has been much comment about the excellent quality of the Signal Corps radiotelephotos. Far superior to the blurred prewar pictures of this type, they are the direct result of extensive experiments which began shortly after Pearl Harbor. One single test picture was sent across the ocean more than 100 times while technicians worked on transmission technique and developed an improved telephoto-transceiver.

This compact machine reproduces a picture or chart in negative form with 100 lines to the inch. It is often impossible to detect the difference between the original picture and the transmitted photograph.

Improvements in international communication fostered by the Army Communications Service of the Signal Corps will be carried over into the commercial system after the war. High speed transmitting equipment and the multichannel system used by the Signal Corps will be widely used by the companies that helped Army technicians develop them.

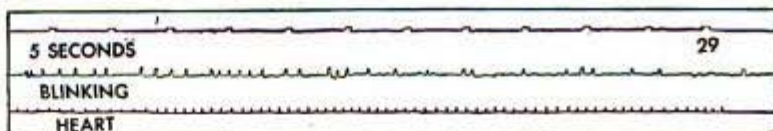
Officers at the Signal Center are confident, however, that one element in communications will remain constant. That is the 4 p.m. to 10 p.m. rush hours. Those are the hours when message traffic, whether civilian or military, always has been heaviest.

Jeep with transmitter-receiver gives combat message training to students

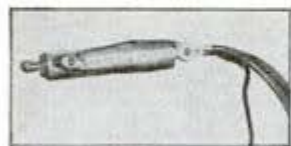


Electrode on Eyelid Records Blinks on Graph

In an experiment to test reading efficiency under various lights, frequency of blinking and heart rate were recorded at Cornell University, Ithaca, N. Y. Continuous recordings, divided into five-second intervals, were made by an ink-writer of the action of heart and eyelid muscles. A small silver electrode was taped just below the brow of one eye directly over the eyelid. The companion electrode was clipped to an ear lobe. When the eyelid muscle contracted to close the lid it produced a deflection which was recorded on the graph. The experiments were conducted by M. E. Bitterman and T. A. Ryan of the university faculty.



Jogs in upper line of chart at top denote five-second intervals. Middle and lower lines show relation of blinking and heart beats to time intervals



Midget Hydraulic "Squeeze Gun" Exerts 1,000-Pound Pressure

Although it can be carried easily in the hand, a hydraulic press with a 1½-ton capacity exerts pressures up to 1,000 pounds per square inch. Equipped with offset platen and ram, the tool accommodates special adapters so that it may be used for pressing bushings and pins, riveting, dimpling, and similar tasks. Its working stroke of 1½ inches is controlled by two ball-type switches. The gun is so small that it easily reaches places normally inaccessible to power tools. It gets its power from a standard hydraulic power unit.

"Jungle Jeep" With Cargo Platform Can Be Led, Driven or Followed

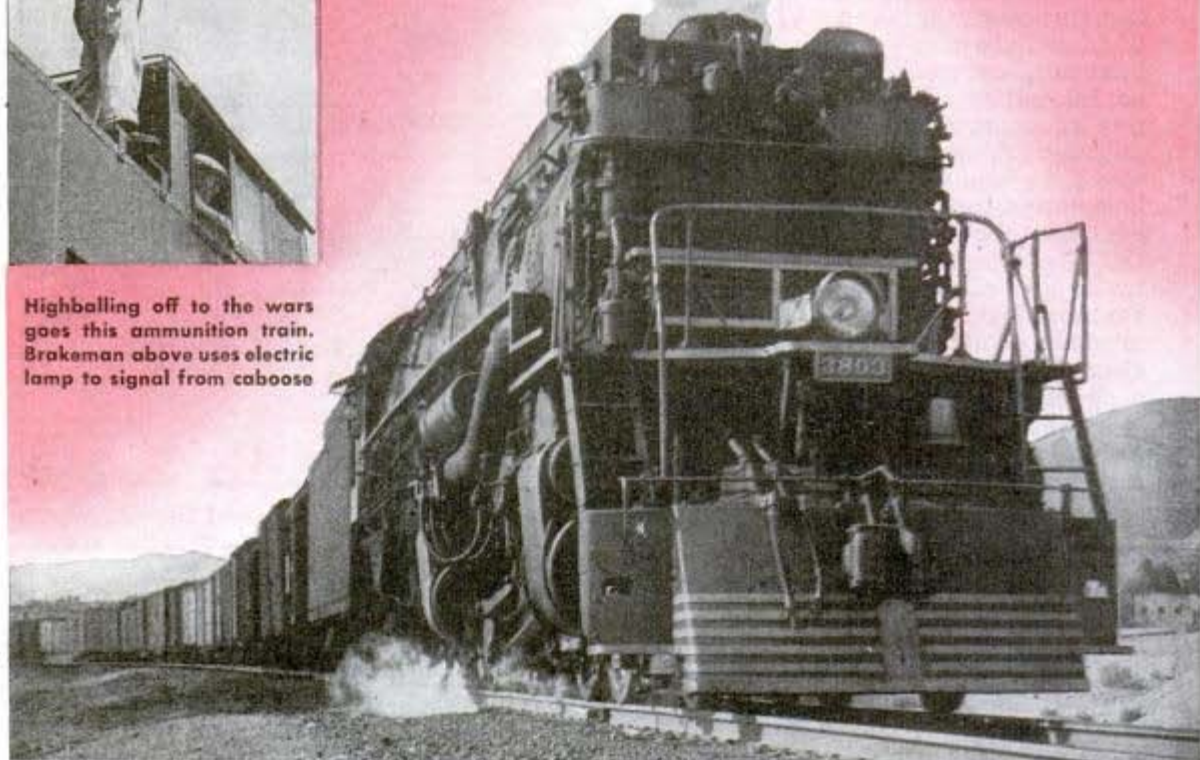
Like a mechanical mule, the Army's "Jungle Jeep" can be led, driven or followed as it traverses rough terrain. With its engine underneath its chassis and a flat platform for cargo instead of seats, it can carry 800 pounds of cargo to areas too difficult for larger trucks. A motorcycle-type hand throttle and a hand-operated lever brake mounted on a swivel tiller bar replace the steering wheel.



TNT SPECIAL



Highballing off to the wars goes this ammunition train. Brakeman above uses electric lamp to signal from caboose



By Thomas E. Stimson, Jr.

THE WORLD'S hottest cargo has been riding the rails.

Practically every blockbuster bomb, every high explosive shell, and every torpedo "delivered" to his enemies by Uncle Sam made part of its trip by railroad.

Millions of tons of destructive materials have been moved from inland storage depots to ports of embarkation since the war began. Incendiary bullets, phosphorus bombs, hand grenades, and rocket shells, to mention only a few types, have been transported secretly, swiftly, and above all, safely.

The story of how America's railroads have performed their ticklish job is told here for the first time.

Several freight trains having a total length of some three miles are required to supply the bombs dropped during a single 1,000-bomber plane raid on Germany. One naval engagement may expend as much munitions, or more. Day-to-day requirements of the fighting fronts alone demand

an immense and ceaseless flow of ammunition of all kinds. Almost all the nation's railroads have had a hand in moving munitions to deep water.

Train crews take no chances. "Take it easy tonight, Jim," a freight conductor cautions as he hands his orders to the engineer. "We've got enough high explosive on board to wipe out a city."

Actually, military explosives are relatively inert in the forms in which they are shipped, but this is one type of freight with which familiarity does not breed contempt. Special orders advise all train crews, including those of helper engines, when they are carrying explosives.

A car or two of ammunition may be found in almost any freight train. If heavy movements are scheduled, whole ammunition trains may be made up. In either case the trains move at regular speeds. If an urgent order for several hundred tons of shells or bombs comes through, as occasionally happens when a convoy's schedule must be met, regular rail traffic may be sidetracked to allow an ammunition special to move along with no delays.

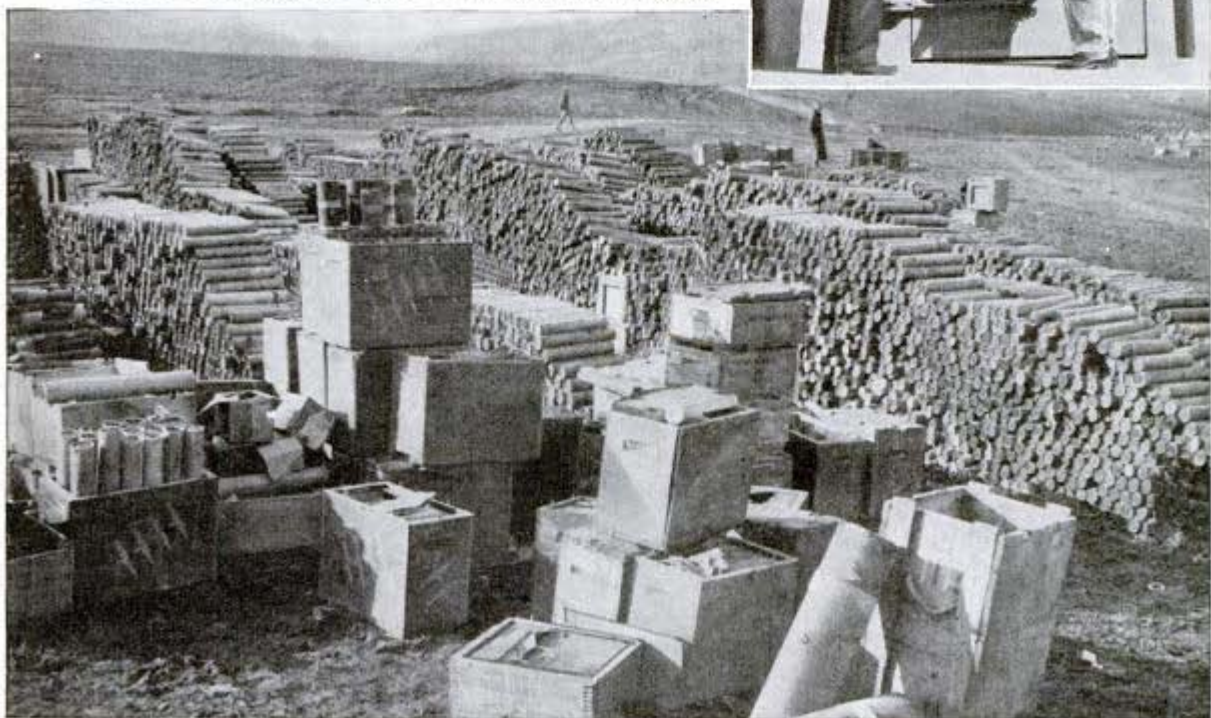


Hauling bombs and "ammo" at express train speeds is permissible because the munitions are protected by numerous safety measures. The Interstate Commerce Commission, the Bureau of Explosives of the Association of American Railroads, the military services concerned, and the carriers all have special rules, rigidly enforced.

First, the so-called Class A explosives can be moved only in certified closed cars that have been swept out, that have no holes or cracks through which sparks might enter, that have no exposed metal in the interior, and have operating gear in first class shape.

Right, military inspectors check seals of ammunition "igloo" which stores shells underground at point of transshipment. Below, 37-mm. shells are piled up at dump near railroad

Yanks in France employ mass production methods for handling huge quantities of ammunition pouring in from across the sea





In case of fire, grab Mike. Note the aerial, above, on Diesel switcher cab in arms yard. Right, engineer tests his radio equipment

These certified cars are loaded according to regulations that define how each kind of shell or explosive must be carried. Bracing prevents all movement of the cargo from the ordinary shocks of transportation. Large bombs are secured separately so they can't bounce or move around.

The loading is supervised by both military and railroad inspectors, who check each other. All cars are then posted with large red-lettered "Explosives" signs on all four sides. The signs are removed at once when the munitions have been unloaded, to keep train crews from becoming careless if a posted car is found empty.

Cars that carry a red "Explosives" sign are never coupled directly to an engine and tender. A buffer car, possibly an empty, is placed between. During switching operations in a yard an explosives car always is protected by a buffer car at each end. A car loaded with ammunition spends as little time as is practical in transit. When one must be switched to a siding, it is placed to require the least possible handling.

Other rules govern the location of ammunition cars in a train.

They are placed preferably in the center of a string of cars. They are never placed next to a loaded tank car, or next to a car loaded with metal pipe, lumber or poles that might break through the end of the explosives car. An explosives car must not be placed next to another that contains lighted heaters, stoves, lanterns, or automatic gas-burning refrigeration. The crew of an ammunition train signals with electric lamps instead of open-flame lanterns.

Ammunition cars must not be cut off while in motion, must not be handled when their doors



Freight cars below were saved from detonation by earth reventments when ammunition ship blew up at Port Chicago, Calif.



are open, and must not be placed under bridges or alongside passenger sheds. Engines must not stand opposite or near them on parallel tracks.

En route, ammunition cars are inspected at every stop for mechanical defects and to make sure that their placards are still in place. Passing crews make a special check for hotboxes on ammunition cars, and the train is stopped at once if a hotbox is signaled.

Ammunition cars usually are delivered to the interchange point of a special military installation adjacent to a port of embarkation. Here similar and additional precautions against disaster are taken.

Such a holding area often covers many square miles and is fenced, guarded, and patrolled against all unauthorized visitors. No smoking is allowed inside except at certain designated points, and no one carries matches.

Before a car is accepted at the interchange point military inspectors examine the exterior thoroughly, inspect its seal for tampering, and look for booby traps that might have been placed on the car en route.

Upon acceptance, a Diesel switcher moves the cars, with buffer

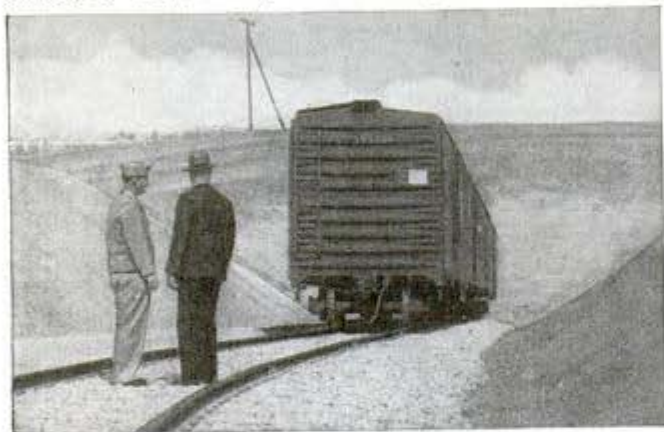


Above, Yanks use crane to load truck with ton bombs marked "Do Not Open Till Berlin." And below, Port Chicago is proof of what happens when a slip-up occurs





Carried safely to its destination by America's railroads, ammunition car is about to have its seal broken by storage yard employee. Explosives placards identify all munitions cars



Above, ammunition cars stored between revetments on siding till needed at dock. Earthworks keep blasts from spreading. Below, girl with elevator truck unloads munitions at a dock



cars in-between, to special sidings where they are stored untouched until the hour they are needed for loading an ammunition ship.

The sidings are protected by huge revetments or earthworks that isolate each storage track from its neighbors. Should a car blow up, the damage would be confined to its own short string of cars without affecting those on the other sides of the revetments.

Everybody employed in these transshipment areas, from the interchange point right down to the docks, has emergency duty to perform if fire or explosion occurs. The big Diesel switchers are equipped with short-wave two-way radio sets, connecting the engineers with the area's security headquarters. In case of fire near ammunition cars, the Diesels could be ordered by radio to rush to the scene and yank the cars out of danger. All transshipment points, too, have large and well trained fire departments. Few fires occur, but even a small one could be disastrous if it reached ammunition stored nearby.

A train wreck is one thing that the crew of an ammunition train fears most, for a wreck may lead to fire which could ignite one shell in a car, thus starting a larger explosion. Few such cases have occurred since the war began, fortunately.

Only recently, a New Mexican was seriously injured near his home when a car of bombs exploded in a train at the Tolar, N. M., siding. The blast, heard 43 miles away, demolished several buildings at Tolar.

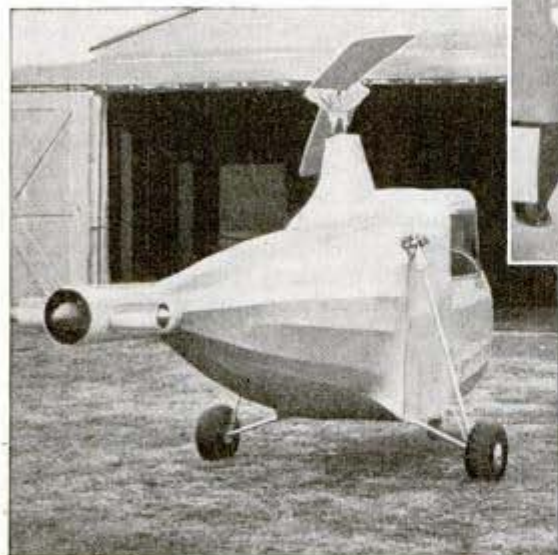
The railroads have adopted every practical safety measure to safeguard explosives shipments, and others always are being sought. No one is ever apt to find out what happened at Port Chicago, Calif., last July when a freighter being loaded with ammunition blew up. Three hundred persons were killed and hundreds more were injured. The explosion occurred outside the jurisdiction of the railroads, but it shows what can happen anywhere when something goes wrong. Everyone concerned with the movement of explosives is doing all that is humanly possible to prevent a repetition of that disaster.

Jet Propelled Helicopter Has Only One Rotor

Powered by jet propulsion, a helicopter developed by Antoine Gazda, inventor of the 20-mm. Oerlikon anti-aircraft gun, is said to have greater speed than helicopters of orthodox design. The Gazda "Helicospeeder" has no antitorque rotor. Other features of this craft are increased weight-carrying capacity, greater stability, and simplified controls, according to the inventor. In piloting the Helicospeeder or other



Inspecting simple controls in the cockpit of jet "Helicospeeder." Left, odd tail nozzle ejects hot gases



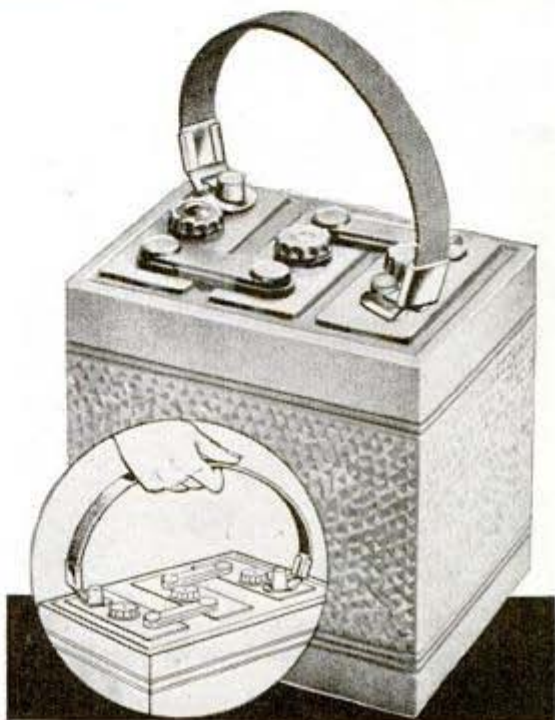
jet propelled craft, such as the AAF jet fighter, the principal problem is learning how to operate a simplified machine. There are few dials in the cockpit of a jet fighter and one throttle does most of the work. Jet propulsion motors are said to be almost free from vibration—a major concern of aeronautical engineers.

"Safety" Battery Carrier Eliminates Danger of Dropping

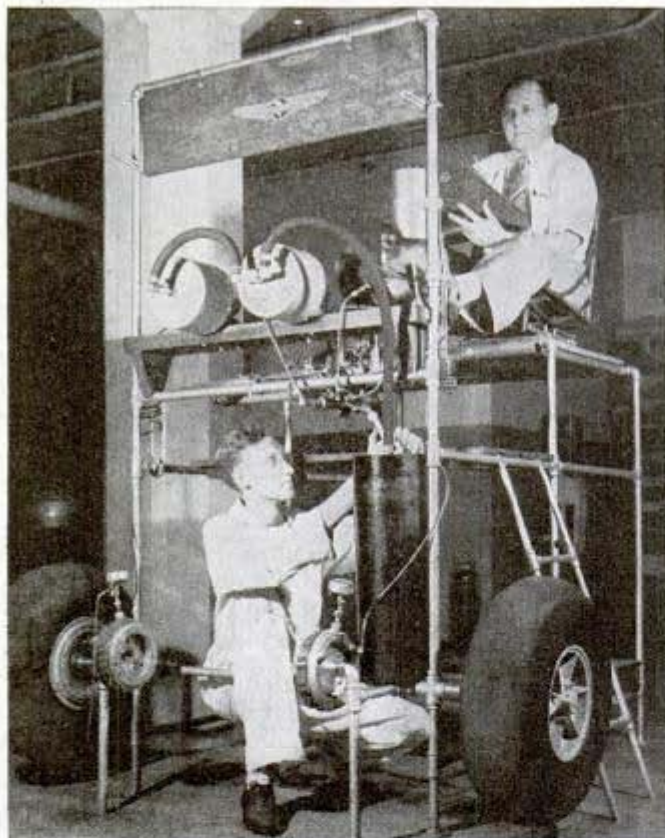
Automobile batteries can be carried easily and without danger of being dropped with a carrying handle that applies tension to the posts before the battery is picked up. It consists of a rubberized strap with metal ends of a universal type that fit interchangeably over either positive or negative posts and lock in place with a constant grip that will not let go accidentally. The easily attached handle remains rigidly curved above the battery and will not sag. This carrier is available for both regular size and long batteries.

Eggs Kept Edible for a Year By "Flash Boiling"

Eggs can be kept fresh for a full year by a "flash boiling" treatment developed at Cornell University. The method consists merely of plunging the eggs into boiling water for five seconds, letting them cool and storing them in a refrigerator, where they will remain edible for a year. Eggs thus treated may even be kept without refrigeration, but only for about six months.



Packaged Unit Steps Up Brake And Lightens Pedal Load



Available in a "packaged" unit for easy installation, a brake intensifier increases the hydraulic brake pressure at the same time that it lightens the foot pedal load. This reduces driver fatigue. The unit consists of only eight working parts and re-

placing units and can be used on planes, trucks, buses, tractor-trailers, and other heavy duty vehicles. The unit can be attached to any convenient part of the chassis. The manufacturer says it will work efficiently even when held in the lap.

Colored Magnesium Sofas Won't Show Scratches

Magnesium furniture so light that children can move it easily is predicted by N. H. Simpson, chief chemist of a Consolidated Vultee Aircraft plant. Simpson explained that wider use of magnesium is practical because of a protective finish developed during the war which makes the metal noncorrosive and gives a harder surface than aluminum alloys and wood. With the new process, magnesium may be used in building refrigerators, sofas, tables, big chairs and other ordinarily hard-to-budge furniture. Since magnesium is one third lighter than the lightest aluminum alloy, a housewife could lift a magnesium dining room chair with one finger or move a refrigerator without assistance, Simpson pointed out. The finishing treatment is simple. After degreasing and removal of a film coating, magnesium parts are connected either to alternating or direct current, after which they are rinsed. The finish can be obtained in any color.

Player Rolls Spares and Strikes With Dice in Parlor Bowling Game



A dice game which simulates "bowling" at home uses ten wooden dice, each of which has a bowling pin painted on one of its sides. After the dice are shaken and thrown, those showing the pin on top are returned to the cup and the player is given a second throw. The game is scored on a regulation bowling tally sheet.

Plastic Goggles Filter Sun Rays Without Reducing Light

Plastic goggle lenses which have been treated with a synthetic chemical by the Polaroid Corporation, Cambridge, Mass., transmit as much light as a windowpane while absorbing more than 99.9 percent of the sun's ultraviolet radiations. This chemical, which is classified as an azine, is expected to be used as a filter in military visual instruments such as range finders and gunsights.



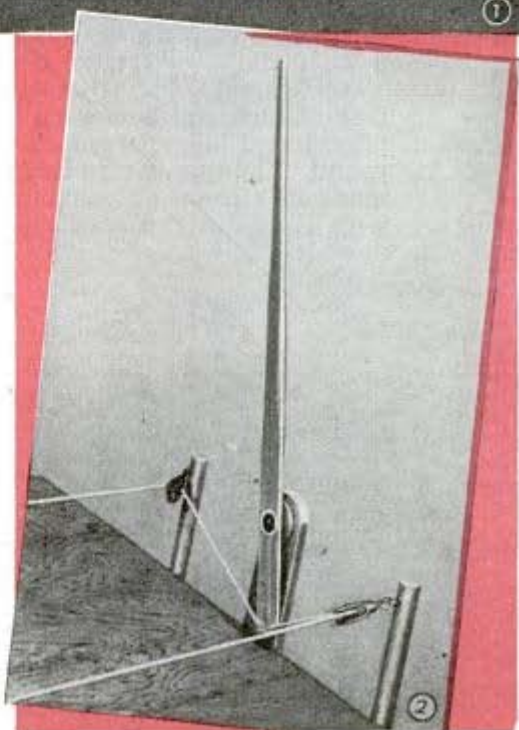
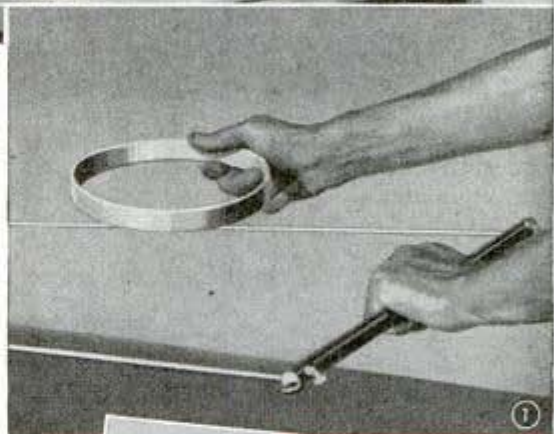
The Craftsman

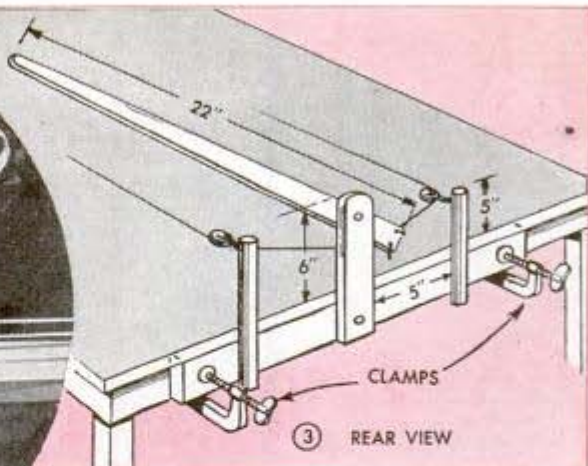



Double-Action QUOITS GAME *has movable stake*

YOU'LL have a lot of fun and excitement with this modified quoits game because the stake at which the quoits are aimed can be moved back and forth like the hand of a dial indicator to help catch the quoits. The stake can be operated by the player as in Fig. 1, or by a teammate as in Fig. 3. In the latter case, it is permissible and also productive of better results for the player moving the stake to use both hands. When only two persons are playing, each player must throw with one hand and move the stake with the other one. When two or more persons are playing as a team the player operating the stake stands to one side of the table, taking care not to move the stake unnecessarily in the excitement of play.

The game can be played indoors or out. If played indoors, the equipment can be mounted on a table by means of screws or clamps. The larger the table the better, but one measuring less than 3 by 6 ft. should not be used. Part of the fun lies in the fact that it is impossible for a player who is both throwing and moving the stake to step in closer than he should, for when he attempts to do so the cords slacken and the stake cannot be moved. This is an especially important point when the game is played outdoors with no table. When two players are paired off, one to throw and one to move the stake,





both should stand an equal distance from the stake. Fig. 2 shows how the stake is rigged on a table, and Fig. 3 gives the dimensions. The rigged assembly consists of a wood block to which the stake is pivoted, and two short dowels to support the pulleys, all being nailed to a wood strip. Long cords tied to the bottom of the stake and run through the pulleys complete the assembly. A length of $\frac{1}{2}$ -in. dowel or broomstick tied to the free ends of the cords simplifies operation of the stake.

The quoits can be made of 1 by $\frac{1}{8}$ -in. strips of hardwood. Soak them in water, bend them into hoops with the ends overlapping and lash the joints with cord. Make three sizes, 6, 9 and 12 in. in diameter.

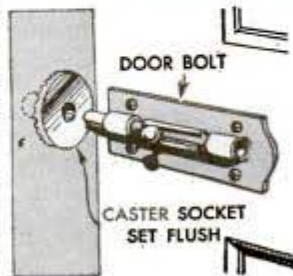
One of each size is enough for play, but a few spares will be useful. The quoits also can be made of strips of sheet metal with rivets in the overlapped

joints. When metal is used be sure to smooth the sharp edges. If the game is played outdoors on the ground, double the size of all equipment and attach the pulleys and pivoted stake to stakes driven into the ground.

Each player has three shots, one with each of the three sizes of quoits. Ringing with the largest counts five points, with the middle size, 10 points and with the smallest quoit 20 points. The winner is the one with the highest score at the end of seven rounds or innings. In the event of a tie at the end of the seventh round, continue play. The throwing player has the right to choose which of his teammates shall move the stake for him. The throwing player must not step closer to the stake than the player who is moving it. A chalkline or a tape is useful in keeping the thrower at the proper distance. If he steps over the line it is a foul and his side is penalized 10 points.

Metal Socket to Take Door Bolt Prevents Wear on Frame

When a door bolt is locked by merely sliding the bolt into a hole drilled in the wood frame, the hole is soon enlarged by wear so that the bolt makes a poor fit. A simple way of avoiding this condition is to set a caster socket into the frame flush with the surface so that the bolt will slide into it. This provides a long-wearing socket that assures a tight lock.

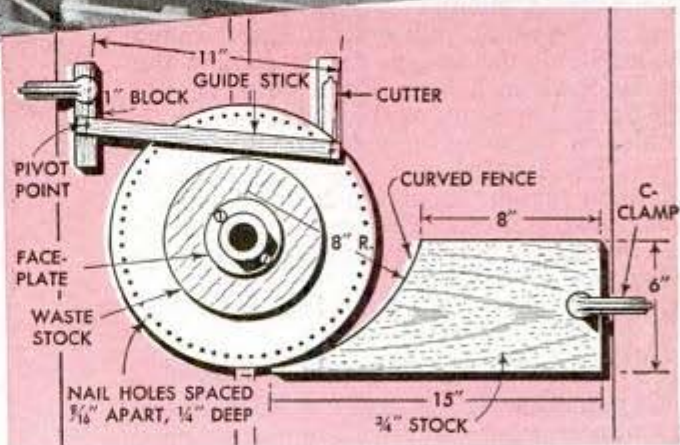
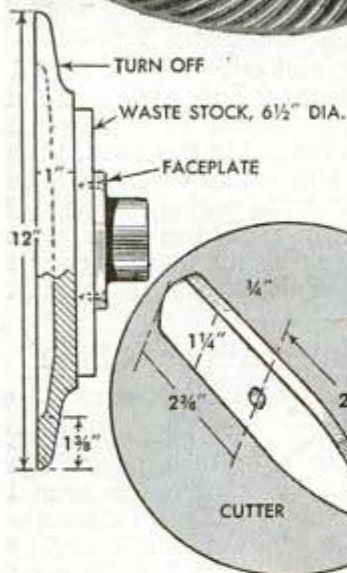


Fred R. Jones, New Kensington, Pa.



CURVED FLUTING

Rims This Plate



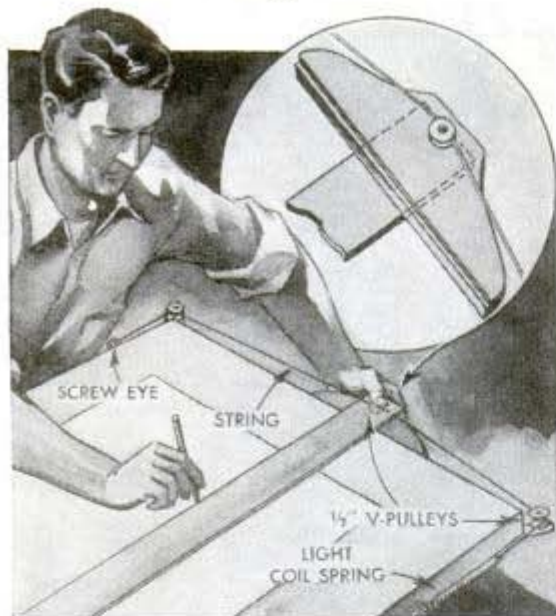
RIMMED with a wide band of curved fluting, this plate is an example of the graceful work that can be done on a circular saw and a lathe. Stock is a 12-in. disk of 1-in. hardwood such as walnut. First, true one surface on the lathe, then remove the disk and glue a piece of waste stock to the trued surface. After this, remount the work and true the edge and face, as shown in the detail at the left. Next, run a pencil line around the rim about $\frac{1}{4}$ in. from the edge and, using a nail, punch holes about $\frac{1}{4}$ in. deep and equidistant along the line. Distance between holes will measure about $\frac{3}{16}$ in. Now prepare a cutter like that in the circular detail, a guide stick like the one in the lower detail, and mount these on the saw as in the photo. By sliding the disk, face down, along a special curved fence and over the cutter, the spiral flutes will be routed in the rim. When this is done, remount the plate in the lathe, turn out the inner portion and underside of the back,

and sand these surfaces carefully, after which you can turn off the waste stock and sand the bottom by hand. Give the work two coats of shellac, rubbing well with fine steel wool between coats.

Benj. Nielsen, Aurora, Neb.

ⓘ When installing new spark plugs, be sure they are tightened correctly. If too loose they will overheat, and if too tight the electrodes may become distorted and the insulators may break. When a torque wrench is not available, screw in the plugs finger-tight, then tighten them one half to one turn with a wrench.

String-and-Pulley Arrangement To Hold T-Square in Place

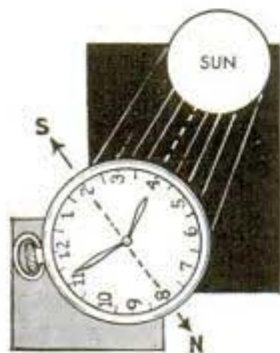


Here is a simple way to hold a T-square at any desired position on a drawing board and yet have the square so that it can be moved up or down easily. As shown in the drawing, small V-pulleys are mounted at the corners of the board and also on the T-square. A string run over these pulleys and anchored at both ends to the drawing board holds the square firmly against the end of the board. A small coil spring should be used at one end of the string to keep it under tension, and the pulley on the square should be located so that it projects about an inch farther from the board than the other two pulleys. The square can be removed from the string and used in the regular way when desired.

W. W. Cary, St. Paul, Minn.

Watch Is Substitute Compass

If you are ever lost in the woods without a compass, your watch will serve as a good substitute provided you can see the sun. Just point the hour hand toward the sun,



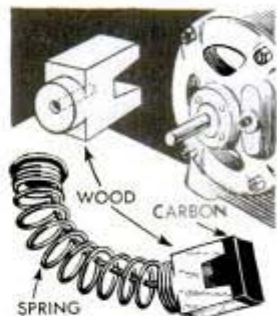
taking care that the shadow of the hand falls directly below and very slightly in front of it. A twig or piece of paper may be used to extend the hand, especially on a wrist watch, thus lengthening the shadow and assuring a more accurate reading.

A line bisecting the space between the hour hand and 12 o'clock will point north and south, as indicated.

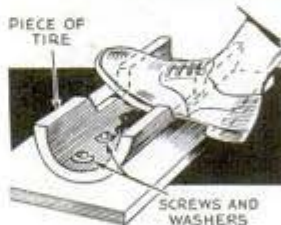
Stanley J. Drazek, Fort Myers, Fla.

Emergency Repair for Brush In Electric Motor

If you break a brush in a small electric motor, and a replacement is not at hand, here is one way that an emergency repair can be made until a new brush can be obtained. Just shape a piece of wood to slip into the brush holder, slot one end and round the other to take the brush spring. Then shape the commutator end of the broken brush to slip into the slot in the wood. This will lengthen the brush so that it can be used. Be sure that the carbon portion of the repaired brush makes good contact with the holder so that the electric circuit is not broken.—Frank Skalla, Niles, Mich.



Portable Foot Scraper Is Safe And Easy to Clean



Besides being safe to use where there are small children, this rubber foot scraper can be cleaned easily merely by turning it upside down. To make it,

just cut a piece from an auto tire to the shape indicated and screw it to a hardwood block, using washers under the screw heads to prevent them from pulling through.

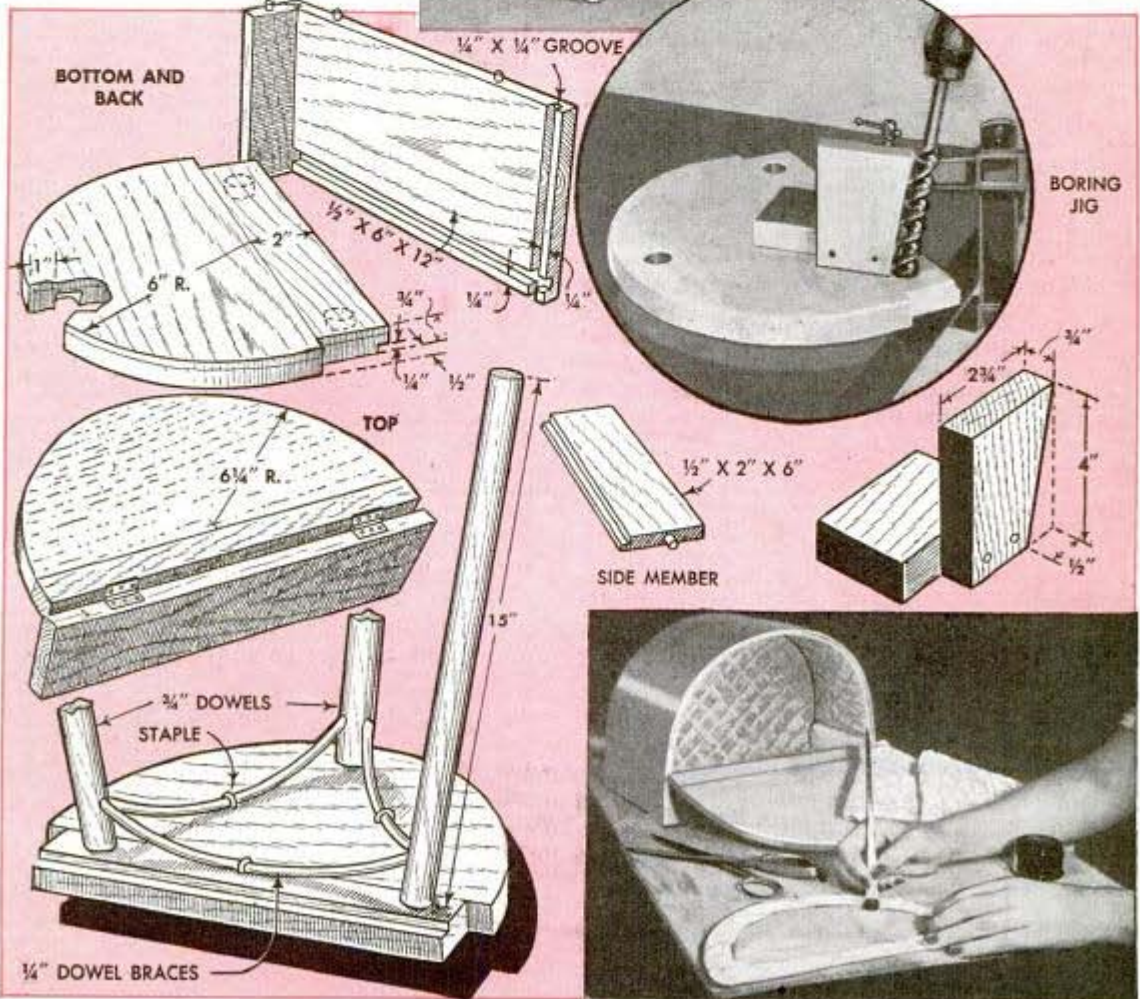
Shellac, when used for gluing, can be made heavier and much more tacky by pouring the desired quantity in a saucer and then burning off the alcohol.

TELL YOUR FRIENDS

through the medium of Popular Mechanics just how you solved that little tricky problem encountered in your home, work or hobby. Money and labor-saving ideas, shortcuts to do things quickly and more efficiently, wrinkles that others will appreciate knowing—that is the kind of information we try to pass along on these pages. Just send us a clear sketch or photo with a brief description giving the essentials. For those ideas that are suitable we will send you a check. Those we cannot use will be returned. Address Homecraft Editor.

Chairside SEWING BOX

YOUR sewing accessories for doing those last-minute repair jobs will always be together in this box, which also is large enough to store some unfinished sewing. It is not out of place in any room and goes well with almost any type of furniture. The bottom, back and hinged top are of solid stock, and the sides and curved front are formed from a single piece of veneer, thin plywood or even linoleum. Dowel legs support the box chair-high and are braced with curved dowels located so they are hidden under the box. A lining of quilted fabric gives the box a dainty appearance—Chas. and Bertram Brownold, Woodmere, N. Y.

