

BAT PILOTS *of the* NIGHT FIGHTERS

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT



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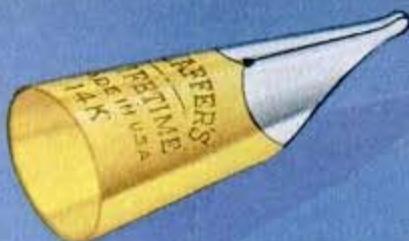
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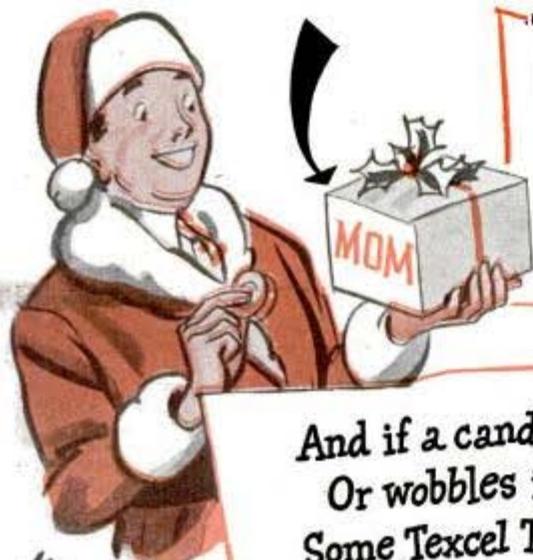
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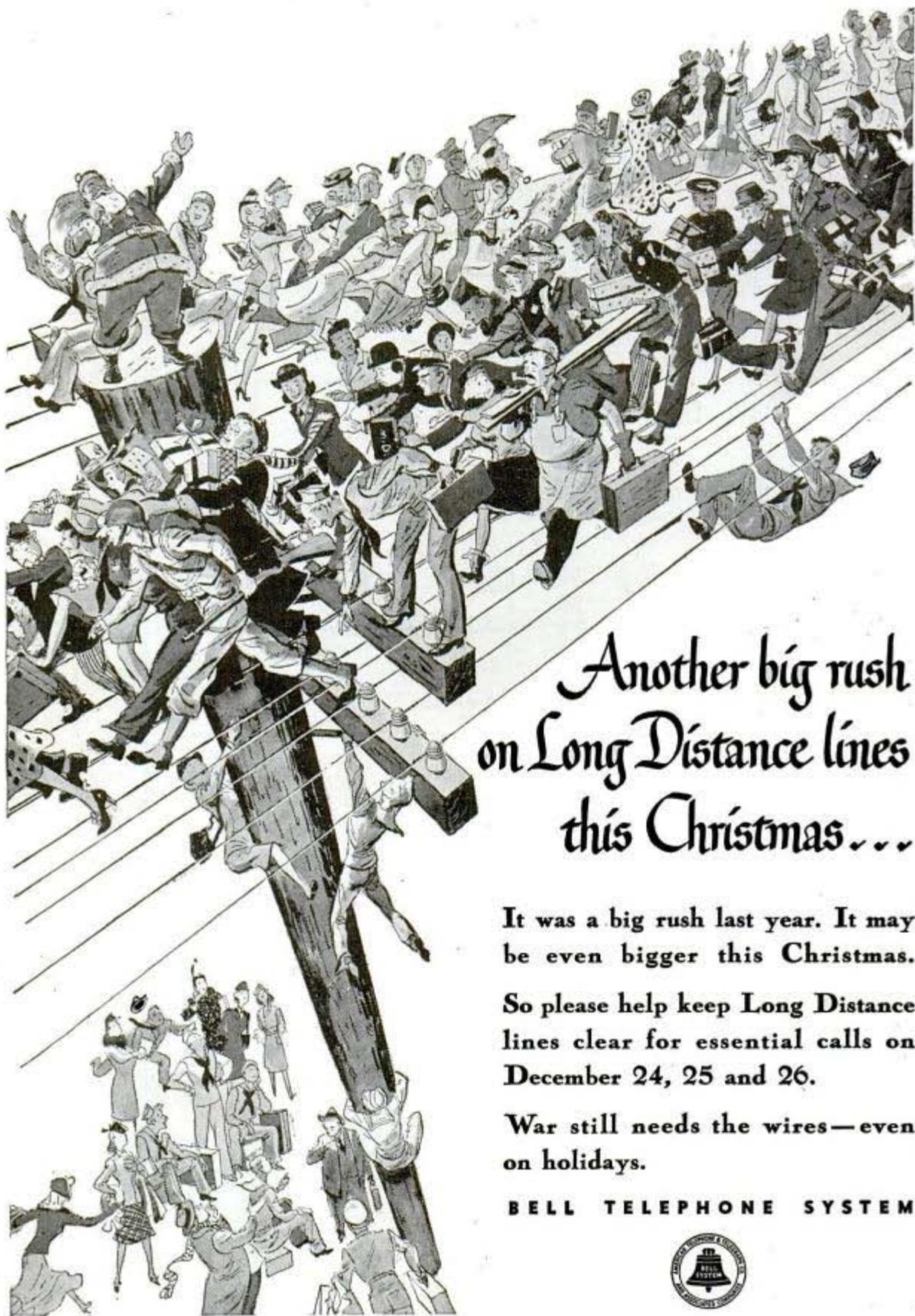
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DECEMBER, 1944



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1A



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December, 1944

Vol. 82, No. 6

Next Month

YOU can make a million dollars in cold cash, says our West Coast correspondent, by simply devising a third-dimensional effect for the movies. For two or three decades movie makers have been pining for the effect of depth and distance of grandpa's stereoscope, but so far the hundreds of engineers who have worked on the problem have failed to produce anything practical. Meanwhile, the movie studios use special lighting, amazing combinations of full-scale and miniature models, photographs and painted scenes for depth effect. A January feature, "Giving Depth to the Movies," tells a few secrets of the trade.

Black Diamonds

CAPTAIN KIDD's buried treasure is just a drop in the bucket alongside Uncle Sam's buried "black diamonds" valued at seven trillion dollars. And Uncle Sam knows just where to find his rich coal hoard that provides not only power and heat for the nation, but scores of vital chemicals. Coal tar helps make plastics, TNT, sulfa drugs and parachutes. How we are using this "Seven Trillion Dollar Treasure" is told in the next issue.

Race Track Robots

YOU don't have to be a betting man or even a horse lover to get a kick out of the intricate devices that rule the race tracks: It takes the biggest adding machines in the world to handle a half million in bets made in half an hour. Giant timepieces, electric eyes and photochart cameras add up to a January article, "It's All Electric But the Horses."

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Flying the Power Midgets

ANY doubts about the future of aviation in the U.S.A. are cast aside in the face of one lone fact: 25 million bucks are spent each year by the fellows, both young and old, who build and fly powered model airplanes. Recently a new speed record of 112 miles an hour was set by a two-pound model with a 12-ounce engine. The rage now is jet propulsion craft. One rocket plane, described in a January feature, consists of a glider with a firecracker attached under the fuselage. The aerial midgets include gliders with wing spans up to seven feet, flying wings, and helicopters that rise under their own power.

Torture Chambers for Airplanes

THOSE testing rooms for new planes and parts present a picture of organized chaos to the visitor, but to the combat pilot they are gilt-edged security. Take the B-29 and its pressurized cabin, for example. What happens to that cabin when punctured by a bullet or cannon shell at 25,000 feet? The Boeing engineers had the answer for that one long before the first super-bomber was sent overseas. How tough is the wing of a Mariner? Or a Hellcat? Read "Torture Tests for Sky Rangers" next month.

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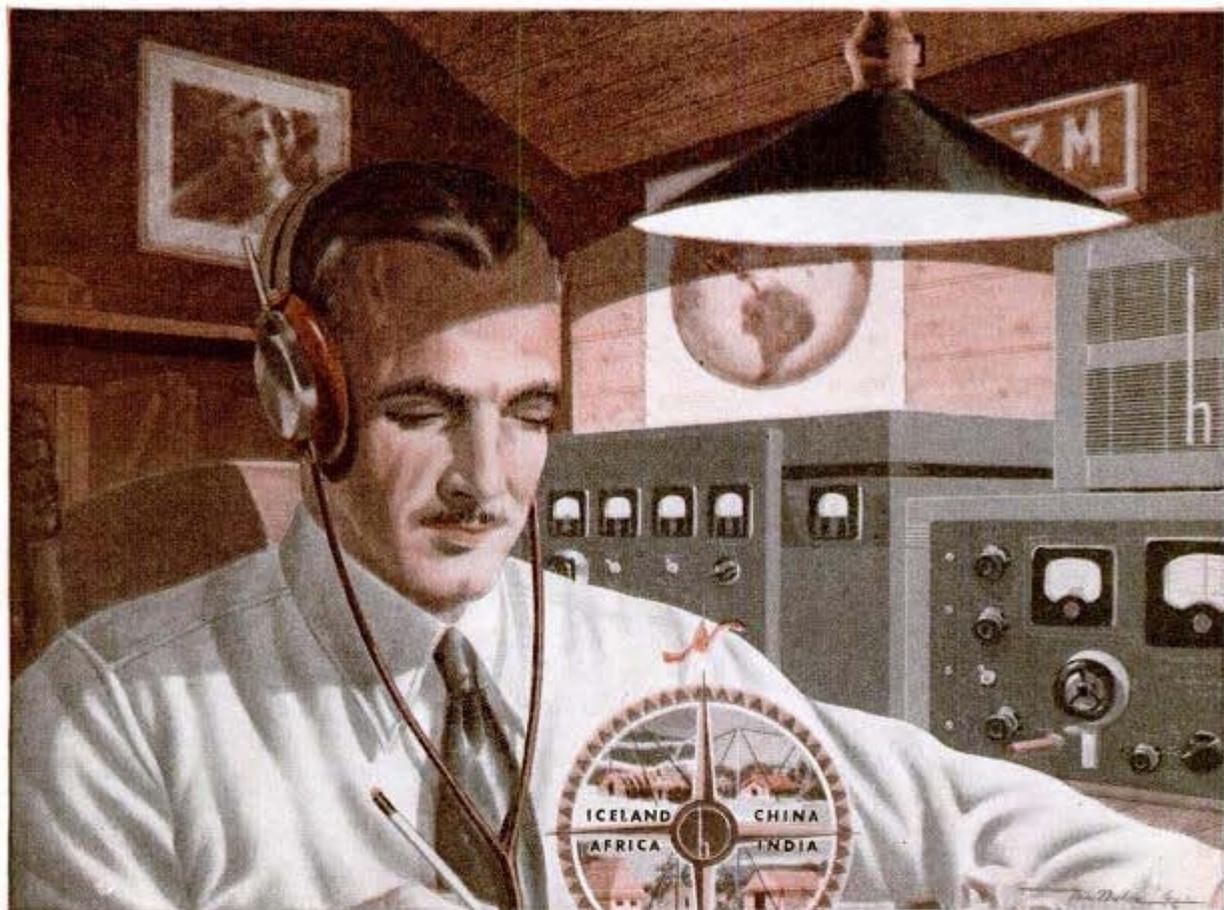
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OUT OF THE ATTIC...

This is only part of the story of the role played by amateur radio in extending the lines of victory around the world. It is a long, exciting and strictly American story. Before the war the amateur used to love to sit in his attic and talk to fellow enthusiasts on the other side of the globe. But long before war came he got out of the attic and began to use his special skills, his inventive genius to help establish wartime communications. The amateur radio expert found an especially valuable place in the ranks of the AACs—Army Airways Communications System. This group by the end of 1943 had established 600,000 circuit miles in 48 states and 52 foreign countries. It maintained vital communications over 100,000 miles of airways. Hundreds of millions of dollars worth of aircraft and tens of

AROUND THE WORLD!

thousands of lives have been guarded by the far-flung safety and navigation facilities of the AACs.

It is officially acknowledged that the technical and operating leadership of this great group has come from amateur circles. Hundreds of their unsung heroes are licensed amateur radio operators. These are the anonymous workers on the radio front who should share some of the praise given to Edison, Bell, Marconi and the other giants of communications. Long before the war Hallicrafters served these exacting technicians with the best possible equipment. Hallicrafters sets were developed in the great testing grounds of amateur radio. They have served an "attic apprenticeship" and have come out of the attic to go around the world with victorious Allied armies.



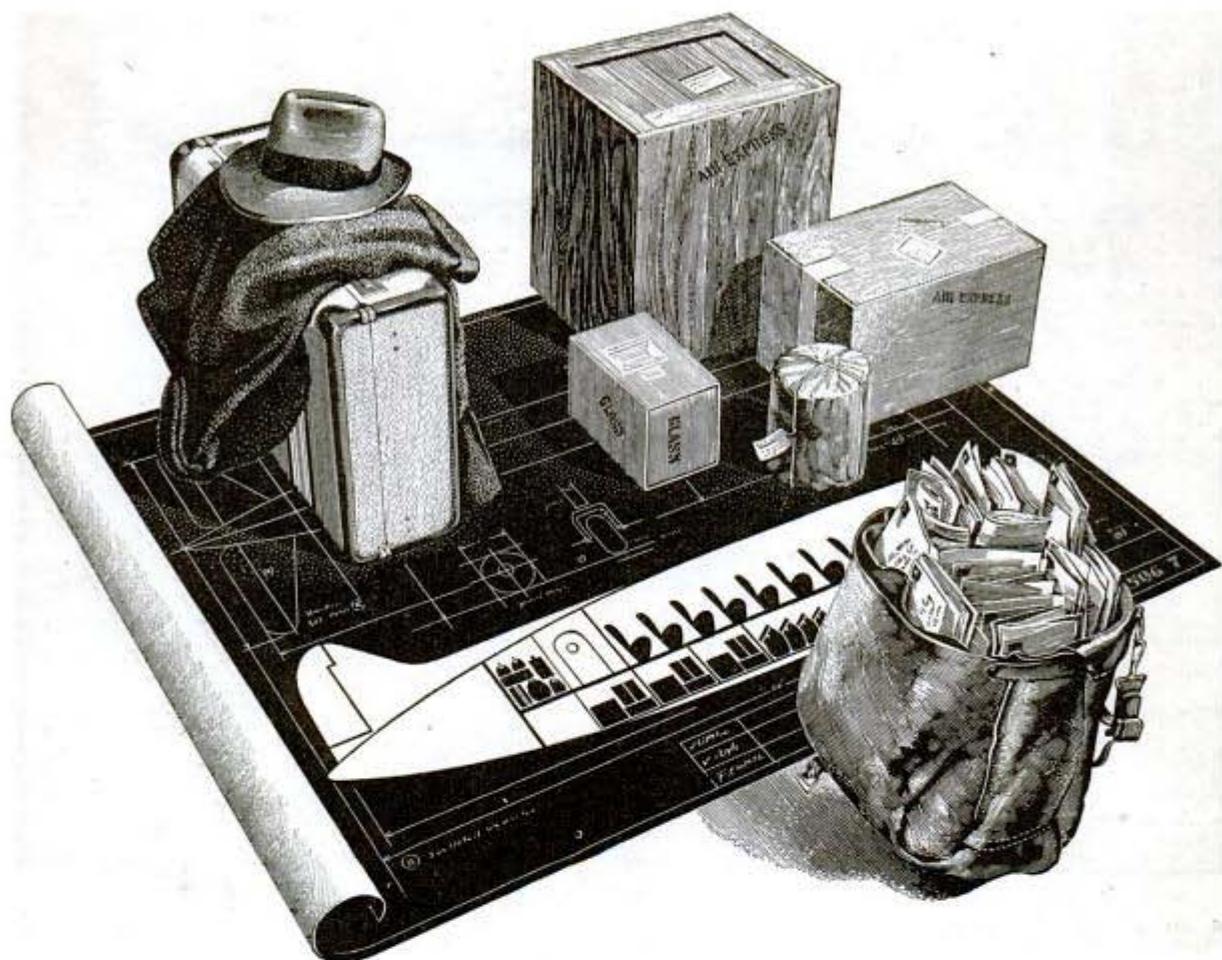
For radio equipment that won't be satisfied with the limits of the pre-war world, for radio that will go places and do things hitherto undreamed of and uncharted—look to Hallicrafters, builders of the radio man's radio.



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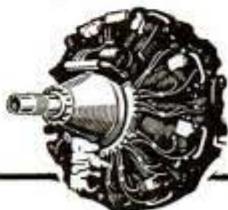


The real payload is the full load

Let's be realistic. Many have prophesied, ourselves included, the future vastness of air transportation. The industry well knows its great possibilities. But the most pressing problem in aviation will be to make sure that *all* transports, large and small, fly full.

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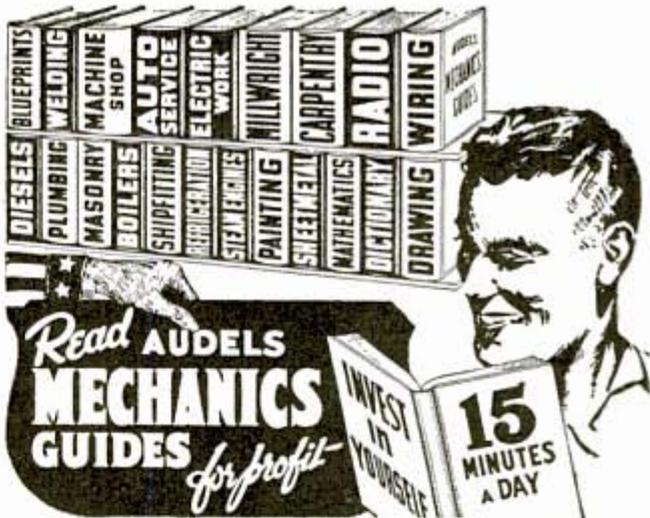
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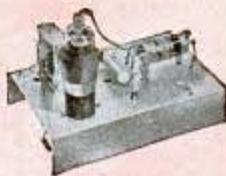
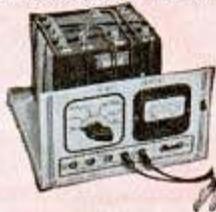
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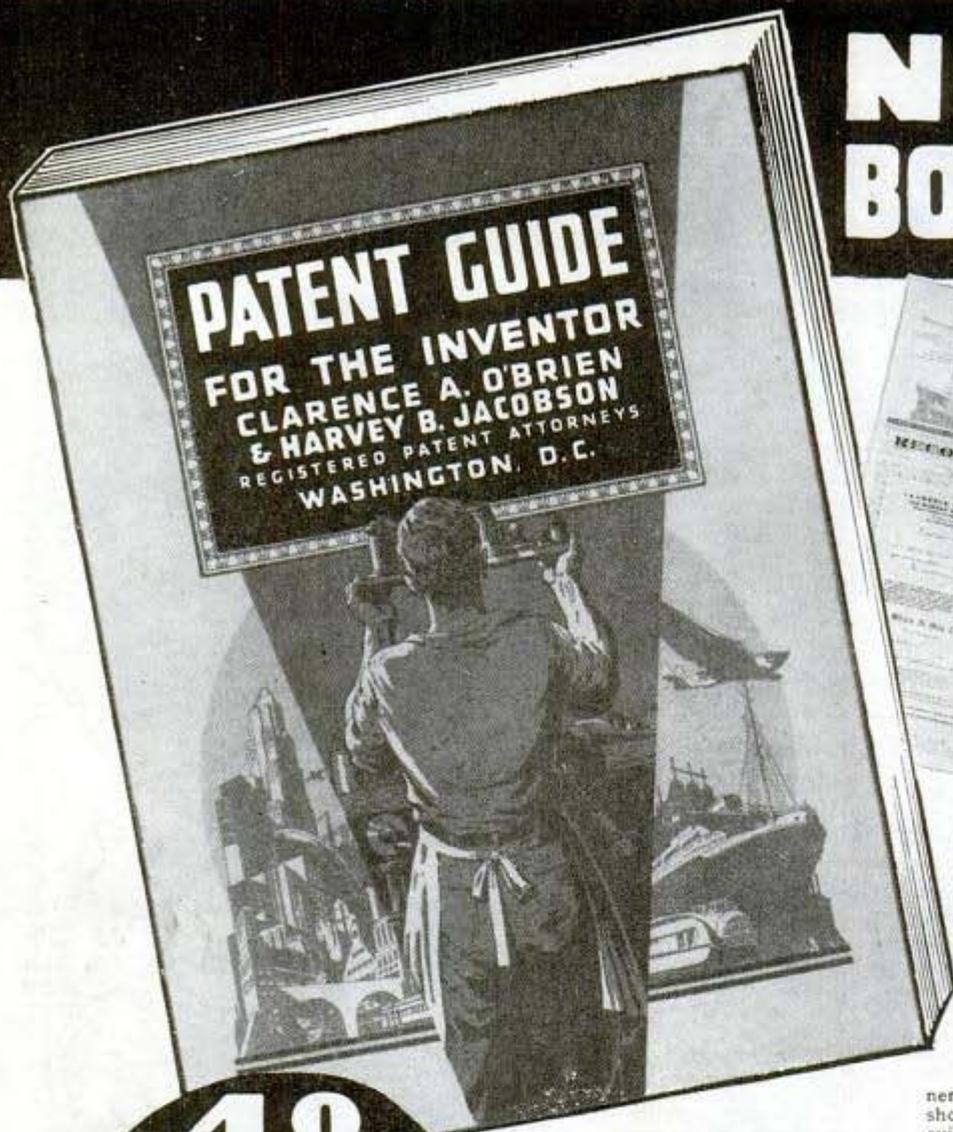
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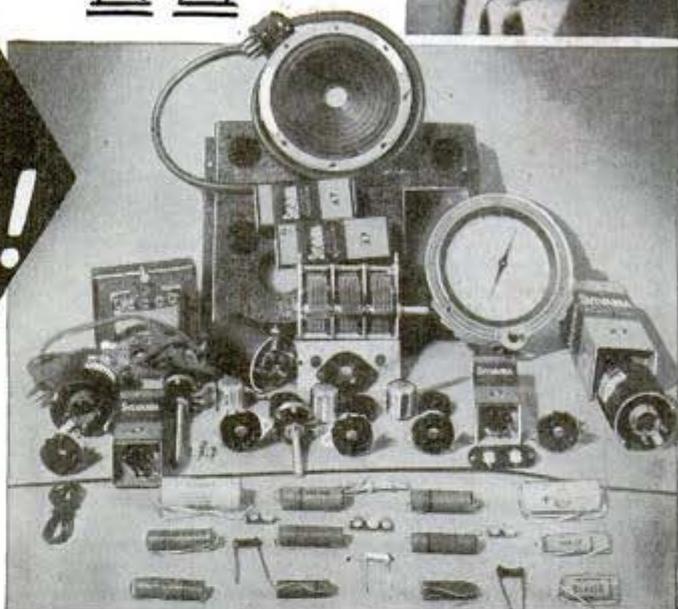
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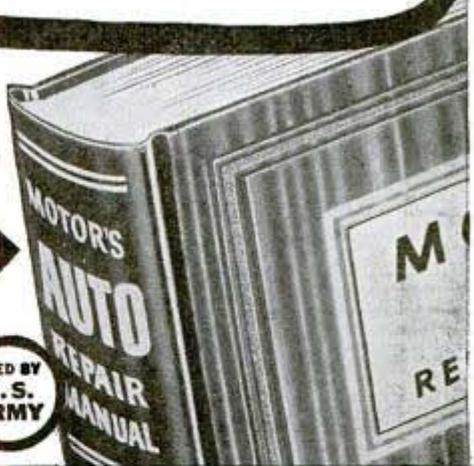


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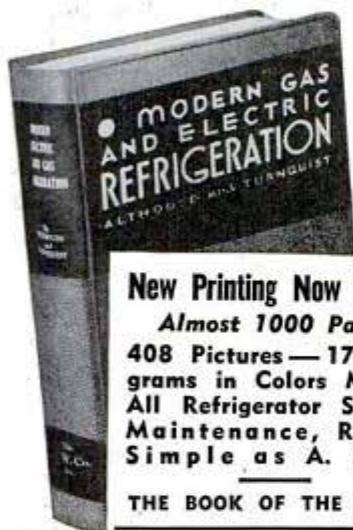
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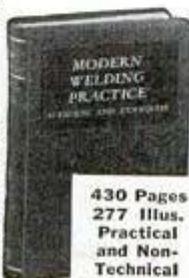
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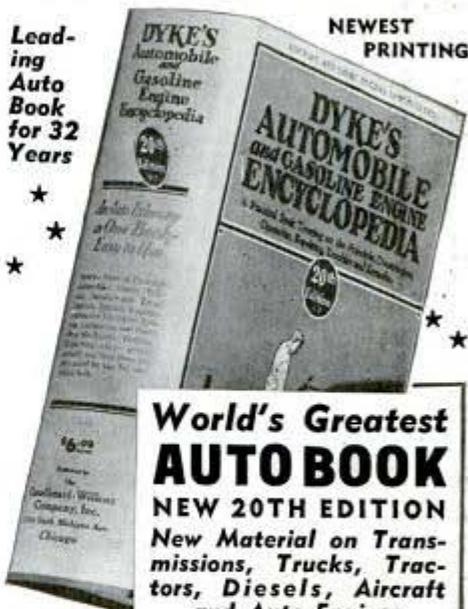


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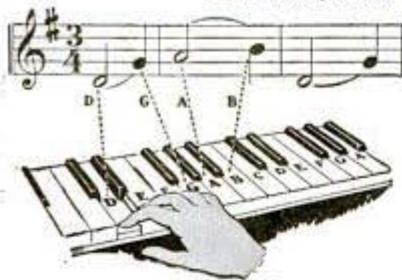
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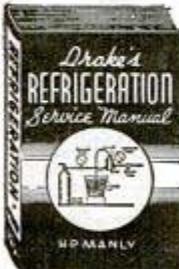
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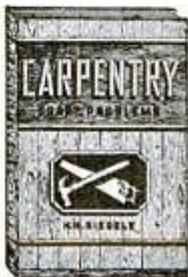
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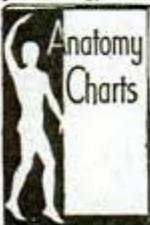
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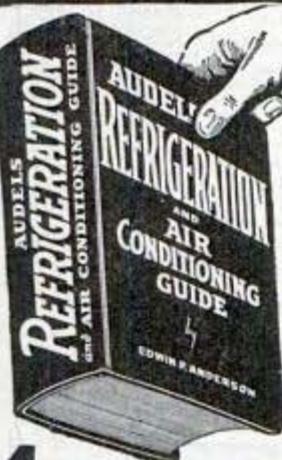
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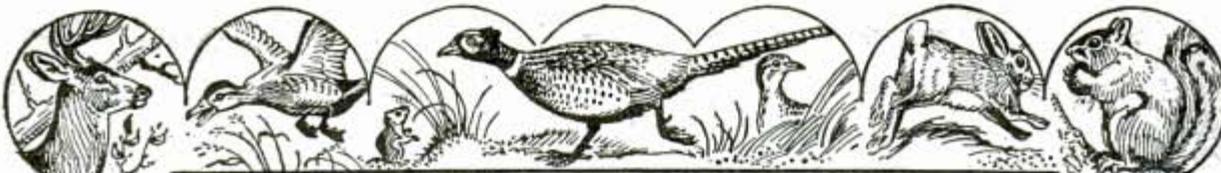
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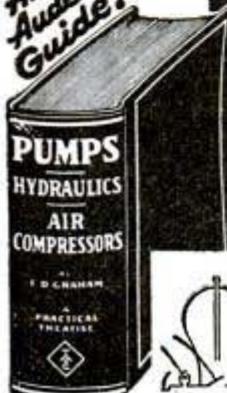
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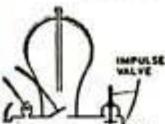
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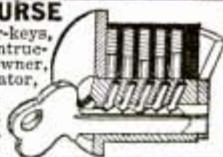
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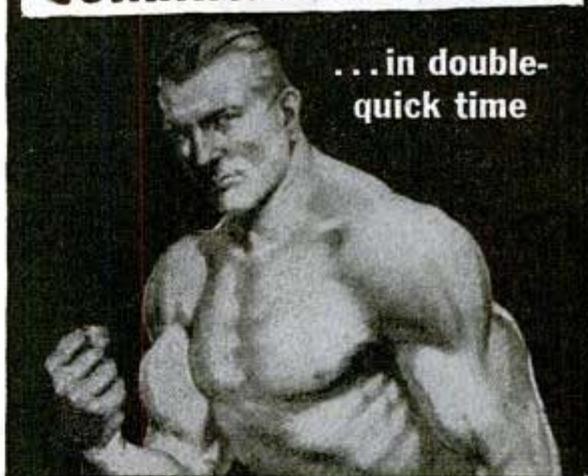
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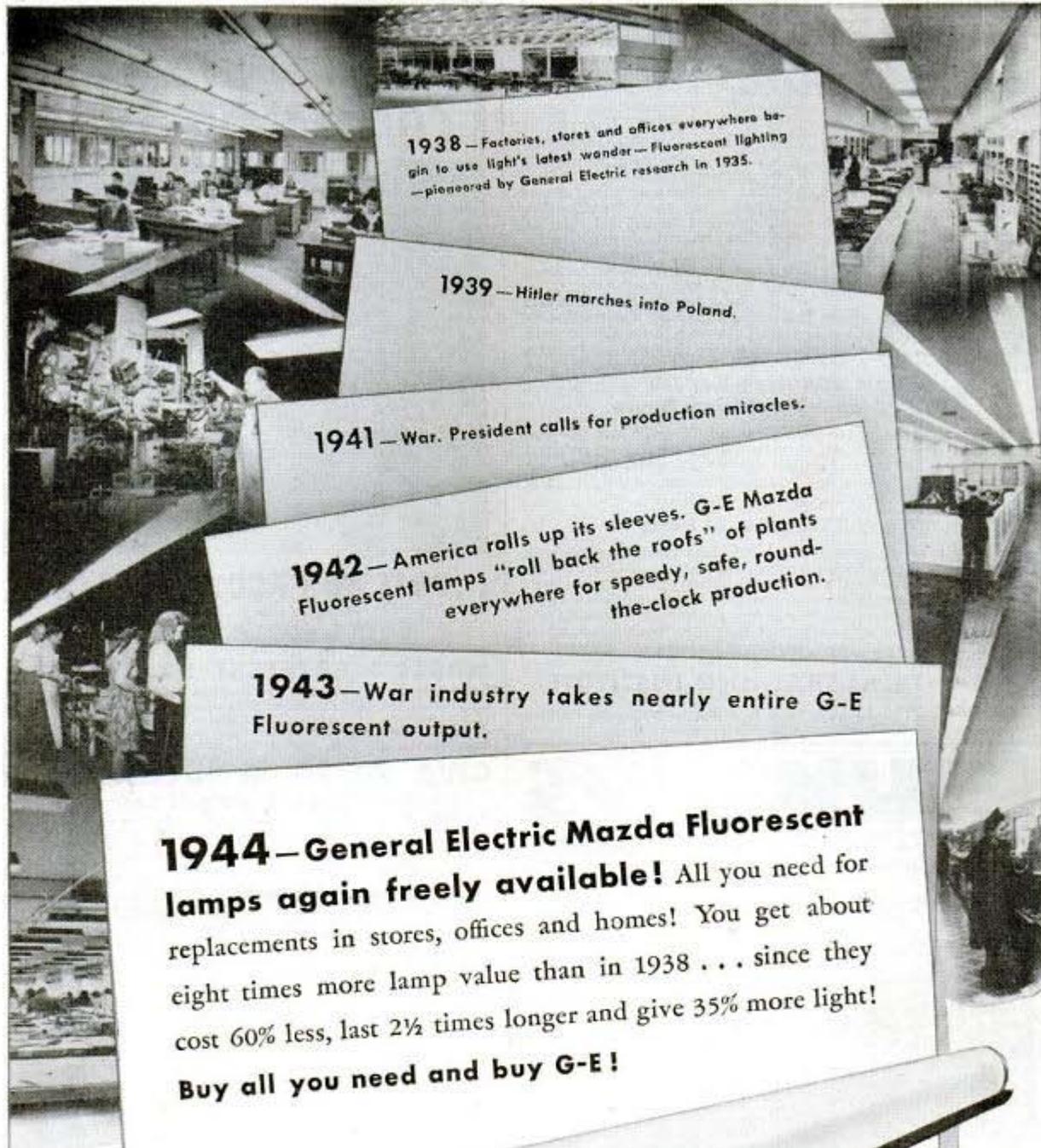
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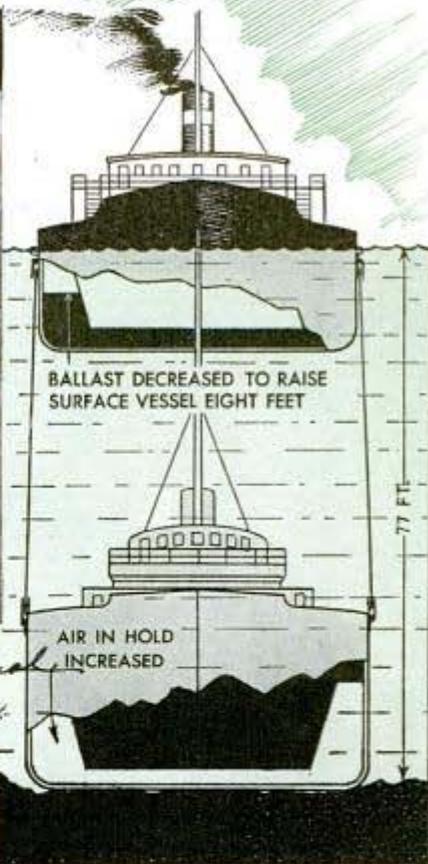
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DECEMBER, 1944

No. 6

FISHING for a MILLION



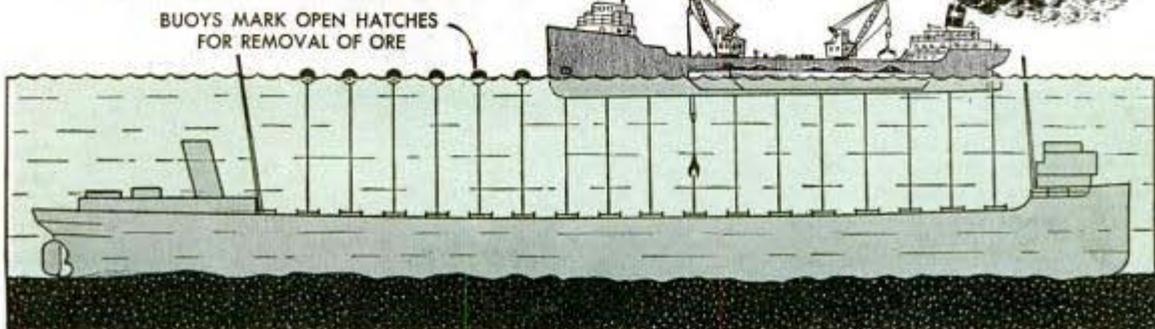
By Ross M. Dick

of The Milwaukee Journal Milwaukee, Wis.

INGENIOUS Capt. John Roen has given Great Lakes shipping men something to talk about. From a 77-foot depth in the Straits of Mackinac, he recovered a million dollar prize—the sunken steamer George M. Humphrey. Captain Roen has been salvaging derelict ships on the lakes for a number of years. The raising of the Humphrey is his greatest feat.

The Humphrey, a 600-foot-long ore, coal and grain carrier, sank on June 15, 1943, after a collision in fog with the steamer D. M. Clemson a mile and a half northeast of Mackinaw City, Mich. Built in 1927, the Humphrey was valued at \$1,600,000 by her owner, the Kinsman Transit Company of Detroit. She was

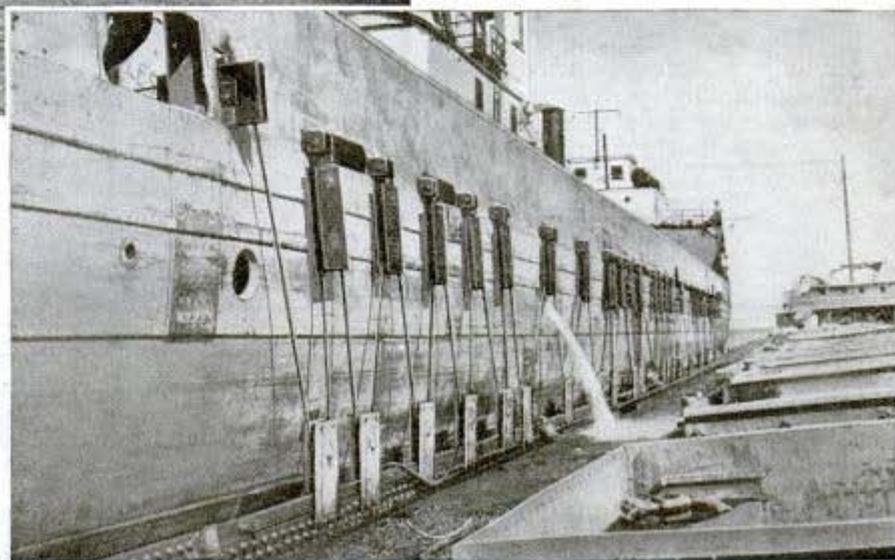
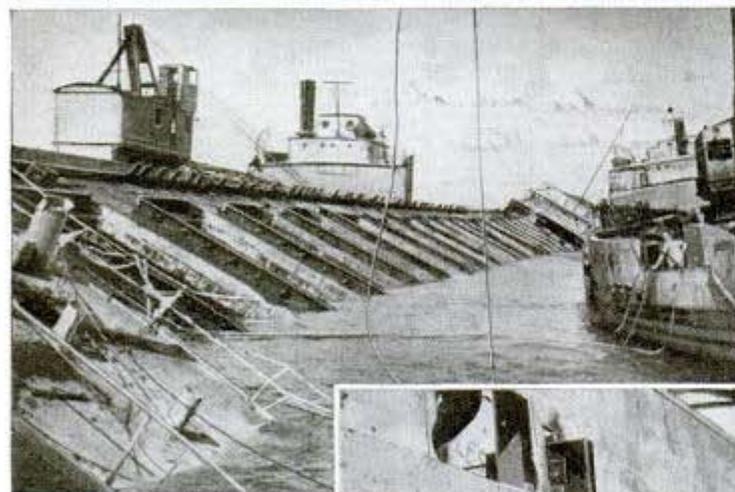
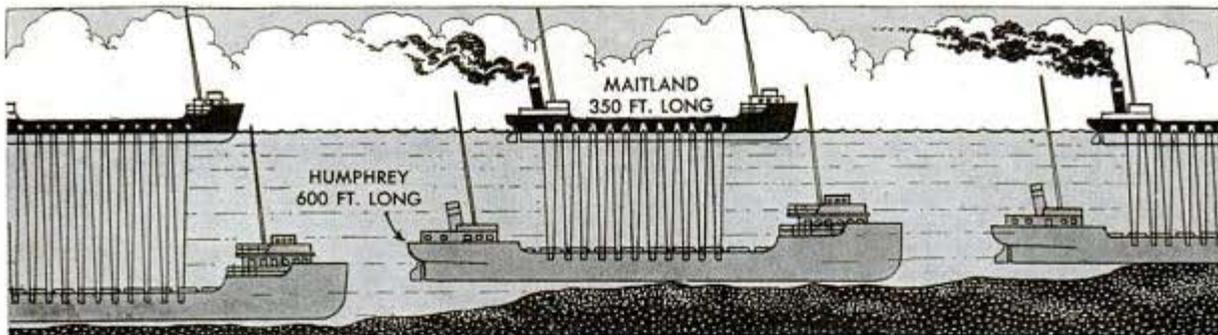
Top left, stern and bow of salvaged ship emerge between barges. Above, pickaback method gives vessel first lift. Below, cranes removing the ore



DECEMBER, 1944

1

Roen Steamship Co., Sargan Bay, Wis.



Top, two barges lifting submerged carrier; note bubbles from carrier between barges. Center, carrier starts rolling over when ballast tanks become unbalanced. Air lines can be seen on water. Right, bolted to side of barge and carrier are the sheaves (grooved wheels) through which cable is laced with the end attached to deck winch. This view looks toward the bow

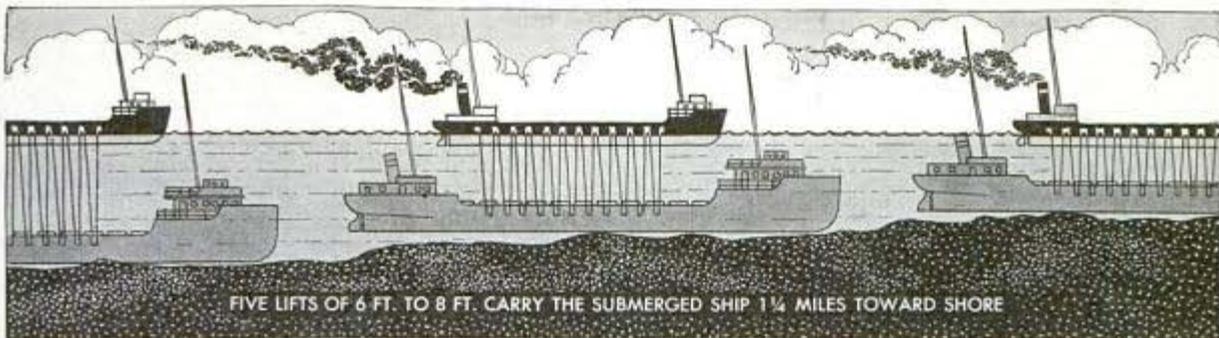
Submerged Humphrey is laced to surface craft with 15,000-foot cable

the largest ship ever to sink in the Great Lakes.

Underwriters surrendered their claims after leading marine salvage experts declined to undertake recovery of the carrier, which was loaded with 14,000 tons of ore. Only a few feet of her bow and stern masts marked her position in the busy shipping lane.

The federal government sought bids on cutting down her superstructure to clear the channel. Only Roen would undertake the job. His offer was a bold one. If he could raise the Humphrey, she became his; otherwise, he would cut down her superstructure and absorb whatever loss he sustained in his efforts to recover her.

In October, 1943, Roen tackled the first problem, that of removing the ore.

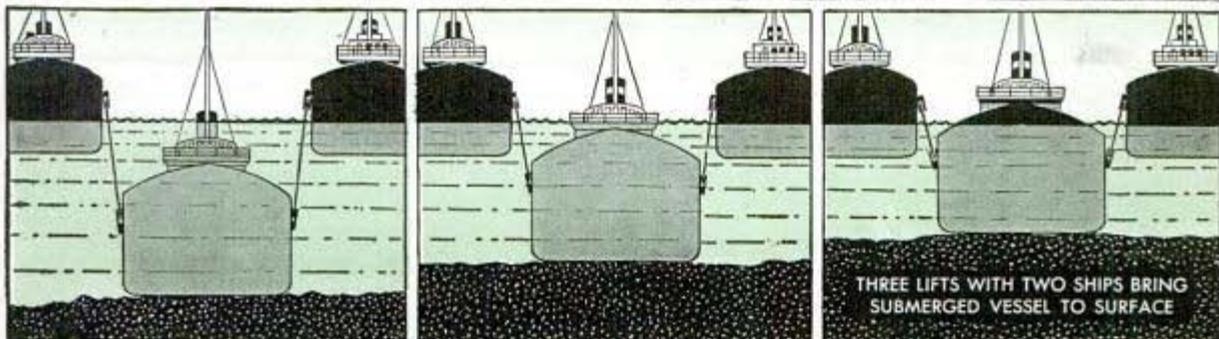
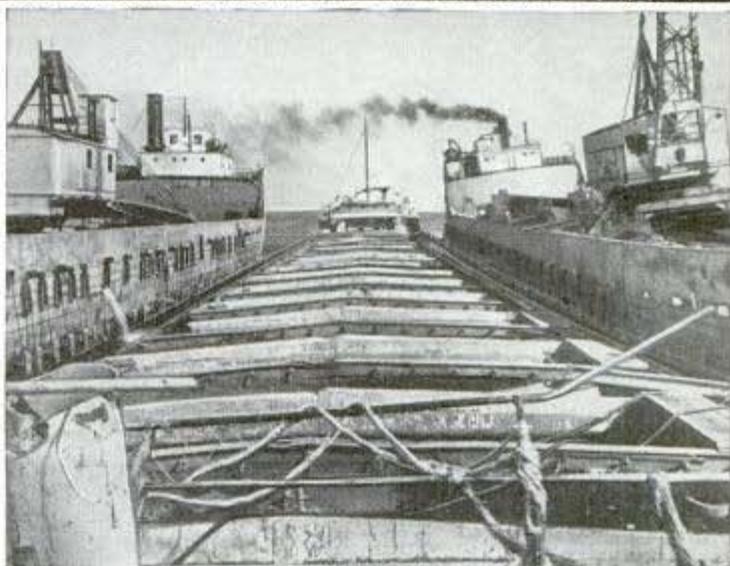


FIVE LIFTS OF 6 FT. TO 8 FT. CARRY THE SUBMERGED SHIP 1 1/4 MILES TOWARD SHORE

Right, million-dollar prize breaks surface; barges serve as pontoons

There were herculean jobs to be done, such as removing the huge steel hatches. Much of the work demanded that divers struggle against the strong currents of the straits—up to seven miles an hour. Buoys were placed to mark the hold openings, making it simple for a crane operator to drop his scoop accurately into the ore. Before winter and its high seas made it impossible to continue, 8,000 tons of ore were salvaged.

The winter months were



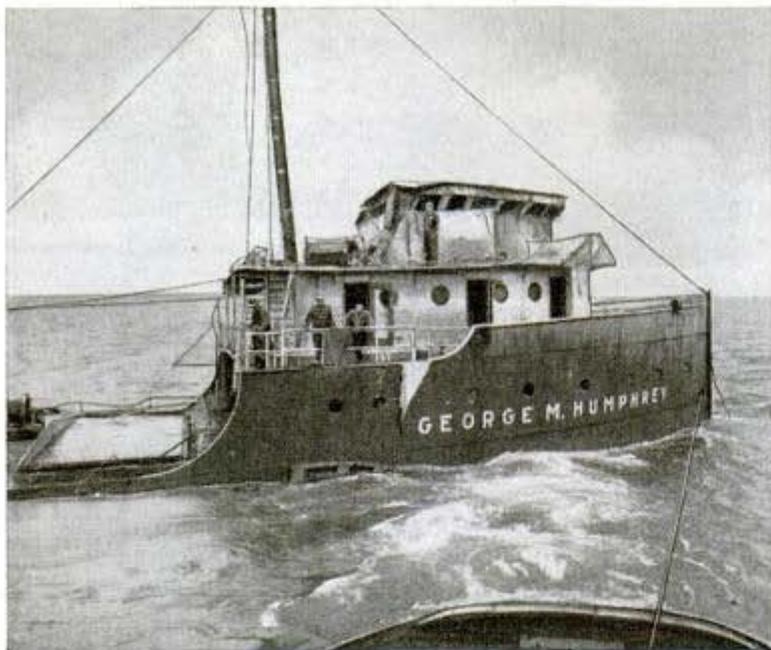
THREE LIFTS WITH TWO SHIPS BRING SUBMERGED VESSEL TO SURFACE

In second stage of tow, ballast tanks on barges are emptied on side near carrier. Right, diver at work

spent in planning at the Roen Steamship Company yards at Sturgeon Bay, Wis. The captain's idea, previously untried as far as shipping men can remember, was to raise the Humphrey by a series of pickaback lifts and tows. The pickaback "rider" was to do a large share of the lifting. Blueprints of the proposed operations were prepared; special tools were acquired or built, and a model representing 140 feet of the Humphrey's midship section was erected for tests.

In May, 1944, Roen's wrecking barge, Industry, and one of his larger barges, the Maitland, returned to the wreck. Two thousand more tons of ore were salvaged. Most of the remainder was dumped into

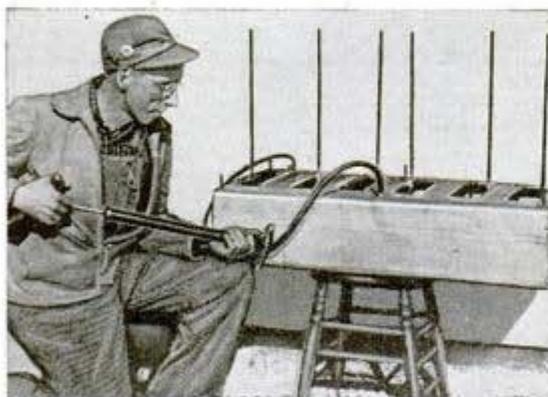




Bow of salvaged Humphrey with decks barely clear; pilot house was battered by ice. White marks on mast indicate distance of successive lifts

the water as unreclaimable. Then many hours of underwater work began for the four divers employed. They found that air pressure created as the Humphrey went down had crushed bulkheads and split seams of the ballast tanks.

Quick sealing cement, lowered to the



legs for it. Fifty sheaves also were bolted to each side of the 350-foot-long Maitland. Then 15,000 feet of $\frac{7}{8}$ -inch cable were used to lace the two ships together. So that the longer carrier would not pull down the bow or stern of the Maitland, the center of gravity of each had been predetermined.

The normal draft of the Maitland is eight feet. Her ballast tanks were filled to sink her an additional eight feet. Meanwhile, air was pumped into the carrier's tanks. Then the pumps went to work to reduce the added draft of the Maitland, thus slowly hoisting the Humphrey six to eight feet and making it possible to tow her a few hun-

Left, a model of Humphrey midship section used in tests. Below, carrier under tow; note patch on side



divers in bags, was applied to make the tank seams airtight. After being emptied, the tanks were to be partly filled to assist in the raising job. Theoretically, the Humphrey could have been raised by blowing enough air into her repaired tanks, but that probably would have resulted in her turning over.

Perhaps the hardest job for the divers was attaching sheaves (grooved wheels) to the gunwales of the carrier. To place 50 sheaves on each side, 300 one and one-half inch rivets had to be cut. This was done with a steam hammer mounted on a powerful chisel. To enable the divers to handle the one-half ton hammer more easily, Roen devised

dred feet into shallower water. Five such lifts and tows were necessary to move the 6,000-ton derelict a mile and a quarter southeast and out of the shipping lane.

Roen had feared the sunken ship might be stuck in gummy clay. That would have added an estimated 1,000 tons of suction. Just in case, he built an 80-foot steel tower to carry large blower pipes to the bottom to blow the clay clear of the keel. Fortunately, the equipment wasn't needed.

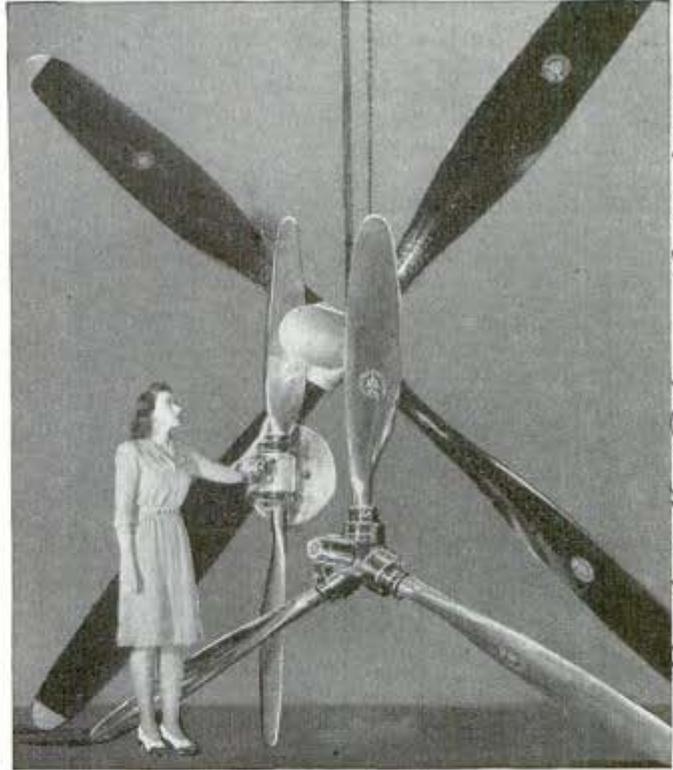
Once the operations were imperiled when, during a fog, a steamer bore down on the Maitland as it lay anchored above the wreck. Despite the Maitland's signals, the steamer did not veer aside until a collision seemed inevitable.

When the Humphrey had been brought into water too shallow for the Maitland to be used over her, the lifting method was altered. The Maitland and the Hilda, another large barge, then were maneuvered on either side of the still submerged carrier. Sheaves on the near side of each barge carried cables to the sheaves on the carrier. The ballast tanks of the barges are separated by a lengthwise bulkhead. The tanks on the sides of the barges adjacent to the Humphrey were emptied, while the outer tanks were filled with water. Thus made to serve as pontoons, and balanced against rolling over by the adjusted tanks, the barges made three lifts and tows to bring the carrier a mile toward shore until she touched bottom a half mile from the beach. The 32-foot depth from deck to keel then brought her deck above water.

Disaster again stalked the salvagers during these final stages. Gauges regulated the air in the Humphrey's tanks and they had to be kept trimmed carefully. As she crawled shoreward between the Maitland and the Hilda, the "trim" went awry and the long steamer began to roll over. A quick thinking crane operator fired several shots at one of the air lines, piercing the hose below a gauge. Other men jumped to open other gauges and the escaping air halted the roll.

Divers closed the 18- by 24-foot hole the Clemson had rammed in the Humphrey's starboard side with huge timbers and tarpaulins. Her holds were pumped and two

18-Foot "Props" of Hollow Steel Reduce Weight of Plane



Although they are the largest ever flown in this country, the 18 foot, 2 inch Curtiss-Wright propellers used in the Air Forces are lighter than many smaller aluminum propellers because they are made of hollow steel. Designed to absorb 3,000 or more horsepower, they effect a 20 percent saving in weight over a propeller of comparable diameter with four solid aluminum alloy blades, thus increasing the useful load of the plane approximately 650 pounds. The four propellers and engines are synchronized by a single control and the propellers are capable of fast feathering under all conditions.

tugs towed her across Lake Michigan to Roen's yards at Sturgeon Bay.

It was a triumphant comeback for the battered "ghost" ship. Hundreds of townfolks lined the shores as she came into the bay amid the shrieking of horns and whistles.

During the winter there's a lot to be done to make the Humphrey ready to sail in 1945 as flagship of Roen's line. Her engines, however, were but slightly damaged.

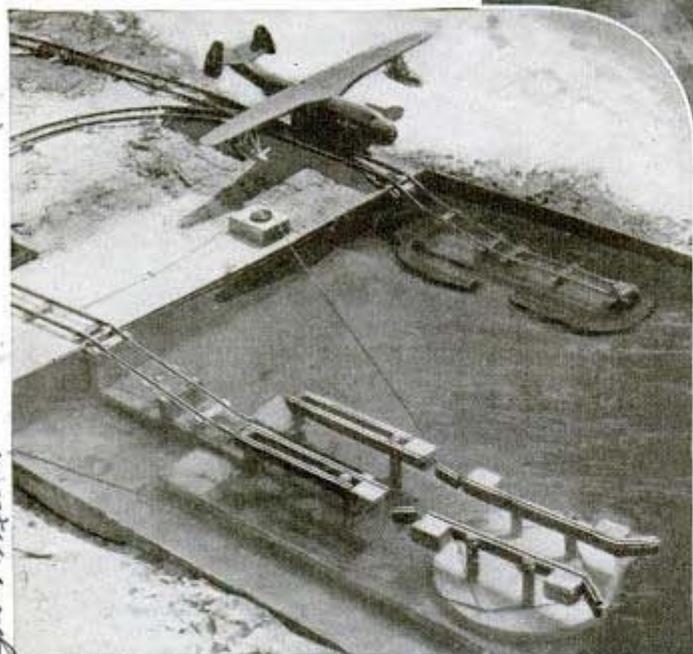
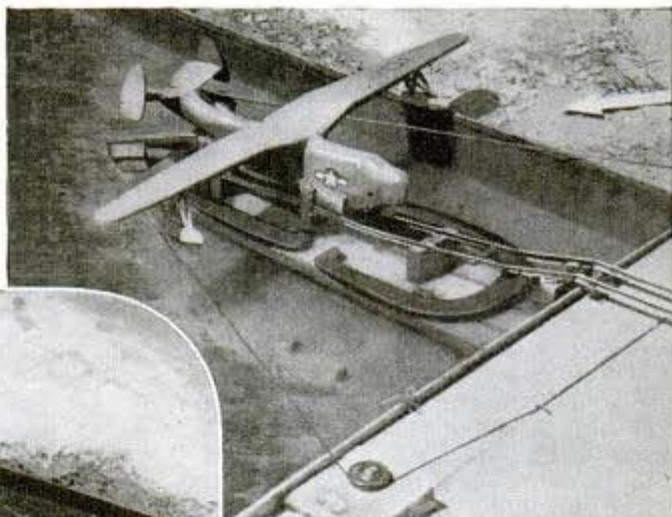
In the admiralty suit following the collision, a court valuation of \$1,088,000 was placed on the Humphrey. Roen estimated the salvage job cost him \$200,000 to \$300,000, and it will cost perhaps that much more to restore her. There is still bound to be a good showing on the profit side of his ledgers, and there is no denying what U. S. district engineers said: "The raising of the Humphrey is a feat unparalleled in American marine history."

Copy 30 Rockefeller Plaza N. Y. N. Y.

0-590

Turntable Steers Big Seaplane Onto the Beach

Seaplanes can be safely beached in a hurry with an installation which saves the beaching crew a ducking. The operation is handled by the pilot and one or two men on the beach. A turntable or ferry type slip is adjusted to wind direction by winches. As the plane taxis into position, a hook from the



tunnel hatch engages an extension on the rear of a cradle car. The plane is moved forward on rails under its own power or by a winch. For launching, the cradle car drops away when the plane becomes waterborne. It will handle planes ranging in size from the PBM Mariner to the giant Mars. A working model has been constructed by its designer, Lt. Frank J. Walters, USN, Naval Air Station, Banana River, Fla.

0-504

"Tumbling Bar" Cribbage Board Reveals Correct Score at a Glance

An "argument saving" cribbage board which reveals the correct score at a glance is made with the peg holes on two square revolving bars. Arrows on the four faces of the "tumbling bars" indicate the direction of play, the bars being turned over when the 30th, 60th and 90th holes are reached. The 121st, or "game holes," are placed on the end sections of the board to which the bars are attached. To begin a new game, the bars are turned over to "start."

Twin bars are lifted slightly before turning; inset shows how the bars are attached →



Save Waste Paper!

Like to help send ammunition overseas? Like to hurry vital supplies to the men who are battering down the gates to Berlin and Tokyo? You can—by giving something you don't want! Call your local salvage committee when you are ready to toss out old newspapers and magazines. Tons of scrap paper must be fed into our war machine to pack guns, shells, rations, and equipment. Save paper!

*Henry H. Johnson
4-54 Division
650 Lake St. Kalamazoo, Mich.*

0545

Tank Hurls "Flying Dustbin" and Lays Track

To smash German fortifications on the Atlantic Wall and Siegfried Line, British engineers designed a tank with a special mortar mounted in the turret. It is officially known as the Armored Vehicle Royal Engineers (AVRE), and is similar in design to the Churchill tank. The charge hurled by the mortar has far more explosive in it than any other projectile of similar dimensions. British Tommies call this charge the "flying dustbin." It is effective against steel, concrete, or masonry obstacles, and on D-Day along the Normandy coast this super tank spearheaded landing operations at many points. The AVRE is also used to lay "carpets" of flexible track over marshes and sand dunes so other vehicles can follow without bogging down

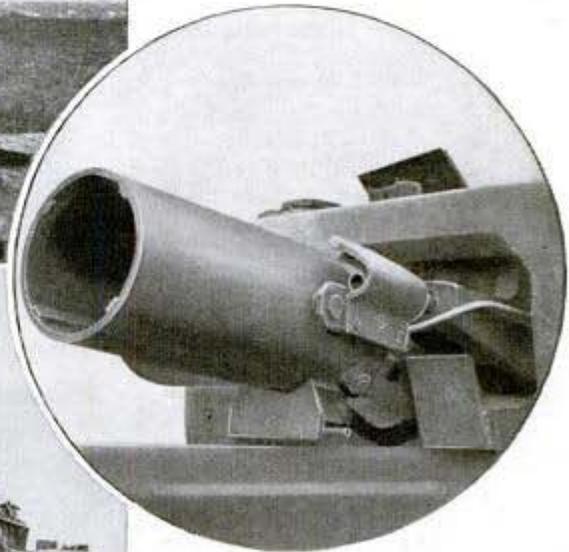


Mr. Hunt

*British Experimental Service
360 Ft. Muckley Ave.
Chermsley, L.A.*



Soldiers examine "flying dustbin" (above) which contains heavy charge of explosive. Yanks would call it "flying ashcan" to denote comparison with deadly depth bomb. (The British term for ashcan is dustbin.) Left, tank loaded for track laying



Stubby barrel of mortar (above) on AVRE turret is the most distinctive outward feature of the new tank. It is entirely different from weapons mounted on other tanks. Left, front view of the AVRE on way to Berlin



BAT PILOTS of the NIGHT



IT WAS pitch black inside the cockpit of the Black Widow except for the faint blue-green radiance of the instruments. No stars were visible and the pilot was guiding himself solely by the fluorescent artificial horizon on the instrument board.

"The Betty is left, a little further left," a voice said sharply in his earphones. He turned the wheel a bit.

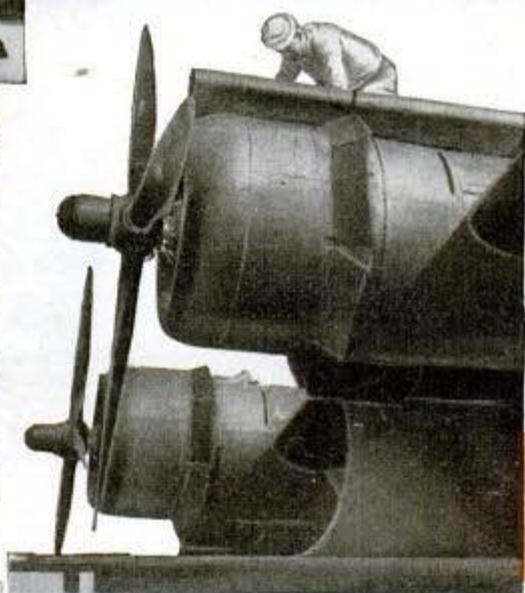
"That's it, straight ahead now." With one hand the pilot pulled his electric binoculars in front of his face. There, closer than he had supposed, he could see the target for his guns.

He corrected his course a trifle, pressed the trigger, and immediately a red glare from the muzzle blasts of the guns in the overhead turret lighted his compartment. Then, suddenly, the sky in front of him blew up in a blinding flash. He had gotten the Jap bomber with his first burst.

The Jap never realized what had happened, for the Black Widow had given no warning of its approach. On the prowl in the night skies for enemy aircraft, one of these deadly fighter planes gets on the track of an unidenti-

Right, crewmen prime one of the twin 2,000-h.p. engines on a P-61
Northrop Aircraft photo

Above, a night-firing test for B-25's guns. Right, a "Black Cat" has its motors tested



FIGHTERS

Army pilot dons "night adaptation glasses" in the afternoon and wears them until it is time to take off in a night fighter



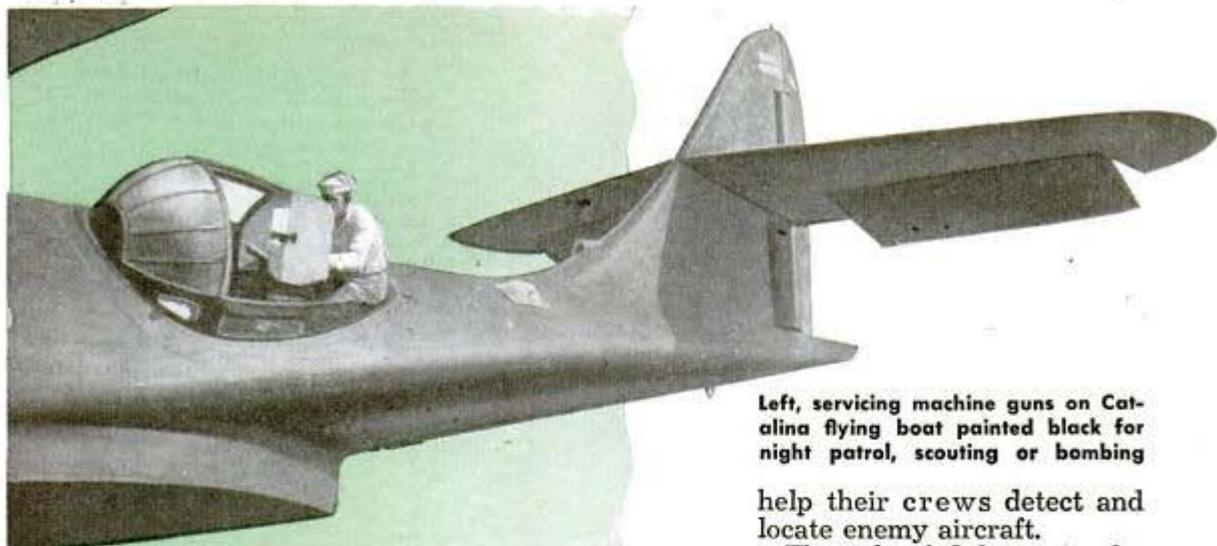
fied aircraft, stalks it until identification is complete, and then, if it is an enemy, closes in for the kill. Not until he is all set does the pilot open up with his machine guns and cannon.

The bat men who fly these planes eat high-vitamin diets to improve their after-dark vision. Late in the afternoons they strap night adaptation glasses to their faces, excluding practically all light rays. By dark their eyes have opened to the fullest and are at high night efficiency. They wear the glasses constantly until they are in their planes, ready to take off.

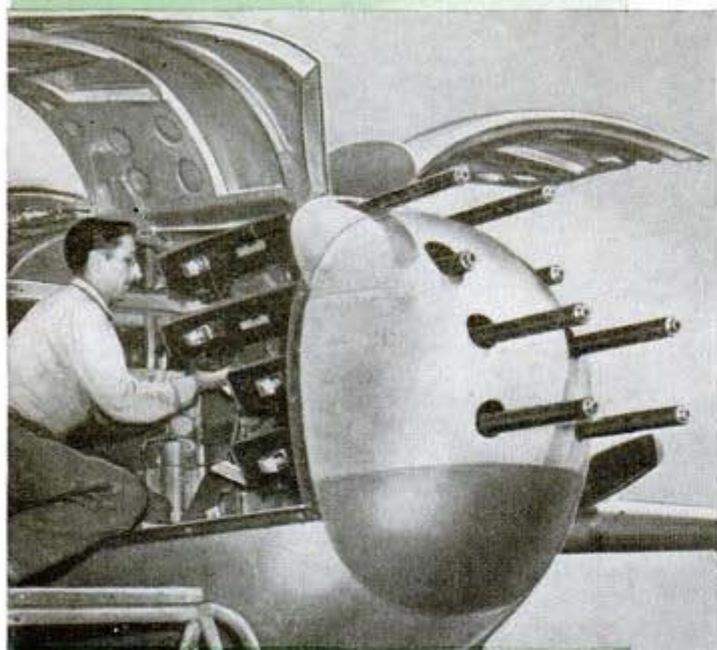
Sharp vision is vital for after-dark fighting but it isn't enough for locating other aircraft in the dark. The night fighting planes are equipped with special search instruments that

Factory men study action of retractable aileron or "spoiler" on wing of a P-61

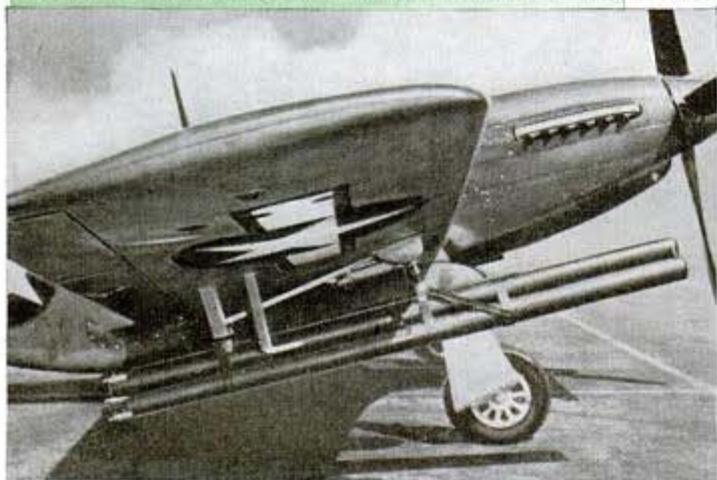




Left, servicing machine guns on Catalina flying boat painted black for night patrol, scouting or bombing



Above, mechanic servicing the battery of .50-caliber machine guns in nose of a B-25 bomber that has been used as a night fighter in the Pacific. Below, note rocket tubes under wings of a P-51 Mustang



help their crews detect and locate enemy aircraft.

The job of fighting in the dark has been called the spookiest in the Air Forces. Sometimes a fighter pilot roams the sky alone, other times he forms one link of a protective chain of defense fighters. Over his own territory he gets assistance by radio from spotting stations on the ground; over enemy territory he depends on his ability and his instruments for tracking other planes.

Night fighter pilots sometimes run into an invisible storm center which bounces the plane joltingly around in the air. Pilots can see storms in the daytime and avoid them, but after dark a pilot has no way of knowing when he will fly into rough air.

The night fighter is a new type of airplane that made its first appearance in this war. British fighters were sent aloft hastily equipped with search instruments, some with powerful headlights, to combat the



after-dark bombing raids early in the war. Prime Minister Churchill publicly lauded them for helping turn the Luftwaffe away from London.

With time the nocturnal fighting craft became more and more specialized. All were heavily armed so that a target could be destroyed on the first pass. One of our own night fighters, the P-70, a jet black version of the standard Douglas A-20 attack plane, carries four 20-mm. cannon, all firing forward. The newer A-26, an improved version of the A-20, likewise goes aloft at night on occasion.

Recently North American's B-25 Mitchell bomber has been doing night fighting work in the



Above, crewman prepares to drop a fragmentation bomb from a PBY on deck of Jap ship located far below. Left, full view of the deadly Black Widow, largest of pursuit ships



Pacific. Fitted with a nose that carries eight .50-caliber machine guns, the plane has been tracking and destroying Jap fighters and bombers. The eight nose guns, four package guns fastened to its fuselage, and two guns in its upper turret, all directed ahead, give the Mitchell concentrated firepower second to none.

Even a relatively slow airplane can take on the duties of a fighter after dark. Some of the Navy's Consolidated Catalina flying boats—specially armed—have been doing after-dark patrol and scouting work. These "Black Cats," whose top speed was only 120 knots, proved so successful against Jap shipping this year around the Philippines and the Celebes that

(Continued to page 162)



Originally designed for patrol and rescue work, the Catalina, or "Black Cat" (below) has made a great record as a night bomber



Portable Flame Gun Fires Blazing Oil Chunks



Axis armies have been introduced in recent fighting to three new chemical warfare weapons—a jungle flame gun of long range, the flame-throwing tank, and the gas detector. The gun, designed for tropical climates, is known officially as the M2-2 portable flame thrower, informally as the "atomizer" because it has a small atomizer hole in the nozzle which sprays a fine, readily ignited mixture as a booster to help start the main stream of fuel. The fuel is a jellied oil, a thickened product made

0483

Crystal Precise to 1/1,000 Second Puts Pendulum Out of a Job

For years Greenwich time, the world's standard, has been ticked by the traditional pendulum clock at the British royal observatory. But the pendulum soon will be out of a job, outdated by its relative inaccuracy. It kept time within 1/100 second of perfection daily. Its place is to be taken by a quartz crystal clock accurate within 1/1,000 second a day, and it may be that its precision can be brought within 1/10,000 second a day. At that standard it would require more than 2½ years for the clock to gain or lose as much as one second. The pendulum swung once a second; the quartz crystal vibrates 100,000 times per second and its vibrations can be recorded electrically to measure time.

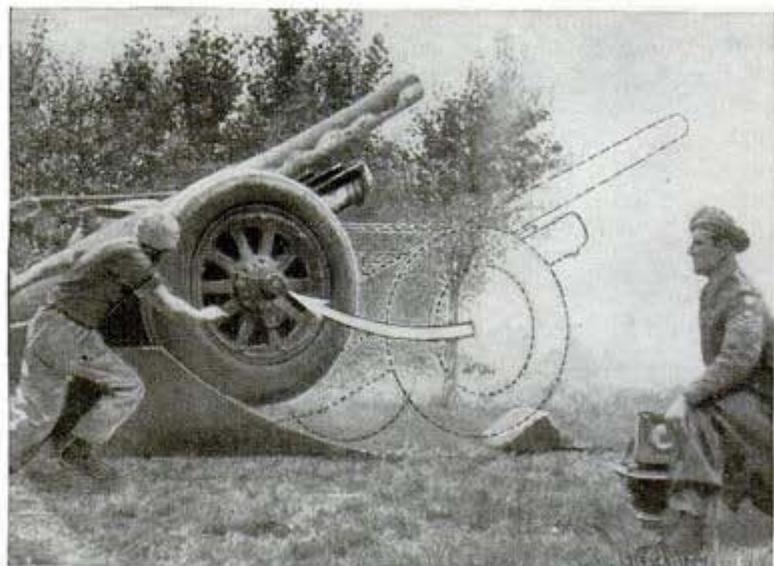
of blazing oil chunks which spatter and cling to the target. Other features include a revolver type ignition cylinder at the nozzle and pistol-grip triggers. The gun is so waterproof that it could be immersed in the ocean for several hours and still be ready for action. The weapon has a greater range than the old model and is so accurate that troops have practiced with it on rifle ranges. The flame tank is one which moves into point-blank range of targets inaccessible to infantry flame throwers and hurls a stream of blazing oil from flame throwers mounted on both sides. The M9 chemical agent detector kit, which reacts with great sensitivity to several types of war gases, is a miniature gas-analysis set packed into a 2½-pound cotton duck carrier slung by a strap from the shoulder.

Should Green, as tower

Ten-Ton Howitzer Climbs Up Ramp To Absorb Recoil

0-588

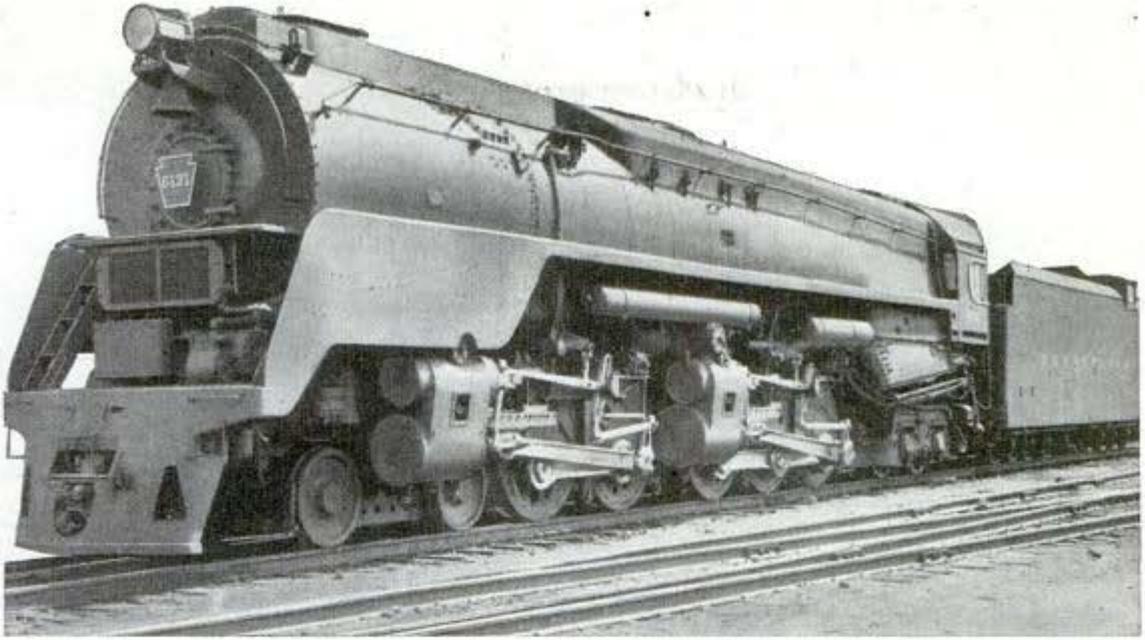
Special ramps help absorb the recoil of the new British 7.2 howitzer which weighs 10 tons. The recoil on this gun is so strong that it climbs the ramp despite hand set brakes. The howitzer, which helped batter the fortifications of the Siegfried Line, fires a 200-pound shell up to 16,000 yards. It was used successfully in Normandy to knock out lines of communication vital to the enemy.



*Mr. John La Cerda
145 Seenie Rd., Springfield,
Delaware City, Pa.*

*546
0-503*

4-Cylinder Engine Has 78 Percent More Power

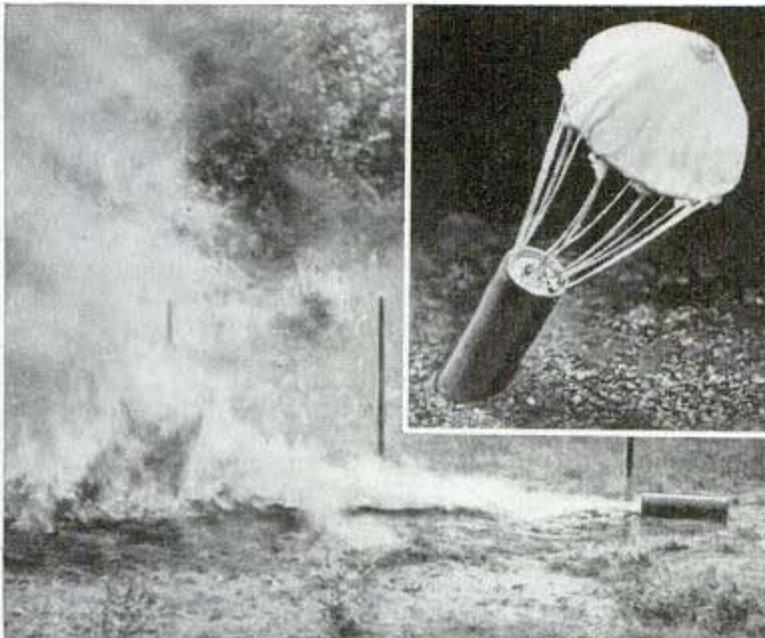


One of the most powerful steam locomotives ever built, the Pennsylvania's new Q-2 model is capable of pulling 125 freight cars at more than 50 miles per hour. It can develop a tractive effort (pull exerted on a standing train) of 114,860 pounds, or 78 percent more than that of the standard high speed freight locomotive now in service on the Pennsylvania road. The Q-2 is novel in that it is essentially two engines harnessed together in a single frame. Four cylinders are used, of which the front two

drive two pairs of driving wheels and the second two provide the power for three pairs of driving wheels. There is a 4-wheel leading truck and a 4-wheel trailer truck with a booster engine to provide extra starting power. With tender, the locomotive is 124 feet, 7 inches long, 16 feet, 5 inches high, and weighs more than 1,000,000 pounds. Its tender carries 40 tons of coal and 19,000 gallons of water. The Pennsylvania expects great economy in maintenance and operation.

0505

'Superflamer' Dropped by 'Chute Throws Fire for 15 Feet

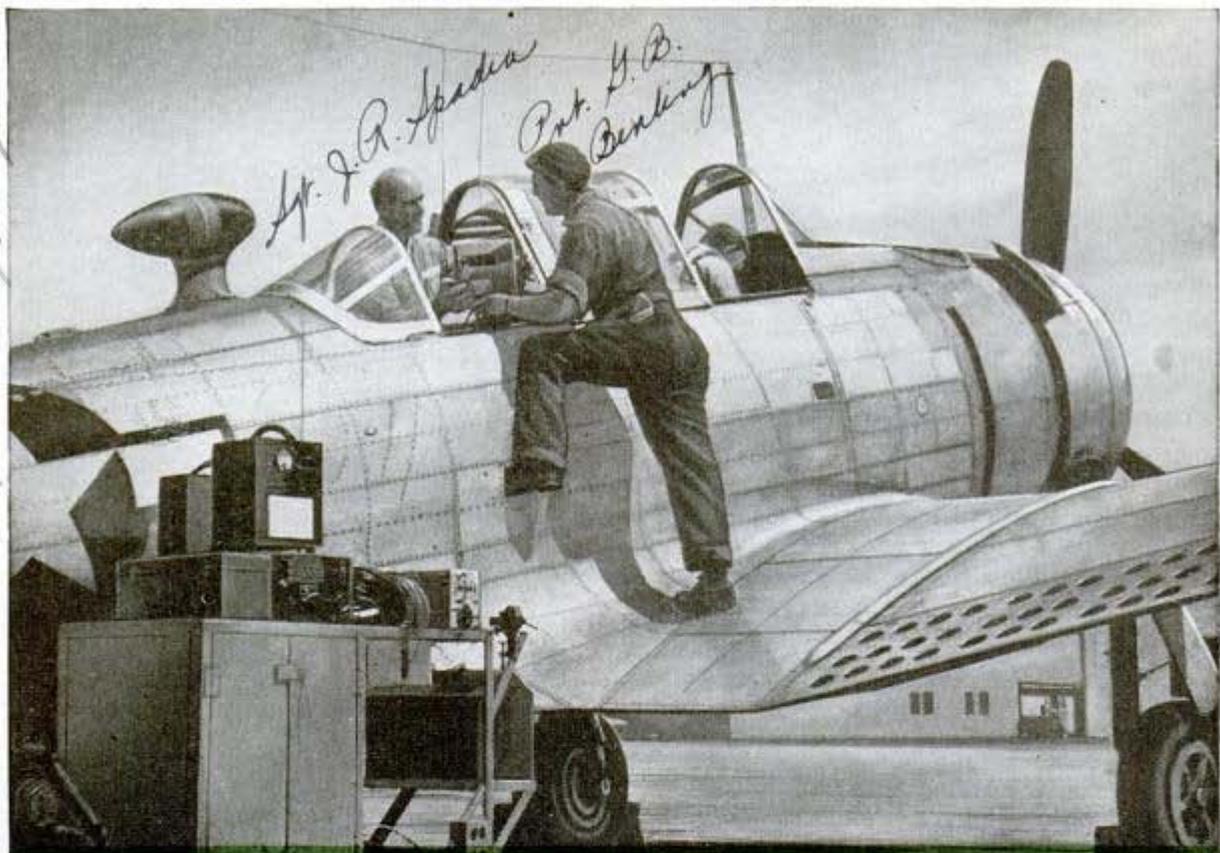


Emitting a white jet of flame fifteen feet long, a super-incendiary bomb developed for Royal Air Force bombers is said to be the most devastating of its kind. The bomb, which is dropped by a small parachute, weighs 30 pounds and is enclosed in a 21-inch metal cylinder. The "superflamer," as it is called by the R.A.F., is hot enough to crumble a brick wall. The flame lasts for about two minutes.

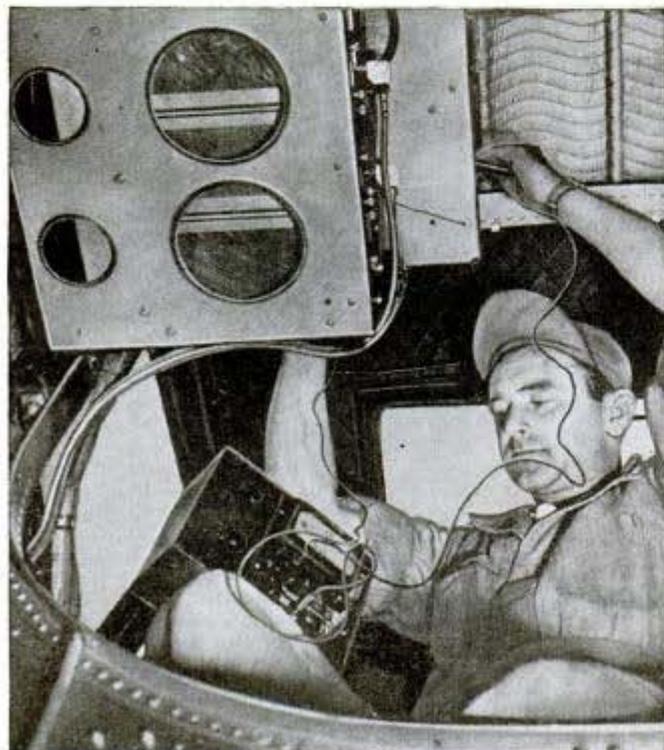
Dreaded by the Nazis, small incendiary bomb (inset) is so devastating that its 15-foot stream of flame (left) will crumble thick brick wall

*Revised by: Prof. Donald Thomas April
Townsend, head of the
Lads N. of England.*

RADIO TROUBLE-SHOOTERS



Above, members of the Air Service Command's First Radio Squadron install motor generator set on an A-24. Below, a radio equipment test viewed through B-25's escape hatch



WHEN the first Thunderbolt fighters reached England last year, they were grounded by a new kind of static-like interference which killed reception on their radios.

For days, experts tore down the radios, checked them against installations on planes that were receiving clearly, poked around in the engines, ripped apart electrical systems. No clue to the disturbance's origin could be found. Meanwhile, the enemy was taking a heavy toll of big bombers denied long-range escort.

Then a call was sent to the First Radio Squadron at Air Service Command headquarters, Patterson Field, near Dayton, O. Within a few hours, Master Sgt. Robert A. Swan was in a Britain-bound air transport.

Sgt. Swan landed at an AAF fighter base, tugged on a new suit of coveralls and headed for the nearest Thunderbolt. He discovered the cause of the paralyzing static in three hours. It was a chemical applied to the engines to

Sgt. O. W. B. Signer

Mr. Leonard Engel, 530 E. 88th St. N. York, N. Y.

with WINGS

shield them against English dampness. The chemical caused certain parts to function like transmitters and emit a reception-killing buzz. Swan visited all P-47 bases and showed crew chiefs what to do. In a month he was back at First Radio's Patterson Field barracks and Thunderbolts were shepherding our bombers over Europe.

Sgt. Swan's feat is only one of dozens of similar accomplishments by this squadron—the AAF's radio troubleshooter. Whenever Army air units, no matter where they may be, encounter special radio problems it is First Radio that rushes to the rescue. It is also First Radio that makes field installations of new equipment and introduces the latest modifications and servicing wrinkles for old.

All of First Radio's men except Maj. William C. Ackard, commanding officer, First Sgt. Richard A. Hall and a handful of clerks have been overseas at least once, and some wear all three campaign ribbons. All are in constant readiness to go. Each, for example, is automatically given his overseas physical examination as soon as the valid period of the

Sgt. Robert M. Johnson, Brookley, N. Y.
Cpl. Henry R. Cox, Canton, O.

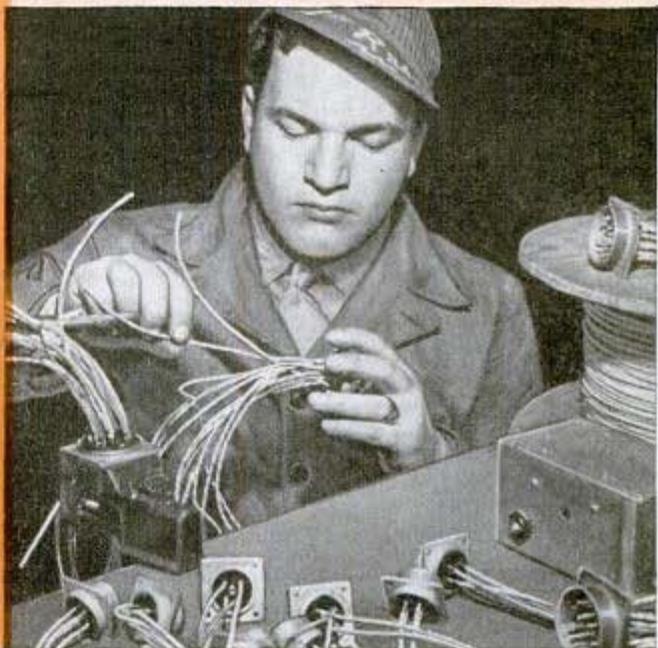
Capt. J. R. O'Reilly, Shreveport, La.



0503
1st Sgt. Robert O. Ross



A First Radio sergeant (above) at the operator's bench in a bomber. When they are not "troubleshooting" all over the globe, members of this squadron study new techniques and refresh their knowledge in class (left) at Patterson Field, O., base. Below, Sgt. William H. Ware, who knew no radio before entering the army, devised "continuity checker" for testing receivers



Repair crewmen (above) measure voltage and resistance of a radio with voltmeter

*Sgt. Charles E. Vaughan
Anderson, Ind.*



First Radio crew was sent out to install high frequency equipment to foil the enemy. The job took nine months.

The big trouble was weather which not only delayed work but also prevented movement from island to island. The crew would finish at one base, then have to wait for weeks to proceed to the next. On one occasion on Adak Island the men were treated to an earthquake. On another, they had to take turns holding down the flap of their tent in the teeth of a 120-mile-an-hour gale that lasted 24 hours.

"We had to work out of doors," recalls Pfc. Stanley E. Hall, of Huntington Park, Calif. "Often we had to clear the snow away several times during the day. It was so cold solder wouldn't run; we had to spread it over a connection like paste. We could work only for a few minutes at a time; then we

(Continued to page 158)

Above, transmitter aboard a bomber is tuned in by a repairman

previous exam expires. Inoculations against disease, as well as clothing, equipment and personnel records, also are kept up to date.

An important feature of the squadron's work, according to Maj. Ackard, is the task of making changes without interfering with military operations.

"If that were not necessary," he says, "the modifications could be made by sending the plane back home." That means night work much of the time. It also means that First Radio men working on a fighter may have to leap out of the cockpit to make way for a pilot going out to meet enemy attack. It means further that First Radio does much of its work in bad weather, occasionally without a hangar shelter.

In 1942-43 the Japanese in the Aleutians made a practice of jamming the frequencies on which our planes broadcast and sometimes even put out fake orders. A



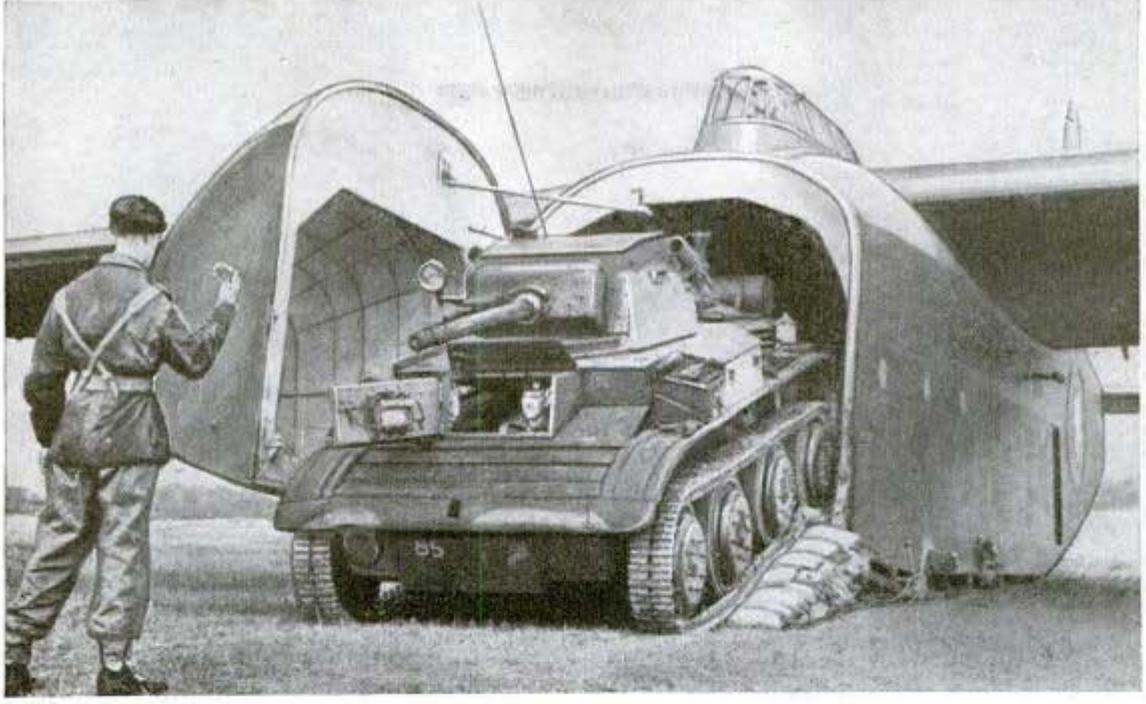
Comanche, Texas

Above, Tech. Sgt. Weldon Withers and the device which he developed to demonstrate high frequency wave characteristics. Below, 2½ ton repair shop which services any type of communications equipment



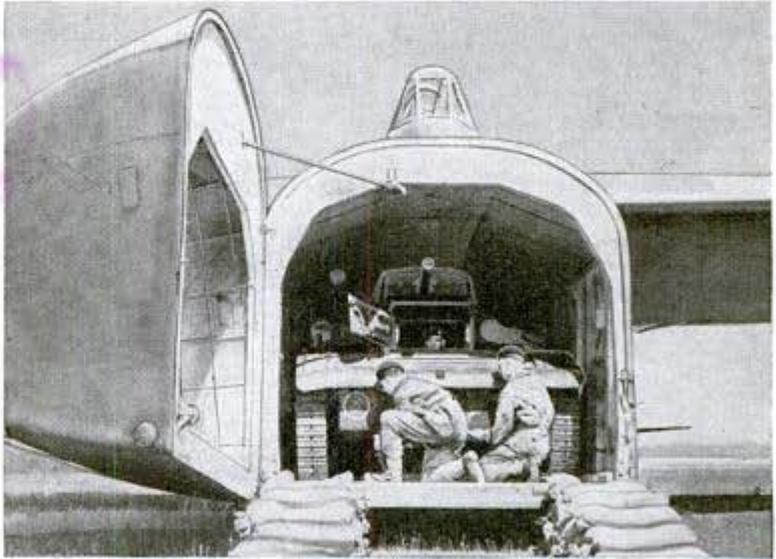
0574

Huge Gliders Spill Tanks Behind Enemy Lines



After its takeoff, the Hamilcar glider drops its wheels and lands on skids, its nose swings open and out upon enemy soil rolls a light tank

One of the surprises of D-Day in Normandy and a potent factor in every airborne strike behind the enemy lines has been the landing of American tanks by huge gliders. One motorless carrier used is the British Hamilcar glider, first towed over Normandy by four-engine Royal Air Force bombers. As soon as it is airborne, its takeoff wheels are dropped. Landing on skids, the fuselage is almost on the ground and the glider's nose swings open to let the tank come out fighting. Wing span of the Hamilcar is more than 110 feet—wider than the Lancaster bomber. It is highly maneuverable and can land in a meadow after gliding from a release point several miles distant. The 7½-ton tank, designed especially for transportation by air, was built by the



American firm of Marmon-Herrington and was nicknamed the "Locust" by the British. It is entirely welded, with a low silhouette and low center of gravity, and packs a 37-mm. gun and two machine guns.

0596

Red and Green Rockets Signal Stop and Go to Army Wire Layers

Colored "stop and go lights" in the sky solved a problem of communication between reel crews and wire layers of signal construction battalions of the 15th Air Force in Italy. In open country the men handling the reels could signal by hand to

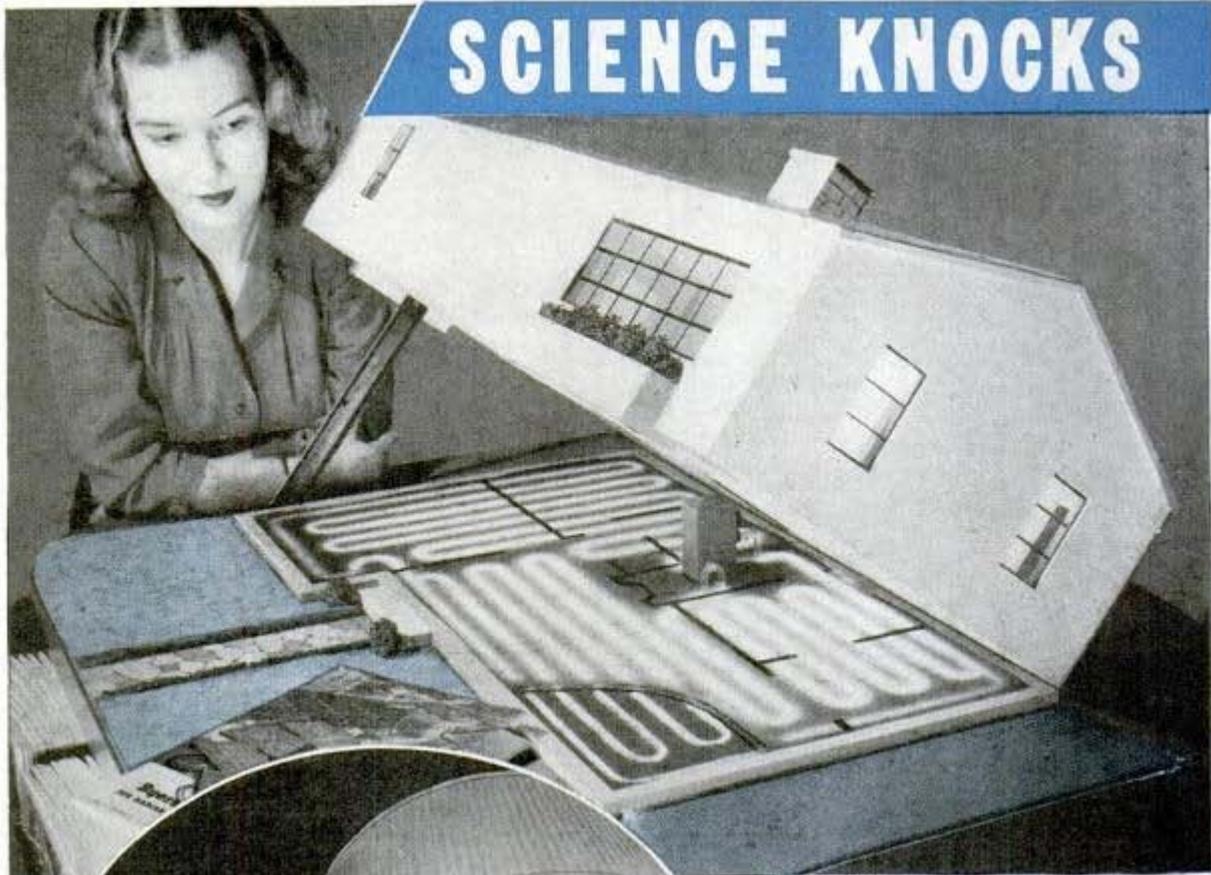
the pole line crew to pause when the end of the reel of wire was reached. In mountainous and wooded country, however, direct communication was impossible. The solution was the use of a Very pistol to send up flares, green to go ahead, red to stop.

DECEMBER, 1944

Major Wm. C. Hadapp, Air Force Group, War Dept, Bureau of Public Relations, Washington, D.C.

Mr. Allen Warren & Matt
- 7 Park Ave., N. Y., 16, N. Y.

SCIENCE KNOCKS



A. M. Byers Co.

Above, model of radiant heated home shows pipes under floor. Left, lamp which combines two fluorescent tubes with an incandescent bulb

proving the old. The war has caused a lag in home-building, but no lag in ingenuity.

Take one little item, the simple infrared lamp which is drying paint on army vehicles in a few minutes where it used to take hours. Why couldn't these lamps be equipped with a light filter and screwed into the wall sockets of your bedroom or bathroom to take the winter chill away in a hurry? They can and will be. One experiment shows you can throw all the windows open in 40-degree weather and stay warm if bathed in infrared rays from fixtures embedded in walls and floors.

Another example of how wartime lamps will solve peacetime problems was illustrated when a scientist dropped two eggs and a few strips of bacon on the upturned lens of a sealed-beam headlight of an army bomber. They fried in a jiffy. Light rays for speedy cooking—a new wrinkle for your postwar kitchen.

Wietinghaus

*Twentieth Century
Fund Co.*

*Charles W. Willoughby
of the Army, photo by...*

IT IS estimated that a million new homes will spring up during the first year of peace. A good guess is that there are a million different ideas of what these post-war homes will be like. Some of these ideas are fantastic.

But a survey among the most conservative American corporations indicates that some surprises are in store for you whether you are planning on a new home or on im-

at YOUR DOOR



Demonstration shows that fabric treated with ammonium sulfamate ~~chars~~, whereas an untreated cloth blazes up

Science is planning to make it hot for you in other ways, too.

For homes, architects propose solar heating—the use of large plate glass windows or glass block walls with a southern exposure to catch most of the sun's rays—and a scientifically overhung roof to curb the heat in hot weather.

One newly patented solar heating unit operates as a cooler, too. Rooftop coils pipe sun-warmed water into an attic tank in the

Minnesota Synthetic Fibers Co. Regulator Co.

Above, girl wears postwar nylon raincoat with nylon umbrella and turban. Spacious windows of the "solar house" shown below take advantage of heat from sun in winter

Libbey-Owens-Ford Glass Co. photo

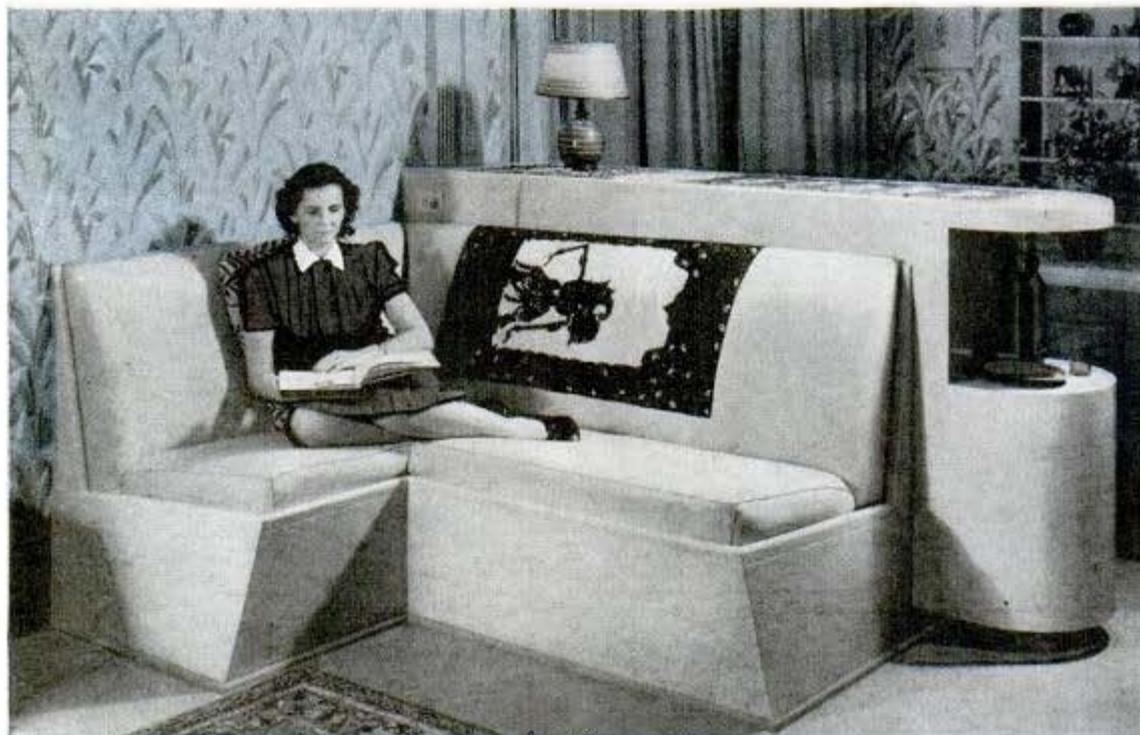




American Optical Co.

Only half of this painting is hidden by reflections because the rest of the glass is treated with a "reflection remover"

Living and dining areas of a modern home are divided by built-in, plywood davenport and snack bar with storage space



20 Douglas Fir Plywood Assn.
Tacoma Bldg.
Tacoma, Wash.

daytime and by automatic controls reverse the process at night. Special metals and chemicals hold either heat or cold in the tanks, as desired.

To take full advantage of fuel, the Moduflow system of thermostats will be ready for new and old homes. This can be installed so that the livingroom may be kept at 70 degrees, the bedroom at 60, the storeroom at 35 and the kitchen at 55, or whatever temperatures are desired.

New homes can take advantage of radiant or panel heating in which the pipes are in walls, beneath floors or behind baseboards. You feel warm without feeling heat. Ceramic experts have found that floors and walls of clay, which need no paint and may be cleaned with a damp cloth, are ideal for radiant heating installations.

Electronic heating, already used in war applications, is feasible but still too expensive for general purposes. However, a steak can be broiled in a few seconds by the Megatherm process, which uses less current than an electric stove. The device, which can be plugged into standard current outlets, holds two plates between which food is passed.

Several mighty midget heating units developed for the armed

Federal Telephone & Radio Corp.
 M. J. Shryver & Co.
 W. M. Coyne & Co.

forces will be ready for your home. One gasoline-consuming heater weighing less than 25 pounds will warm a 20-room house.

Before you visit a postwar home you may want to wire the occupants that you are coming. Just go to an automatic telegraph box, write your wire, push a button and drop the collect message in. A copy will be flashed to a telegraph office by facsimile.

Your wife will be clothed practically from head to foot in nylon, including her raincoat, umbrella and hat. Her shoes will be nylon except for the synthetic soles and scuff-proof heels of plastic. Her pleated nylon collar doesn't have to be ironed any more than your nylon necktie, which can be shaken out to remove wrinkles. Her clothes are water-resistant, shrinkless, treated to be flame-proof and tough—as durable as the nylon collar and cuffs of your shirt, which will outlast the rest of the garment. Your felt hat will be made of milk.

Transformations are in style and the extra hair which your wife has piled attractively on her head is nylon, too—better than the real thing.

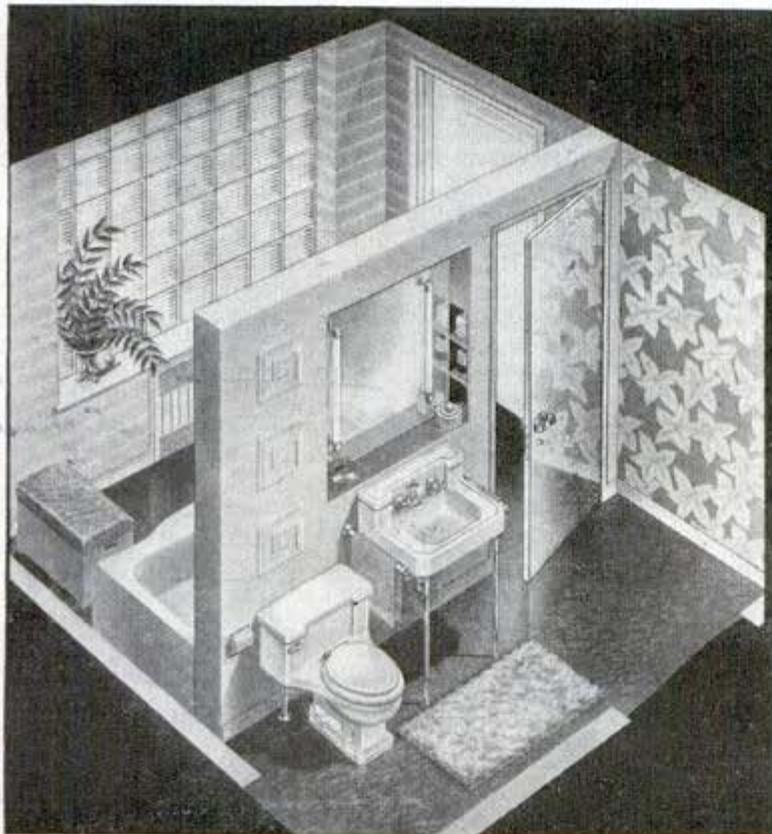
See Post



Above, ultraviolet sterilizer kills any germs on baby's bottles in refrigerator. Below, postwar bathroom arranged so two people can use it at the same time, one in each compartment.

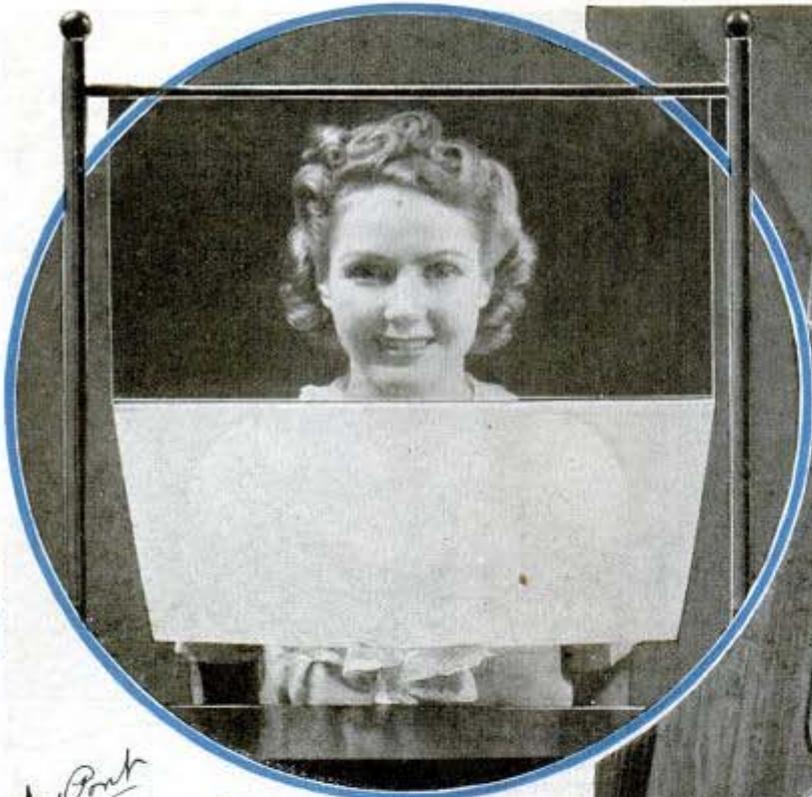


Drop a telegram in slot above and it will be sent automatically



You hop into your auto and speed to the house. As you turn up the driveway, your headlights activate electronic cells which flash on floodlights, ring the doorbell and open the garage door.

You park the car beside a couple of jeeps which are jacks-of-all-jobs and stroll to the front of the house along the rust-resistant, steel-mesh driveway, invented for airplane runways during



Dow Pont-Firestone Ind. Products

Dow Pont

Above, how different angles affect identical sheets of **Louverglas**, a plastic; one sheet looks transparent, the other translucent. Right, "piped light"—Plexiglas rods that conduct light around curves. Lucite house numbers that reflect light are easily visible at night

the war. The rain has gone right through the mesh, which provides dry footing.

On the porch, you stop to finger the upholstery of the porch furniture, which looks too dainty and perishable to stand weather. However, it's one of several new shrink-proof, sunproof, rainproof, insectproof fabrics which have been developed during the war. The more it's rained on, the cleaner it is. *Dow-Pont-Firestone Ind.*

You note the fireproof awnings and the rustproof plastic screens which are color-impregnated to match the plastic paint on the house. One of the screens has a hole in it, as if someone had poked it with a pencil. So you place your palms on its surface and stretch it. The hole closes as the weave straightens. *Westinghouse*

Electronic cells open the front door and inside the foyer there is an ultraviolet lamp which kills germs you may have brought in. You examine a table lamp and pick it up easily because it is made of aluminum, one of the most plentiful and cheapest of postwar metals. The horseshoe-shaped fluorescent light fixture in the lamp has no wires and you realize that radio transmission of electric current is now an accomplished fact.

Your hostess greets you from the kitchen

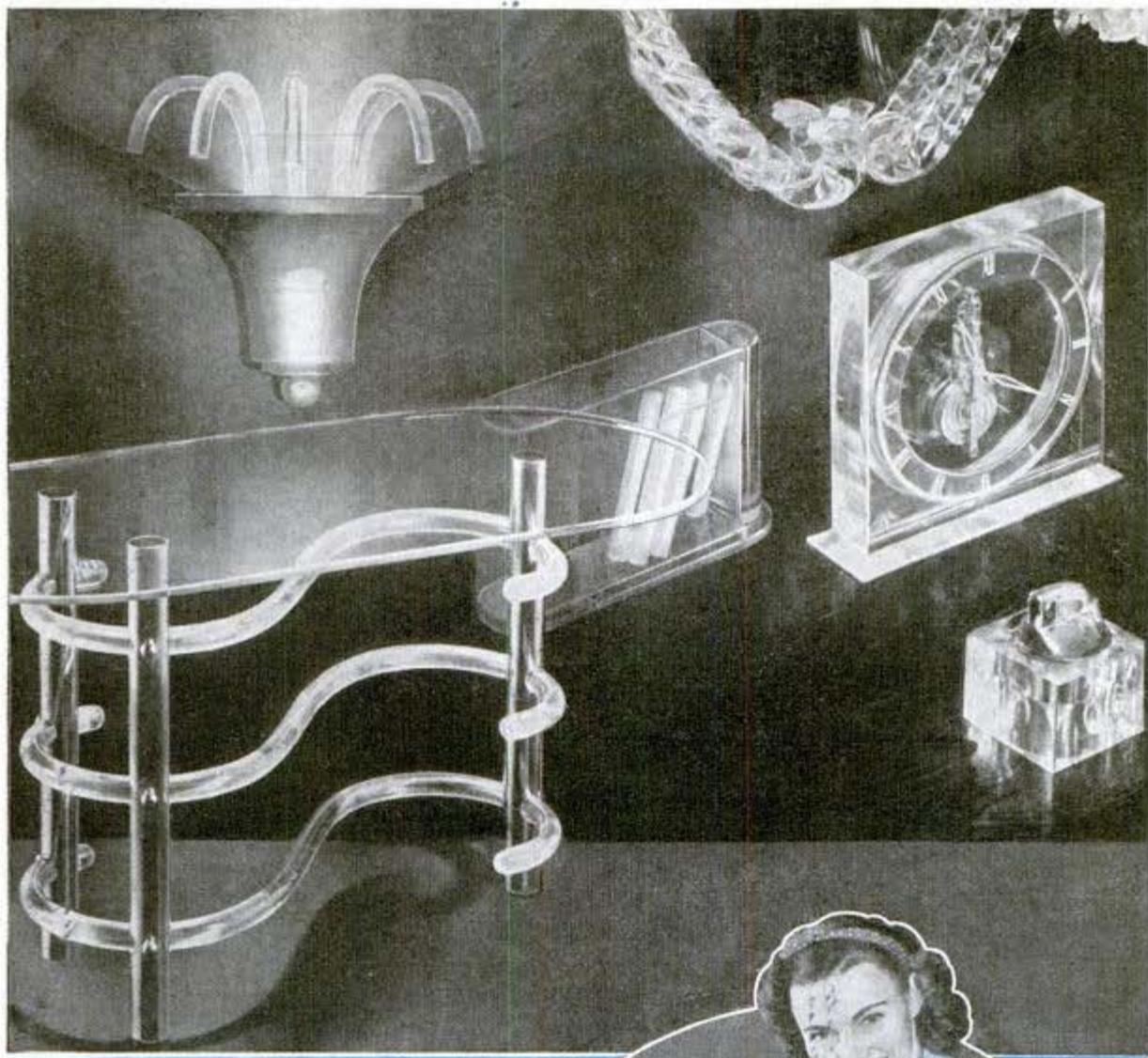
over the interroom sound communications system, installed primarily for the nursery so the family can hear the baby stir. Your hostess tells you to make yourselves at home and you know that she has watched your arrival from the kitchen by means of a television "peeping screen" attached to the front of the house, a high-priced laboratory item during the war. *Westinghouse*

The livingroom is big, but looks bigger because of wartime research in furniture placement. The draperies glow softly with phosphorescent light and closer scrutiny shows draperies and curtains are made of glass fiber, fireproof, stretchproof and needing only the application of a wet rag to remove dust and fingermarks. *Quincy-Corning Glass Co.*

Moldings and wall panels are made of plastic-bonded plywood stronger than steel and the wallpaper looks so fresh you examine it closely. You find it has been covered with a transparent plastic film which soap and water cleans. You open an ornate *Durabond*

H. S. Chapman Corp.

POPULAR MECHANICS



Above, some novel postwar decorations—Plexiglas table, "piped light" and ornamental accessories made of DuPont Lucite. Right, tennis racket has waterproof strings of nylon

R. C. Q.
 box in a corner, thinking it is the new, plastic-lens television set which projects a 6 by 6-foot image on a screen. But it's a swanky, wood-finished, parlor refrigerator designed for cool drinks. *Philes*

You locate the frequency modulation radio-television set and turn it on to read the evening paper, displayed page-by-page before your eyes, hot off the presses. *Amelia & Arthur*

Afterward you stroll to a window, lean against it and look out into the rain. The window bends and you jump back in alarm before you re-



with packed frozen foods in the level above six feet, vegetable and bottle storage in the very bottom. A "butter conditioner" keeps the butter soft. The refrigerator is also equipped with a small ultraviolet Sterilamp to tenderize meat.

A labor-saving unit is the combination servicing unit and dishwasher. Food is placed in heated and refrigerated sections. Dishes, washed after the last meal, are in the dishwashing section. The contraption is wheeled to the dining table, where food is served on the dishes which accompany it. After the meal, the dishes are put back in the vehicle and rolled into the kitchen, whereupon the washer is started.

The whole prefabricated kitchen setup is made of steel. The built-in mixing unit includes a potato peeler. The concealed ironing-board used for small pieces is faced with Asbeston, nonburning cloth, used in wartime for the suits of aircraft carrier fire fighters. The bread and cake boxes are impregnated with Mycoban, which prevents mold. A transparent plastic tea pot tells when the tea has brewed sufficiently. An electric disposal unit in the sink takes care of food scraps and garbage.

The electric range has its own fluorescent light and glass panel for food inspection, clock and interval timers.

Our hostess reaches into the frozen-food locker and selects the dinner from shelves including frozen unbaked pies and cakes, chop suey, hash, grapefruit sections, lobster, fish filets, chicken a la king, baked beans and hors d'oeuvres, tropical fruit, meats and wild game fowl.

From a shelf she takes a can of cream which, when opened so that the fluid is exposed to air, becomes whipped cream. The mashed potatoes are dehydrated, the coffee is in small, compressed Cellophane-wrapped portions which need only to be dropped into hot water.

By this time your host has arrived and you sit at a table laid with flameproof cloth on a scuff-proof finish and set with light plastic dishes surrounded by plastic forks and spoons and plastic-handled knives.

(Continued to page 156)

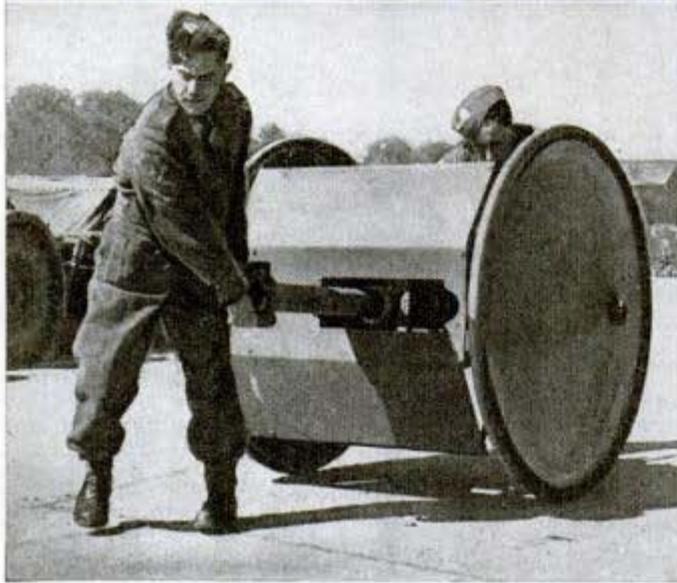
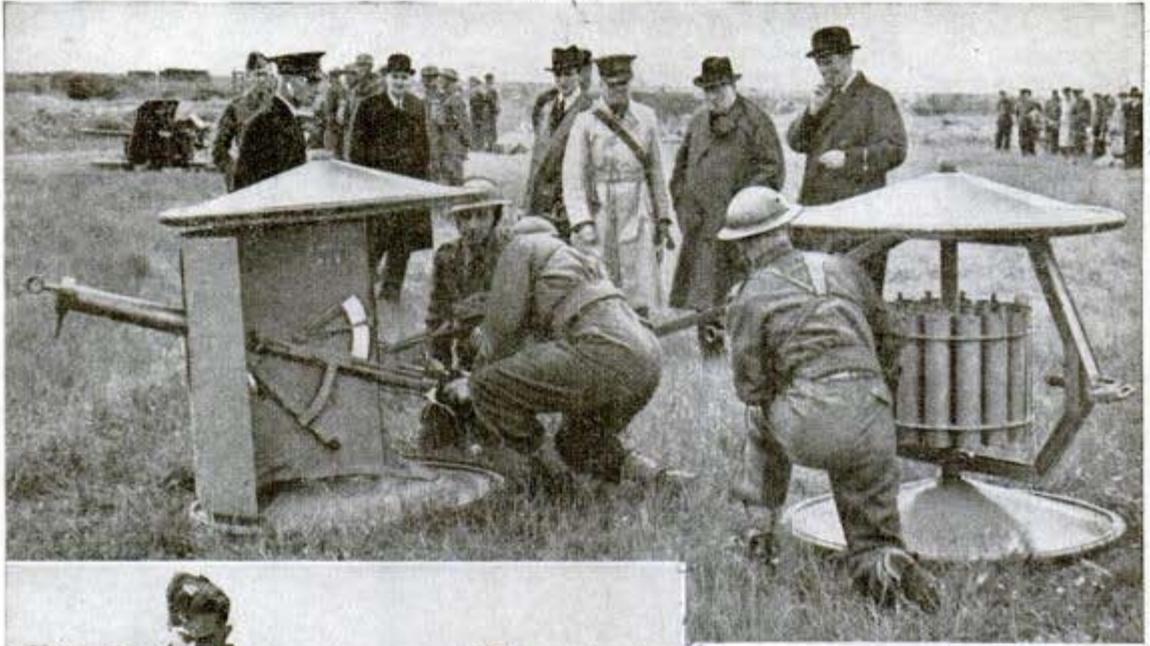
DECEMBER, 1944



The transparency of Plexiglas adds novelty to this spring-type chair. Below, Plexiglas can be fashioned into winding stairway
Rohm & Haas photo



British Gun Is Tipped on Its Side for Firing



Revolutionary in design, the 3-inch Smith gun used by the British Home Guard need only be pushed over on its side to be ready for instant action. There are two wheels—one concave and one convex—which form a stand and top-cover when the gun is turned on its side in position for firing. The smooth-bore gun fires two types of shell, anti-personnel (weighing 8 pounds) and anti-tank (weighing 6 pounds). It can be towed by automobile or horse and carries its own supply of ammunition in special housings.