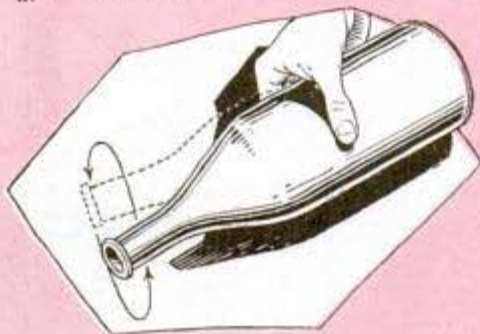




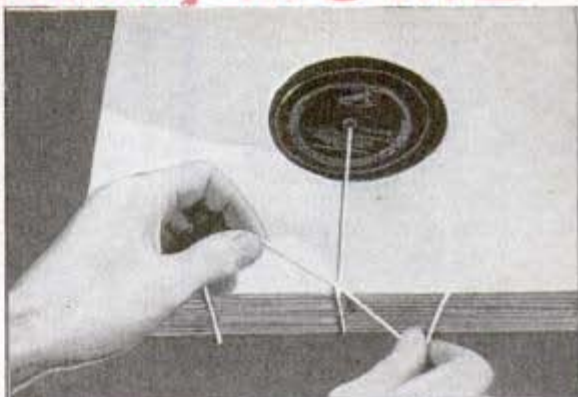
When the strands of a duster or floor mop become entangled and wadded together just twirl the handle between your hands. Centrifugal force will cause the strands to untangle so the mop will work efficiently



The next time you have to sift finely powdered material, do the job inside a large paper bag as above. The bag will confine the dust and keep it from floating around in the air and settling over the room



Liquid can be emptied from a large, narrow-neck bottle in much less time than it usually takes if you hold the bottle at an inverted angle and give it a quick, swirling motion to form a passage for air to enter



When carrying or transporting phonograph records in albums, they cannot slip out and become scratched or broken if you tie them with a stout string as shown above

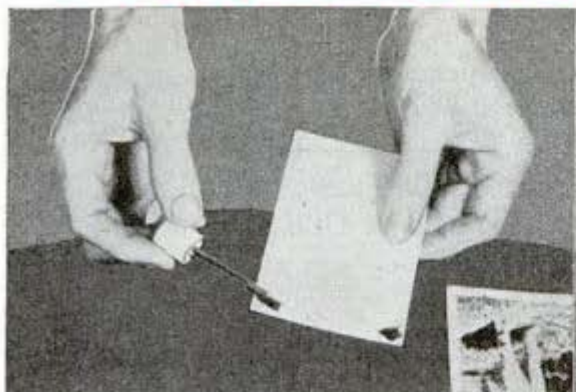


A chopping bowl will not skid around over a table if it is supported on a pan about half its size. Also, the bowl can be shifted to any angle that will facilitate chopping



Before driving a nail into a plastered wall, press a strip of adhesive tape over the spot and drive the nail through it and thus avoid chipping the plaster

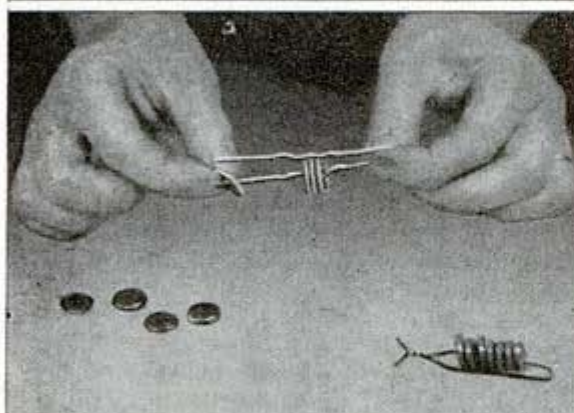
PROBLEMS



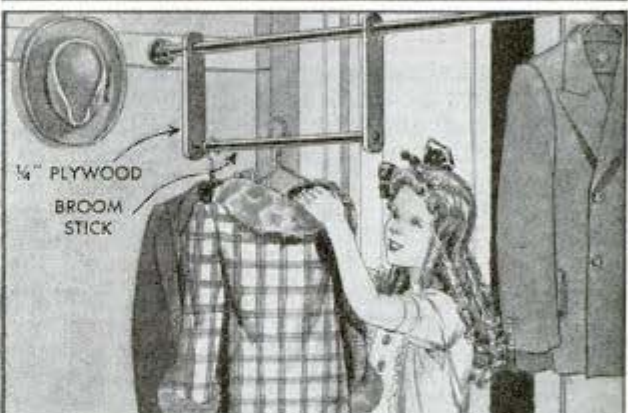
Applied to the corners of photos, daubs of clear nail polish provide an ideal adhesive for mounting them in an album. The polish dries quickly and does not stain



Most of the work of carrying out heavy ash cans is easily handled by your lawnmower if it is turned upside down and used as a wheelbarrow. An ash can will balance nicely on the mower when used as shown



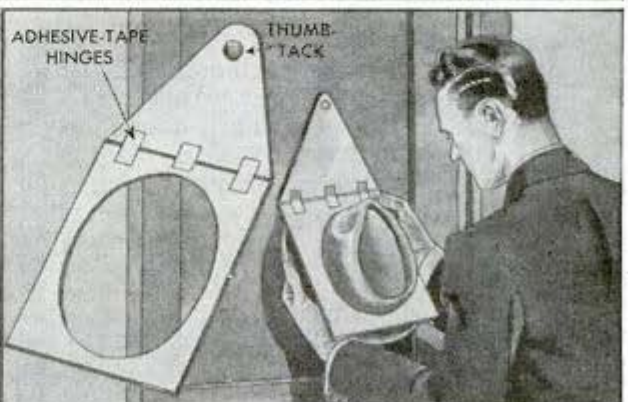
After removing the buttons from a garment, string them on a hairpin and twist the ends together. The buttons will be together when needed, and none will be lost



Where a small child cannot reach a clothes pole in a closet, you can solve the problem by making a shorter one and suspending it from the regular pole within easy reach of the child as indicated above



If you have occasion to carry finger rings in your purse, pin them to the lining. In this way, they will not be pulled out accidentally when removing your handkerchief



A hinged hanger like the one above will keep your hat handy. It is made of cardboard and hinged together with pieces of tape, and can be attached to a wall or a closet door by means of a thumbtack

Handy Way to Hold Ink Bottle On a Drawing Board



By using a counterweighted string as indicated, it is a simple matter to hold an ink bottle at any convenient position on a drawing board. If the bottle is kept in approximately the same position on the board most of the time, a notch can be cut in the upper edge of the board to receive the string and thus avoid any tendency of it moving to either side.—Senor Orlando Dominques Sotolongo, Havana, Cuba.

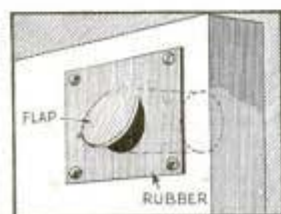
Shield to Avoid Pinched Fingers When Using Bench Vise



Injury to your hand by having a vise handle drop unexpectedly can be avoided by slipping a short piece of hose, split for half its length, over the screw.—H. Arrall, Newburyport, Mass.

Rubber Flap Valve in Storm Door Makes It Easy to Open

When a storm door fits snugly enough to keep out cold air, both it and the regular door are likely to be hard to open and close.

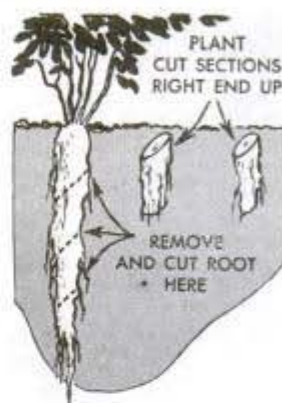


When closing one of the doors air is compressed slightly between them, and when opening one, a partial vacuum is created momentarily. To avoid this trouble

without affecting the efficiency of the storm door install a valve in it. A valve can be made from a piece of inner-tube rubber and tacked over a large hole bored in the door. The valve will permit air to escape when closing a door, and permit it to enter and avoid a vacuum when opening a door.

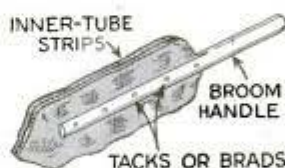
Oriental Poppies Multiplied By Root Division

Instead of waiting for slow-growing seeds to multiply your oriental poppy plants, remove a few of the mature ones, cut the roots at an angle as indicated and plant the root sections. Be sure to plant them with the large ends up. The original plant may be reset.



Strips of Inner Tube on Handle Provide Good Bench Brush

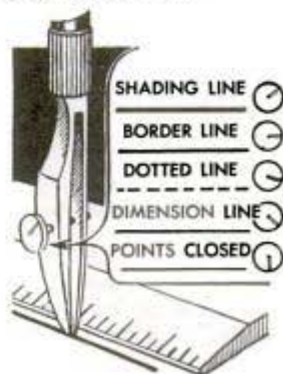
A handy bench brush that will not pick up pieces of steel shavings or filings can be made from three or four strips of old inner-tube rubber and a length of broom handle.



The brush can be any size desired, and is made by slotting the handle near one end for insertion of the rubber strips, which are held in place by driving small nails through the entire assembly. The brush can be shaped as desired by merely cutting off the edges of the rubber strips to suit.

Screw on Ruling Pen Notched To Show Adjustments

If a notch is filed on the adjusting screw of a ruling pen, it can be used as a visual means of setting the spacing of the pen to predetermined widths. A chart similar to the one shown can be kept in the pen case as a guide in adjusting the pen.





CRACKLE FINISHES

with glue-and-water paint

CRACKS or checks in a wood finish often appear by accident, but when you exaggerate this effect deliberately, you get an attractive crackle finish that is particularly suited to novelty furniture, household utensils and also to reproductions of antiques. Application is simple. Heat some fish glue in luke-warm water and coat the bare wood with it. Follow immediately with a spray coat of water-mix paint. The cracks will develop in about 10 min., as always happens when a fast-drying top coat is applied over a slow-drying undercoat. You will have best results with fish glue. Animal and other glues produce checks too fine to be readily seen. Heating allows the glue to flow better. If you brush on the paint, allow the glue to set 2 or 3 min. before applying the

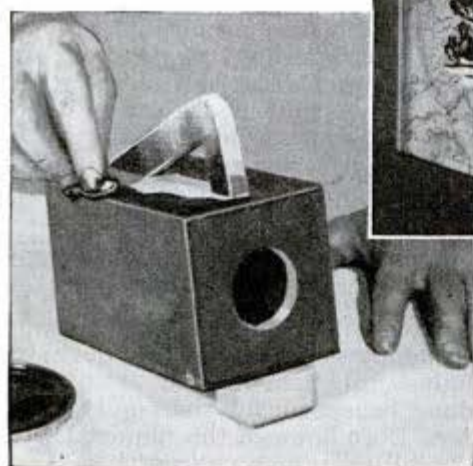


*Plain
Finish*



Glaze Finish

paint. In either case the paint should be of normal consistency—not too heavy. The finish will look best if a coat of white or light-color paint is applied over dark wood. If the wood is too light for contrast, it can be stained. Dark paint on light wood is not so effective, however. If you use open-grain wood, first fill it with walnut paste filler and allow this to dry thoroughly. For a true antique effect, the work should be glazed. The glaze coat is made by mixing any brown oil color in japan with turpentine to make a thin fluid. Brush this on over a sealer coat of clear lacquer, and then wipe off almost completely, leaving just a trace of color in spots, as shown in the lower photos. In all cases, the work should have a finish coat of clear lacquer or varnish.

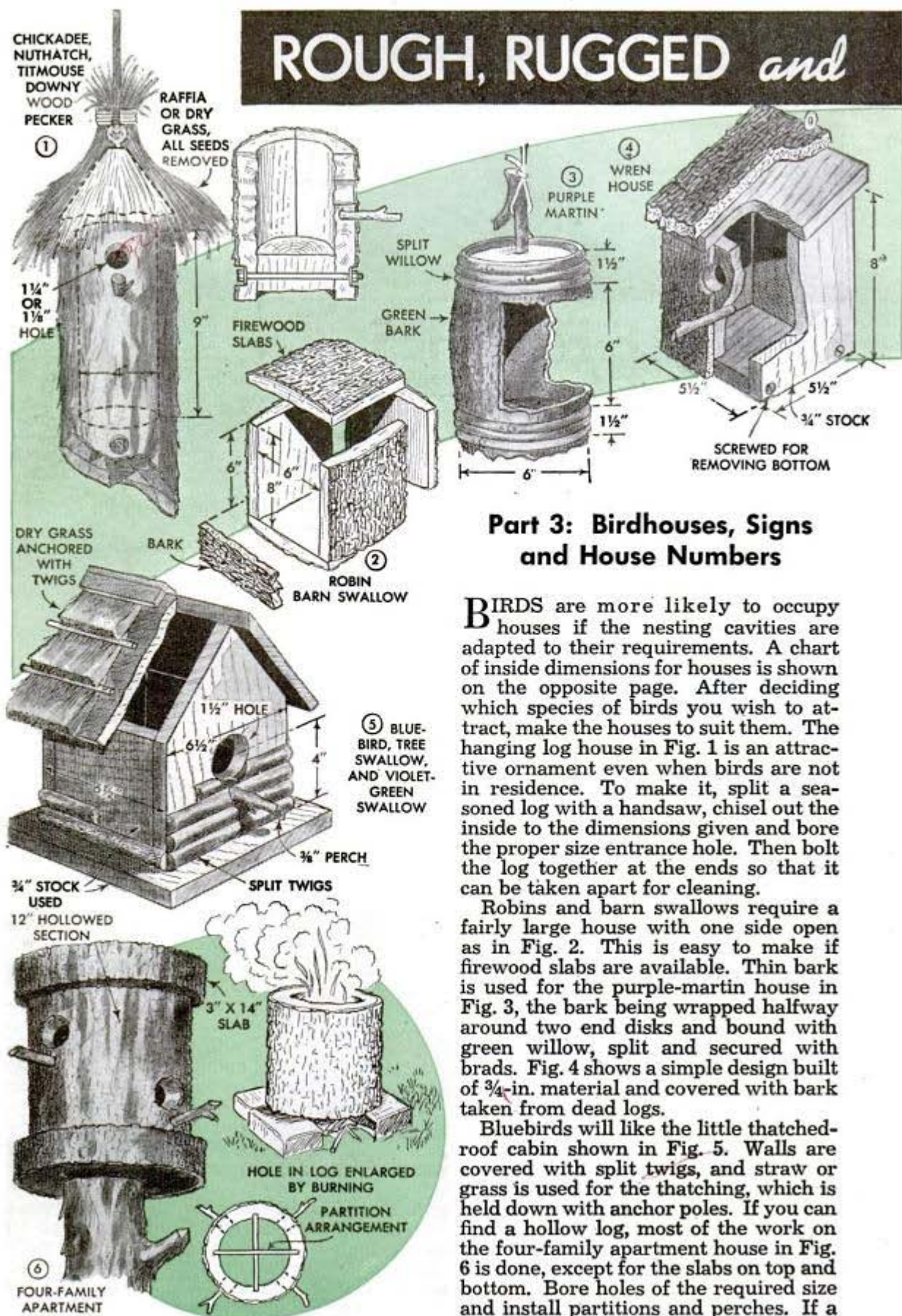


APRIL, 1945

also made by:

*General Cement Mfg Co.
921 Taylor Ave
Rockford, Ill.*

ROUGH, RUGGED *and*



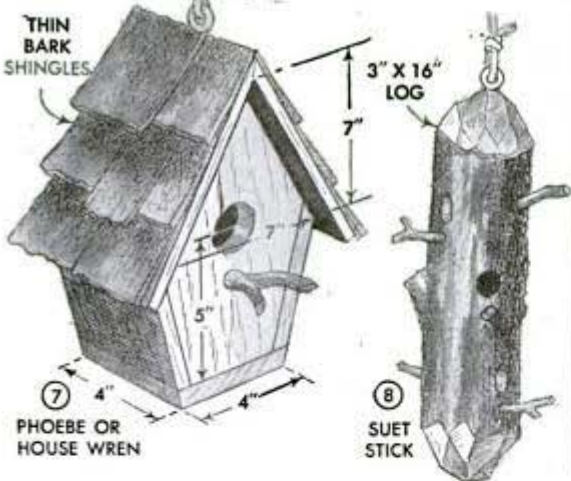
Part 3: Birdhouses, Signs and House Numbers

BIRDS are more likely to occupy houses if the nesting cavities are adapted to their requirements. A chart of inside dimensions for houses is shown on the opposite page. After deciding which species of birds you wish to attract, make the houses to suit them. The hanging log house in Fig. 1 is an attractive ornament even when birds are not in residence. To make it, split a seasoned log with a handsaw, chisel out the inside to the dimensions given and bore the proper size entrance hole. Then bolt the log together at the ends so that it can be taken apart for cleaning.

Robins and barn swallows require a fairly large house with one side open as in Fig. 2. This is easy to make if firewood slabs are available. Thin bark is used for the purple-martin house in Fig. 3, the bark being wrapped halfway around two end disks and bound with green willow, split and secured with brads. Fig. 4 shows a simple design built of 3/4-in. material and covered with bark taken from dead logs.

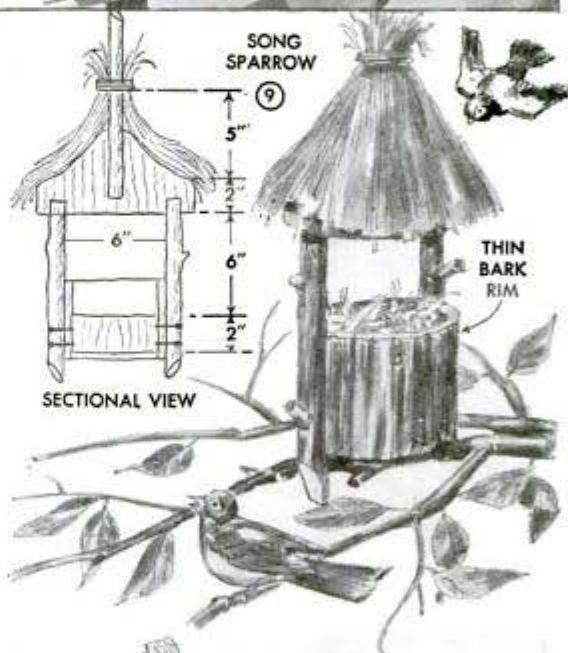
Bluebirds will like the little thatched-roof cabin shown in Fig. 5. Walls are covered with split twigs, and straw or grass is used for the thatching, which is held down with anchor poles. If you can find a hollow log, most of the work on the four-family apartment house in Fig. 6 is done, except for the slabs on top and bottom. Bore holes of the required size and install partitions and perches. If a

RUSTIC

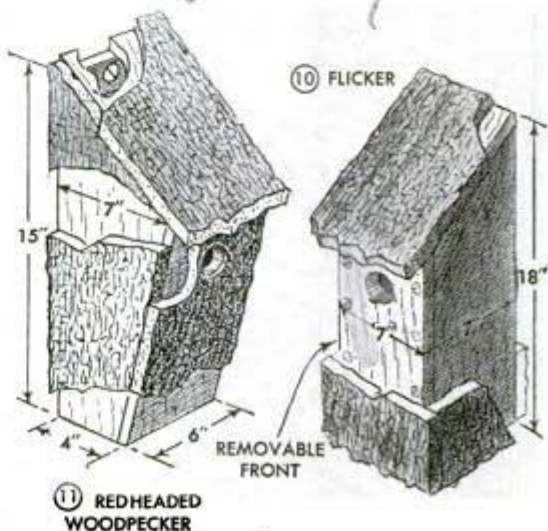


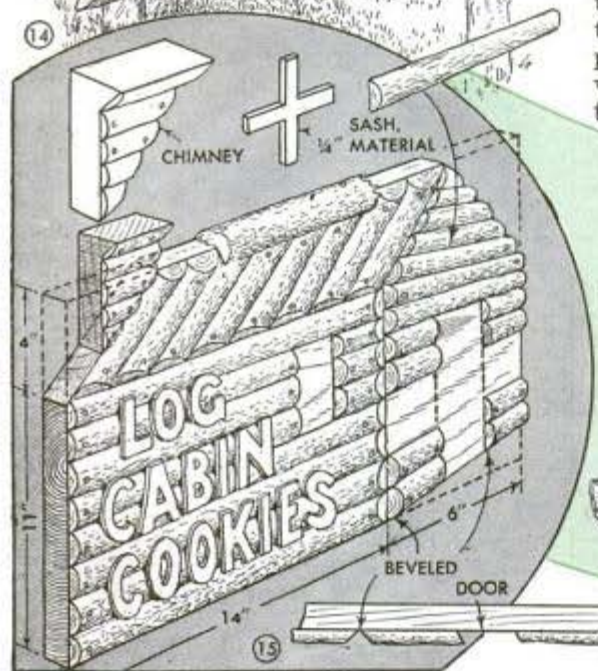
log has only a small hole in the center it can be enlarged by burning it out.

The song sparrow isn't so exclusive as most birds and likes a house with all sides open like the miniature summer house in Fig. 9. It can be set on the end of a tree branch, provided it is not over 3 ft. above ground. On the other hand, the flicker and redheaded woodpecker demand privacy and considerable depth. Homes for them are illustrated in Figs. 10 and 11. They are merely wooden boxes covered with bark and attached to a tree trunk. The fronts



| NESTING BOX DIMENSIONS IN INCHES | | | | | |
|----------------------------------|------------|-------|----------------------|------------------|----------------------------|
| Species | Floor plan | Depth | Entrance above floor | Dia. of entrance | Height above ground (feet) |
| Wren | 4 x 4 | 6-8 | 1-6 | 1 | 6-10 |
| Chickadee | 4 x 4 | 8-10 | 6-8 | 1½ | 6-15 |
| Nuthatch | 4 x 4 | 8-10 | 6-8 | 1½ | 12-20 |
| Titmouse | 4 x 4 | 8-10 | 6-8 | 1¼ | 6-15 |
| Downy woodpecker | 4 x 4 | 8-10 | 6-8 | 1¼ | 6-20 |
| Bluebird | 5 x 5 | 8 | 6 | 1½ | 5-10 |
| Tree swallow | 5 x 5 | 6 | 1-5 | 1½ | 10-15 |
| Violet-green swallow | 5 x 5 | 6 | 1-5 | 1½ | 10-15 |
| Robin | 6 x 8 | 8 | One side open | | 6-15 |
| Barn swallow | 6 x 6 | 6 | One side open | | 8-12 |
| Song sparrow | 6 x 6 | 6 | All sides open | | 1-3 |
| Flicker | 7 x 7 | 16-18 | 14-16 | 2½ | 6-20 |
| Red headed woodpecker | 6 x 6 | 12-15 | 9-12 | 2 | 12-20 |
| Phoebe | 6 x 6 | 6 | One side open | | 8-12 |
| House wren | 4 x 4 | 6-8 | 1-6 | 1 | 6-10 |
| Purple martin | 6 x 6 | 6 | One side open | | 15-20 |

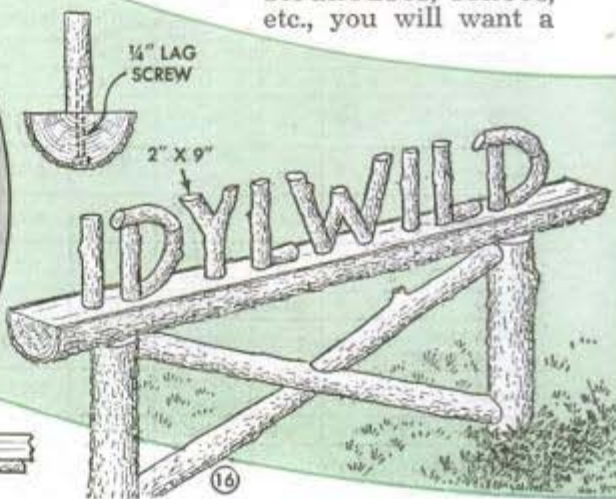




should be screwed in place for easy removal when cleaning time comes. The little cottage in Fig. 7 will interest the phoebe if the front wall is left out, and the house wren if it is left in. Use material surfaced on one side only, the rough side out, and shingle with strips of thin bark.

To attract birds, scatter the kind of food they like. The kinds of fruit and berry bushes around your home will determine the species of birds that will congregate there. Those that remain through the winter like suet. A suet stick fitted with perches as in Fig. 8 and suspended in a tree will be well patronized. Bore 1-in. holes in the stick and stuff them with the suet.

If you have rustic birdhouses, fences, etc., you will want a



sign, residence name or street number to match. In localities where birch trees are available, many exceptionally attractive projects can be made with logs and bark. Fig. 14 illustrates a farm name above a rural mail box. A three-dimensional effect is achieved on a flat board in Fig. 15 by using tapered sticks and beveling the ends as shown. With dark sticks, white-pine letters stand out prominently.

When saplings are plentiful a sign post and substantial gate can be erected with little labor as in Fig. 12. One end of the gate is suspended on old rope, the other resting in the crotch of a post. The sign board is cut to an irregular outline from surfaced pine. A standing dead tree with a wide crotch can be adapted to the sign in Fig. 18. Weathered boards with irregular outlines are suspended on ropes as in Fig. 20 for a fishing resort. White lettering is suggested.

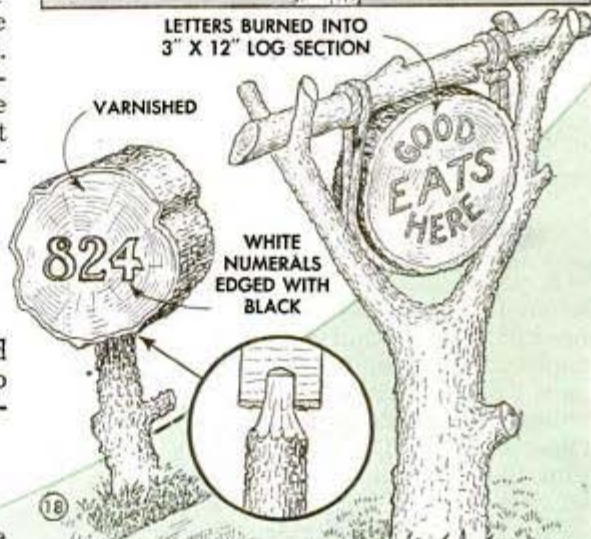
Another sign for a summer colony is built on a large split log supported by a couple of posts as in Fig. 16. The letters are assembled with screws. Direction boards, Fig. 17, can be made by splitting out the center section of 5-in. logs, smoothing one side sufficiently for painting on the letters. More elaborate than the others, and somewhat on the order of iron grille work is the hanging sign in Fig. 13. Willow whips bent while green are bound with raffia or rawhide for the arm bracing. The signboard is of surfaced material stained a light brown with letters in bronze.

House numbers should be placed near the curb, or at least they should be large enough to be seen at a distance. The left detail of Fig. 18 suggests a simple and attractive arrangement. Fig. 19 shows two other pleasing designs, one of which combines a name and number.

(To be continued)

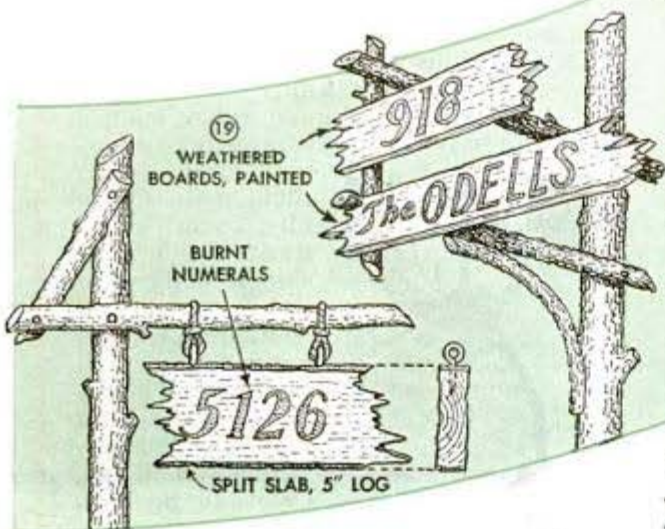


LETTERS BURNED INTO
3" X 12" LOG SECTION



VARNISHED

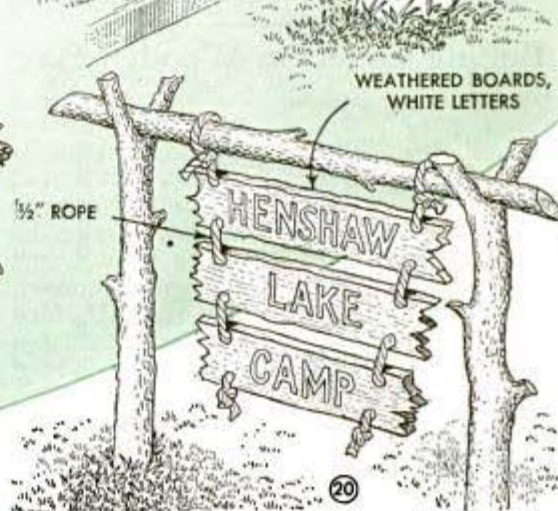
WHITE NUMERALS
EDGED WITH
BLACK



WEATHERED
BOARDS, PAINTED

BURNT
NUMERALS

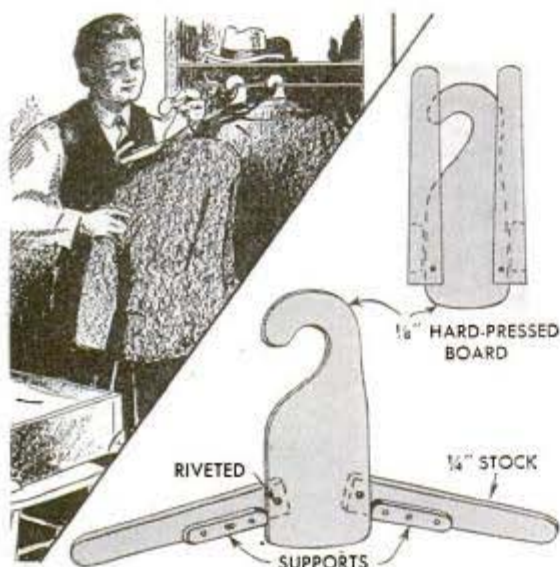
SPLIT SLAB, 5" LOG



WEATHERED BOARDS,
WHITE LETTERS

1/2" ROPE

Traveler's Folding Coat Hanger Takes Little Space



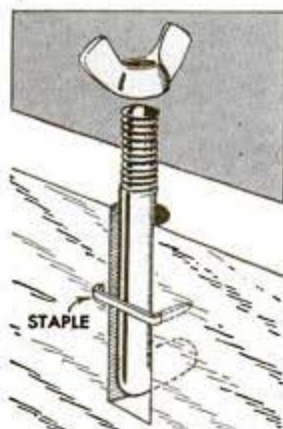
Ideal for travelers as it occupies little space when folded, this coat hanger is easily assembled. The center portion or body is jigsawed from hard-pressed board and the arms are cut from $\frac{1}{4}$ -in. stock. The arms are pivoted to the body with rivets, and small blocks are screwed on the arms to bear against the edges of the body and support the arms in a horizontal position.

Washing Flat-Painted Walls

If your flat-painted walls streak or spot when they are cleaned, try the following method: First, mix washing soda, $\frac{1}{4}$ lb., commercial size, $\frac{1}{2}$ lb., with water, $1\frac{1}{2}$ gals. Brush this solution onto the wall, working the solution into the dirt. Then rinse well with a sponge. You will find that the solution cleans the walls without leaving streaks or dark spots.

J. Seeley Nivison, Webster, N. Y.

Bolting Cover on Wooden Box



The next time you want to fasten the lid on a wooden box tightly and yet have it easy to remove, use L-bolts and wing nuts as indicated. To install the bolts, clamp a block to the side of the box and drill a hole centrally between it and the box. This will provide a groove in

the box side in which to set the bolt after drilling a small hole horizontally at the lower end of the groove to take the L end of the bolt. A wide staple will help hold the bolt in place.—Don Brooks, Chicago.

Artificial Glaze for Pottery

If you have pottery that is decorated with water colors that run or blur when wet, a couple of coats of high-grade spar or Bakelite varnish will give the pottery a glaze that will closely resemble a kiln job. After this treatment, the pottery can be wiped with a wet cloth without any danger of damaging the colored decorations.

Charles T. Pearson, Detroit, Mich.

Nut Slotted to Lock It in Place

When a lock washer is not at hand, or when the use of one is undesirable, a nut can be locked on a bolt by making a hacksaw cut along one side near the top as indicated. Then partially close the slot with a light hammer blow. This will depitch the threads so that when the nut is driven on a bolt, the threads are forced back into



place and the compressive force thus set up provides an excellent locking medium. A nut altered in this way can be taken off and put on numerous times without losing the locking feature.—B. Brownold, Woodmere, N. Y.

Carpenter's Knife With Notch Serves as Linoleum Cutter

Cutting linoleum neatly with an ordinary knife is almost impossible. Usually the brittle piece tears or the knife slips out of place and ruins the surface. However, a serviceable linoleum knife that will cut without tearing or slipping out of control can be improvised from an ordinary carpenter's knife by

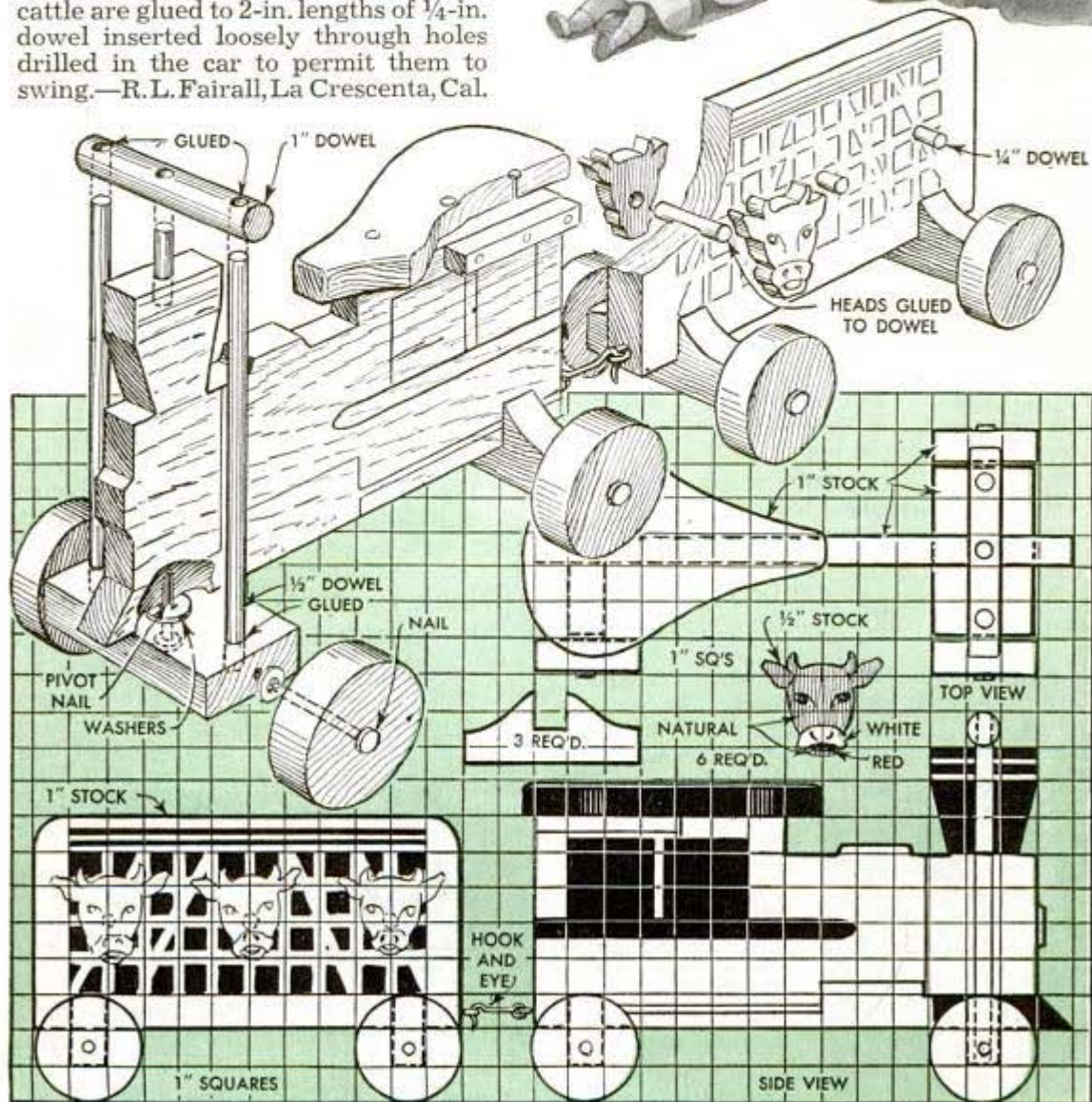


filing a notch in the inner edge near the tip as shown. Edges of the notch should be filed sharp. The notch can be used for making circular as well as straight cuts.—Wallace B. Case, Colorado Springs, Colo.

CATTLE TRAIN

in the Nursery

JUST to show that this is a cattle train, the animals extend their necks and wag their heads as the young engineer pilots the locomotive around the playroom. Car and engine are cut to the shape shown in the cross-hatched pattern. The front-axle support is pivoted on a nail, washers being inserted as shown, and is turned for steering by lengths of $\frac{1}{2}$ -in. dowel that extend to a handlebar pivoted on a center pin, which is a short length of $\frac{1}{2}$ -in. dowel. Wheels of 1-in. stock are drilled for nails that are driven into the axle supports to serve as axles, washers being used here, too. Heads of the cattle are glued to 2-in. lengths of $\frac{1}{4}$ -in. dowel inserted loosely through holes drilled in the car to permit them to swing.—R. L. Fairall, La Crescenta, Cal.



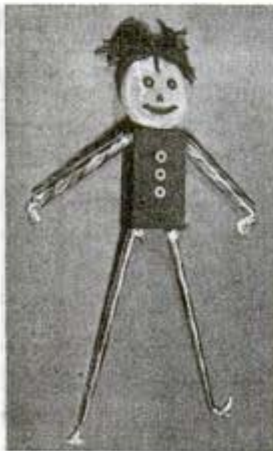
Split Wedge to Pull Long Nails With a Claw Hammer



This handy wedge will take the place of a block that carpenters sometimes place under a hammer when pulling long nails. It is made from two pieces of $\frac{1}{2}$ -in. hardwood about 10 or 12 in. long and tapered from 2 in. to a point as shown. The pieces are screwed at the butt ends to a $\frac{3}{16}$ -in. filler block. Place the wedge over the nail so that the claws of the hammer will grip the nail head. As the nail is pulled, push the wedge along to maintain the leverage.

Child's Dangle Doll Is Amusing

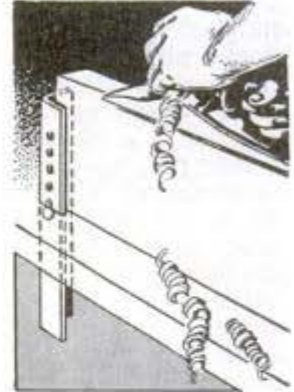
Any small child will enjoy this doll, which you can make in a few minutes. You will need a powder puff in a round Cellophane case, a rubber sponge and four sticks of paper or Cellophane-wrapped candy. To assemble the doll, run a stout cord up through the length of the sponge, then through the Cellophane case, but not through the puff, and out at the top, using a long needle. Then attach the arms and legs by sewing through the twisted wrapping at the ends of the



candy sticks. Gummed reinforcements are used for the eyes and buttons down the front of the sponge. A gummed heart does duty for the nose, while a piece of rubber jar ring furnishes material for the mouth, which may be glued. Bits of yarn in varying lengths are attached atop the powder puff for a realistic tangle of hair.

Angle-Iron Bench Stop Supports Board for Edge-Planing

The annoyance of trying to hold a board vertically for edge-planing may be avoided by the use of this bench stop, which is merely a length of angle iron. It fits snugly in a triangular hole in the bench top so that it may be driven up or down as the occasion requires. Several holes are drilled through the angle iron to take a pin, which holds the stop at the desired height to accommodate varying sizes of work.



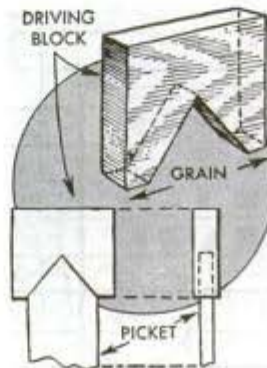
Safe Way to Wash Lace Collars

When laundering lace collars, crocheted doilies and similar articles, you can avoid stretching them out of shape by washing them in a jar of soap suds. Just fill a quart fruit jar with water and soap, put in the articles, replace the lid and shake the jar up and down several times. After washing, rinse the articles thoroughly with clear water in the same way.

Mrs. Hal Geihm, Aurora, Ill.