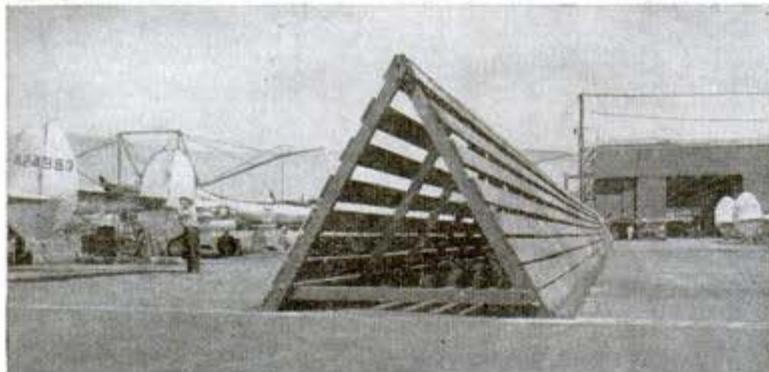
0 550

Fences Deflect Propeller Wash During Plane Engine Tests

Rows of wooden "propeller-blast fences" are used by the Lockheed Aircraft Corp., Burbank, Calif., to deflect the terrific wash

stirred up during pre-flight engine tests of closely parked P-38 fighters just off the assembly line. The fences have proved so

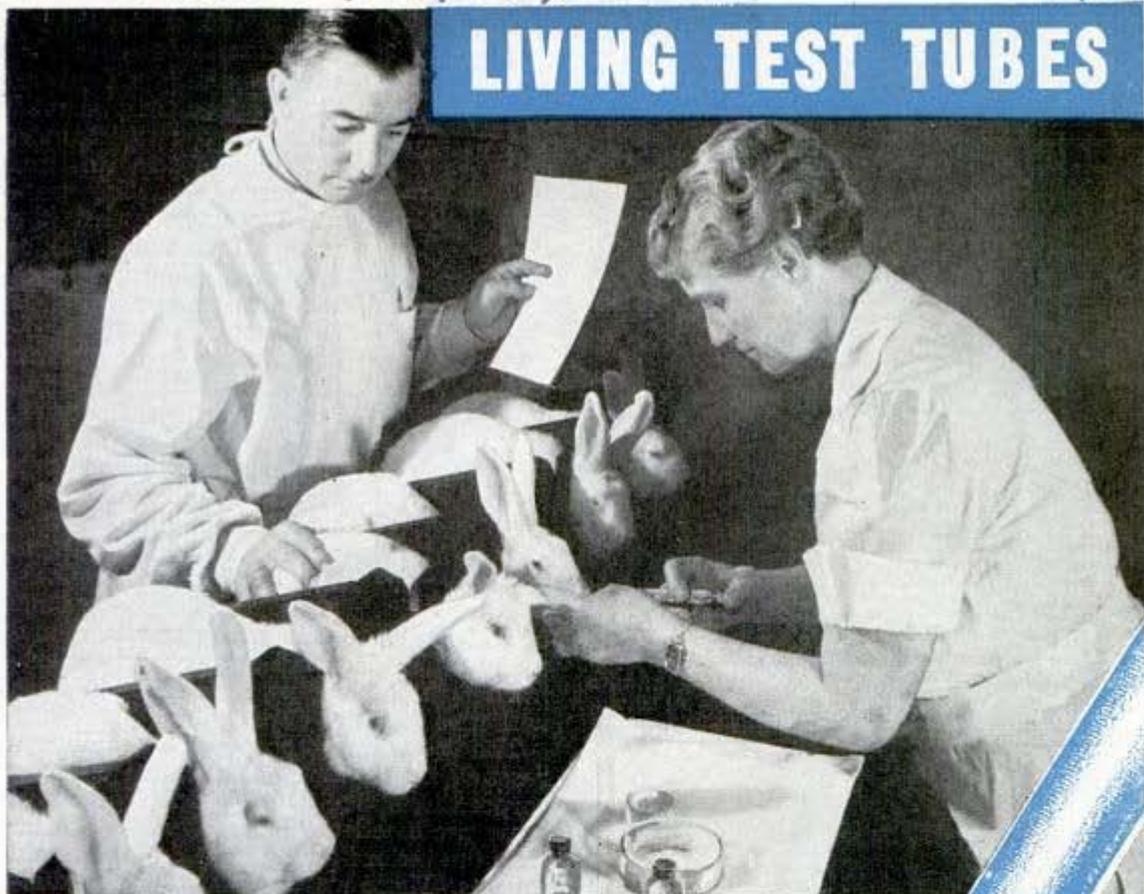
successful that they have been installed at the heads of runways in the Lockheed Air Terminal to protect adjoining property from "prop wash."



☐The pupil of the king penguin's eye is a perfect square when contracted fully, but when dilated halfway it is a hexagon and when fully expanded it is a circle.

Better Vision with Stetson
POPULAR MECHANICS

LIVING TEST TUBES

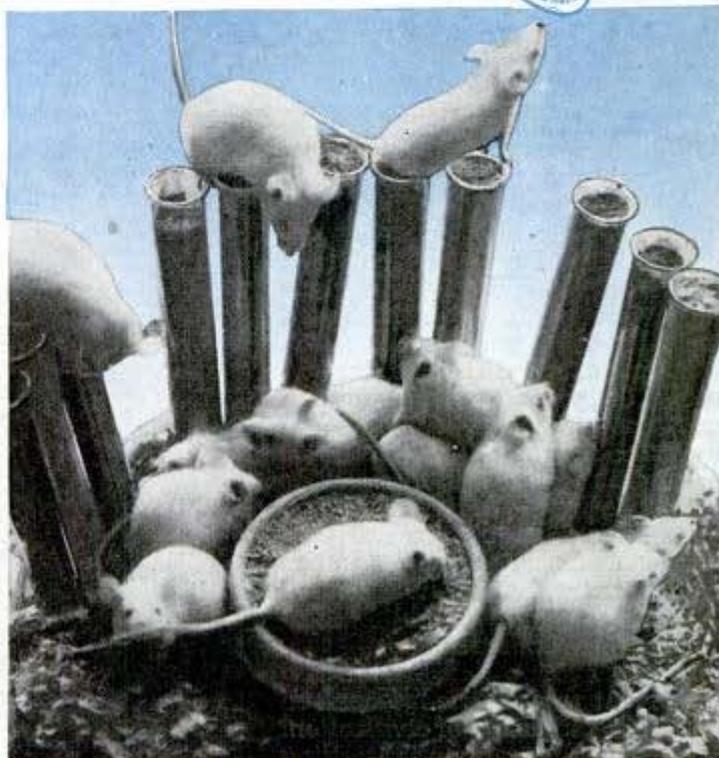


SCATTERED throughout the scientific laboratories of the nation is a world of gagged bats, thirsty dogs, drowning ducks, hungry mice and sick insects—a multitude of animals, birds, insects, fish and reptiles serving as living test tubes. They are increasing the life span of mankind.

It seems strange to connect bats with the miracle of radar—the war wonder which will effect many changes in our postwar life. In the University of Rochester Medical School, it was found that nature had invented radar—the use of high-frequency echoes to locate objects hidden from sight—millions of years ago. Now that we have caught up with nature, the question is: how can we get full use of the invention? Perhaps the bats will inform us.

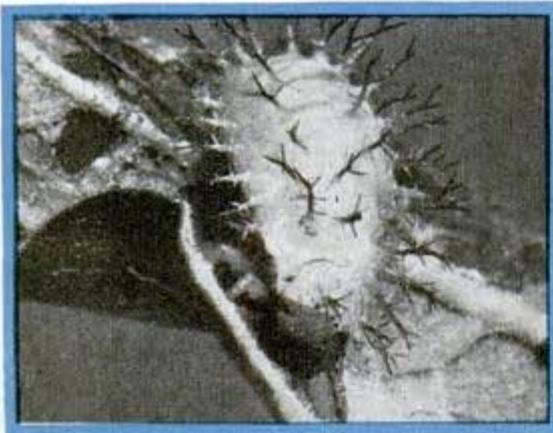
Wondering how a bat can flit at high speed through dense foliage by starlight, Dr. Robert Galambos put the creatures in a dark room and

These healthy rabbits are doing their bit by sampling penicillin to save wounded Yanks. Below, white mice in government laboratories with symbolic test tubes





To test a new moth insecticide, eight apple worms are placed on each sprayed apple. Below, larva of Mexican bean beetle—a \$2,000,000-a-year menace



tied their mouths shut. Puzzled, the bats tried to fly and only bumped their heads against the walls. Next, Dr. Galambos freed their mouths, but stuffed their ears. Once more the bats banged their heads.

Then, using delicate instruments, he proved that bats emit a constant stream of cries in frequencies around 50,000 cycles at a rate of 30 times a second, sounds inaudible to the human ear. The supersonic sounds are reflected from an unseen obstacle and the bat instantly changes its course of flight.

These experiments are still under way and no one knows how important the knowledge derived will be to the future of civilization.

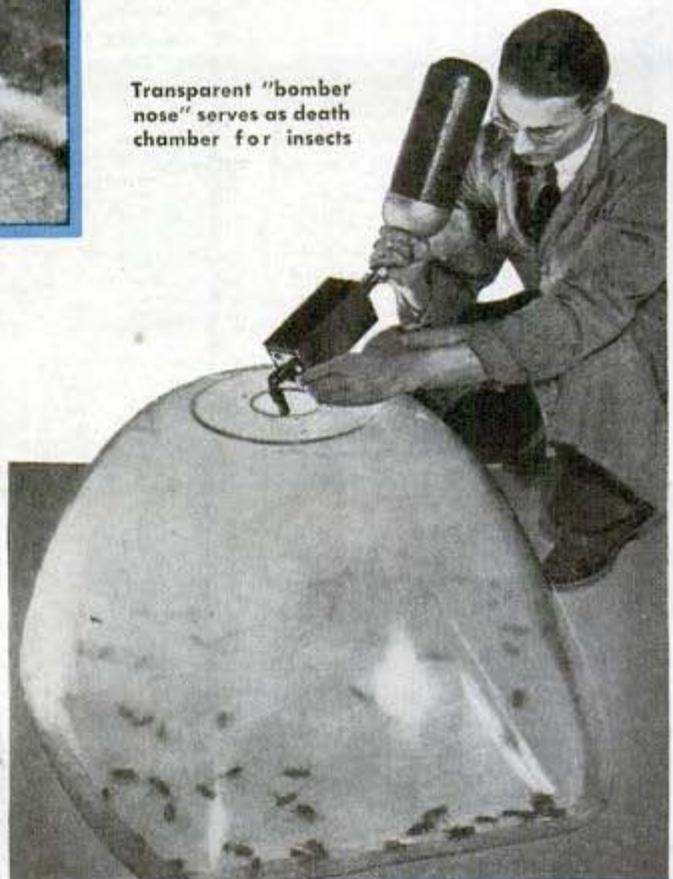
Perhaps they will be as startling

as the case of the thirsty dog in the laboratories of the University of Toronto. Two scientists removed the pancreas from a canine and the animal recovered from the operation only to exhibit a tremendous thirst. Then the world learned what diabetes was—a lack of secretions from the pancreas which prevented the animal from burning carbohydrates. Instead, the dog washed them out of his blood by drinking water. Insulin, from the pancreas of cattle, was produced. Diabetics, who lived only about 45 years, now reach an average age

of 65, thanks to this living test tube and today other dogs are subjects of experiments which, leading specialists believe, will cure diabetes entirely.

The drowning ducks, which are always rescued in the nick of time, are used by corporations like Du Pont in tests that have produced varieties of water wetter than the water flowing from the household faucets. These waters have special indus-

Transparent "bomber nose" serves as death chamber for insects



trial uses. They are so liquid they permeate the grease and saturate the duck's feathers, leaving it no more aquatic than the chicken.

The hungry mice, along with a great host of small animals, are used mainly in diet experiments, and from what scientists have discovered from them comes many of the new things we know about vitamins and minerals.

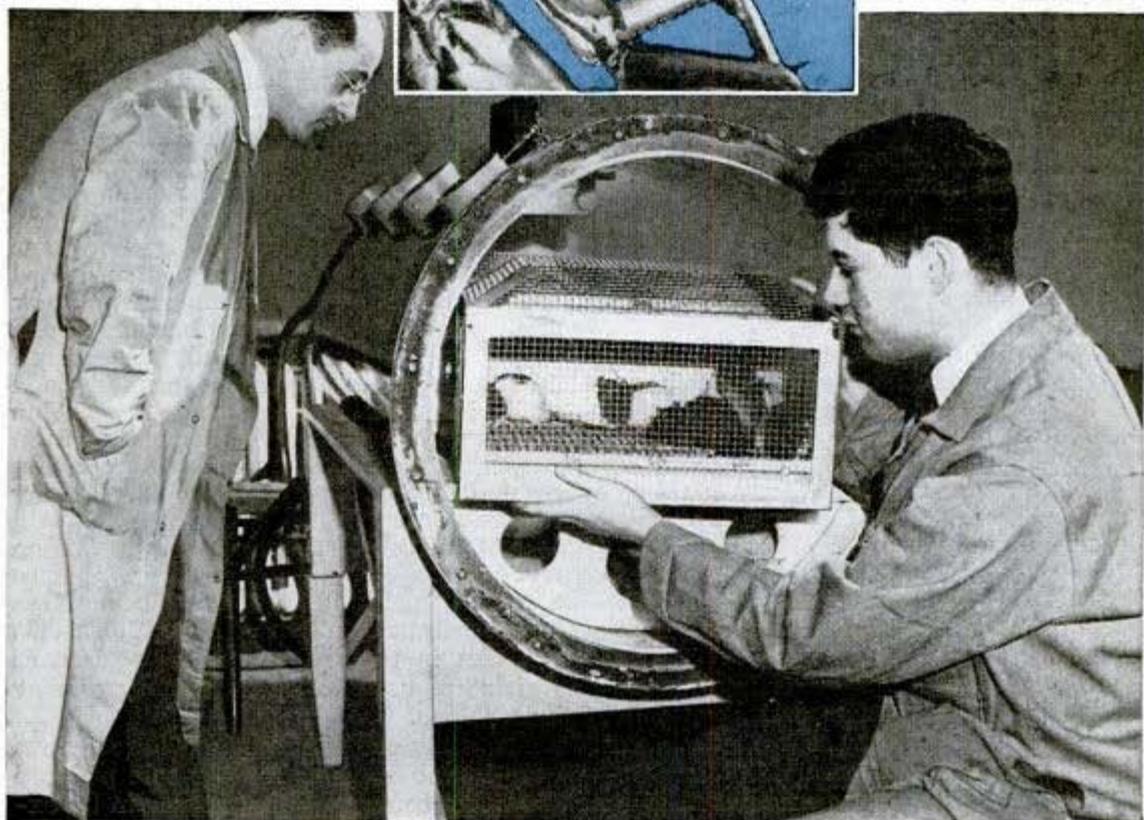
Mice, rats and their rodent cousins are the most numerous animals in this world of experimentation. They live their lives faster and the effects of certain conditions can be studied down through generations during a matter of months.

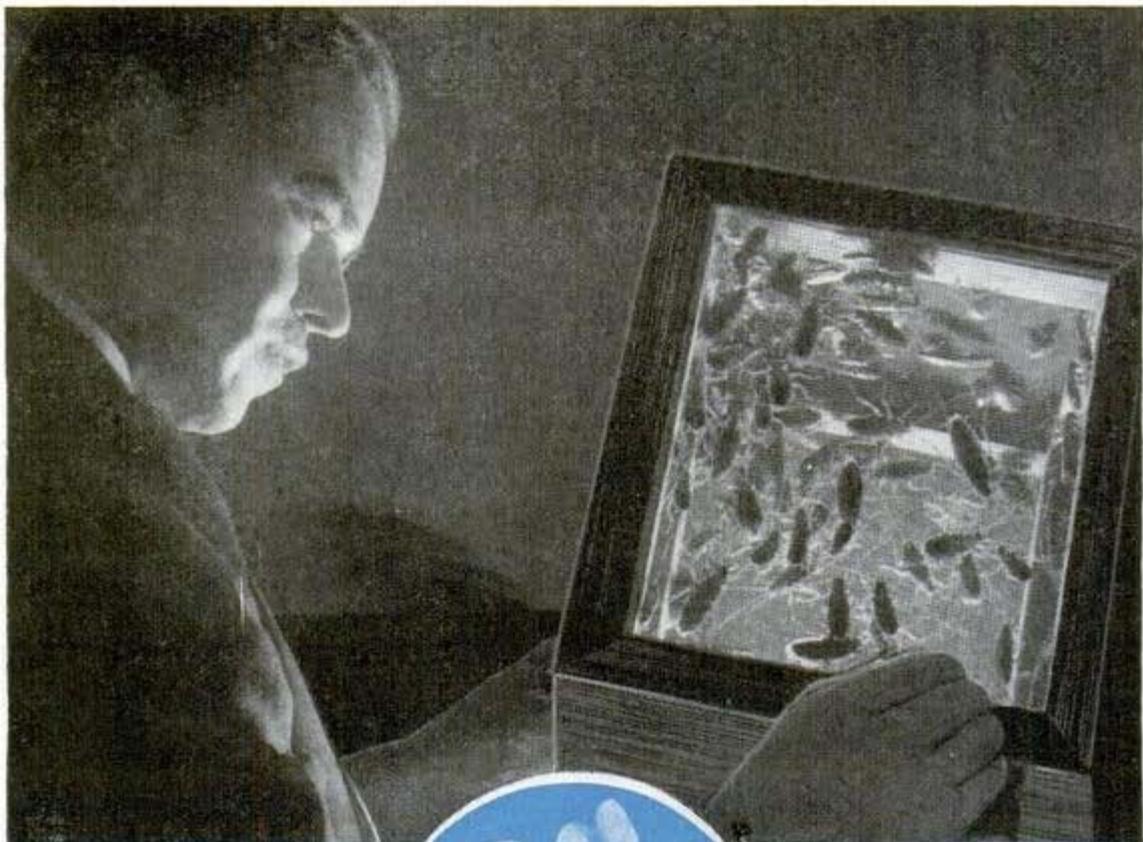
One group of rats, undoubtedly puzzled by the sensations of air sickness, is now being subjected in New York University's rodent decompression chamber to atmospheric conditions prevailing at 34,000 feet. What happens to them may be important to you if you plan to fly your own plane.

At the same school, other rats find themselves in a little chamber which records their basal metabolism, or the burning rate, at which the body uses up food. The food you eat a



Canary helps detect carbon monoxide in mine. Cockroach (left) is about to taste a new synthetic insecticide. Below, rats are put in decompression "high altitude" chamber





Cockroaches hatched in government laboratories are used for testing rotenone and pyrethrum

few years hence may be changed according to these experiments on living test tubes.

Still another group of rats is being used at Pennsylvania State College to find out what kind of food makes us want to work. They race around in a circular cage which shows the difference in "mileage" between cheese and carrots, and other foods.

In connection with food, you may never have heard of a cow named Penn State Jessie, but she gave the world much of its knowledge of vitamin B. Scientists at Pennsylvania State College put a window in her stomach so they not only could observe the workings of this organ, but also remove partially digested food. By feeding this food to experimental rats, it was discovered that vitamin B can be manufactured by bacteria living in the body's digestive system.

You might not think of rabbits in connection with the miracle drug, penicillin, but they are part of its manufacture. When corporations like Commercial Solvents began mass production of penicillin in giant



The "bite" test for repellent—mosquitoes alight only on untreated area

vats, it was necessary to check each batch. To do so, they keep a colony of healthy rabbits and mice. A test portion of each batch of penicillin is injected into their bodies to make sure it is safe before it is sold. They live to a ripe old age because the product is so carefully produced.

Not so lucky, however, was a group of guinea pigs at Syracuse University. It was suspected that a certain area of farmland in New York state was infested with the bacillus which produces botulism, the deadly ailment resulting from eating home-canned food which is not boiled at least 20 minutes. The guinea pigs were fed vegetables from the suspected area and the next day they were dead. In dying, they probably saved many human lives.

Pete, the rabbit, a useful pet in the Rohm and Haas Laboratories at Bristol, Pa., lives a wonderful life—except for the fact that he is continually bitten by mosquitoes. His function is to feed the flying nuisances which are used to test a variety of new insecticides.

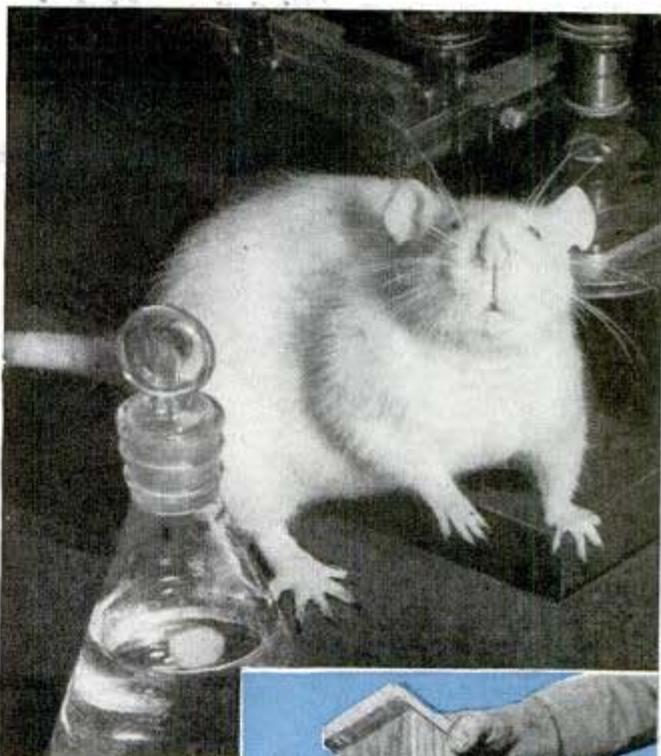
The same company has a 300-acre farm near its laboratories for the sole purpose of raising common bugs which can be ex-

terminated as living test tubes. It's the only farm in the world on which the farmers moan when the insect crop is short.

The Borden Company laboratories imported a short-tailed, fat-cheeked little animal of Asia, the hamster, because it reacts to food like humans. These little fellows have paved the way for experiments which have improved cheese and milk and led to the discovery of new types of vitamin and mineral-rich beverages.

Monkeys helped the medical profession solve the mysteries of yellow fever, and also are used in the study of infantile paralysis. The cow was instrumental in bringing about control of smallpox and pernicious anemia. The horse provided antisera which have been successful for diphtheria, lockjaw, meningitis, botulism, pneumonia and scarlet fever.

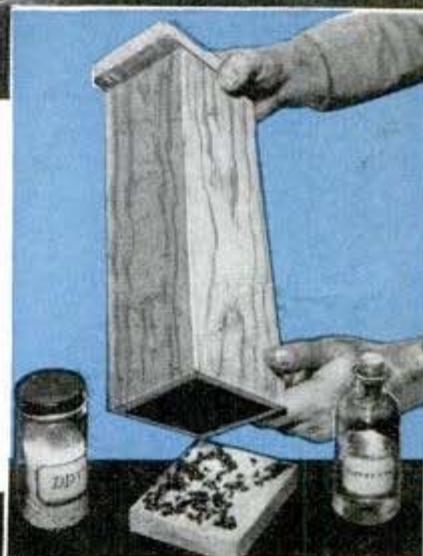
Rabbits have been useful in the fight on cancer and hydrophobia. Dogs have taught the profession how to use anesthetics, how to cure stomach ulcers, Addison's disease and hookworm. Thousands of these animals have died to save human lives. The fate of laboratory insects, the most numerous of living test tubes, is to teach mankind how to kill other insects. Moths, flies, mosquitoes, army worms, beetles, caterpillars, lice, fleas, bedbugs, cockroaches and hundreds of other members of the



This rat has a pink tinge to whiskers due to diet devised for killing bacteria

Right, box sprayed with DDT is removed from flies which died quickly

Below, mice live in "glass houses" for observation after a dose of penicillin

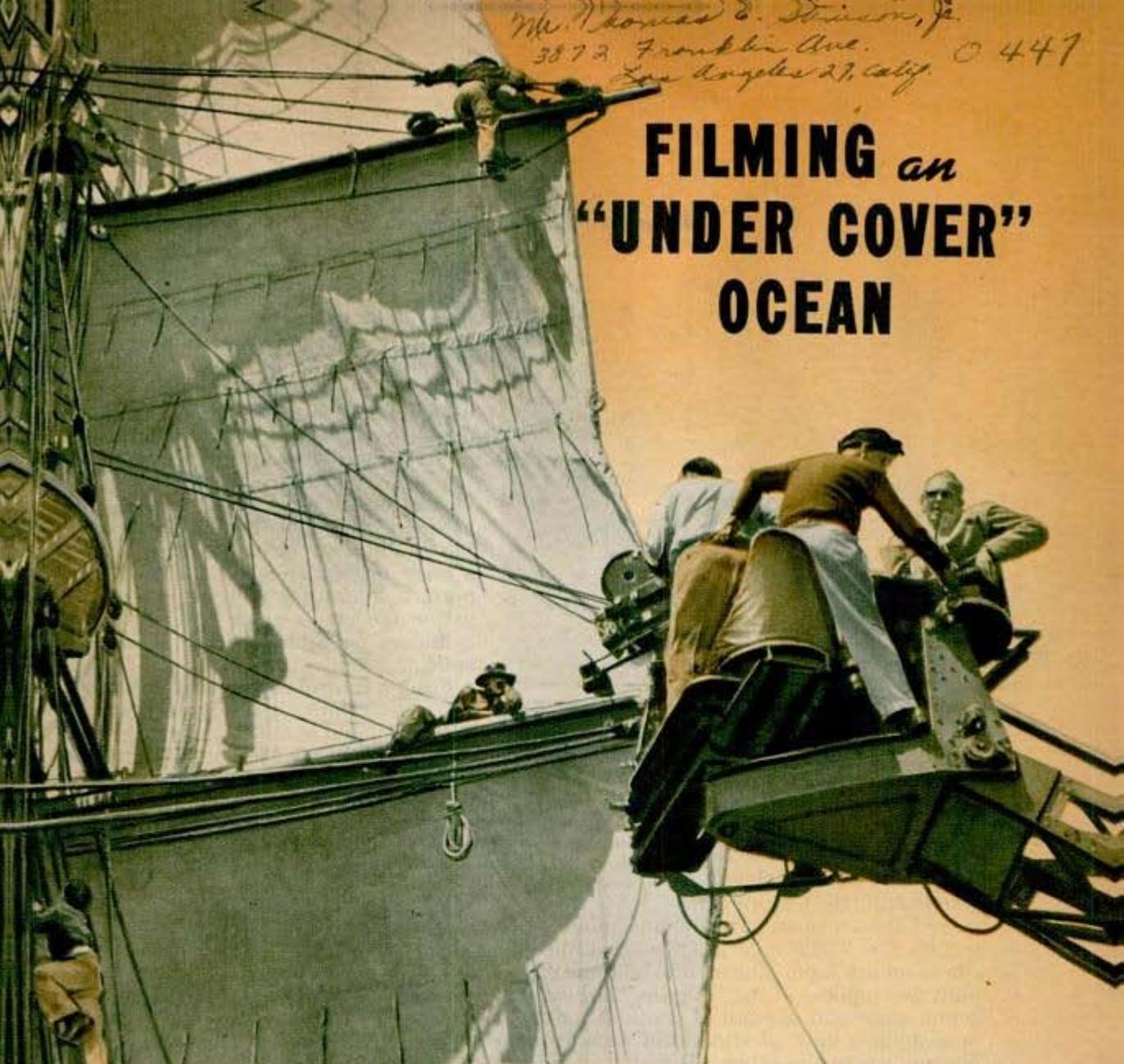


insect family find themselves born and raised in the happiest world possible. Food is plentiful, temperatures are scientifically controlled and everything is fine until—alas for them—the day comes when they are placed in a "death house" where they are sprayed, dusted or fed poison.

When the last of these living test tubes has died in a laboratory, mankind will have controlled what many scientists believe is his greatest future enemy—the creeping, crawling, flying billions of insects.

Mr. Thomas S. Stinson, Jr.
3873 Franklin Ave.
San Diego 27, Calif. O 447

FILMING *an* "UNDER COVER" OCEAN



The camera crew rides the boom to film a scene in the rigging of the brig "Pilgrim," afloat on a Hollywood sea. Below, huge seaweed frond made of plaster and cloth is placed in tank for M.G.M. underwater movie

NO MATTER whether Hollywood shows you a raging Cape Horn gale in one of its movies or, by contrast, brings you delightful underwater color pictures of a swimming star, the making of any water picture is a technical and complicated task.

At Paramount recently Russ Brown, assistant technical superintendent, and Ray Hinsdale, master mechanic, were putting a storm together for "Two Years Before the Mast."

"Ray," Brown was saying, "we'll need about 180,000 cubic feet of wind per minute delivered on deck, and we





ought to put more pressure on the overhead sprinklers so that the rain really pours down." Over a model of the brig "Pilgrim" the pair worked out details of rocking and pitching a full-sized ship inside a sound stage.

In making the picture version of Dana's classic, Paramount found it best to film the 15,000-mile sea voyage inside the studio on dry land. The men behind the scenes built two replicas of the "Pilgrim," one inside a sound stage and one out of doors. Each floats in a shallow tank of water and each is complementary to the other. The ship indoors is complete in every detail except for the masts, which end abruptly under the sound stage roof. The out-of-doors ship has 92-foot masts and a full set of sails and rigging, but her hull is merely a timber framework erected on a barge. This duplication allowed most of the deck scenes to be made under the controlled lighting

Rain from overhead water pipes provides a drenching tropical storm on a movie ship's deck

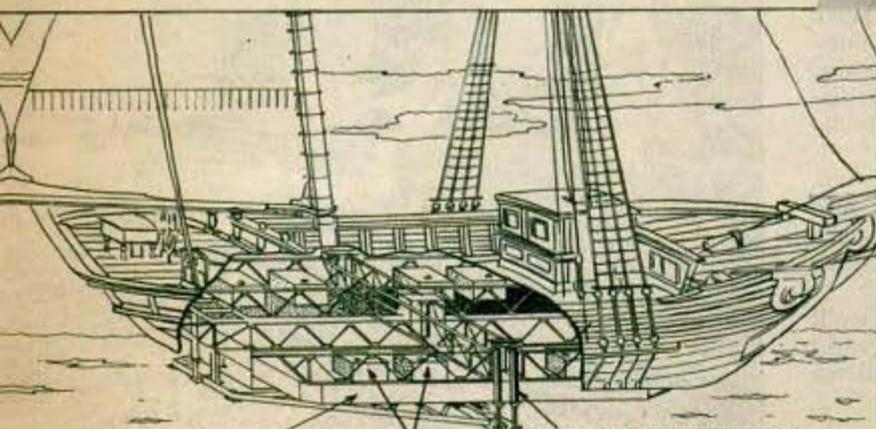
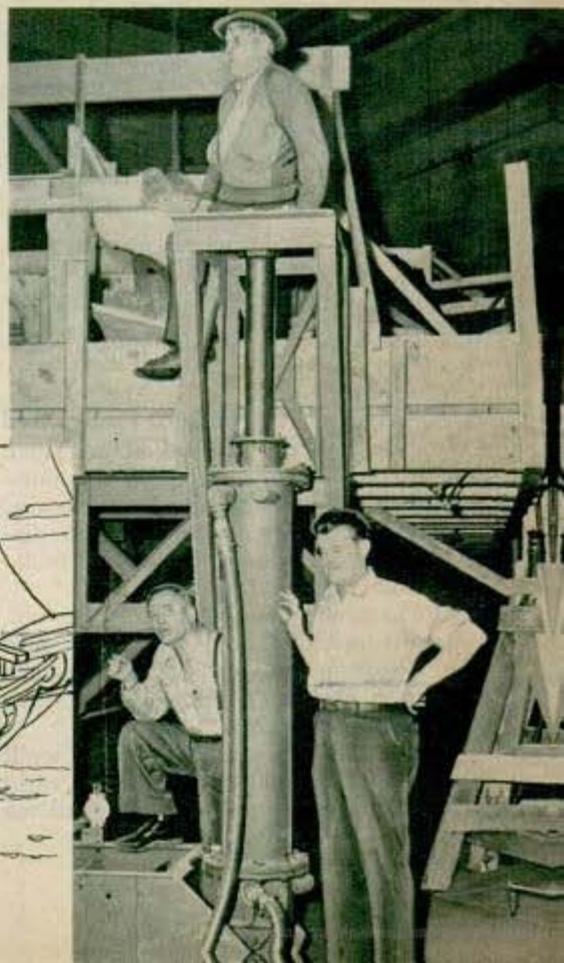
The hydraulic cylinders shown below pitch and roll the ship with such realism that cameramen have become seasick

and storm conditions of the sound stage, while the exterior ship was used for scenes that showed the ship under sail and for close-ups of men at work aloft.

The 100-ton ship in the sound stage is a complicated structure, built up over pontoons and ballast tanks that provide just enough buoyancy to float the ship, allowing the vessel to be towed through the water by ropes out of camera range. The ship can be trimmed to heel on either side by shifting the water ballast.

To give the ship the rolling and pitching motions that she would undergo during a storm, additional water ballast is first admitted into the tanks to sink the hull so that its bottom rests on the bottom of the tank. In this position, a "floating hydraulic boat rocker" built into her hull can be used. This rocker is a huge triangular steel grid that supports a hydraulic cylinder and piston under the ship's stern and additional cylinders on each side of the ship at amidship points.

From a control room inside the vessel water is alternately admitted to the stern cylinder and then released, raising and lowering the stern in a natural pitching motion. Similarly, the amidship hydraulic cylinders are alternately operated to roll the ship from



STEEL PONTOONS

BALLAST TANKS

HYDRAULIC CYLINDERS PITCH AND ROCK THE BOAT

side to side. Three men are in the crew. A foreman on deck transmits orders by telephone to the control room, where two men handle the valves. The combination of movements is so realistic that cameramen on the ship have become seasick.

Merely rocking the ship is only part of the work of making a storm scene. A wave-making machine is plunged in and out of the water, creating waves that beat realistically against the bow and sides. Water from a tank under the roof is occasionally discharged down a chute to provide the effect of a big wave washing across deck.

Wind is created outside the stage building by two huge blowers and is brought into the building through wind tunnels, then conducted to the part of the ship where it is needed by movable canvas ducts. Rain comes from overhead pipes and its direction is controlled by the wind.

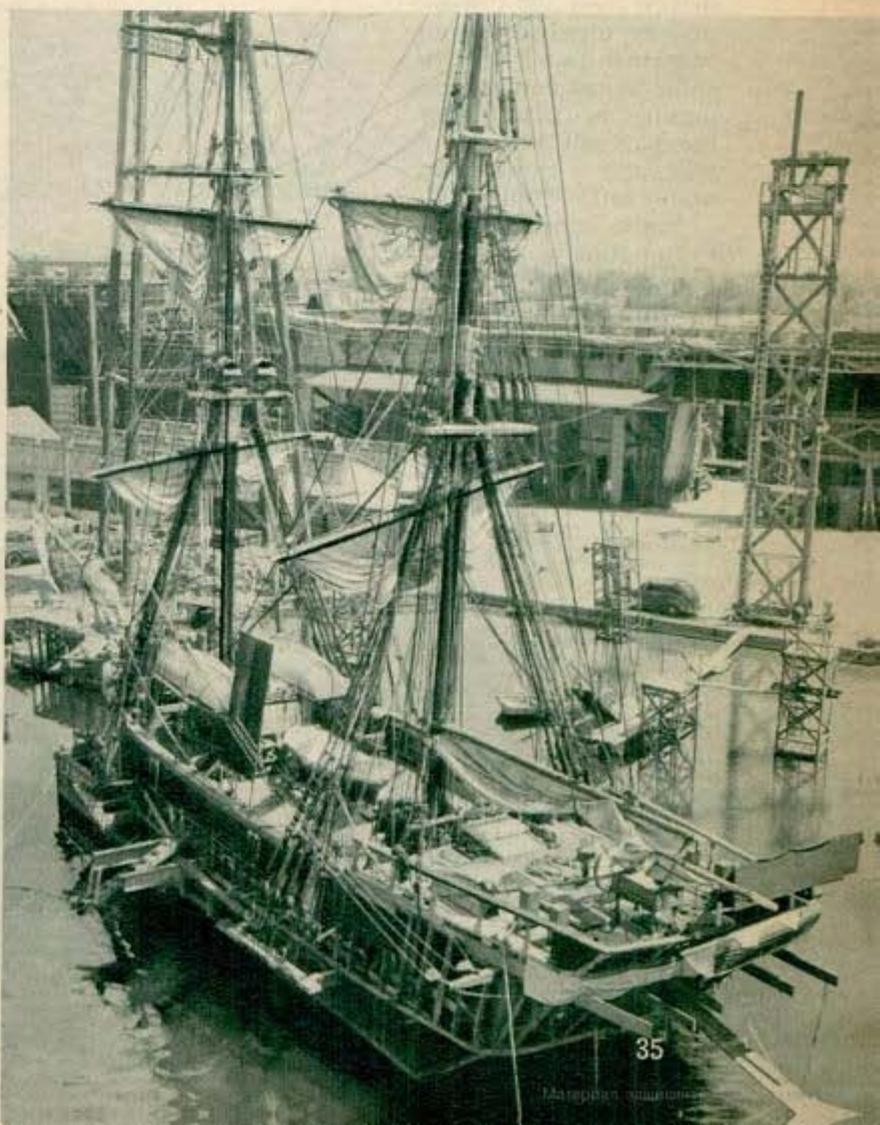
For background scenery a huge painted cyclorama of sky and clouds was curved around three walls of the sound stage. The cloud formations were changed for each scene. For some sequences the background consisted of a huge screen on which motion pictures of tropical ports, horizons, and sea storms were flashed.

All these details combined to make a realistic picture of sea travel and storms. The fact is that this is about the only way such pictures can be made. If a picture company were to embark on a ship to film action in a real storm they might search for months before they encountered a storm of the type required and then the actors might be swept overboard and the camera and film ruined by salt spray.

The exterior ship, used for photographing action aloft in the masts and spars, is also rocked and pitched hydraulically for the camera while wave machines at one side churn the water. In a couple of scenes it was necessary to



Esther Williams, swimming star, descends into pool with a color chart for cameramen to make underwater test exposure of color film. Below, overhead view of the ship in Paramount's Hollywood "ocean"





Esther Williams performs underwater dance. Numbers tell focus distances

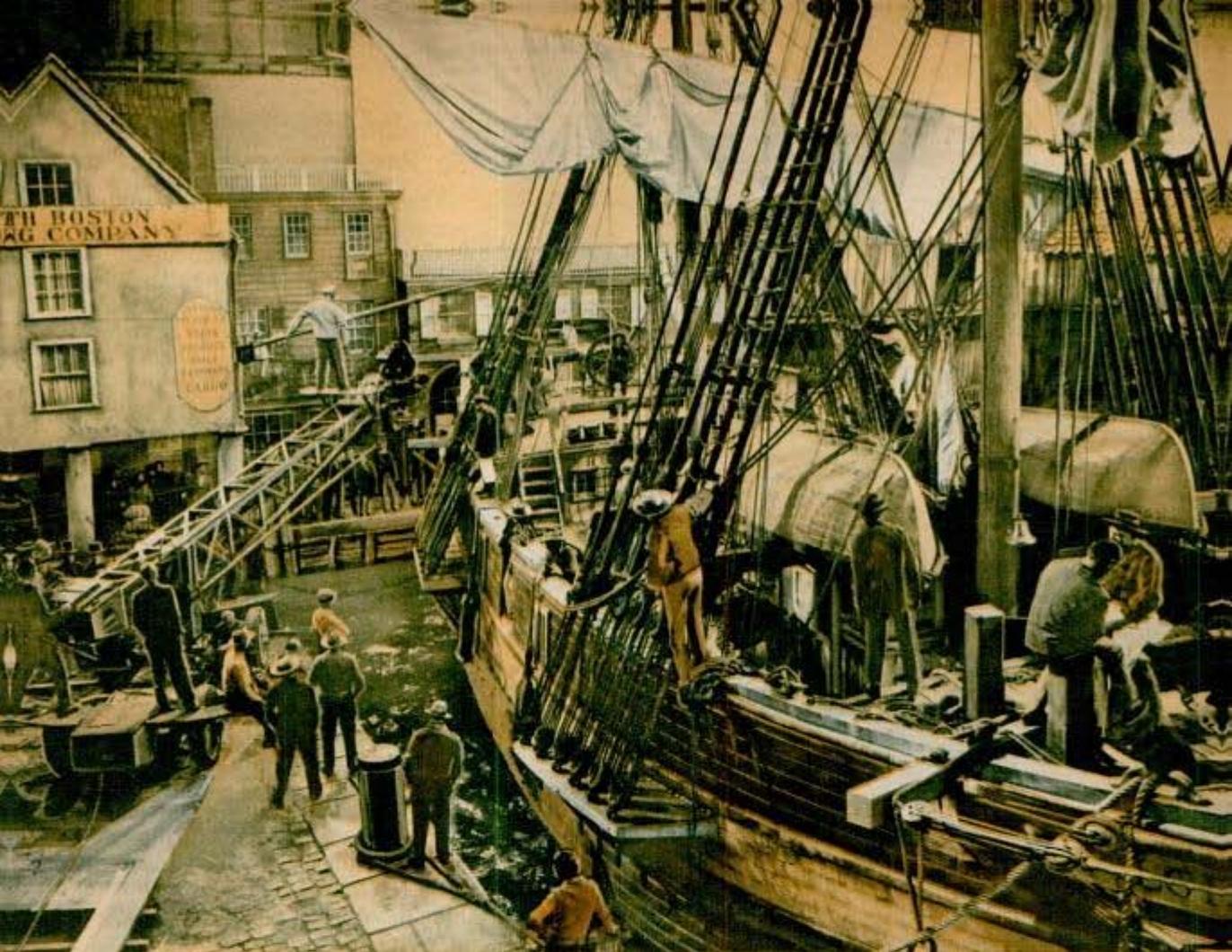
show the towering masts listing at an angle, with all sails set and filled by the wind. The underwater hydraulic apparatus tilted the masts to the desired angle and five huge wind machines at the side of the tank, each driven by a 350-horsepower engine, were pointed toward the sails. When you see the picture you can judge for yourself how convincingly a real ship under sail is duplicated.

At the same time that Paramount was manufacturing its ocean storms, an entirely dif-

Huge fans whip up winds to fill sails of the brig "Pilgrim"

ferent but equally difficult kind of water picture was being filmed at Metro-Goldwyn-Mayer. The script of "Ziegfeld's Follies" called for an underwater ballet dance number by Esther Williams, the star. The picture was being made in full color. The stage consisted of a semi-spherical 300,000-gallon water tank with heavy plate glass windows in the walls for the cameras. Conventionalized sea weeds and fronds, built of plaster, cloth, and rubber, with weights to anchor them to the bottom, were placed in the tank. Then the technical preparations began. First it was necessary to filter the water to remove all algae and suspended material that might reduce the water's transparency. Next the batteries of sun arc lamps arranged around the top of the tank to pour light down into it had to be adjusted





The indoor ship on the sound set, showing a wharf in old Boston
Stage hands direct open end of wind duct to blow a gale on ship

to offset the refraction of the water's surface. Then various color filters over these lamps had to be experimented with to offset the filter effect of the water itself, so that underwater reds and blues would photograph in their normal hues.

Miss Williams was coated with oil to make her skin glisten under water, her coiffure was impregnated with vaseline and pinned so that it would retain its shape under water, and a transparent film was placed over her nose so that she could make numerous dives, day after day, without danger of sinus complications. The finished film shows a girl dancing under water in a sequence that lasts only a few minutes. It took months of rehearsal and preparation, and the skill of 40 people out of camera range to make the one short scene. Moviemakers discovered long ago that a moment of perfection is worth a month of hard work.



0 586

Airplane Controls Lift Bed So Patient Can Sit Up

Hospital beds will be raised and lowered after the war by the same hydraulic system which operates airplane landing gear control systems, according to the American Hospital Association. A recent demonstration of the mechanism showed that the patient himself can fold the bed into a comfortable, upright chair.

*War Conference
Cleveland, O.*

Metal Shot Hurling at Tools Helps Resist "Fatigue"

Metal shot hurled at high speed against tools gives a surface finish that guards against breaks under repeated stress. These breaks, a result of metal "fatigue," sometimes occur after long-continued bending and twisting under loads much less than the tensile strength of the metal. The metal shower, delivered by a shot-peening machine, stretches surface particles of the metal tools. This puts the surface under a compression stress which tends to offset later tension and thus prevents breaks.

*American Foundry & Equipment Co.
Michigan, Pa., U.S.A.*



0 583

Hand-Pumped Inhalator Eliminates Oxygen Tank

Among battlefront innovations which will find wide civilian use after the war is a hand (or foot) pumped resuscitator. This lightweight, compact unit requires no oxygen and is easily carried about. It is used by amphibious troops for reviving soldiers, and is operated by one man. The resuscitator would be handy for camping trips, or could be stowed away in the luggage compartment of an automobile for emergencies, according to the National Safety Council.

"Reviving" a soldier with portable inhalator which is pumped by hand



Dr. M. M. McDonald

Barbara Kilduff

*J. H. Emerson Co.
22 Cottage Park Ave.
Cambridge, Mass.*

Powder on Match Welds Broken Wires in Burned-Out Appliances

By applying a few grains of Chanite flux, a new alloy, to broken wires, housewives can weld burned-out electric stoves, coffee urns, waffle irons, toasters, and other appliances. The operation, which can be completed in a few seconds, consists of placing the powder over the wire ends to

be welded with a wet match or toothpick, and putting the electric plug in the socket. Experiments show that Chanite has 500 times the resistance of carbon. The flux is powdered from crushed rock taken from mine deposits discovered by Adolph Chansky of Fort Worth, Texas.

0 413

38 *Chanite Sales Co.
714 South Main St.
Fort Worth 4, Texas*

Full-Size 'Berth' in Coach Affords Semi-Privacy

Postwar travelers in day coaches will be able to stretch out at night in the semi-privacy of a "day-night" compartment designed by the Pullman-Standard Car Manufacturing Company. The back of the seat has an extra degree of recline, and an upholstered leg rest swings down out of the seat ahead. Window drapes swing around to serve as curtains separating each pair of seats. They are hung on hinged rods and snap to the back of the seats. Individual spot-type lights afford illumination for reading without disturbing other passengers. The new cars will have three washrooms for men and three for women. Other special features include luggage compartments for bulky articles in addition to the conventional racks above the seats.



Civil Aeronautics Administration Photo

0582

Plane 'Prop' Moves Barge Built by Airport Crew

When "amphibious action" is called for at the Washington National Airport, which juts into the Potomac River, repair and maintenance crews use a specially constructed barge which they made themselves. The shallow-draft barge is powered by a small airplane engine and propeller. Ropes extend around three sides of the barge to keep the crew from being blown overboard by the "prop wash" from the propeller. When the barge is under way it sounds like an airplane.

Crew hangs on tight while "pilot" of barge races engine for "takeoff"

0456

Tractor-Pushed One-Man Rake Scoops Up 40 Loads of Hay in Day

You can make a lot of hay while the sun shines with a "buck rake" built by a young Michigan farmer who handles the equivalent of 40 loads in a day. The rake, which is attached in front of a tractor, has 11 wood "tongues" 15 feet long which scoop up the hay. It is mounted on two rubber-tired wheels, and when loaded the rake is tilted up by block and tackle operated from the driver's seat. The tractor rushes the load to the

barn where it is dropped onto the floor and hoisted into the mows. Loading hay with a tractor and conventional hay loader is considered a two- or three-man job.

John Snyder
Owasso, Mich.



information supplied by
Michigan State College

SPORTS

for

the

BLIND

0543



Competitive sports for the sightless are sponsored by the Hazel Hurst Foundation for the Blind at Pasadena, Calif. In "baseball," the pitcher (above) uses a steel rod to fling a steel ring down the wire in such a way as to deceive the keen ears of the batter

Above, athletic supervisor at Hazel Hurst coaches blind man in how to bowl. The bowler is kept in position by a special guide rail invented by the supervisor for this purpose. By holding on to it, some of the blind bowl a better than average game, making spares when told the pins left standing. The games tend to make the blind more careful and alert



Batter (above) takes a lusty swing as the ring comes in "grooved"—below the wire, and centered. The ring travels as fast as a pitched baseball. Even persons with normal sight have difficulty striking it



There goes a hit! (left) Behind the pitcher, three fielders with special long-thumbed gloves try to intercept the ring and slide it back to home post before the batter reaches base. At each base is a device to "brake" the runner

"Shark" Plane Is Marker For Combat Formation

Fighter pilots started it in China—painting the noses of planes to resemble ferocious sharks, tigers and lions. At an 8th Air Force base in England, a squadron commander uses a gaudily painted Liberator for a more practical purpose than scaring the enemy. This Liberator, called the "show-off" ship, has a nose resembling a shark and is used to guide other bombers into combat formation. When the formation of circling bombers is completed, the "show-off" returns to its base and the other planes set off for the target.



The noses of the B-24 Liberator bomber and the P-40 fighter are favorites with air-men for "scare" decoration.

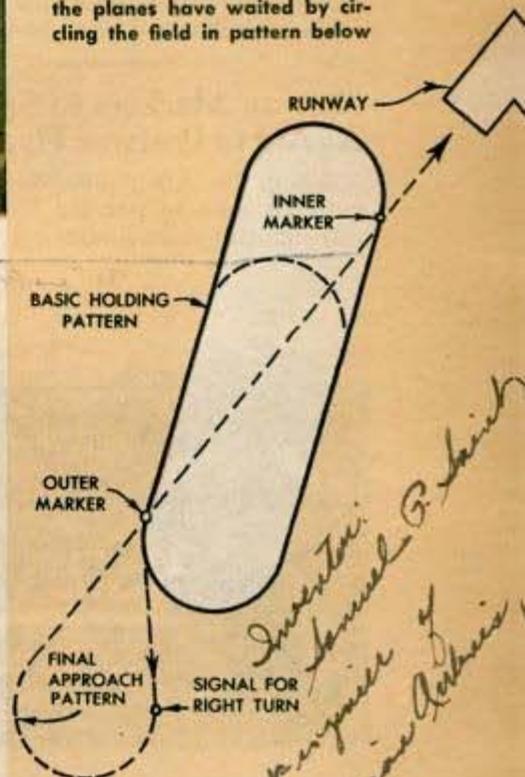
Slide Rule Is Airport Traffic Cop for Landings During Bad Weather

0511



Left, slide rule adaptation in airport control tower brings in flight after flight of traffic after the planes have waited by circling the field in pattern below

By adapting the old-fashioned slide rule into a kind of robot traffic cop, airport managers have solved the problem of long delays between landings in bad weather. In a demonstration at LaGuardia field the device cut the average interval between the landing of five "stacked up" planes circling the field from 12 minutes to four. Instead of the sliding flat rule, the middle element of the instrument is a rotatable drum. On it can be set up all the elements required to keep the airplanes a safe distance apart both laterally and vertically, including wind direction and force. The tower control operator has a concise visual picture of where his stacked up planes are, or ought to be, at any given instant. By simple adjustments in the computer, he changes the picture as he brings in one plane after another for its landing. This eliminates many hand computations and notes and enables him to send his radio instructions after a glance at the computer.





0571

Bomb-Shaped Paper Gas Tanks Attached to Nazi Planes

At a captured airfield near Brussels, Belgium, Royal Air Force men found that the Germans adopted droppable paper gasoline tanks for their aircraft. Made of pressed paper in a bomb-like design, the tanks were hung under the wings to carry extra fuel and jettisoned when empty.

0482

Skyway Markers to Span Nation As Aid to Postwar Flyers

When the Army lifts its ban on navigational aids to private flying, the Civil Aeronautics Administration will launch a

Washington, D.C.



program for the placing of 100,000 air markers. These grid system markers will cover the nation so that postwar pilots can tell the exact location of every city and village at a glance. The marking system involves the lettering of a town's name on a roof or wall in characters 10 to 20 feet high, along with the latitude and longitude of the place, separated by an arrow pointing to true north. Special symbols will direct the pilot to the nearest landing strip or airport. Colors used on the markers will be chrome yellow and black or orange and white. Some may be illuminated at night. The plans also call for the placing of markers made of crushed rock on mountainsides, and others made of enameled metal strips in desert areas.

0553

Spigot Serves Carbonated Drink Without Unsealing Bottle

Carbonated beverages can be kept fresh indefinitely after the bottle has been opened by means of a combination bottle



stopper and dispenser. The clamps of the dispenser, which contains a kind of spigot, are hooked under the bottle cap and the cap is pierced by pressing down on a plunger. This permits pouring the beverage frequently without losing any of its tang. Light in weight, the dispenser can be adapted to any standard bottle.

See the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

1215 N. East Ave.

0580

Free-Wheeling Electric Tricycle Goes 30 M.P.H.

To solve the problem of gasoline-less transportation for his wife and children, C. O. Blaisdell, Oak Park, Ill., invented an electrically-driven, three-wheel cycle which will go 30 miles per hour and costs only two-thirds of a cent a mile to operate. Blaisdell bought a standard ladies' bicycle for \$26 and spent \$20 in converting it. He interchanged the wheels in order to locate the coaster brake in the front fork. Then he added an extra wheel at the rear to support the weight of a one-quarter-horsepower AC electric motor, which drives the forward wheel, and a 6-volt storage battery under the seat. Starting, which is done easily in zero weather, and speed are controlled by a foot accelerator; braking is accomplished by a lever on the handle bars. The design permits free-wheeling and thus saves battery drain. The battery can be re-charged quickly through a motor-driven automobile generator, the leads from which can be



plugged into a jack mounted on the chassis. The tricycle includes a wooden box between the rear wheels to hold large parcels and a seat for small children immediately behind the driver's seat.

Portable "Escalator" Shifts Cargo From Truck to Plane

0584



Resembling a small escalator, a completely automotive mechanized unit for loading and unloading air freight is being used by American Airlines, Inc. A conveyor belt which has been adapted to a gasoline-powered tractor keeps a continuous stream of baggage, express and mail moving from truck to plane, or vice versa. It can be adjusted to the height of the forward cabin of a DC-3 or a postwar DC-4. Both operating and elevating mechanisms are hydraulically operated.

430 N. Michigan Ave. Chicago, Ill.

Seven-Minute 'Electric Sleep' Restores Sanity to Split Personality Cases

0269

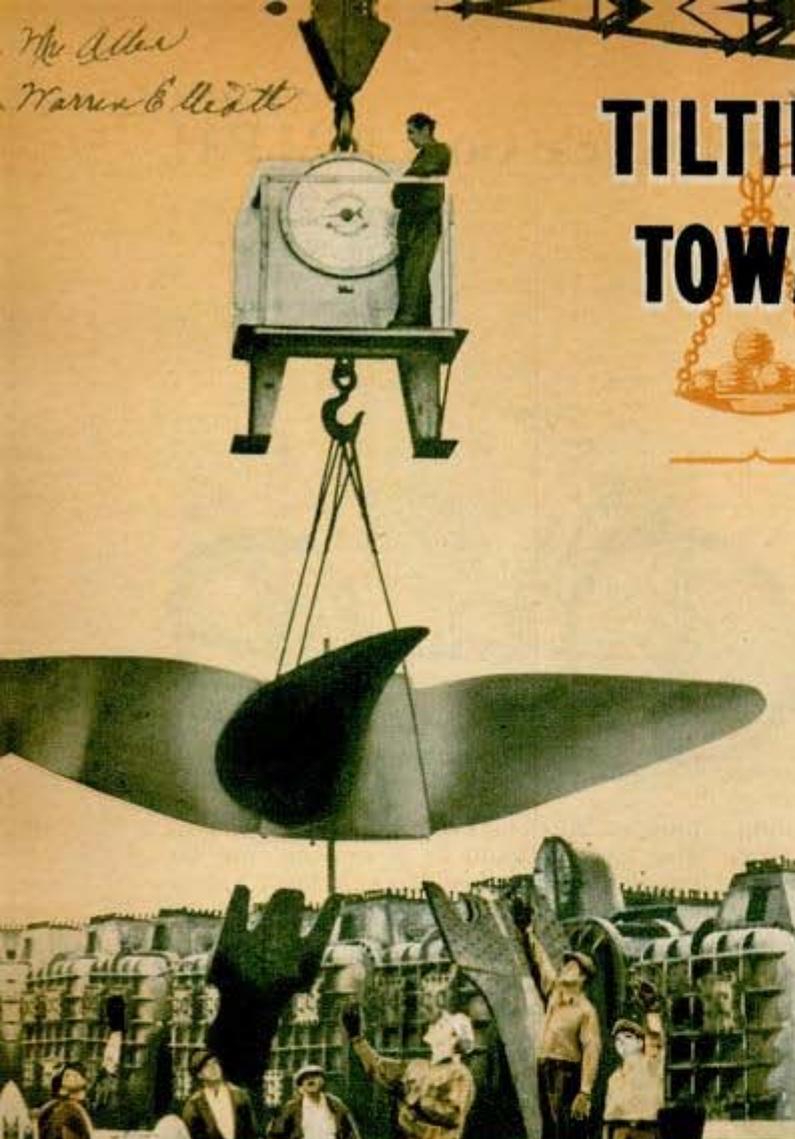
Schizophrenia (split personality) can be cured by electronarcosis, or "electric sleep," it was announced at a meeting of the American Psychiatric Association. The treatment differs from electric shock methods in that the electric current passed through the patient's brain is controlled to produce a convulsion and then to keep him unconscious for seven minutes. Dr. George N.

Thompson, of Los Angeles, Calif., who directed the development of the method, said electric sleep resulted in the recovery of 76 percent of the mental patients treated, approximately the same as with insulin shock treatment, in comparison to the 43 percent recovery record made by electric shock. Of 1,000 patients treated, none died or developed significant complications.

The Allen
Warren & Heath

0 462

TILTING *the* SCALES TOWARD VICTORY

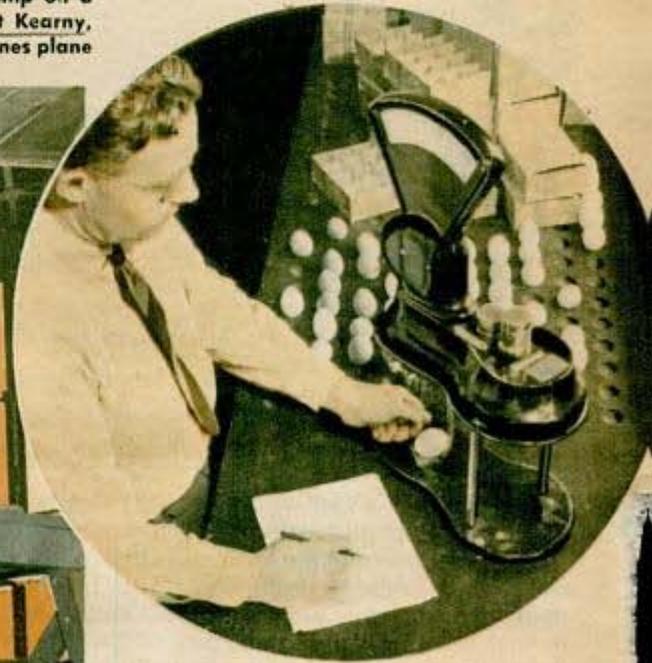
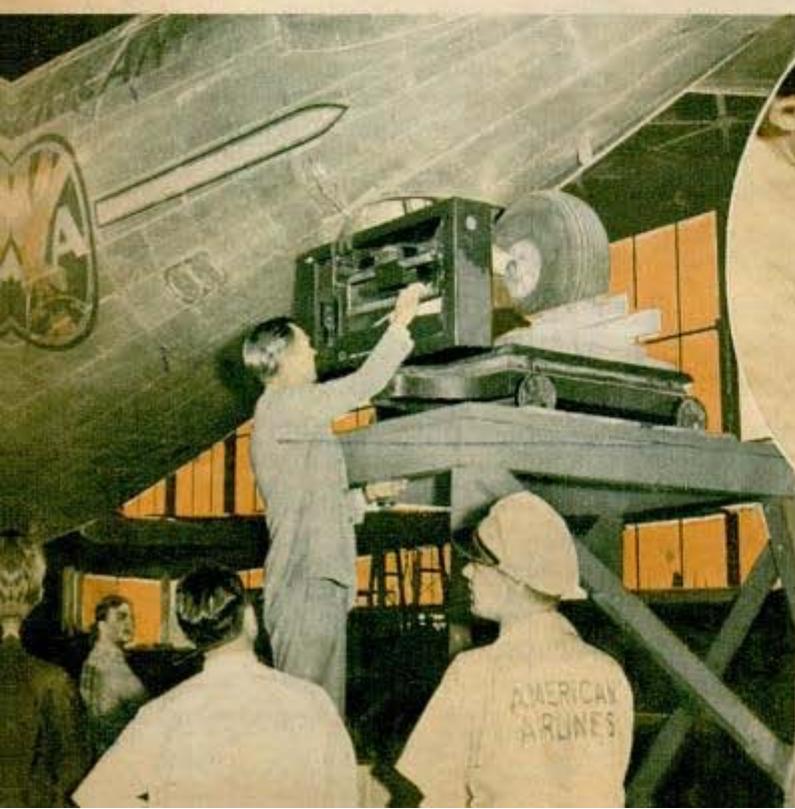


WHEN the butcher put his thumb on the scales with your Sunday roast, he put his finger on one of the first industrial mechanisms used by civilization—and one of the most important.

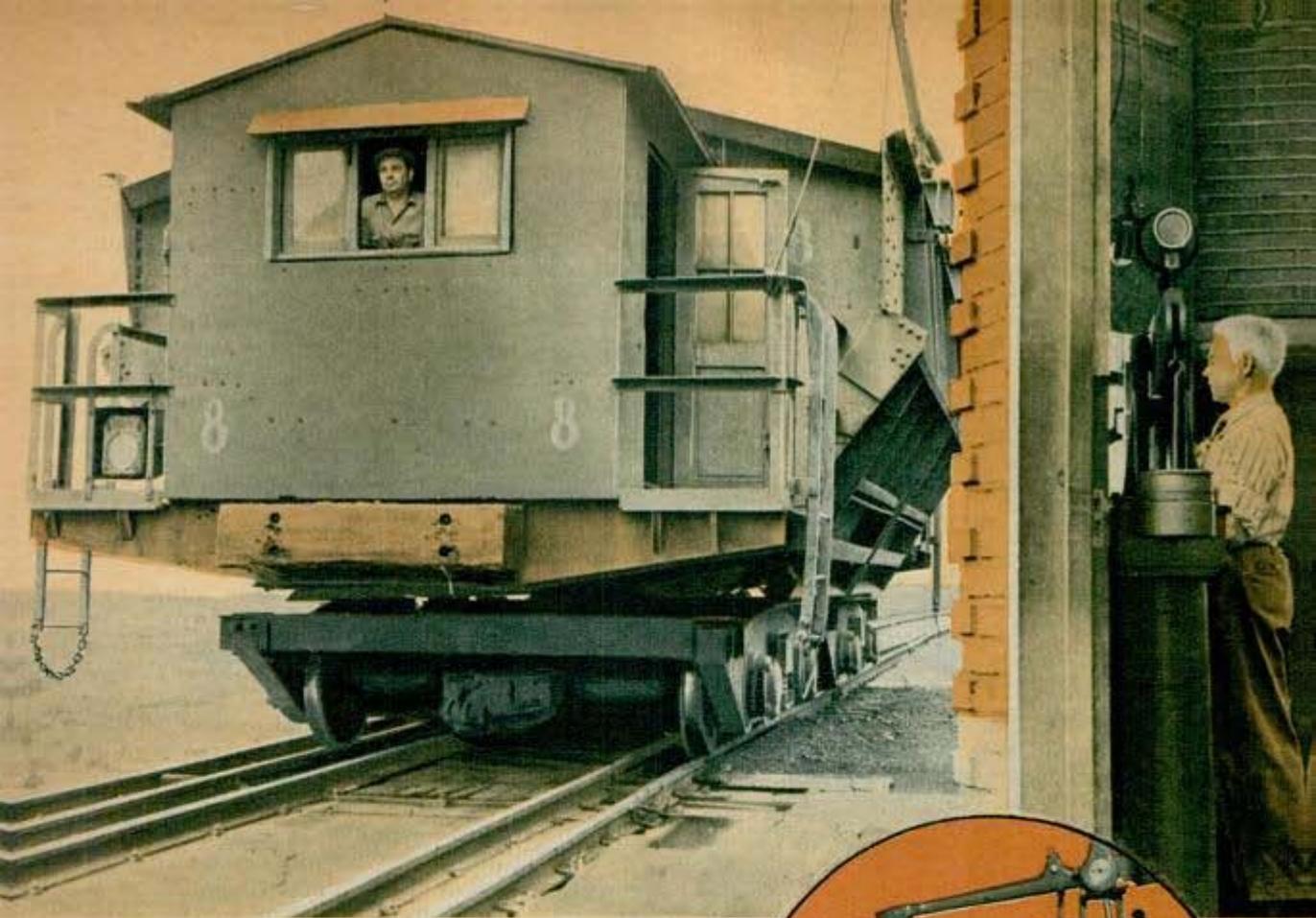
There are thousands of varieties of scales performing thousands of odd jobs, some of which seem impossible to accomplish by measuring weight. The novel weighing machines and methods devised by American ingenuity in the last three years can surely be credited with tilting the scales of war toward victory for the United Nations.

The Pennsylvania railroad uses more than 6,000 scales to weigh freight. They cost up to \$128,000 apiece with a top capacity of 800,000 pounds and weigh a loaded car as it rolls past.

"Weighing in" a 30,000-pound propeller for a troopship on a suspension scale at a U. S. Steel Federal shipyard at Kearny, N. J. Below, maintenance men weigh an American Airlines plane



↑ A Department of Agriculture poultryman records weight of eggs to fraction of gram



Ships are balanced and powered according to weight and, as a vessel is built, each piece is weighed at the shipyards. One navy suspension crane scale has a capacity of 170,000 pounds to check parts of giant battleships.

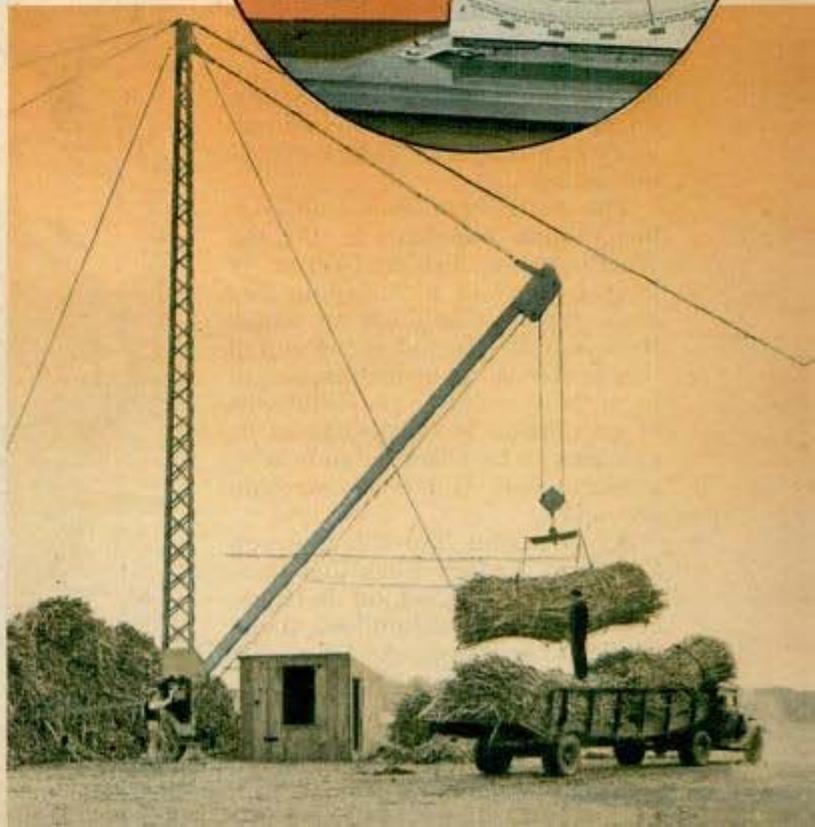
Uncle Sam's air armadas fly only by the grace of the balance built into planes by scales. Everything from a gargantuan bomber to the tiniest bolt you could hide under your fingernail finds itself on a scale somewhere along the assembly line.

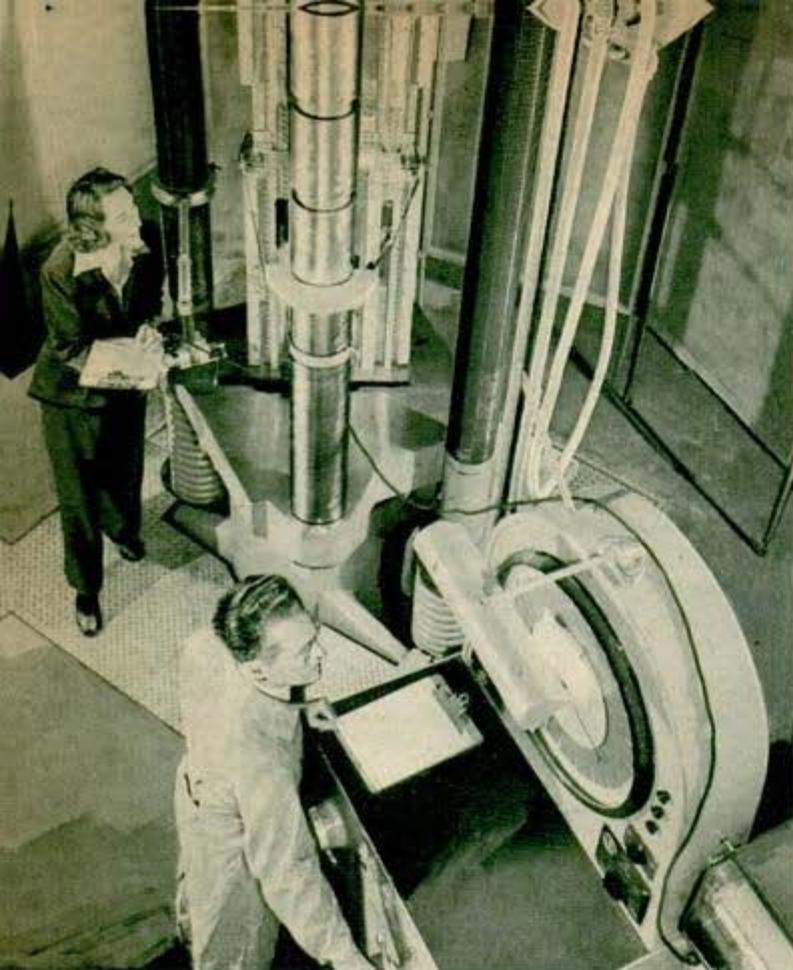
But weighing is only one function of the modern scale, which is becoming incredibly versatile under the stress of war. Scales also count, sort, test, measure fuel consumption, help keep books, calculate torque, mix chemicals, aid in making up payrolls, inspect bullets, keep shells accurate, assist in scientific experiments, speed inventories, cure hams, compute mechanical effort and save workers' lives by handling dangerous operations automatically.

Simple scales actually keep the OPA from breaking down under

Fairbanks-Morse derrick scale hoists and weighs sugar cane in a single operation

Operator at upper right weighs car-load of limestone for Bethlehem Steel blast furnace. Car holds 75 tons. Right, counting ration stamps by weight on Toledo scales





Consolidated-Vultee photo
 Test engineer records data as part of a metal aircraft wing is compressed to destruction in 400,000-pound hydraulic press.
 Below, United Air Lines Mainliner on a floor scale

the huge volume of ration stamps. At first the stamps were counted by hand at a rate of 1,500 an hour per clerk. By installing scales, to count by weight, this number was jumped to around 600,000 an hour per clerk. One office installed 112 scales on which 112 clerks count stamps at a rate of about 67,000,000 an hour. This would require an army of nearly 45,000 clerks without scales.

The accuracy of some scales defies human imagination. At the Westinghouse laboratories in Pittsburgh is a rust-detecting scale sensitive enough to weigh the ink in the period at the end of this sentence. It measures weight in units as small as ten-billionths of an ounce. Movements of its pointer can be observed only with a microscope. It detects corrosion on metals.

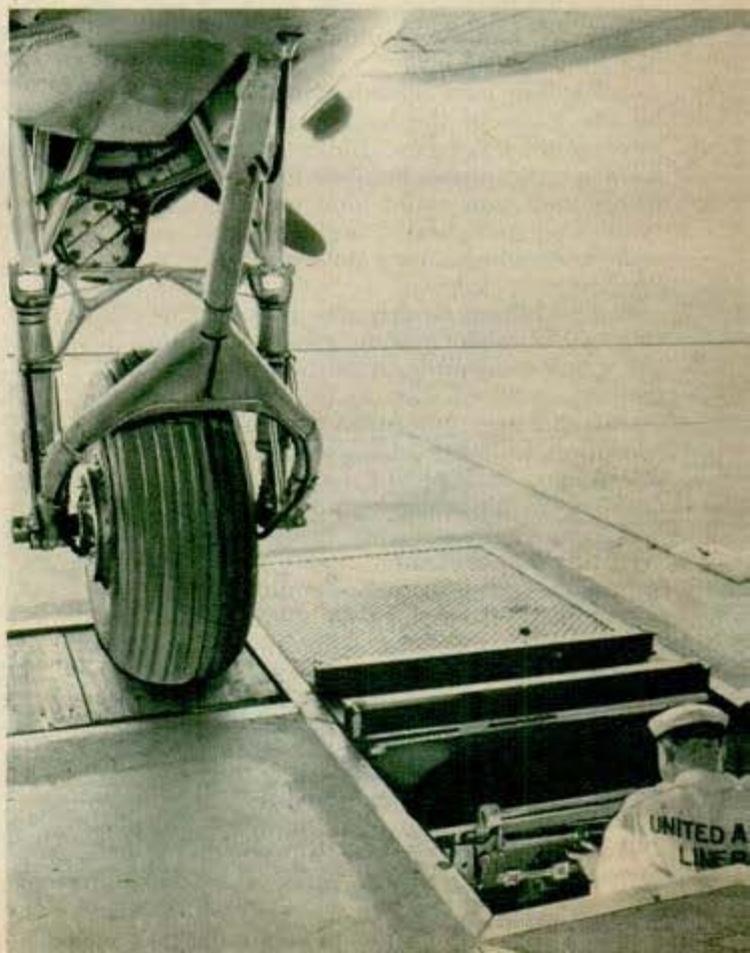
At Diamond Tool Research Company, in New York City, diamonds are weighed on balances showing one two-hundred-thousandth of a pound. At Baumgold Brothers, Inc., in New York,

world's largest diamond merchants, gems are weighed on scales with pivots made of rubies. These scales, which operate in points of a carat, or one five-hundredth of a grain, are tested every morning.

The U. S. Army Quartermaster's Depot in Philadelphia has scales which weigh objects as light as feathers. One scale is attached to a drying oven so that even the slightest bit of moisture won't affect the balance. A Du Pont scale in Wilmington, Del., weighs the dye in a bit of textile.

The Dodge Division of Chrysler Motors in measuring mercury for Sperry gyro-compasses, employs balances so delicate that the mercury is placed on the scale with a hypodermic needle. Another Dodge cathode ray scale will balance a rotor to infinitesimal accuracy while it is turning 6,000 times a minute.

The airplane industry provides a cross-section of modern use of scales. When a Liberator bomber rolls off the assembly line at Ford's Willow Run plant, it lands on a heavy duty "T" type scale with three platforms connected with scales in a pit below. Readings are taken electrically by remote control. The landing wheels and nose





B. F. Goodrich Co. uses this scale to detect mismatched, misaligned, wrongly inflated tires

wheel occupy the "T"-shaped platform arrangement so that the plane is not only weighed but checked for balance. The capacity of each scale is 25 tons.

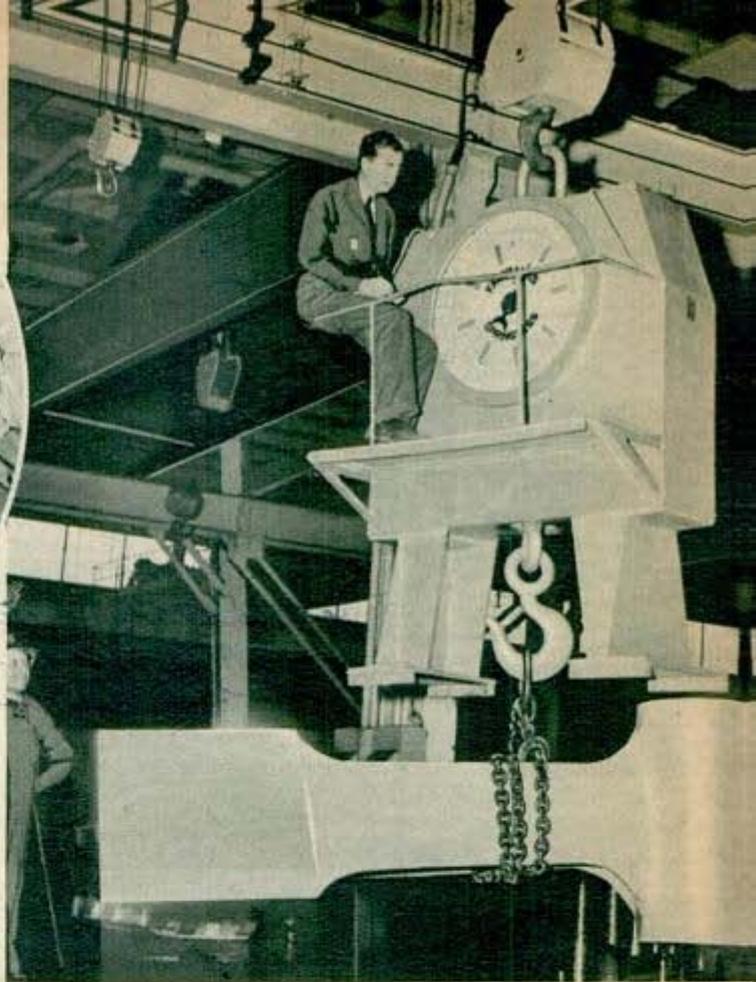
Similar scales weigh all air line planes; others weigh passengers and baggage. Pan American weighs its Clippers every nine months and between weighings keeps a careful record of any equipment additions or removals and structural changes that might alter the weight. Any changes of one-tenth of a pound or more must be reported. Allowance is made even for dust entering through the air ducts, and for dust on the rugs.

Hundreds of scales which specialize in weighing stresses set up by weight on seaplane structures are part of the testing equipment of the Glenn L. Martin plant in Baltimore. Scales which weigh the strains set up by atmospheric force are the basis of all huge wind-tunnel testing devices for planes.

A novel scale in a Wright Aeronautical plant tells in advance how much oil a B-29 engine will use in flight as soon as the engine is built. It weighs the oil every ten minutes while a motor is run for five hours, the difference in weight indicating consumption. Another Wright scale checks plane engines for interchangeability; these engines must match within three pounds.

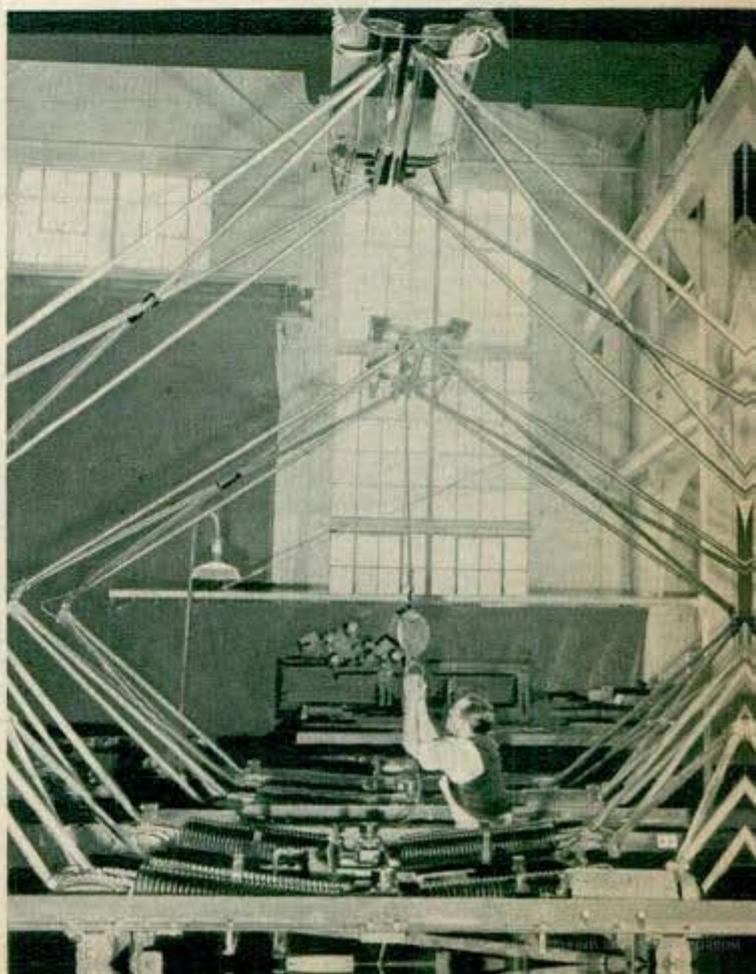
Special scales balance propellers, check fuel consumption by weight, measure rate of oil circulation, or standardize the weights of engine

(Continued to page 156)



Casting for destroyer escort weighs 3,500 pounds, yet scarcely moves hand on dial of 40,000-pound scale. Below, testing adjustment of pantograph for an electric locomotive

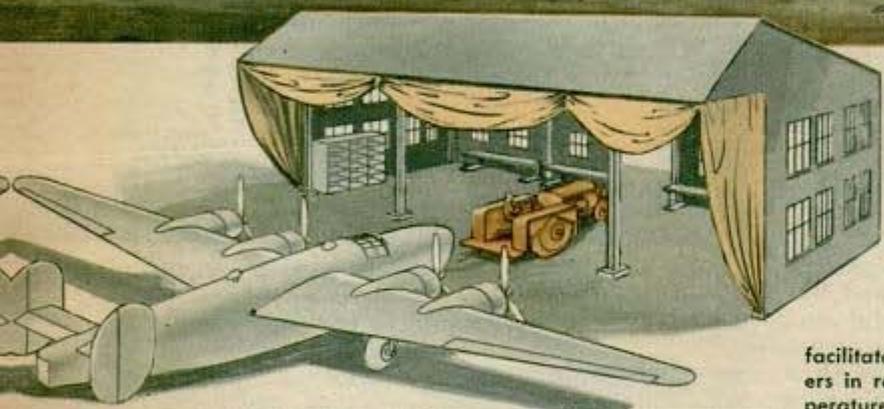
Westinghouse photo



"DRY-DOCKS" for BIG PLANES

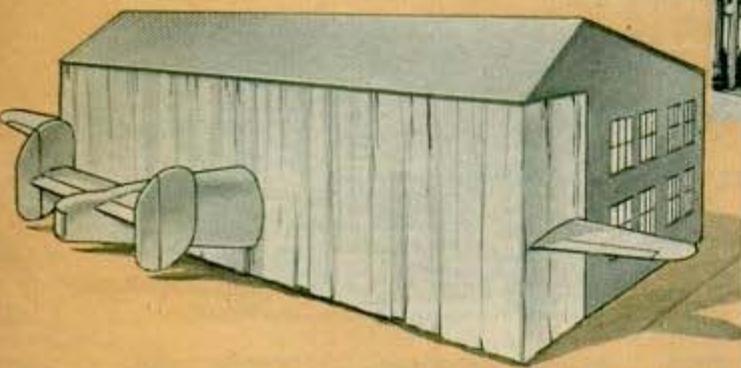
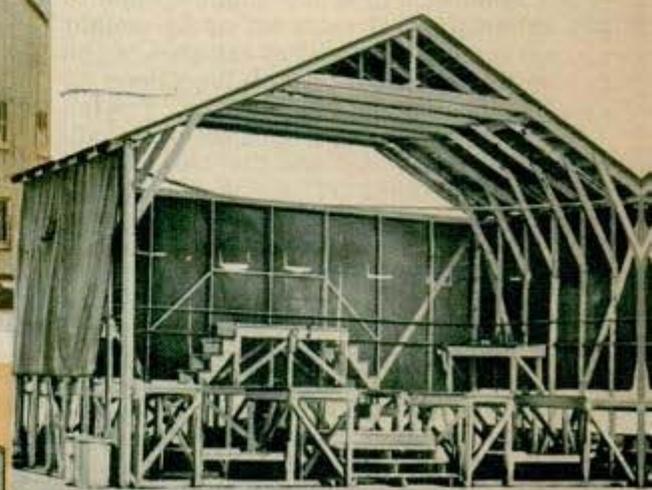


*Consolidated Vultee Aircraft Corp
San Diego, Calif.: Also at Bowman
Field Army Air Base, 1 Troop Carrier Command
Louisville, Ky.*



The Army Air Forces provide special repair shops, or "service docks," for the convenience and safety of ground crews who take care of large planes. The C-47 transport above is having its "face lifted" by mechanics at a maintenance stand on Bowman Field, Ky. The drawing at left illustrates how a plane can be towed to the dock nose-first by a small tractor or "dolly." To

facilitate the overhauling of Liberator bombers in remote combat areas, where low temperature or bad weather makes it impractical to work outdoors, an enclosed dock (lower left) has been invented. The structure which can withstand an 80-mile gale, is so simple that eight men can set it up in three days



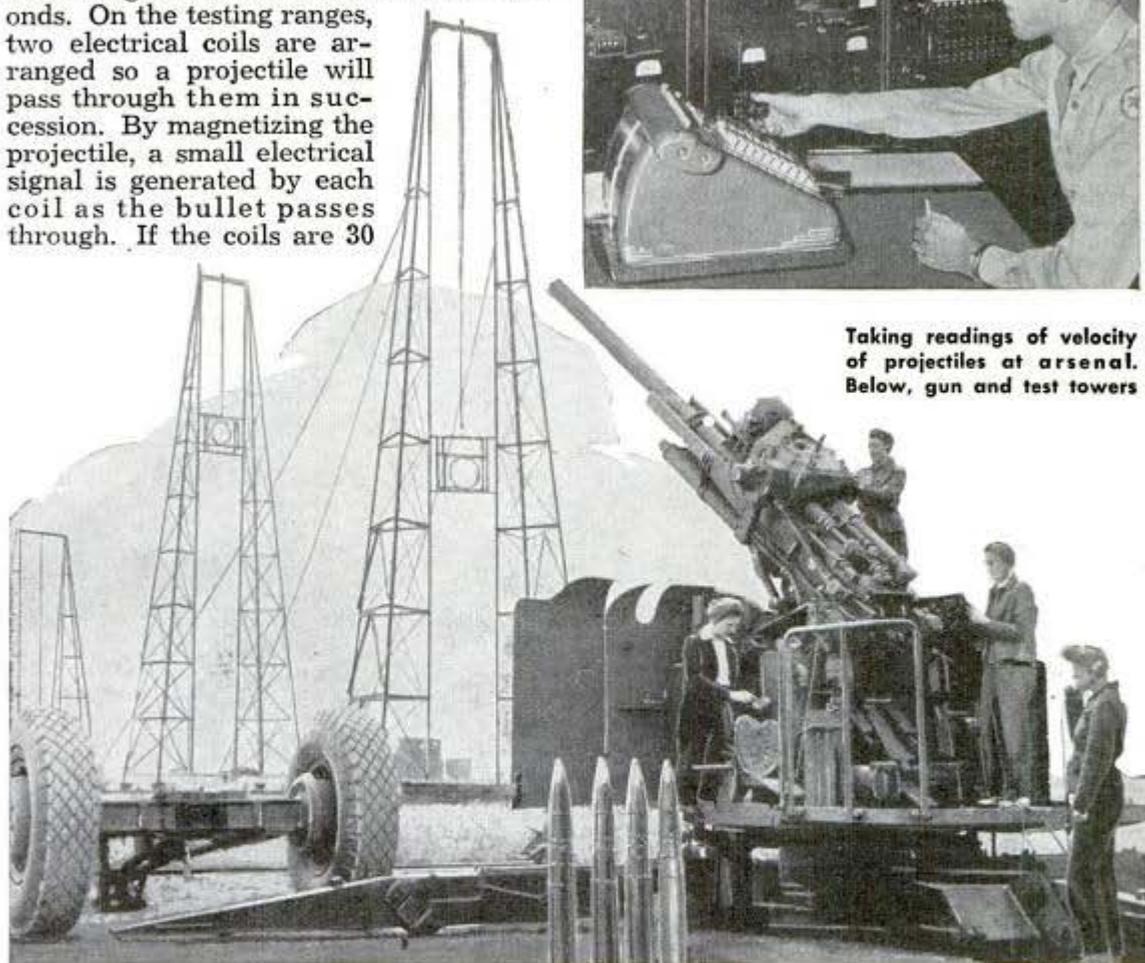
Above, closeup of the maintenance stand invented for Troop Carrier Command ground crews, who service C-47's which evacuate wounded. Left, when dock's curtains are drawn, only wing tips and tail protrude

Electronic "Counter" Measures Bullet's Speed 0 471

By splitting seconds into 100,000ths, an electronic time-interval counter provides accurate muzzle velocity measurements for all types of Army and Navy guns. The "counter," which was developed by RCA and is widely used at government arsenals and proving grounds, checks the performance of a gun and ammunition in a few seconds. On the testing ranges, two electrical coils are arranged so a projectile will pass through them in succession. By magnetizing the projectile, a small electrical signal is generated by each coil as the bullet passes through. If the coils are 30



Taking readings of velocity of projectiles at arsenal. Below, gun and test towers



feet apart, and the time between the two signals is one one-hundredth of a second, the bullet is traveling 3,000 feet a second. The three essential parts of the counter are an oscillator, gate (actually a vacuum tube circuit), and counter proper. The oscilla-

tor, regulated by a vibrating quartz crystal as in a radio transmitter, delivers exactly 100,000 pulses each second. The counter shows the number of pulses, or 100,000ths of a second, that elapse between the opening and closing of the gate.

Sour Milk Acid Makes Synthetic Rubber From Waste Dairy Product 0 227

Lactic acid—the stuff that sours milk—is the principal ingredient of a synthetic rubber developed by chemists of the Department of Agriculture. It is called lactoprene. Molecules of the acid are chemically welded into larger molecules to form methyl acrylate, long used as a raw material for various plastics. This is converted into lactoprene. Milk sugar in whey, con-

sidered almost a waste product in making cheese and industrial casein, provides an abundant source of lactic acid. It can also be obtained from molasses or starch. Other recent developments in the field of synthetic rubber include the addition of fine non-black pigments to prevent heating in tires, and the use of chemical compounds of copper to speed vulcanization.

R. S. A. L. S. P. M. N. J.

Mr. Jensen, Jr.

3872 Frankia Ave.

Los Angeles 27, Calif.

TRICKS of the DOG TRAINERS



Upper right, finish of obstacle course at war dog school. Left, teaching dog to attack. Below, bandaging wound of a British war dog trained to hunt mines
British official photo

DOGS make good soldiers, and thousands are serving with the Army, Marines, and Coast Guard at home and abroad. They are vigilant guards, excellent message-carriers, and ferocious fighters. In the Pacific, the "Devil Dogs" of the Marine Corps go right into combat, sniffing out enemy ambushes and locating Jap snipers.

A military dog is a dangerous animal but he is not vicious. The proof is that the armed forces can train dogs as fighters, put them in active duty for a couple of years, and then untrain them so that they return to civilian life as friendly, tractable animals.



By: Carl Johnson
 7240 Coldwater Canyon Ave.
 North Hollywood, Calif. 0460



That is the procedure at such posts as Fort MacArthur, California, where Warrant Officer Robert Pierce trains dogs to defend a post with their lives, and trains others for message-carrying duties. All dogs first get a course in obedience and learn to sit, drop, stay, come and heel upon command. Then comes the training for military duties.

The guard dogs learn to regard everyone except their handlers with suspicion and to attack, savagely, upon command, any intruder who approaches. The dog knocks the intruder down, hangs onto an arm and keeps the man out of action until his soldier-keeper takes charge.

Messenger dogs get specialized training of a different sort. Their job is to make their way rapidly to a distant command post, carrying messages in a collar pocket, and then to bring back other messages. These dogs must go through, over, or around any obstacles in their paths. One of the training facilities at Fort MacArthur is a dog's obstacle course. Messenger dogs learn to hurdle four-foot barriers on this course, to scramble up 10-foot walls, worm their way through extensive barbed wire entanglements, climb ladders, and make their way



Soldier and combat dog trainee leap from foxhole

Mouse trap with tension of spring adjusted so it will not injure dog is placed on chair in living-room to scare dog out of habit of nap in chair

Its owner grooms prize-winning St. Bernard dog





In teaching a dog to "heel," turn sharp corners while using training leash. The animal soon learns to watch your direction

down steep inclines. Another part of the training is to expose the animals to the sound of heavy gun fire. Dogs naturally dislike loud noises and they must be trained to carry on their duties in spite of this.

Two years of active duty tires out the average dog and he is ready for a rest. Before he goes back to civilian life he must be retrained to break him of his military habits. This is a gradual process. Taught in the service to regard strangers with suspicion, the dog is now taught to look upon them as friends. More and more people approach and handle him and the dog slowly learns that he can trust them all. By the time he is discharged, he has completely forgotten the fighting habits that had been trained into him.

This sort of training can be adapted by any dog owner to break his pet of

War dog trained to attack keeps grip on right arm to prevent enemy's use of gun

undesirable habits. Admonition or punishment when a dog does wrong is not often successful. It's much better for the dog to find out for himself that he shouldn't do certain things. Such habits as running out in the street, chasing cars, or jumping on overstuffed furniture for a nap are easy to eliminate if you know how.

The thing to do, says Earl Johnson, Hollywood trainer of motion picture dogs, is to cause something to happen that the animal doesn't like whenever he offends.

To train the animal not to jump up on a davenport, for instance, set a mouse trap on the davenport. Loosen the spring tension of the trap so that you can spring it against your finger and receive only a moderate rap. Now invite the dog to jump up on the furniture, or let him decide to do so by himself. Inevitably, he steps on the trap. It raps against his leg with a sharp snap. The dog isn't hurt but he doesn't like it, and he jumps down again. One treatment is usually enough and from then on you can trust him to stay off

that particular piece of furniture.

Car chasing can be cured in one easy lesson by asking a couple of friends to drive by your house in the oldest rattletrap automobile they can borrow. The more noise



the car makes, the better. As soon as your dog runs out in the street and begins to chase the car, a passenger should dump out a few large tin cans filled with rocks right in the dog's path. Backfiring the engine at this point would also help, the point being to make as much noise and clatter as possible. The dog has been enjoying himself but now he finds himself in a noisy, frightening situation. He scampers home, cured of car chasing for a long time to come. Pet the dog when he returns home and encourage him to stay.

Spoken commands are rarely effective at the start of any training program because ordinarily a dog is more interested in whatever he happens to be doing than in listening to your voice. A good way to keep him alert, says Johnson, is to toss a handful of metal chain at his hind quarters when his attention is wandering. This isn't harsh treatment at all. Use a piece of chain about a foot long, weighing half a pound. When this is tossed at a dog it thumps and startles him but doesn't hurt. The chain is noisy and makes a clinking sound the dog doesn't like.

Throw the chain at him, then call him to you. He is glad to respond, partly because he is now paying attention and partly because he's glad to get away from a spot where something unpleasant happened to him. Always pet and encourage the dog

(Continued to page 150)

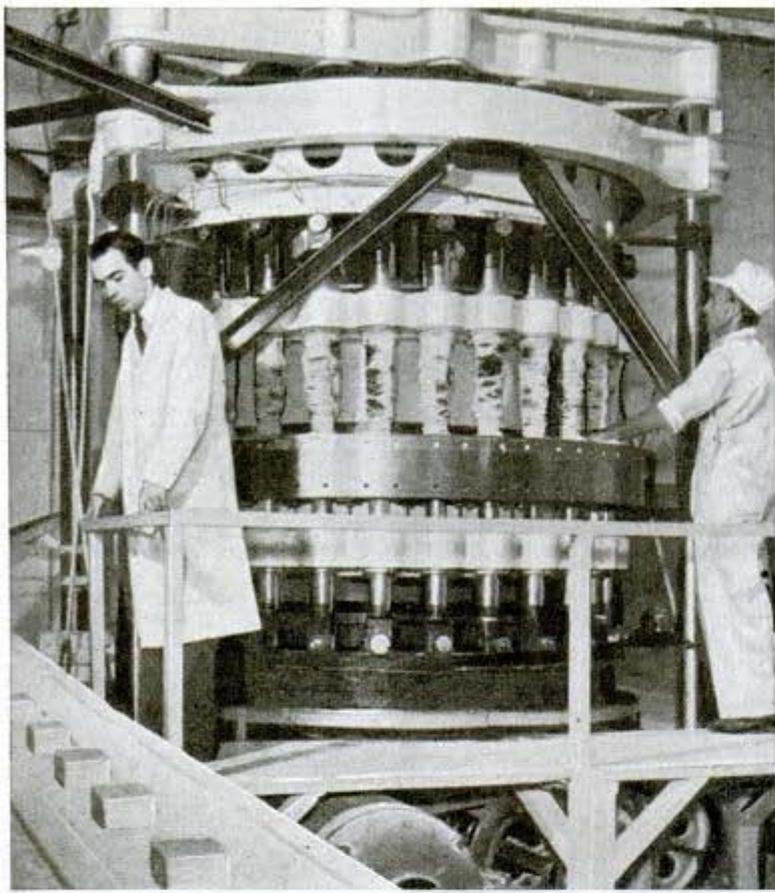
Right, British soldier marks a mine "sniffed" out by dog. Twenty of these animals can clear a 16-yard lane 200 yards long in a half hour. Below, U. S. Army dogs have private kennels at Fort MacArthur, Calif.

Army work dog tows soldier on cart loaded with feed



Rotary Food Press Produces Soup in 1-Pound Bricks

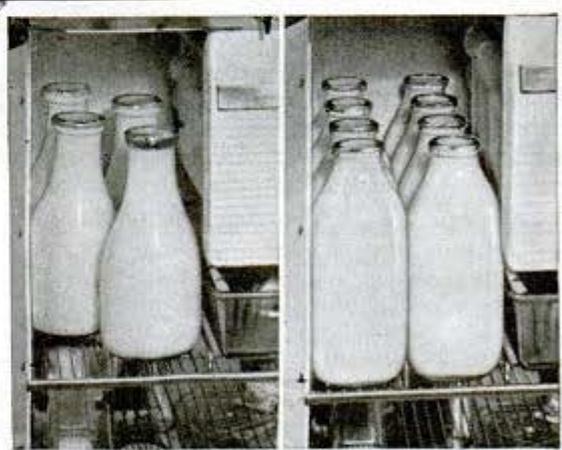
Less space in cargo ships is needed for dehydrated food turned out by a \$250,000 rotary food press, which makes it possible to pack 56 one-pound food bricks into a case which previously held only six five-pound cans. The cylindrical machine, used by the Doughboy Mills Company, New Richmond, Wis., produces 180 bricks of compressed, dehydrated soup per minute, 24 hours a day.



Left, bricks of cheese soup on the conveyer belt of the rotary food compressor used in New Richmond, Wis. One-pound package of this dehydrated soup will yield about twenty-five average servings

Square Milk Bottles Weigh Less And Occupy Less Space

Square milk bottles developed by the Owens-Illinois Glass Company, Toledo, O., save from 20 to 50 percent in storage space, depending on the size of the refrigerator compartment. The firm announced that one large dairy company found that grocers could store 36 square bottles on a shelf which holds only 25 round bottles and that three square bottles fit into a sack which admits only two round bottles. The new bottle also has a no-drip feature. The square quart bottle weighs 17³/₄ ounces in contrast to the old-style 22-ounce bottle.



0 517

8-Sided 'Doughnut Desks' Save Steps for Clerks

Eight-sided "doughnut desks," each of which has 17 files within reach of the clerk sitting inside it, have appeared in the offices of the Texas Division of North American Aviation, Inc. Built in the company's woodshop, they increased clerical efficiency 850 percent, reduced personnel needs 72 percent, and halved the floor space needed for ordinary files.



0 490

Troops Use Indian "Tump-Line" to Pull Loads

Canadian soldiers carry equipment over rough terrain and evacuate wounded with the "tump-line" method used by North American Indians and fur trappers. This consists of a strap broadened in front to fit across the top of a man's head, and with long ends which are attached to whatever is carried or pulled. It is said that greater loads can be carried by tump-line with less fatigue once the neck muscles are hardened. The Canadian Army uses tump-lines with packboards to carry medical supplies, machine guns, mortars and other equipment. A sled-type stretcher with tump-line attached is used to move wounded under fire.



0532

Yanks Concoct "Hillbilly Code" to Name Jap Warplanes

In combat reports, Japanese aircraft are identified as Zeke, Nate, Rufe, Jake, Lily, Nell and scores of other snappy personal names. This is known in the armed services as the "hillbilly code." It was so named, relates Air Force Magazine, because the officer in charge of the Air Technical Intelligence Unit who put the system into effect in July, 1942, was from Tennessee and the first code names had a backhills ring. At that time there was much confusion as to what to call Jap planes, and only about a dozen were haphazardly labeled. Official names used by the Japs were almost hopeless. The Zeke, for example, was officially

the Type Zero Mark I Carrier-Borne Fighter Model I. Identification by manufacturer was impossible, for companies such as Mitsubishi or Nakajima made several types. The ATIU inaugurated its own system—personal names, with fighters and observation planes masculine; all bombers feminine—and in four months 65 types of aircraft had been named. The number today is about 100 and the code system has been officially adopted by the Allied Air Forces in the Southwest Pacific, the ground forces and the Navy. Recently a joint arrangement was worked out between the Army, Navy and British and new code names are officially assigned by the Technical Air Intelligence Center at Anacostia, Washington, D. C. In many cases, the code name has some connection with the type of craft. Zeke, for instance, is the best known of the "Zero" types. Nell is a "twin-finned belle," and Dinah has a "nice linah." One fighter was named Tony because it was first mistaken for an Italian plane. Ships have been named not only for hillbillies, but sweethearts, wives, daughters and airmen.

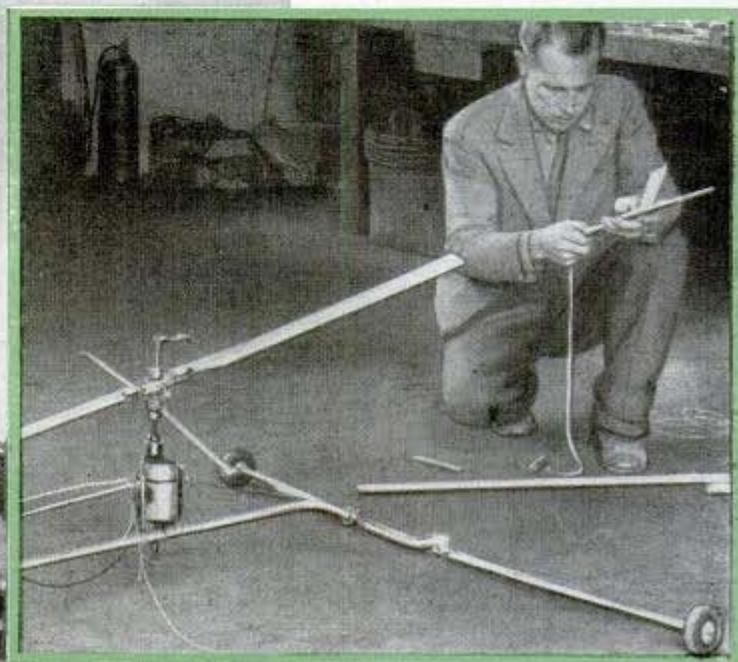
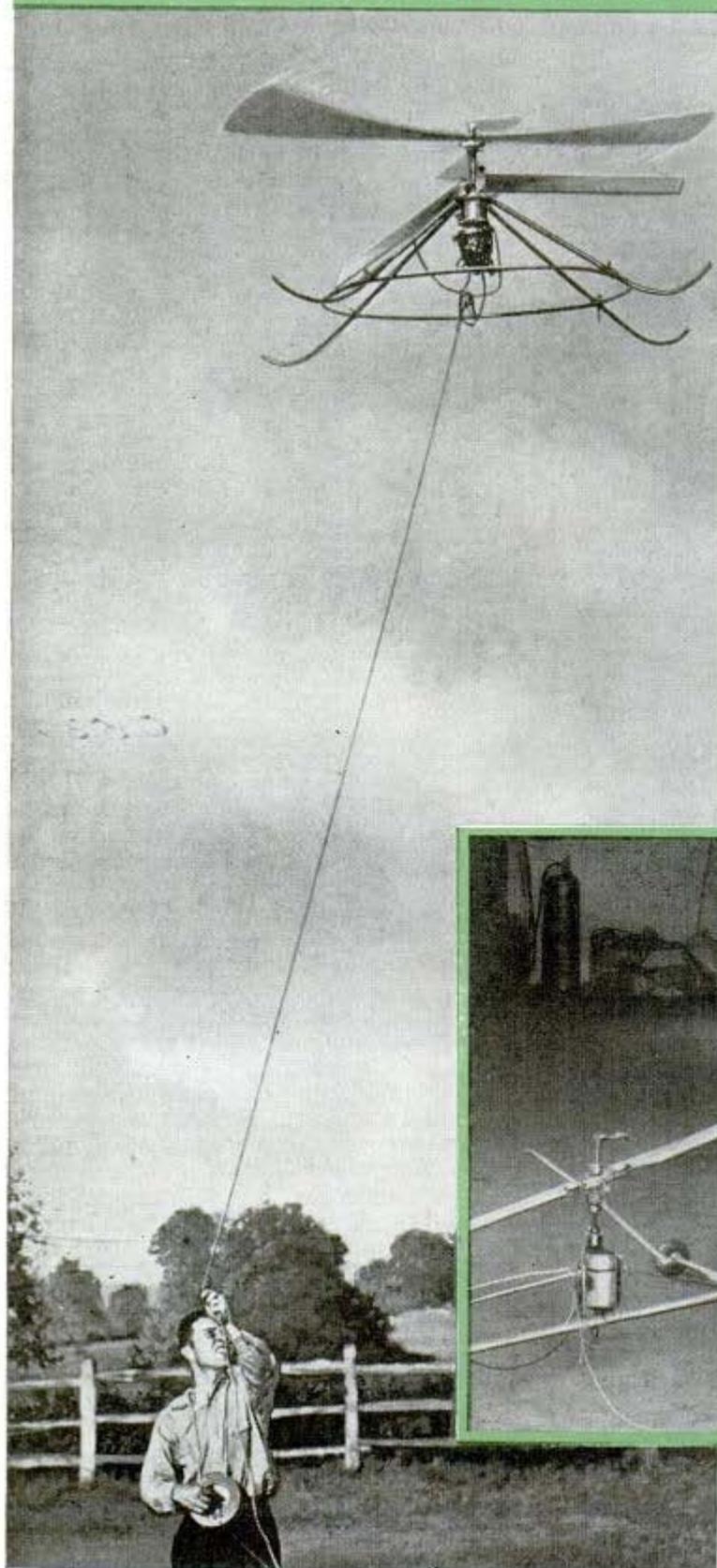
TONY		T 3; single-engine, single-seat fighter
ZEKE	T 0, Mark 1 and 2; single-engine; single-seat fighter	
BETTY		T 1; twin-engine, medium bomber, torpedo bomber; reconnaissance
SALLY	T 97; Mark 1, 2 and 3 twin-engine, medium bomber	

The TOY that GREW UP

IT LOOKED like a toy—a small contraption resembling the rotary part of a windmill, revolving in a horizontal plane. Each blade had a propeller to pull the rotor around. When a switch was turned, an electric motor set the little propellers in motion, thus drawing the big windmill around rapidly. The machine took off in clumsy, teetering flight.

True, that flight was a bit on the wobbly side; but it was one of the first steps in a long period of experimentation, trial and error, and disappointments that finally brought the inventor the satisfaction of seeing his brain child—a new and simplified helicopter—fly in full-scale size.

The inventor of this “windmill” is Arthur Middleton Young, of Philadelphia, who began work on the helicopter soon after his graduation from Princeton in 1927. He tackled the problem by performing his own mechanical experiments in



Months of tinkering with models in the workshop (above) preceded the completion of a small-scale helicopter that would actually fly (left) under control

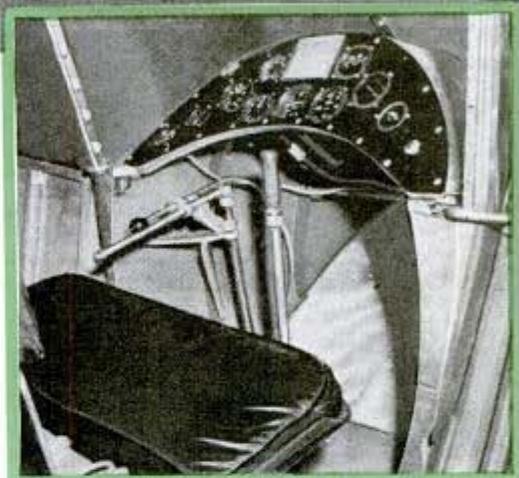


Hovering over Wright Field is the Platt-LePage XR-1, a dual-rotor helicopter undergoing tests for the Air Forces

his shop along with his theoretical studies.

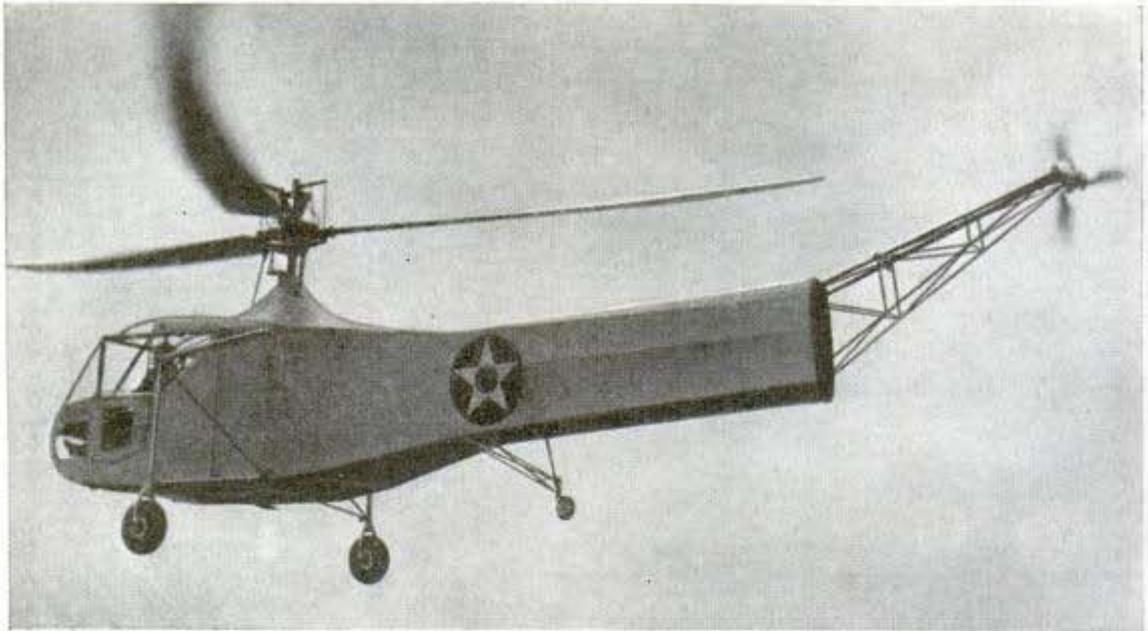
From early models, the inventor went to a larger one powered with a quarter-horsepower electric motor. After this model proved its ability to fly, he experimented with a 20-horsepower model. But the use of small propellers had introduced many difficulties so the design was changed to the shaft-powered model, both in the single rotor form and in the form of coaxial models. Test flights with these models indicated that instability was an inherent characteristic of then conventional helicopter types.

Prolonged search for a method of obtaining stability led eventually to the introduction of an "artificial horizon," a gyroscopic device to



Below, the Bell helicopter hovers just above the ground; above is its cockpit, showing the stick and lever at its left, which are the only controls





The Sikorsky helicopter was the first adopted by the AAF. This is its latest version, the XR-6

govern the position of the rotor in space. A model with such a rotor, governed by a rotating bar, was built, and satisfactory stability characteristics resulted. The net effect of the stabilizing bar was to keep the rotor in a horizontal or near horizontal plane despite any gusts of wind or other forces which might affect the cabin. Not many models later, came one having the general proportions of a full scale helicopter, incorporating the rotary bar for stability, and with a small propeller in the tail to overcome torque and provide directional control. This model also had a satisfactory landing gear, directional gyro, and was op-

erated by a portable control box and cable.

Inventor Young brought the remote control model to Buffalo in a suitcase and demonstrated it for Lawrence Bell, president of Bell Aircraft, in 1941. Mr. Bell had long been interested in helicopters. They made a deal, and work was begun on a full-size machine. On July 30, 1943, Model 30 made its public debut at a local airport, an occasion described by one of Young's associates as follows: "Amid wisecracks of local light airplane pikers, the rotor was started and the helicopter went to town."

Fourteen years of pioneering, persistent hard work had made the dream a reality.

From then on, many flights under varying conditions have been made. All the problems of low first cost, ease of control, etc., have not yet been solved. Larry Bell is highly enthusiastic, yet careful not to arouse false hopes of "every family owning a helicopter right after the war." He believes the helicopter will lead to a big postwar industry, when commercial applications become possible, and that ultimately helicopters will reach the hands of private owners.

The pilot of the Bell "windmill" gets a congratulatory handshake after landing in an aiming circle in Buffalo armory. Notice the five-foot stabilizer bar



A large stride toward simplified control has been taken in the Bell ship. If you were in the pilot's seat, you would face an extremely simple instrument panel with indicators for engine revolutions per minute, rotor revolutions per minute, vertical speed, air speed, manifold pressure, oil pressure and temperature. There are two controls, the stick and a lever at the left. The stick exercises tilting control of the rotor and the ship flies in the direction in which the stick is pushed. The engine control or throttle is on the head of the stick and is operated by twisting the grip on the handlebar.

The lever is raised and lowered to control the pitch of the main rotor blades. Moving it to right or left changes the pitch of the tail rotor, controlling direction of flight. Attached to the lever is a control for the governor which regulates engine power to maintain constant the revolutions per minute of the rotor despite changes in pitch.

This current Bell ship employs a two-bladed rotor as compared with the three and four blades of other helicopters. The blades are rigidly connected to the hub, which is mounted on the mast by a universal joint. This construction makes it possible to control the rotor by rocking the entire hub unit about its longitudinal axis, and the design adapts itself well to the stabilizing rotating bar.

Power is furnished by a 160-horsepower six-cylinder opposed Franklin engine. The present model cruises at 80 to 90 miles per hour and has a top speed of 100 miles per hour. Hovering is about the toughest job for the helicopter; that requires about 110 horsepower. Minimum power, approximately 60 horsepower, will maintain the ship in forward flight at about 50 miles an hour.

Should the engine fail, the craft could land safely by "free wheeling" vertically to earth at 26 feet per second with its freely rotating rotor supporting the ship.

Pilot and passenger sit side by side. Panels of transparent plastic, plus ingenious cabin design, afford excellent visibility. The occupants can look almost straight down from the side windows. Loaded, the 'copter weighs approximately 1,950 pounds.

The outstanding feature of the craft is the stabilizer bar, which is about five feet long, weighted at the ends and placed at right angles to the rotor blades. It is fastened to the mast so that it is free to pivot vertically. It acts as a flywheel, tending to continue rotating in the same plane, regardless of changes in the angle of the mast. The bar is linked to the rotor in such a way that it tends to maintain the rotor in a gen-

(Continued to page 152)

0 536

Drawings Printed on Metal With Light-Sensitive Paint



By developing special layout paint and a layout paint primer, the Eastman Kodak Company has simplified the method of printing working drawings directly on a metal surface. The primer serves as a base for the paint, which is sprayed in ordinary room light directly on the cleaned metal surface. The paint dries rapidly and the prepared metal is ready for immediate use or it can be stored for a reasonable time in a dark place. The drawing—prepared beforehand with black ink on a transparent or translucent material—is then laid in contact with the prepared surface and an exposure of a few minutes duration made before arc or mercury vapor lights. When the drawing is removed, the metal is flooded with warm, weak ammonia water. Next a vigorous spray of tap water washes away the entire exposed coating, leaving only white lines where black lines appeared in the drawing. Another thin spray of paint primer protects the finished product. Parts marked in this fashion are said to be as accurate as the original drawing. The special paint withstands bending, shearing and punching without loosening.

(See the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.)

"Kodak Transfer Process"
Rochester, N.Y.

BATTLEWAGON STEEL

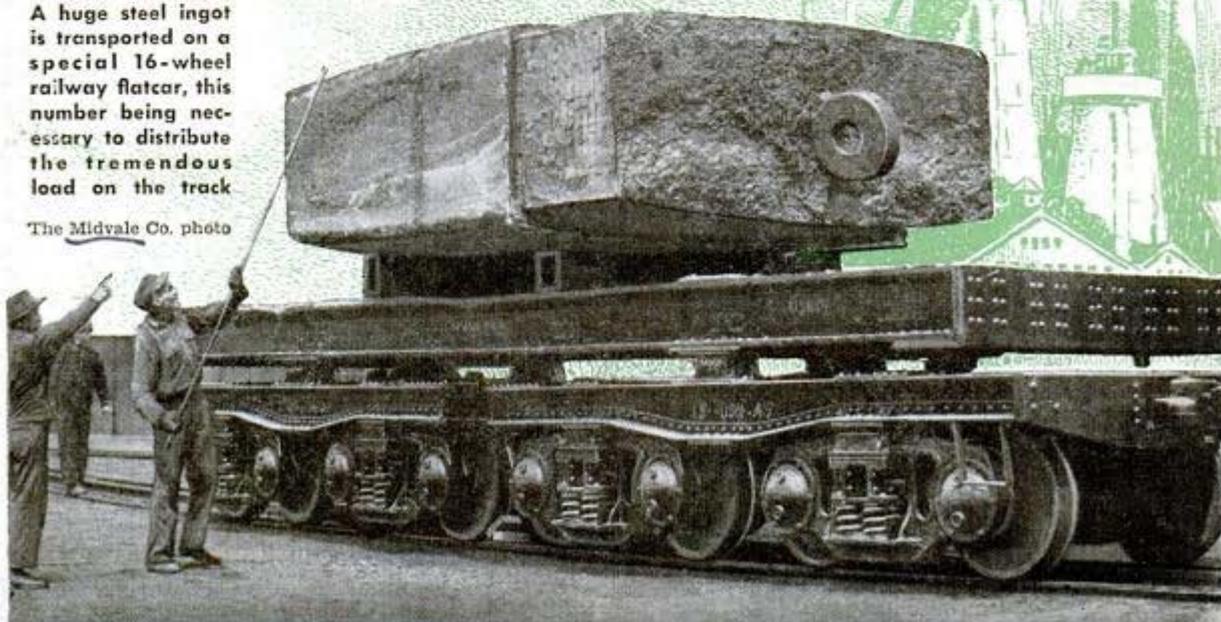


The armor steel that is winning the war—the U.S.S. Alabama, one of our newest 16-inch gunners. Below, checking temperature with optical pyrometer in furnace of a Naval Ordnance plant



A huge steel ingot is transported on a special 16-wheel railway flatcar, this number being necessary to distribute the tremendous load on the track

The Midvale Co. photo



ONE of the biggest naval victories in history hasn't gotten a headline during the war.

It was a battle against time. It was fought in a few gigantic steel mills where the highly specialized task of producing battlewagon steel—heavy armor plate for our largest warships—goes on night and day. It was won by the sweat and brains and brawn of grimy steel workers, engineers, scientists, civilian executives and navy experts. It was a struggle to rush out great flat slabs of tough, hard steel to protect our battleships and heavy cruisers, and to improve the quality at the same time.

When it was over, we were getting heavy armor plate in about

half the time it had taken previously.

What this victory means is indicated by the fact that it still takes more than five months of continuous operation to make a single slab of this precious material.

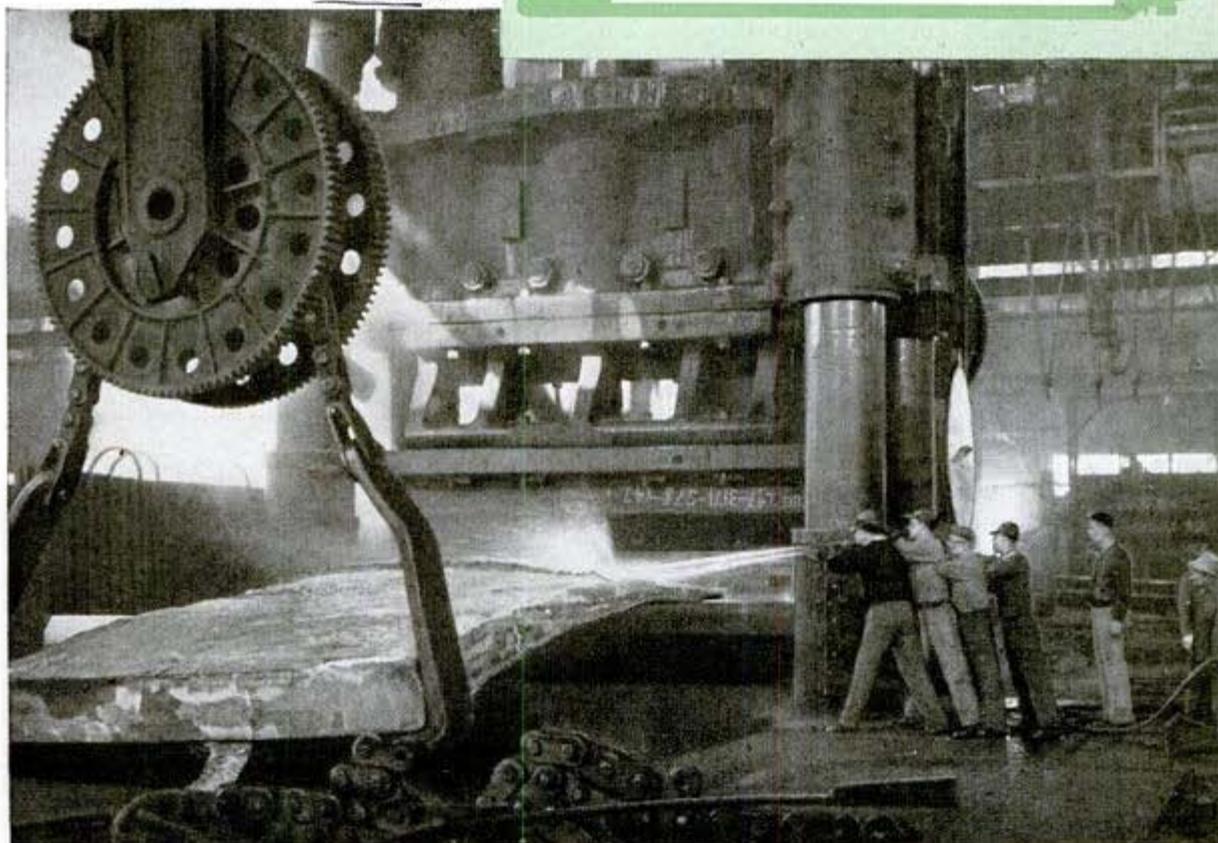
How good is the stuff? Well, it is one reason why the Japs are hiding their navy. Superior armor plate enabled the battleship South Dakota to slug it out, toe to toe, with the best the Japs had to offer. She helped sink five warships in two engagements. The Missouri is demonstrating some new wrinkles in deck armor including a special new light armor which sheds strafing attack bullets like a duck sheds water.