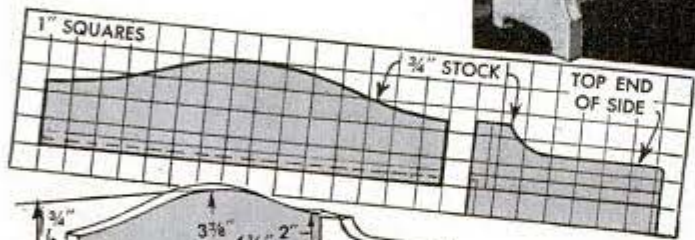
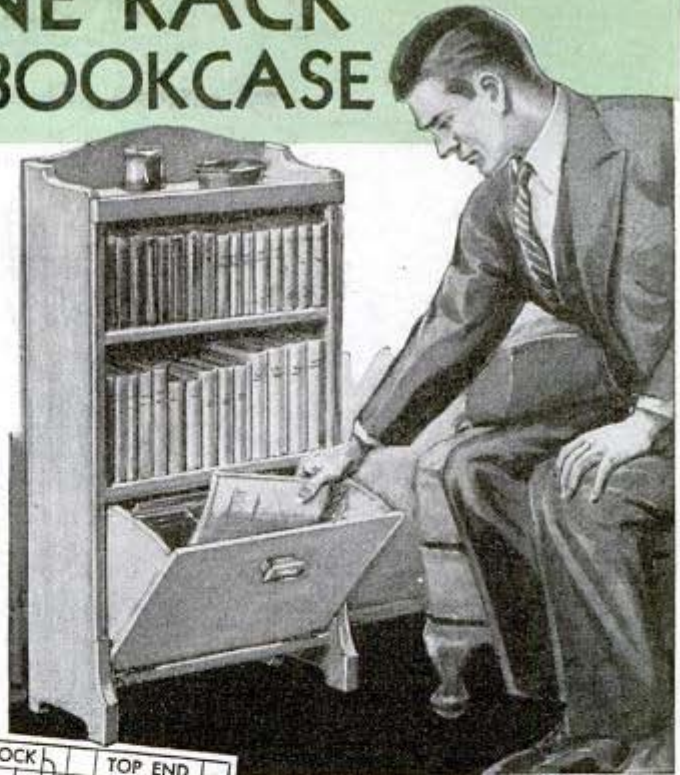
Block Protects Ends of Stakes When Driving Them

To avoid damaging pointed ends of stakes and pickets when they must be driven into the ground, use a driving block that is shaped to fit over the top as indicated. The block should be made of hardwood to avoid splitting easily. If available, a block of metal would be better, especially if you have many pickets to drive in hard ground.—William Salamer, Milwaukee, Wis.

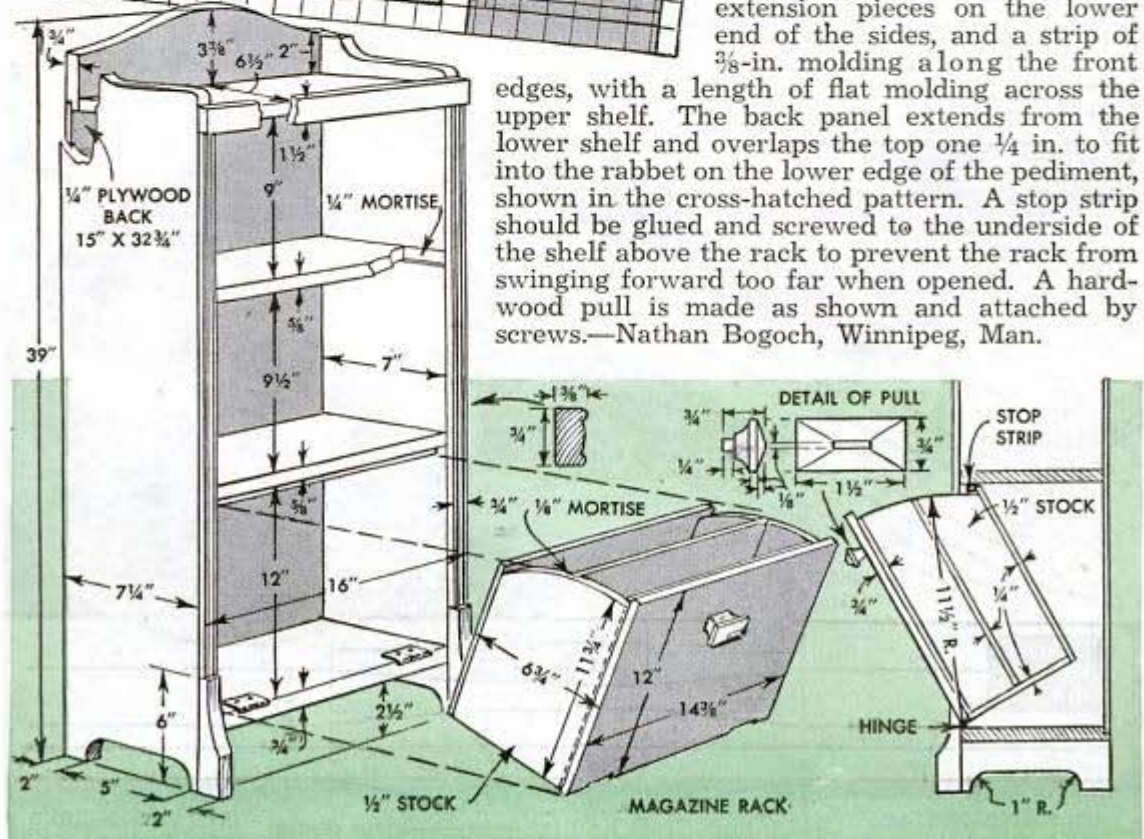


MAGAZINE RACK Swings Into BOOKCASE

HOUSED in the lower section of this bookcase, a hinged rack holds your current magazines in order, out of sight, yet instantly available. It swings outward like a bin to show its contents, but when closed, its front side comes flush with the front of the case. Hardwood, such as walnut, will produce a beautiful case, but you can use oak, gumwood or oven pine, depending upon how you want to finish it. Both side pieces can be sawed out together, then mortised for the shelves, which are not all of the same thickness. The lower one is of heavier stock so that it can be recessed for



hinges on which the rack pivots. For trim, glue and nail two 6-in. extension pieces on the lower end of the sides, and a strip of $\frac{3}{8}$ -in. molding along the front edges, with a length of flat molding across the upper shelf. The back panel extends from the lower shelf and overlaps the top one $\frac{1}{4}$ in. to fit into the rabbet on the lower edge of the pediment, shown in the cross-hatched pattern. A stop strip should be glued and screwed to the underside of the shelf above the rack to prevent the rack from swinging forward too far when opened. A hardwood pull is made as shown and attached by screws.—Nathan Bogoch, Winnipeg, Man.

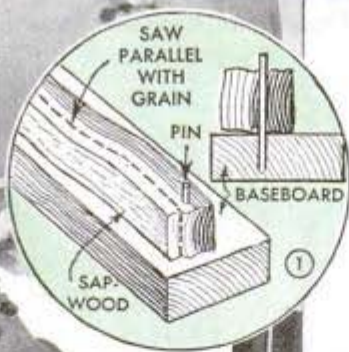


BOWS to Bring

By Sam Brown

HUNTING game with bow and arrow packs a real wallop. There's a thrill in seeing an arrow go winging toward its mark. Even a close miss is fun. So many sportsmen have adopted this sport that some states have exclusive bow-and-arrow hunting reserves where firearms are prohibited.

A bow for hunting should be as short as practical, ranging in length from 4 ft. 8 in. to 5 ft. 6 in. It should be a plain bow, able to stand a lot of knocking around.



2

3

NET SIZES FOR 40 TO 50-LB. BOWS

| WOOD | T | W | SAP |
|--------------|---------|---------|-------|
| OSAGE ORANGE | 1 1/16" | 1 5/16" | 3/16" |
| YEW | 3/4" | 1 3/16" | 1/4" |
| BOAM | 3/4" | 1 1/2" | 3/16" |
| LEMON-WOOD | 1 1/16" | 1 1/4" | NONE |

SAP SIDE IS BACK (OUTSIDE) OF BOW

1/16" UPPER LIMB
3/8" LOWER LIMB

WASTE

5

HANDLE

6

SAW

SAW

1/2"

2"

HANDLE RISER

7

SAW

3 3/4"

2"

2"

3 3/4"

1 1/2"

1/2"

9

TRUE CENTER

UPPER LIMB—34" LONG

LOWER LIMB—32" LONG

BELLY OF BOW

SAW

1/2"

2"

HANDLE RISER

7

SAW

3 3/4"

2"

2"

3 3/4"

1 1/2"

1/2"

9

TRUE CENTER

UPPER LIMB—34" LONG

LOWER LIMB—32" LONG

9/16"

3/16"

18"

3/16"

TAPER BELLY SIDE

3/16"

UPPER LIMB—34"

LOWER LIMB—32"

3 3/4"

2"

2"

3 3/4"

1 1/2"

1/2"

9

TRUE CENTER

UPPER LIMB—34" LONG

LOWER LIMB—32" LONG

3 3/4"

2"

2"

3 3/4"

1 1/2"

1/2"

9

TRUE CENTER

UPPER LIMB—34" LONG

LOWER LIMB—32" LONG

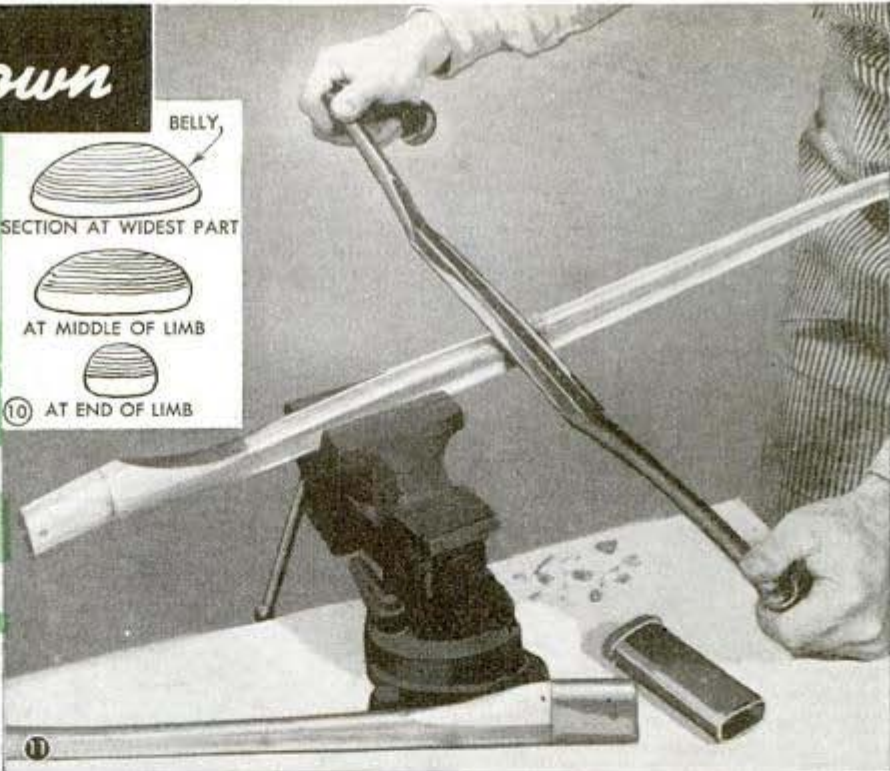
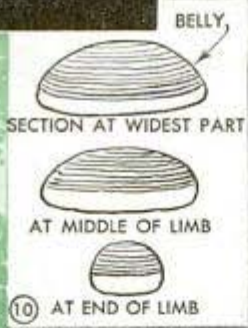
3 3/4"

2"

2"

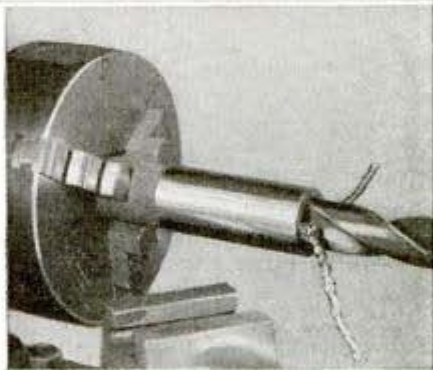
3 3/4"

'em Down



The drawing weight need not be excessive; you can bring down the toughest game in the country, including moose, bear and wild boar, with a 45 to 50-lb. bow and a steel broadhead arrow. Most hunters prefer a flat or semiflat bow. The demountable type of semiflat bow described here is popular because of ease of transportation, and the knockdown handle in no way affects smooth, fast shooting. If this is your first bow, by all means make it of lemonwood, as this compact and nearly grainless wood permits mechanical shaping without any regard to grain structure. If you want the best, however, use osage orange or boam. Yew is good, too, although a little too soft for rough usage. All bow woods except lemonwood require careful following of the grain.

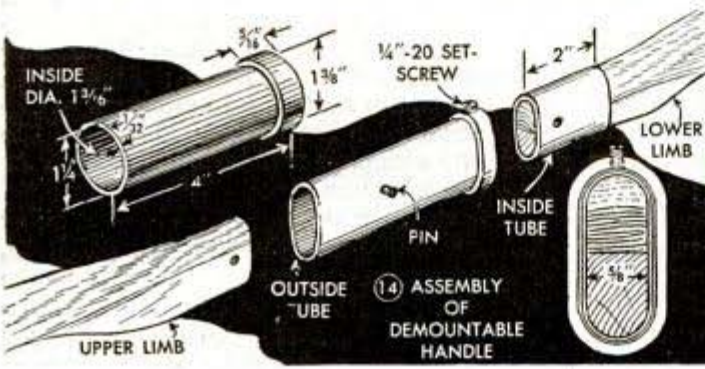
Start by roughing out the back of the bow. Osage orange is perfect in this respect; just peel off the bark, and the remaining layer of sapwood, about $\frac{3}{16}$ in. thick, is just right. Yew and boam have more sapwood and will require trimming down. This can be done best on a band saw as in Figs. 1 and 2, mounting the stave on a guide board and then saw-



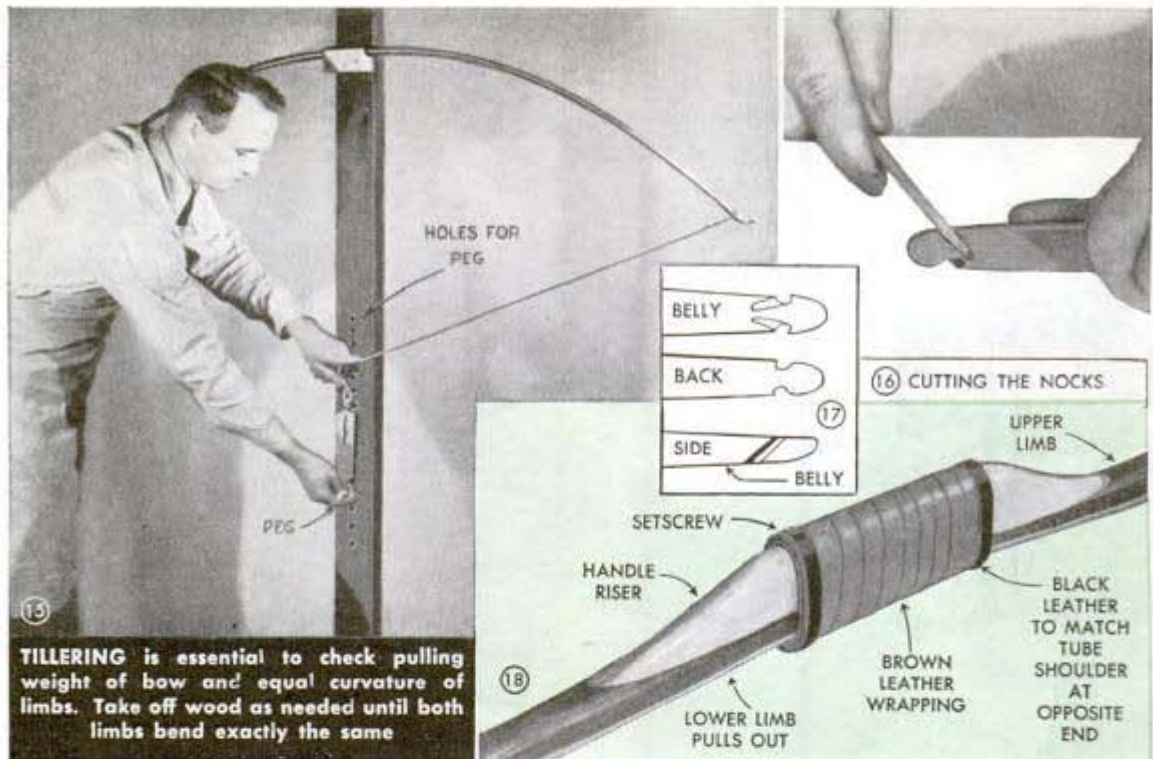
12 BORING THE HANDLE TUBE



13 VISE PRESSURE GIVES OVAL SHAPE



THE HUNTING BOW should be as short as practical, with pulling weight of 40-60 lbs. Style shown is semi-flat, with demountable handle for ease in transportation



ing on a line the required distance away from the heartwood. Pins holding the stave should be a snug drive fit in holes drilled squarely across the chord of the grain, as indicated in Fig. 1. If there is too much heartwood, it can be trimmed down with the same setup. Where there is just a little extra wood on the heart side, a planer head in the drill press will remove it in a jiffy, Fig. 3. In the absence of power tools, the staves can be trimmed with a drawknife. The first stage of cutting gives you a flat stick about $\frac{3}{4}$ by $1\frac{1}{2}$ in. with a thin layer of white sapwood on the back as shown in Fig. 5. Here you can see why it is easy to work with lemonwood; you have no sapwood to worry about, and the compact grain permits ripping and jointing to straight lines. All the other woods will be crooked, the back of the bow following every dip and curve in the grain. After band-sawing, smooth up the back of the bow with drawknife and scraper, following the grain. Fig. 4 shows table of net sizes for bows of different woods.

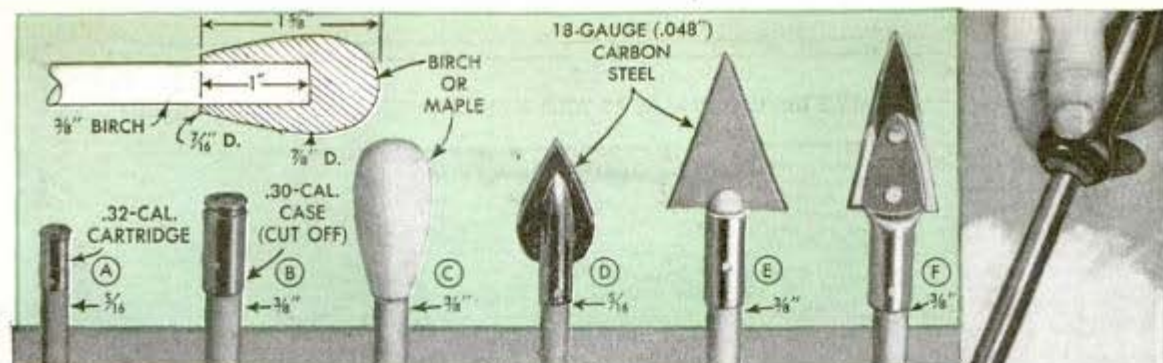
On the back of the stave, draw the outline shown in Fig. 5, band-saw to shape and taper the belly side as in Fig. 6. You will cut across the grain to some extent in both operations, but it is only on the back of bow that you positively must follow the grain. Glue the handle riser in place, Fig. 8, and then band-saw it both ways to the shape shown in Fig. 7. Both limbs of the bow are treated in the same way except that the upper limb should be 2

in. longer than the lower one, as in Fig. 9.

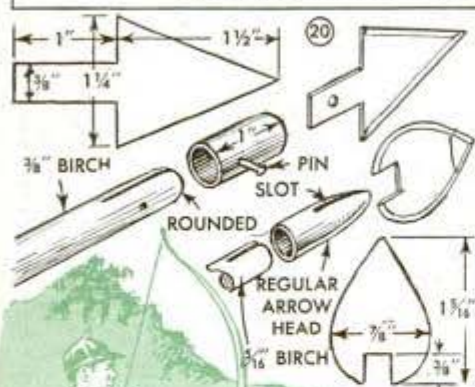
The demountable feature is accomplished by fitting the limbs of the bow inside a metal tube. You can buy telescoping tubes for this purpose, or you can make your own. Fig. 14 shows the general nature of the assembly. The short inside tube is pinned to the lower limb and the long outer tube is pinned solidly to the upper limb, the lower limb being a slide fit inside the outer tube, where it is held rigidly by means of a setscrew. Making your own telescoping tube is just a matter of turning and boring, Fig. 12, and then squeezing the assembled tubes in a vise as in Fig. 13, to get the required oval section. It is advisable to heat the work, otherwise the steel may crack at the shoulder portion. The original fit of the round tubes should not be too snug.

Figs. 10 and 11 show the final stage of shaping the bow, rounding off the belly with a drawknife or coarse and fine rasps. Osage orange may be so knotty as to require entire shaping by filing. Whenever you run into a knot, leave a little extra wood to compensate for the natural weakness caused by the defect. Finish off the limbs by scraping with a hook scraper or a piece of broken glass.

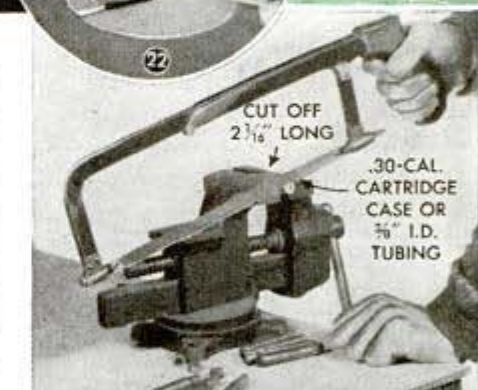
As you work down the belly side, tiller the bow frequently as shown in Fig. 15, checking its drawing weight, and more important, the bend of the limbs. Some workers tiller against a wall and use a grid of pencil lines to check for equal bending.



19 VARIOUS STYLES OF BLUNT AND BROADHEAD HUNTING ARROWS



HUNTING ARROWS in blunt and broadhead styles are shown on this page. Steel for heads can be obtained from old power-hacksaw blades



22 CUT SLEEVES FROM .30-CAL. CASES

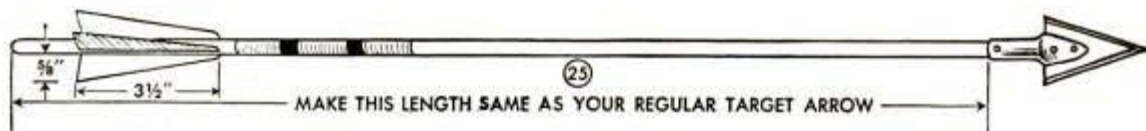


23 SQUEEZE 3/8" FLAT AT SMALL END

However, good results can be obtained by eye inspection alone, and by noting if the string tends to pull off to one side as you pull it back. The bow should be rigid through the handle, and almost rigid the full length of the handle riser. Starting at the end of the handle riser, the limbs should bend in a graceful arc. Go slow at this stage; it is very easy to remove too much wood and ruin the bow. If you get a little under the poundage you want, cut an inch off both limbs and try it again. Get the pull about 5 lbs. more than you want; it will let down about that much after you have used it a few hours. If the bow is much too heavy throughout, make a fast dip immediately beyond the handle riser to get a thinner section, and then taper gradually to the tips. Nocks should be of the plain type cut into the wood as in Figs. 16 and 17. Fig. 18 shows the finished bow at the handle.

There are two kinds of hunting arrows: blunts and broadheads. The blunt points, details A, B and C of Fig. 19, can be made from cartridge cases or turned from wood. These heads have tremendous hitting power. They will bowl over a rabbit or knock a squirrel out of a tree. The need for the blunt point is obvious; you can imagine what happens to a sharp steel broadhead when you wham it into a tree trunk, or worse, a high tree limb.

Steel broadheads are needed for both small and big game. With sharp-cutting edges, even a 40-lb.



bow will send one of these shafts right through a two-point buck. The smallest practical head is the lancet shown at D, Fig. 19. This is made by slotting a regular bullet-type arrow head, and then soldering the notched steel head into the slot as in Figs. 20, 21 and 22. Easiest type to make in any size of broadhead is the tang-and-sleeve style shown at E and explained in Fig. 20. The step-by-step operation in making a broadhead, style F, is shown in Figs. 23 to 28. If you use .30-cal. ball cartridge cases, it will be necessary to have a tang on the broadhead for needed strength. With a sleeve of thicker copper or steel tubing, the split ends of tube alone will hold the head, which can be made a simple,

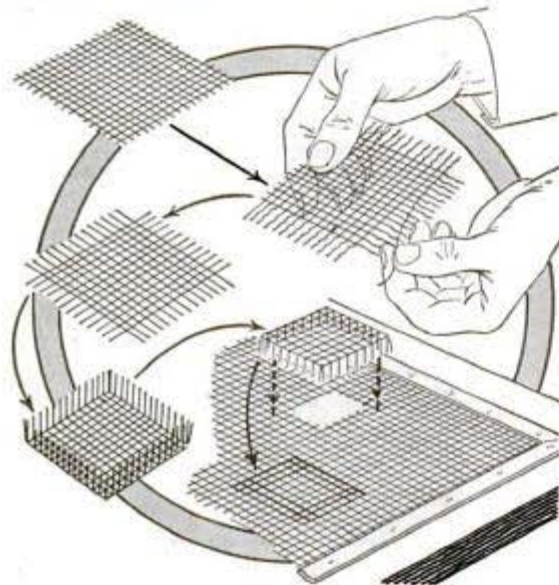
triangular shape without tang. Old power hacksaw blades furnish good steel for heads. All of the styles shown can be purchased readymade if desired. Fletching of shafts follows standard practice except that the feathers are preferably of the low, long triangular style as shown in Fig. 25. Complete construction kits including heads, cut feathers and birch shafts can be purchased at a nominal cost and provide an ideal method of working. The diameter of shafts will depend somewhat on the pull of your bow. If the pull is 40 lbs. or under, $\frac{5}{16}$ or $\frac{1}{2}$ -in. shafts are plenty heavy. Bows pulling over 45 lbs., especially when big broadheads are used, must have $\frac{3}{8}$ -in. shafts to stand up under the terrific impact.

Holes in Window Screen Mended by Easily-Made Patches

Small holes in window screens can be mended by easily-made patches cut from ordinary screen wire, thus making it un-

necessary to replace the entire screen. To make a patch, cut a piece of screen a little larger than the hole to be mended. Next, pull two strands from each side of the cut piece, and bend up the projecting wires at a right angle as shown. Place the patch over the hole, push the wire ends through the screen and fold them inward to secure the patch. For a tight seam all around, tap the folds lightly with a hammer, using a block of wood as a support.

H. S. Siegele, Emporia, Kas.

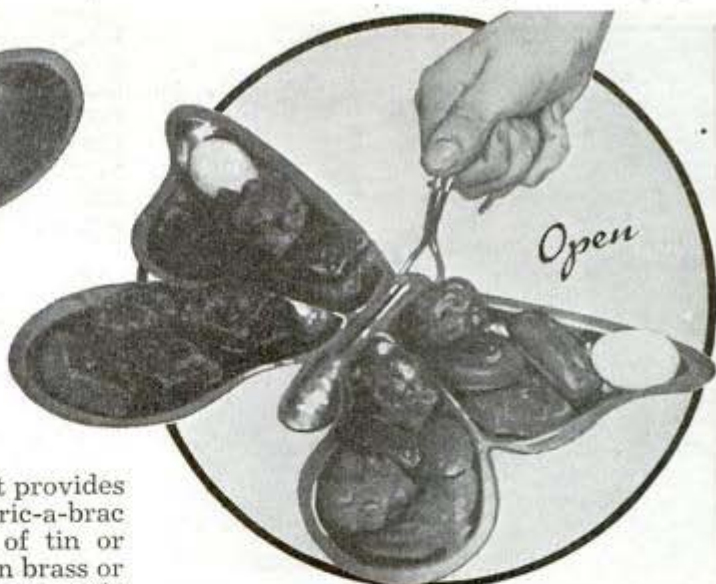
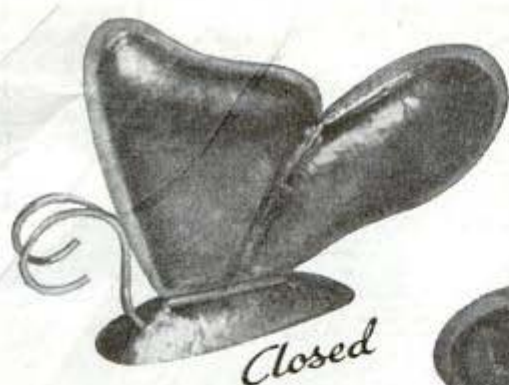


Sticking of Stamps Avoided When Carried in Pocket

I find that when carrying loose postage stamps in my pocket or purse they will not stick together if I first rub the gummed surfaces lightly over my hair. The thin oil film deposited on the stamps from the hair will last indefinitely and keep the stamps ready for use without interfering with the adhesive.

George K. McKeowan, Painesville, Ohio.

Hammered "Butterfly" Dish Has Hinged Trays



In the opened position, this dish serves as a candy or nut tray, while in a closed position it provides an attractive ornament for a bric-a-brac shelf. It is made from pieces of tin or other sheet metal, preferably thin brass or copper if available. The wings are made by being hammered to a depth of $\frac{3}{4}$ in., after which the lower ends are bent around a short length of brass rod. The hammering is best done over a hardwood form. Before the body is shaped, however, two slits are cut in the positions shown, making it possible to round each end $\frac{3}{16}$ in. higher than the center portion to accommodate the hinge pins. Two holes are drilled to take the "feelers" which are bent from a length of brass wire and soldered in place on the underside. Wings are attached by slipping both hinge pins under the raised ends of the body and dropping a small amount of solder on each one to hold it securely in place. After a thorough polishing, the dish is finished with two coats of clear lacquer.

J. Brumfield, Philadelphia, Pa.

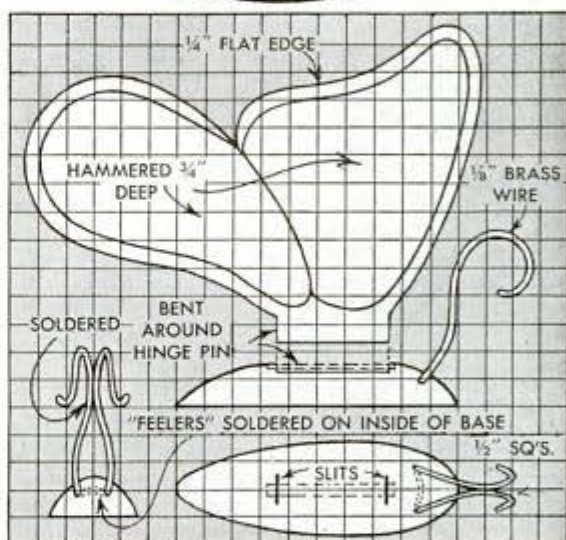


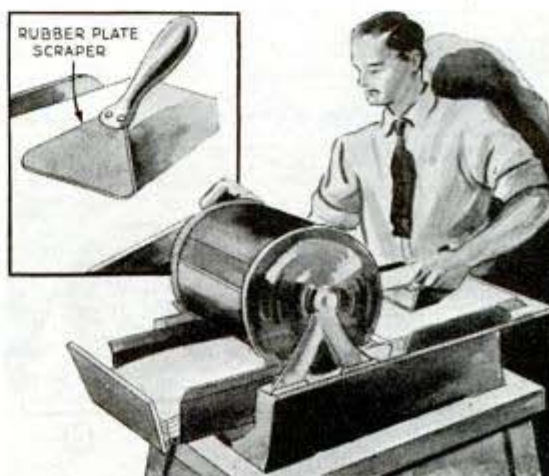
Plate Scraper Simplifies Feeding Mimeograph Machine

To slip sheets of paper easily into a hand-fed mimeograph machine, one operator uses a rubber plate scraper. The width of the scraper prevents the paper from twisting to either side and permits accurate feeding with little trouble.

Strengthening Pipe Frames

When making home-workshop machines where pipe is used for the framework I find that by filling the pipe assembly with cement, the machine is more rigid, has much less vibration, and in most cases, the added weight is desirable. A 50-50 mixture of portland cement and sand makes a good mixture for this purpose.

John D. Reynolds, Liberty, N. Y.



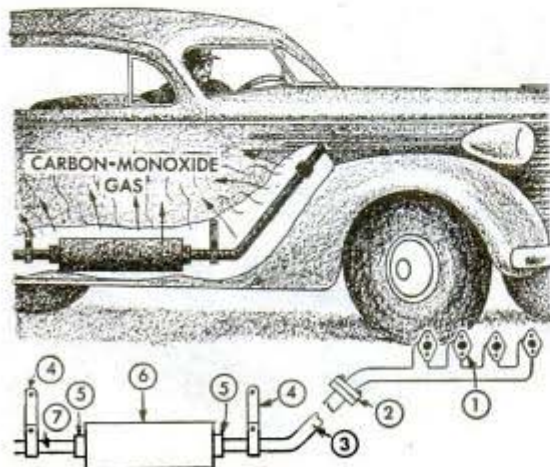
Stamp From Mimeograph Stencil Prints Names and Labels



For printing names, labels, etc., this stamp is ideal. The lettering can be changed easily and at practically no cost. To make the stamp, round one side of a wood block of suitable size and fit it with a handle. On the rounded side place a piece of moleskin cloth and coat it with mimeograph ink. Then, over this place a piece of mimeograph stencil in which is cut the desired lettering. A couple of rubber bands will hold the assembly to the block.—H. Hale, Brooklyn, N. Y.

Points Where Leaks May Occur In Your Car Exhaust Line

The danger of carbon-monoxide gas entering the body of your car cannot be overemphasized. This danger is especially threatening when all car windows are kept closed. The various points where leaks may occur in the exhaust line are shown in the lower detail. Leaks indicated at Fig. 1 can be stopped by installing new gaskets.



A leak at Fig. 2 is prevented by installing a new gasket and tightening the nuts. At Fig. 3, look for rust spots that have eaten through the exhaust pipe. Be sure brackets, Fig. 4, are tight to prevent vibration of the line. Also, check line joints into the muffler as indicated by Fig. 5, and check the muffler itself for rust holes as indicated at Fig. 6. Last, inspect the tailpipe for rust holes. Any defective parts should be replaced immediately.

Tenon End of Turning Slotted To Fit Tightly in Hole

Instead of trimming tenons in order to get a tight fit in holes, one carpenter forms the tenon to the approximate size and then cross-slots it with a fine saw. This allows the end of the tenon to be squeezed and driven into the hole to make a tight fit.



Shop Towels on Rubber Hooks Removed Without Tearing



Noting that towels were torn by workmen jerking them from hooks, one garage owner nailed narrow sections of old auto tire to the wall in place of the metal hooks. A pull bends the hook downward so that the towel slides off without damage.

Short Piece of Weather Strip Serves as Pencil Holder

A handy pencil holder for use on a sloping desk or drawing board can be made by tacking a short length of fabric weather strip of the type indicated to the upper edge of the board. It is only necessary to insert the point of the pencil between the board and strip to hold it at an angle for easy removal when needed.

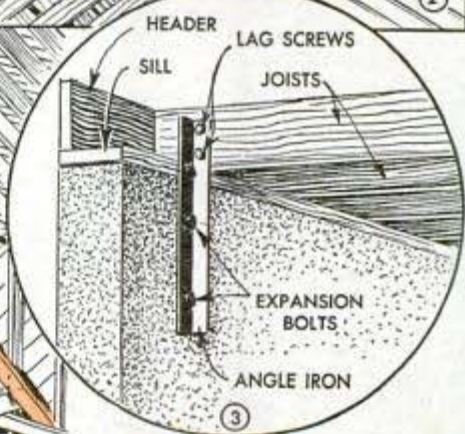
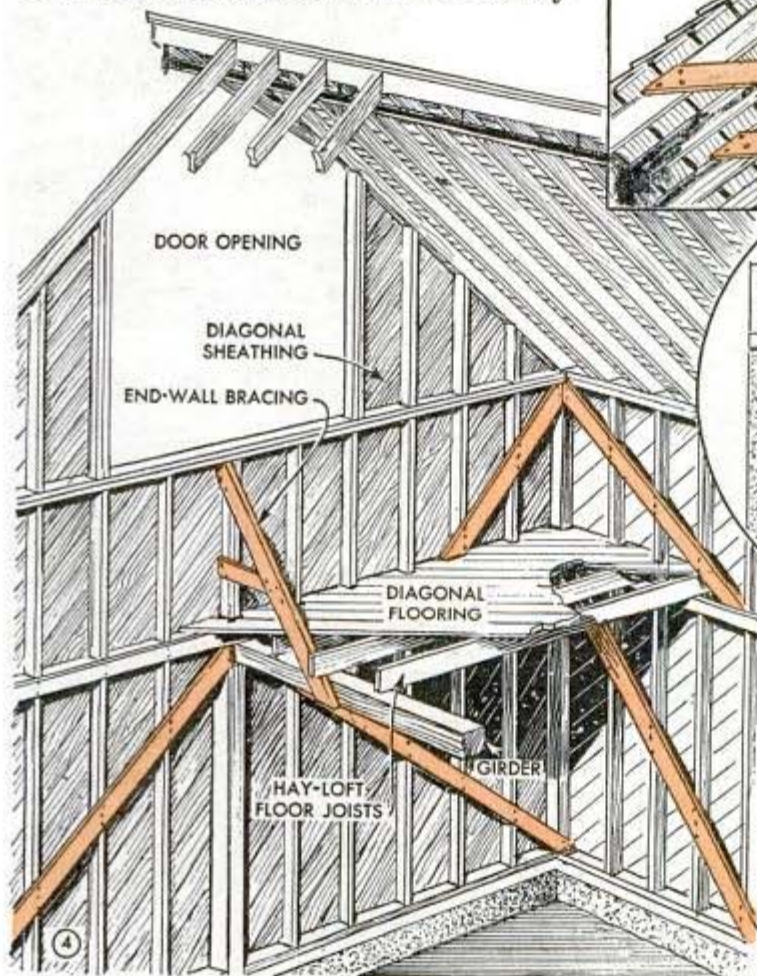
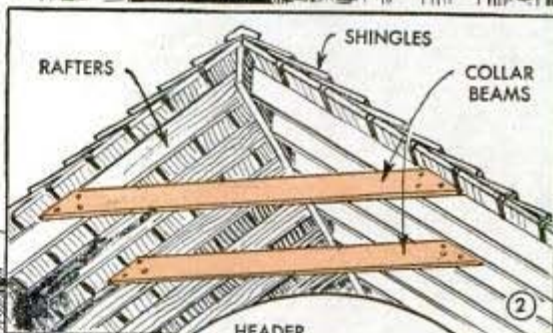


BRACING SAVES OLD BUILDINGS

By W. Clyde Lammey

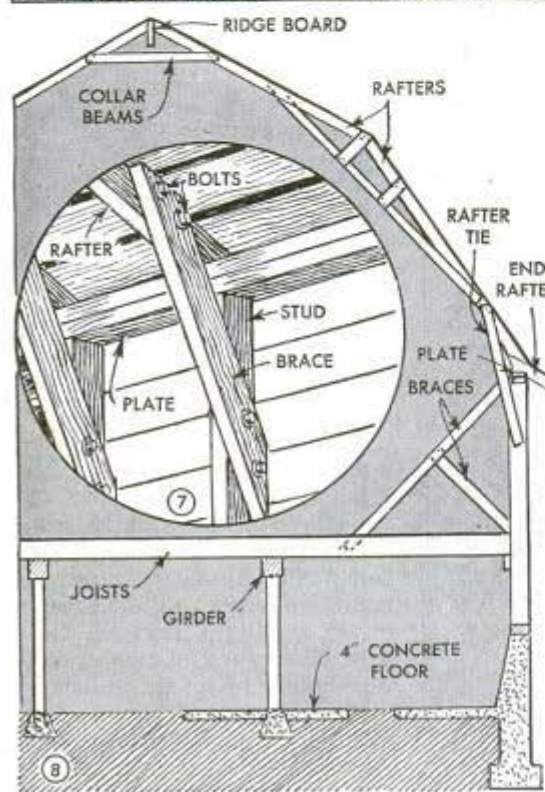
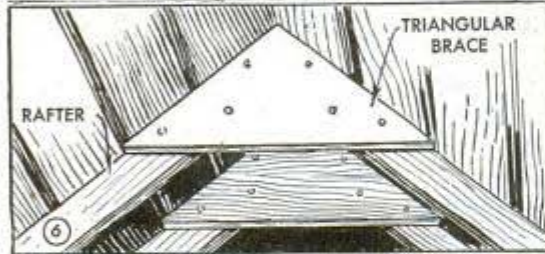
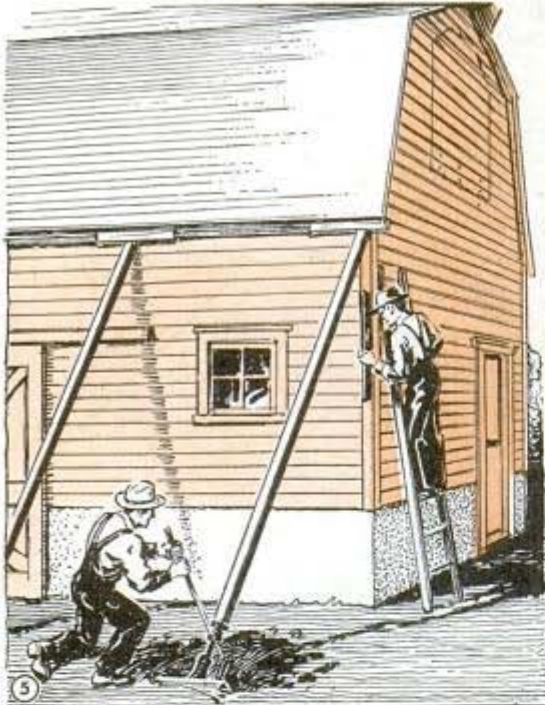
ALL parts of a building that is even slightly out of plumb are subjected to undue stresses, which, if allowed to continue, gradually slacken the normal hold of the nails, cause studding and plates to take a permanent "bend" and unbalance the load on the foundation. Sooner or later wind pressure is likely to combine stresses on the framing to the point where something "lets go." The result is generally an expensive repair job if not a new building.

Where the building stands plumb and is of open-frame construction, sheathed and sided on outside walls only, diagonal braces in the four corners, Fig. 1, are good insurance against sagging and wind damage. Where possible, braces always should be of equal length, should extend from the sill to the plate or ceiling line, and should be spiked to each stud. Where braces must be of unequal length, they should be so located that the stresses will be equalized. Carry bracing around a window or door by



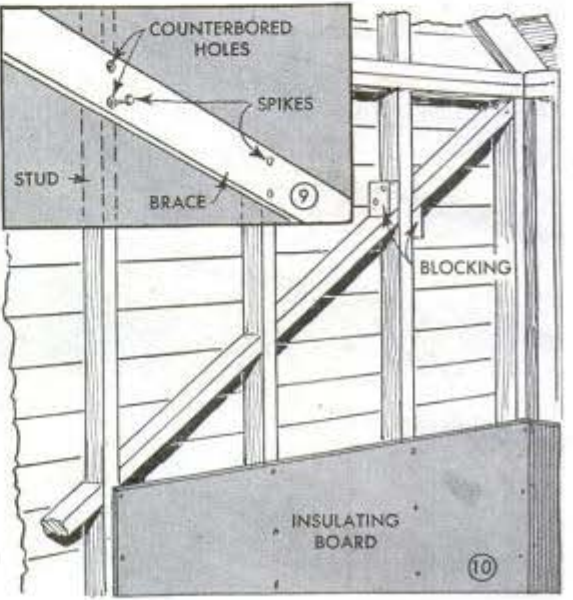
cutting the first piece at the frame, then continue on to the sill with the second piece, the latter being in line with the first. A third member, reaching across at least four studs, is spiked in place parallel with the first two at the top or bottom of the door or window frame.

Usually the weakest points in a roof of conventional framing are at the ridge and



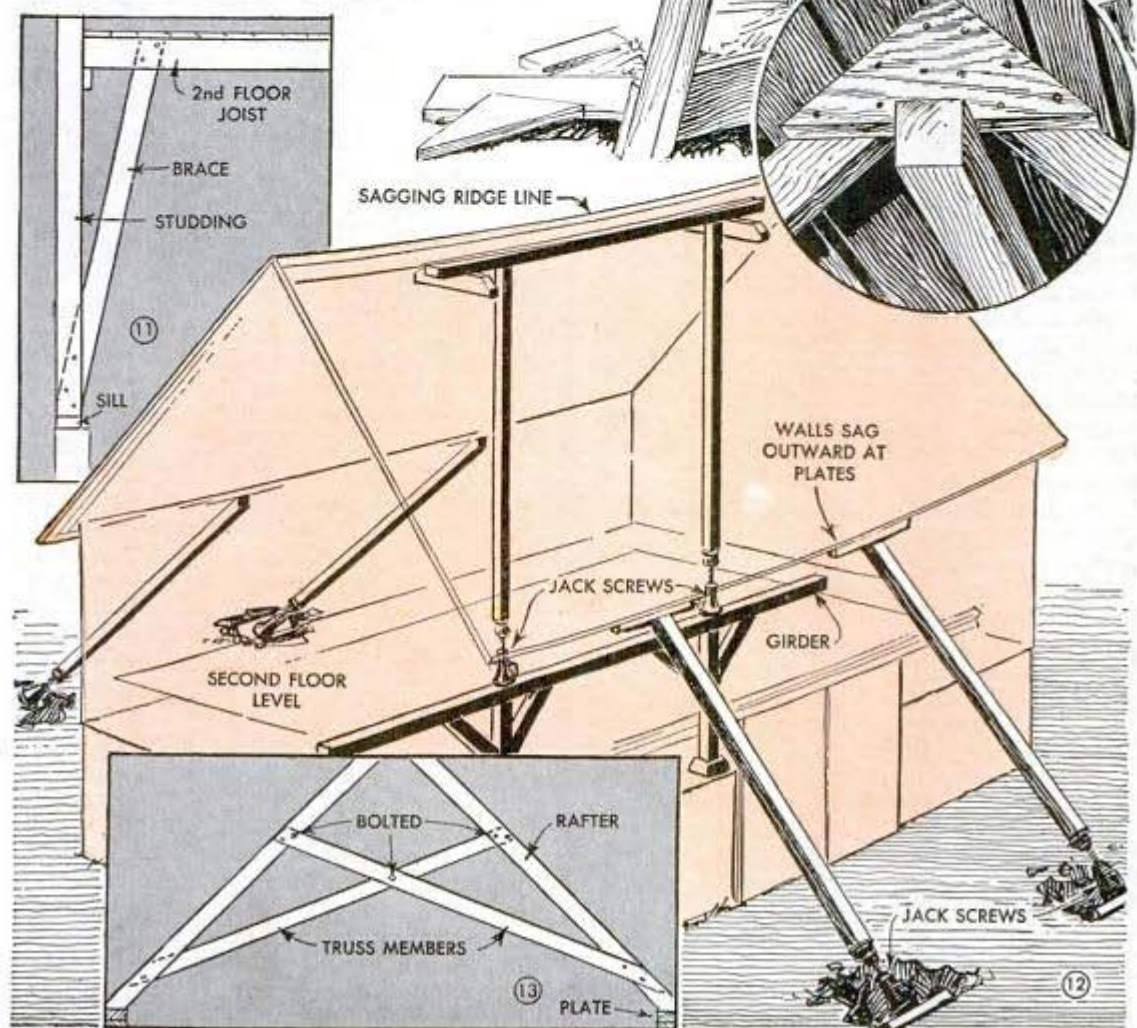
at the plate or ceiling line. If the ridge line is straight you can strengthen the whole roof structure by nailing or bolting in collar beams as in Fig. 2. These should be either of 1 by 8 or 2 by 8-in. stock, whichever is in proportion to the size of the building. Wood-framed structures often are wrecked by windstorms because the frame is not anchored properly to the foundation. Fig. 3 suggests one effective method of anchoring the wall to the foundation where there is a basement or a foundation wall above ground. Another method, somewhat similar in application, is the use of flat-iron ties, bolted to the foundation on the outside and lag-screwed to the studs through the siding.

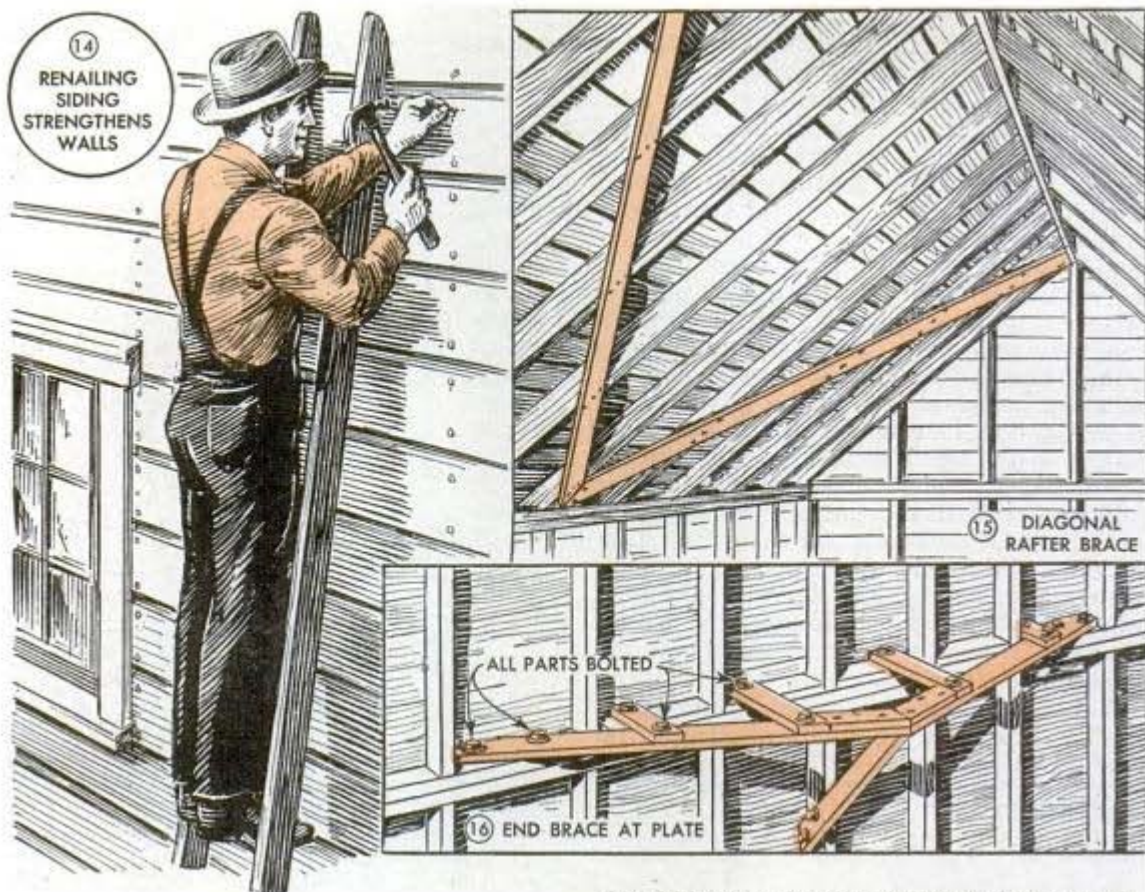
Fig. 4 shows approved methods of bracing an average-size building of open framing and full two-story height. On a new building diagonal sheathing is desirable but on those already built the bracing indicated will be quite effective. Before nailing or bolting in any bracing, always make sure that walls and corners of the building are plumb, and that the plates and ridge are straight. If a building is out of plumb one way, a common method of jacking it back is shown in Fig. 5. Block under the upper ends of the pressure beams so that when pressure is applied the beam ends will not crush the siding and corner boards. Use at least two pressure beams, one at each corner, to prevent racking. If the plates are curved outward and the ridge sags it will be necessary to apply pressure at the center of the building on both sides and at the same time the ridge must be "eased up" with jacks as in Fig. 12. If the walls sag outward at the plate, a fault which may be due to any one of a number



of conditions, and the building is full two-story or is built with hayloft, it's likely that the studs have taken a more or less permanent bend. If any considerable pressure is applied to the wall at the plate or upper-floor ceiling line, the second-floor joists will act as a fulcrum, causing the lower ends of the studs to exert an outward pressure on the foundation wall. If this seems likely to happen, braces from the studs to the floor joists, Fig. 11, will be a good precaution. Install these before bringing pressure on the top of the wall. Once the walls have been plumbed and the ridge straightened give all the jackscrews an extra half turn and then install rafter trusses each way from the center of the building as in Fig. 13. If there's no ridge board, short "collars" nailed to the rafters as in Fig. 6 will strengthen the ridge. Finally, tie the rafters to the studs as in Fig. 7. Ordinarily, one tie and collar to every second stud and rafter will be sufficient, but if the parts were sagged or curved badly, one tie and collar on each stud and rafter will be good insurance. An equal number of joist-to-stud braces, Fig. 11, will take any lateral strains off the foundation walls. Three to five rafter trusses spaced equally usually are sufficient.

It should be remembered that the type of bracing discussed above is applicable in





general only to those buildings which are framed conventionally, and that the procedure applies only to old buildings and to those of later construction which show faults due to various causes. If the roof is supported by purlin-and-post framing or other older types of "barn-framing" consisting of heavy timbers joined with pinned mortise-and-tenon joints, then, of course, somewhat different methods will apply. However, diagonal corner bracing, extending in both directions from the top or ceiling line of the corner posts to the sills at a 45-deg. angle, will greatly strengthen such a structure.

Fig. 8 shows an approved method of bracing a gambrel-roofed building. Generally, this particular bracing can be installed in both old and new buildings and for greater strength it always should be bolted in place. If loose hay is stored in the mow it is necessary to "part" the hay directly over the brace so that the latter will not carry the weight of the hay above it. Sometimes it is desirable to cover the inner walls of outbuildings with insulating board. To save a lot of angle cutting, bracing can be installed over or under the board lining as in Figs. 9 and 10. Where the bracing is applied over the insulating board it's a good idea to drive the spikes in counter-bored holes as shown. The counterbore

should be of a depth equal to half the thickness of the board. Where the bracing is located between studs as in Fig. 10, each piece should be cut to a snug fit, all sections should be kept in line and the ends must be blocked as indicated. Although both methods take more time, the completed job is very nearly as effective as is a brace nailed directly to the studding.

On old buildings, merely re-nailing the siding, as in Fig. 14, helps materially to strengthen the whole structure. Tighten all old nails and add at least one new nail to each board and add at each stud. Re-nailing always should be done after plumbing a building by any of the methods shown, as the nails are certain to be loosened on some parts of the structure. Another added precaution against racking wind pressures is the installation of diagonal rafter braces as in Fig. 15. These run from the ridge to the plate or ceiling line as indicated, and are spiked to the underface of each rafter. These braces usually are installed as a part of the general bracing procedure already discussed. Where it is desirable for any reason to have smooth end walls up to the ceiling line the A-brace shown in Fig. 16 may be substituted for the end-wall angle brace shown in Fig. 4. Properly installed, the A-brace is quite as effective. It should be supported at the center by a short angle brace to one stud.

Make Your Own Combination Hoe and Weeder

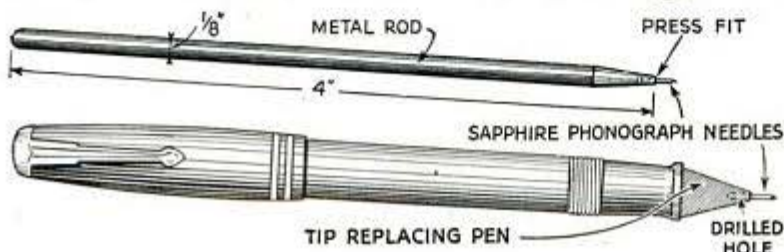
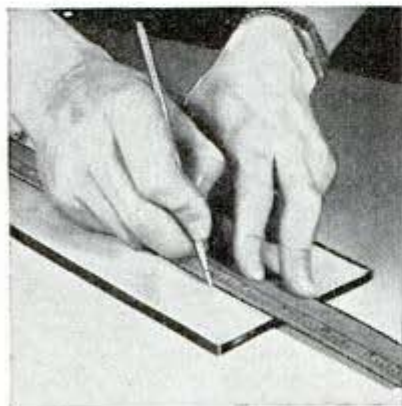
Anyone can make this substitute hoe, which, in some respects, is handier than a regular hoe. It can be used with a chopping motion in the usual way to loosen the ground, or it can be pulled along with the blade just under the surface of the ground to act as a shallow cultivator or weeder. The hoe is attached to a broom handle held in place with a nail and consists of a hardwood block to which is screwed a U-shaped blade made from an 18-in. length of barrel hoop or other thin metal of suitable hardness. The lower edge of the blade is sharpened similar to a hoe blade. — Junior H. Ross, Danville, Ind.



Inexpensive Sapphire-Tipped Pencils to Write on Glass

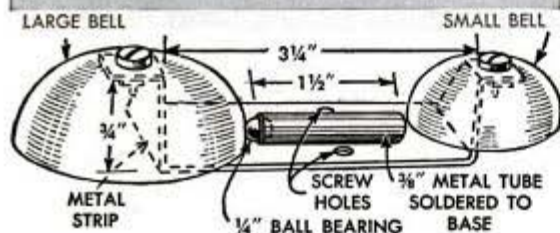
Ideal for lettering chemical glasses and other glassware, or even for cutting glass, this pen and pencil are easy to assemble at practically no cost. The cutters or scribes are sapphire phonograph needles used for recording or for playing phonograph disks. They can be purchased inexpensively or used ones sometimes can be obtained from music stores. The pencil is made from a

piece of 1/8-in. brass rod cut and filed to the shape shown. A small hole drilled in the pointed end takes the needle with a force fit. Care should be taken not to injure the jeweled tip. The barrel of an old fountain pen is used for the pen. After removing the ink sack and other parts a small piece of Bakelite, wood or metal is inserted in the tip in place of the pen point and a hole is drilled in the end for the needle. In use, the pen or pencil is held in the ordinary writing position. Do not use too much pressure. The sharp point of the sapphire may break off but this will not affect the efficiency of the tip for scoring glass. When used for cutting glass, the pencil is held in the same manner as a regular glass cutter. — Herman R. Wallin, Washington, D. C.



☐ If you have trouble installing a new windshield glass into the rubber weatherstrip when replacing a broken one, just squirt some liquid soap into the weatherstrip grooves to serve as a lubricant for the glass.

Two-Tone Gong on Hobby Horse Pleases Small Children



Screwed to a rocker of a chair or hobby horse, or to the wheel of a pull toy, this bell will make the toy more appealing to the child. Two bells of different sizes are attached to a metal strip, which has the ends bent upward to support them as indicated. A small bearing ball rolling in a tube between the bells strikes first one and then the other as the level of the metal strip changes.

Wet Microscope Slides Dried Quickly With Chemical



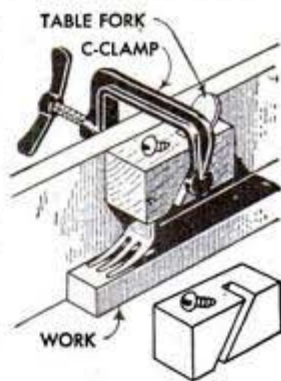
To avoid this, an inexpensive chemical drier can be constructed as shown. Just place some calcium chloride in a Petri dish or similar container and support the slide, specimen side down, directly above the chemical on a couple of small wooden blocks. Get the specimen as close as possible to the chemical without actually touch-

ing it. Then cover the container with another just like it and in a short time the chemical will absorb the moisture and the slide will be dry. Calcium chloride can be used repeatedly for this purpose if it is heated for a short time to drive out the moisture that it has absorbed.

Ira J. Laufer, New York, N. Y.

Work Hold-Downs on Power Saw Improved From Table Forks

Spring hold-downs for work in a jointer or circular saw can be made with old table forks, which are clamped in hardwood blocks, using screws to hold the forks in the blocks. The drawing shows one applied to hold small work on a jointer.



A similar setup can be used on a saw by clamping the block to the fence with a C-clamp.

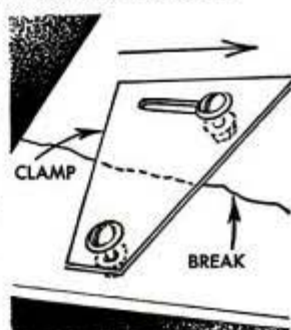
Pvt. Wayne C. Leckey, Aurora, Ill.

Transferring Feathers in Pillows

Instead of opening entirely the ends of two pillows when transferring feathers from one to another, make a small opening at one corner of each pillow. Stitch the corresponding edges of the pillows together to provide a passage for the feathers, which then can be shaken from one pillow to the other without being scattered over the room. After the transfer has been made, cut the stitches to separate the pillows and sew up the openings.

Clamp Helps to Repair Flaws In Cracked Metal Plates

You will find this clamp of help in repairing cracked metal plates and similar articles. The clamp consists of a triangular piece of metal, which is pivoted on one side of the break in the work. At the other end of the clamp is a slot in which a rivet or screw slides, the slot being at a slight angle so that when the clamp is forced toward the rivet the crack in the work is pulled together.



—Arthur K. Taylor, Baltimore, Md.

Aim at

CONTACT PRINTING

First

By Fred G. Korth

IT'S fascinating to print your own pictures. Anyone can master the few tricks and do good work with simple and inexpensive equipment. To start, all you need is a package of contact printing paper the size of the negatives, a printing frame of larger size, developer, acid hypo and some 28-percent acetic acid, three trays and a 25-watt red bulb for a safelight.

After mixing the solutions according to directions furnished, select a convenient place such as a bathroom or kitchen to do the work at night. Use the red bulb for illumination while handling and developing the paper. Pull down shades to keep out street lights. For printing, use a white bulb of 60 to 100 watts. Set the three trays on a bench or table, one tray for developer, another for acetic-acid short stop and a third for hypo as in Fig. 8. Mark the trays to identify them as they should be used for the same chemicals; this can be done with a wax crayon or a piece of waterproof adhesive tape with inked identification.

Regarding paper, there are different grades used to obtain various degrees of contrast in pictures. These grades are: very soft, soft, medium, hard and very hard, indicated by numbers between 0 and 5. Also, papers come in different surface finishes, and can be obtained in



① GOOD PRINT — CORRECT PAPER USED



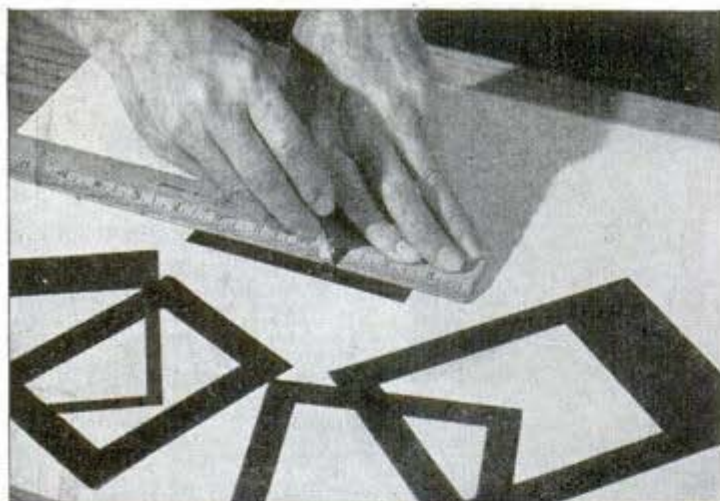
② GOOD NEGATIVE — USE MEDIUM PAPER



③ FLAT NEGATIVE — USE HARD PAPER



④ CONTRASTY NEGATIVE — USE SOFT PAPER



③ MAKE AN ASSORTMENT OF CELLULOID MASKS TO FRAME THE PICTURES



⑥ MASK LOCATED OVER NEGATIVE FOR BEST COMPOSITION OF PICTURE

single or double weight (thickness). The grade of paper to use (soft or hard) depends on the negative, and the surface finish on your preference. For a normal negative like the one in Fig. 2, use the medium grade to get normal prints like that shown in Fig. 1. If your negative is flat—lacks sufficient contrast—as in Fig. 3, use a harder paper for best results. If the negative is too contrasty, as the one in Fig. 4, use soft paper.

For a white border on prints, you need a mask, which is laid between the negative and the paper. Masks are made from black paper or red celluloid. Cut them with a razor blade or sharp knife and a straightedge as in Fig. 5. Provide several masks having openings of different sizes to include only desired portions of negatives. One end of a mask should be wider than the other so that it

can be kept in place on the negative by the narrow part of the hinged back of the printing frame as in Fig. 6.

Pour the desired amount of developer and hypo into the two trays and some acid short stop into the middle one. Acid short stop consists of acetic acid (28-percent strength) in the proportion of 1 oz. of acid to 1 qt. of water. This solution stops action of developer instantly. As the solutions are likely to stain, don't get them on your clothes or on the table. The solutions are most effective at 70 degrees F., although a few degrees variation is permissible. Keep your hands thoroughly free from traces of the solutions—and also dry—while handling the paper. Lay the printing frame face down on the table, remove the back and place the negative, emulsion side up, on the glass, which must be free from finger marks. Adjust the mask over the negative and clamp the narrow part of the back over part of the wide



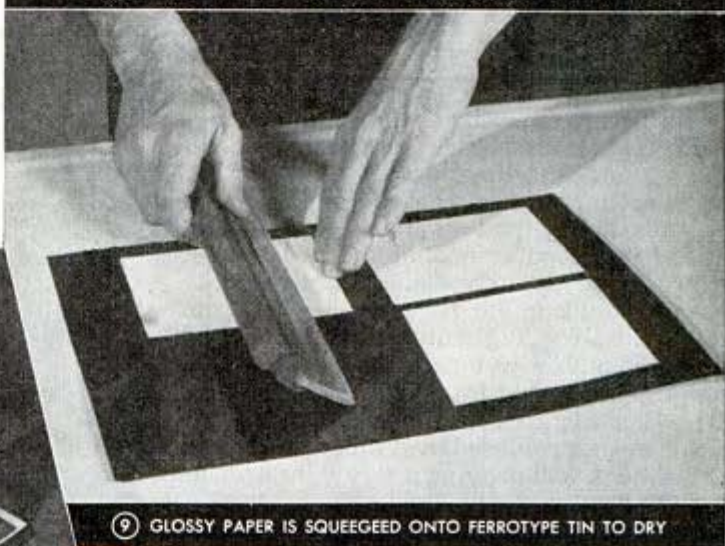
⑦ HOLD PRINTING FRAME SO ALL PORTIONS ARE EQUIDISTANT FROM LIGHT

margin of the mask. Next, place the paper, emulsion side down, on the mask and lock the wide part of the back. Hold the frame about 12 in. from the lamp, Fig. 7, and turn on the light, exposing say for 10 sec., being sure that other paper is covered. All portions of the glass should be equidistant from the lamp for uniform

exposure. Always hold the printing frame the same distance from the lamp and always use the same size lamp. A good method is to clamp the lamp on a table a certain distance from the wall so that you merely have to hold the frame against the wall. After exposure, remove the paper and "slide" it into the developer, Fig. 8, wetting the entire surface at once. Keep the print submerged while rocking the tray slightly. In a few seconds the image will appear. The print is kept in the developer from 45 to 60 sec. If the print gets too dark during this time it is overexposed. After some practice you will be able to make fair estimates of printing time for various negatives. To avoid waste you can try out for correct timing by using strips of paper instead of entire sheets. Leaving prints in the developer too



8 SLIDE PAPER INTO DEVELOPER QUICKLY AND SMOOTHLY



9 GLOSSY PAPER IS SQUEEGEED ONTO FERROTYPE TIN TO DRY



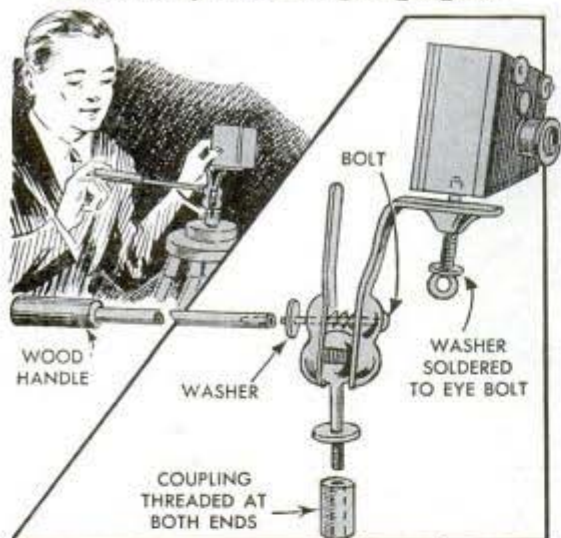
10 TRIM PRINTS FOR UNIFORM MARGINS

long will stain them. Prints are removed by picking them up at one corner (preferably with tongs) and allowing excess developer to drip back into the tray before rinsing them in the stop bath for $\frac{1}{2}$ min., after which they are immersed in hypo, rocking the tray at the beginning for complete coverage. Prints should remain in hypo about 15 min. If they appear too light they are underexposed, but don't put them back into the developer because this won't help and will spoil the developer. Keep the solutions perfectly clean—with no trace

of one in the other. When the developing solution gets brown, and the image of prints given suitable exposure is slow to appear, the solution is exhausted and should be discarded. Hypo, being very inexpensive, should be discarded after each night's work.

Prints removed from hypo are washed thoroughly from 30 to 60 min., preferably in running water, but where this is not available, in a large container, the water being completely changed every 5 min. Thorough washing removes all traces of hypo. After washing the prints, put them on a glass or other flat surface and wipe off excess water with a squeegee, roller or sponge. To dry the prints, place them face down on a cheesecloth stretched over a frame, or between white blotters. Prints that have a high-gloss surface are ferrotyped—squeegeed or rolled on a ferrotin tray as in Fig. 9, on which they are allowed to dry, after which you can trim them to get uniform margins with a sharp knife and straightedge, or with a trimmer as in Fig. 10.

Swing-Head Tripod Attachment Made by Altering Optipod

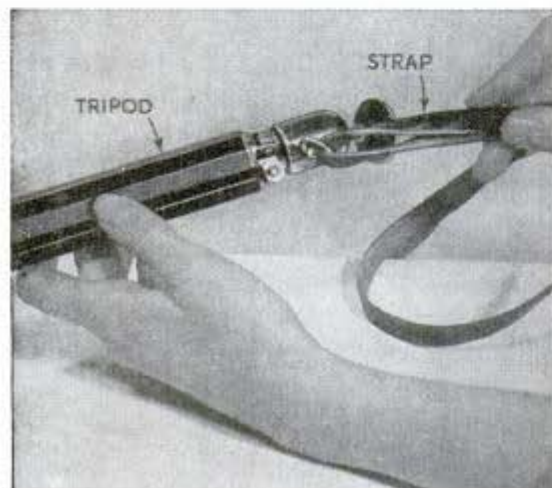


An Optipod may be changed to a swing-head tripod attachment as shown. Drill and tap an 8-in. length of $\frac{1}{2}$ -in. brass $1\frac{1}{2}$ in. deep to screw on the end of the clamp bolt of the optipod in place of the wing nut. Fit the outer end of the rod with a suitable wooden handle. If desired, the swing head can be reversed so that the camera will swing with the handle, and you can purchase an adapter, which is a coupling threaded internally at both ends, for attaching the head to the tripod. A small washer soldered over an eyebolt close to the head will provide a screw for attaching the camera to the swing head.

J. J. Davis, Middleton, Mass.

Over-the-Shoulder Tripod Strap Leaves Both Hands Free

If your tripod has a tension screw fitted with a wire loop like the one shown, a leather strap can be passed through the



loop to form an over-the-shoulder carrying handle. Carrying the tripod in this manner leaves both hands free for using other equipment when the tripod is not in use. On a tripod not fitted with this type of screw, similar results can be obtained by soldering a wire loop to the nut of a $\frac{1}{4}$ -in. stovebolt, which can be screwed onto the top threads of the tripod.

Roland Swedlund, Buffalo, N. Y.

Jig Holds Parts of Film Cartridge For Quick Assembly in Dark

With a jig of the kind shown, parts of 3-piece metal film cartridges are held together so that they may be reassembled in the dark after the spool is loaded without confusing them with parts of other cartridges. With this jig, the spools are taken out and the shells positioned before the light is turned out. In a piece of 1-in. wood about 6 by 10 in., rows of $\frac{1}{4}$ -in. blind holes are drilled as shown. After rounding the edges and corners, the jig can be painted to suit.



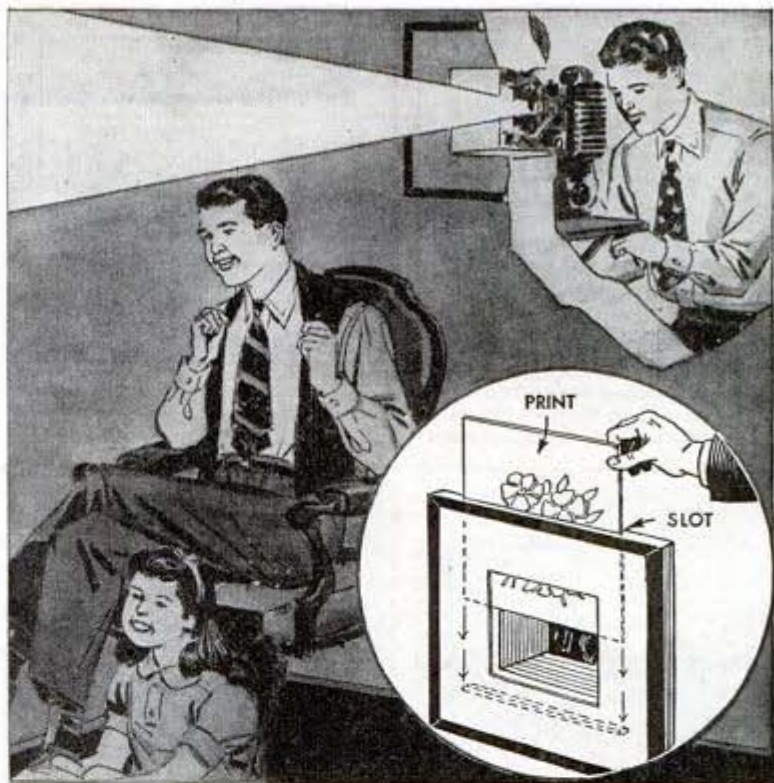
Using Battery Case as Film Tank

When an empty storage-battery case is used as a film-developing tank, the partitions may prevent equal distribution of solution in each compartment as well as make it difficult to pour the liquid back into the bottle when finished. Rather than break out the partitions, holes can be burned through them near the bottom with a stiff wire, the end of which is bent at a right angle and heated red hot.—Walter E. Burton, Akron, Ohio.



Movies Shown Through Aperture in Closet Wall

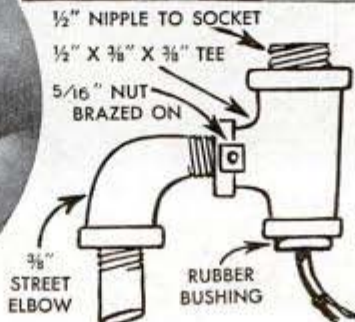
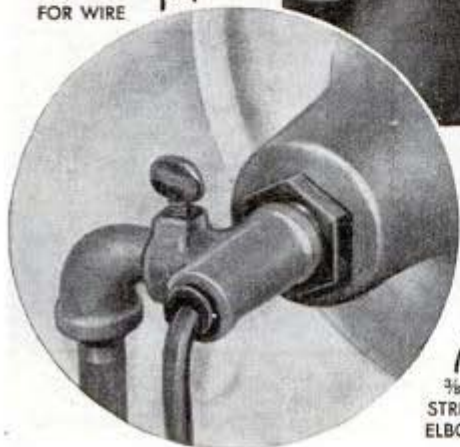
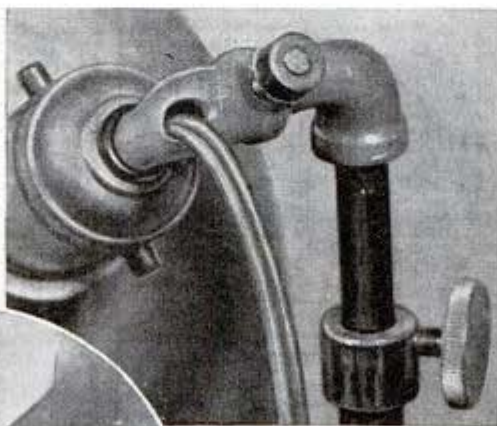
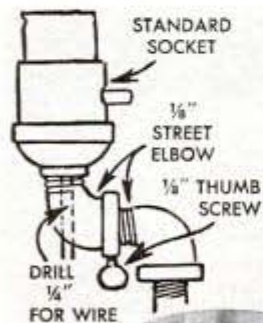
To have his projector permanently set up so that movies could be shown on the living room wall without unpacking and assembling his equipment, one home-movie hobbyist cut an opening through the wall between the living room and an adjoining closet. The projector was set on a shelf adjusted to screen height, and other shelves held reels and film within easy reach. When not used, the opening was hidden by a mounted picture which could be slipped in or out of a frame. For variety in place of the picture, he installed a removable piece of ground glass through which a small light in the closet shone to display colored transparencies.—F. H. Colman, Orange, Cal.



Adjustable Mounts for Reflectors Made From Pipe Fittings

Here are two mounts for photo-lamp reflectors, each of which provides for full range of tilt adjustment. The simplest

mount is made from two $\frac{1}{8}$ -in. street elbows. The elbow which fits into the lamp socket is drilled straight through to take the wire, the outer edges



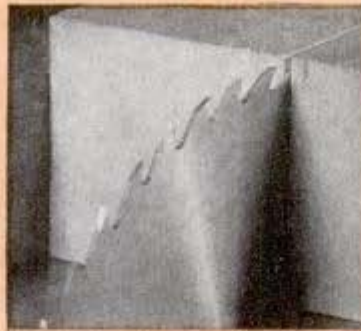
of the hole being filed to a light round in order to protect the wire. A thumbscrew tapped into the shoulder locks the joint. The second style is well suited for mogul sockets but can be used also for standard sockets by reducing the size of the pipe fittings used. In this installation, a $\frac{5}{16}$ -in. nut is brazed in place to provide solid anchorage for the adjusting screw. The wire goes through a reducing tee fitted with a standard rubber bushing.

☞ To keep finger marks off a negative while re-touching it, cut a hole in an envelope and place the negative inside so that just the part being re-touched appears.

CRAFT QUIZ ?