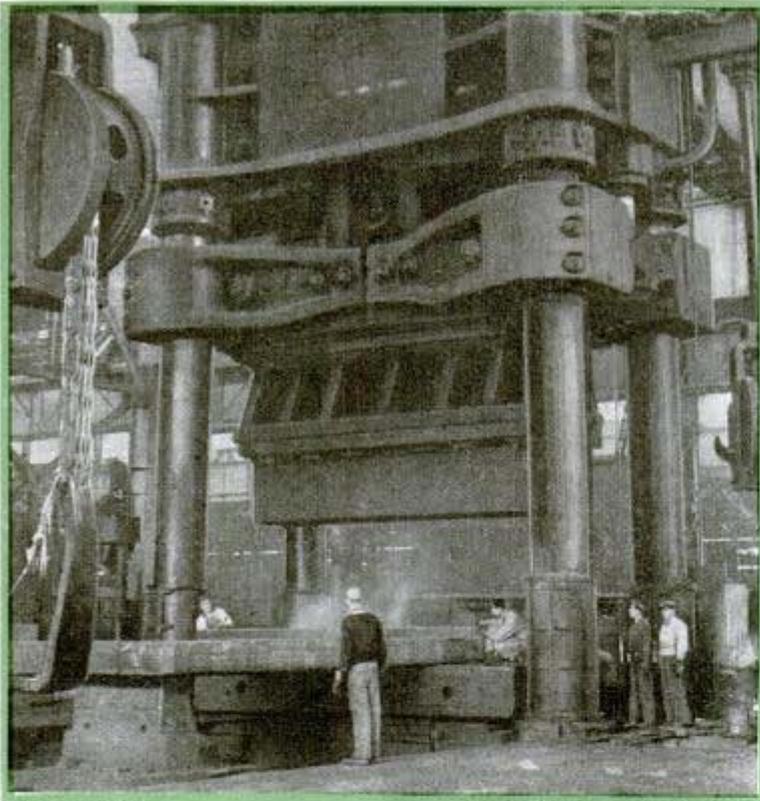
It's the big stuff that counts when the foe begins tossing steel slugs the size of beer

Nickerson 40, Pa.

At upper right, sample of melted steel from Midvale Co. furnace is poured into 2-inch test ingot for chemical analysis. Diagram shows armor-plated area of battleship. Below, flushing pulverized coal off a slab of armor plate before forging

U. S. Steel Co.





U. S. Steel photo
Checking flatness of an armor-plate slab under 14,000-ton press. At right, X-ray unit examines stresses in marine casting

kegs at the vitals of a great warship. This type of steel is placed in a thick belt which extends from below waterline to deck, across the decks and over the gun turrets. The object is to shield the big guns, the ammunition and the propulsion equipment from a crippling hit.

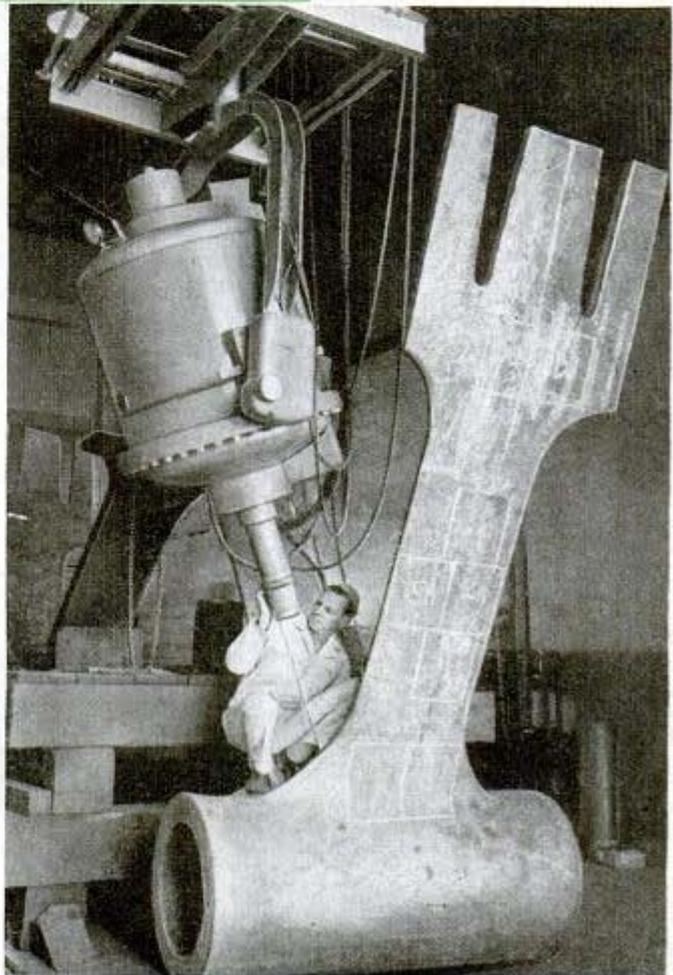
It takes two kinds of steel to make one of these plates, but the two kinds must exist as integral parts of the single piece. The outside must be hard. The inside must be tough. Treatment of one part can't be allowed to ruin the other.

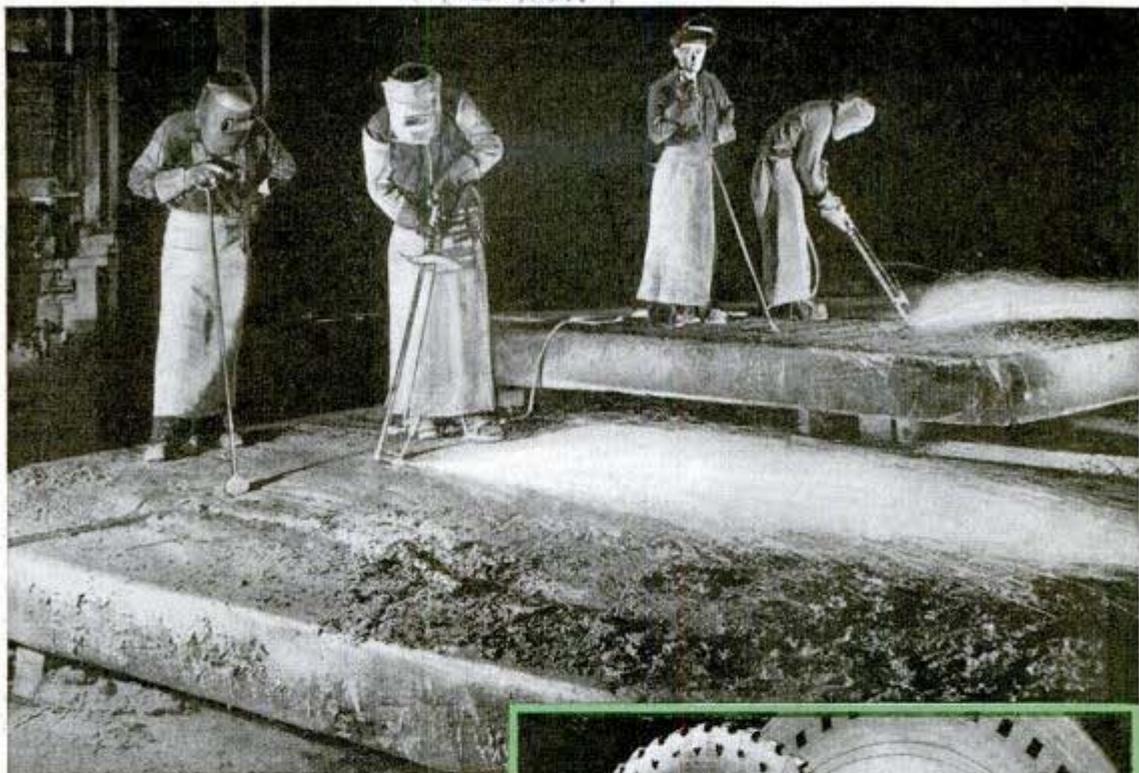
The constant labor of five months can be spoiled in five minutes. It's delicate work on a piece of metal which often weighs more than a house. The two greatest hydraulic presses in the world, each exerting a force of 28,000,000 pounds, are devoted to this task in a plant of the United States Steel Corporation.

A plant of Bethlehem Steel Company has produced a single ingot, which was later pressed into armor plate, weighing 500,620 pounds, pouring it, moving it from

point to point, shifting it in and out of presses and bending the slab into shape, all the time controlling temperature, time and metallurgical processes with watch-making precision.

Without this precision, the necessary relationship between the hard face and tough body of armor plate cannot be achieved. The face must be hard enough to take most of the velocity out of a steel shell traveling 1,200 feet a second within perhaps half an inch of armor. This it does by converting the forward force of the shell into heat, bringing instantaneous temperatures above 2,800 degrees Fahrenheit, at which point both shell and the surface of the armor are likely to splash



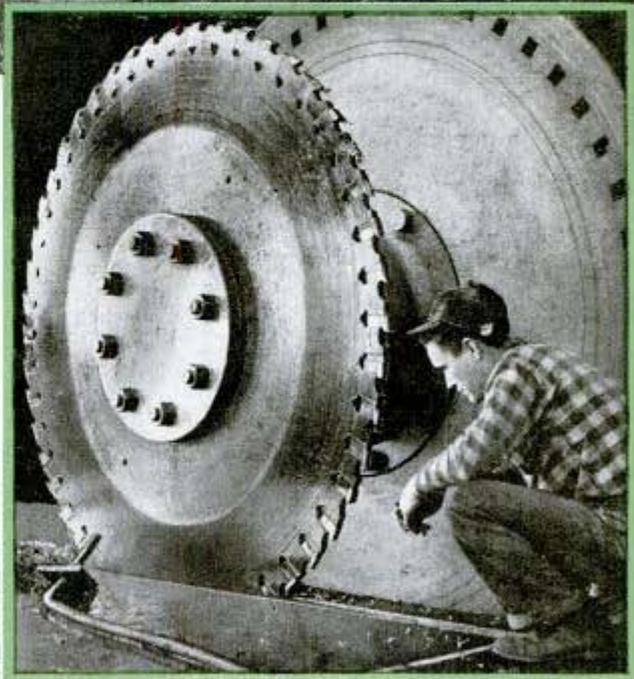
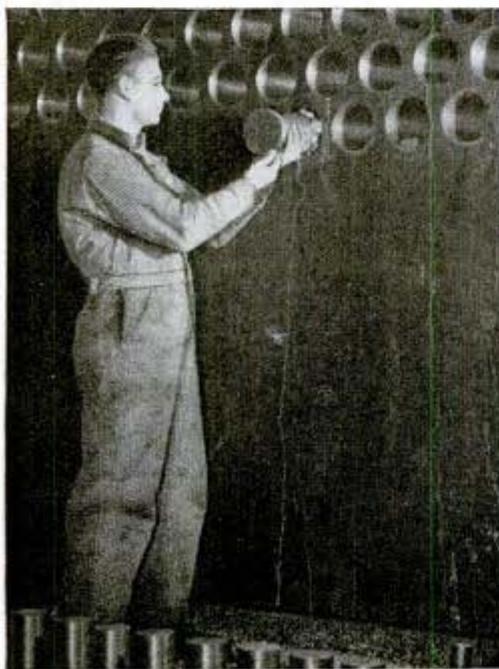


Bethlehem Steel Co.

Torches remove debris and surface imperfections from a nearly finished slab of steel

like water, only to congeal into rigid steel again.

If the armor face is hard enough, the shell is likely to splash, skid, dig a furrow and fall off into space. But if the whole plate were hard, it would crack or shatter and the shell would plow through. So, beneath the hard face is the core of tough, more elastic



Carnegie-Illinois Steel Corp.

Steel-toothed rotary saws cut rough edges from naval armor plate. Left, boring holes in armor grating for battleship

steel which gives the necessary "bounce" to shunt a shell away, or disperse the concussion which the hard face withstands.

This super-tough steel used in backing the face of belt armor is also applied to decks, to withstand the shock of an aerial bomb.

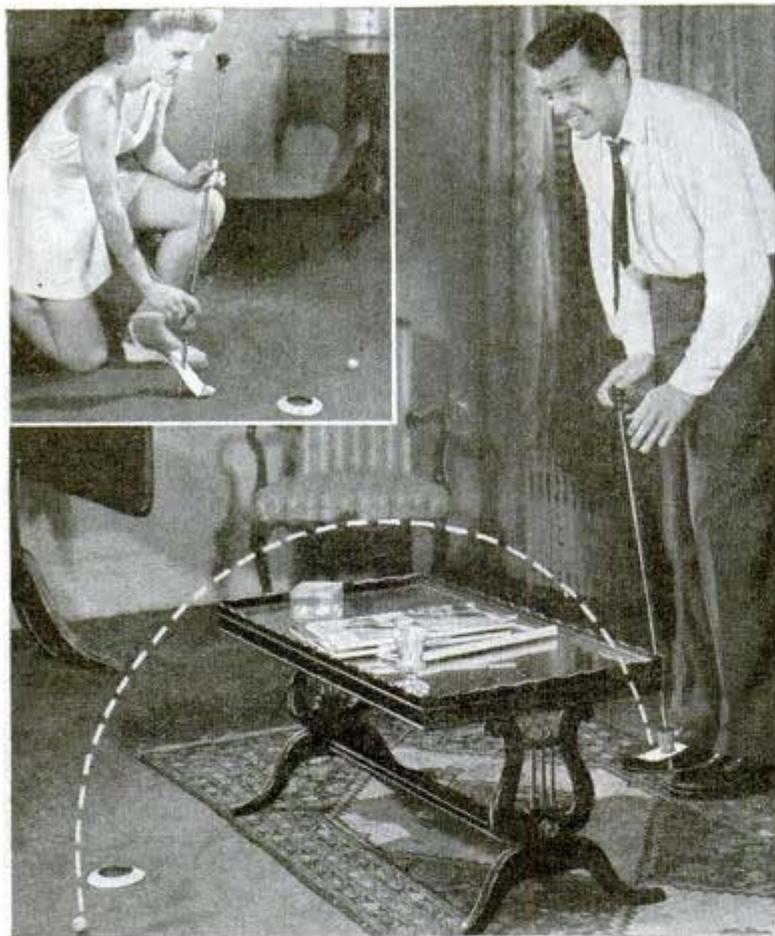
With the exception of recent advances, the method of face-hardening steel by infusion of carbon was invented by Krupp of Germany and perfected by an American, H. A. Harvey. It consists of "carburizing"—applying a black

(Continued to page 154)

Burgess Battery Co., Sandicraft Div.
180 N. Wabash Ave.
Chicago, Ill.

0487

"Kicker" Club Lifts Parlor Golf Ball Over Table



Nine holes of golf can be played indoors with a parlor set complete with disklike numbered holes and special clubs. The club consists of a stick with a plunger which is dropped against the "head" to push or kick the ball. The trick is to adjust the movable head, or paddle, in the proper direction and to release the plunger at the desired height. By falling on the back of the club head, the front is lifted to propel the ball. The stick is held perpendicular for a short-pitch shot, and is tipped forward for distance and to reduce loft. Various types of hazards can be made with books, pillows or pans of water.

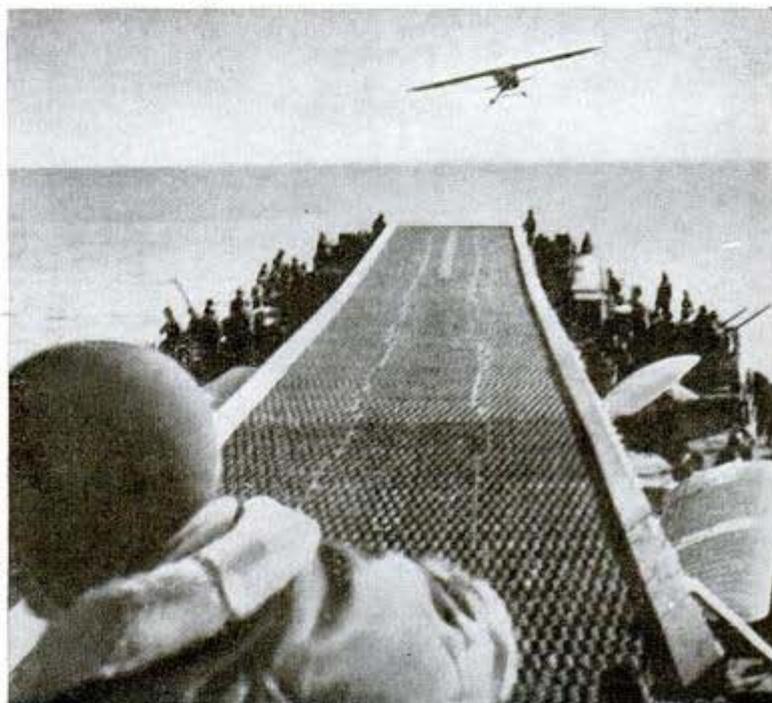
Parlor golf player drops a neat one over coffee-table hazard right onto the "green." The trick is to drop plunger on club (see inset) from proper height to kicker

0516

Flight Strip Makes a Flattop Out of an Invasion Craft

With a portable landing strip covering the deck, an LST (Landing Ship, Tanks) serves as a baby aircraft carrier. Small reconnaissance planes can take off or land on the strip during invasion operations, it was revealed recently by the Navy. An LST "flattop" manned by Coast Guardsmen and carrying eight aircraft took part in the beach-head battle off Anzio.

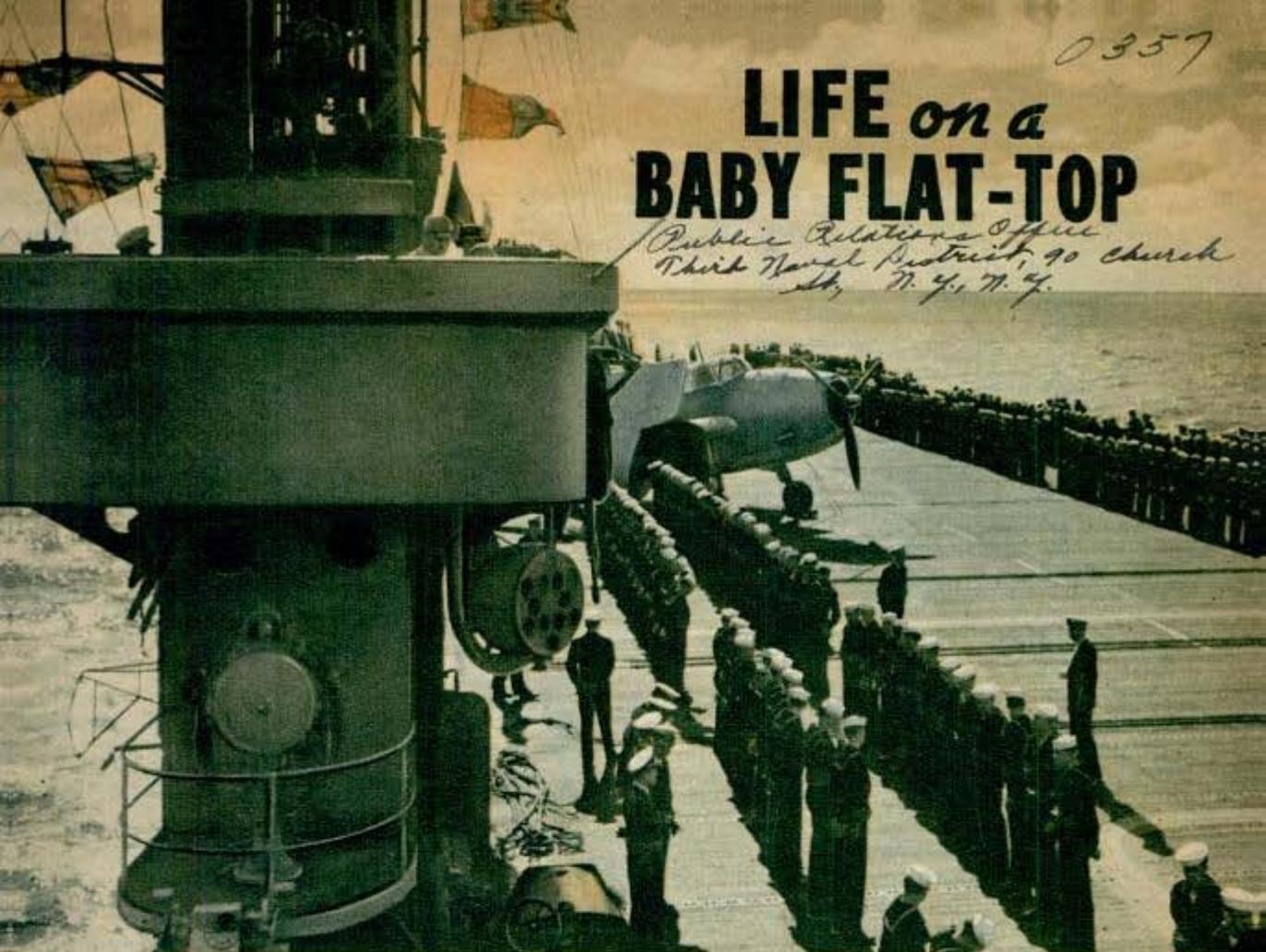
Reconnaissance aircraft takes off from portable landing strip covering deck of an LST. Planes can also land on these steel mesh strips after a mission is completed



0357

LIFE on a BABY FLAT-TOP

*Public Relations Office
Third Naval District, 90 Church
St., N. Y., N. Y.*



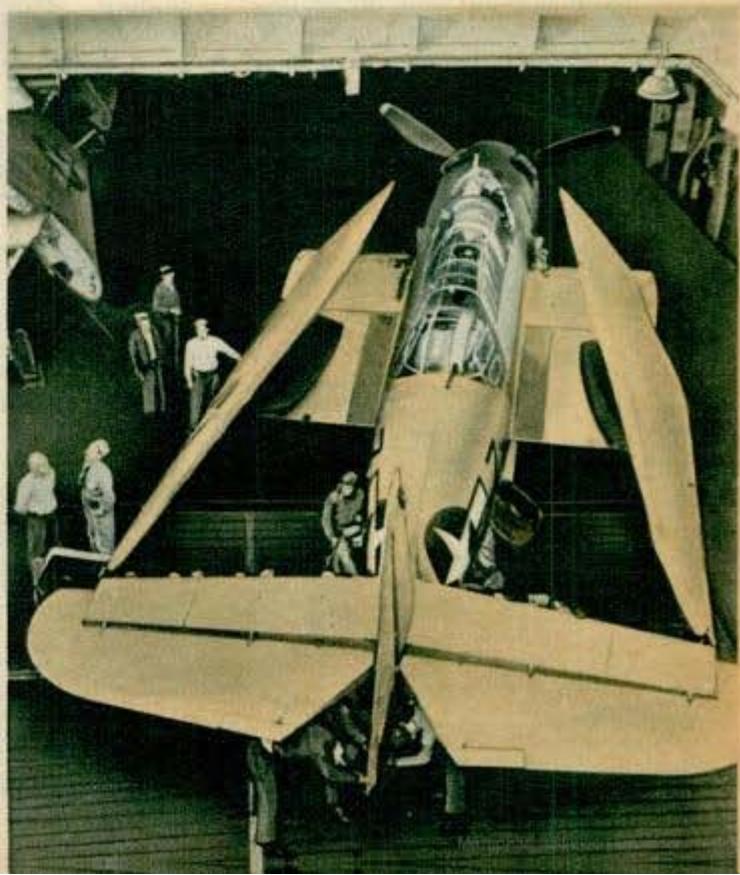
BABY FLAT-TOPS — auxiliary escort carriers—have become the most numerous type of large-sized warships plowing the seas today. They have far out-numbered the huge carriers they were intended to supplement. They have graduated from mere conquerors of wolf packs to important naval units. Where carriers are counted singly, these ships are reckoned by scores.

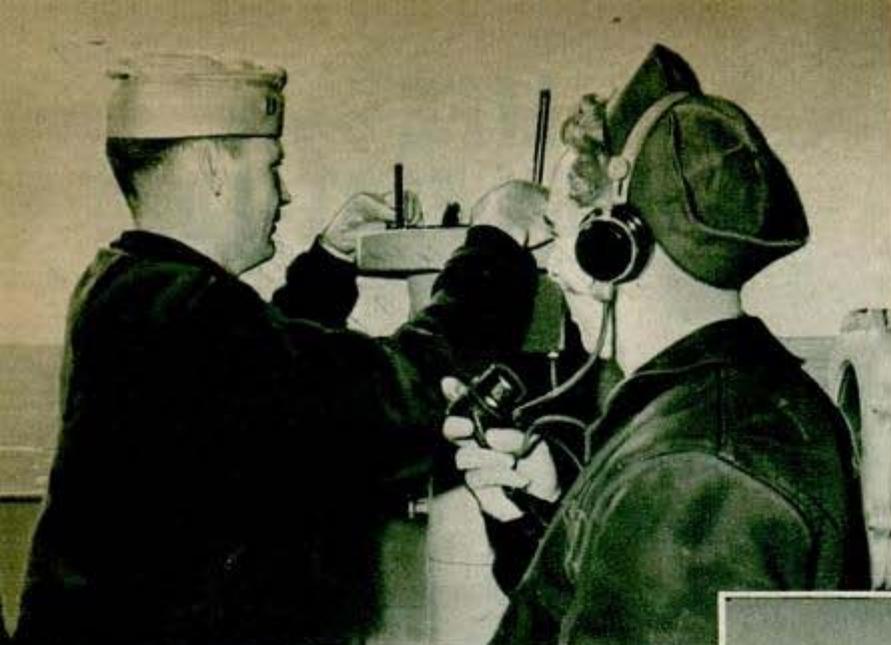
These "battling baby carriages," averaging around 10,000 tons and costing around \$11,000,000, were originally converted merchant ships, or made-over tankers, but now they have an identity of their own. They have added thousands of men to the list of those trained for carrier duty.

Thanks to the mighty midgets, carrier men have become a sizable branch of the Navy, numbering thousands—a new breed of seafaring fighter, perhaps. And life on a flat-top is becoming a way of life itself.

The veteran of a \$75,000,000 carrier might sniff a bit and pull in his elbows on a baby flat-top, but a de-

Captain's inspection (above) is about the only time crew on an escort carrier is out of dungarees on a war cruise. Below, torpedo bomber, with wings folded like tired bird, is pushed off elevator which lowered it from flight deck





U. S. Navy photos

Officer of deck and "telephone talker" are inseparable team who pass on vital information to the men

stroyer man's eyes would pop at the spaciousness. A flight deck comparable to a football field. A hangar deck which would cover a good part of a city block. A whopping machine shop to service planes. Plenty of bunk room, instead of hammocks for the over-flow crew.

A submarine man's ears might wiggle at this kind of Navy service. There's room for basketball, volleyball, and other sports. A corner of the hangar deck, blacked out and minus portholes, makes a good-sized movie theater. There's even an organ or piano to boot.

Food? There's real storage room on a baby flat-top and big galleys, including ovens extending all the way from one deck to another.

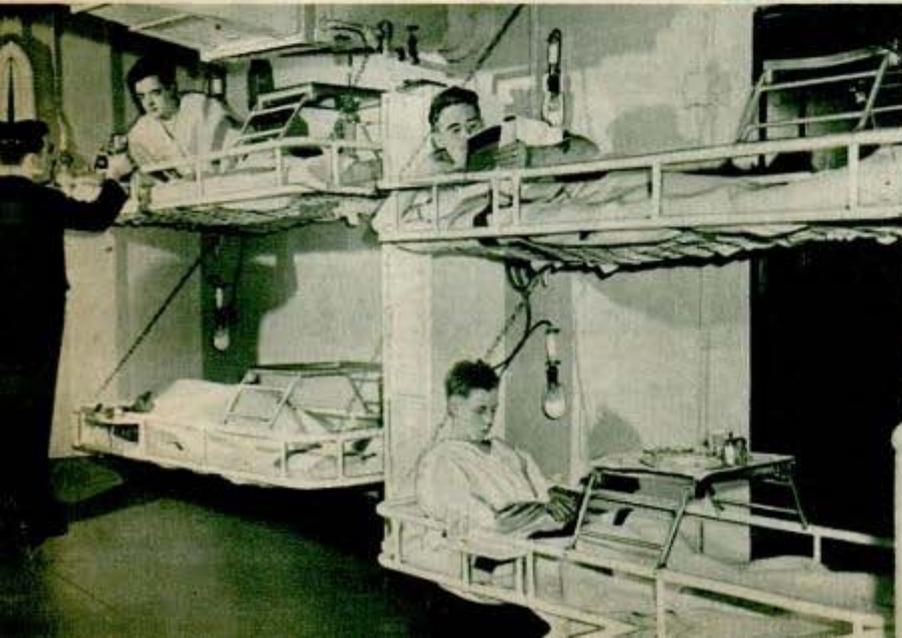
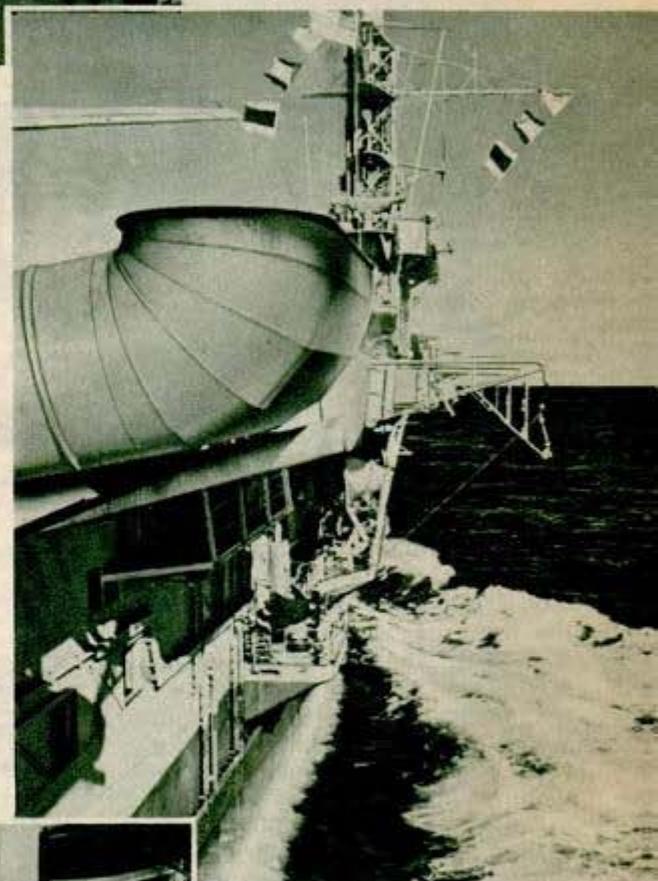
The sick bay is a small hospital compared to some on smaller warships. And there is a tailor shop, barber shop and

Right, odd smokestack and island on starboard side. Below, pharmacist's mate calls on men in sick bay

soda fountain. Instruction rooms. Ready-rooms. Staterooms for pilots and officers. Laundries. Parachute rooms. Storage rooms for torpedoes and plane parts.

The increasing range of the airplane may cause the baby flat-top to vanish from the seas as quickly as it appeared. But some of the varieties of sea-going scrappers on these ships will live on in naval history.

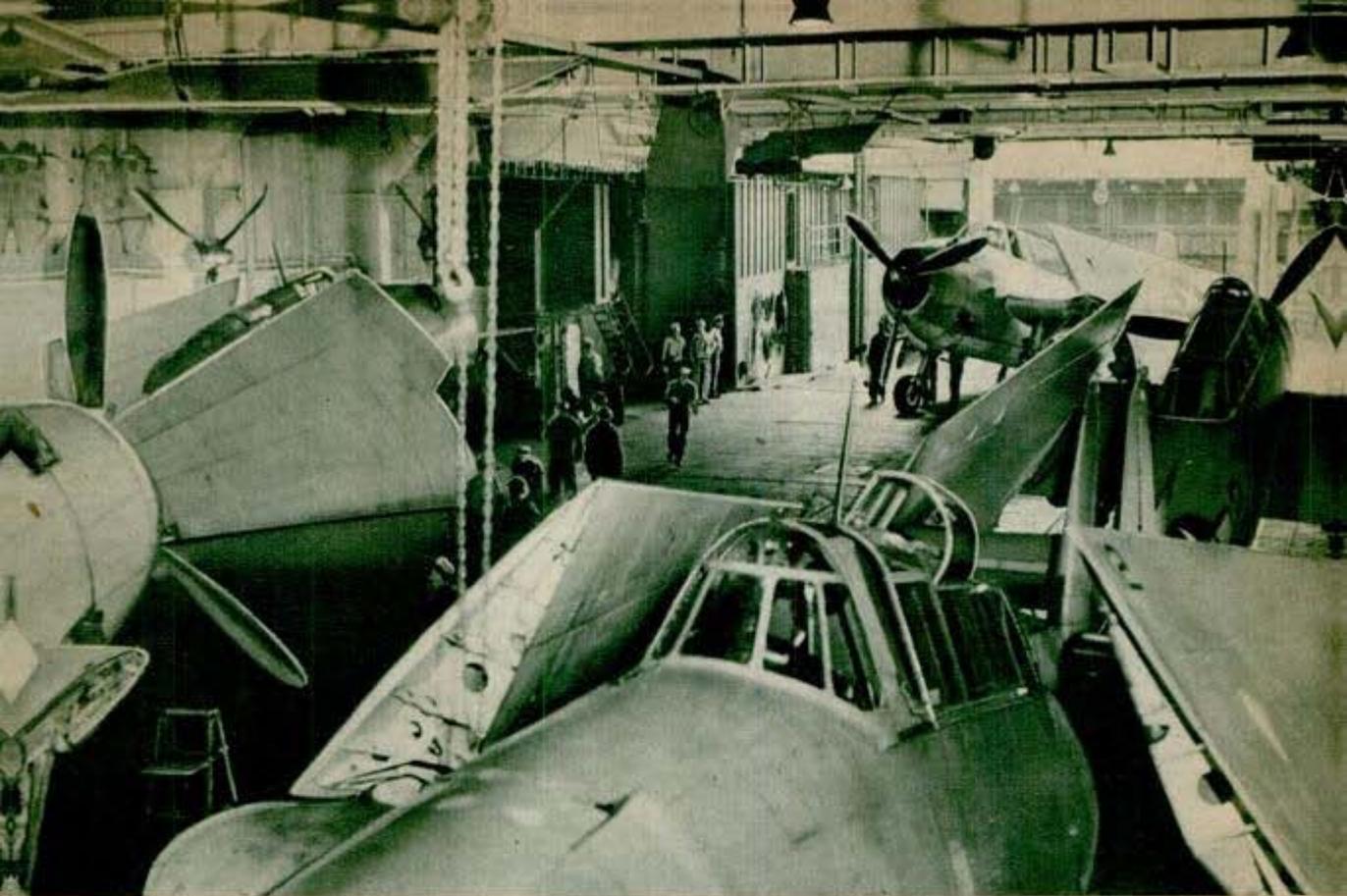
First, of course, are the flyers, many of whom



would not have become carrier pilots except for the midget flat-tops. They will have stories to tell their children of an existence interval during a landing or takeoff packs more danger than most men face in a lifetime.

The landing signal officer is one of the most highly efficient experts on Navy rosters. His col-

POPULAR MECHANICS

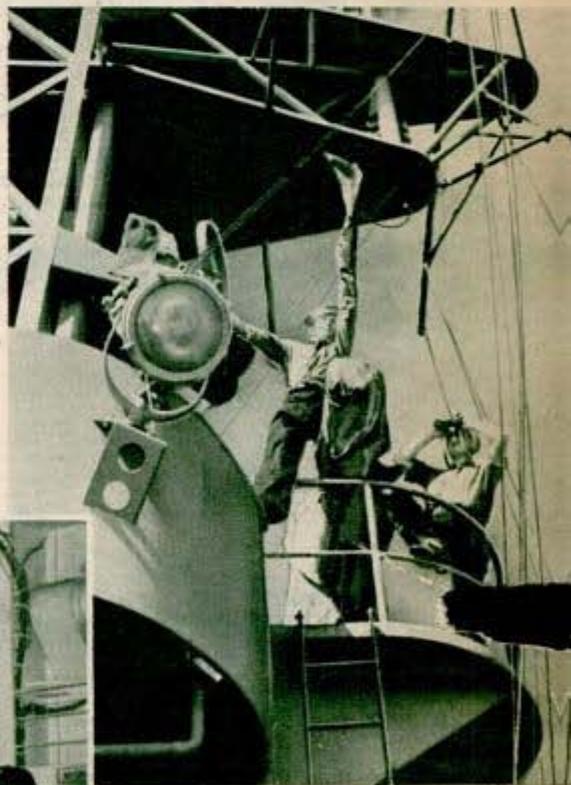


Hangar deck on the carrier buzzes with activity day and night

ored paddles spell life or death for the pilot as he signals "cut" for a nearing plane to land or waves the pilot off for another try. This must be done in the instant made necessary by an 80-mile-an-hour approach of a skittish plane to a rolling deck.

The quick-witted "talker" stands nearby. His eyes are fastened on the section of the deck which is invisible to the landing signal officer. He warns the signalman "clear" or "foul" according to the ever-changing condition of the deck.

Other relatively unsung heroes of the baby flat-top are members of the flight deck crew, the nimble-footed plane jockeys. They not only risk being blown overboard by the stream of air from propellers, but must dodge these whirling menaces, duck sweeping wings, roll away from speeding under-carriages and



Talking with flags (above) is one way to communicate without the enemy hearing



Basketball on hangar deck for pilots off duty helps them keep in top condition



Wildcat fighter attempting to land gets a "wave off" from landing signal officer whose flags rule deck

Below, 40-mm. gun crew on an escort carrier stands "alerted" by General Quarters awaiting enemy attack



leap from swerving plane tails. They learn to interpret the sign language used by pilots and gunners because of the roar of motors and props. They crawl on hands and knees at the risk of their lives to place and remove wheel chocks. They are expert at folding the wings of a plane and speeding a landed plane out of the way. They are good mechanics, too, in most cases, and many serve as operators of the giant plane elevators as well as drivers of the jeeps and tractors used to haul planes around the flight and hangar decks.

Their method of dress, aside from identifying vari-colored sweaters setting forth various "teams," is already becoming a Navy legend. Because any article of clothing is apt to become ripped and oil-stained in a hurry, they wear almost anything—as long as it lasts.

As time approaches for Captain's Inspection, however, the barber and tailor shops become busy once more and these helter-skelter dodgers turn out as trim sailors, typical of the best in Uncle Sam's Navy.

Specialists among these baby flat-top specialists of the flight deck are the plane captains, who are not officers in spite of their names. Each has a special plane assigned to him. The assigned plane is con-

stantly under his care and some captains spend most of their leisure time in the pilot's seat, checking and rechecking. When the pilot settles into his seat for the takeoff which may be his last, the plane captain fusses over him like a hen over a chick.

The lair of the baby flat-top mechanics is the hangar deck, and after the return of a group of planes they may be seen crawling around planes, looking like swarms of insects, checking, repairing, adjusting, hour after hour.

There are dozens of other specialists, whose number has been multi-



Pilot uses hand signal due to roaring engine to indicate to men at catapult that he is all set to go

plied by the birth of the baby flat-top—riggers whose job is to check parachutes every 30 days, torpedomen who examine and grease the torpedoes each day to fight off corrosion, and aerographers who are as much interested in the weather of the sky as the weather at sea level.

In addition there are the gunners who are among the best shots in the Navy. They have to be, for the baby flat-top is a prey to the very same killers it launches—torpedo and bombing planes.

Baby flat-tops may pass out of the picture, but legend will keep alive the memory of the crews who baby these babies.



Torpedoes are carefully stored on racks aboard escort carrier; torpedomen grease and check them daily

Right, bomb bay doors of Grumman Avenger torpedo bomber are open to receive another tin fish for Tojo



0573

Evacuation Horse Has Stretchers For Two Men

Two wounded soldiers can be carried at one time by horses and mules in steep mountain terrain where motorized ambulances would stall or turn over. The injured are strapped to stretchers mounted on a Johnston carrier across the back of the animal. With a third soldier leading the animal, this provides secure transportation to an evacuation hospital.

"Johnston" carrier

Left, a demonstration of how two wounded soldiers balance one another from yoke over horse's back. Horses and mules are the only means of evacuation in steep, craggy regions



0567

One-Man, Self-Feeding Twine Baler Ties Up Six Tons of Hay an Hour

To save labor on the farm, a self-tying pickup twine baler which can be operated by one man who drives the tractor has been developed by the International Harvester Company. The baler is powered by a 4-cylinder, 14-horsepower engine with an enclosed, automotive type transmission. Width of the pickup is 54 inches. Self-feeding is accomplished with open-end floating auger and packer fingers which are considered an improvement over belt or chain cross conveyors. Automatic bale separation is done by needles which obviate the use of blocks. As the hay is raked into

the bale chamber, a knife mounted on the plunger slices each charge on the packing stroke. An adjustment for the packer fingers regulates the placing of materials within the bale chamber so as to make a symmetrical bale regardless of material being baled. Neatly-formed firm bales weighing from 40 to 65 pounds can be turned out at the rate from three to five bales per minute, or up to six tons per hour, depending on the kind and condition of the field. Although designed primarily for windrow pickup baling, the baler is also effective for stack baling.

*International Harvester Co.
180 W. Michigan Ave.
Chicago 1, Ill.*



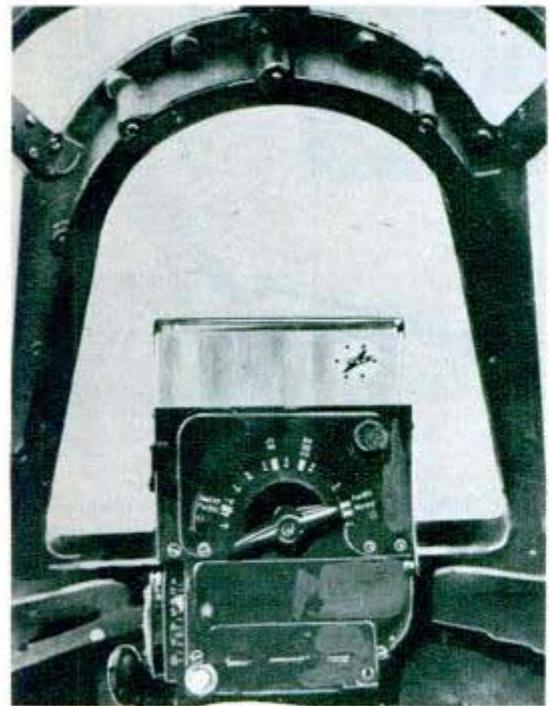
Walter Kidde & Co.

40 E. 34th St., N.Y., 16, N.Y.

0564

Jammed Gun Fixed in Jiffy By Compressed Air

With a two-pound pneumatic gun charger, aerial machine guns are cleared in one second and fire-power restored. All the gunner has to do is press a button to operate the charger which uses either compressed air or gas. Formerly, jammed guns had to be cleared by muscle power alone, a difficult and perilously slow process—especially in combat when every second counts. The charger was designed for use on .50-caliber aerial machine guns and can be operated at stratosphere temperatures as low as 65 degrees below zero, or in the heat of the tropics.



Gyro Gunsight for Fighter Plane Projects Enemy Craft on Screen

0477

British fighter planes have doubled their hits on enemy aircraft with a gyro gunsight that combines reflector and computer types. It permits effective fire at ranges of more than 400 yards with both planes speeding at over 400 miles an hour. The gunsight, which consists of a computer and sighting head, projects an image of the target on a transparent glass screen along with an aiming ring of six diamonds in a movable circle. The gunner adjusts the diameter of the ring so the wingspan of the target is contained within the circle. With a twist grip, he registers the range on the computer which feeds the information automatically to the sighting head. As he nears the target, the gunner increases the size of the aiming ring. This gunsight is operated at angles of deflection considered impractical until a few months ago. R.A.F. gunners praise the gyro sight highly.

Left, gunner must keep the "enemy" plane shown on screen within movable "aiming ring" of six diamonds

Fireproof Medical Crash Kit Carried by Shoulder Straps 0-565

To provide better emergency treatment, medical crash packs in the Army Air Forces are made of a heavy grade of fire-resistant duck and are supported on the back with shoulder straps, with a light metal framework to fit the shape of the back. Closed by a zipper, the pack is compartmented to make all medical supplies easily accessible. It weighs about 30 pounds filled, in contrast to the old-style wooden crash pack which weighed 100 pounds.



Right, the 30-pound crash pack includes complete equipment and is easy to carry

DECEMBER, 1944

idea conceived by: Major R. S. Mooney
pack designed by: Edward Lockhart, Parachute Dept,
Army Air Field, Ardmore, Okla.

71

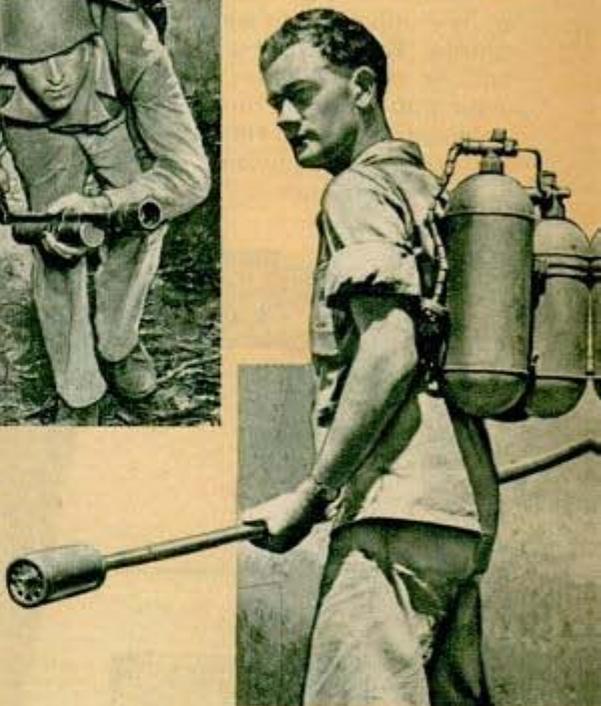


Mr. W. Hellaker
 O-519

U.S. vs. AXIS WEAPONS



U. S. Army Ordnance provides the world's best fighting men with weapons superior to enemy's



The U. S. flamethrower (above at left) and portable Jap model (right) captured at Munda are similar in appearance, but the American weapon is far more deadly due to special "jellied" gasoline developed by American chemists. The American flamethrower can shoot a stream of fire through a two-inch slot in a pillbox 180 feet away

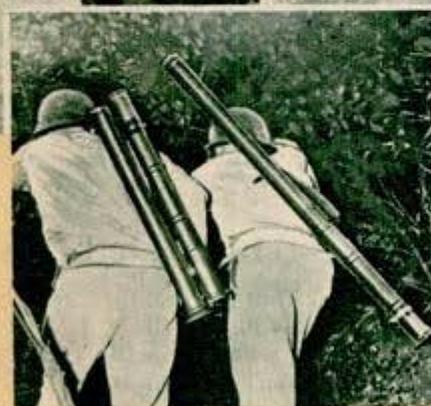
The rifles across the bottom of these pages are, left to right, Jap, German and American. Jap .25-caliber is second-rate, relatively accurate up to only 500 yards. Both Jap and German rifles are of Mauser type, but the Nazi gun is a good weapon. It is manually operated, compared with semi-automatic Garand, and has an effective range of 800 yards compared with 1,000 for Garand

Signal Corps photo
 Top, 105-mm. howitzer, backbone of American artillery, has caused dazed prisoners to ask to see our "automatic cannon." It has seven-mile range and is capable of either high- or flat-trajectory fire. German 88 (center) is both antitank and antiaircraft weapon with range about the same as American 105. New model has effective ceiling of 36,000 feet. Welded construction of U. S. gun is superior and Nazi weapon is more likely to break down. Bottom, Jap 75-mm. field gun looks like museum piece





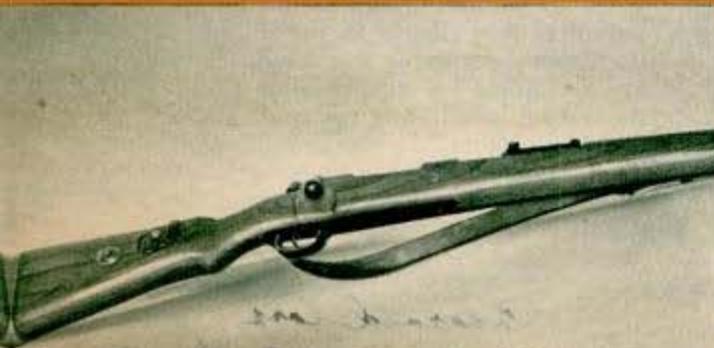
Left to right, Jap "knee mortar" which hurls grenades 700 yards and weighs only 10 pounds; 50-mm. German mortar weighs 31 pounds and throws two-pound shells; 60-mm. U. S. mortar weighs 42 pounds and throws three-pound shell to superior range of 1,900 yards. G. I.'s also use a grenade launcher fitted on rifle muzzle



Above, Yanks test German version of bazooka picked up in France. Right, latest type of American folding bazooka; which was originally supplied only to paratroopers and jungle fighters, is carried by the man on the left. It is now issued to all invasion forces and can be assembled in a few seconds to form a 61-inch launcher for firing. The old-style one-piece five-foot bazooka, carried by the man at right, was awkward to handle on jungle trails, in planes and gliders or when used by paratroopers dropping behind lines



American jeep (above) is sturdier than a German volkswagen (below) which has engine in rear. Jeep carries 500-pound load



National Safety Council
20 N. Wacker Dr.
Chicago, Ill.

0572

Auto Takes Nose Dive as Lesson to Motorists



Left, sedan is hoisted by 40-foot crane and dropped on nose (above) to simulate collision at 35 m.p.h.

Highway smashups at the relatively low speed of 35 miles an hour are equivalent to the free fall of an automobile from a height of 41½ feet, according to the National Safety Council. The council recently

demonstrated the effects of such an accident by dropping an automobile from that height. The automobile, salvaged from a junk yard, was suspended from a giant electro-magnetic crane.

0-4-31

Germans' Push Cart Pillboxes Have Detachable Wheels



*Off. Ramon
Meyar, 2115 W. Commercial
St. Los Angeles, Calif.*

Mobile pillboxes which look something like a peddler's push-cart were found abandoned by the Germans on a road on the Fifth Army front in Italy. The pillboxes are small circular steel ramparts on two wheels and sprouting short wagon tongues. The Nazis usually rolled them into place, detached the wheels and dug them in at strong points.

0570

"Invisible" Signs Warn Motorist If Wrong Lights Are Used

Trick polarizing traffic signs recently patented are visible at night only when improper headlights are used. The signs are designed for automobiles fitted with polarizing headlight systems in addition to ordinary lights. If the proper lights are used, the warnings are invisible; if not, the signs flash: "Shift to polarized beam" or "Shift to unpolarized beam."

*Polaroid Corp.
Cambridge 37, Mass.*

Frod Machinery Corp.
Orlando, Fla. 0-554

"Props" Spray Insecticide Into Citrus Orchards

Improved fruit and citrus tree production is possible with the help of a combination tractor and seed sprayer which throws a stream of germ- and insect-killing liquid into orchards to annihilate pests. The clouds of insecticide are shot into the trees by a powerful motor equipped with 10 airplane propellers. One man can operate both the tractor and the sprayer, which is attached to the rear of the tractor. The machine was tried out successfully on a 160-acre orange grove in Florida.



"Sky Hook" Spirals From Plane With Emergency Supplies

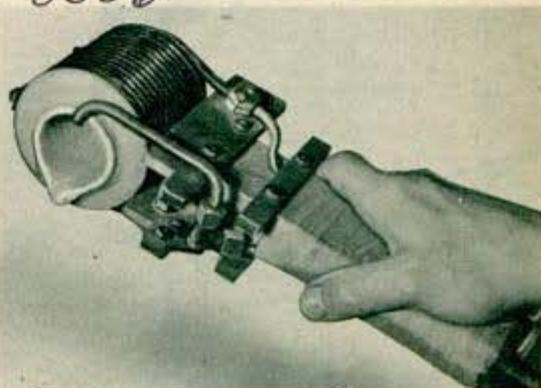
Shaped so that it will fall like a maple seed, a "sky hook," or rotary wing container, may be used by the Army Air Forces to supply isolated combat troops with emergency supplies. Approximately 65 pounds of food and medicines can be packed into the bulbous plastic container, roughly 8 inches by 20, the counterpart of the maple pod. The wing or blade of the hook, approximately one foot wide and three feet long, is a flat wooden frame covered with airplane cloth. Released from an airplane in a flat position, the device spirals to the earth in a flat spin around its own center of gravity at an approximate speed of 35 feet per second—slightly faster than a parachute. Drift is negligible, making it more accurate than a parachute. Now undergoing experimental tests by the Air Forces, it may be used after the war for aerial delivery of mail.

Left, 65 pounds of supplies can be packed into the bulbous plastic container of the "sky hook." Note resemblance to a maple pod

Tiny Ladle Furnace Melts Metal In Small Quantities Cheaply

Metals can be melted economically in small amounts, thanks to the development of a high frequency furnace shaped like a ladle. The unit, which melts steel, copper, brass, or precious metals which are not subject to carbon contamination, makes it easy to pour the metal directly from the ladle. It is available in three models having melting capacities of 1, 1½ and 2 pounds.

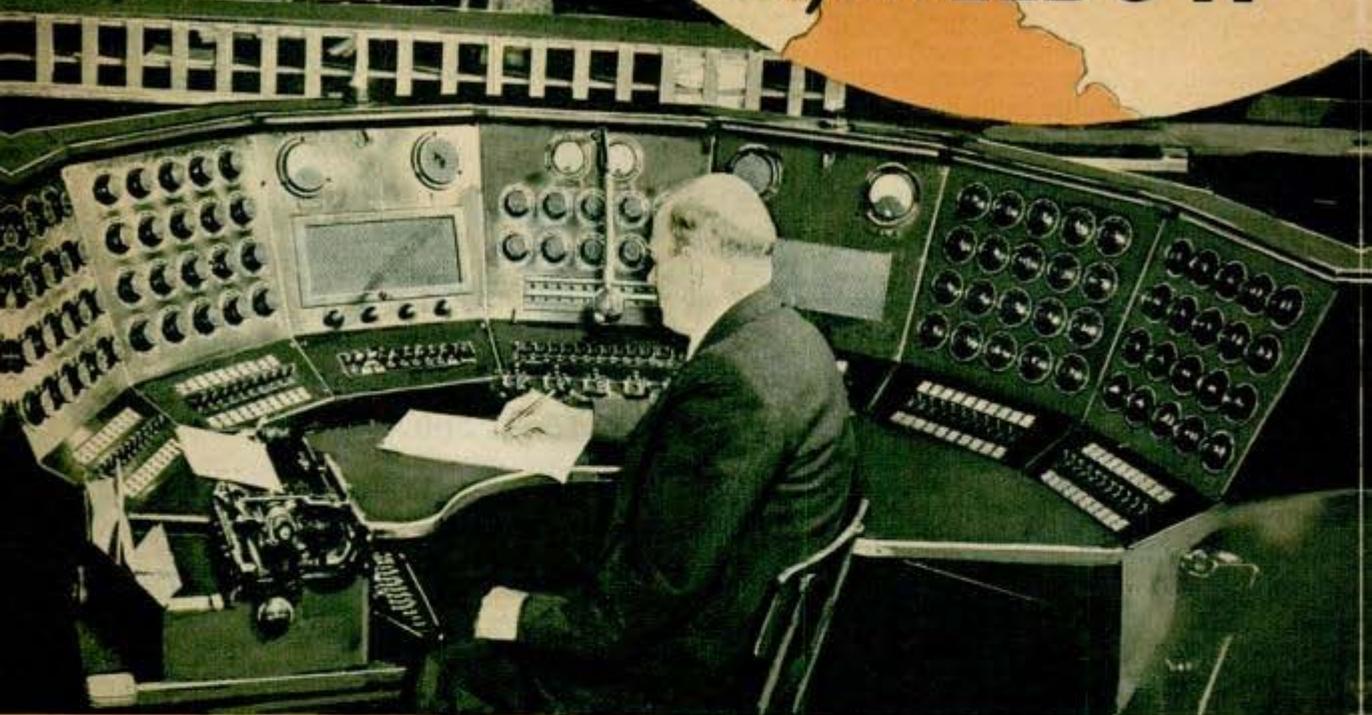
Metal can be poured directly into the molds by this miniature high frequency "furnace"



DECEMBER, 1944

0556
Ecco High Frequency Corp.
7020 Hudson Blvd.
North Bergen, N.J.

The WORLD at Your ELBOW



Above, the nerve center of RCA's central office in New York City, where a technical control is maintained over all its radio-telegraph circuits

Below, in tests conducted by RCA's engineers, the horns are receiving and the zigzag aerial is sending short waves



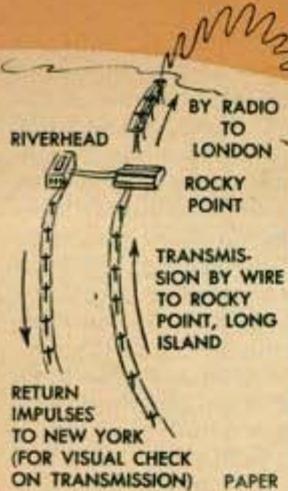
WHILE airplane designers toil night and day for blinding speed that will further shrink the size of the earth in relation to its puny inhabitants, another group of scientists is just as busy working to place the whole world at your elbow. These are the radio communication engineers who employ electrons instead of high-octane gas to girdle the globe.

Suppose you let them take you for an electronic ride into the future. Seat yourself in an easy chair in the parlor, cross your carpet slippers, and settle back to read the evening newspaper reproduced page by page on your television set. A bell rings in a box at your elbow. You yawn and reach over.

Someone hurries into the room and says that it must be a letter from Johnny, college track star, now in New York waiting to fly to Paris to participate tomorrow as a sprinter in the Olympic games.

You flick a switch on the facsimile machine and put in a piece of paper. A cylinder soon shuttles back and forth, turning slightly at the end of each movement. A tube sprays little ink spots occasionally onto the paper. It's Johnny's handwriting all right. It reads: "Flying tonight. Please send check for fifty dollars."

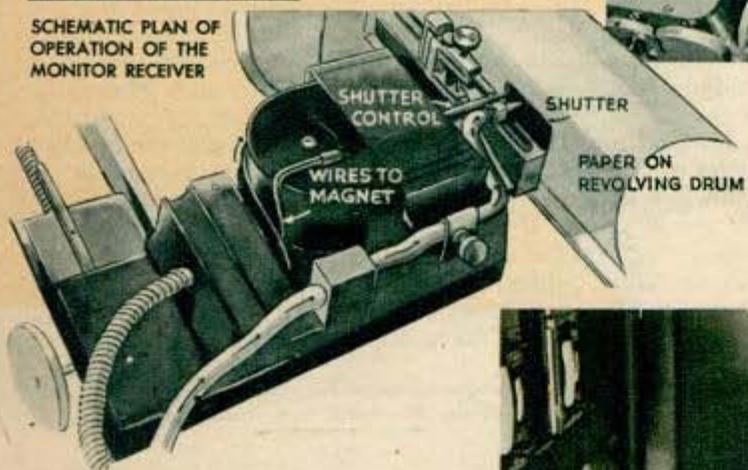
You groan amiably, write a reply, address it, make out a check and attach it to your note. This you affix to the facsimile sender and push another button. The note and check



INTERCEPTION OF SPRAY BY MAGNETICALLY ACTUATED SHUTTER PRODUCES VARIATIONS IN DOT SIZES



SCHEMATIC PLAN OF OPERATION OF THE MONITOR RECEIVER



Upper left, monitor receiver which makes pictures constantly visible by means of ink spray as they are being received. Above, RCA operator adjusts radiophoto receiving machine before tuning in a distant transmitter. Below, engineers in control room of a television studio

are reproduced in a local facsimile station and then relayed to New York by radio waves, where facsimile banking is common practice.

Early the next day you tune in your television set, see Johnny win the 100-yard dash for the United States. You grin, write and send congratulations to Paris, together with another radio check. For the next week you follow Johnny and the rest of the U. S. Olympic team as they tour the continent of Europe. Your television set takes care of this detail.

If that sounds fantastic, you should know that every device necessary for the accomplishment of this coming miracle is in operation today. Only expansion and a market are needed.

The same facsimile machine which would flash Johnny's letter





RCA's direct radio circuits which link the U. S. A. to South America

into your parlor is now working commercially, but thus far it is used only as an operating adjunct to the much more efficient radiophoto machine operated by RCA Communications, Inc.

On the radiophoto machine, all of the illustrations in this article, reduced in size by photography to 6½ inches wide, can be radioed to Moscow, 4,614 miles away, in about 13 minutes, after which they could be enlarged to original size. An airplane would have to travel approximately 21,300 miles an hour to get them there as quickly.

Or the pictures, reduced to an area of five by seven inches, will reach Melbourne, Australia, 7,420 miles from San Francisco, in 10 minutes, about the time it takes to read this article. The elapsed time changes only with the short width of the transmitted picture, since it requires two minutes for the magic eye of the machine to scan a linear inch, starting from the top. The difference in distance in sending to Moscow and Melbourne isn't much since the radio impulses circle the earth something like seven times in a second—a record for airplanes to shoot at for some time.

Photos and facsimiles can also be exchanged between New York and such distant points as London, Cairo, Buenos Aires, Berne and Stockholm. And between San Francisco and Honolulu. Berlin and Tokyo are out of service at this time. Many of the war pictures which keep Americans the best informed people on earth have been sent in this manner.