1. He is smoothing work with a—
(a) Smoothing plane (c) Jack plane
(b) Block plane (d) Rabbit plane



2. This circular saw is—
(a) Swage set (c) Stagger set
(b) Wave set (d) Spring set



3. Following up this job you need—
(a) Dowel pins (c) Miter box
(b) Splines (d) Plug cutter



4. Wood filler often is wiped with—
(a) Excelsior (c) Steel wool
(b) Cellulose (d) Shredded paper



5. This inlaid picture is called—
(a) Intarsia (c) Marquissette
(b) Intaglio (d) Marquetry



6. He is using a—
(a) Saber blade (c) Plain end blade
(b) Pin blade (d) Band-saw blade



7. This job requires the use of a—
(a) Rip fence (c) Dado head
(b) Tenoner (d) Miter gauge



8. These cutters are part of a—
(a) Dado head (c) Grooving saw
(b) Coping head (d) Gang saw



9. This turner is all set to cut a—
(a) Cove (c) Bead
(b) Fillet (d) Shoulder

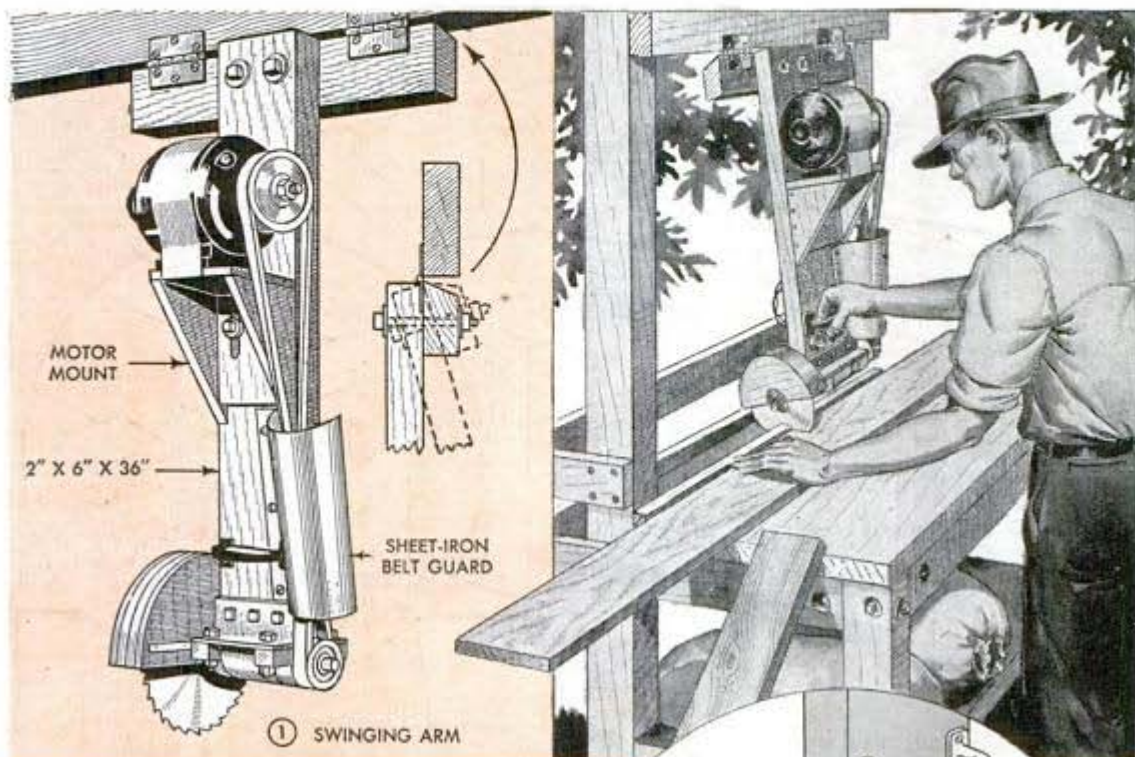


10. Wood shingles on this dog house are—
(a) Yellow pine (c) White oak
(b) Red cedar (d) Select ash



11. The term for this wood bit is—
(a) Solid center (c) Multi-spur
(b) Brad point (d) Double twist

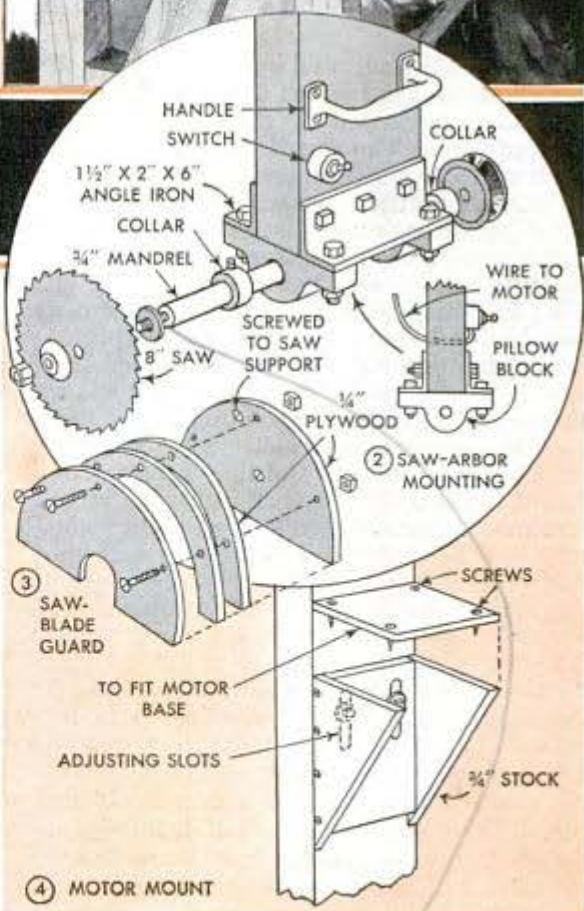
ANSWERS:
1-c 2-d (teeth set
alternately left and
right); 3-b; 4-a; 5-
d; 6-c; 7-d; 8-a;
9-a; 10-b; 11-d



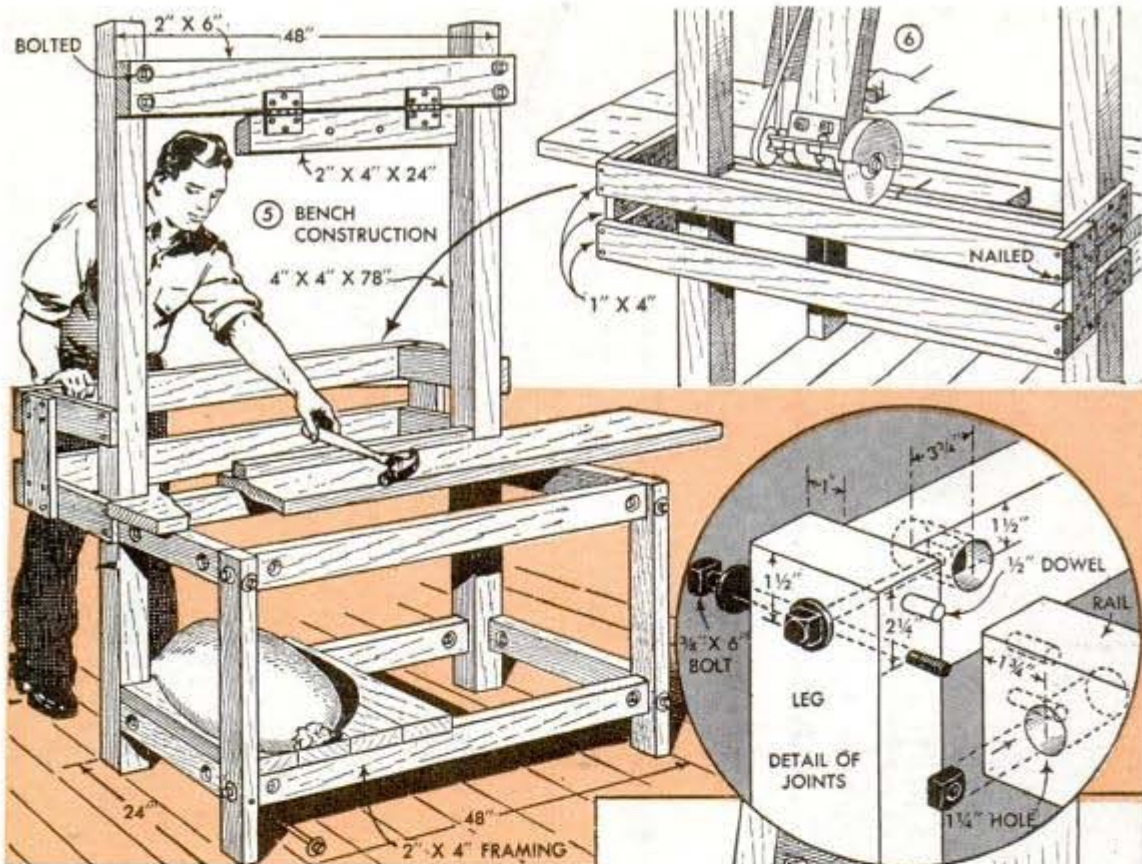
You can make this SWING SAW

YOU'LL find a swing saw one of the handiest tools in your shop. Besides taking care of practically all sawing operations usually done on a small bench saw, it will handle wide or long work. With one hand pulling the saw and the other holding the work firmly against the fence, there is no reason for having the hands near the cutting edge. Also, the saw is safe in that it swings away from the operator by its own weight when not in use.

You can do crosscutting, mitering or ripping, Figs. 7, 8 and 9, by simply screwing suitable fences to the table. In ripping, the saw is locked in a vertical position with a suitable fence fastened to the bench to guide the work. Metal cutting is easily accomplished by using a cutting disk in place of the saw blade. Likewise, a sanding disk may be used on the mandrel for many disk-sanding operations. The capacity of the saw as



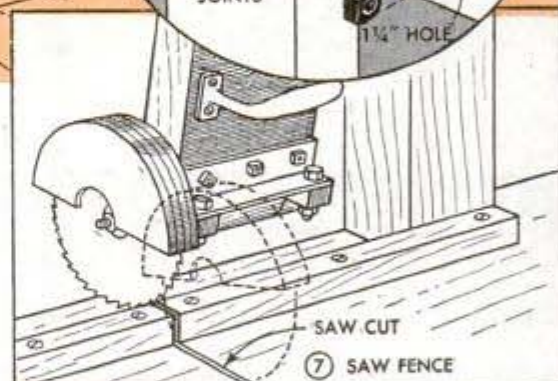
Must be of hand...



to thickness is governed by the diameter of the blade, and the width of the material it will cut is governed by the length of the swinging arm. The saw illustrated will cut work up to 11 in. wide and $2\frac{1}{4}$ in. thick.

Fig. 1 shows the saw on its swinging arm. Some operators make the saw portable so that it can be used in different places, such as outdoors, in the basement, garage or other building, suspending the saw from a joist in the basement and using a special bench outside or in the garage. When the saw is made portable, large butt door hinges are ideal for suspending it. In this way, the saw can be released for moving by simply pulling out the hinge pins. The hinges should have snug-fitting pins to eliminate practically all play, and some means of locking the pins should be provided. You can readily understand what would happen if one of the pins should work out while the saw is in operation.

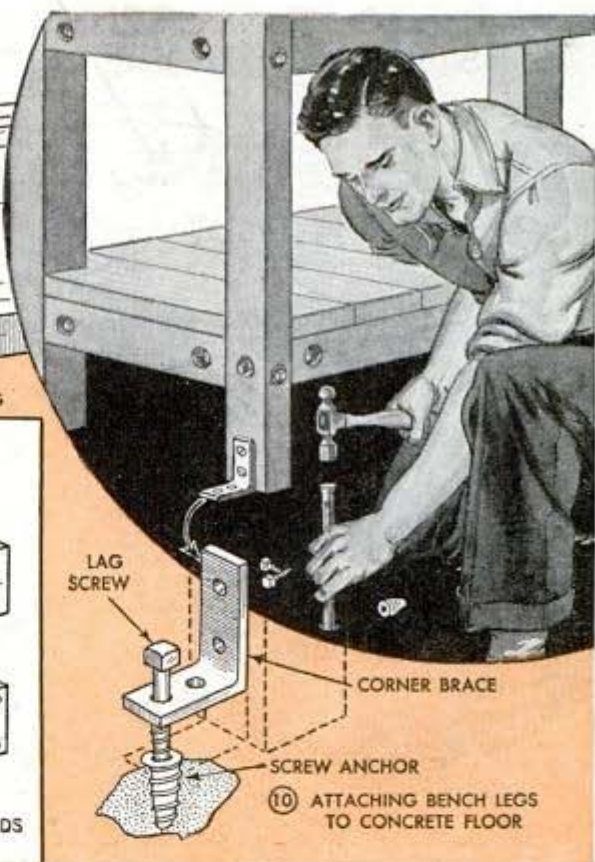
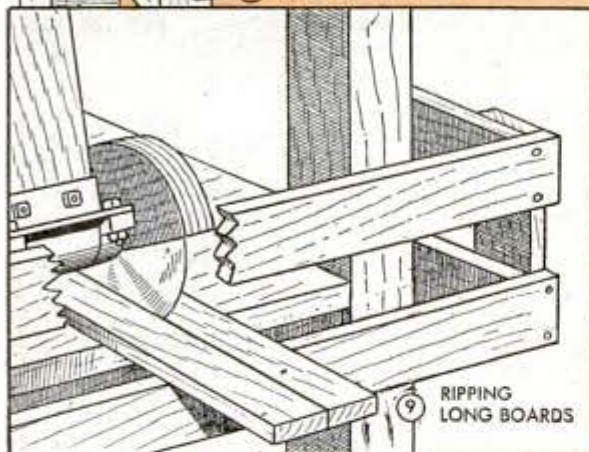
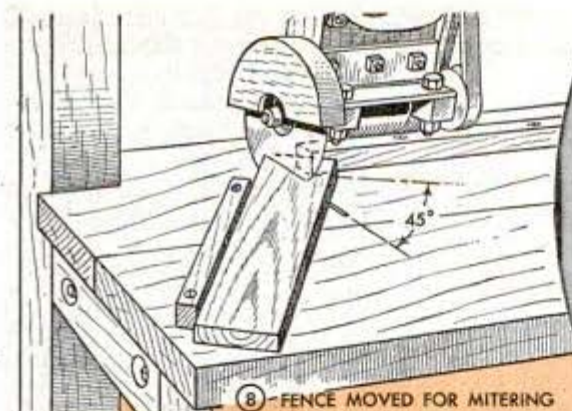
Notice that the 2 by 4-in. horizontal member of the swinging arm is beveled on the upper edge so that the saw can be pushed back past the vertical position. Fig. 2 shows the assembly of the mandrel and saw blade, and Fig. 3 shows the blade guard. The latter can be cut from $\frac{1}{4}$ -in. plywood or hard-pressed board, and is assembled with stove bolts and screwed to the edge of the swinging arm. A toggle



switch is placed close to the handle on the arm so that the motor can be controlled without releasing the arm.

To prevent any possibility of injury from the belt, a sheet-metal guard should be provided. This can be shaped and attached as in Fig. 1. Whether or not the belt is crossed as shown will depend on the direction in which the motor rotates. Fig. 4 shows the motor mount. This is adjustable vertically for tightening the belt, the adjusting being done by loosening two bolts that slide in slots in the mount. After making an adjustment be sure the bolts are tight before operating the saw.

Construction of the special bench is given in Fig. 5. The circular detail at the right shows how the joints are assembled with bolts. This type of construction is desirable because bolts can be tightened to compensate for wood shrinkage, thus as-



sureing a rigid bench at all times. Although overall width of the bench is given as 4 ft., it can be made any size desired. If you want to use the saw for cutting large sheets of plywood, make the bench accordingly, allowing room to install suitable fences. To prevent creeping or tipping, it may be necessary to provide some means of holding the bench. If it is desired to have the bench portable, a couple of large sandbags will do. But, where portability is not a require-

ment, a better way is to fasten the front legs to the floor by means of corner braces or angle brackets. On a concrete floor, anchoring can be done as in Fig. 10, using lag screws held in expanders.

For safety's sake be sure to provide a rear guard on the bench. A simple one assembled as in Fig. 6 will prevent anyone from accidentally coming in contact with the saw. Be sure to locate it so that work can slide between the strips when ripping.

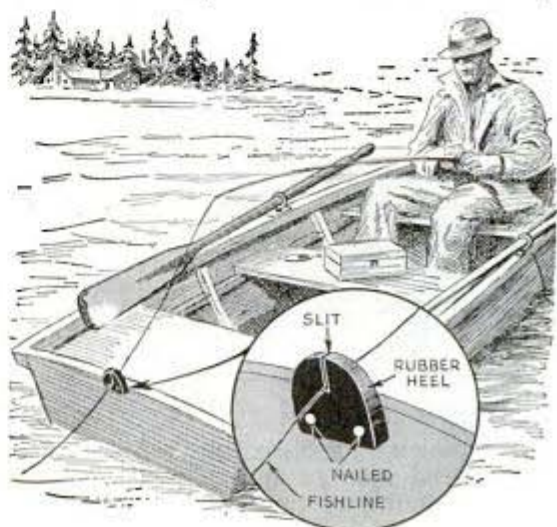
Rubber Heel on Stern of Rowboat Wipes Fish Line Dry

One fisherman nails an old rubber heel on the stern of his rowboat and uses it to squeeze water out of his fish line after each trip. The heel is slit as shown in the circular detail, and the line is run out, then inserted in the slit and reeled back through it. Pressure is sufficient to wring out the water but not enough to fray the line.

G. E. Hendrickson, Argyle, Wis.

Pepper Repels Flies in Market

A butcher who was bothered by flies which gathered around his slicer found that he could rid himself of this annoyance by sprinkling pepper liberally around the scrap catcher of the machine. The pepper acts as a repellent, keeping the flies at a distance.—Lewis Garber, Sandston, Va.

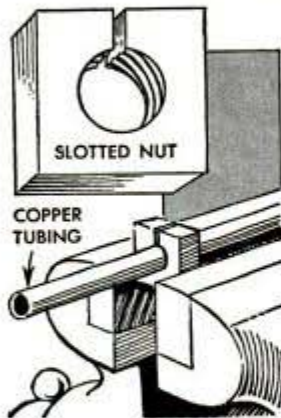


Syphon Hose Can Be Kept in Place By Simple Spring Holder



In laboratories and other places where small syphon hoses are used considerably, and often have to remain in a jar or other container for some time, a holder like the one shown will be of help. It will prevent any possibility of the hose slipping out of place when not attended. The holder is simply a small coil spring bent to a U-shape to slip over the edge of a container, the hose being slipped through the spring.

Metal Tubing Gripped in Vise With Aid of Slotted Nut



Thin metal tubing can be held in a vise without crushing if it is gripped in a slotted nut. Make the slot just wide enough to permit the tubing to be gripped when the slot is closed. If several sizes of tubing are used, make a nut for each size.

Repairing Leaky Pipe Joints

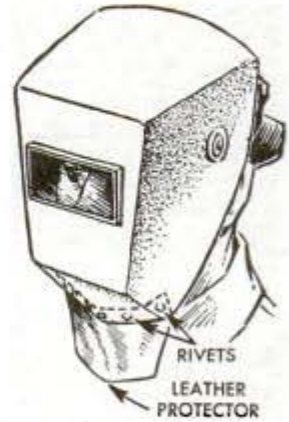
Tiny holes and leaky joints in pipe can be repaired with an application of a mixture consisting of fine steel wool pulled

apart and mixed with regular commercial iron cement. After applying the mixture, wrap cloth around the repaired part to keep the cement in place until it sets. A spiral wrapping is easiest to apply.

Robert Kemp, Troy, N. Y.

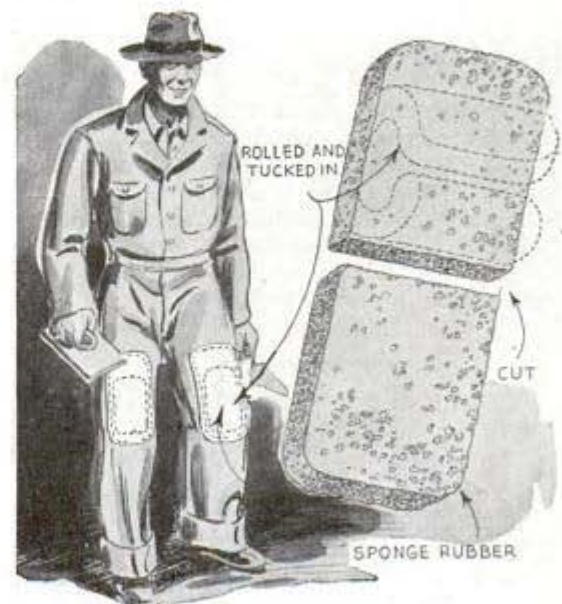
Welder's Helmet Has a Shield To Protect the Throat

One welder who found that sparks often flew up against his throat and burned his skin provided a shield at the lower end of the helmet. The shield is made from a piece of leather about 8 in. wide and is riveted in place.—John Krill, Youngstown, Ohio.

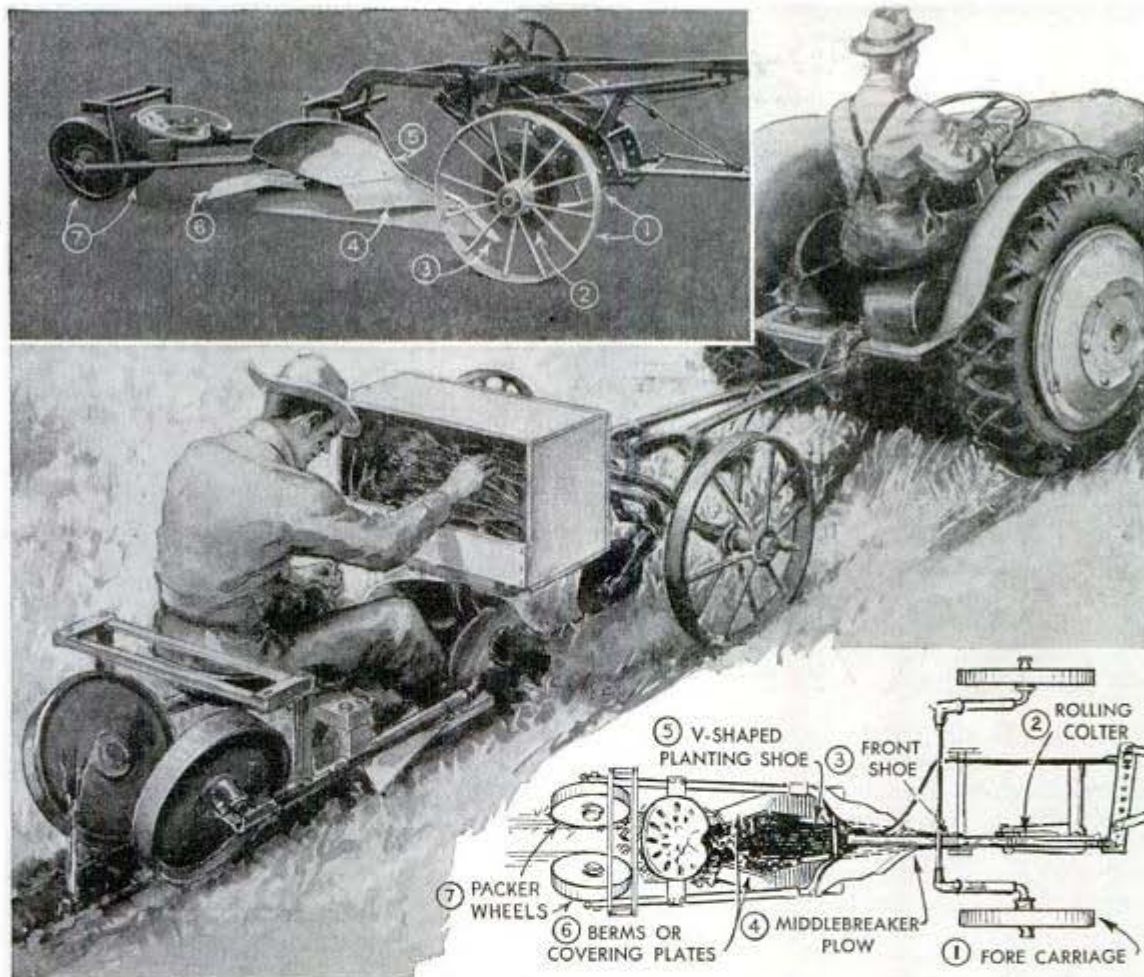


Knee Pockets in Overalls Hold Kneeling Pads

Sidewalk finishers, linoleum layers, and others who must kneel for long periods of time at their work, will find this knee pad arrangement unusually handy. As most overalls have an extra thickness of cloth over the knees to reinforce them, it is a simple matter to rip out part of the stitching in the reinforced pieces to form pockets. When this is done, pieces of sponge rubber cut to size are inserted in the improvised pockets. When not needed, it is only a matter of a couple of seconds to remove the pads.



Homemade Tree Planter Saves Time and Labor



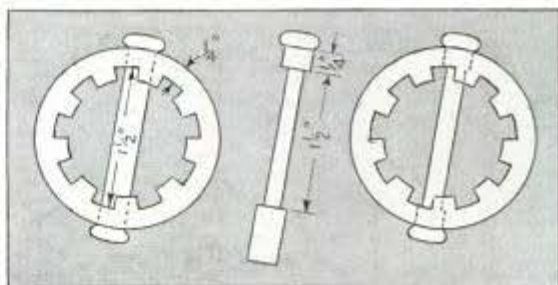
As demonstrated in thirteen Wisconsin counties, young trees, from seedlings to 4-yr. stock, can be transplanted with this machine in less than a fifth the time it would take to plant them by hand. In fact, a farmer and two boys have planted 3,600 per hour. One person on the machine takes trees from a box before him and places them in the trench by hand. Another person drives the tractor, and a third person places the trees, roots in one direction, in piles from which the planter is supplied.

The planting machine resembles a tractor plow having two moldboards to form a lister or middle breaker that opens a furrow in which the trees are placed. Dirt is pushed over the roots by two covering plates and is pressed down firmly around the roots by two packer wheels, which also support the rear of the machine. A front shoe, which guides the point of the middle breaker, is sandwiched between the two moldboards as indicated in the photo.

F. Trenk and H. Bruhn, Madison, Wis.
U.S. ENGR. BILT. UNIV. OF

Replacing Rivet in Worn Splined Sleeve to Prevent Shearing It Off

When replacing a rivet that has been sheared off in a splined sleeve, it is a good idea to reduce the diameter of the central portion of the rivet by grinding or turning off an amount equal to the wear in the splines as indicated. This allows for the play in the splines and prevents the torque being applied against the rivet instead of the splines. Unless this is done the rivet will wear rapidly and soon be sheared off again.—T. E. Roberts, Abilene, Tex.



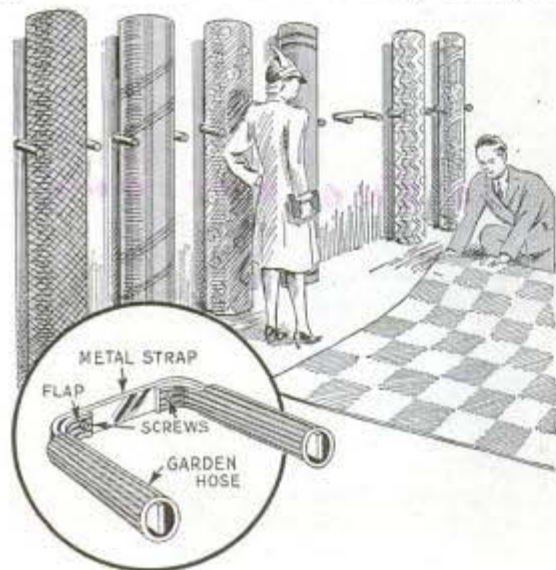
Spiral Point on Lineman's Pole Better Than Usual Hook



Finding it difficult to keep a hook from becoming detached when using his pole to dislodge wires from tree limbs, one lineman substituted a coiled heavy wire spiral for the hook. By placing this against a wire and giving it a few turns it is engaged securely. The same number of turns in the opposite direction releases the spiral.

Flat-Iron Holders on Store Wall Aid in Displaying Linoleum

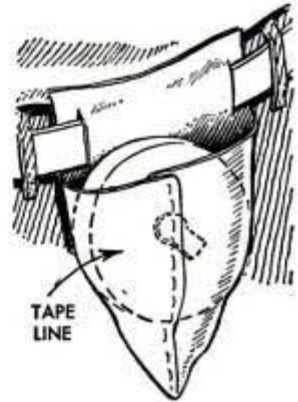
Rolls of linoleum can be displayed neatly along a store wall if individual holders of the type shown are used to keep them in place. The holders are merely U-shaped



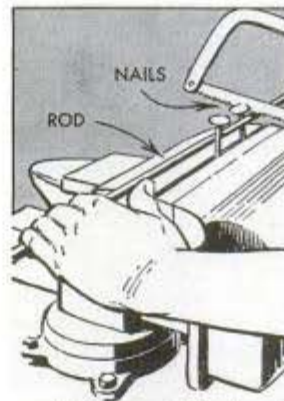
pieces of flat iron, with short lengths of garden hose slipped over them to protect the linoleum from scratches. Note that each piece of hose has a flap through which the attaching screws are passed.

Tape Line Is Easy to Remove From "Squeeze Pocket"

To keep his tape line handy for instant use, one workman made a tapered pocket from heavy cloth, the upper part being slit to fit over his trouser belt. The tape line fits snugly inside the pocket and only requires a squeeze at the tapered end to remove it.



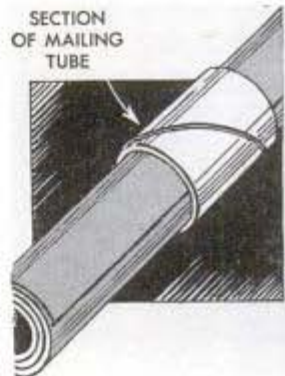
Nails Help to Grip Rod Firmly When Sawing Short Lengths



When sawing off a number of short lengths from a small rod, grip a couple of nails in the vise. These will enable you to hold the work without opening the vise jaws each time the work has to be adjusted. Insert the rod between the projecting nails as shown

Cardboard Sleeve Is Substitute For Rubber Band

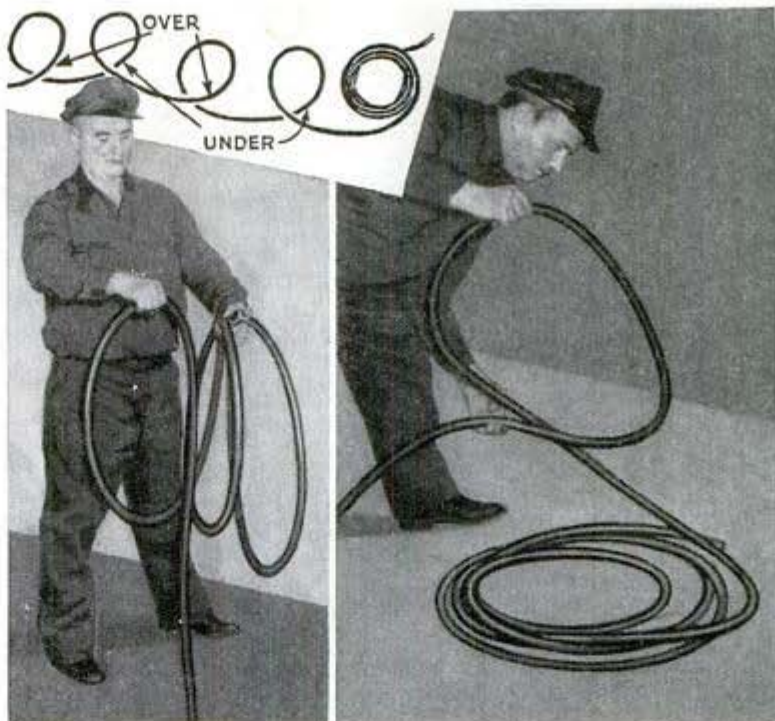
A short section of a cardboard mailing tube provides a good substitute for a rubber band to hold rolled blue prints. If the sections are hard to slip off, roll the prints a little by inserting the finger inside and giving them a couple of turns.



Simple Method of Coiling Hose to Avoid Kinks

City Fireman Louis Haller of Burlington, Ia., has perfected a simple method of coiling hose so that it will not kink when uncoiled. This method is applied only to the smaller hose used by the fire department, and is not used on the large hose. The method also can be applied to garden hose and rope and will eliminate the use of reels. The hose is merely coiled in a series of figure-eights or half hitches. You can do this on the ground or hold it aloft in a series of loops resembling a small letter "e" as written in long-hand, but with the long piece or end of the hose on top on alternate loops and underneath on the others. The same thing can be accomplished by

making a loop as if all were to be either from right or left and making every second one from the right and the others from the left (or over and under) as indicated in the detail. In making a pile of hose, give the second loop a half turn and place it on top



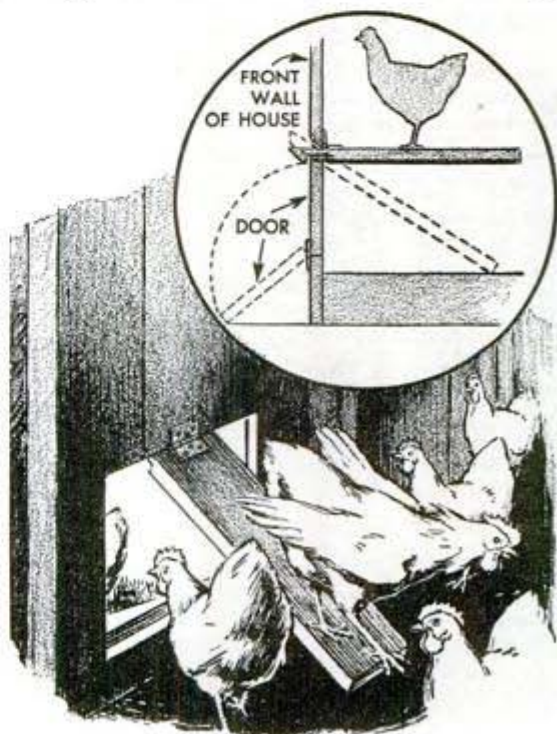
of the stack, remembering to make alternate ones to right and left. When uncoiling the hose the second loop from the top straightens out the one above it as the free end is pulled away.

Ted Hammer, Burlington, Ia.

Chickens Can Open Their Coop Door in the Morning

This automatic door opener will permit chickens to leave their coop early in the morning without someone making a trip to open it, yet keep them shut in safe from predatory animals during the night. Since chickens desire to leave their coop at the break of day, they usually crowd around the entrance door, and in doing so, one of them will fly up on the trigger board, which will allow the door to drop down. The trigger is a 3 or 4-in. strip notched on the underside to fit over the top of the door and hinged to the upper edge of the door opening so that it projects inside the coop. Spring hinges should be used on the door so that it will open when the trigger is tripped. Or, you could use regular butt hinges and mount them so that the door pries against them a trifle before it closes. This would provide a tension to spring the door open when the trigger is released.

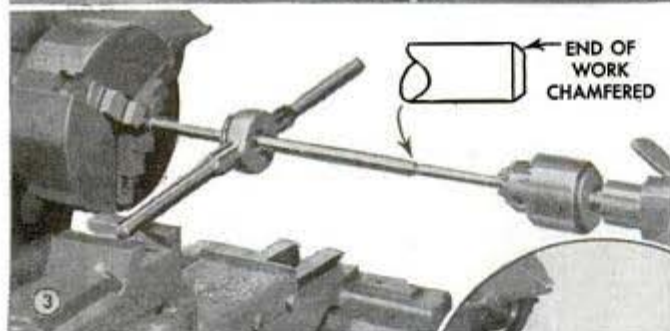
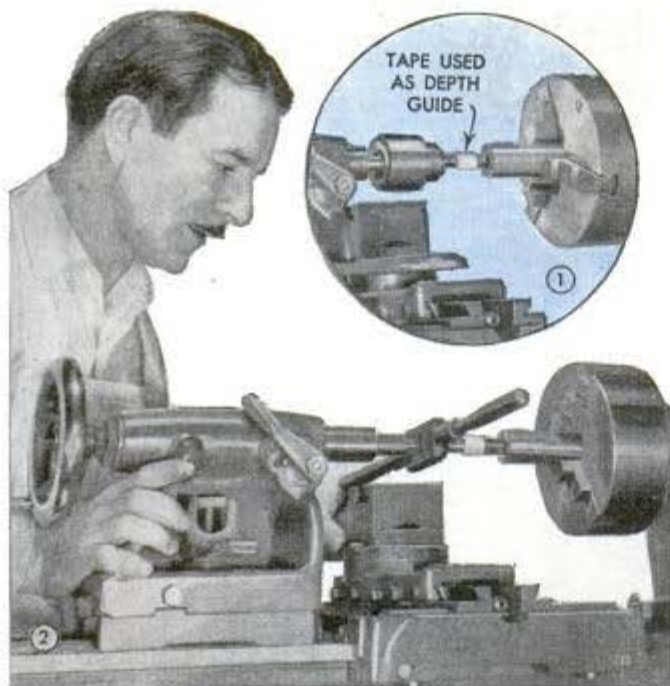
☞ Some poultrymen find that coarse sawdust is more satisfactory as nesting material for chickens than straw, as they do not scratch it out of the nests so easily.



Using TAPS

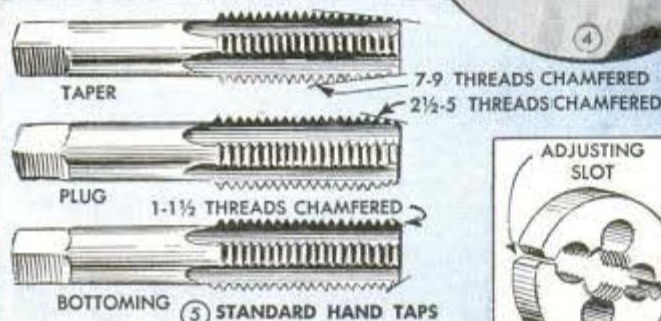
SPEED in operation and uniformity of work are features of threading jobs done in a lathe with the use of taps and dies. Many of the setups are ideal for short-run production work. It will be obvious, too, that taps and dies are the natural solution to thread cutting when available equipment is a lathe without a lead screw.

Tap wrenches and die stocks can be used for simple setups in the lathe. Fig. 2 shows a tapping operation in which the tap is projected into the work by pushing on the tailstock. The lathe is turning at low speed and the tap itself is held stationary by the tap wrench, which rides against the top of the lathe compound. A piece of tape wrapped around the tap as a depth guide indicates when the desired thread length has been obtained. At this point, the lathe is stopped and then reversed to back the tap out of the work. Instead of using a tap wrench, the tap can be gripped in the tailstock chuck, as in Fig. 1, but this method lacks the positive drive of the tap wrench as it is difficult to hold the polished shank of the tap in a three-jaw chuck. Dies are used in a similar manner, the work turning at slow speed while the die



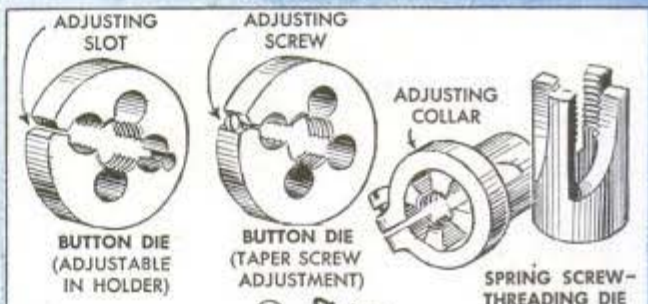
Tap wrenches and die stocks

provide the simplest means of power threading in the lathes. Low speed is used when doing this



Taps

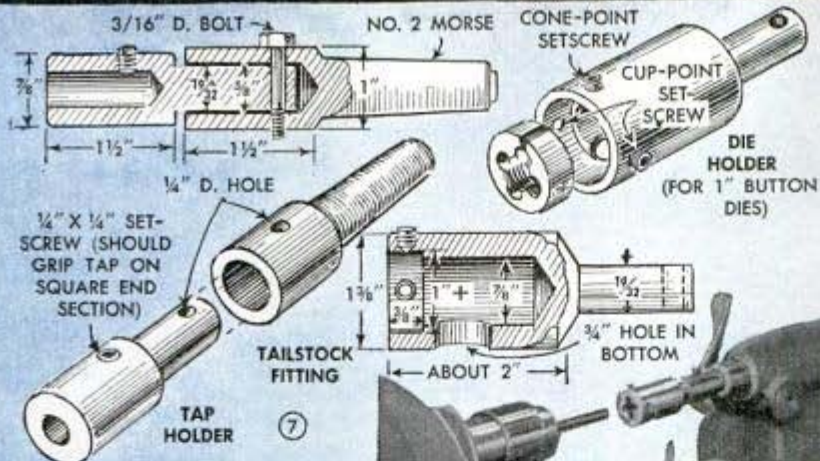
for power threading are identical with taps used by hand. The standard four-fluted hand tap is excellent for general work. The spiral-point tap is good for deep through holes, the angular cutting edges forcing the chips ahead of the tap



Dies

of the familiar "button" style are suitable for power threading. The 1-in. diameter size can be obtained in a thread range of 1/8 to 7/16 inch

and DIES in the LATHE



Floating holder

allows the tap or die to align perfectly with the work. The style shown is easy to make, the tailstock fitting being common to both the tap and the die-holding parts



is held motionless by the handle riding the bed or compound as shown in Fig. 3. The end of the work always should be chamfered to assist the die in starting. An easy way to start the die is to press it forward with the tailstock ram handle, as in Fig. 4. Short work normally will require no support other than the chuck, but long, slender work should be supported from the tailstock with a 60-degree pointed rod, Fig. 3. Taps and dies are self-leading once the thread has been started.

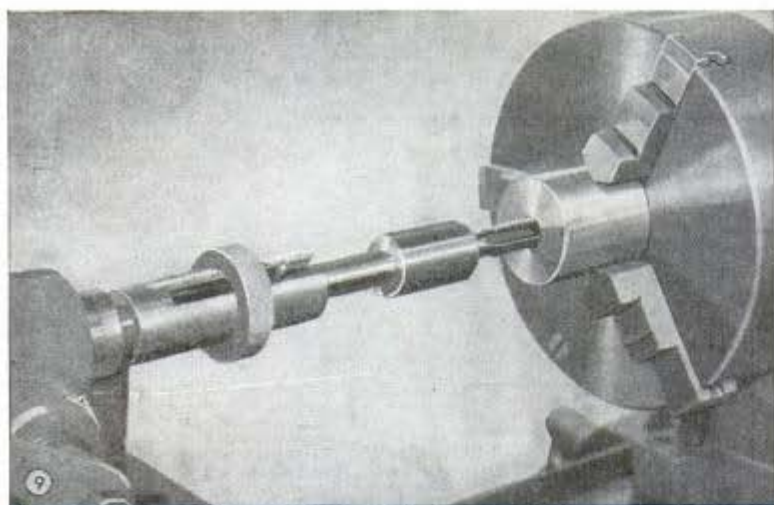
Lubrication of the work is important and assists materially in obtaining clean threads. Straight lard oil or a 20-percent mineral lard oil is excellent for general work. Cast iron and brass can be tapped dry. Half-and-half lard oil and kerosene is suitable for aluminum. The lubricant is best applied by brush although an oilcan will do if the work is flooded properly.

Speed should be the lowest available and should not exceed 150 r.p.m. for taps or dies under $\frac{3}{8}$ in. and not over 100 r.p.m. for larger sizes. If your lathe has a lower speed, say, 50 r.p.m., use it. It is true that tapping can be and is done at high speed, but it doesn't work with these setups.

Taps and dies used are standard. Some confusion results from the use of the term "hand taps." Actually these are no different from machine taps except the size designation. Hand taps are in fractional sizes while machine taps are the numbered ma-

chine-screw sizes. The style of tap—taper, plug or bottoming, Fig. 5—will depend on whether or not the hole to be tapped is blind or goes clear through the work. The spiral-point or "gun" tap is a very good type for power-tapping, especially when tapping deep, through holes. The angular cut at the end produces a long curling chip which is forced ahead of the tap, thus eliminating chip clogging. All taps can be obtained with two, three or four flutes. The common style (four flutes) is practical for all-around work, but is not good for deep holes except in cast iron. Two-fluted taps in the small sizes are used extensively for deep holes in all metals, and those having three flutes can be used for all tapping, especially blind holes in soft metals. Dies used most commonly include the simple button type and the spring, screw-threading die, Fig. 6.

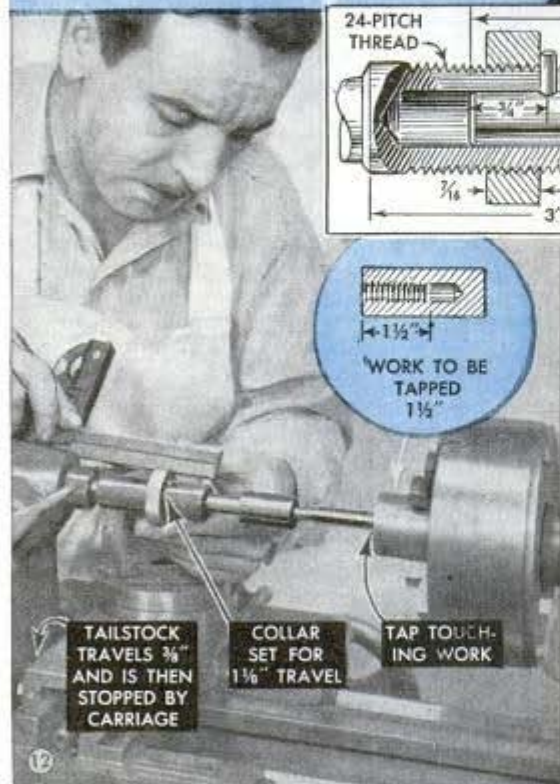
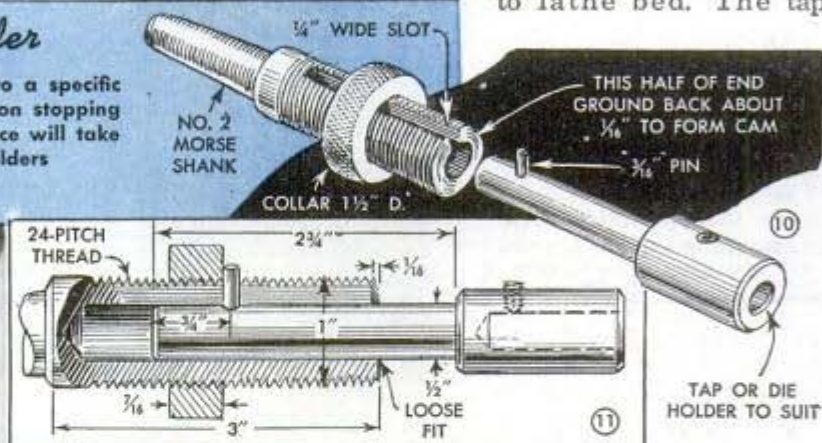
The floating holder, Figs. 7 and 8, has a certain amount of side play which permits the tap or die to follow its own lead. The float feature takes care of any slight misalignment between the work and die, thereby eliminating tapered work. The method of working is the same as when the tap or die is held in a rigid mounting. Engagement is made by pushing forward on the tailstock, the lathe being stopped and reversed at the end of the cut.



Releasing holder

is excellent for threading to a specific length without depending on stopping the lathe. The tailstock piece will take either tap or die holders

excellent for die-threading to a shoulder or tapping blind holes, and can be set accurately to within $\frac{1}{16}$ in. The manner of setting up is shown in Fig. 12, which illustrates a tapped hole $1\frac{1}{2}$ in. deep. The tap is pushed up until it touches the work, after which the tailstock ram is locked. The tailstock itself is free to slide, but is limited to exactly $\frac{3}{8}$ in. forward travel, and is then stopped by the carriage or by a stop clamped to lathe bed. The tap



holder itself is set for $1\frac{1}{8}$ in. travel by means of a knurled collar. With the setup made, the tailstock is pushed forward by hand, allowing the tap to engage smoothly. The tailstock feeds forward $\frac{3}{8}$ in. after which the tap holder runs out $1\frac{1}{8}$ in. and then spins free. The total tap penetration is $1\frac{1}{2}$ in. Reversing the lathe will automatically backtrack the tap. The setup repeats exactly on any number of similar pieces.

The self-opening die head is a manufactured device available in a number of sizes and styles. The die head is mounted in the tailstock, Fig. 13, and is pushed forward to engage the work. After engagement, the die pulls the tailstock along until it strikes a stop clamped to the lathe bed, at which point the thread chasers in the die head automatically open to a size that entirely clears the work. Besides providing full control over thread length, the die head can be backed off without stopping or reversing the lathe. Interchangeable thread chasers provide for cutting a number of different threads with the same head, the one shown having a range from $\frac{1}{8}$ to $\frac{1}{16}$ in.

Sizing the work to the right diameter or bore is one of the most important features

A releasing holder like the one shown in Figs. 9, 10 and 11 threads the work to a certain set depth and then automatically releases and spins with the work. This style of holder permits definite control over the length of thread that is to be cut, and can be used at a speed higher than that used when the length of thread is controlled by stopping the lathe. It is

TAILSTOCK TRAVELS $\frac{3}{8}$ " AND IS THEN STOPPED BY CARRIAGE

COLLAR SET FOR $1\frac{1}{8}$ " TRAVEL

TAP TOUCHING WORK

WORK TO BE TAPPED $1\frac{1}{2}$ "

TAP DRILLS

80 TO 90% FULL THREAD

1. SHALLOW HOLES OR THIN WORK WHEN DEPTH OF THREAD IS LESS THAN DIAMETER
2. CAST IRON
3. HAND TAPPING

75% FULL THREAD

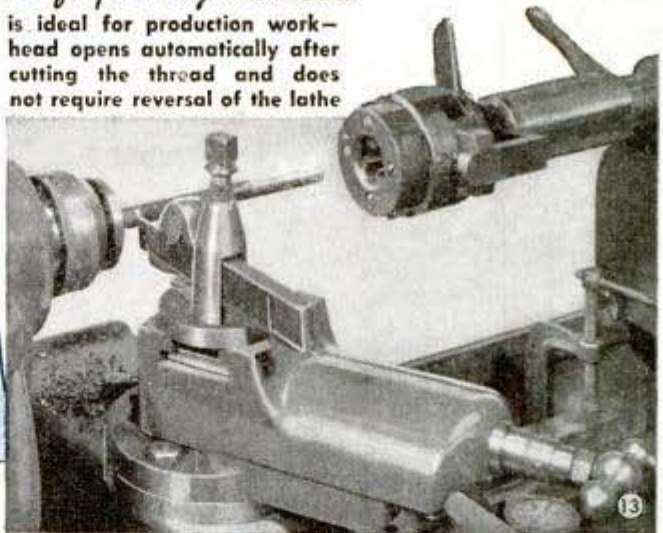
1. ALL GENERAL WORK
2. ALL STEELS
3. WHEN THREAD LENGTH IS BETWEEN 2 TO 4 DIAMETERS
4. FINE THREADS—(NF OR FINER)

50% FULL THREAD

1. WHEN DEPTH OF THREAD IS OVER 2 DIAMETERS
2. COPPER, BRASS, ALUMINUM—ALL SOFT METALS
3. COARSE THREADS—(NC OR COARSER)

Self-opening die head

is ideal for production work—head opens automatically after cutting the thread and does not require reversal of the lathe



TAP DRILL SIZES AND PERCENTAGE OF THREAD

| COARSE THREAD SERIES | | | | FINE THREAD SERIES | | | |
|----------------------|-----------------------------------|--|--|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Tap | 90% * | 75% | 50% ** | Tap | 90% * | 75% | 50% ** |
| 2-56 | No. 51-83% | No. 50-70% | No. 49-56% | 2-64 | No. 50-80% | No. 49-65% | $\frac{5}{64}$ -40% No. 48-50% |
| 3-48 | No. 48-85% | No. 47-78% $\frac{5}{64}$ -77% | No. 44-50% | 3-56 | $\frac{3}{64}$ -91% | No. 45-74% | No. 44-56% |
| 4-40 | No. 44-81% | No. 43-72% | No. 41-50% $\frac{3}{32}$ -56% | 4-48 | No. 43-85% | No. 42-70% $\frac{3}{32}$ -70% | No. 40-52% |
| 5-40 | No. 41-90% $\frac{3}{32}$ -97% | No. 38-75% | $\frac{7}{64}$ -50% | 5-44 | No. 40-90% | No. 37-70% | No. 35-50% $\frac{7}{64}$ -53% |
| 6-32 | No. 37-83% | $\frac{7}{64}$ -71% No. 36-78% | No. 32-53% | 6-40 | $\frac{7}{64}$ -91% | No. 33-78% | $\frac{1}{8}$ -41% No. 31-59% |
| 8-32 | No. 30-88% $\frac{1}{8}$ -90% | No. 29-68% | No. 27-49% $\frac{3}{64}$ -56% | 8-36 | No. 30-100% | $\frac{9}{64}$ -64% No. 29-78% | No. 27-56% |
| 10-24 | No. 27-85% $\frac{3}{16}$ -91% | No. 25-76% $\frac{5}{32}$ -63% | No. 20-54% | 10-32 | $\frac{5}{32}$ -83% No. 23-88% | No. 21-76% | $\frac{1}{16}$ -44% No. 18-51% |
| 12-24 | No. 18-87% | No. 16-72% $\frac{11}{64}$ -81% | No. 12-50% $\frac{3}{16}$ -54% | 12-28 | No. 16-85% | $\frac{3}{16}$ -61% No. 14-74% | No. 11-54% |
| $\frac{1}{4}$ -20 | No. 10-88% $\frac{3}{16}$ -97% | No. 6-71% $\frac{13}{64}$ -72% | $\frac{3}{32}$ -47% No. 3-57% | $\frac{1}{4}$ -28 | No. 4-89% | $\frac{7}{32}$ -67% No. 3-80% | No. 2-63% No. 1-48% |
| $\frac{5}{16}$ -18 | $\frac{1}{4}$ -86% | $\frac{17}{64}$ -65% F-76% | $\frac{3}{32}$ -43% I-55% | $\frac{5}{16}$ -24 | $\frac{13}{64}$ -87% | I-74% | $\frac{3}{32}$ -57% |
| $\frac{3}{8}$ -16 | N-90% | $\frac{5}{16}$ -78% | Q-53% $\frac{21}{64}$ -58% | $\frac{3}{8}$ -24 | $\frac{21}{64}$ -87% | Q-80% | S-50% $\frac{11}{32}$ -57% |
| $\frac{7}{16}$ -14 | $\frac{31}{64}$ -84% T-85% | $\frac{3}{8}$ -66% U-74% | $\frac{25}{64}$ -50% | $\frac{7}{16}$ -20 | $\frac{3}{8}$ -95% | $\frac{23}{64}$ -72% W-78% | $\frac{13}{32}$ -48% Y-51% |
| $\frac{1}{2}$ -13 | Z-87% | $\frac{7}{16}$ -63% $\frac{27}{64}$ -79% | $\frac{29}{64}$ -47% | $\frac{1}{2}$ -20 | $\frac{7}{16}$ -97% | $\frac{29}{64}$ -72% | $\frac{15}{32}$ -48% |
| $\frac{5}{16}$ -12 | $\frac{13}{32}$ -87% | $\frac{31}{64}$ -72% | $\frac{1}{2}$ -57% | $\frac{5}{16}$ -18 | $\frac{1}{2}$ -86% | $\frac{33}{64}$ -64% | $\frac{17}{32}$ -43% |
| $\frac{5}{8}$ -11 | $\frac{31}{64}$ -92% | $\frac{25}{64}$ -67% $\frac{17}{32}$ -80% | $\frac{9}{16}$ -53% | $\frac{5}{8}$ -18 | $\frac{7}{16}$ -87% | $\frac{37}{64}$ -65% | $\frac{19}{32}$ -44% |
| $\frac{3}{4}$ -10 | $\frac{41}{64}$ -85% | $\frac{21}{32}$ -72% | $\frac{11}{16}$ -48% | $\frac{3}{4}$ -16 | $\frac{43}{64}$ -96% | $\frac{11}{16}$ -78% | $\frac{45}{64}$ -58% |
| $\frac{7}{8}$ -9 | $\frac{3}{4}$ -87% | $\frac{49}{64}$ -77% | $\frac{13}{16}$ -44% $\frac{51}{64}$ -54% | $\frac{7}{8}$ -14 | $\frac{51}{64}$ -84% | $\frac{13}{16}$ -68% | $\frac{53}{64}$ -51% |
| 1-8 | $\frac{59}{64}$ -87% | $\frac{7}{8}$ -77% | $\frac{59}{64}$ -48% $\frac{29}{32}$ -58% | 1-14 | $\frac{59}{64}$ -84% | $\frac{15}{16}$ -68% | $\frac{61}{64}$ -51% |

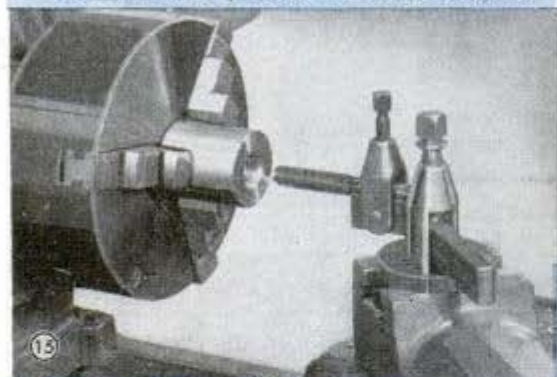
* Not recommended for power tapping.

** 50% of full thread in lengths over $1\frac{1}{2}$ -diameter is 80% as strong as full thread—Recommended for machine tapping.



Power feed

can be used for jobs of precision threading. This provides a safe method of starting the thread without any danger of thread stripping



Using tap as threading tool

is a useful trick when threading a number of odd-size holes. The tap is advanced by the lead screw, and cuts with one flute only

of tap and die threading. External cuts with a die are usually net, with perhaps .004 in. undersize when working soft metals over 1/2 in. in diameter. The drilled hole for the tap can run from 50 to 90 percent of a full thread. Machine tapping, in general, favors a drill that will give 60 to 75 percent of a full thread. This is sufficiently strong for all average work and is easier and smoother to work. A 50-percent thread is all that is needed for soft metals and deep holes in any material.

Power feed is useful for precision threading. By mounting the tap or die on the lathe carriage, Fig. 14, and feeding it at the same rate as the thread or die, the lead is positively and accurately controlled.

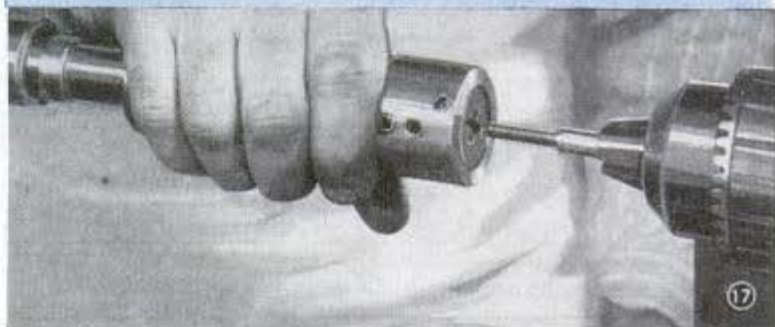
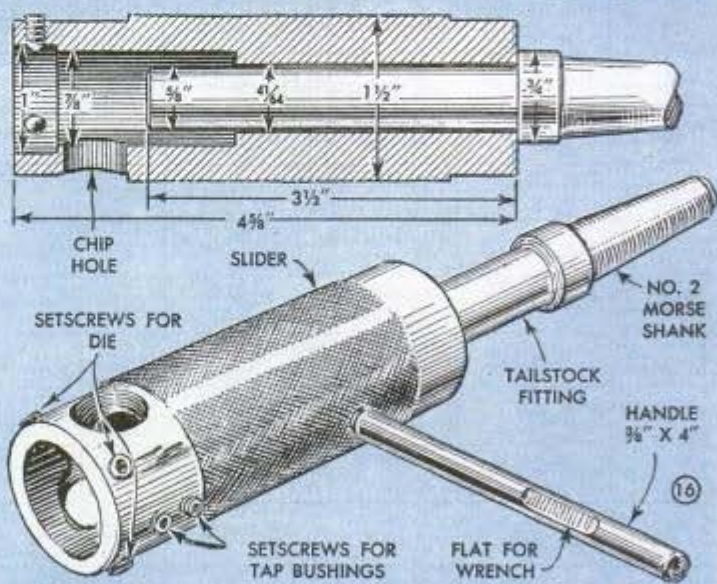
This setup is not commonly used for short threads, but is occasionally useful on long threads requiring an accurate lead. A secondary advantage is that the start of the thread is automatic, eliminating any danger of stripping the thread.

A tap used as a threading tool is illustrated in Fig. 15. This method of working often is useful on odd-size holes. The tap is mounted on the compound and is advanced with power feed at the same thread rate as the tap itself. Threads of 12 to 20 pitch can be cut in two or three passes by using this method.

A sliding holder such as shown in Figs. 16 and 17 is a useful type for occasional work and is especially good for die threading small work right up to a shoulder. The sleeve is held by hand during the threading operation and, when released at end of cut, spins with the work. A removable handle is provided so that heavier threading can be done in the conventional manner with handle riding the compound.

Sliding holder

is excellent for threading to a shoulder or to bottom of blind holes. The tailstock is fixed; forward travel of die holder is guided by tailstock fitting, and holder is held by hand



Old Car Converted to Heavy-Duty Farm Tractor



Shortage of farm tractors did not hinder Dennis Barker and Reo Reid of Concordia, Kans., who converted an old car into a tractor that has pulled a 17-ft. grain combine over all kinds of ground in harvesting 15,000 acres of wheat. Mainly, the tractor is a large car shortened and fitted with a heavy truck rear axle and two transmissions which give the tractor thirteen speeds forward and seven in reverse, the forward speeds ranging from 1 to 50 m.p.h. The higher speeds are used on the road when traveling from one job to another. The truck wheels and tires are left on the axle, and larger wheels with tires are bolted to them. This arrangement has been found advantageous when it is necessary to work in fields where the ground is wet and soft. If the large tires sink too deeply, the truck tires come in



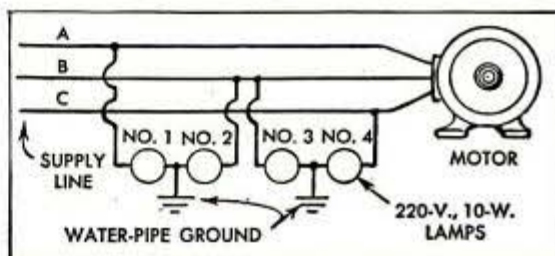
contact with the ground and thus increase traction as well as load-carrying area. A tractor radiator instead of the one on the car provides a cooling system large enough to cool the motor under heavy loads.

Leo D. Harris, Killdeer, N. Dak.

Lamp-Bank Hookup to Detect Grounds in 3-Wire Electrical Circuit

To locate a grounded wire in a three-phase, three-wire electrical circuit of 220 volts, such as is used to supply many mercantile and small industrial establishments, all you need are four 220-volt, 10-watt lamps with sockets, a ground clamp and a few short lengths of wire connected into the circuit as shown. Under normal conditions all four lamps will burn dimly, each pair being in series, with the connecting lead grounded to a water pipe. However, a ground on wire A will cause light No. 1 to go out and No. 2 to become brighter. If wire B is grounded, lights Nos. 2 and 3 will

go out and Nos. 1 and 4 will become brighter. A ground on wire C will cause light No. 4 to go out and No. 3 to become brighter.—Neal Houtman, Holland, Mich.



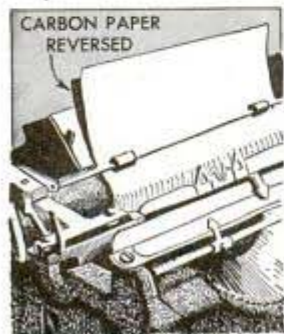
Floor Rest Holds an Electric Drill Conveniently Within Reach



One mechanic whose job consists of drilling ventilating holes in boxes found that a rest for the electric drill to keep it ready and in position for use, but out of the way, saved considerable time and labor. The rest consists of two notched posts screwed to a wooden box which forms a base. The steadying post of the drill was removed and a longer piece of pipe substituted, thus providing more leverage and permitting the drill to be placed easily in the notched posts of the rest when not in use.

Ken Murray, Baltimore, Md.

Carbon Copies Double-Typed To Make Good Blue Prints

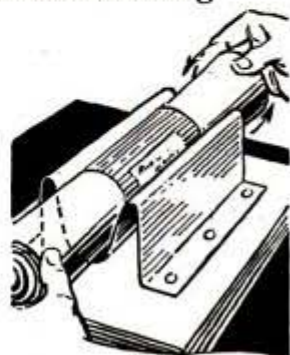


In our shop, which consists of a number of departments, we often sent out general notices, copies of which were put on the bulletin boards of each department. This made it necessary to type several

copies of each notice, and in order to save some of this work, we tried to type the notice on tracing paper and make a blue print of it, but the prints were not very clear. However, it was found that if a piece of carbon paper was placed behind the sheet to be typed, with the carbon surface next to the paper, the double-printed sheet thus obtained would produce very good prints.—Dana H. French, Fitchburg, Mass.

Metal Trough Aids in Wrapping Newspapers for Mailing

In newspaper offices where many copies must be wrapped individually for mailing, this sheet-metal trough will simplify the job. The newspaper is rolled in its wrapper in the usual manner and immediately is placed in the trough with a rolling motion, which smooths down the wrapper and causes it to adhere securely. The paper is left in the trough while the next one is being prepared, in order to give the glue extra time in which to dry and hold.



Cleaning Sanding Disks and Belts

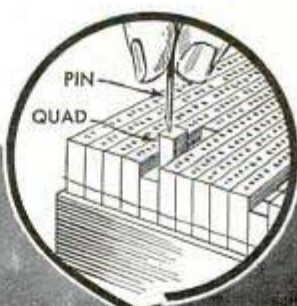
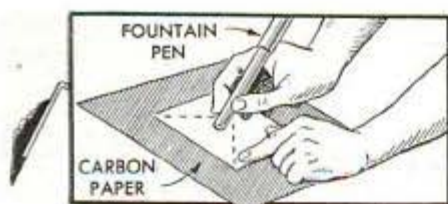
Sanding disks and belts that have become clogged with resin or soft metal may be restored to usefulness by a light rubbing with a wire brush. Disks should be brushed from the center toward the edge radially while belts should be brushed crosswise.

William C. Reichard, Netcong, N. J.

Soldering-Iron Cleaner Is Handy When Kept in Floor Flange

Steel wool or cotton waste packed into a floor flange provides a handy cleaner for a soldering iron. In most cases the flange will be heavy enough to prevent skidding around. However, if more weight is required, the flange can be screwed to a wood block. If soldering is always done in the same place, the flange can be screwed to the bench top within easy reach of the working area.





7 Shortcuts in PRINTING

1—Make-ready for envelopes is simplified by laying an envelope over carbon paper on the tympan sheet and rubbing the envelope with a blunt object to mark the high spots

2—To remove a quad without disturbing adjacent type, drive a pin into it and pull it up high enough to be grasped by tweezers

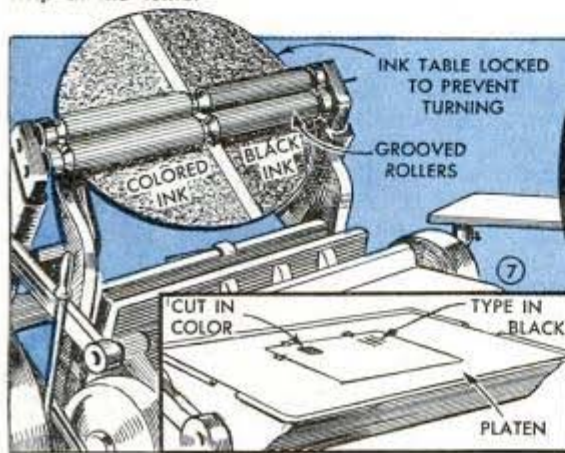
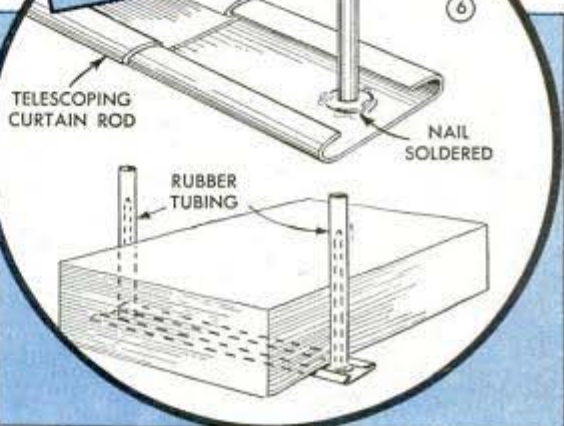
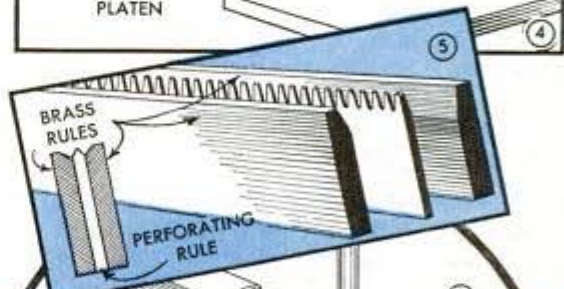
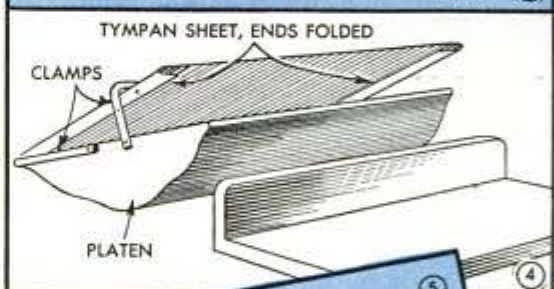
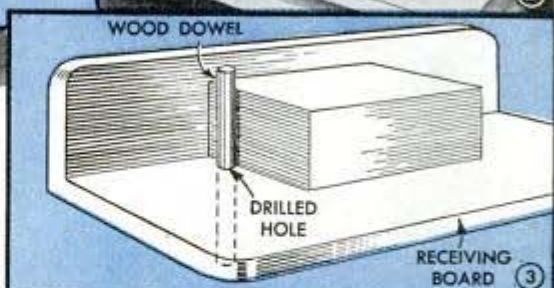
3—A dowel fitted snugly into a hole drilled in a receiving board serves as a stop for envelopes or small cards and eliminates jogging

4—To prevent platen clamps bowing out, use tympan paper slightly wider than the platen and fold ends instead of top and bottom

5—A perforating rule will not punch into the draw-sheet, and is more easily withdrawn, if a rule is set on each side of it

6—Paper stock is held straight on a feedboard in an adjustable rack of flat, telescoping curtain rod to which 4-in. nails are soldered

7—On a platen press, two colors can be printed at the same time. Disconnect the ink-plate dog and use C-clamps to keep the plate from turning. Use old rollers and groove them as shown. When applying the inks to the plate with hand rollers, leave a clear strip at the center



Roofers' Shoes Will Last Longer If Patched on the Sides



Roofers who find that their canvas shoes wear quickly on the sides can make them last much longer by applying patches to the sides of the shoes where wear is the greatest. Regular inner-tube patches are ideal for this purpose. Best results are had by applying two coats of rubber cement to the shoe and allowing them to dry before applying the patch.

Ralph S. Wilkes, Elbridge, N. Y.

Large Notch in Truck Tailgate Avoids Shifting of Pipe Load

When hauling a few lengths of pipe in his small truck, one plumber keeps them from shifting by placing them in a large notch cut in the tailgate. The pipe is held



in position by means of a strap and buckle as indicated. This keeps the pipe in a compact bundle and avoids wasting space.

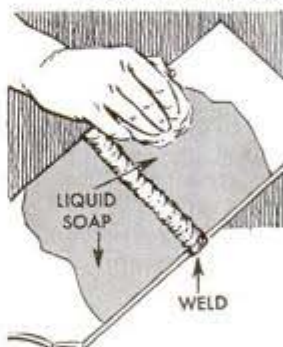
Blowtorch Shielded Against Wind By Screen-Wire Cage

When using a blowtorch where wind interferes with its efficient operation, I find that a cylinder of screen wire slipped down over the torch provides sufficient protection without causing the tank to overheat. The wire should project about 2 in. above the torch, and the end of the burner should project through one side. The wire is light in weight and permits you to see the entire torch at all times.

A. H. Waychoff, Phoenix, Ariz.



Soap Protects Finished Surface Of Work to Be Welded



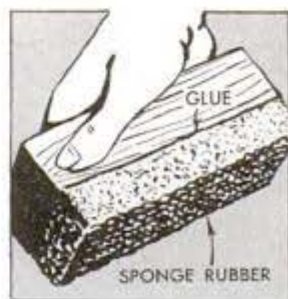
When welding work that has a highly finished surface, the latter often is marked by spatter from the welding metal, which adheres to it. To avoid this, one workman spreads liquid soap over the surfaces adjacent to

the joint to be welded so that the spatter will not adhere, and can be brushed away when the job is completed.

Stippler for Show-Card Work

A suitable piece of sponge rubber glued to a wood block and used with a stencil provides a good applicator for stippling show cards. A vignette effect can be produced by repeating the applications on certain areas of the work. The sponge is charged with ink by spreading the latter thinly on a smooth piece of cardboard and then pressing the sponge against it.

Joseph Jay Gold, Brooklyn, N. Y.

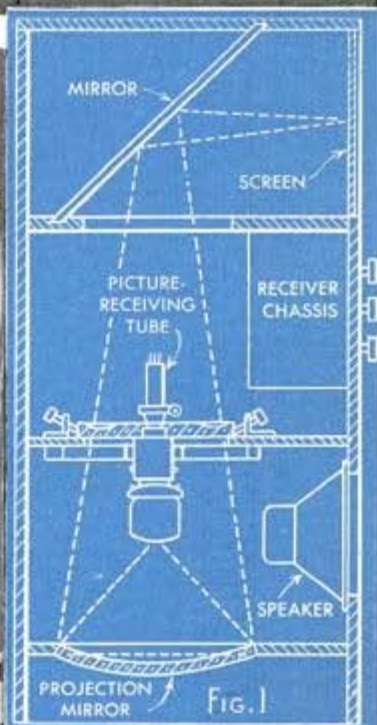
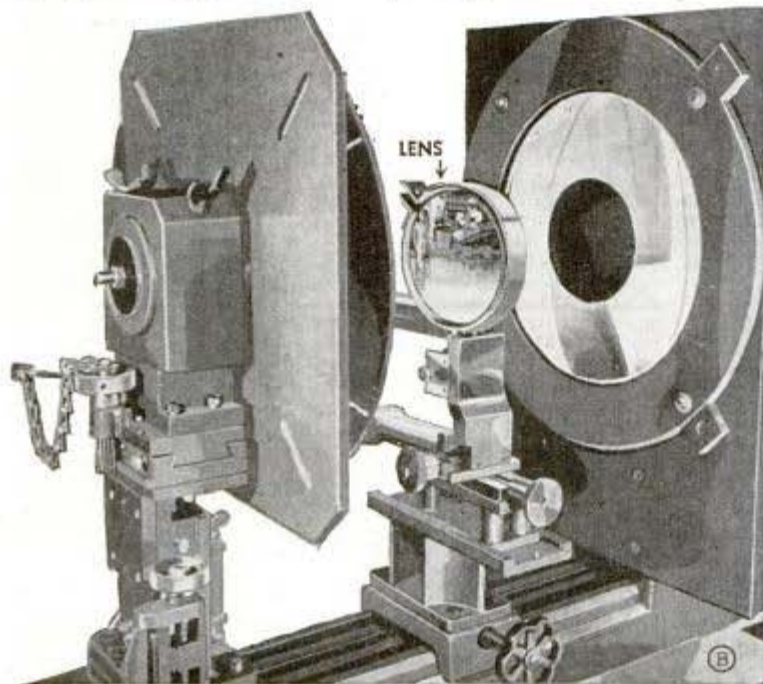
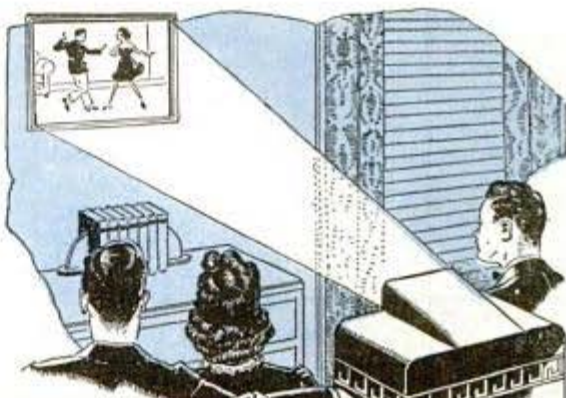




Television Projection System

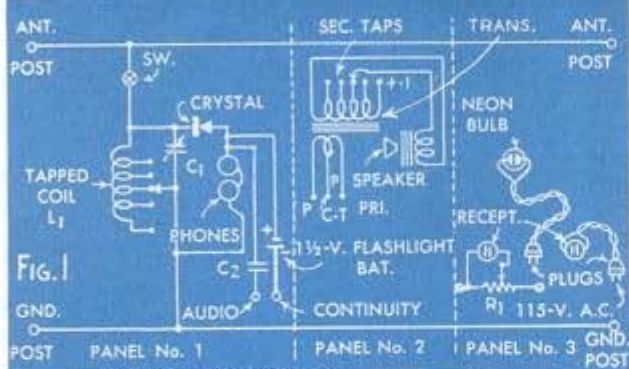
EMPLOYING special types of mirrors and molded plastic lenses in a highly efficient reflecting optical system, designed for home television receivers, RCA engineers are now picking up images from the cathode ray receiving tube and projecting them onto a screen. These screens range in size from 13½ by 18 inches to about 18 by 24 inches. One is a wall type and this is viewed like a home movie screen as illustrated; others will be translucent screens mounted in a retractable frame that will slide down into the front of the console cabinet when not in use.

An outline sketch of the translucent screen projection television receiver appears in Fig. 1. The projection system, mounted near the floor of the cabinet, consists of a spherical front mirror, shaped like a shallow bowl, and a plastic lens. This lens is flat on one side with the opposite side having a special surface contour, and is molded out of clear plastic material. Photo A shows the lens being removed from the mold in which it was made. The mirror arrangement resembles the principle that astronomers use to view the solar system. It projects the image up to a flat mirror inclined at 45 degrees. Photo B shows a laboratory setup for demonstrating the light-gathering power of the optical system.

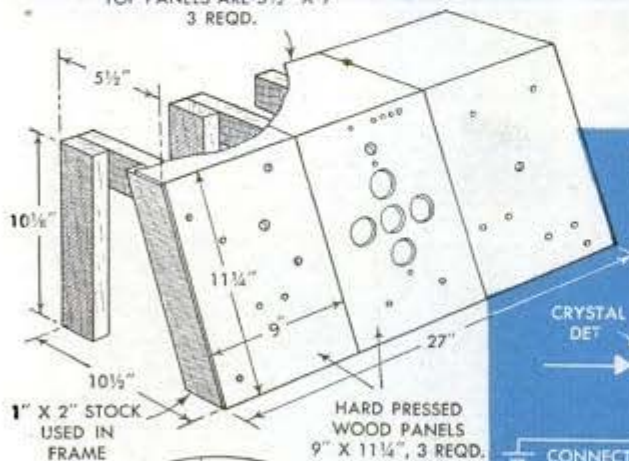


LOW-COST THREE-UNIT

By S. A. Johnson



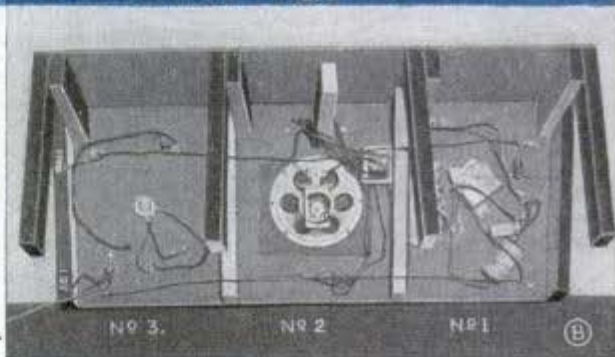
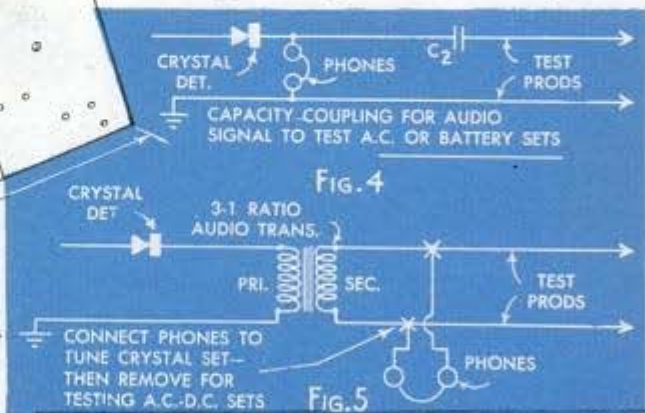
TOP PANELS ARE 5 1/2" X 9" 3 REQD.



NO METERS are required in the construction or operation of these useful set-testing units which are assembled in handy bench form for radio and electronic students and experimenters. The combination includes: a continuity checker to test for open circuits and for tracing wiring; an audio signal generator for testing amplifiers and checking the audio stages of receivers; a simple neon-bulb voltage reader which will give approximate voltage readings from 55 to 720 volts a.c., and from 71 to 925 volts d.c. The loud speaker panel No. 2 is provided with a tapped universal matching transformer so that it can be used to meet any receiver or amplifier requirements.

Although complete for beginners as shown in photos A, B and C, a separate oscillator-type signal generator can be added later for testing receivers by the popular "signal tracing" method, if desired.

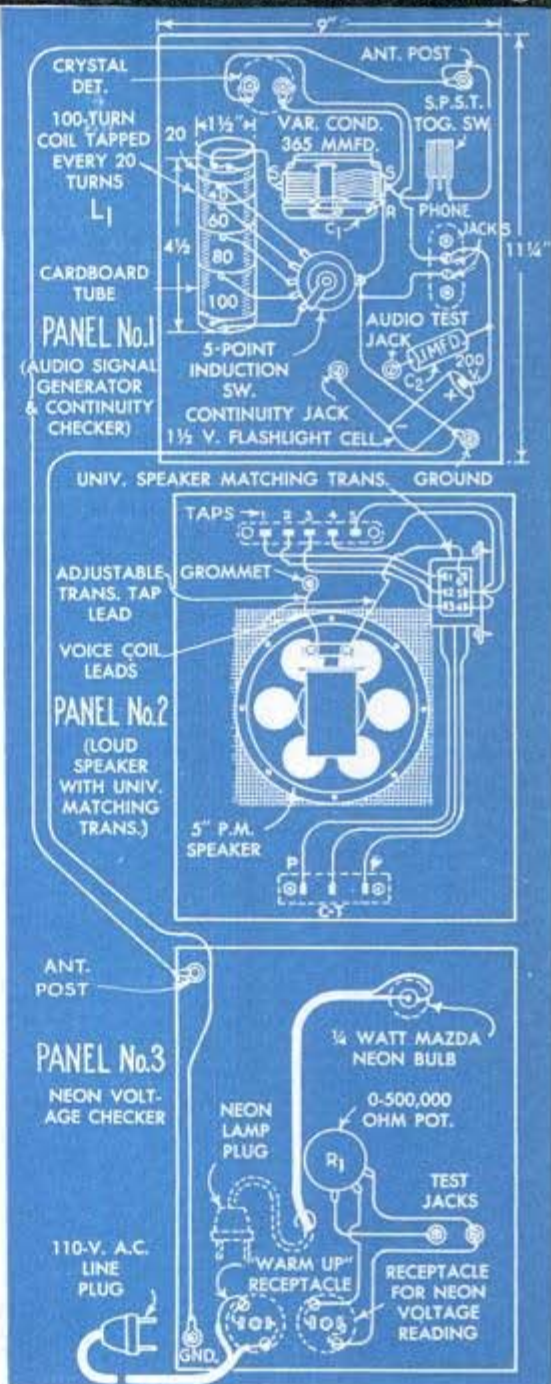
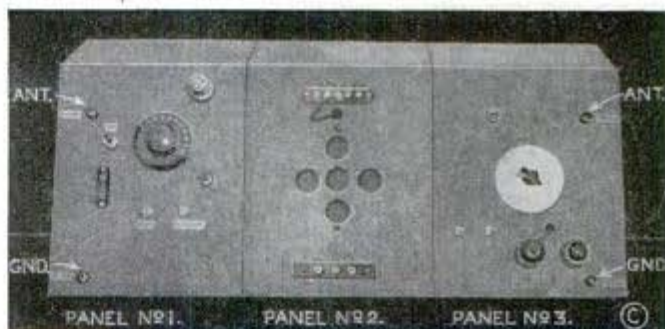
The schematic circuit diagram for the three-panel assembly appears in Fig. 1. Simplified rear-view pictorial



TEST BENCH for BEGINNERS

wiring diagrams for each panel are shown below the front view photo C. The test bench proper can be an inexpensive wooden table. All panels and their supporting framework are detailed in Fig. 2; each slanting panel is a separate unit and the assembly is designed so that additional panels can be added; the top panels provide a handy shelf for plug-in coils, etc.