If the hypothetical case of Johnny and the radioed check seems far fetched, consider that RCA Communications have often carried checks between London and New York, the facsimiles being honored

Below, left, workmen add another "tree" to forest of receiving antennas for radio-telegraph messages. Below, right, "fishbone" type of radio antenna at the Riverhead, L. I., receiving station



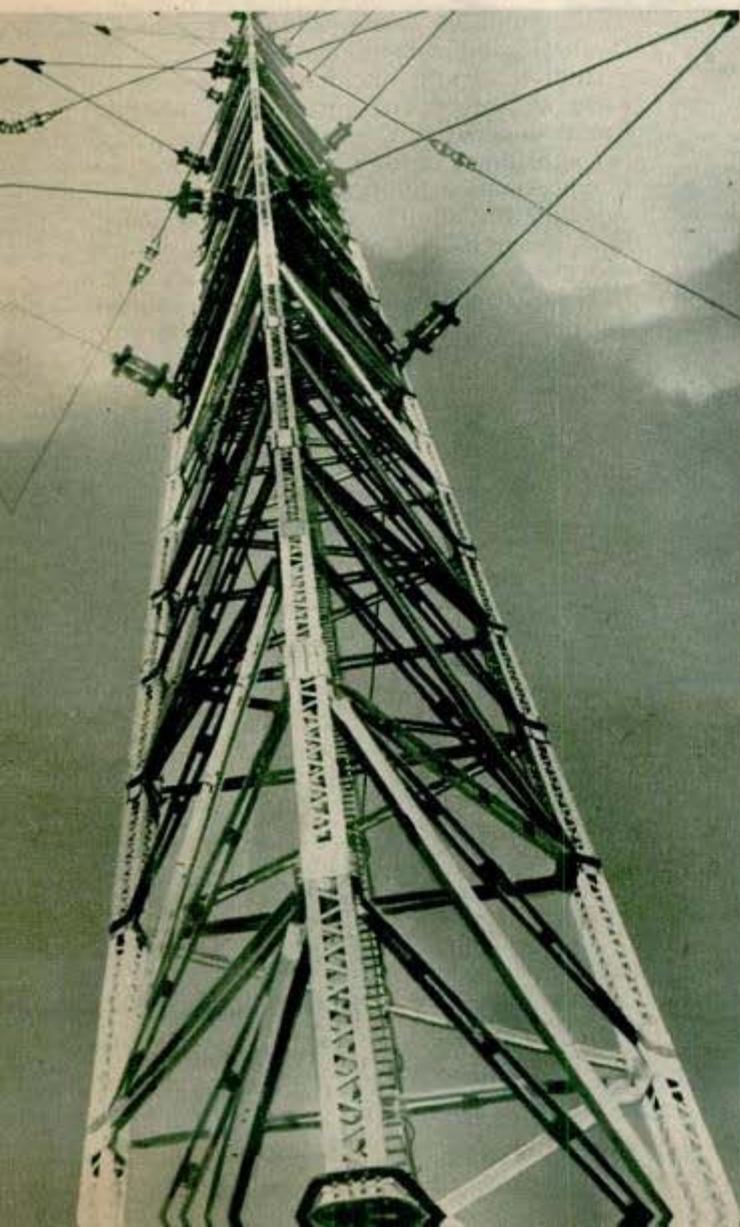
without the originals ever having been sent by mail. In one case, payment of \$6,000,000 was authorized by power of attorney sent as a radiophoto.

Ships at sea have received weather maps. Patent drawings have been transmitted, as have building plans, fashion sketches, financial statements and birth certificates. A vessel lost its rudder at sea. Blueprints of the rudder were flashed from England to New York and by the time the ship limped hundreds of miles to an American port, the new rudder was waiting.

Criminals have been apprehended by radio-



Above, radio telegraph operator in the Naples, Italy, station. Below, rising 810 feet, this transmitting antenna tower at Tuckerton, N. J., is the largest in the world. Big plans are afoot in radio communications



photo, too. The fingerprints of a suspect arrested in New York were radioed from Europe. In another instance, a bank cashier absconded with a suitcase full of cash. His picture and fingerprints beat him to his destination.

Not long ago, Mrs. Gerald Mayer of New York City wrote her husband, whom she had not seen for a year and a half, saying she wondered how he was looking. In reply, he radioed a specially posed picture. Mrs. Mayer then radioed hers to him. It reached Switzerland in 10 minutes.

The task of arranging for your television set to follow Johnny on his Cook's tour of Europe is only a matter of spending the money to establish relay stations on buoys strung across the Atlantic.

Another alternative would be to establish similar land-based relay towers, each resembling a streamlined lighthouse with little eye-like windows, strung over the top of the world.

Concerning relay towers, Ralph R. Beal, assistant to the vice president in charge of RCA Laboratories, said: "Automatic, unattended radio relay stations located 20 to 50 miles apart, will link television stations into national chains. But the scope of this new development goes much further afield in communication than merely to hook up television



Above, closeup of theater television equipment from the balcony. This may become common in peacetime



All RCA photos

Above, the world at a man's fingertips—section of RCA's international control board. Right, this quartz crystal, guarded by the glass bell, is used in the frequency-measuring laboratory. It is 500 times more accurate than the world's best watch

transmitters, some of 50-kilowatt power.

"Think what these unattended radio relay stations promise to such vast areas as China, Russia and Africa; think what they will mean for countries which haven't enjoyed the splendid trunk line communication services as found in the United States and the British Isles. It is my belief that in the postwar era other regions will also have extensive trunk line

systems of communication made possible by radio relays of telegraph messages, telephone calls, sound broadcasting and television."

A similar relay system recently put into operation out of New York City to form the first television network is simple compared with the possibilities already envisioned by RCA engineers. These include multiple channels to improve efficiency, flexibility and service. The relay towers will handle numerous circuits, which can be multiplied to any reasonable extent, to carry not only one television program but several simultaneously, as well as frequency modulation sound broadcasts, facsimile and radiotelegraph.

Radiotelegraph incidentally, seems to have an interesting future. It's another function of RCA Communications, which is a subsidiary of the giant Radio Corporation of America, along with RCA Laboratories and National Broadcasting Company. Last year, RCA Communications, which operates more than 50 circuits between the U. S. and foreign nations, handled 130,000,000 paid words, and the estimate for this year is 145,000,000 words. Since May, 1940,



more than 2,300,000 EFM, or Expeditionary Force Messages, have been sent and received by RCA.

If a new-type, automatic radiotelegraph machine had started sending the text of this article to Sydney, Australia, more than 7,000 miles away, at the same instant you began to read it, the machine would have finished quite a while ago. It shoots words through the air at the astounding rate of 650 words a minute.

It's a form of electronic double-talk which scrambles messages so they can't be picked up by eavesdroppers of the airlines. During the infinitesimal lapse of time between radio impulses, other radio impulses are interlaced. A machine at the other end takes the babble apart. The direct circuits have reached 54 countries, the number shifting according to the effects of war.

You'll probably be hearing more of the accomplishments in radio communication when peace lifts the security veil and you will become famous if you can figure out how to send television waves without relay towers on land or sea. These high frequency waves have a stubborn way of refusing to follow the curvature of the earth, flying off into space.

However, when they hit the Heaviside layer, in the upper atmosphere, they sometimes bounce back down. Unfortunately, like a lop-sided tennis ball, they don't come down with any regularity.

If you can't figure out how to bounce them in a predictable path, perhaps you can induce short waves to travel in a curve. Some scientists say it can't be done, but they said the same thing many years ago when a pitcher threw the first curve with a baseball.

0601 "Fresh" Cider Concentrate Preserves Apple Flavor

Fresh cider is made merely by adding water to a concentrate developed by the Department of Agriculture. It is said to taste and smell exactly like newly made apple cider. The concentrate is made by heating the juice rapidly to avoid changing the natural flavor and collecting the vaporized essence which is later added to the concentrated juice.

DECEMBER, 1944

0529

Heating Pits Warm Bus Engines In Outdoor Parking Lot



Philadelphia buses left standing in the yard are kept warm for easy starts in cold weather by parking them over infrared heating pits. Each pit, measuring 27 by 42 by 16 inches, contains three 250-watt drying lamps which direct heat on the engine when a bus is parked over a pit. Unable to build more garages because of wartime restrictions, the bus company rigged up the pit system at a cost of \$3,000 to save the 5,000 gallons of gasoline it would take to idle the engines all winter.

0164

Wires Joined Without Soldering Provide Better Service

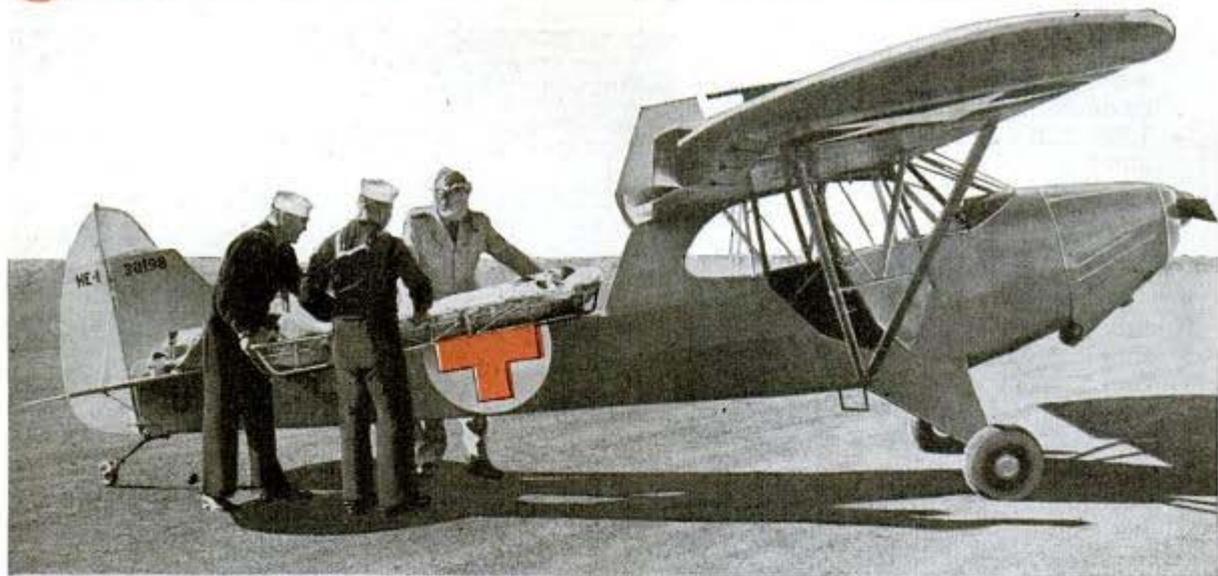
Soldering to make terminal connections may become obsolete as a result of the solderless wiring method made possible by a hand tool resembling pliers. Pressure on the handle of the tool crimps the connections in such a way that a perfect connection is made without necessity for heat. For quantity operation, press dies are available. In contrast to conventional soldering methods, which often give widely varying results, this method makes the terminal and the wire a homogenous mass, thus sealing the wire against accelerated corrosion. Tests show uniformly excellent results from the standpoint of tensile strength, voltage loss and resistance to corrosion. Besides making it possible for unskilled workers to turn out foolproof terminal connections, solderless wiring can be used in cramped places where ordinary soldering is difficult.

Aircraft-Marine Products, Inc.
Harrisburg, Pa.

Philadelphia Transportation Co.
1405 Locust St.
Philadelphia, Pa.

Mr. C. W. Moore, 1362 N. Dearborn St.
Chicago 10, Ill.

SPEEDING THEM BACK to GET



Loading an injured man into navy ambulance plane for quick transport to a base hospital. Below, built to carry guns, this Army vehicle was converted to a litter carrier at the front



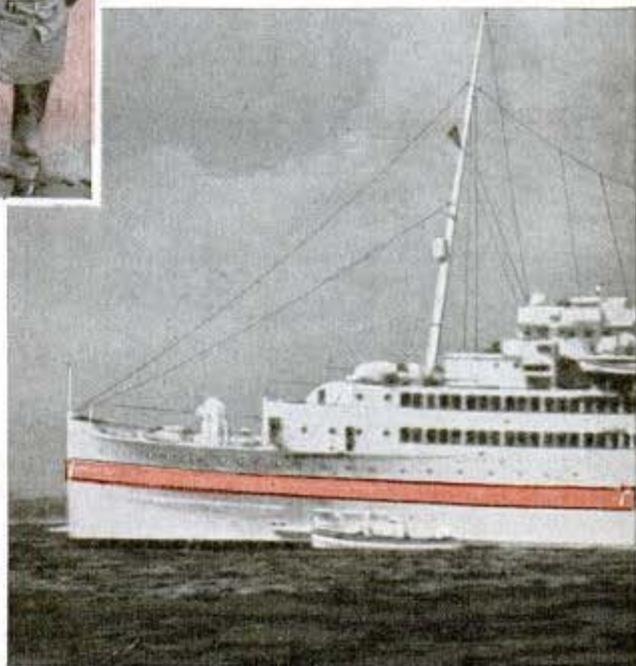
IN A SMALL clearing deep in the jungles of Burma, 40 wounded American soldiers were surrounded on three sides by Japs. Even had escape by ground been possible, weeks of tedious travel, dangerous for men in the best of condition, were ahead.

Then, two by two over the treetops, came tiny planes—not fighters or scout planes, but “grasshoppers” and “flying jeeps.” They glided swiftly into the cramped area. Each carried a litter and room for two wounded men who could walk. Each was piloted by a flying sergeant of the AAF.

While Jap bullets whistled overhead,

the planes were loaded and took off safely. All 40 of the wounded were flown without mishap to a hospital miles behind the lines.

Situations like this illustrate the usefulness of the small L-1 and L-5 mercy planes on the front lines. These planes represent only one link in a vast system for moving the wounded to main hospitals in this country or overseas. This system is so efficient that the recovery rate for U. S. troops wounded in battle is 97½ percent after treatment in evacuation hos-



THEM WELL

pitals—by far the highest in the history of warfare.

Evacuation of wounded in planes, ranging in size from the flying jeeps to giant hospital planes carrying as many as 60 litters, probably is the most spectacular phase of this system. Air evacuation is recognized as one of the three greatest lifesaving measures in modern military medicine, the other two being blood plasma and the sulfa drugs.

Transportation of the wounded involves virtually every known means of travel. These include amphibious vehicles, litter, mule back, sled, jeep, truck, tractor, barge, LCT, plane, ship and train. The most primitive forms of transportation are sometimes pressed into service. During the conquest of Saipan, the Marines organized an "ox cart route" on a regular schedule for carrying ammunition and supplies to the front and wounded men to the rear.

New equipment and methods bring the hospitals and emergency surgeries closer to the front lines. This includes mobile evacuation hospitals with van-type operating rooms, newly devised mobile

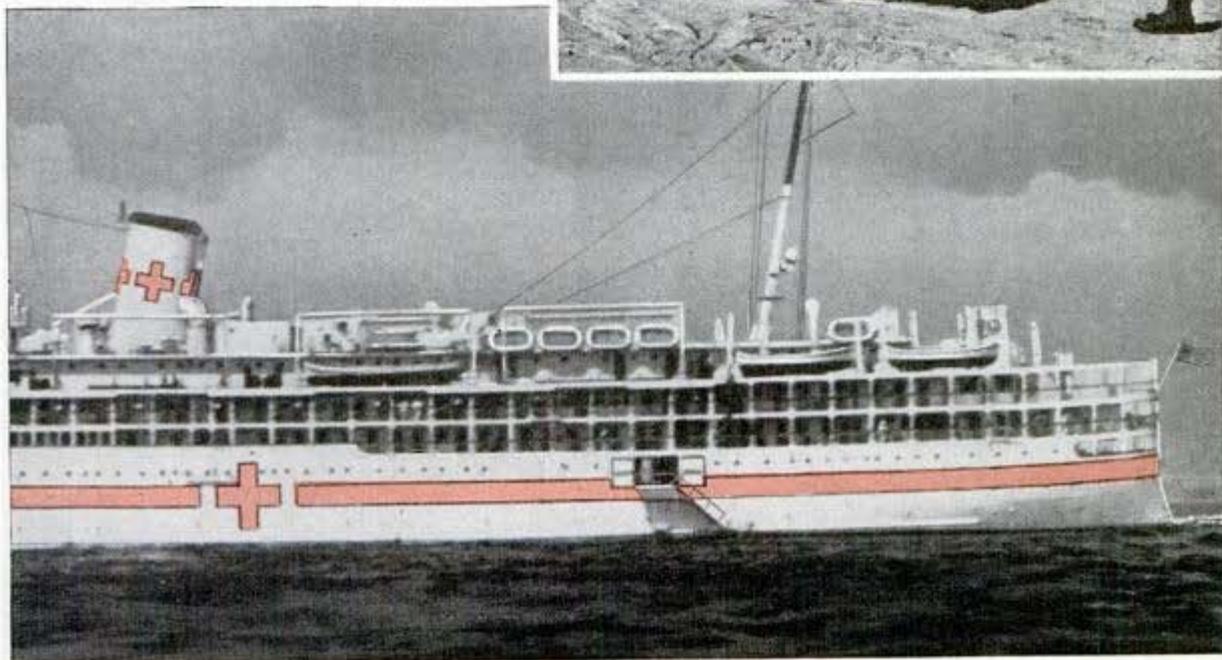
The hospital ship, U.S.S. Solace, has vivid markings that Japs "fail" to see

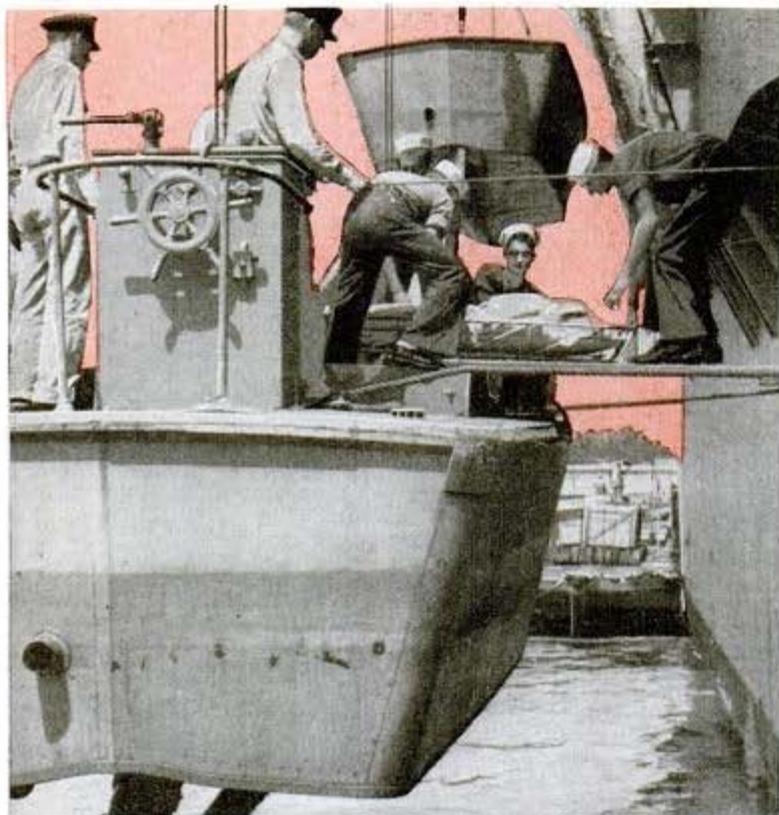
U. S. Navy photo



Administering blood plasma to wounded soldier aboard an Air Transport Command hospital plane. Below, improvised sled made of two skis supports litter; officer at rear holds guide rope

Signal Corps photo





wounds are received. The wounded man is then transported quickly through a network of stations to the place where he will best recover, depending on the nature of his wounds. All along the line, he is never without constant attention.

All fighting men are instructed in the principles of first aid and carry with them a supply of sulfa drugs and first aid dressings. If a wounded man is helpless, a medical corps-

Left, easing wounded man aboard ship. Below, adjusting oxygen mask on patient in plane



X-ray units, new orthopedic portable field tables making possible far easier management of fracture cases, and equipment that can be dismantled quickly and carried on the backs of medical officers as they move forward.

The wounded man not only is closer to the physician or surgeon with his modern drugs and methods and modern equipment, but he can reach him faster. Often within 10 minutes after a man is injured he is under the care of a highly skilled surgeon. Many major operations are performed in operating vans 30 minutes after

Removing the wounded from English Red Cross hospital train



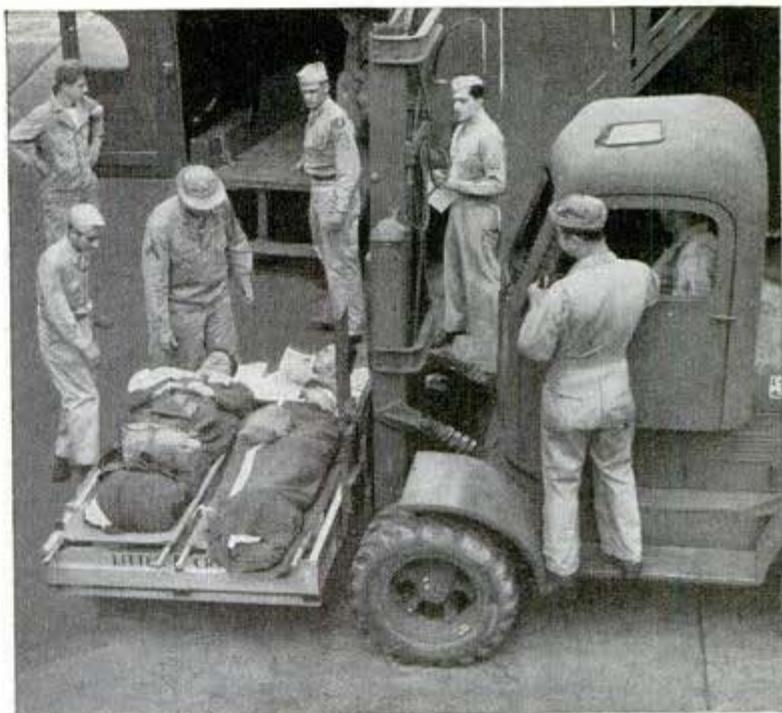
man is almost immediately at his side, gives him first aid treatment, removes him to protective covering and sticks the man's bayonet in the ground with a strip of gauze attached to attract attention of litter bearers.

Litter bearers follow closely on the heels of the troops. They pick up the wounded who are unable to walk and take them to mobile battalion or regimental first aid stations which have moved up close to the line. Here the condition of the wounded is carefully checked. Shock is treated with blood plasma. Wounds are dressed or redressed. Splints are applied or adjusted. As soon as his condition permits, the wounded man is moved to a collecting station.

All cases are rechecked at the collecting station, also a mobile unit, and those who can be moved are sent at once by ambulance to another mobile unit. This is usually about five miles back of the battalion first aid station where a surgical unit is available for men requiring immediate attention.

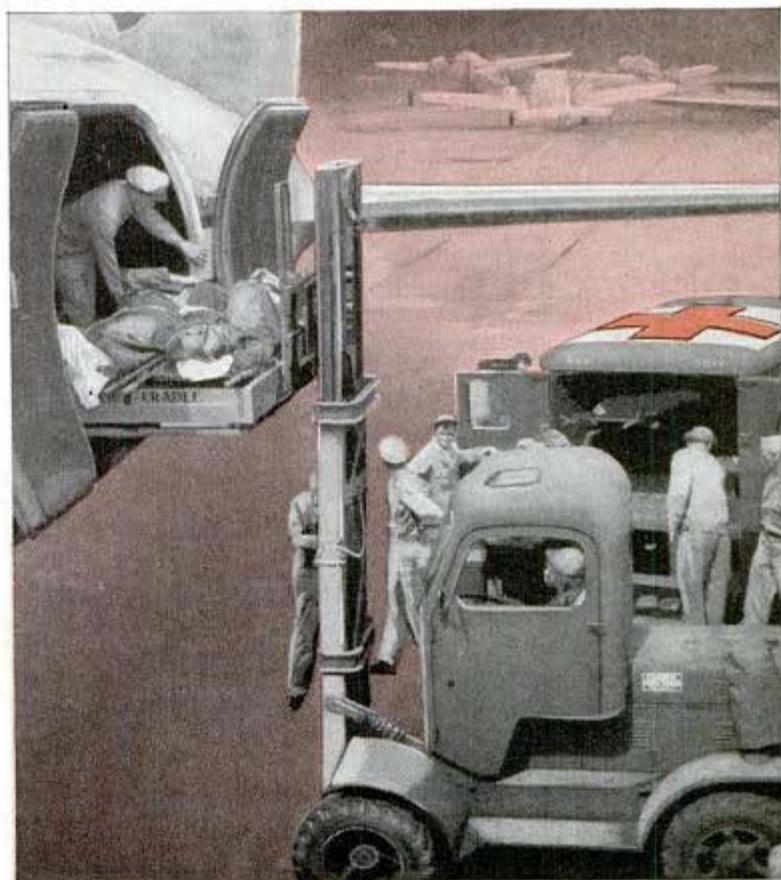
The next step is the evacuation hospital which may be 20 to 50 miles behind the line. Sometimes the evacuation hospital is of the mobile variety, but more often it is not. Facilities for all types of medical and surgical work are available, and men who need no longer than 30 days to recuperate usually are kept in this hospital. If the wounds are serious, removal is made to a general hospital, still farther back of the lines. Here the man is kept if it appears he will recover in 120 days or less; otherwise he is sent back to the United States.

This system has many variations, with many



Litters bearing wounded airmen are transferred from plane or hospital to ambulance with special pallet attached to truck with lift arrangement

Litter cradle is raised to level of door in fuselage of hospital plane at Mitchel Field where overseas wounded are transferred to ambulances





Native carriers in New Guinea help Yanks. Right, landing craft loaded with wounded

factors to be considered. The extent of the wounds, location and nature of the fighting, facilities available, number of open beds near the front lines, all are taken into account. Moreover, the entire chain of evacuation changes as the troops advance.

Hospital planes make the system more flexible and efficient. Wounded men may be transferred from an evacuation hospital to a distant general hospital or back to the United States by air. In some instances men have been evacuated in 45 minutes by air when otherwise they would have had to be carried for 21 days on mule back. In other cases, men have arrived in the United States five days after they were wounded.

All branches of the service now operate a far-flung system of hospital plane routes, stretching three quarters of the way around the world. Troop and cargo carrier planes, ingeniously converted to flying ambulances are employed.

One cargo carrier, capable of operating from small, rough fields, has removable seats. Normally accommodating six passengers and a crew of two, it can be converted speedily by the use of litter supports



of webbing-strap. Six to eight litters can be carried. The same type of support can be installed in C-47 cargo aircraft, giving a capacity of 24 patients. Larger ships can carry up to 60. Many different types of planes, even gliders, help carry wounded.

Both the Army and Navy have regular transcontinental plane service for the wounded. Navy war casualties arriving from the Pacific are transferred to inland hospitals aboard flying ambulances.

0507

Stretchers are fitted to bulkheads in after sections like double deck bunks. Patients are strapped in place and medical officers and hospital corpsmen sit in the forward end of the plane. Within 20 minutes after delivering the patients, the plane can be converted back into an aerial box-car.

Air evacuation of wounded, sick and injured personnel has been singularly successful. In one 12-month period, there were only 11 deaths in flight out of 173,527 men carried. In one combat area where flights are made to a hospital 230 miles distant, less than one percent of the patients developed air sickness. The AAF medical service now has a personnel of nearly 100,000, including 8,000 physicians, and 4,000 flight surgeons.

Between 75 and 85 percent of the wounded are brought to the United States by hospital ships or troop transports equipped with medical facilities. The Army Service Forces recently put into operation 10 new hospital ships, bringing the total to 18. The Navy has a fleet of hospital ships, including its newest and largest, the U.S.S. Refuge, formerly the luxury liner, President Madison.

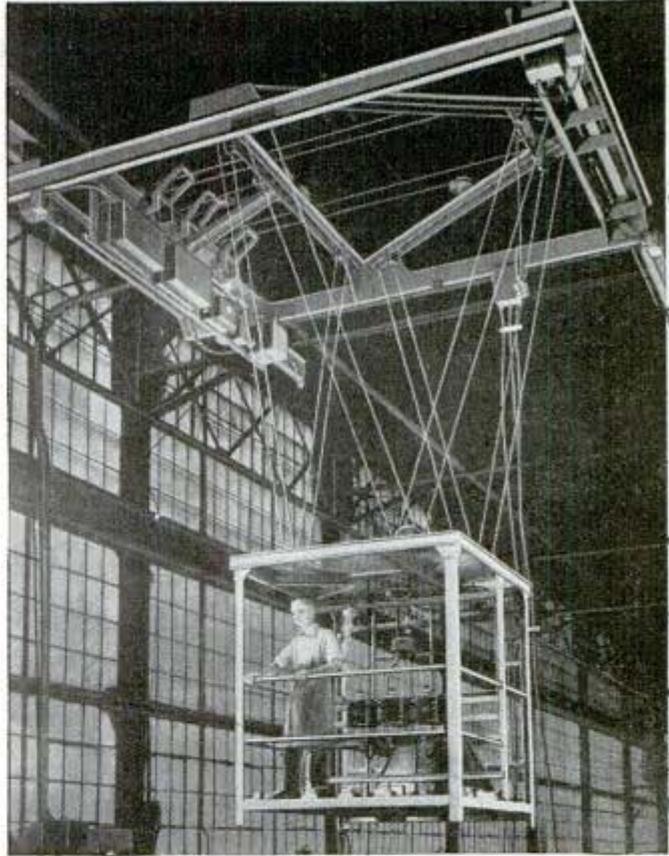
The Refuge has berths for 630 patients and a mobile field hospital with 72 cots. With a complement of nearly 300 medical officers, nurses and men, the ship has such features as complete laboratory, X-ray equipment, 12 wards, each with surgical dressing room, diet pantry and utility room, and the most modern scientific equipment including centrifuge, bacteriological incubator and autoclaves. An elevator serves six decks.

To help move the wounded to proper hospitals in this country, 100 new "unit-type" hospital cars are being built for the Transportation Corps. These include all necessary facilities in one car, including dressing rooms and kitchens. In addition, the Army is converting all 120 of its rail ward cars and ward dressing cars into these new units. Air conditioned Pullmans commonly are made into hospital trains. Forty medical kitchen cars are operated for these trains.

The various branches of the service co-operate closely in the

(Continued to page 150)

Platform Suspended by Cables Will Not Sway When Moved



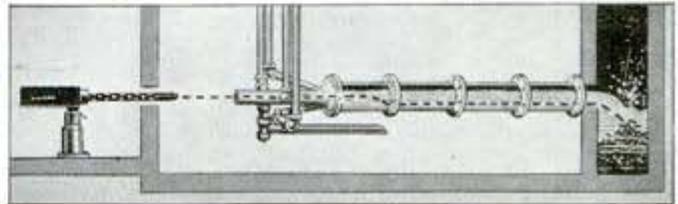
*The Cleveland Crane & Engineering Co.
1129 E. 28th St.
Wickliffe, Ohio.*

Ingenuously rigged flexible cables have almost entirely eliminated sway from a painting and maintenance platform while it is in working position or being moved about by a crane. The hoist mechanism keeps the platform rigid, even with 800 pounds loaded on one side. The unit can travel both vertically and horizontally.

Four Jets of Water Stop Bullets In Test Firing of Machine Gun

0406

In a test-firing apparatus, four separate jets of water converging at one spot are used to stop bullets. Stopping bullets by water pressure instead of



the conventional sand traps has been found to be safer and more efficient. This method was developed at the General Motors Corp., Syracuse, N. Y.

(To learn where to buy commercial products described in these pages, see the index.)

General Motors, Syracuse, N.Y.

0-535

Ulrich Products Co.
1039 N. Crosby St.
Chicago 10, Ill.

Mein-Willy Co., 222 N. La. Bank Bldg.
Chicago 54, Ill.

Roaster Made Into Toaster By Adjusting Coffee Grill



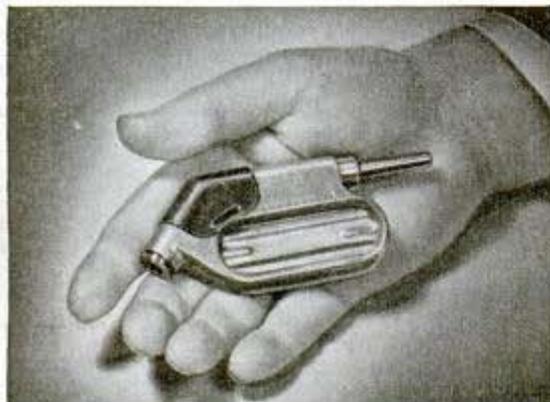
Worker gets entire breakfast on a roaster-toaster

America's traditional breakfast—coffee, toast, ham and—may be cooked on a single convenient tabletop unit after the war. The convertible cooker, promised for early postwar marketing, is changed from roaster to toaster by adjusting a movable grill section which is attached to a metal pot about three inches above the heat unit.

0506

"Pork Chop" Drill Attachment Permits Work at an Angle

Angle drilling is possible with an attachment shaped like a pork chop. The unit is small enough to fit the palm of the hand and can be attached to or detached from the drill easily. A steel snap-on guard protects both the operator and the gear assem-



Drill attachment is smaller than the palm of the hand

bly. The drill's drive shaft is precision ground and the gears are heat treated for long wear.

0520

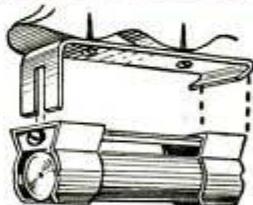
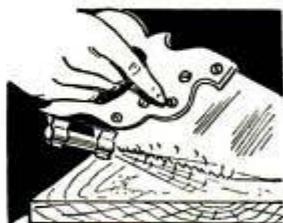
"Needle's Eye" Rust Remover Penetrates Smallest Cracks

Rust is removed from various metals with a penetrating chemical that leaves a protective film to guard against corrosion. It can be applied with a brush, swab, or by dipping, and removes a thin coat of rust in a few minutes. The chemical, which is non-explosive and will not burn the hands, penetrates corners and crevices. This makes it possible to clean intricate pieces of machinery without taking them apart. It can be used on all kinds of hand tools, power tool tables, lathes, drill presses, household articles, lawn mowers, files, sheet metal articles before painting, automobile bumpers, and even tiny watch screws.

0464

Dust "Blower" Attached to Saw Keeps Line Mark Clear

Bothersome sawdust that often obscures the line mark on a board is blown away with a simple device attached to a hand saw. It consists of a small cylinder that is clamped onto the base of the handle. The sawing motion operates a plunger which forces air through a hole in the end of the cylinder near the saw teeth. This sawdust remover weighs only three ounces and does not interfere with operation of the saw.



0403

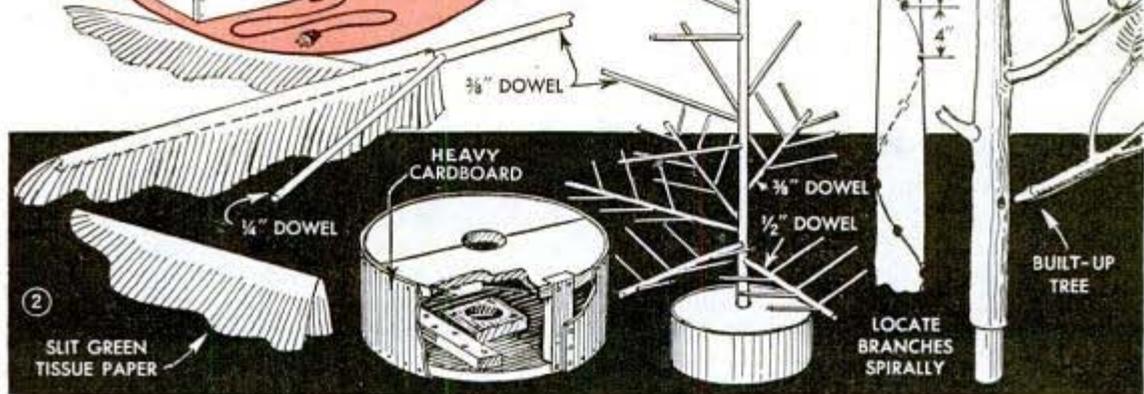
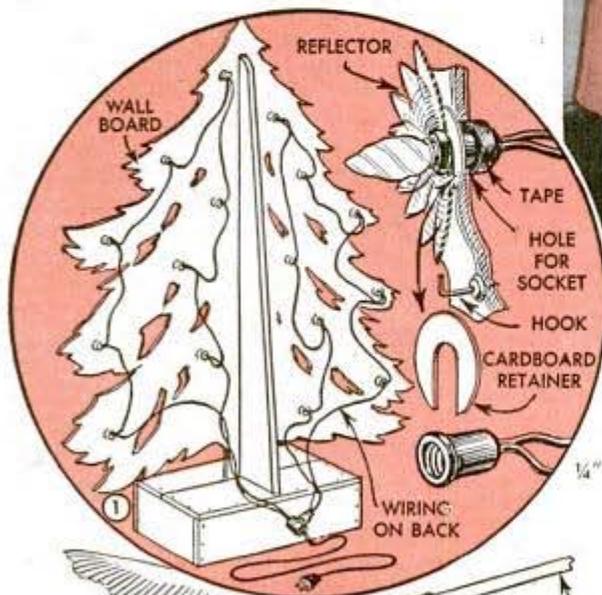
Navy's First 2-Engined Fighter Can "Hang by Its Props"

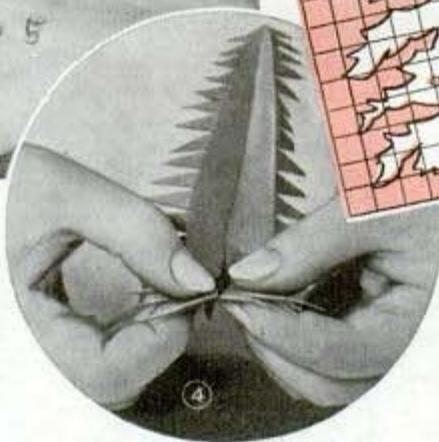
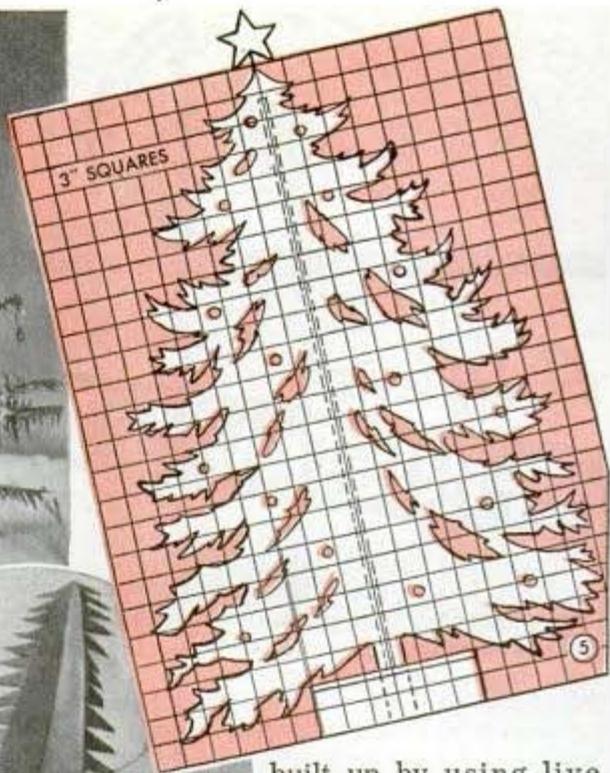
Faster, more maneuverable and more powerful than its predecessors, the Grumman F-7-F is the Navy's first twin-engined fighter plane. It gets so much power from its two Pratt & Whitney engines that in its first public tests at the Grumman plant at Bethpage, L. I., the F-7-F took off from level flight into a vertical rise which literally "hung it on the props," according to witnesses. The ship can also take off and land in comparatively short distances. While nearly all of its characteristics were kept secret, it was demonstrated to be speedier than the Grumman Hellcat, which can exceed 400 miles an hour.

Zephyr Mfg. Co.
2012 Linden Ave.
Inglewood, Calif.

Artificial CHRISTMAS TREES

CHRISTMAS trees that can be used year after year without "shedding" or drying out can be made easily at little cost. The silhouette model pictured in Fig. 1 can be cut from wall board, hard-pressed board or thin plywood according to the pattern in Fig. 5 and it is painted in realistic colors. To light it, strings of regular Christmas-tree lights





are used. Holes are drilled so that the lamp sockets can be inserted from the rear, the sockets being secured by cardboard retainers in front, and a wrapping of adhesive tape in back. Small hooks hold gifts and ornaments. An advantage of this type of artificial tree is that there is less fire hazard in using it than there is when you use real evergreen trees.

Fig. 2 shows a more elaborate tree built up with dowels. Holes drilled at a 20-degree angle for the branches are located spirally around the trunk. The branches are painted dark brown and, when dry, pieces of green paper shaped and slit along the edges as shown in Fig. 2, are glued to them for foliage. A drum-shaped base is made by tacking heavy cardboard around two wooden disks, the upper one having a hole in the center to take the tree trunk, which rests in a socket nailed to the lower disk. A similar but more realistic tree can be

built up by using live evergreen branches instead of dowels, but this, of course, will have to be discarded at the end of the holiday season.

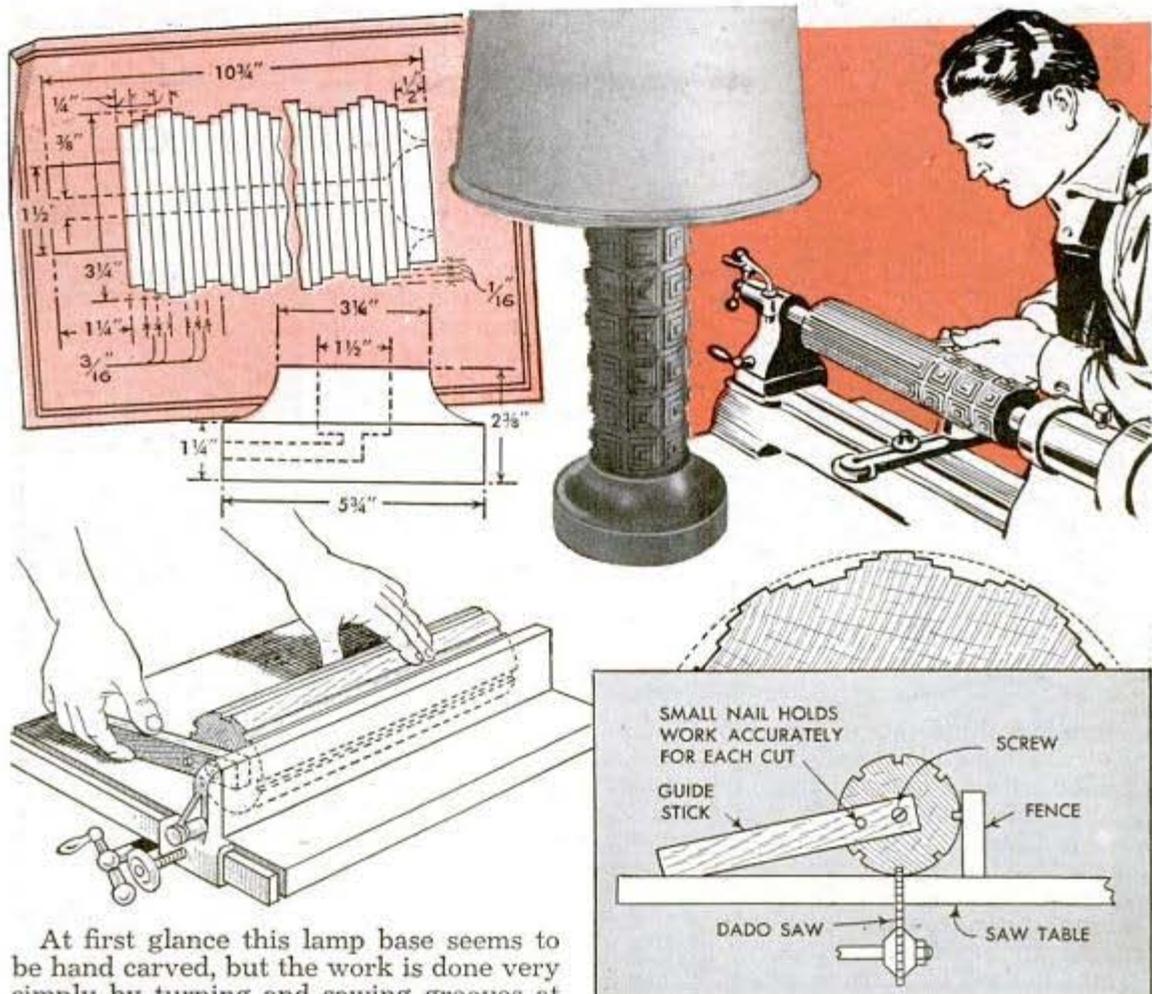
The table-top tree shown in Fig. 3 is made by gluing or stapling paper branches to a mailing tube or a roll of heavy paper. Branches are tapered strips of heavy green paper, such as construction paper, available at artists' supply houses and variety stores. The strips are folded at the center and then near each side lengthwise. The folds tend to stiffen the branches, and a tuck taken at the wide end of each branch will add rigidity when stapled in place. The branches then are serrated along the edges to produce a frond effect. The trunk should be wrapped with green paper before attaching the branches. These are located spirally around the tree, starting at the bottom with one 14 in. long and making each branch 1 in. shorter than the preceding one.

Simple Method of Measuring a Pitched Roof to Determine the Area

With a ball of twine, you can measure the area of a pitched roof from the ground. Pull the twine end from the center of the ball and, holding the end, throw the ball over the roof to a helper on the other side, who then ties a marker, such as a nut, to the line. Now, pull your end to raise the marker to the eave and, holding the line

taut, knot it where it meets the base of the building at each side. Remove the twine, measure the distance between the knots and subtract twice the distance from the marker to the closest knot which gives you the width of the roof. Multiplying this width by the length of the roof gives the area if both sides are alike.

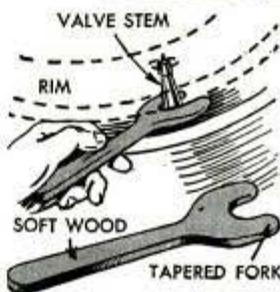
Lamp Base "Carved" by Turning and Sawing



At first glance this lamp base seems to be hand carved, but the work is done very simply by turning and sawing grooves at varying depths. Walnut, maple or any other hardwood of close grain is best for this purpose. First turn the stock to a diameter of $3\frac{1}{4}$ in. Then, at carefully measured intervals, as shown in the upper detail, cut a series of grooves in step fashion, at depths varying by $\frac{1}{16}$ in., and to the widths indicated. The waste stock at the ends is not removed until after the vertical cuts are made. For cutting these on a circular saw, use a guide stick to prevent the stock from moving out of line while sawing. This is screwed at exact center to one end of the work and is held in place by a short nail, which is removed when the work is rotated for the next cut. The vertical cuts duplicate the horizontal ones in depth and spacing so that the resulting design will be a series of squares in line both lengthwise and around the work. After sawing, the work is remounted in the lathe and the ends are turned as shown, one as a tenon to fit the lower member, which is a simple turning. After drilling lengthwise for a cord, the base is sanded with very fine sandpaper. This is wrapped on or glued to

flat, narrow sticks to permit getting into the grooves, while the work is held in the lathe. Three coats of shellac, rubbed down well between applications, and a short pipe nipple screwed into the top for attachment of a socket, complete the project.

Tool for Guiding Valve Stem When Repairing Tires



Whittled from a piece of soft wood, this tool is handy in guiding the valve stem into place when removing or putting on a tire. The fork of the tool is held over the stem between the tube and the wheel rim. In removing a tire, the tool is used to push the stem out of the rim, and when putting on the tire it is used to guide the stem through the hole.

Simple Stand for Christmas Tree Is Cut From One Piece



Here is a simple stand for small Christmas trees that can be made from one piece of wood with a coping saw and a hammer. A block of wood 20 in. long and $1\frac{3}{4}$ in. wide is used, a portion being sawed out from one edge and pivoted in the center with a screw as shown. The screw should be long enough to turn into the base of the tree to anchor it firmly. A wood block about 3 in. long is nailed to each side of the support at the center to give it added strength and also provide a wider place for the base of the tree to stand on.

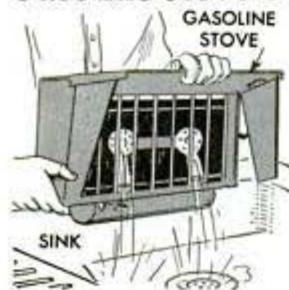
—Bruce E. Stevens, San Francisco, Calif.

Paraffin on Rubbers Seals Jars

If it is necessary to re-use jar rubbers in canning, brush the rubbers with paraffin before screwing on the lids, to make a more secure seal. Even when using new rubbers, this procedure is an added safeguard against spoilage.

—Mrs. Susie Lemaster, Maryville, Mo.

Gasoline Stove Cleaned by Tilting



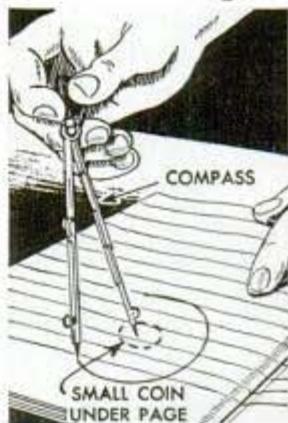
When the burners of a gasoline stove fail to operate efficiently because gasoline that has seeped out of leaky valves and water boiled over from kettles have collected in

them, they can be readjusted by tilting the stove over a sink and letting the accumulated water and gasoline run out. When the stove is lit again the flame will burn blue and hot.

—Lester M. Diehl, Pittsfield, Mass.

Coin Used as Pivot for Compass

When using a compass where it is desired to avoid having the pivot point penetrate more than one thickness of paper, a small coin will solve the problem. Just place the coin under the sheet of paper on which the compass is being used, as indicated.



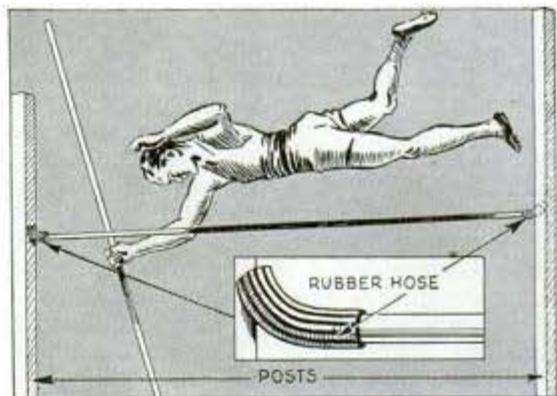
Screw-On Watch Cover Loosened Using Sealing Wax and Block

Watch covers of the screw-on type that cannot be removed by ordinary means often can be loosened by melting a small amount of sealing wax on the cover and, before it hardens, pressing a small block of wood into it. The wood provides a hand-grip for turning the cover, and if the wax breaks off the first time, another application generally gets results.

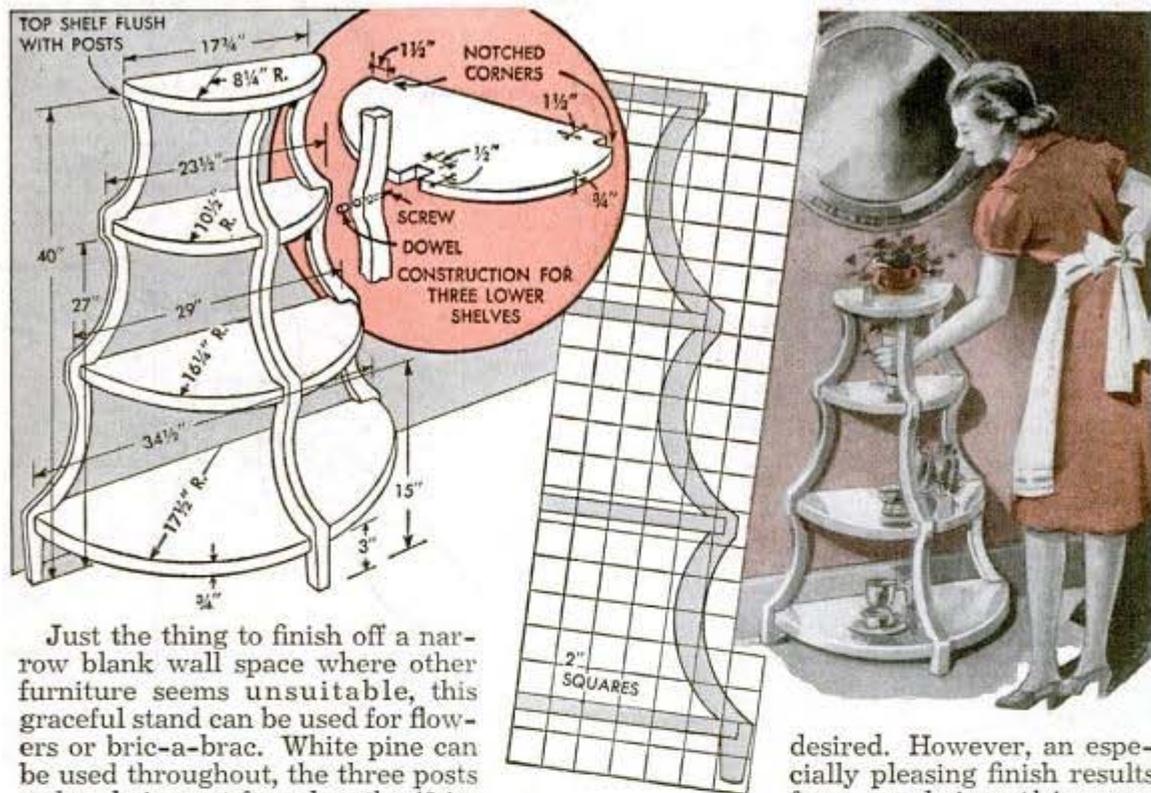
—Joseph Horvath, Farrell, Pa.

A Hurdle Bar for Pole Vaulting Wedged Safely With Rubber

A good way to hold a hurdle bar for pole vaulting is to slip short sections of rubber hose over the ends and wedge it between the two standards that support it. In this way, there is no danger of tripping a vaulter if he should fail to clear the bar, as a touch will dislodge it.



Four-Tiered Flower Stand Has Jigsawed Legs

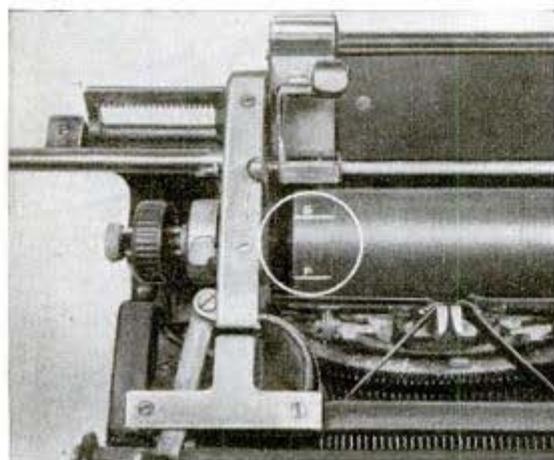


Just the thing to finish off a narrow blank wall space where other furniture seems unsuitable, this graceful stand can be used for flowers or bric-a-brac. White pine can be used throughout, the three posts or legs being cut from lengths 40 in. by 12 in. by 1½ in. Standard lumber is wide enough for the two upper shelves, but the two lower ones will have to be cut from a panel made by gluing together narrow pieces of lumber. All shelves except the top one are assembled to the legs as shown in the circular detail. The top shelf is set on the ends of the posts flush with their outer edges. The stand can be painted as

desired. However, an especially pleasing finish results from applying thin gray paint to a small area at a time and wiping off the surplus while still wet, continuing in this way until the desired depth and shade are obtained. Then three coats of shellac or varnish are applied, each coat being well sanded, and the final coat rubbed with fine steel wool saturated with linseed or paraffin oil. Wax may be added as a finish if desired.

Marks on End of Typewriter Roller Locate Bottom Margin

Uniform spacing at the bottom of typewritten sheets is no problem if you mark the roller at one end as shown. To do this, first put a mark on the end of the roller



even with the horizontal paper guide, labeling it S for "start." Then insert a sheet of the paper to be used, on which the location of the lower margin has been penciled. Now, turn up the paper on the roller until the pencil line is in position for typing the last line, and put another mark on the roller even with the guide, this one labeled F for "finish." In use, turn the roller so that the S mark is in position at the paper guide before inserting the sheet to be typed, and stop typing when the letter F appears in position at the guide near the bottom of the sheet. By doing this, it will be unnecessary to mark each sheet before typing or to count space lines to determine when to stop.

Ⓞ Tar on shoes is removed readily by rubbing the stain with a cloth soaked in a popular type of fly spray.

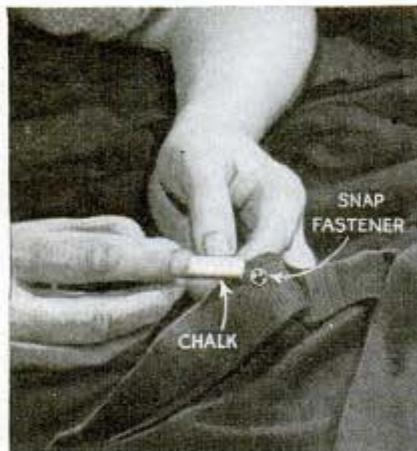
Solving HOME



A creeping baby is less likely to pull a lamp off a table if the cord is tied to one of the table legs



To prevent the cap of a cardboard toothpowder or talcum container from loosening and allowing the contents to spill when carried in a bag while traveling, secure the cap by pushing a straight pin through both the cap and the upper part of the container as shown below

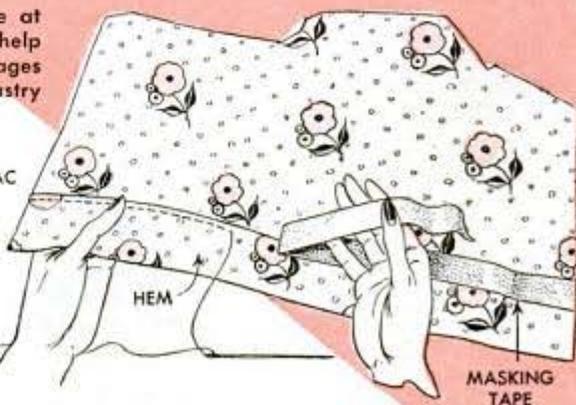
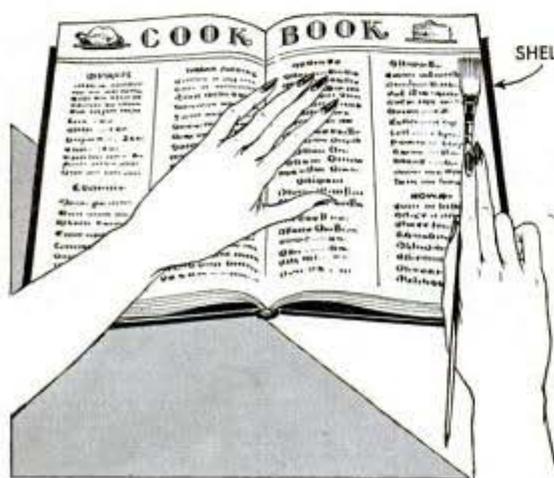


To locate snaps accurately first sew on the stud and then rub chalk on the point after which the other cloth edge is pressed against the point in order to mark it

A soda straw will transfer a few drops of perfume to a tiny vial if, with the straw immersed, you close upper end with your finger, which holds perfume inside by vacuum while making transfer



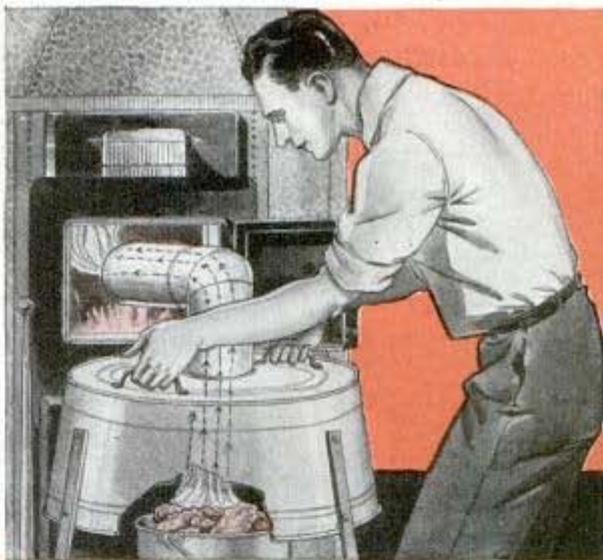
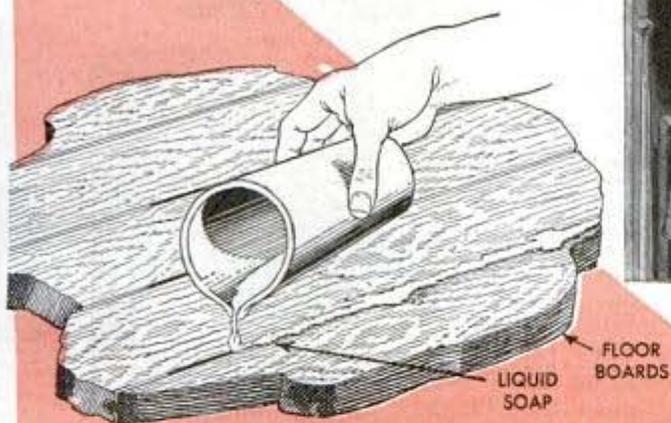
Applying a coat of clear shellac about 1 in. wide at the marginal edges of your cookbook pages will help to keep them from being soiled when turning the pages while your fingers are covered with grease or pastry



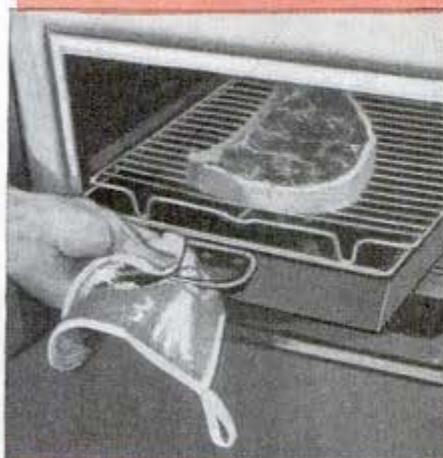
Instead of basting hems on sheets, pillow cases and similar articles, secure them for sewing by using masking tape. This will save much time, and the tape can be peeled off just ahead of the needle as you sew the hems permanently

PROBLEMS

Squeaky floor boards often can be silenced indefinitely merely by pouring liquid soap into the cracks between the boards causing the trouble. The soap acts as a lubricant where the boards rub together and should be applied hot to assure penetration into the wood fibers

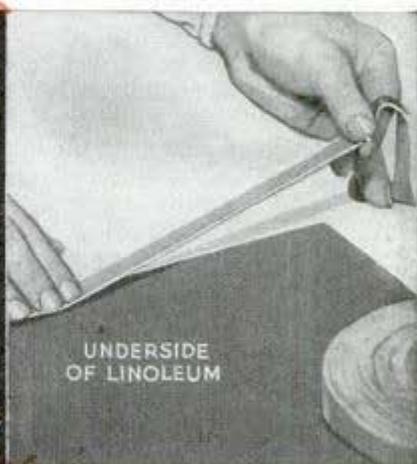


Fitted with legs and a short smokepipe, a metal washtub inverted over a bucket of live clinkers, as above, will keep fumes out of the basement



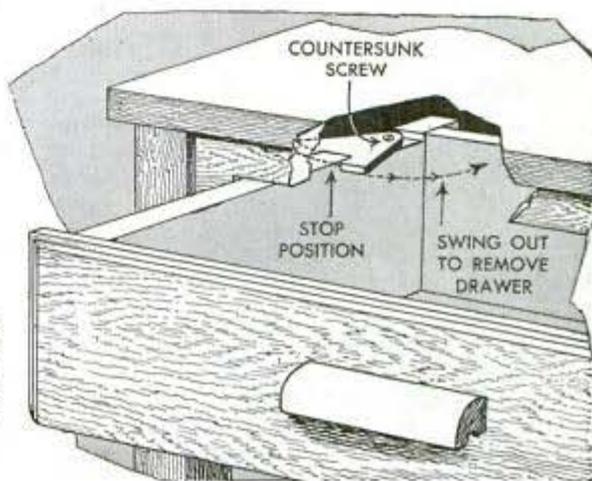
There's no need to use and clean a large broiler for a small amount of food; you can substitute a cake rack in a shallow pan on broiler

Tearing of linoleum, which usually occurs first at the corners, is easy to prevent by applying strips of adhesive or cloth masking tape along the underside edges

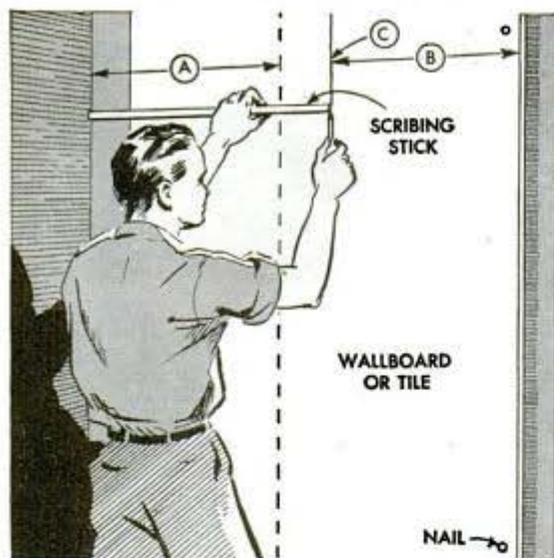


If a key to open sardine cans and similar containers is not at hand, you can make one from a large nail. Bend it at right angles in the center, cut off the point and slot the end. This can be done easily with a fine hacksaw blade if the nail is gripped firmly in a vise

Pivoted in a recess cut in a drawer top near the back as below, a piece of hard-pressed board or plywood provides a handy stop that can be swung to one side and out of the way when you wish to remove the drawer



Marking Off Wallboard to Fit Accurately in Corners



When covering a wall with large sheets of wallboard or imitation tile and you come to a corner where a full-size sheet cannot be used, here is a good method of marking it for cutting so that it will fit accurately. Set the full sheet in place with one edge in or near the corner with the opposite edge overlapping the wallboard already installed, and fasten it temporarily with two or three nails. Then, measure the distance from the corner to the edge of the wallboard already in place, as indicated by A, and transfer this distance to the opposite side of the temporary sheet as indicated by B. Now, using a scribing stick having a length equal to the distance from the corner to point C, scribe a cutting line, keeping the stick in a horizontal position. When the sheet has been cut and the portion represented by distance B is set in place it will fit accurately in the corner. This method also can be used when fitting wallboard around doors, windows and other openings.—R. Logocki, Hammond, Ind.

Eye-piece Wired to Sun Glasses For Viewing Close Work



A magnifying eye-piece used in reading fine print or in close-inspection work can be held in place comfortably and securely by attaching it to an old pair of sun glasses from which one of the lenses has been removed.

Drill three or four small holes in the shell of the eyepiece and attach it with wire to the rim of the glasses. Blacking out or covering over the other lens of the sun glasses will make it unnecessary to close the other eye while using the eyepiece.

—M. A. Jacobson, Chicago.

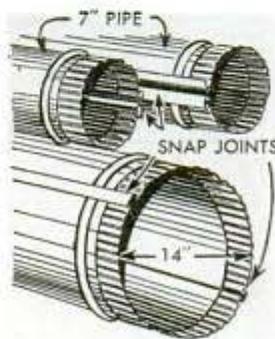
Shoe Scraper Has Brush Attached To "Sweep" the Soles

Screwed to a doorstep or sidewalk, this handy shoe scraper is made from a large scrub brush and a strip of sheet metal. As indicated, the brush is screwed in place flush with the edge of the step, after which the sheet metal is fastened so that the upper edge is approximately the same height as the brush bristles.—Don Brooks, New Caledonia.



Narrow Stovepipes Re-assembled To Form One Larger Section

When you need a length of 14-in. stovepipe and none is available, you can combine two pieces of 7-in. pipe to form one



length of the larger size by unhooking the interlocking joints and spreading each piece to a radius of 7 in. When these are joined edge to edge and interlocked again, they will have a 14-in. diameter. Similarly, three pieces of 7-in. pipe

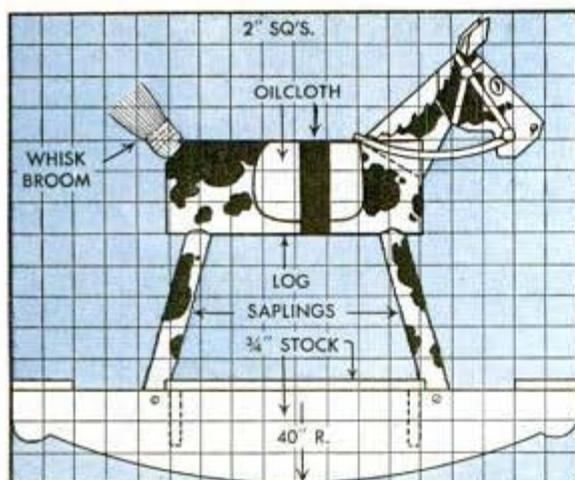
may be joined in the same manner to form one section of 21-in. pipe.

—W. Lynn Williams, Richmond, Va.

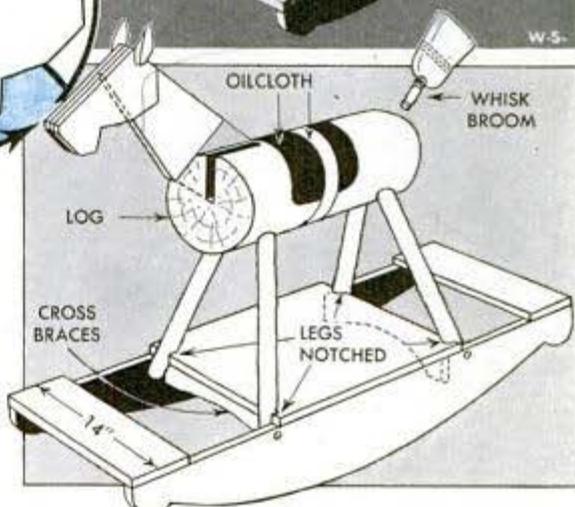
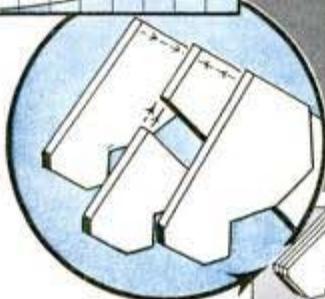
Keeping Christmas Trees Green

You can keep your Christmas tree fresh and green for the longest possible time if you support it in a crock or jar containing the following solution: Citric acid, 5 grams, malic acid, 6 grams, mixed in water, 3 qts. To this is added calcium carbonate, 15 grams. As this mixture is absorbed into the tree, more water should be added. Hemlock will not respond to this treatment.

Stovewood Hobby Horse From the Woodpile



With its pinto coloring and jaunty whisk-broom tail, this hobby horse has a realistic appearance and action that will delight any young cowboy. Except for a couple of short boards, the average woodpile will yield the needed material. The body is a 6-in. log or it can be built up from three pieces of 2 by 6-in. stock and rounded to suit. It is slotted at one end for the head and is bored for the sapling legs and tail. Straight saw cuts shape the head and neck, which are built up of four pieces as indicated. The rockers can be roughed out with a handsaw and finished to a curve with a drawshave and plane; the rounded ends, which serve as stops to prevent the horse from tipping, can be cut with a keyhole saw. Two cross braces are installed between the rockers. The lower ends of the legs are notched to rest on the edge of the footboard, and are also flattened to be screwed to the rockers.



The saddle can be made of oilcloth and the reins of leather or a substitute. The horse is painted a mottled white and brown like a pinto, and the rockers yellow.

Suggestions to Reduce Cost of Heating Water in the Home

If fuel bills for heating water in your home seem excessive, often they can be reduced by such simple things as changing your habits in using the water and installing new washers in the faucets. Washing hands or dishes generally takes more water if it is running than if you use a pan. On the other hand, taking a tub bath requires more water than a shower. A leaky faucet that needs a new washer may lose only a drop per second but will waste 2 or 3 gal. per day. When you consider that to heat a gallon of water from 39 to 120 deg. Fahr. requires roughly 2 oz. of fuel oil or

a cubic foot of gas, it is apparent that a little water wasted each day increases your fuel costs considerably over a period of months. A saving of fuel can also be effected by using water as cool as possible. Naturally, it takes more fuel to keep water at 140 deg. in a storage tank than it does at a lower temperature. Keeping the heater clean and adjusted efficiently saves fuel too. The storage tank should be flushed regularly to remove sediment. Last but not least, operate the burner flame as low as possible. A high flame wastes more fuel up the chimney than a low one.



2

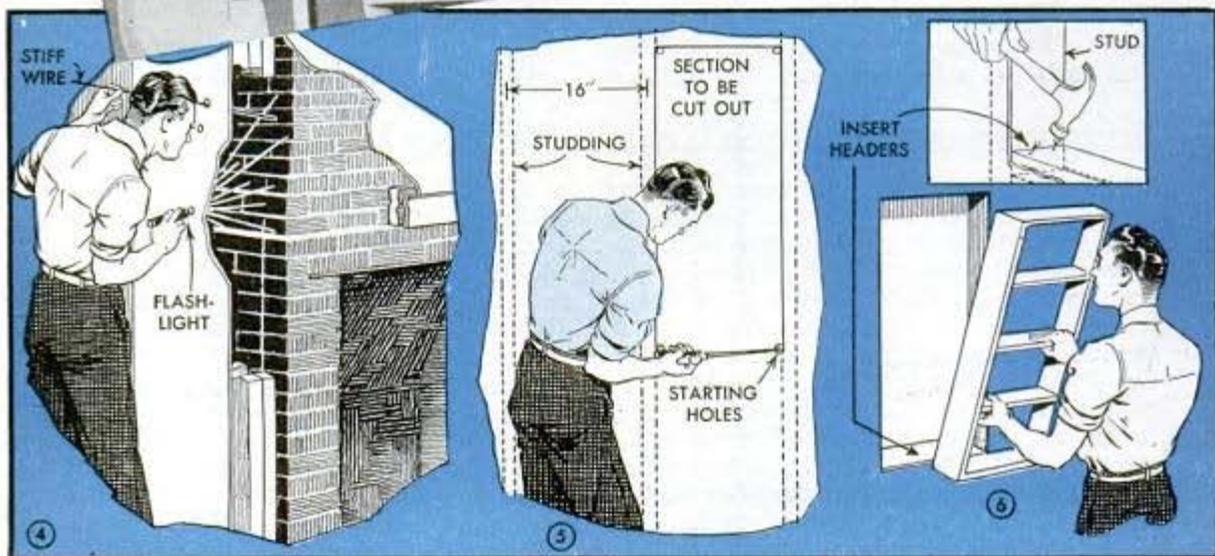
OVERHANGING SHELVES

BUILT-IN SHELVES *utilize waste*

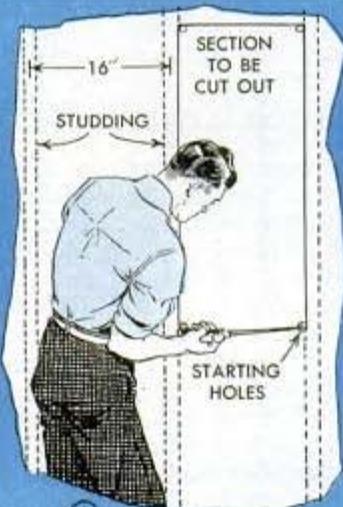
NEEED for additional closets, cupboards and shelving often can be met by making effective use of dead wall space. For instance, ironing facilities can be provided by building an ironing-board compartment on a door as in Fig. 1, or a separate wall cabinet can be installed for this purpose. Also, a telephone niche, Fig. 2, may be built in a wall or partition of standard thickness if sufficient base space for the instrument is provided by letting the shelf project. Sometimes hot-air furnace ducts and plumbing are spaciouly enclosed in extra wide partitions which offer available wall space for cabinets, Fig. 7, or other small compartments. Waste corner space in rooms can be put to good use by installing corner cabinets for linens, books or dishes, as in Fig. 8. Corner cabinets are available ready-made in a variety of sizes and shapes



3



4



5



6

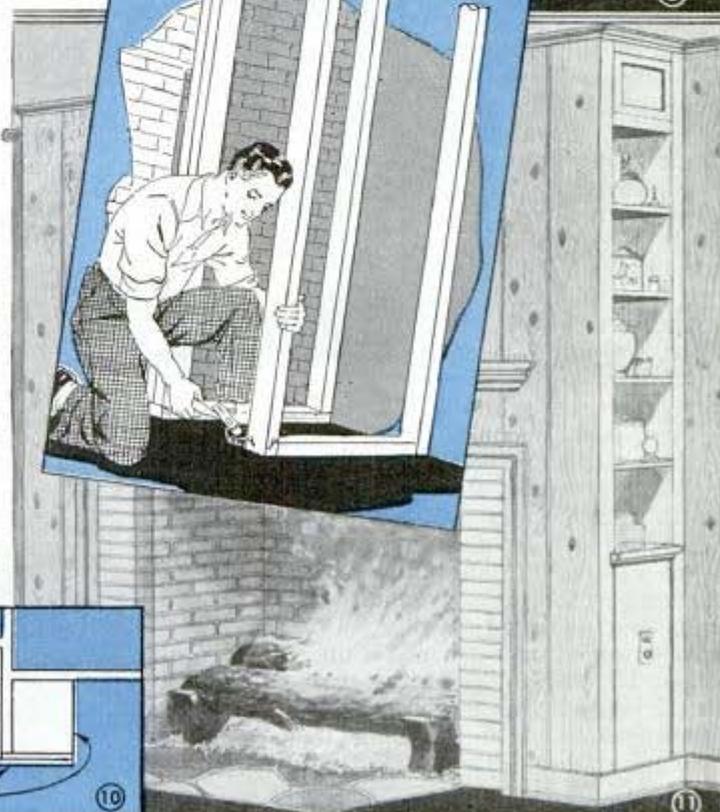
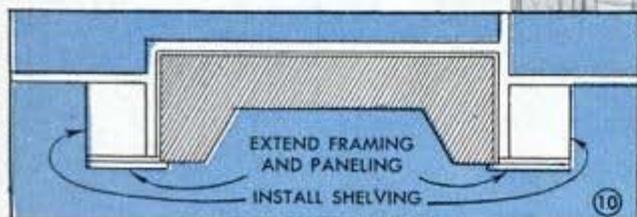


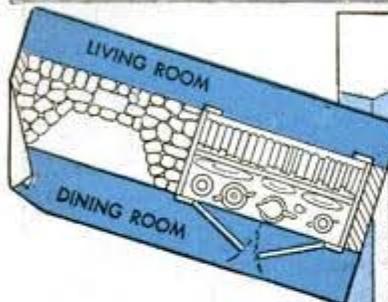
and CABINETS wall space

if you prefer not to build your own.

Among other places where dead wall space may be found are the enclosures surrounding the masonry of fireplaces and chimney stacks, which are commonly blocked off with straight and square-cut walls for the sake of appearance and to cut framing costs. The size and shape of such spaces can be determined without doing any appreciable damage to the surrounding walls by probing behind them through peep holes, using a flashlight and a length of stiff wire as illustrated in Fig. 4. After such a survey, the holes can be plugged with patching plaster.

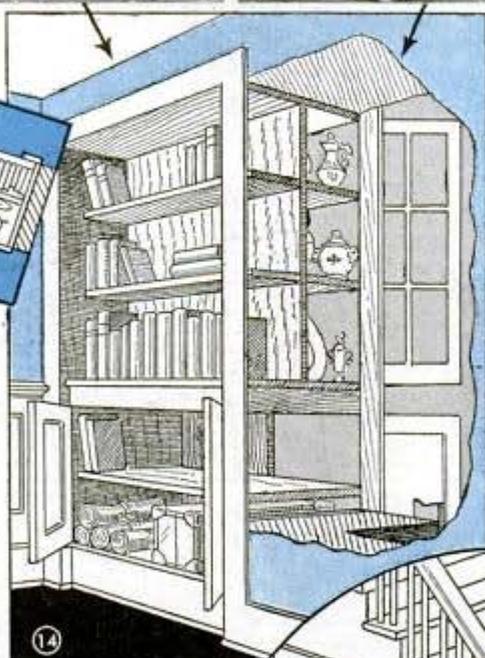
A simple method of installing shelving between the studs of a wall is shown in Figs. 3, 5 and 6. Begin by drilling four straight holes through the wall surface between studs. Then, using an old keyhole saw, cut down each side, holding the blade snugly against the stud while sawing. After sawing across the top and bottom, remove the cut section. Insert headers at the top and bottom, toenailing these to the studs. Take





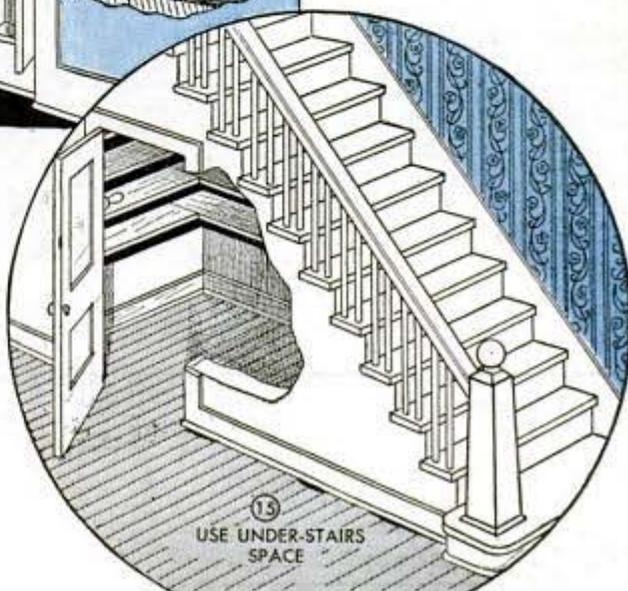
accurate measurements of the opening, cut your lumber to size and assemble the shelf unit, after which it is slipped between the studs and nailed or screwed in place. The joints between shelving and wall surface are covered with trim to match that in the room, or you can use any suitable molding of smaller size as illustrated in Fig. 3.

In a living room, a little space at each side of a fireplace might be converted into useful shelving for books or knickknacks as shown in Figs. 9, 10 and 11. In some cases, fireplaces faced with wood paneling can be extended to incorporate a shelf unit at each end. Deep portfolio cabinets, handy for storing such things as maps, blueprints, drawing material and large albums can be built into the waste space flanking the brickwork of a fireplace located on an interior wall like that shown in Figs. 12, 13 and 14. The upper part can be



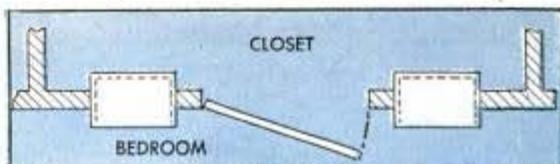
divided with bookshelves facing on one side and a china cabinet on the other, as in Fig. 14. A false drawer front and two cabinet doors give the china closet a full-length appearance. If the space under a stairway is not utilized as headroom, it may be enclosed and, with some shelving installed, will serve as an extra linen closet, as shown in Fig. 15.

Shelf depth, in addi-



tion to that offered by the thickness of a standard partition, also may be taken from a closet on the opposite side of the wall by letting the cabinet jut into it as shown in Fig. 16. In most cases the closet space thus used would not be missed. And, if you face the projecting part with red-cedar lining, it will add a touch of natural wood finish besides making the closet moth-repellent.

When building wooden shelving close to heat-conducting masonry, such as a chimney, take care to allow the same clearance between the masonry and the new work that was allowed originally between the masonry and the wall framing. This distance may vary from two to several inches. Where there is doubt about proper clearance, use fire-resistant material such as plasterboard for the back of the cabinet, Fig. 19. Old houses built around a central masonry structure having fireplaces, Dutch ovens or smoking chambers offer good opportunities for building in close to the stonework, parts of which never become warm due to its massive size. In such cases clearance is unnecessary and the cabinets can be butted directly against the masonry. Where depth is limited, trowel a thin coat of plaster directly to the stonework, or onto a sheet of



METAL LATH
NAILED ON STONE

COOL
MASONRY

SCRIBE
TO FIT

18

FIREPROOF
BOARD

AIR SPACE
2" OR MORE

19 TWO METHODS OF
INSULATING CABINETS

17

metal lath nailed to it to serve as the back, as in Fig. 17, thus giving the shelves the greatest possible depth. Scribe the frame and shelves to fit the plastered surface if it is uneven, as in Fig. 18.

Another likely spot where waste space may be found is in a pipe-carrying partition. Being several inches thicker than an ordinary inside wall, it generally offers ample depth into which an extra bathroom cabinet or set of shelves may be recessed. Naturally, the walls containing the bathroom and kitchen plumbing fixtures are the ones to check for available space. You can compute this space from the house plans if you have them, or make sure the space is clear by probing behind it with a wire as already suggested. Although smaller water pipes may take unexpected turns inside a partition, the large 4-in. soil pipe, which forms the main waste-and-vent stack of the drainage system, usually runs vertically from basement to roof in a straight line. And, while you are building into your waste space, keep in mind the possible future needs of your home. A conveniently located shut-off closet or a fuse cabinet can be built in now with little extra work. It is best to consult your local electrician or electric company on this subject to assure the correct installation.

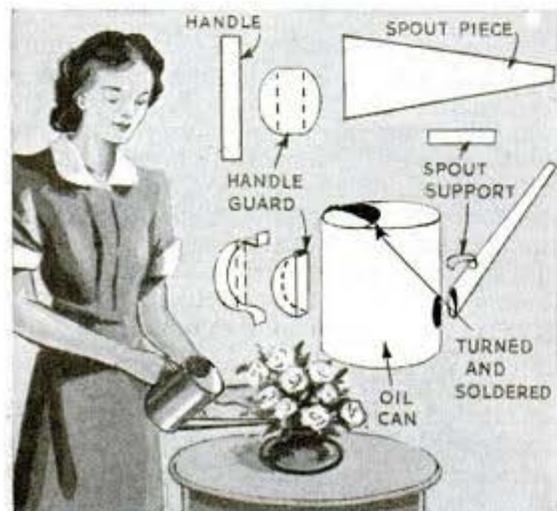
Adjustable Square Drilled at Ends Serves as Marking Gauge



To convert an adjustable square into a marking gauge, drill a $\frac{1}{16}$ -in. hole $\frac{1}{2}$ in. from each end as shown. In use, set the gauge at the required distance, insert the tip of a pencil through the hole and slide the square along the edge of the work to mark off the line.

Watering Can for Potted Plants Made From Empty Oilcan

An empty quart-size oilcan or similar container can be made into a watering can for potted flowers and plants by adding a spout, handle and cover formed from scrap metal. By cutting off only part of the top, the remaining portion will serve as a non-spill guard, the edge being turned under

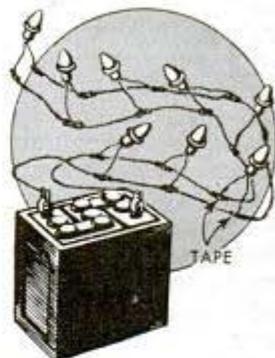


for safety. The spout is formed on a round file and soldered over a hole near the bottom, after which the spout support is added. For use on small potted plants, the spout should be extra long and tapered to a narrow opening. To add rigidity to the handle, as well as for comfort in using, a guard is bent as shown and soldered to the handle. Painting the can will hide trademark labels and improve its appearance.

—Frederic Hillegas, Syracuse, N. Y.

Christmas-Tree Lights Operated From 6-Volt Storage Battery

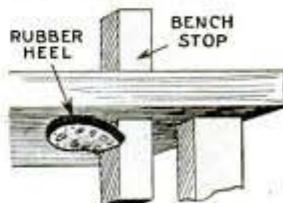
If you do not have electricity in your home, you can use electric lights on your Christmas tree by operating them from a storage battery. To do this, use an inexpensive string of 110-volt, series-wired lights and rewire them in parallel. Cut up the string of lights so that two wires about 3 in. long extend from each socket. Then connect the short wires from each socket to two longer wires as shown, and tape the connections thoroughly. When connected to a 6-volt storage battery, the lights will glow satisfactorily although not quite as brilliantly as when used on 110-volt current. If two batteries are used in series with the lights, they will glow almost as brightly as on the heavier current.



—Wayne Sheppelman, Chicago.

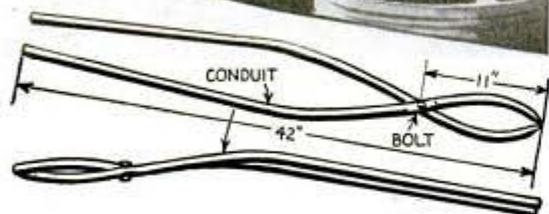
Adjustment of Bench Stop Held By Rubber Heel

When a bench stop becomes so worn that it will not hold securely in an adjusted position, tack a rubber heel to the underside of the bench so that it presses tightly against the stop. This will permit the stop to be raised or lowered easily, yet remain in any desired position.



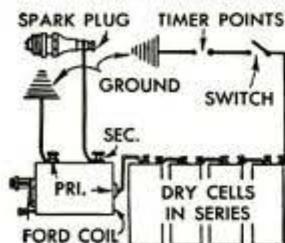
☐ You can reduce the shine on clothing by rubbing the surface with a pressing cloth moistened in a mild vinegar solution, to raise the nap, after which the cloth is again moistened in the solution and used in the regular manner for pressing.

Light Clinker Tongs Made Easily From Pieces of Old Conduit



If you have some old rigid electrical conduit lying around from which you can get two 42-in. lengths, you can easily make a pair of tongs for removing clinkers from your home heating plant. Flatten one end of each piece, bend them to the shape shown in the upper detail, and then pivot them together about 11 in. from the flattened ends. A stove bolt will make a good pivot if the threaded end is riveted to keep the nut from loosening. After the tongs have been assembled, bend the handles to the shape shown in the lower detail so that it will be easier to reach down into the firebox with them.

Battery Ignition Substituted For Magneto on Engine



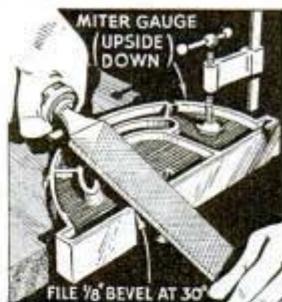
If the magneto on a small gasoline engine fails and another cannot be obtained, often a coil and battery can be substituted. Either a 6-volt storage battery or three 1½-volt dry cells can be used. A vibrator coil of the type used on model-T Fords is required and is wired as shown. If dry cells are used, they should be wired in series. One primary terminal of the coil is grounded

and the other is connected to the battery or cells, which are in turn wired through a switch to one of the timer points on the engine. The other timer point is grounded, and the secondary terminal of the coil is wired to the spark plug.

—F. A. Quigley, Jr., Kennedyville, Md.

Preventing Saw Miter Gauge From Catching on Table

Did you ever have the miter gauge catch on the edge of the saw table when you were starting a critical cut on a wide piece of work? If so, it is easy to avoid this trouble by filing a ⅛-in. bevel on the lower edge of the guide block as shown. Be careful not to file the bevel more than ⅛ in. wide. Hold the file at about a 30 deg. angle with the face of the guide block.



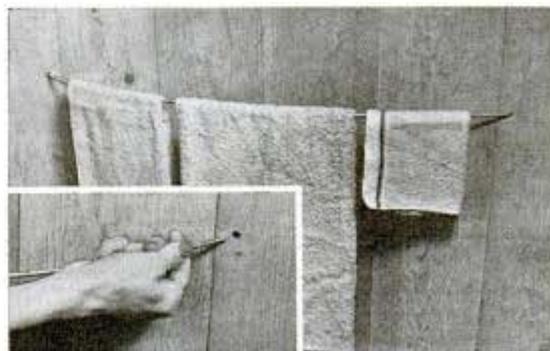
—W. C. Lammey, Sandwich, Ill.

Small Christmas Tree Supported In a Bucket of Wet Sand

If you use a small Christmas tree and have no suitable stand to support it, just insert it in a bucket of wet sand and pack it well. Besides supporting the tree, the moist sand will help keep the branches green longer.

Towel Rack Made From Wire

A towel rack that can be installed quickly and cheaply in cabins and summer houses consists of a single length of stiff



galvanized wire inserted into holes drilled in the studding or wall panel. The holes are drilled at an acute angle in opposite directions and close enough together so that the wire must be bowed outward in order to insert the ends as shown.

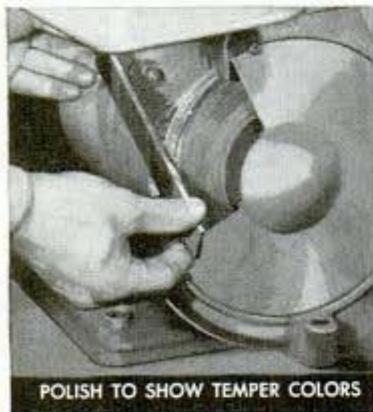
—Benj. Nielsen, Aurora, Neb.

Here's Your HUNTING KNIFE



KNIFE BLADE IS MADE FROM 10" MILL FILE. TEMPER CAN BE JUDGED VERY ACCURATELY BY COLOR

Under the rusty exterior of an old file there's high-grade steel to make a sturdy, razor-edge hunting knife. Rough-polish one side for a surface on which to observe tempering colors. Heat the tang to a full red and watch the blade portion change from straw color to brown, then to purple and blue. When blue shows, remove from heat and let the work cool in air. Shape and bevel the knife by grinding carefully, dipping it in water constantly to prevent heating. Smooth the rough-ground surface on a sander. For the handle, shape the bolster from soft metal, drive it in place and add leather and plastic washers with glue between them. Squeeze up with a nut and fit the threaded tip. Then shape the handle by filing and sanding carefully while the knife is held in a vise or a lathe

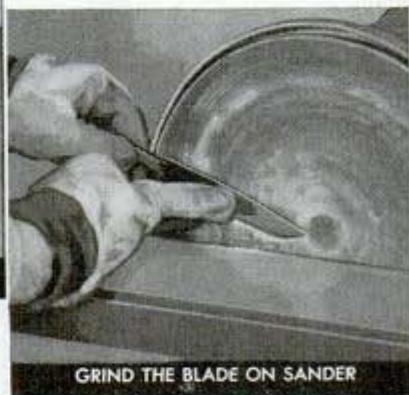


POLISH TO SHOW TEMPER COLORS

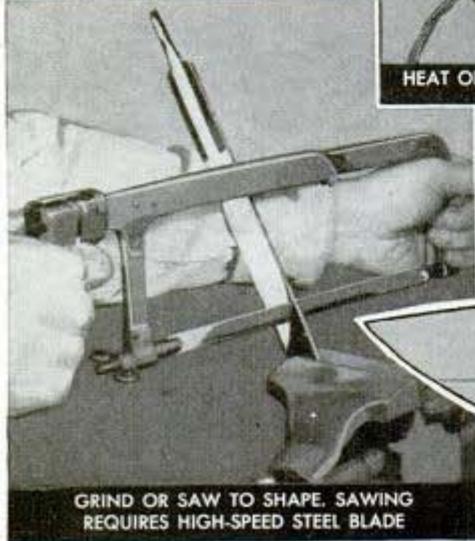


POLISHED SIDE SHOWS HEAT COLOR

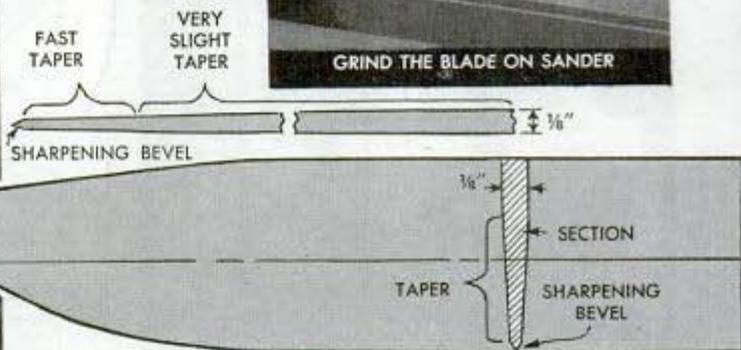
HEAT ON GAS OR ELECTRIC PLATE



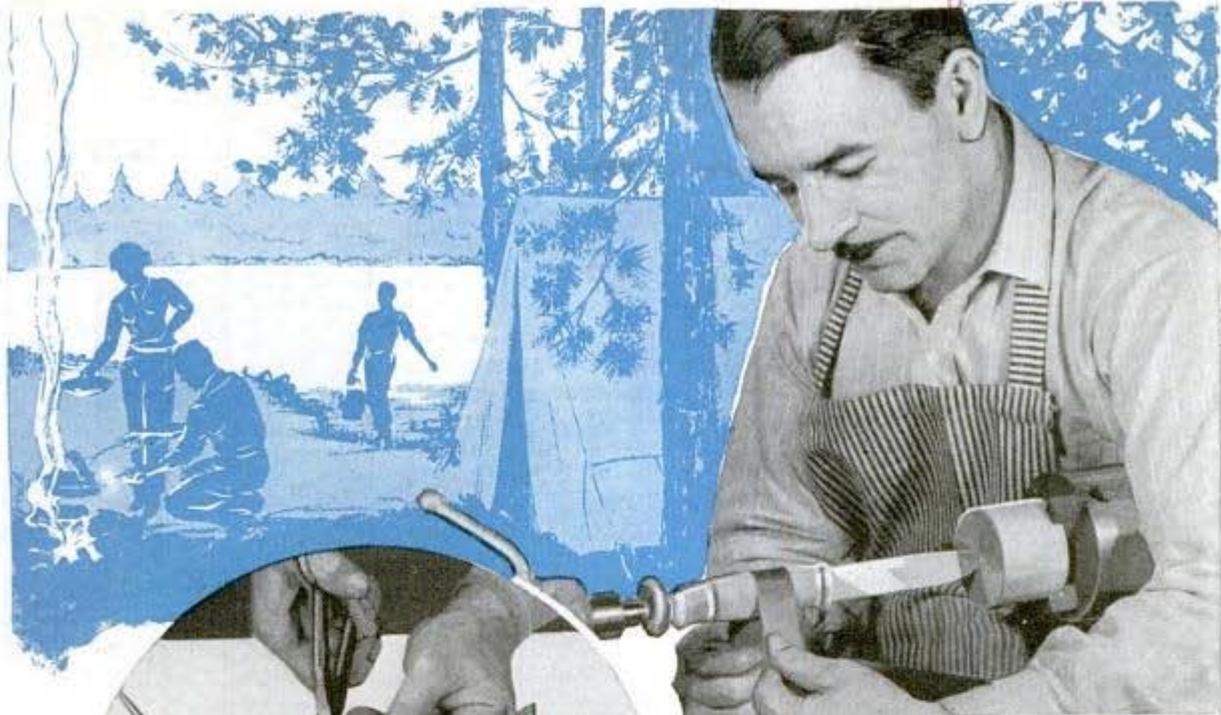
GRIND THE BLADE ON SANDER



GRIND OR SAW TO SHAPE. SAWING REQUIRES HIGH-SPEED STEEL BLADE



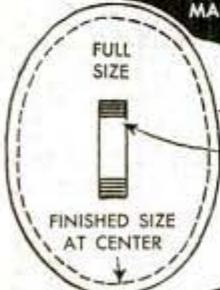
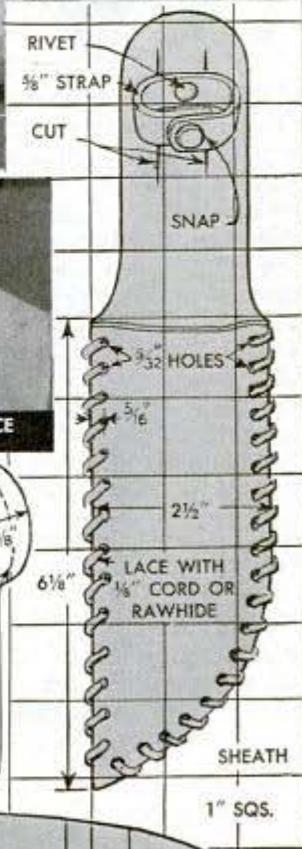
Use this full size pattern



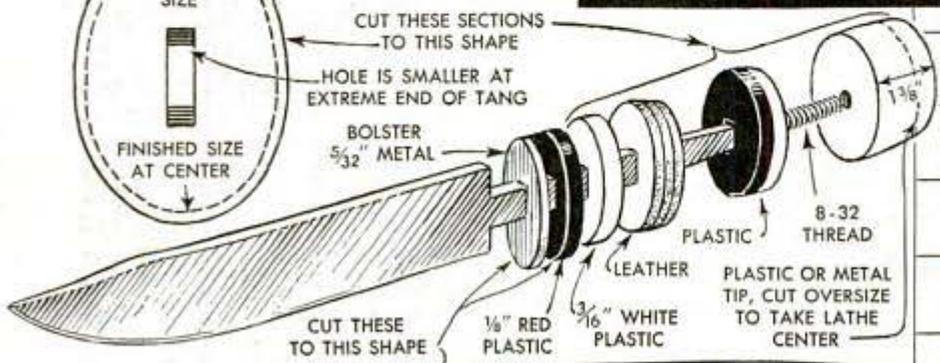
CUT LEATHER WASHERS TO MAKE TOTAL THICKNESS OF 2 3/4"



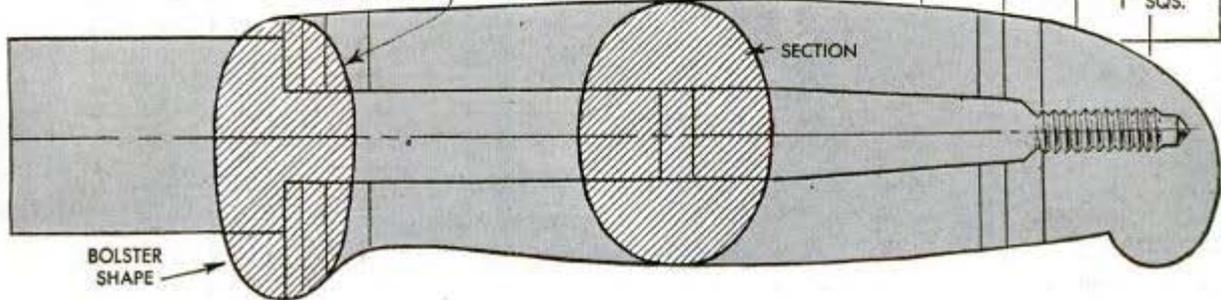
SHEATH: DRILL HOLES FOR LACE



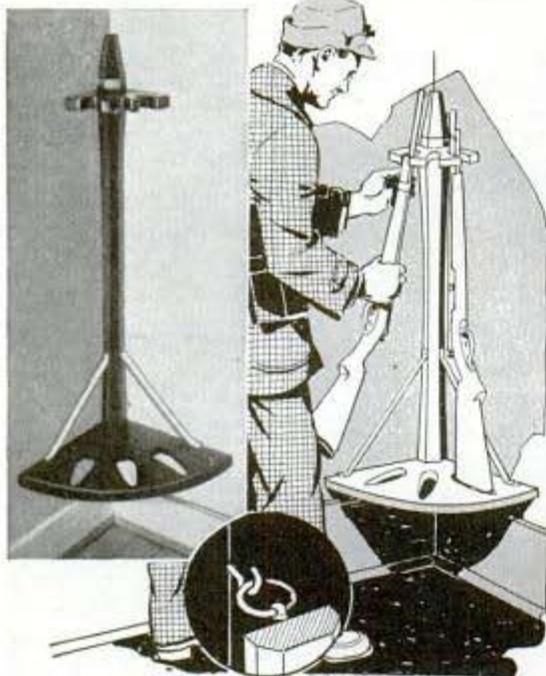
CUT THESE SECTIONS TO THIS SHAPE
 HOLE IS SMALLER AT EXTREME END OF TANG



CUT THESE TO THIS SHAPE



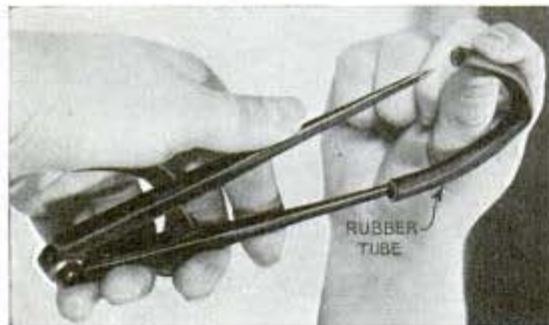
This Gun Rack Hangs in a Corner Where It Takes Little Space



Different from the usual gun rack in that it can be hung in a corner above the floor to make cleaning under it easy, this rack consists of a standard carrying a shelf at the bottom for the gun stocks and a notched holder at the top to receive the barrels. The shelf is cut on a 14-in. radius and is screwed and glued to the lower end of the standard. Metal braces add further support to the shelf. The notched holder at the top is screwed to the standard, which is chamfered at the edges. A ring at the top for hanging the rack engages a hook in the wall. If desired, small holes can be drilled in the notched holder to take cleaning rods.

Sharp Divider Points Protected By Length of Rubber Tubing

In addition to protecting sharp divider points, a piece of rubber hose slipped over them also eliminates the danger of pricking your fingers when removing the tool from a rack or drawer. A similar guard



used on an ordinary compass not only serves as protection for the point, but keeps the lead from being broken.

Novel Christmas-Tree Ornaments Are Easy to Make

These novel and attractive Christmas-tree ornaments can be made from a few bits of cotton, some stiff paper and red nail polish. A small ball of cotton forms the body, while smaller wads make the arms, legs and head. A paper hat is glued on the head, and the buttons on the coat and eyes, nose and mouth are simulated with drops of nail polish.

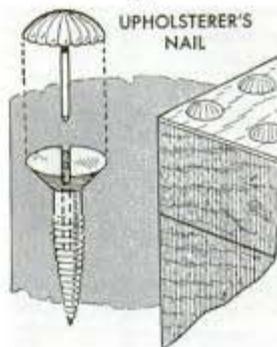


Pipes Inside Partition Thawed With a Hair Drier

When pipes freeze inside partitions where they cannot be reached for thawing by ordinary methods, clamp a portable hair drier to the pipe where it enters the wall. Enough warm air will be forced through the crack between the pipe and the wall and rise up between the studs so that the water soon should begin to flow again, probably within an hour's time.

—H. Horwedel, Fairfield, Conn.

Screw Head Is Concealed Neatly Using an Ornamental Tack

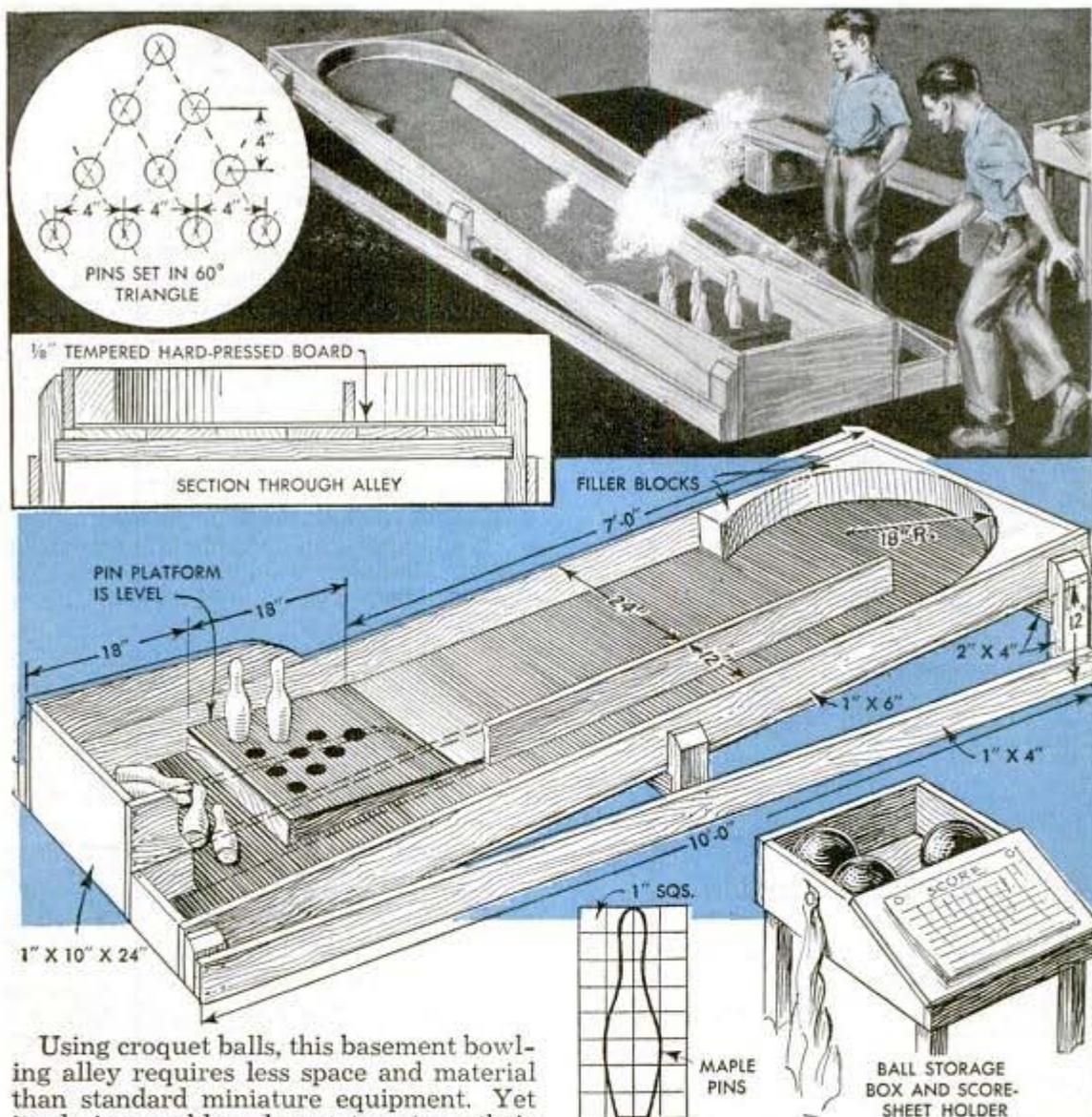


Screw heads on finished surfaces can be concealed and a pleasing appearance given to the work by inserting upholsterer's nails or ornamental tacks into small holes drilled into the screw heads as shown. If the tacks are bent

slightly before inserting, they will hold firmly. This method is particularly useful when the wood is too thin to permit the use of a wood plug to cover the screw head.

☛ To locate a leak in a gas pipe, brush it with thick suds, and if there is a hole, the escaping gas will cause bubbles to form at the leaky spot.

Return-Ball Bowling Alley Will Test Your Skill



Using croquet balls, this basement bowling alley requires less space and material than standard miniature equipment. Yet its design enables players to set up their own pins, and the balls always return to playing position. Dimensions given are for a small alley, but a longer one will provide a more exciting and exacting game. Common lumber may be used, as the alley floor is covered with tempered, hard-pressed board or other material having a wear resistant surface. The alleys are inclined as shown, but the pin platform must be level. Note that the floor covering extends unbroken from the incline over the platform

so that there will be no joint to throw the balls off course. Pins are turned from maple or similar hardwood and varnished in natural finish. They are placed on marks painted on the platform, as shown in the circular detail. In setting up the alley, be sure the pin platform is level. A stand with a storage box for spare balls also will accommodate score sheets, towels and pencils. Rules and scoring are the same as for the regulation game.

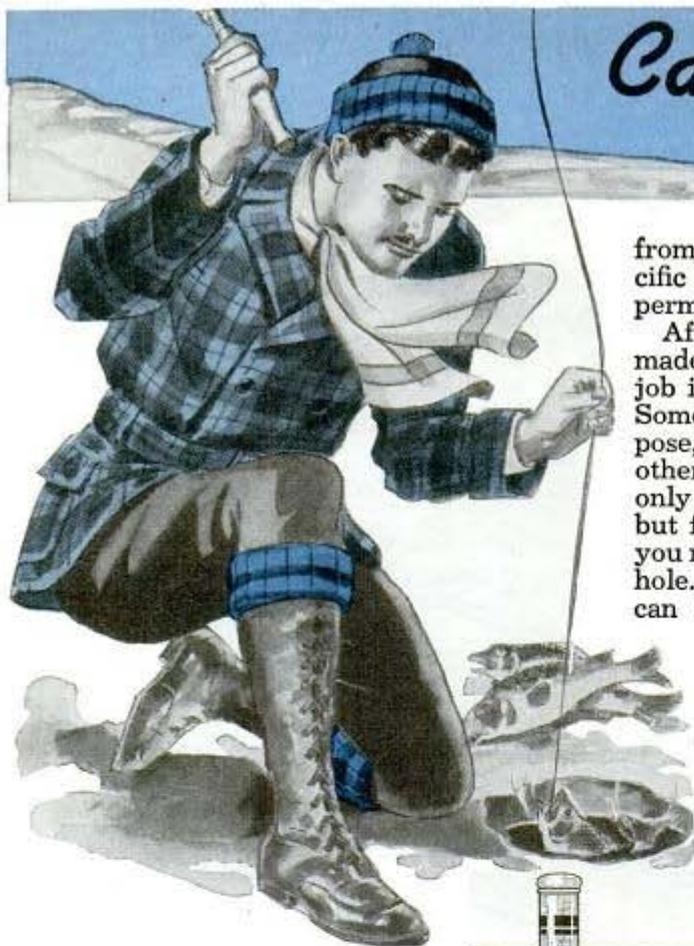
Harmless Stain for Live Specimens Makes Microscope Study Easier

Living specimens, such as paramecia, hydra and daphnia, can be stained harmlessly to make them much easier to study under the microscope, where the different structures are clearly visible in various shades of the dye color. The base for this

coloring is a stock dye product called intravitem, with the red shade preferred for this work. A 1 percent solution of this dye is mixed, using distilled water. As it is needed, one drop of this solution is added to about 10 c.c. more of distilled water.



Catching 'em



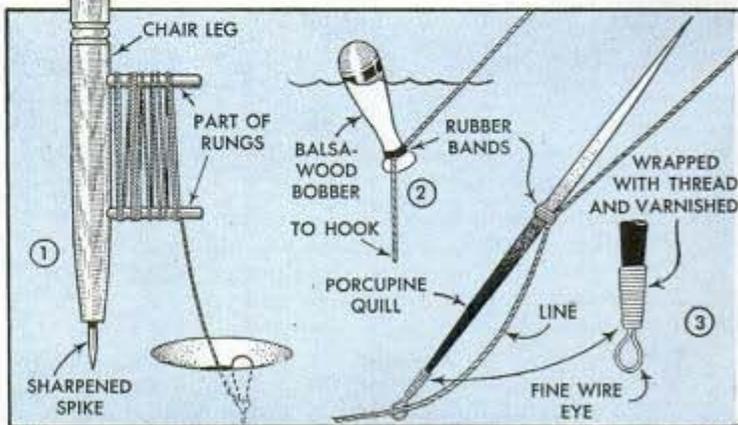
from one state to another that no specific rules can be given as to what is permitted in the way of winter fishing.

After you have selected your spot and made provisions for comfort, your first job is to break a hole through the ice. Some fishermen use an ax for this purpose, some use a chisel or crowbar, while others prefer a boring tool. If the ice is only a few inches thick, an ax will do, but for chipping through a thick layer you may need a tool that will cut a clean hole. The chipping tool, Fig. 5, which can be manipulated more accurately than an ax, is made by welding an old wood chisel to a length of iron pipe jointed so that it can be taken apart and carried with your other equipment. The auger-type digger, Fig. 6, may be preferred because its sharpened, dished blade scrapes a hole through the ice. For the handle of this tool you can use an old bit

By Robert Page Lincoln

WINTER is as good a time for fishing as any other. Some fishermen say it's better, for the flesh of fish is firmer than—even the common carp and other "rough" fish such as sucker, red horse, buffalo fish and sheepshead, acquire a tasty tang that makes for good eating. Yellow perch, too, can be pulled through the ice, along with northern pike and pickerel, which are as active in cold water as in lakes warmed by the summer sun. Even wall-eyes, which are inclined to hibernate in deep water during the winter, may be coaxed to your hand by a tempting bit of bait dangled through a hole in the ice, and schools of crappies, black and white, flock as hungrily to the "shiners" on your hook.

Before loading your tackle box for ice fishing, however, it is wise to check your local game laws to see what provision is made for this sport. Some states allow you to build huts on the ice so you can keep warm while fishing, but others forbid their construction. Regulations vary so widely



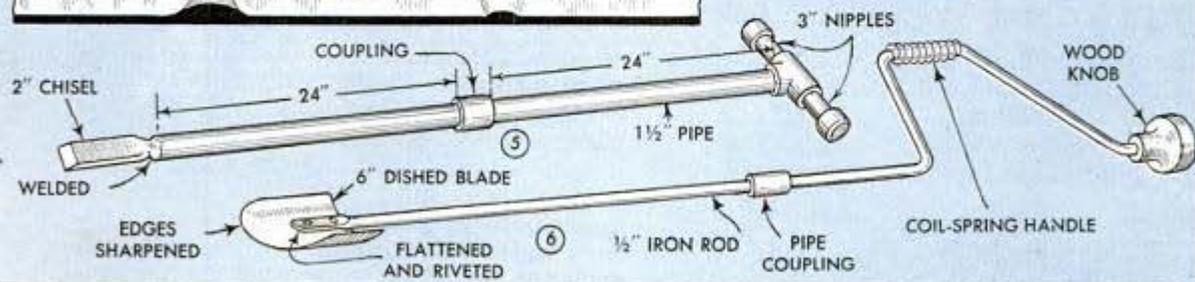
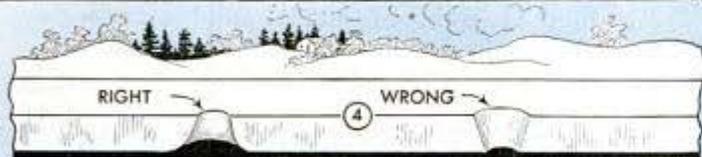
brace, sawing through the shank just above the ratchet and welding a pipe coupling to the shank. Or, bend a length of iron rod to the shape shown, winding a coil spring around the handle for a turning grip. The blade should be made of fairly heavy sheet iron. No matter which type of tool you use, the main idea is to make a hole wider at the bottom than at the top, as in Fig. 4, so that when you feel a tug on the line you can pull in even a large fish quickly, as toward the open end of a funnel. Also, if the hole is narrow at the bottom, its rough edge may fray the line. The hole should

Through the Ice



be at least a foot or so in diameter—the larger the better, just in case you hook a big one.

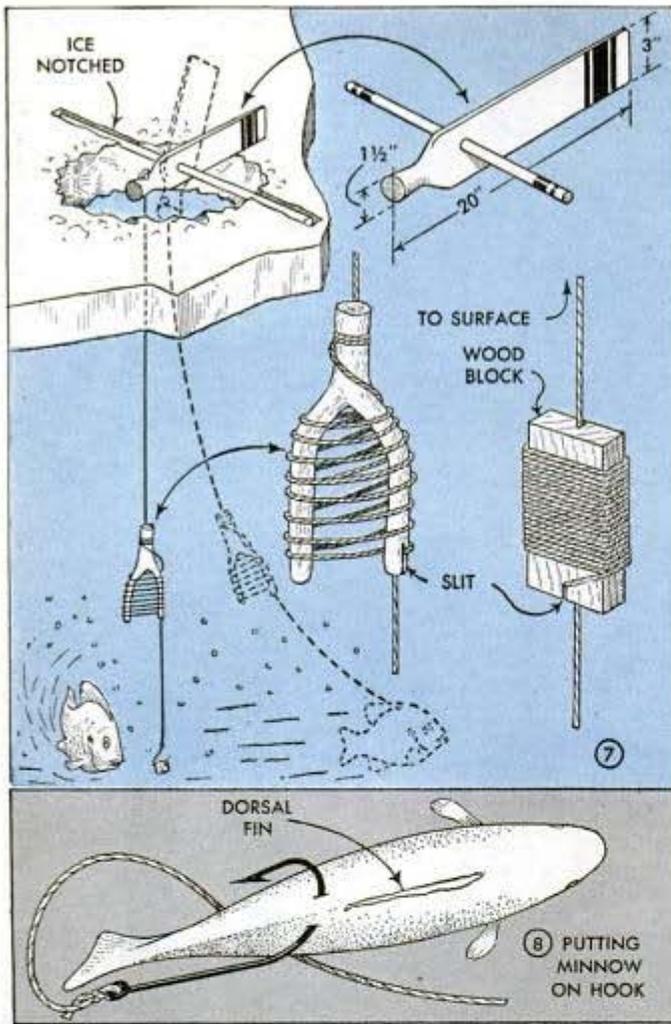
The secret of fishing—in open water as well as through the ice—is to offer as little resistance on the line as possible so that when the fish strikes there will be no tug to warn it away before it is hooked. For this reason, the line must not be too heavy, and the bobber should be small, light and easy for the fish to pull under. For crappies, perch and other light fish, a 9 or 12-lb. test line is best, with a nylon leader testing about 4 lbs. A balsa-wood plug is ideal for



a float. The line is held to it by rubber bands at its narrow end, Fig. 2, permitting it to be moved as desired, and BB-size split sinkers are attached to the leader, spaced about 4 to 6 in. apart to submerge nearly all the bobber so that the end projects only about an inch above the water. Porcupine or celluloid quills make even lighter-weight bobbers. These can be bought ready to use, with a fine wire loop or eye attached to one end for inserting the line, or they can be prepared as shown in Fig. 3. A simple rod and reel can be made from a chair leg by sawing off parts of two rungs and

then inserting a sharpened spike in one end of the leg as shown in Fig. 1.

Fig. 7 shows a method of making fast a line to an "announcer" or automatic "tip up." This is a blade of hardwood thinned at the end for lightness and pivoted on a length of dowel which is placed on the ice across the hole so that when a fish is hooked the blade swings up to record the catch. To break the impact of a strong strike and permit the fish to "run," either a crotched stick or a wood block can be used as a reel attached to the announcer. The line is wound around the reel and inserted in a



knife-blade slit in the lower end so that when the fish strikes and makes its run, the line will unwind for some distance until the fish slows down.

As bait, mud minnows, chubs or shiners about $1\frac{1}{2}$ in. long are generally used for crappies, perch and other small fish. Grubs, tree-borers and slugs also make good bait, and may be obtained, even in winter, by digging open dead limbs and rotting tree trunks. Otherwise, pea-size balls of unsalted, white pork fat will do. For northern pike, larger live minnows are best to use. There should be enough clearance between the hook barb and the stem so that the minnow does not become jammed and unable to swim, and the hook is usually inserted back of the dorsal fin through the flesh, as in Fig. 8, but not deep enough to penetrate the spine and paralyze the minnow so it is unable to move.

A sneak-bent hook with a definite side rake, such as the eagle-claw or falcon-grip, is preferred for small fish such as crappies and perch. For heavy fish the hook should be correspondingly stout, and for northern pike, the so-called spear-point hook is recommended because the long point holds the fish securely.

Improved Water Cell for Living Microscope Specimens

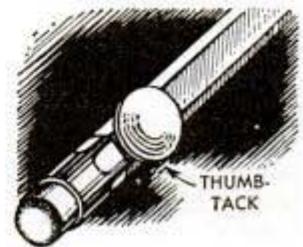
Living specimens can be examined under a microscope with a quickly assembled water cell like the one shown, which is especially useful for viewing material at the spot where it is found. It consists of two

pieces of glass, such as microslips, separated by a fruit-jar rubber ring, the assembly being held together tightly by two spring paper clips. The glass should be not much larger than the ring and the clips should press directly over the rubber. Since the space between the pieces of glass is narrow, water will not run out when the cell is placed horizontally on the microscope.