Panel No. 1 consists of a good crystal receiver that is to be tuned to a strong local station, the signal from which becomes available at the jack on the panel. From here it can be fed by means of a test prod to either the output stage or the first audio stage of a receiver to determine if the audio portion of the set is working properly. The cardboard tube coil form is wound with No. 26 D.C.C. wire. Fig. 4 shows the capacity-coupled method employed to provide the audio signal; Fig. 5 shows transformer coupling to keep hum at a minimum when testing a.c.-d.c. sets. The continuity checker on this panel consists of a single $1\frac{1}{2}$ -volt flashlight cell and the headphones; the test prod is used in the proper jack on the panel, and the ground post is connected to the other side of the circuit. A closed circuit is indicated by a click in the headphones. The voltage checker on panel No. 3 operates on the well known principle that the extinction voltage of a Mazda neon bulb is both critical and constant. After being warmed up for about 30 seconds, by plugging into the 110-volt line receptacle, the neon bulb is then plugged into the receptacle connected to the volume control (R_1), which serves as a voltage divider. The control is then adjusted to the point on the dial where the bulb goes out; the point on the dial at which this occurs depends upon the total volts across the pin-type test jack terminals connected to the volume control. Details for making the original calibrated paper dial used in this model appear in Fig. 3; when this dial is enlarged to a diameter of $3\frac{3}{16}$ in. the results are accurate enough for all practical purposes. For this original dial, the neon bulb and volume control must, of course, be as specified. The dial is mounted directly on the panel over the shaft of R_1 and a pointer knob is used. Your particular dial may be more accurately calibrated by setting up the different voltages by means of a suitable transformer, if desired. Detailed student material list R-333 is available from Popular Mechanics radio department upon receipt of ordinary letter postage.



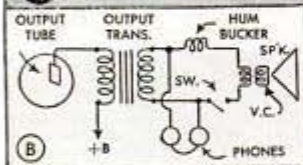
Practical RADIO HINTS



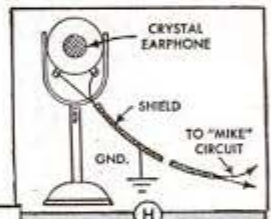
(A) Radio chassis mounted on shock-absorbing rubber pads is housed in a plywood compartment in the end of a foot locker to provide either headphone or loudspeaker entertainment in camp. All control shafts are slotted for detachable extension knobs or screwdriver adjustment. Phone-speaker switching arrangement suggested in diagram B. Holes are drilled for ventilation, speaker grille and recessed line receptacle



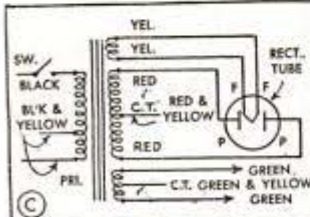
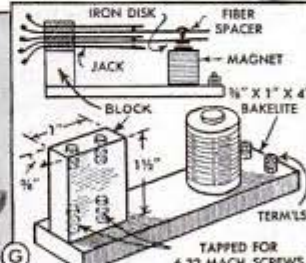
(D) Small pieces of adhesive tape placed at equal intervals between the last needle groove and the recessed title area on each side of a warped phonograph record prevent slipping on the preceding record in an automatic record changer. Slipping is indicated by distortion. (E) Ceramic low-loss self-aligning sockets designed for miniature-type tubes such as the RCA 1S4, 1S5, 1T4 and 1R5 series



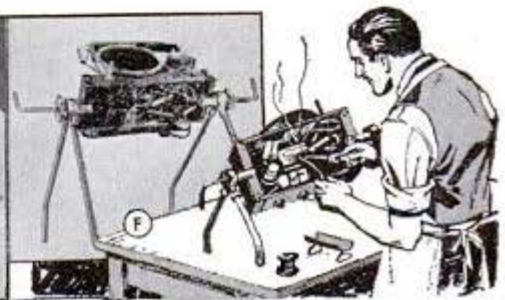
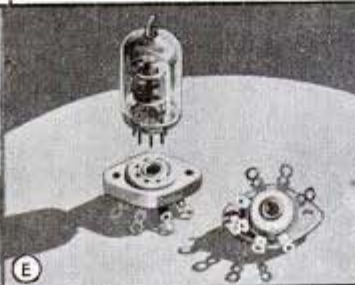
(F) Chassis cradle holds entire assembly in an easy-to-get-at position for inspection and repairs. It is claimed that the cradle reduces danger of damage to tubes, coils and other parts, a common occurrence in ordinary handling. It is adjustable to any position by finger-tip control and leaves both hands free for soldering operations



(C) Standard color-code leads for replacement radio power transformer. If primary winding is not tapped, leads are black. Center taps on primary and rectifier filament windings are seldom used. Green leads are for tube filaments



(G) General-purpose 6-volt relay made from odds and ends. The magnet may be salvaged from an old 6-volt bell or buzzer; the multi-contact jack is assembled from discarded radio jacks and arranged to suit the needs of the builder. Mounting block and base are cut from scrap Bakelite. (H) A single crystal earphone from a headset is connected to substitute for a home recording microphone. The shielded lead prevents feedback and the shield should be grounded on the amplifier chassis



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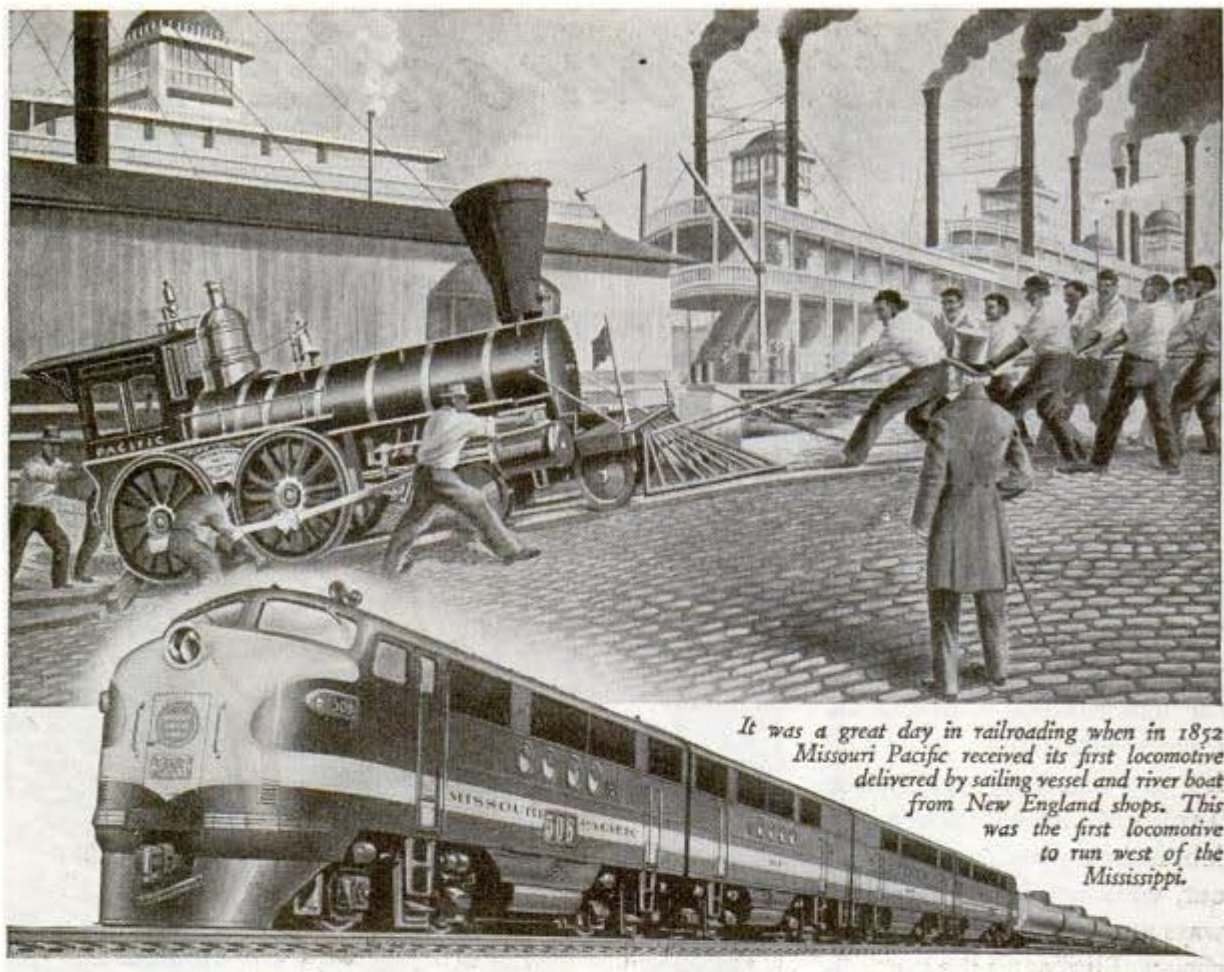
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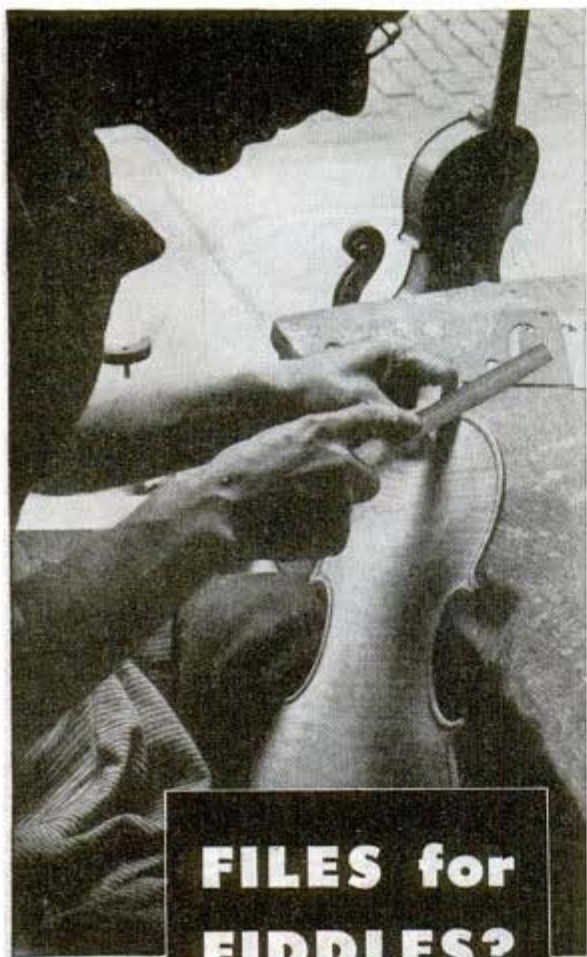
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Air School at the Front

(Continued from page 31)

Returning pilots at an 8th Army Air Force base in England reported operational difficulties with the P-51, then not a year old in combat. A pilot, escorting bombers over Munich in his new Mustang, spotted a convoy of Jerries lying up above. He pulled up to meet them and his motor conked—he was a dead duck, engine gone at high altitude, deep in enemy territory. The Mustang fell off and the engine caught. He pushed the nose up again; the engine cut out again. There was nothing to do but put the nose down and beat it for home.

At the base, the crew chief went over the engine. It worked perfectly. On the next mission, the engine cut out again during a climb at altitude.

One of the Rolling I. Q.'s, as the M.T.U.'s are sometimes called, arrived to dig out the "bug." Into a huddle went the faculty power plant specialist with head-scratching crew and line chiefs. Eventually he came up with the answer. The trouble was caused by gasoline leakage into the air chamber, past the diaphragm of the carburetor discharge nozzle. The "bug" was exterminated by putting a $\frac{3}{8}$ -inch washer under the nut holding the diaphragm.

Staff Sgt. Erven Howard, an M.T.U. armament specialist recently in the ETO, offers a good illustration of the "inventive" side which the instructors frequently show. Gunners were puzzled by short circuits that crippled their turrets. He spent an hour observing gunners entering and emerging from turrets. Finding that they were unwittingly stepping on unprotected wiring, he designed a metal bracket for the wires and that ended the trouble.

Attendance reports reaching Western Technical Training Command headquarters show that an average of 68 percent of the available personnel at overseas bases attends the first classes held by an M.T.U. unit. Then, almost invariably, it jumps to nearly 100 percent. As one liaison officer explained, "It takes a class or two to let it be known that M.T.U.'s are not just another ground school."

Value of the training probably is best illustrated by the fact that the U. S. Navy, the Soviet Air Force and the Royal Air Force recently installed traveling schools patterned after the AAF Training Command's Mobile Training Units.

But the Training Command still sets the pace. To its program it has added what seems to be the ultimate: Combat returnees—veterans who can tell the rookies what they are going to encounter in battle—are being assigned as M.T.U. instructors.



QUICK GET-AWAY FOR HORSEPOWER



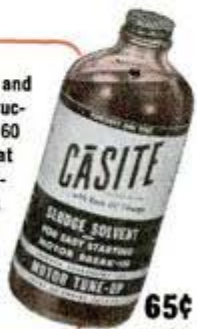
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a pint

They Move the Earth

(Continued from page 25)

and will furnish supplemental irrigation waters for 34,000 acres of farm land. This Bureau of Reclamation project also includes 22 miles of roads to replace those inundated by the reservoir. Half the material for the dam is being moved by conveyor from a pit a mile and a half away.

In eastern Ohio, another earthfill project, the mile-long Mosquito Creek Dam, was completed recently to assure a water supply for war industries. The dam will have lasting peacetime benefits. Fill for the structure, which is 430 feet wide and has a maximum height of 47 feet, was moved by scrapers hauled by tractors. The dam was built in only four and a half months.

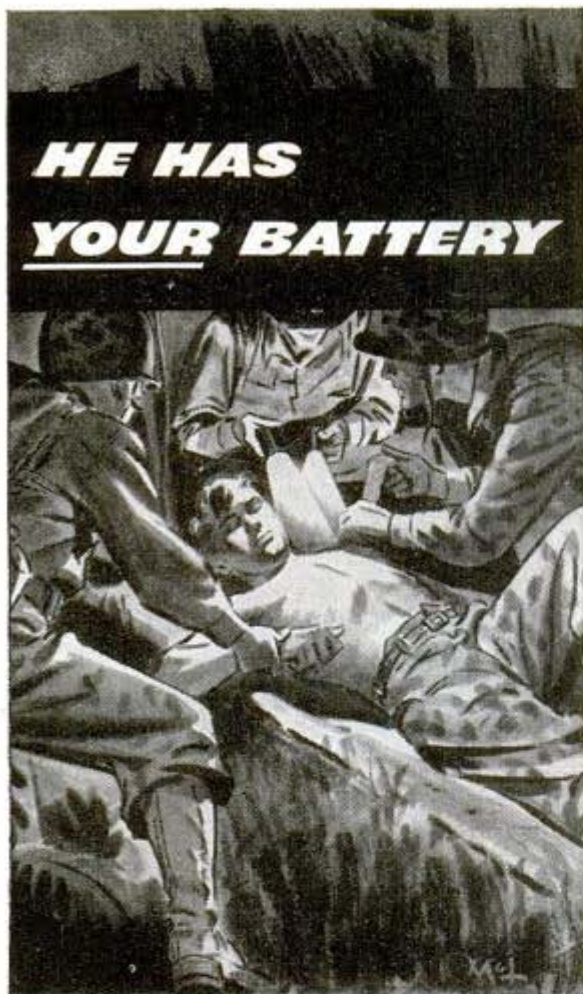
Hundreds of earthfill levees have been built to guard against spring rampages of rivers. These levees save millions of dollars in property every year. Two levees were completed last summer by the Corps of Engineers, U. S. Army, near Memphis, Tenn. One fill was made by a cable and tower arrangement and hauling equipment; the other was built of sand and silt dredged in through a pipe.

Another vital home front earthmoving project was the digging of hundreds of miles of ditches for the laying of oil pipe lines. The ditches are made with a trench hoe that clanks along on caterpillar treads.

Monster earthmovers, which help supply coal for war and peacetime industries, are the stripping shovels used in the "open" coal fields. The largest weighs more than three million pounds and is operated in the Hanna Coal Company's strip mine at Georgetown, Ohio. This power shovel takes a 35-cubic-yard bite, equal to 52½ tons of material.

Dredges have helped construct inland shipyards along waters once scarcely deep enough to float a rowboat. Scrapers and bulldozers have moved mountains of earth to make way for the foundations of airplane factories, engine plants, torpedo plants, arsenals and other structures. They helped build training camps, scores of landing fields, and mile after mile of military highway, including the famed Alaska Road.

Although the earthmovers have been working night and day since Pearl Harbor, leaders in the industry say postwar activities will far exceed anything in the past. One item alone should dispel any doubts about the future of the "dozer" family. The Civil Aeronautics Administration recently recommended to Congress the launching of a billion-dollar airport construction program when the last gun is fired.



Armey Medical Corpsmen run the risks of front line warfare side-by-side with the hard-hitting Infantry. Using battery-powered flashlights to help save time—save lives, gallant "medics" give quick, efficient attention to wounded men. Countless war batteries are needed for weapons and lights—that's why homefront supplies are limited. Use your batteries carefully—make them last longer. Burgess Battery Company, Freeport, Illinois.

Keep Your Red Cross at His Side!



BURGESS BATTERIES

IN THE NATION'S SERVICE

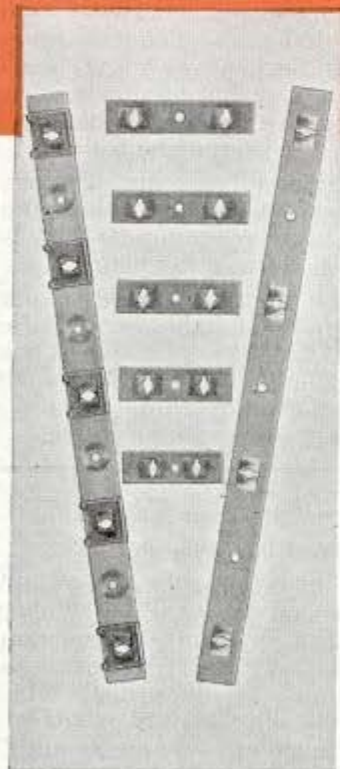


ONE OF A SERIES PORTRAYING "THE SPEED NUT FAMILY OF FASTENERS"

TWIN AND
MULTIPLE
SPEED NUTS



YOU CAN'T BEAT
THIS *Combination!*



Twin and Multiple SPEED NUTS COMBINE Fasteners into One Unit!

● Individual SPEED NUTS offer tremendous advantages over ordinary fasteners, but Twin and Multiple SPEED NUTS go even further. They COMBINE two or more SPEED NUTS into one unit to simplify, reinforce and speed up multiple fastening attachments.

Twin type SPEED NUTS are available with 1/2" to 1" hole spacings, for machine or sheet metal screws. Center hole permits riveting in place for blind location assembly.

Multiple type SPEED NUTS are available, with 1" to 2" hole spacings, for 6Z, 8Z or 10Z sheet metal screws. Supplied in any desired lengths or in coils. Made of spring steel for riveting in

blind location, or stainless steel for welding.

Where "float" is necessary to compensate for unavoidable misalignment of holes, SPEED NUT Retainer Strips are recommended, as shown in panel at left. Here self-retaining "U" type SPEED NUTS are slipped over aluminum or stainless steel strips, in "floating" register with the screw holes.

In writing for samples, please give screw size and hole spacing.

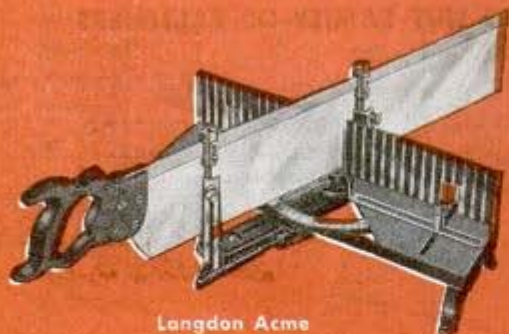
TINNERMAN PRODUCTS, INC.
2023 FULTON ROAD, CLEVELAND 13, OHIO

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario.
In England: Simmonds Aeroccessories, Ltd., London.

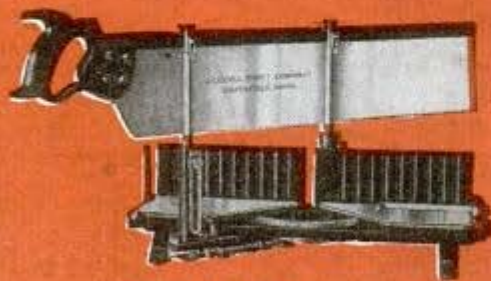


THE BASIC PRINCIPLE
of Spring-Tension Lock is
Embodied in all Speed Nut Designs

Speed Nuts
FASTEST THING IN FASTENINGS



Langdon Acme



Goodell All-Steel

QUALITY TWINS!

Each with Thousands of Friends

These two precision-built mitre boxes have different first names but their family name is the same, Millers Falls. With their thousands of tool-relatives, they have one thing in common—QUALITY.

Thousands of craftsmen prefer the Langdon Acme—others the Goodell All-Steel box. It's all a matter of which one they happened to meet first in their craft careers. For both are equally rugged, equally smooth in operation, and equally accurate.

If you are proud of your shop, if you are proud of your workmanship you'll buy a Langdon Acme or Goodell All-Steel Mitre Box.

ONE THING IN COMMON—QUALITY

**MILLERS FALLS
TOOLS**

SINCE
1868

MILLERS FALLS CO.
GREENFIELD, MASSACHUSETTS

Hollywood Tips to Movie Makers

(Continued from page 37)

elaborate. Ordinary street make-up will do for girls, using no face rouge because this gives a hollow-cheeked appearance. Better still is an application of panchromatic make-up base applied all over the face and neck to hide blemishes, pores, and veins. You can buy it at cosmetic stores.

Use the base by itself to achieve a healthy, robust effect—say for a person working in the garden. Apply ordinary face powder over the base to subdue the highlights and tone down the effect, as for a girl in evening dress. Apply it to the hands as well as the face if the hands are to appear in extreme close-up. Blondes usually have lighter skins than brunettes, so when you are photographing them in the same scene it is wise to coat the blonde with a medium shade of make-up base and use a lighter shade for the brunette.

There is one very common fault in amateur movie photography you should try to avoid. The average person shoots a few frames in one direction, shifts rapidly or pans slowly to another scene, then moves to a new angle. The result is a series of short and disjointed shots. The professional has learned that except for a few special effects he should keep his camera motionless during an entire scene. It should be the picture that moves, not the camera.

Always use a tripod if you can. The professional cinematographer knows that he can't avoid body movement when he holds a 16-mm. camera in his hands.

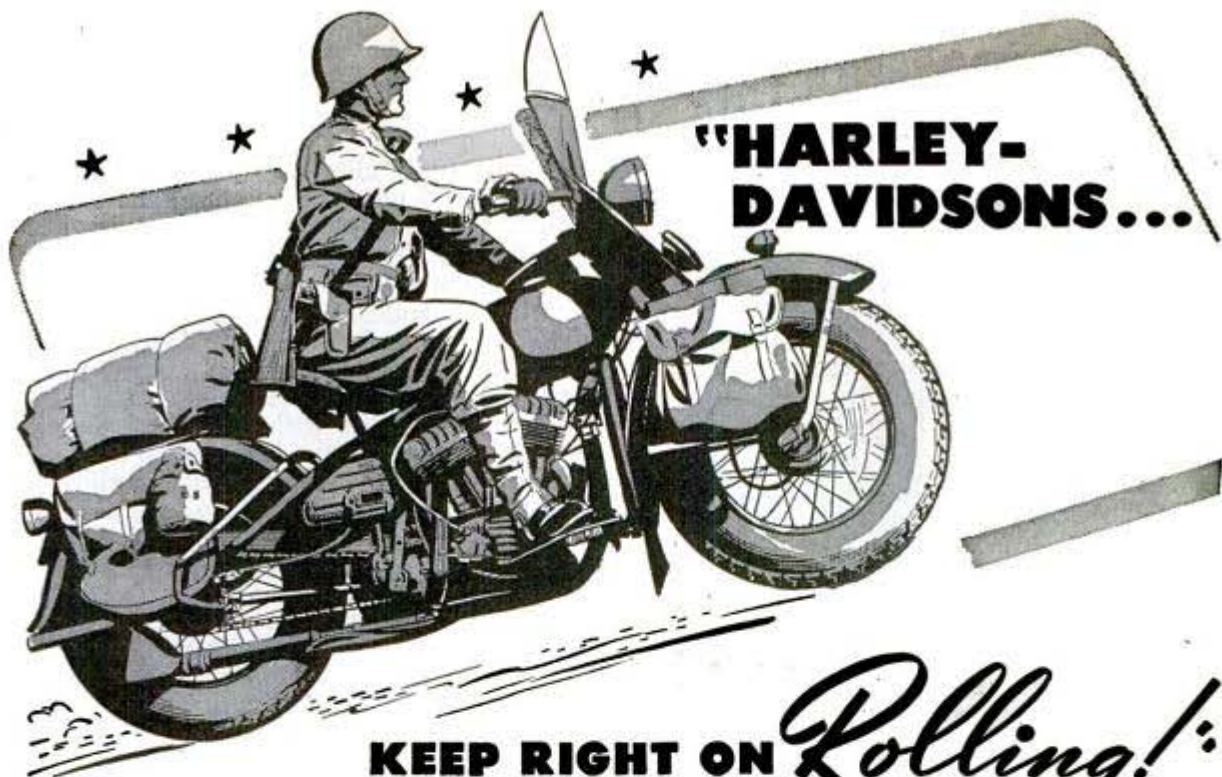
Whenever you go to a movie theater, observe the amount of light that falls on different parts of the scenes, figure out how it was put there, and then try it yourself. There are a great many things you can profit from in any professional movie.

"Bosun—Pass the Word!"

(Continued from page 46)

and trice gear. "Hoist away!" raises ship's boats. The cadenced repetition of "Hoist!" keeps men pulling rhythmically together. "Belay!" sounds avast and make fast, or annuls a previously given order. "Boat call!" calls away a ship's boats or sends a division to its quarters. "Heave around!" sounds for mess gear and also to man a winch or capstan. "All hands!" followed by a long "H-e-a-v-e a-r-o-u-n-d!" and a long "P-i-p-e d-o-w-n!" seats crew at mess. "Sweepers!" turns out parties assigned to broom-up decks. "Pipe down!" signals the end of an evolution to which all hands are

(Continued to page 154)



"HARLEY-DAVIDSONS..."

KEEP RIGHT ON *Rolling!*

Pvt. Sam W., writes from the European front:

"Have been a steady rider the past 12 years. From my experience, and what I've seen of Harley-Davidsons over here in combat, from now on it will be Harley-Davidsons for me. They take all kinds of roads, weather and toughest conditions *and keep right on rolling*. So the greatest compliment I can give you

is that I'm looking toward the day I'm back and can own my own Harley-Davidson."

Thanks, Pvt. Sam W. — it will be swell when you and all your buddies come back to ride in race meets, hillclimbs, endurance runs and other thrilling, fun-packed motorcycling events. Thousands of riders have Harley-Davidsons at the top of their Want-Most List.



**HARLEY-DAVIDSON
MOTORCYCLES**

HARLEY-DAVIDSON MOTOR CO.
Department P, Milwaukee 1, Wisconsin

Please send at once free copy of 24-page "Enthusiast" Magazine, filled with motorcycle action pictures and thrilling stories.

Name.....

Address.....

City..... State.....



WORKSHOP WISDOM

How to cover a table

YOU CAN renew that wooden table or desk top with leather, linoleum, canvas or oilcloth. Here's how:



1. Sand surface. If worn or soft, seal pores with coat of thin *Casco Glue*. Let dry.
2. Apply standard mix *Casco* to top, and stretch your covering material in place, slightly oversize. Iron out wrinkles. Turn table upside down on smooth floor, or cover with weights.
3. Trim edges after glue has set.

Hard compressed fibreboards, formica and other alcohol-proof resinoids also can be used. Rough with heavy sandpaper before gluing. Homecrafters prefer *Casco* for these reasons:

Unusual strength: *Casco* forms a bond of remarkable strength—strong as the wood itself.

Greater durability: *Casco* is highly resistant to dampness, heat and age because it sets chemically, like concrete.

Easy to mix: You mix *Casco* with cold water. You have no heating problems, no "chilled" joints.

Economical: You mix *Casco Glue* as you need it. *Casco* powder keeps indefinitely. Just keep lid tightly covered.

For rugged outdoor jobs and water projects, use *Cascamite*. It's highly water-resistant, moldproof.



You can get *Casco*—and *Cascamite*—in 10¢, 25¢ and larger sizes at hardware stores.

FREE *Casco* Project Booklets and Gluing Guide with useful household gluing hints are yours for the asking. Address Casein Company of America, Dept. PM45, 350 Madison Ave., New York 17, N. Y.

CASCO Powdered Casein GLUE

Sets chemically—hardens permanently!

called, and is sounded after taps sends the crew to their hammocks.

To the bosun's mates, the curving stem of a pipe is "chain pipe," its bowl (above the hole of which "open," "curved," "closed" and "clinched" positions of the user's hand change the pipe's notes) is "buoy," the support of stem and bowl is "keel," the ring through which the pipe's braided lanyard is bent is "shackle."

Bosun's mates have other duties, too. They must see that a warship's decks and superstructures are clear and secure in fair weather and foul and in action. This involves all hoisting with block and tackle, emergency procedure in clearing and replacing gear damaged above decks, all canvas work aboard ship and the several hundred different knots, bends, hitches and splices with rope and wire still used aboard a warship. To bosuns and bosun's mates, as in early Navy days, go casting of anchors and the complicated details of moorings, overhaul and stowage of anchor chain and hawsers, care and handling of ship's boats and call-aways with coxswains of their rating at the helms of barge, launch, gig and whaleboat. They must know the rules of the road, distress and other maritime warnings and guides, be able to "box the compass," lay as well as steer a course, and thoroughly understand salvage operations.

Aspirants for crossed anchors below a "crow" (Navy slangology for the eagle worn on a uniform sleeve) must have what it takes to earn the single stripe of coxswain, the third-class rating in the bosun's mate hierarchy. This is the first rung up the ladder to the twin and triple classification sleeve marks of boatswain's mate 2/c and 1/c and the insignia of chief boatswain's mate, which may lead to the blue-and-gold cuff stripes of warrant and commissioned warrant officer, respectively boatswain and chief boatswain.

Black Light Brightens Tomorrow

(Continued from page 75)

ment in many police and crime detection agencies. They also are used to reveal "counterfeit" paintings and manuscripts bearing false signatures.

A complete meat processing plant in the Dominican Republic has installed ultraviolet equipment in the meat curing rooms for "tenderizing." Baking plants use the equipment to destroy mold and fungi. Epidemics of colds, measles and ringworm have been brought under control in a number of schools through the use of ultraviolet radiation to sterilize the atmosphere.

(Continued to page 156)

AUTO-LITE SPARK PLUGS

IN SERVICE ON EVERY FRONT



"Ain't that the Jap flag Cousin Gulp tuk off'n a Rear Admiral?"

"PLUG-CHEK" SCORES BULL'S EYE ON FAULTY PLUGS

For accurate *trouble-shooting* in helping spot faulty spark plugs . . . ask for an Auto-Lite "Plug-Chek." The famous "Plug-Chek" way of inspecting spark plugs shows what should be done to restore top spark plug efficiency, add as much as 12% to gas mileage, according to tests conducted by the American Automobile Association.

Just cleaning and re-gapping your present plugs may help stretch every ration coupon miles farther. And if you discover new plugs are needed, ask for Auto-Lite spark plugs—they're ignition engineered.

THE ELECTRIC AUTO-LITE COMPANY
TOLEDO, 1 • Merchandising Division • OHIO
BACK THE ATTACK—BUY WAR BONDS

Tune in the
AUTO-LITE
Radio Show
STARRING

Dick Haymes
HELEN FORREST • GORDON JENKINS'
ORCHESTRA

Every Tuesday Night • NBC

Featuring men and women on
the fighting fronts



YELLO-BOLE



\$1.50

IMPERIAL
"Full Bent" Shape
(Actual Size of Pipe 5")

HONEY

cures your smoke

Yello-Bole Pipes are treated with real bee's honey. You can fill a new Yello-Bole with tobacco, light it, and enjoy a mild, pleasant smoke, right away—then and there. There's no "breaking-in," as with some pipes. No period of "getting the newness out of it." Yello-Boles start sweet, and stay sweet, and agreeable. The honey keeps curing the smoke. If you can't get one immediately, it's because men at war are getting theirs—but your dealer is being supplied with his share, as available.

YELLO-BOLE IMPERIAL \$1.50

YELLO-BOLE PREMIER \$2.50

YELLO-BOLE STANDARD \$1



YELLO-BOLE A NAME TO REMEMBER, WHEREVER YOU ARE—
AND WHEN YOU COME HOME

The Pillsbury Flour Mills reports that a 95 to 99 percent "kill" of bacteria in flour was obtained with a 30-minute exposure of room atmosphere to ultraviolet.

At home and abroad, black light is helping to guard the health of the fighting men, even to purifying the drinking water which is stowed in lifeboats and to purging footwear of fungi which cause infection.

Watch Over Greenland

(Continued from page 69)

One outstanding rescue occurred in the summer of 1942 when a flight of P-38's headed for England, equipped with belly tanks and tagging behind a bomber that set the course. The fighters couldn't carry enough instruments to make the flight alone. Suddenly the mother ship developed trouble and had to land on the ice cap in the interior of Greenland. Willy-nilly, the P-38's had to do likewise and 26 men were stranded in the wilds of Greenland. A radio call brought Coast Guard scout planes which dropped food and clothing.

Next a small fishing boat was dispatched from Iceland with the only dog team and sled available and several Army Air Force men to act as guides. These were put ashore and drove to where the hapless pilots were waiting. When the flyers reached the coast, a Coast Guardsman remarked that they were the healthiest castaways he'd ever seen, for the 24-hour sun at that season had given them all a healthy coat of tan. On the hard march to the coast the pilots discarded extra clothing, flashlights and binoculars, but clung to their cumbersome bomb sights.

Adventures in the North sometimes have their ridiculous and exasperating sides, too, as in the case of an Eskimo village to which a Coast Guard cutter brought valuable coal and food. No supplies had reached the village for about a year and starvation was imminent. The cutter battled its way up a long fjord to the village. Ice closed in behind it and the cutter was in danger of being frozen in for the winter.

Speed in unloading was desperately needed. Every Eskimo girl and woman from eight to eighty pitched in, but the Eskimo men stood magnificently by and did nothing. The irate commander called the Eskimo mayor, who explained the men were hunters—women did all the work.

After a few choice and pertinent remarks by the commander the mayor called a conference. The men reluctantly agreed to help. This consisted of carefully placing the packs on shoulders of tottering women

(Continued to page 158)



You can be *Proud* of it!

You get lots more pleasure from your outdoor sports equipment when you are proud of it.

It compliments your judgment and keen sense of values when friends look at the label in your Sleeping Bag or Life-Save Jacket and say, "Ta-pat-co—sure, you can't beat it!" It's economy, too, to buy equipment like Ta-pat-co: Sleeping Bags that will go with you trip after trip, year after year, and still be tops in comfort and good looks; Life-Save Jackets that take the hazard out of your boat trips and are easy and comfortable to wear. You quickly become attached to such equipment.

Ta-pat-co is all going to our fighting forces now, but as soon as our war job is finished, it will be in your favorite sporting goods store. It's well worth waiting a short while to get equipment that you'll be proud of always.



THE AMERICAN PAD & TEXTILE CO.
GREENFIELD, OHIO



Take them with you. Stay-A-Float makes it safe for little brother or sister to enjoy water sports with you. It's a great help, too, in teaching youngsters to swim. Put Stay-A-Float on your after-war want list.



Look for the Ta-pat-co label—buy with confidence—own with pride.

BUILT TO LAST

Deep in the Black Canyon of the Colorado, rising over 700 feet from bed-rock, stands Boulder Dam. The engineers who designed it built it to last.

Plumb tools, too, are built to last. The craftsmen who made them have produced tools that not only last longer, but work better.

Plumb quality means even more than durability. The one-piece head of flawlessly tempered steel, the handle of selected close-grained hickory, the hang, and the ease with which it works are the enduring features of every Plumb tool. Fayette R. Plumb, Inc. Philadelphia 37, Pa.

PLUMB TOOLS ILLUSTRATED:

Top to Bottom: Nail Hammer, Ball Pein Hammer, Half Hatchet.



PLUMB

HAMMERS • HATCHETS • AXES • SLEDGES

and children so they could carry more.

The Greenland Patrol again proves that the valiant United States Coast Guard is living up to its motto: "Always ready."

Coral Nest for the Superforts

(Continued from page 12)

to labor again on the deep cuts through solid coral limestone, every foot of which required blasting after the first few inches of earth had been rooted out.

During the first three weeks of operation air superiority was divided between the Americans and the Japs. During the day it was entirely AAF, and during the night the Japs seemed to take over. Bombing and strafing by the enemy greatly hampered work at night, and retarded the efficiency of the day shift who were on "red alert" all night. Then, following swiftly on the heels of the Jap raiders, came another and more destructive enemy—tropical rains. The pall of dust that had hung like a cloud over the island disappeared, and in its wake appeared a sea of mud.

Despite these hardships the job forged ahead. Mechanics would wade knee deep in mud and place boards under vehicles so they could lie under them and work without sinking out of sight. On July 24 the first 4,000 feet of runway was completed, and work was continued to extend the runway to 6,000 feet so that B-24 bombers could neutralize nearby Jap bases in the Bonin Islands, the Marianas, Yap and Truk.

On August 6 this strip was completed and opened to aircraft, but a lot of hard work still lay ahead. There remained 2,500 feet of airstrip to construct, and this section required the greatest amount of excavation. In order to abide by the specifications, fills up to 20 feet and cuts in depth of 17 feet through solid limestone were required. Tournapulls were used in a borrow pit to make the fills, and carryalls, dozers, rooters, wagon drills, and jack hammers were employed in the cuts. On September 23, 7,000 feet of finished runway lay behind, and the runway was being used by B-29 aircraft, the first island-based planes capable of bombing Japan.

There remained 1,500 feet of runway and 700 feet of cleared zone to build. Day after day, the battalion continued to gnaw off the solid rock bluff. On October 15 the last pan full of rock was removed from the cut, and the coral runway was complete.

The record of the 804th Engineer Aviation Battalion has been phenomenal. In less than four months the battalion had quarried, hauled two and one-half miles,

(Continued to page 160)



How Television Got Its Electronic "Eyes"

As revolutionary as airplanes without propellers — that's how much electronic television differs from the earlier mechanical television!

Whirling discs and motors required for mechanical television were not desirable for home receivers. Pictures blurred and flickered.

But now, thanks to RCA research, you will enjoy all-electronic television, free from all mechanical restrictions — "movie-clear" television with the same simplicity and efficiency as your home radio receiver.

Electronic television is but one example of the great forward strides made possible through research by the scientists and engineers at RCA Laboratories — opening the way for who knows what new miracles of tomorrow?

When you buy an RCA radio or phonograph or television set or any RCA product, you get a great satisfaction . . . enjoy a unique pride of ownership in knowing that you possess the finest instrument of its kind that science has yet achieved.



Dr. V. K. Zworykin, Associate Research Director, and E. W. Engstrom, Director of Research at RCA Laboratories, examining the Iconoscope or television "eye" — developed in RCA Laboratories for the all-electronic television broadcasting and receiving system.

RADIO CORPORATION of AMERICA

PIONEERS IN PROGRESS



Reliably as the sun rises each morning, America's vast milk supply rolls swiftly to market, in farm trucks and specially lined tank trucks. Thousands of the dairies and milk producers who operate these trucks, pin their faith on AC Spark Plugs, for utmost reliability. They also find that they save gasoline and lengthen the life of plugs, by following the AC plan of having plugs cleaned and adjusted every 3,000 miles. You can improve the efficiency of your car, truck or tractor by observing these same simple rules.



AC
SPARK PLUGS

CLEAN PLUGS SAVE UP TO ONE GALLON OF GASOLINE INTEN

SPEED FINAL VICTORY - BUY WAR BONDS

and placed 426,850 cubic yards of coral on the runway, and had excavated, moved, and placed 488,890 cubic yards of rock and earth. The demolition work required is reflected by the fact that 372,000 pounds of dynamite and 226,000 feet of primacord were used by the battalion in blasting the limestone bluff down to grade. During the earthmoving construction the battalion completed several supplementary projects:

Installation of a primary tank farm with a capacity of 504,000 gallons and a secondary tank farm of 20,000 gallons.

Rehabilitation of the Japanese aviation gas system and dispensing unit with a capacity of 45,000 gallons.

Installation of a salt-water line to the airport for use in soil and coral compaction.

Revetments for gasoline drum storage to accommodate 2,000 gas drums.

The laying of 690 feet of 36-inch corrugated metal pipe for runway drainage.

Construction of a Wing Headquarters.

The construction of 20 warehouses.

The pouring of 44 concrete slabs for Quonset huts.

Four other engineer aviation battalions joined the 804th and were assigned to build runways for fighter planes and medium bombers. But the "spearhead" of the engineer aviation force was the 804th, and its assignment was of the highest priority—getting Saipan ready for the B-29s. The construction of the huge base in slightly less than four months is regarded as one of the modern miracles in engineer aviation history and paved the way for the bombing of Tokyo by fleets of Superforts.

Engineering the Impossible

(Continued from page 5)

of metal. And many other developments were once thought impossible—the internally braced wing, the supercharger which enables engines to operate efficiently at high altitudes, the steadily increasing horsepower per pound of weight, the jet propulsion engine, the high-precision calculating bombsight, the modern demand system of oxygen supply, remote controlled guns, electrically operated turrets, special radio and landing light systems that make blind landings possible under the worst weather conditions, retractable landing gear, radar and many others.

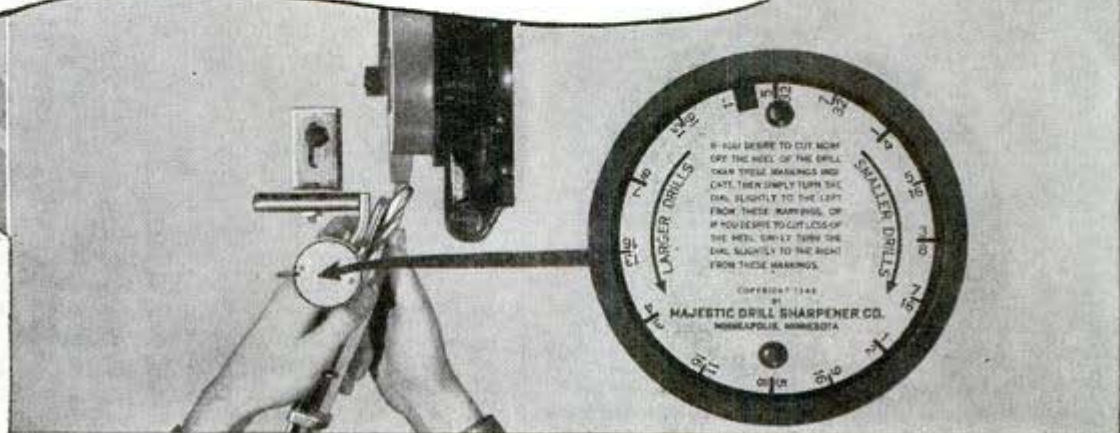
Only five years ago no one would have believed a 75-mm. cannon could be fired in an airplane without wrecking the ship. Now even larger guns are contemplated.

Dreamers had a hand in developing the pressurized cabin which permits the B-29

(Continued to page 162)

Ingenious New Technical Methods

Presented in the hope that they will
prove interesting and useful to you.



New Quick-set Dial Drill Sharpener Eliminates Guesswork... Keeps 'em Drilling Faster—Longer

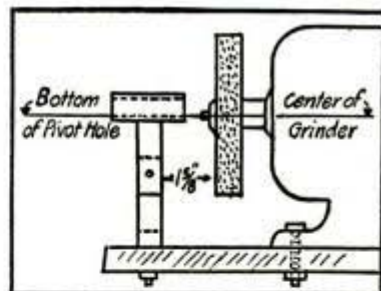
Attached to the Drill Sharpener, it adjusts drill edges to the proper angle for precision grinding, putting drill sharpening on a quick, efficient basis.

QUICK-SET DIAL easily and accurately adjusts Sharpener for sharpening drill from $5/32"$ to $1"$ sizes. Dial insures accuracy in measuring angles and clearances on twist drills, preventing trouble and making drills last longer. Dial-Set sharpened drills cut faster and more accurately, as the edges are alike and uniformly sharpened.

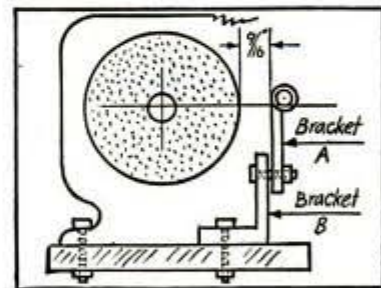
Precision built, calibrated and tested, unit is easy to set up and operate. Saves wear and tear on drill presses—prolongs drill life—cuts costs—improves quality—speeds output.

Another thing worth remembering is Wrigley's Spearmint Gum. That familiar red, white and green package which always meant "a help on your job." No more of this famous brand and flavor is being made for anyone now—even for the Armed Forces overseas—as Wrigley's stockpile of finest quality raw materials is all used up. But—remember Wrigley's Spearmint—The Flavor Lasts.

*You can get complete information from Ameraco Industrial Specialties
122 S. Michigan Ave., Chicago 3, Ill.*

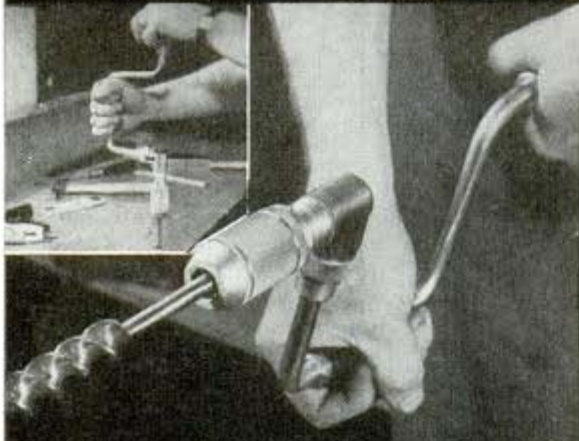


Front view of grinder



Side view of grinder

WOODWORKING IS FUN



... when you have a
GOOD BIT BRACE

While planning to enjoy making things in your postwar home workshop, remember that a fine assortment of Stanley Tools will add good craftsmanship to recreation. Stanley Bit Braces, for example, have long been the choice of professional experts in woodworking. Featuring shorter chucks, stronger jaws, improved head construction, fine finish, Stanley Bit Braces will turn out work you'll be proud of.

Let Experts Help in Your Selection

Stanley has a free booklet for you, "The Joy of Accomplishment." Crammed full of helpful suggestions for the hobbyist, it contains: a primary list of tools and a list of tools to be added as needed. You'll also find the big Stanley textbook: "How to Work with Tools and Wood," mighty useful. It's yours for only \$1.00. Mail the coupon today.

MAIL
NOW

STANLEY

THE TOOL BOX
OF THE WORLD



Stanley Tools, 235 Elm St., New Britain, Connecticut.

Please send by return mail

- The FREE booklet: "The Joy of Accomplishment."
- 188-page book: "How to Work with Tools and Wood." \$1.00 enclosed.
(In Canada: Send order to Stanley Tool Co. of Canada, Ltd., Roxton Pond, Quebec)

Name.....
Address.....
City.....

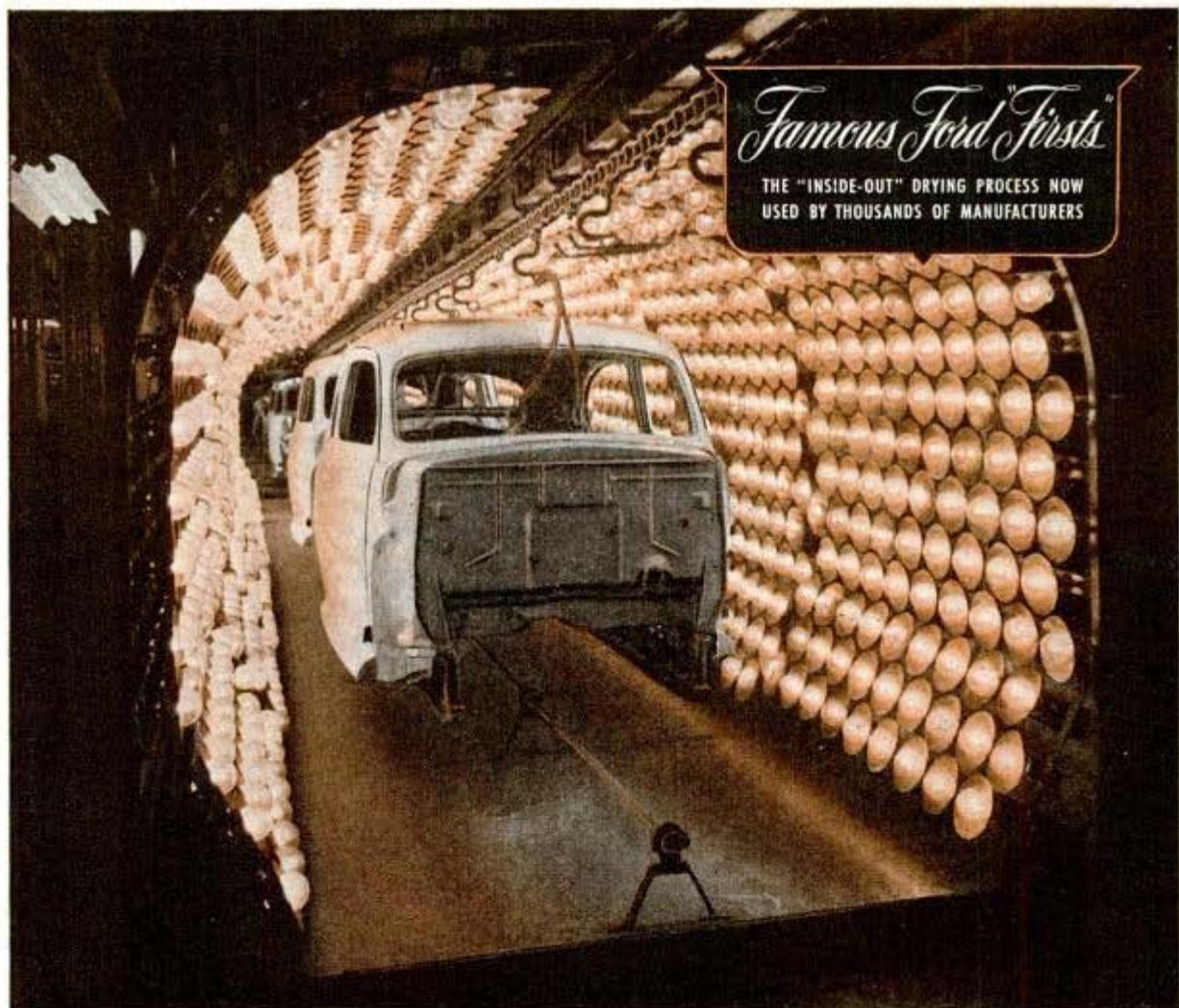
to fly and fight above the effective range of anti-aircraft guns; the crew goes about its duties unencumbered by oxygen mask equipment. Dreamers, too, toiled to develop contrarotating propellers—two air screws turning in opposite directions—to eliminate the effect of engine torque on an airplane. They worked on reversible pitch propellers with which the aircraft pilot can bring a plane of 50 tons or more to a stop much more rapidly, easily and safely than with wheel brakes alone. Use of rockets to build up plane speed very rapidly on the ground also will contribute to smaller airports. Rocket-assist takeoffs today get great loads off short jungle runways.

To test their ideas and designs, engineers must have elaborate equipment. At Wright Field we have in the making something that will play a large part in the design of tomorrow's airplanes. It is a 10-foot wind tunnel which will generate winds of more than 600 miles an hour for testing models of high altitude bombers and fighters at temperatures as low as 67 degrees below zero. Temperature and pressure conditions of altitudes ranging from sea level to 50,000 feet will be simulated. Operation at a vacuum of less than one-eighth atmospheric pressure—approximating pressure conditions found at 50,000 feet—is the most brilliant engineering feature of the tunnel.

Our engineers even have advanced the idea of a glass airplane, which may never be needed, but the plastic plane is a practical prospect soon after the war. Already there is an experimental, and flyable, model with plastic fuselage and wings. I look to plastics as perhaps the answer to the "air flivver" problem, providing cheap, strong materials for Mr. Average Man's airplane.

The world of the future will be dominated by air power, I believe most people will agree. That nation which maintains a three to five-year advance over the rest of the world in its methods and technique is reasonably safe against aggression and can be an enormously important factor in maintaining the peace of the world. Other nations copy American designs and methods, but this takes time. The Norden computing bombsight was our No. 1 military secret at the time of Pearl Harbor. Yet, had we delivered a complete bombsight, with blueprints and specifications, to the Germans on December 7, 1941, they probably could not have built one for at least two years.

A two or three-year jump on potential enemies means safety in military thinking; the same margin against competitors in the air means supremacy for our aviation industry and air lines. Maintaining that edge is of the utmost importance.



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USED BY THOUSANDS OF MANUFACTURERS

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to use infra-red rays

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Invisible rays, with frequencies millions of times greater than the highest frequency radio wave, now do the paint drying at Ford Motor Company.

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Patented by Ford, this infra-red process is one more of the many important developments

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New Ford-built cars and trucks will continue to profit by this progressive spirit and American ingenuity. Mr. Ford has often said: "One thing we don't believe in is standing still."

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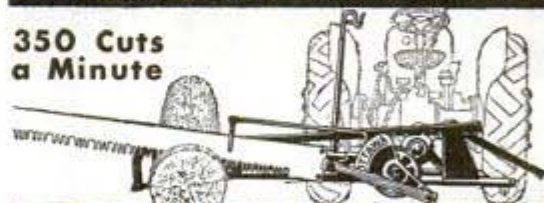
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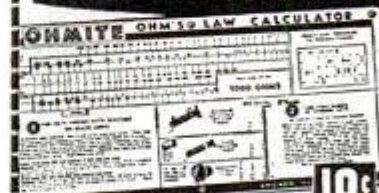
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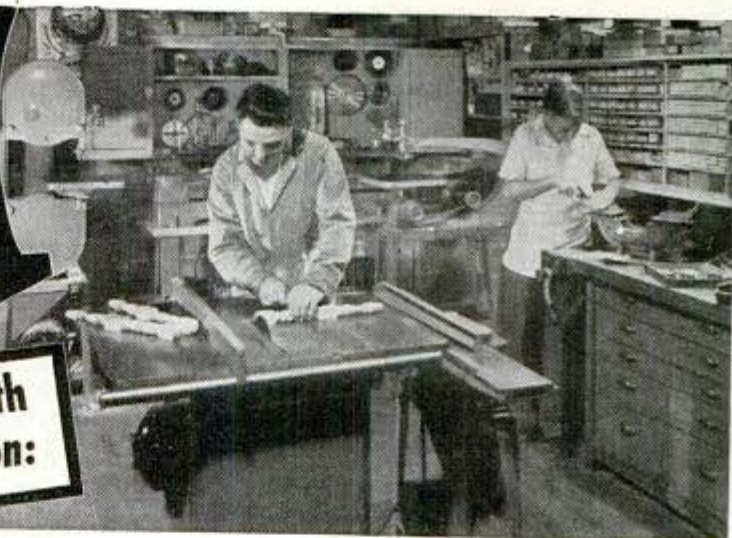


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HIM-24

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You know you're using *quality* power tools, when you see how easy it is to obtain accuracy—when you see how economical Delta Homecraft Power Tools are to operate ... how dependable they are ... and how safe!

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Just what are some of these "extras" that have given Delta Homecraft Power Tools their wide reputation for *quality*?

For one thing, Delta Homecraft Power Tools have *double-sealed ball bearings*. This means that the bearings are fully protected against harmful dust, assuring you of longer bearing life. And it also

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Be Sure You Get Quality!

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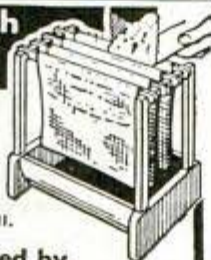


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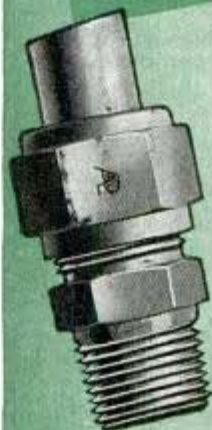
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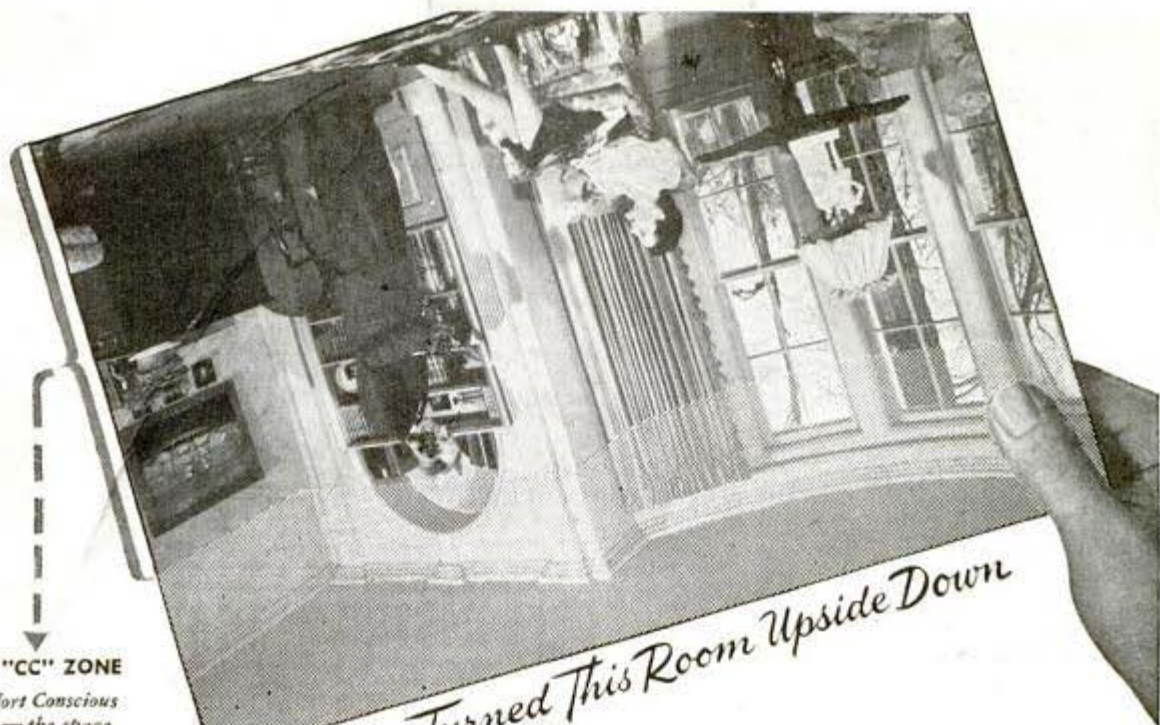
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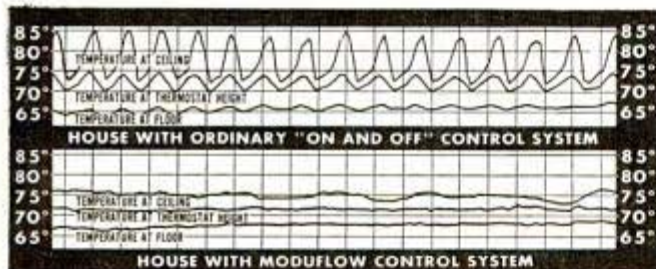
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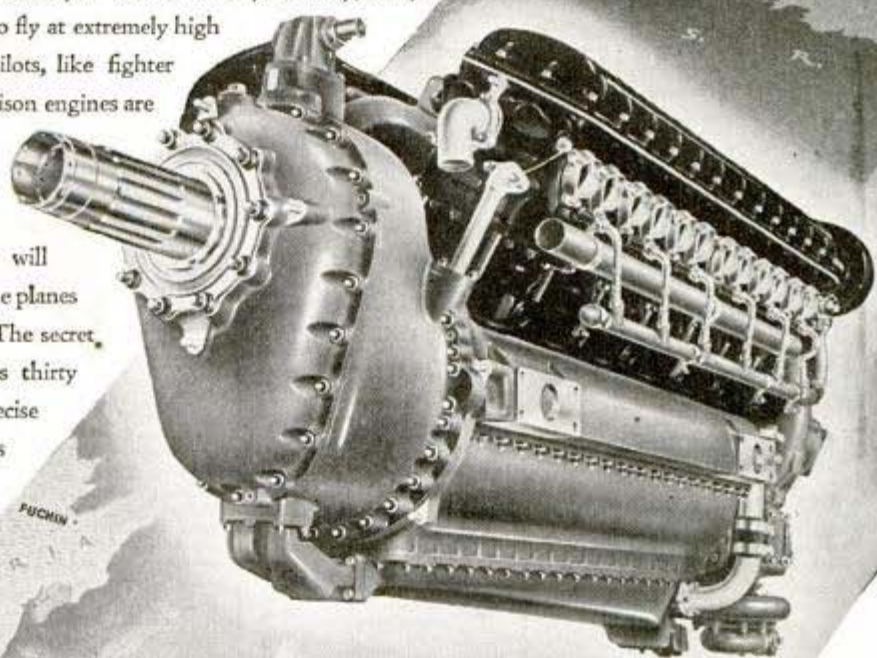
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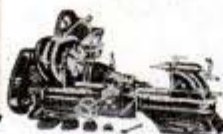
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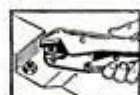
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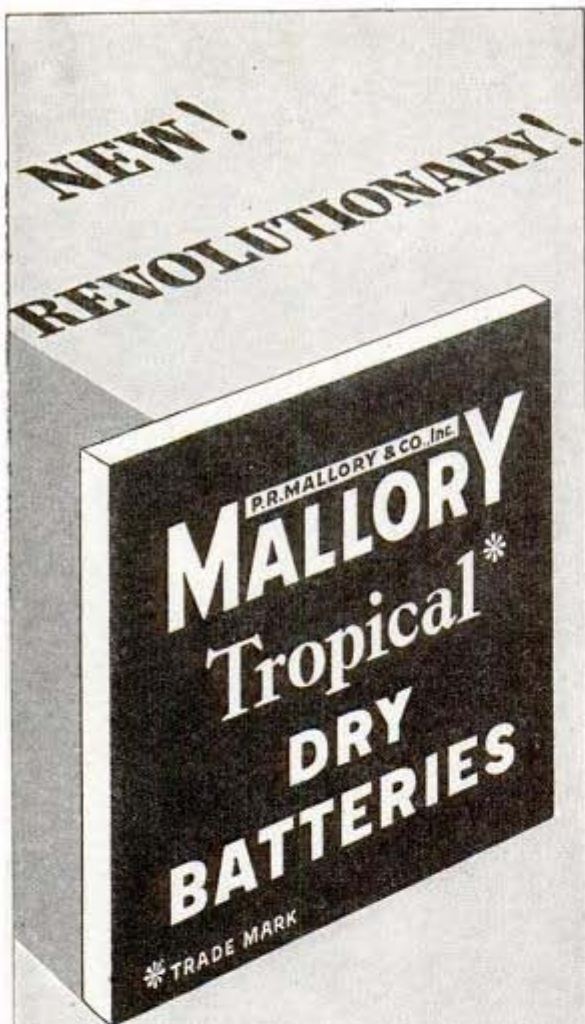


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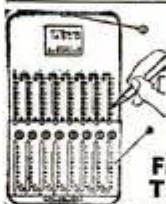
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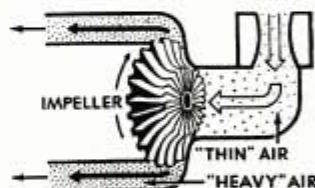
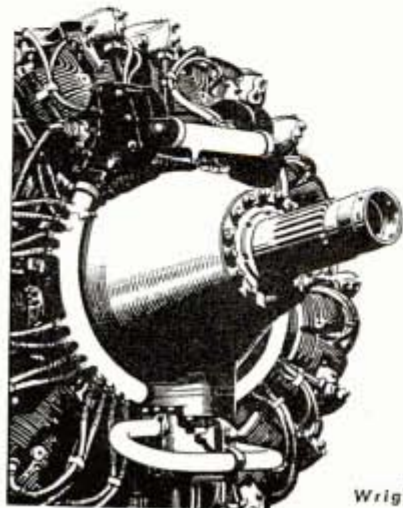


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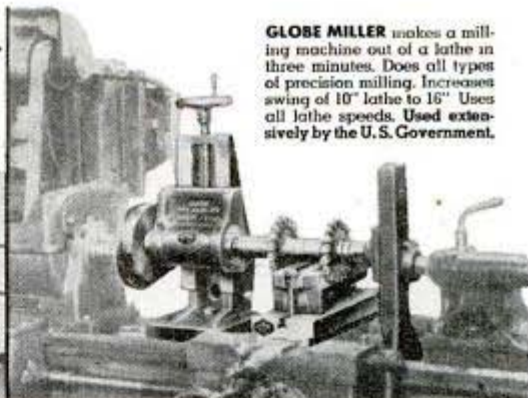
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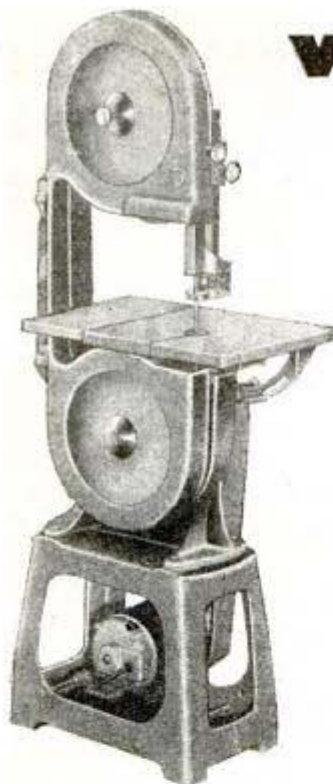
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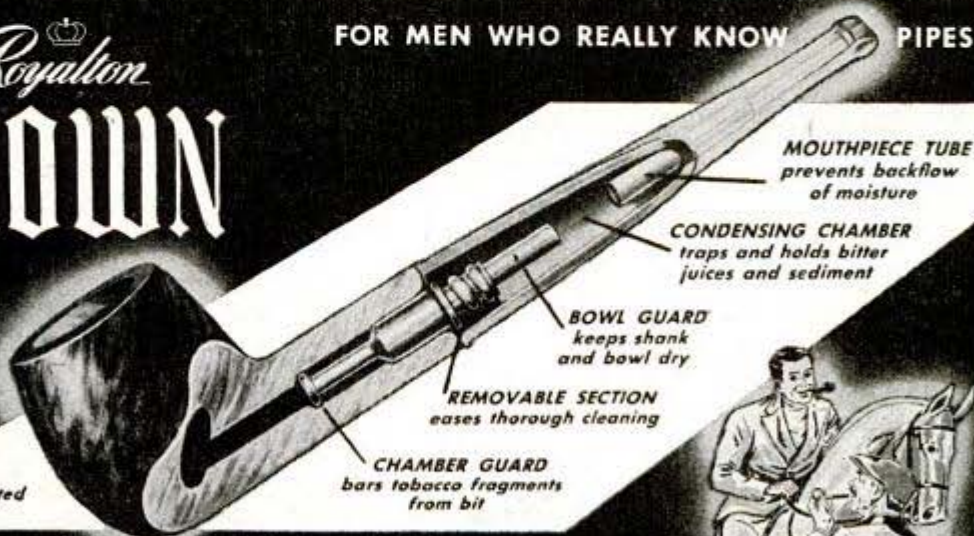
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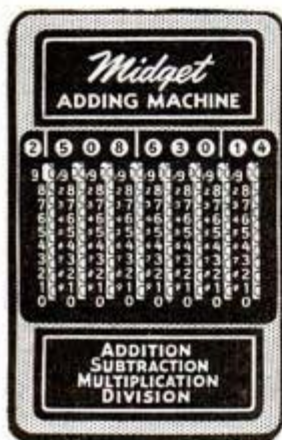
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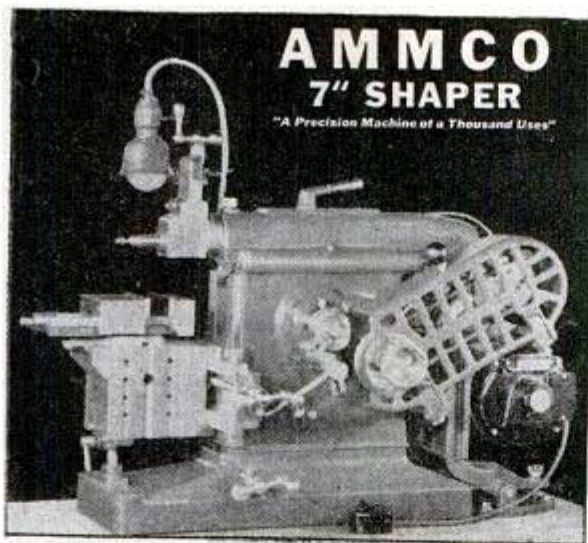
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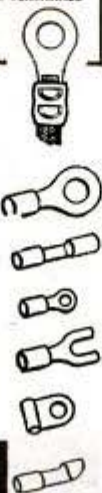
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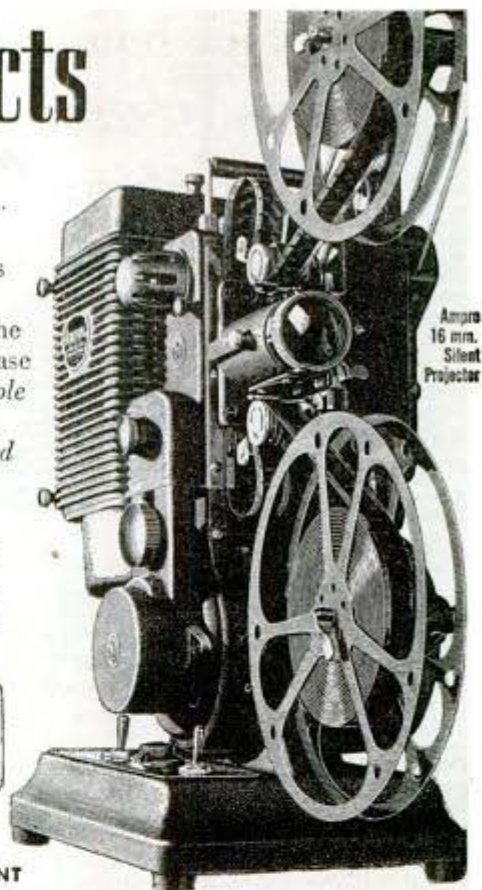
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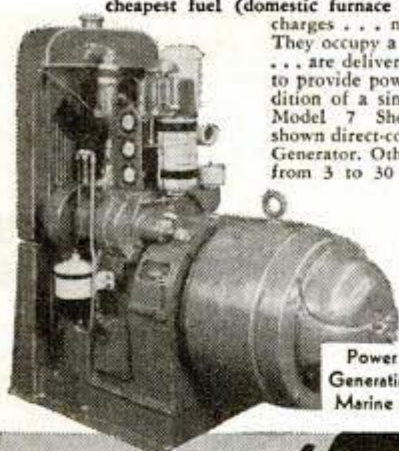
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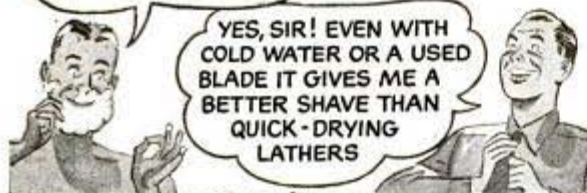
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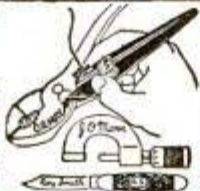


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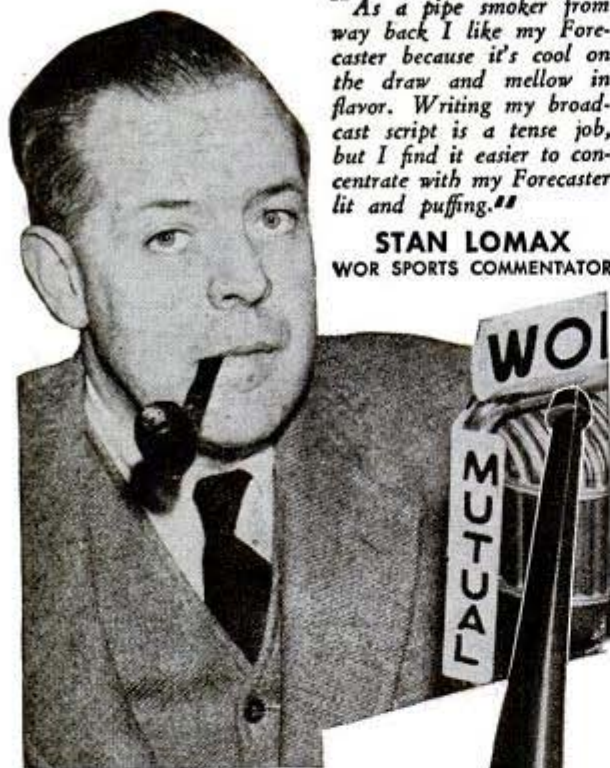


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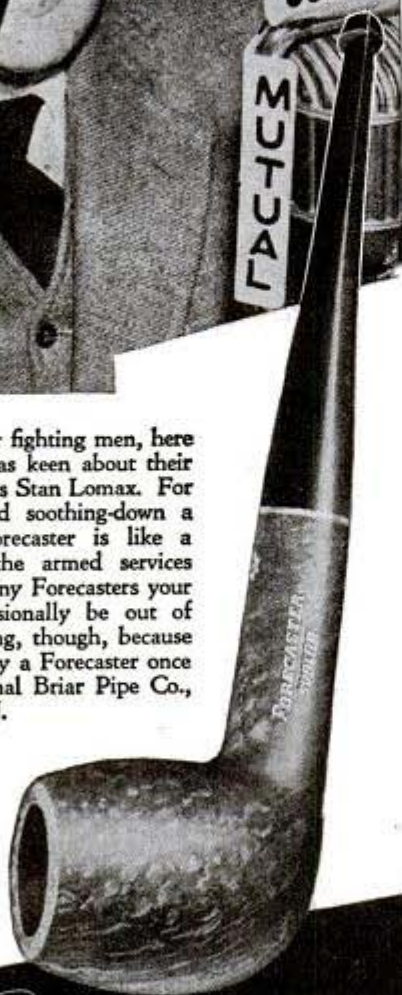
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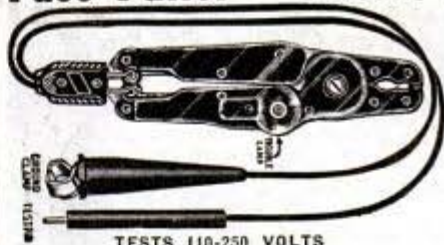
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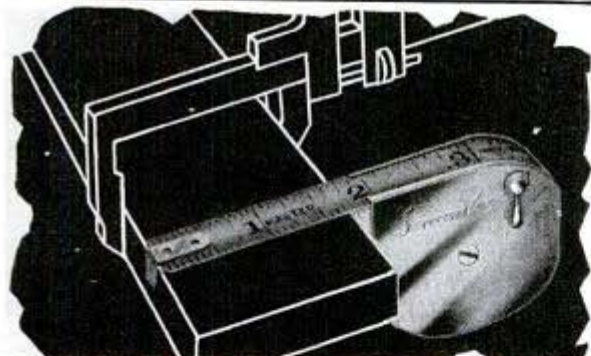
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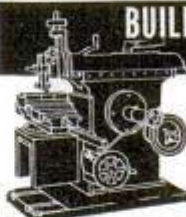
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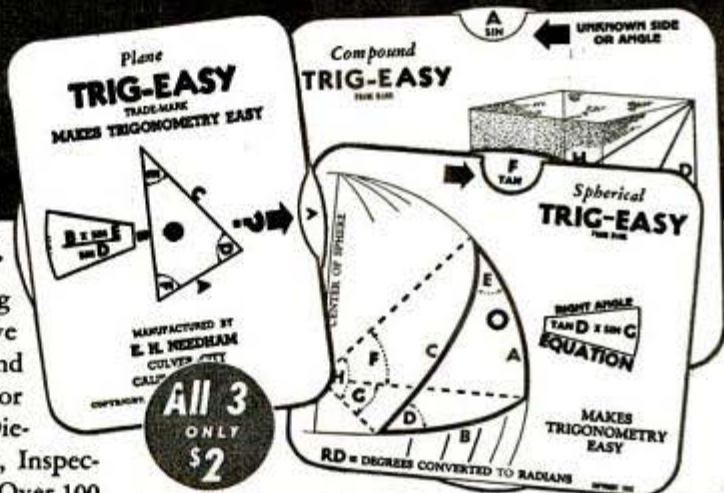
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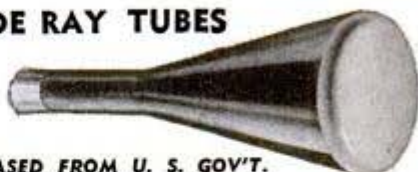
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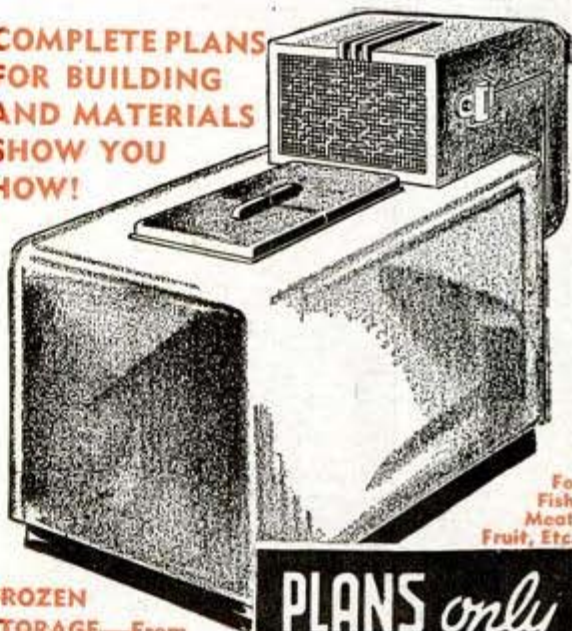
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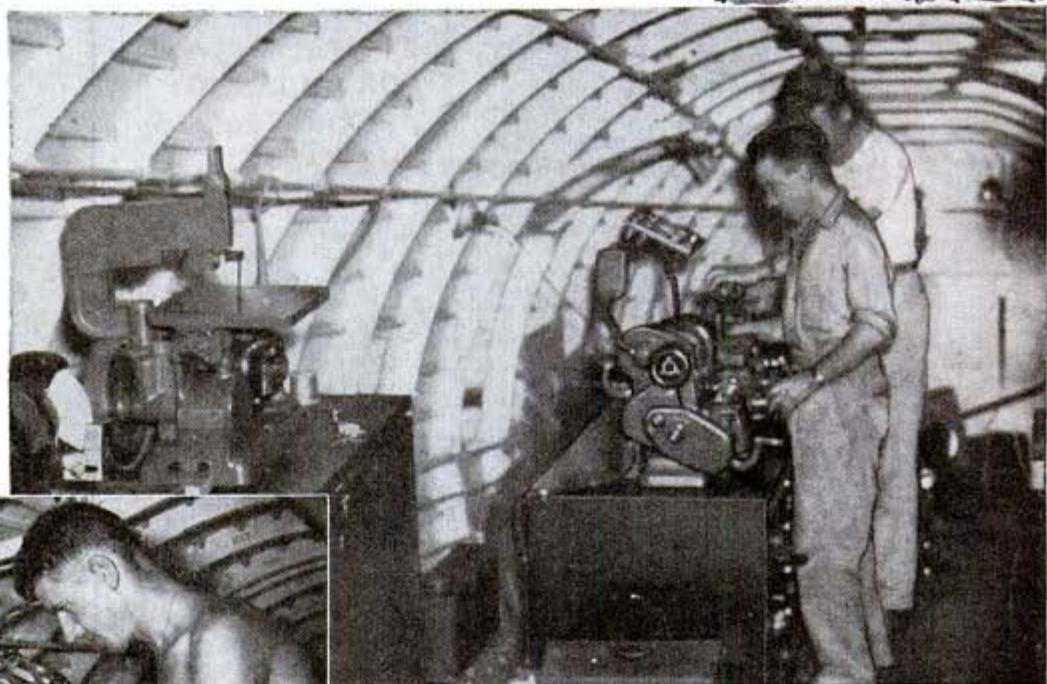
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"signed" to the new tires you buy. The name "Seiberling" molded into a synthetic tire means:

- it was designed and engineered by men who have repeatedly distinguished themselves in the creation of basic tire-building improvements,
- it was built by the organization recognized as "Experts in Rubber",
- it is marketed by people who have a priceless reputation for honesty.

You can select a Seiberling Synthetic Tire with complete confidence. It bears—

THE NAME YOU CAN TRUST IN RUBBER

SEIBERLING

Experts in Rubber

THE BATTLE OF RUBBER IS FAR FROM WON!

This war is consuming tires at a rate so fast no one could possibly have foreseen it. They are the most imperative single need of our armed forces today! One fighting unit alone requires 5000 in 24 hours. That means fewer tires for civilians. *Continued conservation of your tires is essential.* Your Independent Seiberling Dealer can help you make them last longer. You can trust him—he is an Expert in Rubber!



SEIBERLING
TIRES



RETAILED ONLY BY FREE, INDEPENDENT
BUSINESS MEN DISPLAYING THIS
SIGN OF QUALITY