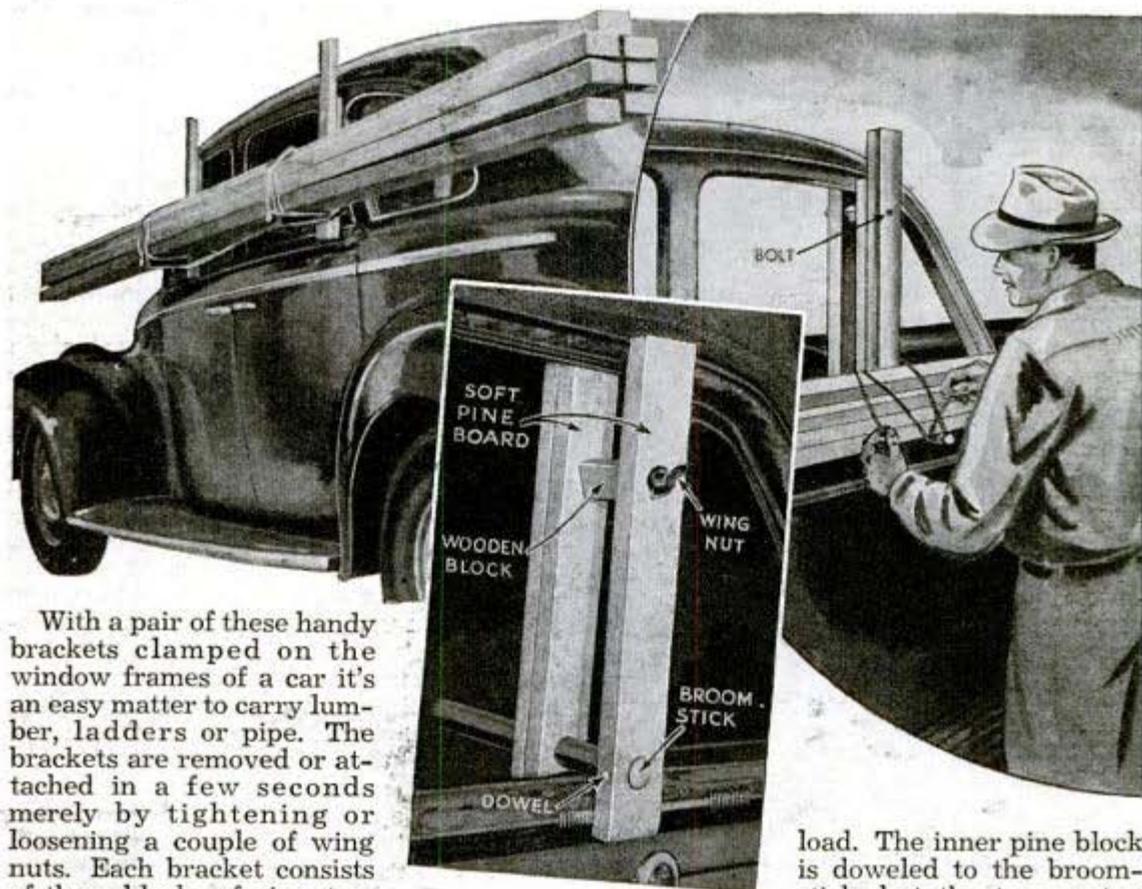


Tack Stops Rolling of Pencil

A simple way to prevent a pencil from rolling off an inclined drawing board is to press a thumbtack into the side as shown. By doing this you will avoid not only the annoyance of stooping to retrieve it from the floor but also the necessity of laying it on a flat surface when using other drawing instruments.



Quickly Attached Brackets Carry Lumber on Car



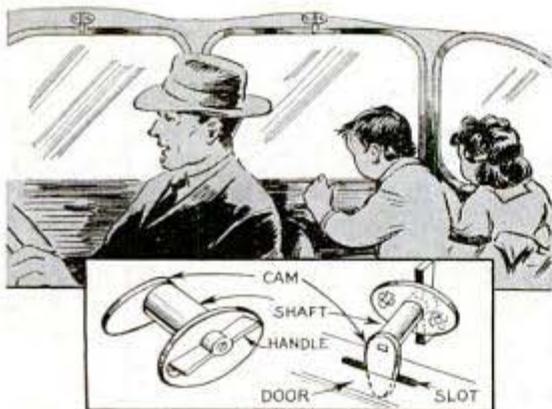
With a pair of these handy brackets clamped on the window frames of a car it's an easy matter to carry lumber, ladders or pipe. The brackets are removed or attached in a few seconds merely by tightening or loosening a couple of wing nuts. Each bracket consists of three blocks of pine, two of which are cut to clamp on each side of the window frame and the third to provide thickness necessary to compensate for the curvature of the car body. The blocks are assembled with a long bolt and a length of broomstick, which projects to support the

load. The inner pine block is doweled to the broomstick, but the two outer blocks slide freely on it. The bolt passes through the blocks with a spacer between them as indicated in the center detail. Thin felt glued to the blocks where they contact the car surface will protect the finish.

—LeRoy Ryan, Quincy, Mass.

Latch Above Car Door Prevents Child From Opening It

To prevent his small children from opening a door while riding in the car, one father used a latch, like the one shown, on each of the rear doors and the right front door. Each latch was installed on the inside just



above the door so that when the handle was turned the cam would engage a slot cut in the top surface of the door. Installation will vary on different makes of cars, but in some cases it will be possible to attach the latch right to the door frame by drilling a hole for the latch shaft and then fastening the latch plate to the frame with sheet-metal screws.

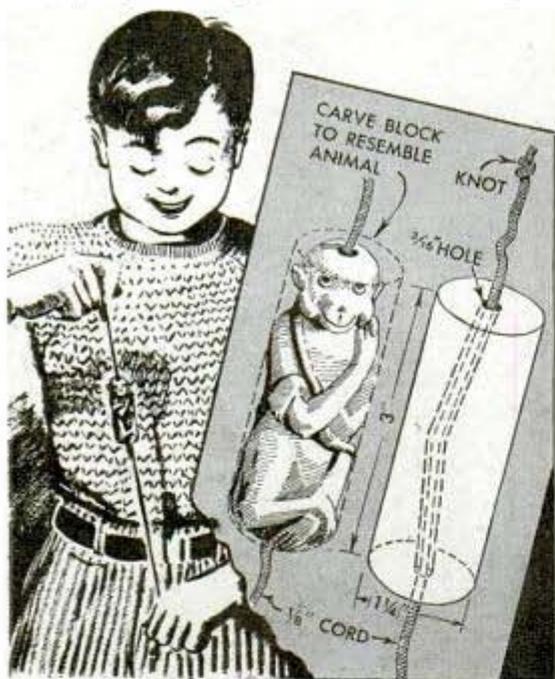
—Wm. Liefbroer, Sheboygan, Wis.

Nail Polish Patches Model Planes

An easy method of patching tears in the covering of model airplanes is to draw the torn edges together with a hooked pin until they are even and then flow a thin layer of clear nail polish over the hole. Such a patch is less noticeable and more substantial than those made by ordinary methods.

—James E. Mooney, Mt. Vernon, Mo.

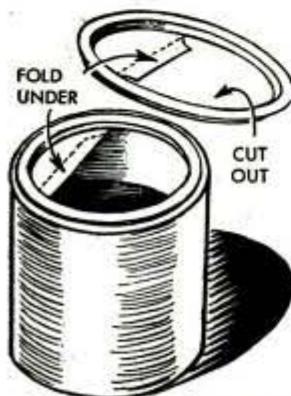
Wooden Animal Moves on Cord By Controlled Tension



Carved from a block of wood and strung on a length of cord, this amusing little animal slides down the cord when the tension is relaxed and stops when the tension is increased. The hole through the block is drilled at a slight angle from each end, thus making it slightly off center in the middle of the block. In this way, a slight tension on the cord causes it to press against the sides of the hole and hold the animal stationary, but when the tension is relaxed there is no friction against the sides and the animal slides down the cord.

—George Barr, Brooklyn, N. Y.

Brush Wiper on Paint Can Made From Extra Lid

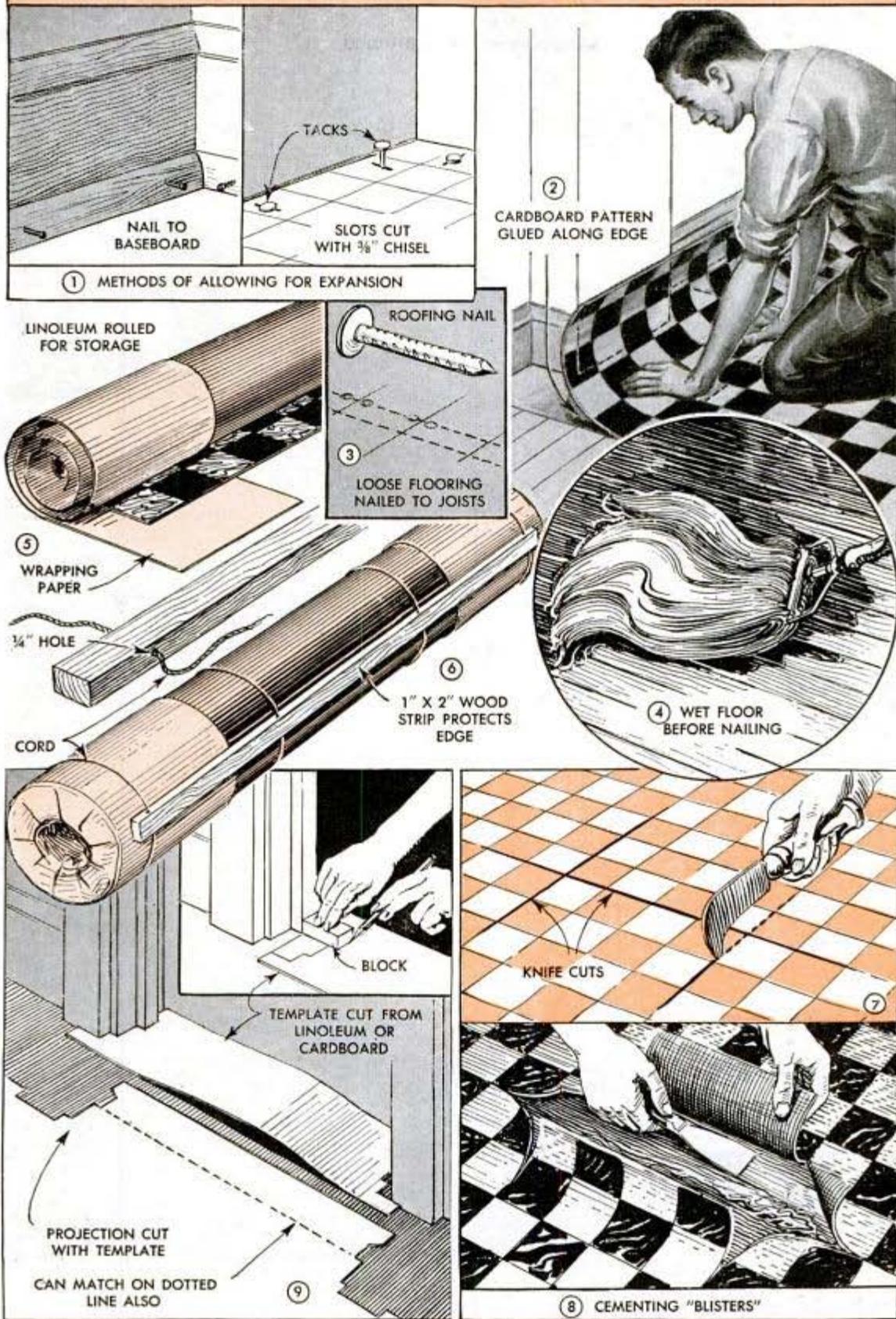


Instead of wiping surplus paint from a brush on the rim of the can or on a wire across the top of the can as is often done, use this handy wiper made from an extra paint-can lid. It is switched easily from can to can and is made by cutting out a portion of the extra lid as indicated, folding under the projecting lip so that paint will drain back into the can.—E. J. Simanek, Cicero, Ill.

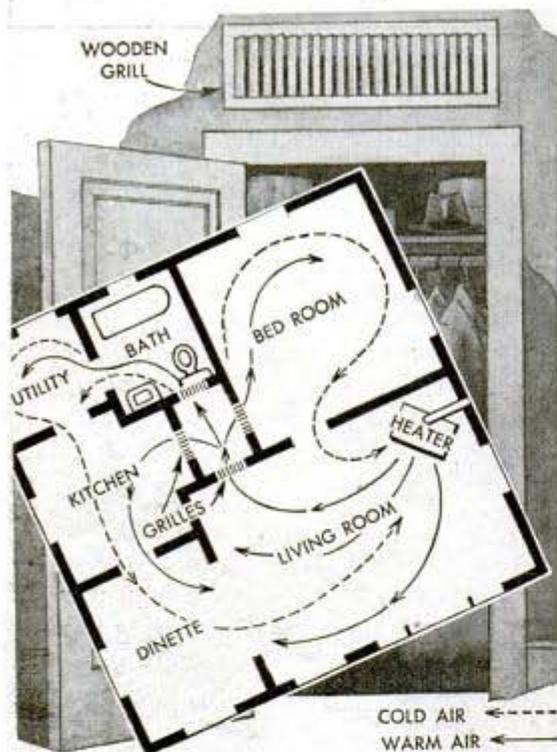
A Few Simple Tricks That Aid In Laying Linoleum

Laying linoleum so that it will not tear, blister or buckle is not difficult. First, unroll the linoleum in a heated room and let it lie flat overnight. This will make it pliable and less likely to crack or tear when handled. In the meantime, remove the quarter-round along the baseboard. If the linoleum is to be laid over an old floor where the boards are cupped slightly, first clean the floor thoroughly and wet the surface uniformly as in Fig. 4. Then, before it is completely dry, re-nail the floor as in Fig. 3 with long galvanized roofing nails, using two nails at each joist. Getting neat fits at doorways and outside corners, pipes and similar projections is easy if you use templates. A piece of cardboard or scrap linoleum cut to shape and then used as in Fig. 9 will help assure an accurate fit around the door trim. If the covering goes through into the adjoining room, you can lay both floors, leaving the width of the doorway open and then cutting a piece to fit between the door jambs. Or, you can match the two pieces on the dotted line as indicated in the lower detail. To get a good fit around an outside corner, use a thin cardboard or paper template to extend at least a foot beyond the projection as in Fig. 2. Coat the upper surface of the extended portion of the template with glue or other adhesive. Then, holding the template carefully in place, roll the linoleum over it and press it down on the adhesive. The template will adhere to the linoleum, which now can be rolled back and cut according to the template to fit perfectly. After laying the linoleum, nail the quarter-round to the baseboard only as in Fig. 1, without binding the linoleum at any point. This precaution will allow the floor covering to expand and contract under temperature changes without buckling. Where you have to tack the linoleum edge at a joint or at a doorway, cut slots and drive the tacks in lightly. This will allow slight movement. Figs. 7 and 8 show a good method of cementing a large blister. Make right-angle cuts as in Fig. 7 and trim the edges so that the flaps fit true and lie flat. Spread the cement thinly. When you take up linoleum for storage or moving, roll it carefully and tie the roll as in Figs. 5 and 6 to protect the ends and free edge.

Tricks in LAYING LINOLEUM

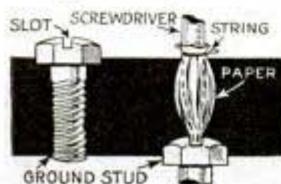


Heating Small Home Effectively With a Circulating Heater



Homes of three or four rooms with a closet or small hallway located in the center of the house can be heated effectively with a heating stove as indicated, by using the closet or hallway as a heat distributor. First, a large grill is installed at ceiling height in the closet or hallway wall next to the room containing the stove. Then smaller grills, leading to adjoining rooms, are put in the other walls. In this way, heated air will pass to all rooms as indicated by arrows in the drawing, cold air returning to the heater via the floors and doorways. The reason this arrangement is an improvement is that hot air rising to the ceiling often is pocketed in one room because the door openings are usually several feet below the ceilings. The grills allow an unobstructed passage from room to room for the hot air. It may be desirable to install a false ceiling below the grills to keep the closet clean.

Replacing Battery Ground Stud



On some cars where, because of restricted space, it is difficult to start the stud when installing the battery ground cable, the job can be done easily with a screw driver. First, slot the head of the stud with a hack saw and

then wrap paper around the screw-driver blade so that it will fit tightly in the stud slot. In this way, the stud can be inserted into its hole with the screw driver and given a few turns, after which it can be tightened with a wrench.

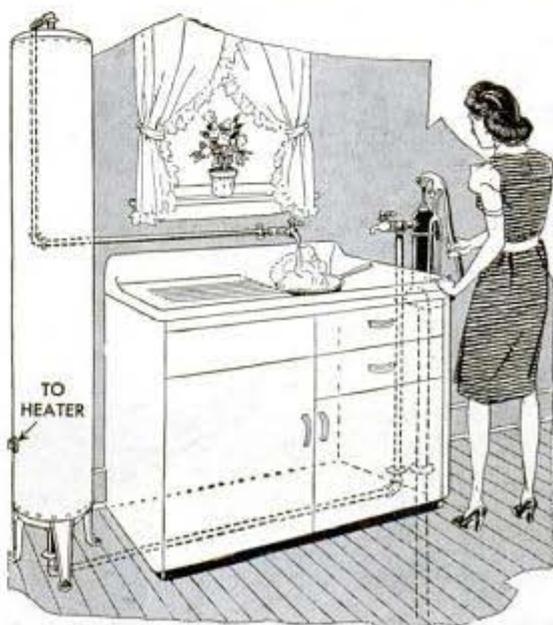
Paper Clip Inserted in Pen Holder Used as Mimeograph Stylus

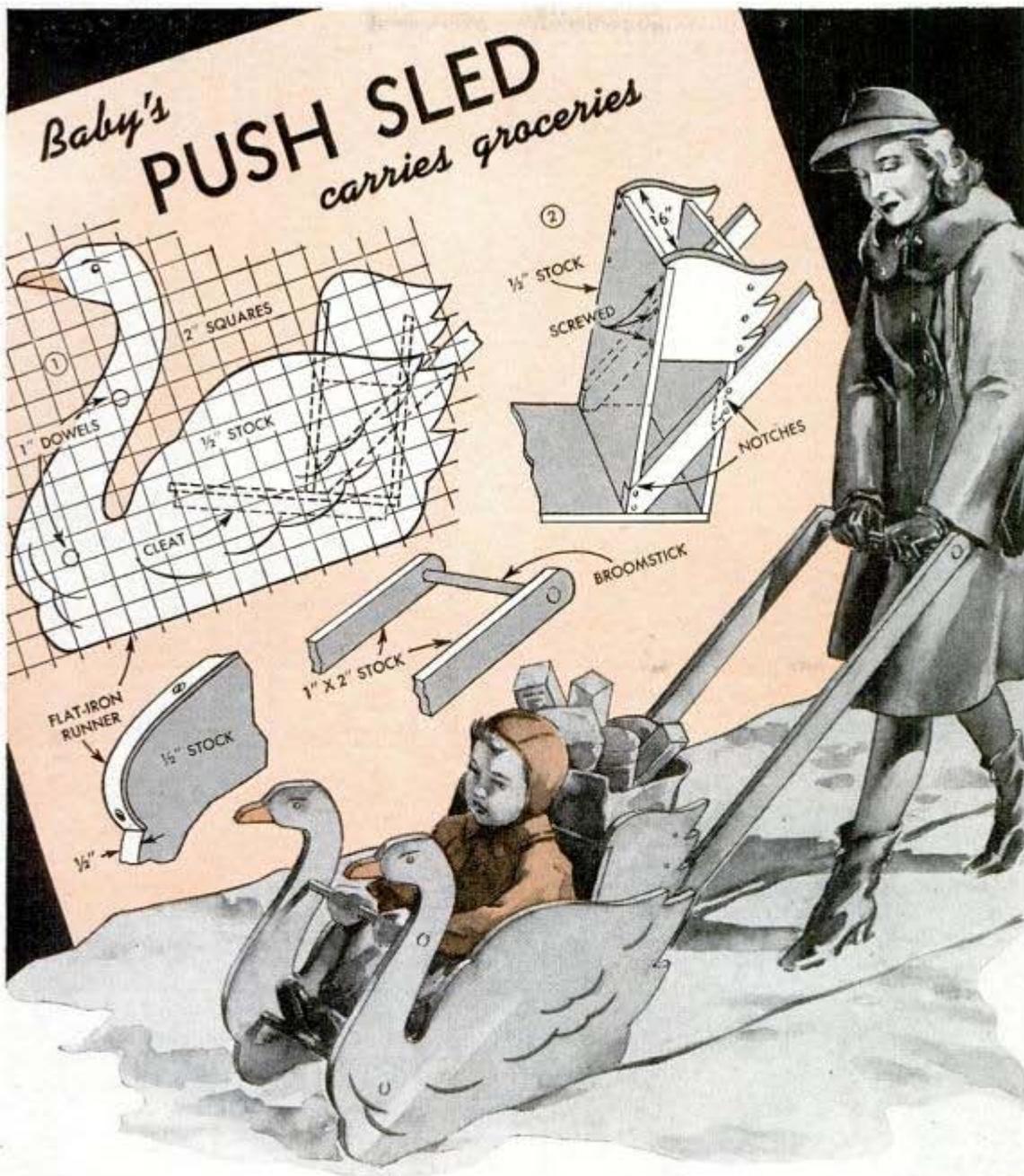
An efficient stylus for ruling lines on a duplicating stencil can be improvised by placing a paper clip in an ordinary pen holder. The rounded end passes smoothly over the stencil without tearing it.



Hot Water Forced by Hand Pump From Tank to Sink Faucet

To obtain hot, running water in rural homes where neither electricity nor a windmill is available for operating the pump, a hand-powered installation such as the one illustrated will work satisfactorily. All that is needed is enough pipe to connect the hand pump, hot-water heater and hot-water faucet, as shown. When the cold-water faucet is turned to shut position, water pumped up will be forced into the tank of heated water, forcing the hot water out through the open hot-water faucet. By opening the cold and closing the hot-water faucet, cold water will be pumped out directly.—R. L. Stroud, State College, Ark.



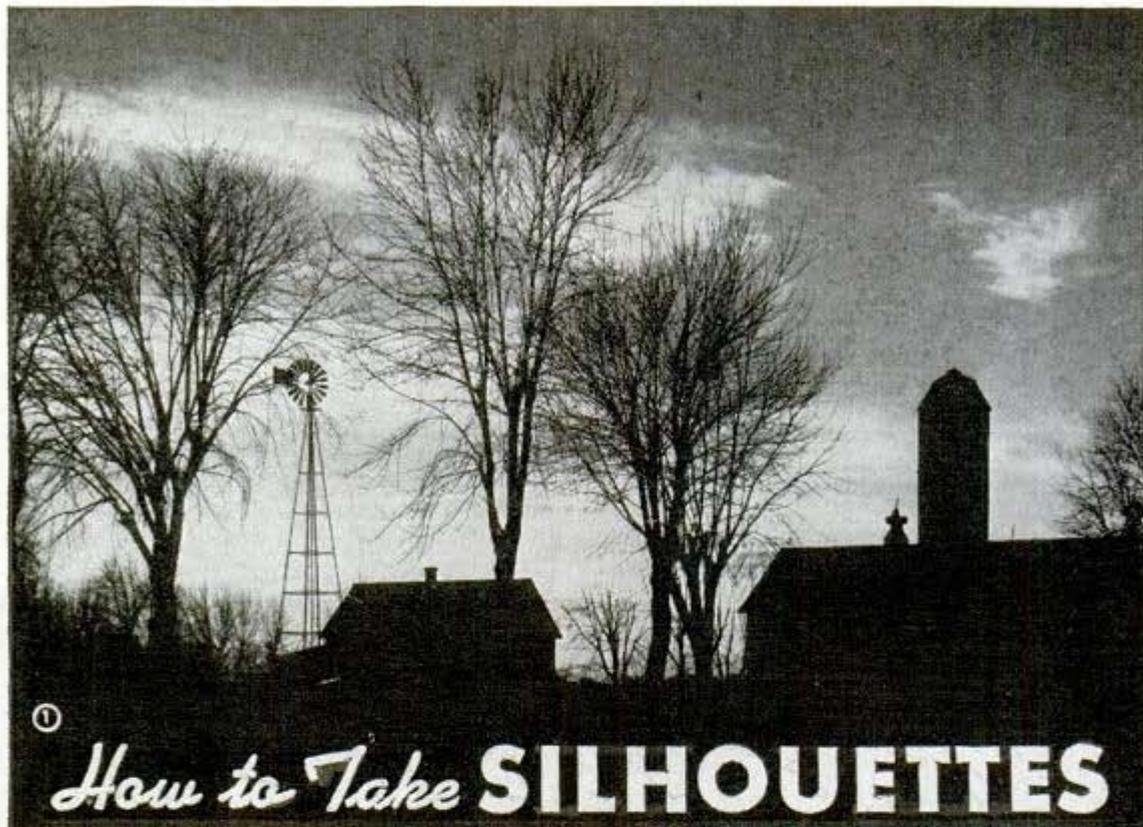


TAKING the baby along on shopping trips when sidewalks are covered with snow will be a pleasure if you have a sled like this one, which has a built-in compartment for carrying groceries. Plywood simplifies construction, but if this is not available, the swan-shaped sides may be cut from glued-up panels of tongue-and-groove stock, placing the pattern so that the neck runs with the grain to give maximum strength. Sawing the swans can be done easily by cutting the neck and body of each one separately, and then joining the neck to the body with cleats or dowels. Note that the bottom of the compartment extends to form a seat. Handlebars are set

in notches cut in the front and rear panels of the compartment and a length of broomstick is inserted through holes at the ends and nailed in place for a handle. Dowel rungs between the swans at the front provide a footrest and a hand-hold. The runners are shod with lengths of flat iron.

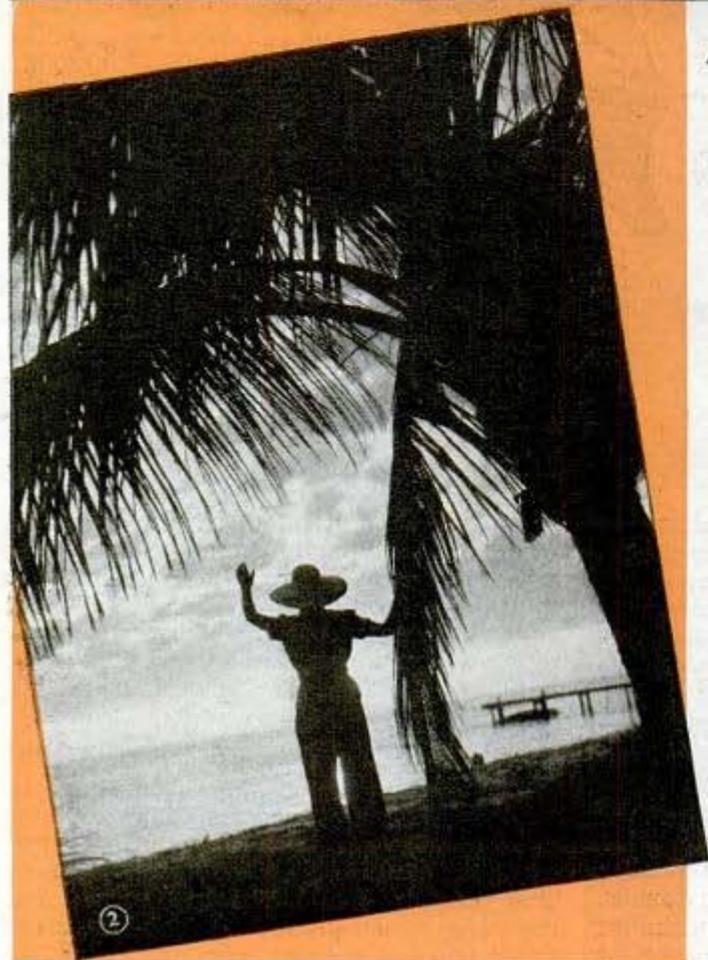
Preserving Clippings and Papers

An excellent method for preserving letters, newspaper and magazine clippings, or other documents is to paint them with transparent nail polish, shellac or lacquer. The printing shows clearly through this covering, which gives the papers a glossy finish and keeps them from crumbling.



How to Take **SILHOUETTES**

By Fred G. Korth

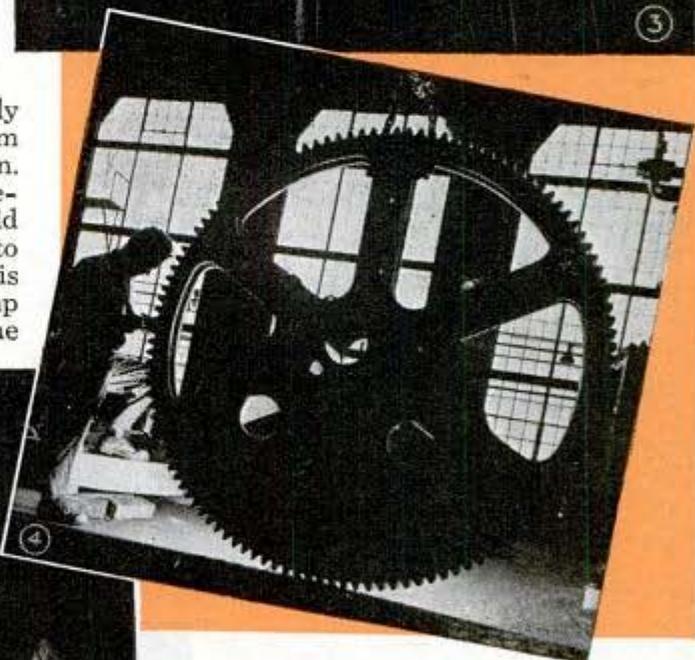


OFTEN a silhouette is more forceful than a well-lighted shot full of minute details. By blacking out details and concentrating on outlines and masses, interest is immediately focused on the thought which the photographer wished to convey. For example, Fig. 1 consists only of black masses and outlines against the sky and shows more than a farm; it suggests evening as well for, by the conventions of illustration, sunrise is usually represented by high tones to suggest oncoming light. More than that, the heavy tone, together with the bareness of the trees, implies an autumn setting.

Likewise, Fig. 2 can be recognized immediately as a beach in summer. In this picture the woman's large hat, rolled sleeves and sport slacks are well adapted to an outdoor scene, and the pier jutting into the water identifies the location as a beach. If this detail were omitted, the idea of "beach" would not be implied so readily. Also, the type of tree suggests definite locality, where-

as merely a mass of general foliage without well-known and recognizable outlines would be vague and general. In photographing outdoor silhouettes, be sure that the sun is hidden completely, either by a heavy, dark cloud or by some object within the picture, and that the subject is backlit. Exposure should be on the short side and, for best cloud effects, a yellow, red or orange filter should be used.

In Fig. 5, a building illuminated at night by flood lamps forms the "backdrop" for the silhouette of a railroad crane. Without the crane, this would have been an ordinary record shot of a building. The diaphragm should be stopped down sufficiently to render sharp images of both the silhouetted foreground and the lighted building at "infinity." Sometimes an object seems suitable for a silhouette just as it is, when really it needs the help of additional lighting to outline it strongly. Fig. 4 is an example. The daylight streaming through the large windows into the factory seemed to reflect sufficiently from the floor to show the bottom outline of the gear and the man. However, the short exposure required by the window-area would have allowed the floor and gear to disappear in blackness. For this reason a large photoflash lamp without reflector was placed on the



floor behind the gear and controlled from camera position to separate the tone values in the lower part of the picture. In Fig. 3, the sparks rushing through the air and the flare of the welding torch outline the operator and equipment. A time exposure is necessary here to allow the sparks to form streaks, otherwise they would register on the film only as tiny points which could not be identified so easily as the streamers of light which we see in welding operations. It is especially important to warn the subject to remain

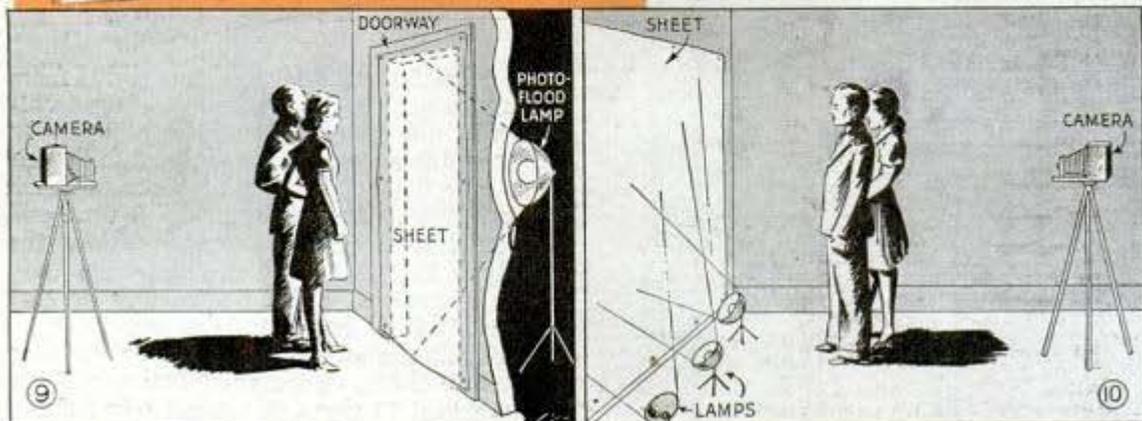


perfectly still during a time exposure on a photograph of this nature. Being clearly silhouetted against a very bright background, any movement would cause a blur.

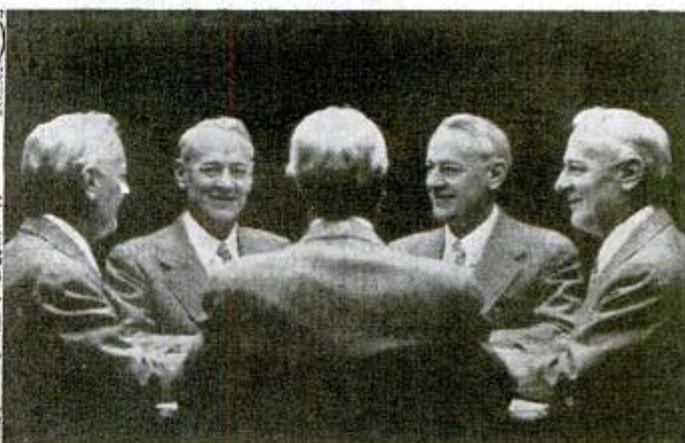
Sometimes it is necessary to use two negatives for one picture because available light is not right for showing both foreground and background objects. Fig. 6 is such a picture. In this case a fast lens and fast film had to be used to "freeze" the movement of the fish. Also, it was impossible to stop down the diaphragm far enough to bring into focus both the fish and the visitors in one exposure. Hence, two separate shots were made, one of the fish tank only, as shown in Fig. 7, which was taken with a lens stop of $f:3.5$, and later the boy and girl were posed as in Fig. 9, the result of which is seen in Fig. 8. The negative of Fig. 7 was printed first, and then that of Fig. 8. Fig. 10 shows an alternate method of photographing the models against a sheet illuminated by lamps placed low so as not to be seen by the camera, and directed against the sheet.

Many other interesting silhouette pictures can be made following the methods described. For instance, a shot of a model airplane against a white sheet can be superimposed on a photograph of a beautiful sky. Houses and windmills, too, can be photographed as silhouettes indoors and double-printed on sky scenes to make composite prints that will pass as actual outdoor scenes.

In making any silhouette, remember that, since there are no details of texture to show the characteristics of objects, they must be faithfully represented in outline. Study the scene carefully from all angles to find the best camera position.



'Five of a Kind' Photography Done With Mirrors



Courtesy Pittsburgh Plate Glass Co.

Photographing a subject in five different poses with a single exposure is a simple trick done with two mirrors. The mirrors, which must be large enough to show the subject's head and shoulders, are supported vertically on a table at an angle of about 72 deg. or enough to show four different views. The camera is set directly behind the subject in a line with the meeting point of the mirrors, as shown in the detail, and the lamps are placed above and behind the mirrors so that the light is directed on the subject.

Camera Cleaner Made From Bulb and Old Shaving Brush

A combination brush and blower for cleaning cameras, lenses, shutters, film holders and other photographic equipment can be made from an ordinary rubber bulb of the syringe type, a shaving brush and a ferrule about $\frac{1}{2}$ in. in diameter. If the brush has a rubber base, carefully cut away the handle and remove the setting intact,

trimming it down to fit tightly into the ferrule. Next drill a hole in the base for the bulb nozzle, which may be cut down to about $\frac{1}{2}$ in. Apply glue or rubber cement to the nozzle, ferrule and base, fit them together and allow them to dry. If the brush is not rubber-set, remove the bristles a few at a time and attach them to the nozzle with rubber cement until a round brush is built up, then wrap several strands of stout cord tightly around the base.

—Howard Rozelle, San Diego, Calif.



Preventing Damage to Scales

Small darkroom scales are delicate precision instruments, and to keep them accurate they must be treated as such. One of the chief causes of damage to these scales is vibration, as a slight jar will cause the beam to strike against the stop. If a small weight is kept in one of the trays while the scales are not in use, damage from this source will be minimized.—Wm. Swallow, Brooklyn, N. Y.



Piece of Rope Nailed to Board Provides a Handy Door Mat



If you want a door mat that will last indefinitely under severe use, just nail some $\frac{3}{4}$ or 1-in. rope to a wide board as indicated. This mat is especially suitable around a cabin during rainy weather.

Watch Is Chronometer Substitute In Air Navigation

With the cost of aviation chronometers beyond reach of the average student pilot, and with a shortage of such timepieces, government bulletins point out that a "dollar" watch is an adequate substitute. To

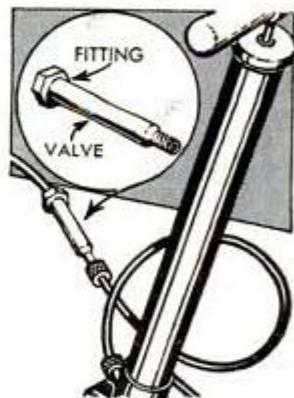


check elapsed time in flight, the watch is merely set at twelve o'clock when taking off. Obviously this timepiece is not used for recording the time of day, but it is effective in checking cross-country performance. The watch is fastened permanently to a clip board, as shown, by removing the back and securing it to the metal clip with small bolts. After pressing the watch into place on the back, it is ready for use. In actual operation, the aerial map is clipped to the board at the top and held in place at the bottom with a large rubber band. The true course to be flown is marked on the map. Since the pilot has little opportunity to study maps, two additional rubber bands are snapped over the board and map to the right and left of the course being flown. A glance at the map brings the pilot's attention quickly to the area with which he is concerned. Knowing the plane's air speed, and being able to follow the course readily, it is possible with this simple equipment to do a better navigating job than would otherwise be possible.

Fitting to Clean Clogged Oil Line With a Tire Pump

Cleaning out an oil or gas line, or any other feed pipe that may have become choked with sediment, will be greatly simplified by making a fitting like the one shown. Cut the valve from an old inner tube and solder to it a fitting that will screw on the choked line. When air is pumped into the valve, it will blow out the sediment.

—Frank Sykora, Chicago.



Testing Pre-Heat Temperature When Welding Aluminum

In shops not equipped with a pyrometer, the pre-heat temperature at which aluminum is ready for welding can be determined by rubbing a pine stick across the metal or dropping a pinch of sawdust on it. When the stick or sawdust chars, the aluminum is at the proper heat for welding. Also, if half-and-half solder melts when held against it, the metal is hot enough for working. However, the temperature of large aluminum-alloy castings should not exceed 700 deg. F., or they may collapse of their own weight.

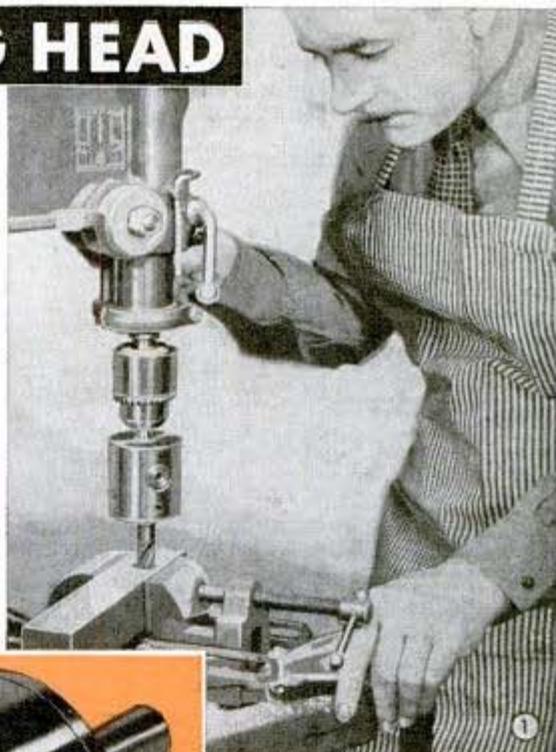


SHOP NOTES

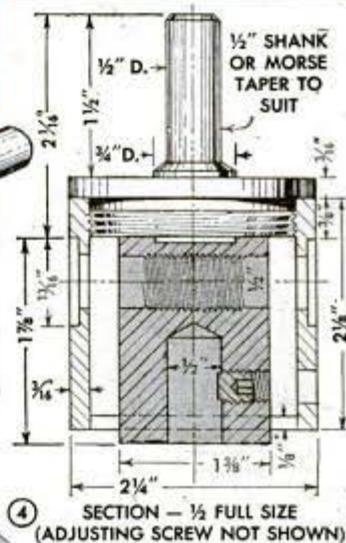
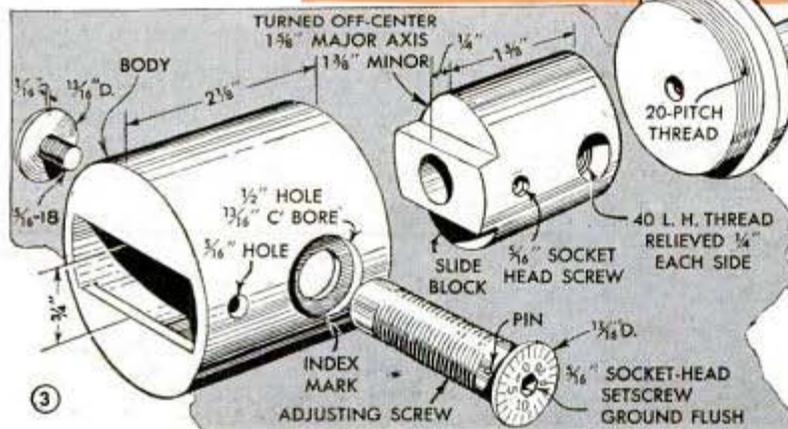
Micrometer BORING HEAD

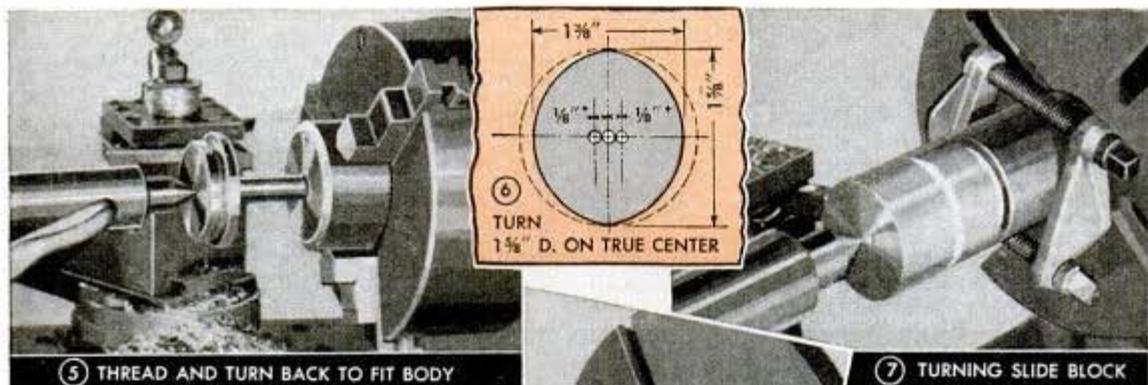
ADJUSTABLE to one thousandth of an inch, the micrometer boring head shown in Figs. 1 and 2 makes an excellent accessory for your lathe or drill press. It can be used as a substitute for large drills not usually found in the average shop. The head demands precision machining and should not be attempted unless you are well up on your lathe work.

Start by making the body. This is a simple job of turning and recessing. The bottom of the bored hole must be perfectly flat and smooth and the slotted opening in front can be run in with a small end mill, with the work mounted in a milling attachment. The cross hole is not bored until later. Next comes the slide block, which is turned round, and then off-centered $\frac{1}{8}$ in. on each side to get the oval shape shown in Figs. 6 and 7. The flat across the outer end is milled, while the back is a simple turning job, as shown in Fig. 5. The shoulder should be turned down carefully so that the slide block will be a stiff slide fit when body, slide block



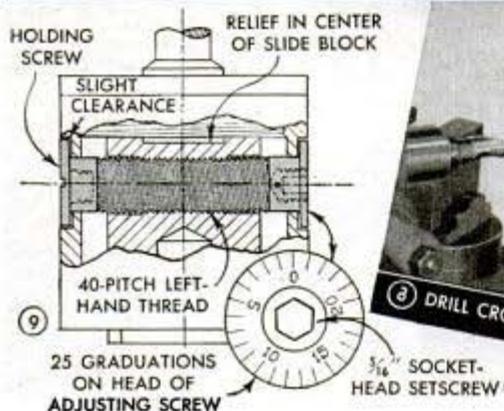
PRECISION BORING TOOL GRADUATED TO .001 IN. CAN BE USED IN DRILL PRESS OR LATHE AND IS ADJUSTABLE $\frac{1}{4}$ " EACH SIDE OF CENTER





5 THREAD AND TURN BACK TO FIT BODY

7 TURNING SLIDE BLOCK



9



8 DRILL CROSS HOLE AFTER ASSEMBLY

adjusting screw can be cut on the lathe if you have a 25-hole dividing head; otherwise the markings must be set off with dividers. Numbers look best if stamped with steel marking stamps, but they also can be scribed or etched. One complete rotation of the adjusting screw advances the boring bar .025 in., while each

and back are assembled. With the assembly made, the cross hole for the adjusting screw is bored and threaded, as shown in Fig. 8. The thread is 40-pitch, left hand, relieved about $\frac{1}{4}$ in. on either side of the slide block, as can be seen in Figs. 3 and 4. The left hand thread is preferable since it will advance the boring bar when the adjusting screw is turned clockwise.

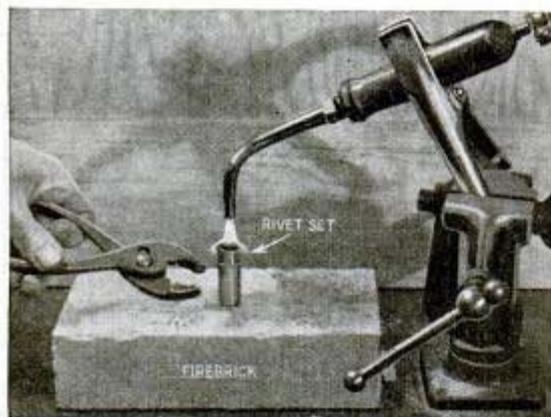
The adjusting screw is made last. It is 40-pitch to fit the hole in the slide block. One end is shouldered and fitted with a socket-head set screw, which is pinned in place. The free end is tapped to take the $\frac{5}{16}$ -18 holding screw, as can be seen in Figs. 3 and 9. Graduations on the head of the

small division represents .001 inch.

The most important point of the machining is the fit of the slide block between the inner faces of the body and the back. It is important that the block must be an accurate, stiff slide fit as any play will destroy the rigidity of the head. To take up play, a light shaving is removed from the shoulder of the back piece.

Boring bars used are conventional shape and can be ground from the stub shanks of old drills. A $\frac{1}{4}$ -in. bar will bore $\frac{1}{4}$ to $\frac{3}{4}$ -in.; a $\frac{1}{2}$ -in. bar will bore from $\frac{1}{2}$ to 1-in., etc. If the boring head is used on the drill press, the speed must be reduced to suit the operation.

Torch Setup Is Used to Harden Small Tools on One End



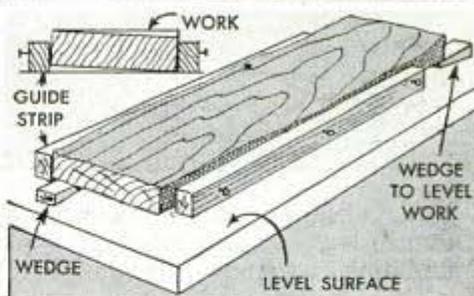
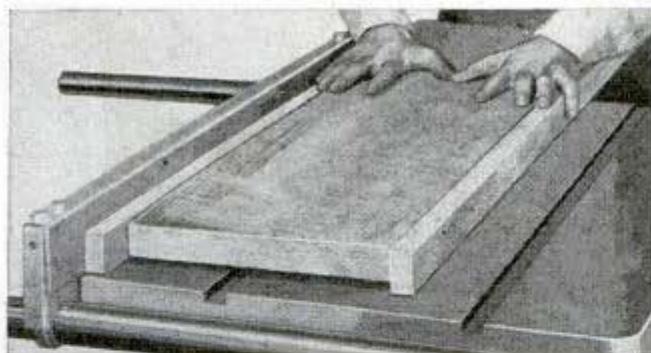
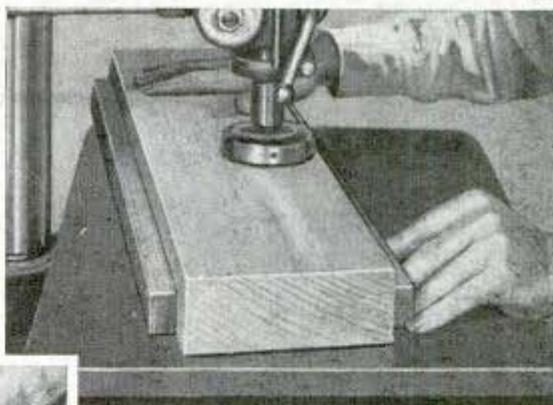
Rivet sets, punches and similar tools that are to be hardened on the end only may be heated conveniently with a torch in the manner shown. The tool is set on a piece of firebrick or asbestos, or otherwise supported in a vertical position so that the flame of a torch can be directed down on the end to be heated.

Cash for Your Ideas

We pay cash for shortcuts telling how you solved those little problems pertaining to your home, workshop, car, work, sport or hobby. Send in sketch, photo, or both, and a brief explanation to Technical Editor, Popular Mechanics, 200 E. Ontario, Chicago 11.

Guide Strips Level Twisted Board for Planing

A warped board can be planed to a true level surface by fitting side guide strips to it and then running the work on a drill press fitted with a planer head. A similar operation can be done on a circular saw by using a dado head or molding head with straight knives. First, the work is placed on a level surface and rocked by hand to determine the high spots, after which it is leveled by fitting small wedges under it as shown. This should be done carefully in order to strike a level plane with the re-



moval of the least possible amount of wood. With wedges in place, straight guide strips of $\frac{3}{4}$ -in. stock are nailed in place, one on each side. When placed on the drill table for planing, the guide strips provide an accurate working face. If the work is run on a circular saw with a molding head, the first cut is made through the center, after which the fence is set over and alternate cuts made on each side of the center by

reversing the work. This is repeated until the whole surface is planed level. Once one side has been trued, it is a simple matter to plane the opposite side with the planer head in a drill press. The guide strips are not needed for the second cut. If both sides are to be worked on a circular saw, the guide strips should be wide enough to extend beyond both surfaces and are left in place for both operations.

Rope Prevents Stones Sticking Between Truck Wheels

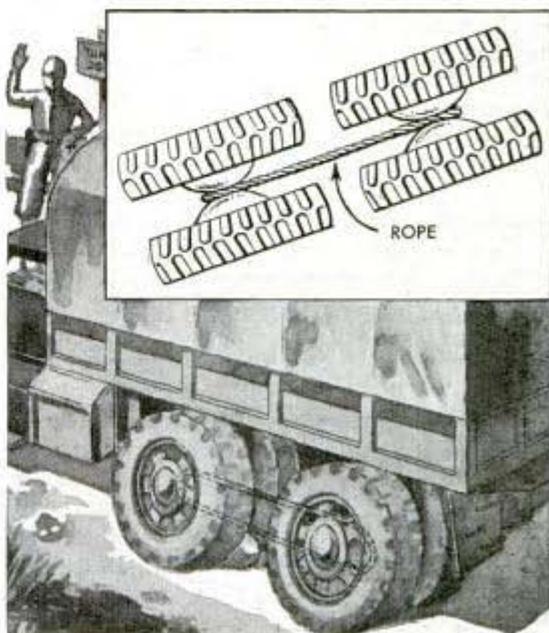
Troubled by stones and other objects lodging between the multiple dual wheels of an army truck, one driver solved the problem by using a heavy rope between the wheels as indicated so that it served as an endless belt. The rope will not rub against the tires and will dislodge immediately any object between the wheels as they rotate.

—Orin B. Dunn, San Francisco, Calif.

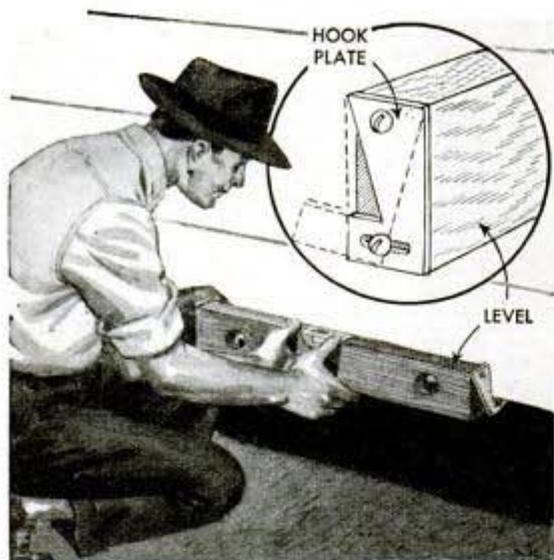
Hints on Avoiding Damage to Car In Removing Tires

When changing tires, always remove the spare before jacking up the car; then, if the spare sticks in its holder, there is less danger of pulling the car off the jack. When it is necessary to repair a tire, always take it off from the inside of the wheel. This will avoid marring the painted surface on the outside with the tire tools.

—Opie Read, Jr., Chicago.



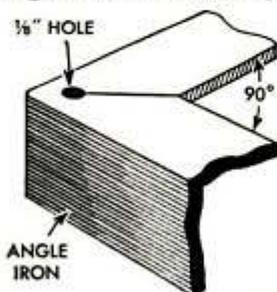
Hooks on Ends of a Level Help When Leveling Large Objects



To level large tanks or other objects as they are lowered onto supporting piers or foundations, one mover fitted his level with hook plates that could be swung out and held with clamping screws whenever necessary. The hooks engage the underside of the object so that the level will show an accurate reading.

How to Bend Angle Iron Neatly

The next time you want to bend a piece of angle iron at right angles, try the method shown. First, drill a small hole in the position indicated and then saw out the V-shaped piece of metal in the usual way, having the bottom of the V end at the hole. Metal removed in drilling the hole prevents buckling at this point and permits the iron to be bent neatly.



—Robert Clark, Chicago.

Quick-Change Tongue for Trailer To Pull It With Horses



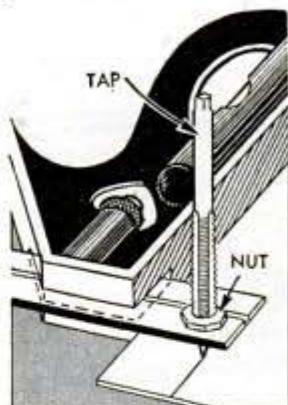
Occasionally finding it desirable to hitch a team of horses to his trailer, one farmer rigged up this tongue extension which can be attached or re-

moved in a few seconds. Since his trailer hitch was of the ball-and-socket type, an extra ball was bolted to the extension and a loop of flat iron was bolted to the trailer tongue about 2 ft. back of the hitch socket. With this arrangement, attaching the extension is just a matter of inserting the rear end through the iron loop and gripping the ball in the trailer-tongue socket.

—E. R. Gorton, Maryville, Mo.

Metal Scriber on Square Is Easy to Use

One hand is free to hold the work when this metal scriber is used on the end of a combination square. After a discarded tap has been pointed, a nut is screwed on, and the tap is screwed into a hole which has been drilled and tapped about $\frac{1}{4}$ in. from the end of the square.



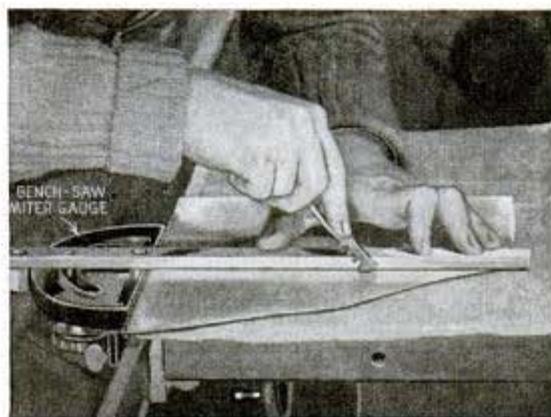
When about $\frac{1}{8}$ in. of the point shows on the other side of the square, the nut is tightened to hold the tap in position.

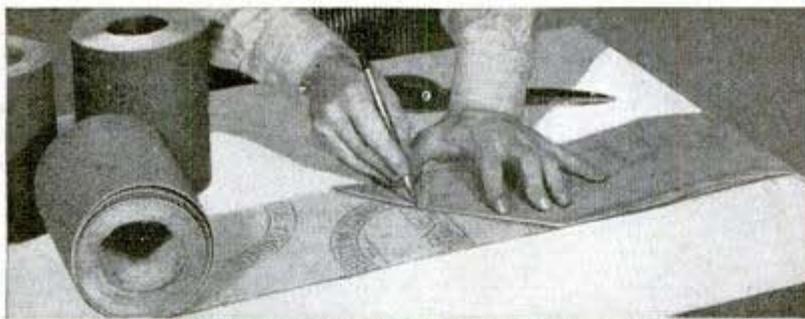
—Stanley Peterson, San Francisco, Calif.

Bench-Saw Miter Used as Guide For Cutting Pieces of Glass

Placed upside down on the saw table, a bench-saw miter provides an excellent straightedge for cutting glass. The miter can be squared on the front edge of the table or adjusted to any angle. In use, the saw blade is lowered below the table, which then is covered with a piece of newspaper on which the glass is laid. The paper cushions the glass and its column lines aid in aligning the glass for cutting.

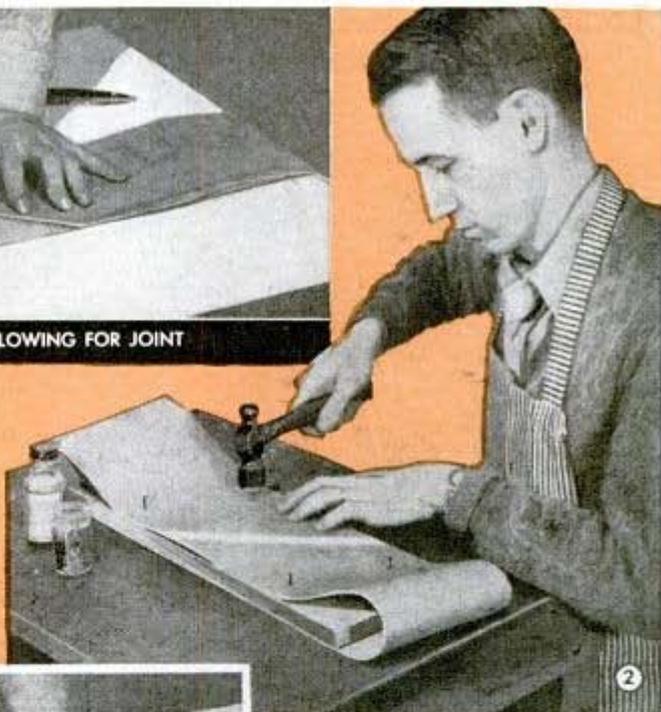
—Jack Stanley, Hollywood, Calif.





1 MARK LENGTH FROM OLD BELT, ALLOWING FOR JOINT

Make Your Own SANDING BELTS



2

YOU can buy cloth-backed abrasive in 10 to 50-yd. rolls and make your own sanding belts at a considerable saving in cost. By making your own you can use special grits and abrasives as needed. Start by taking the length from an old belt, allowing for the joint, as in Fig. 1. Next, remove the abrasive from each end of the belt by rough sanding, as in Fig. 3, with a coarse, silicon-carbide stone—the kind used for dressing grinding wheels. Then dampen the joint with water, Fig. 4. Let it stand a few seconds to soften the adhesive, and scrape with a knife as in Fig. 5. If the belt has a light cloth backing, make the joint by dry sanding only, in order to avoid puckering the cloth. Line the joint



3 ROUGH-SAND THE JOINT



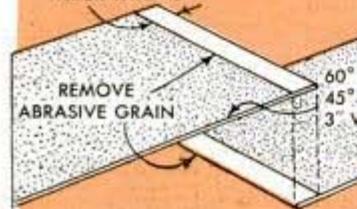
4 DAMPEN WITH WATER



5 SCRAPE CLEAN WITH KNIFE

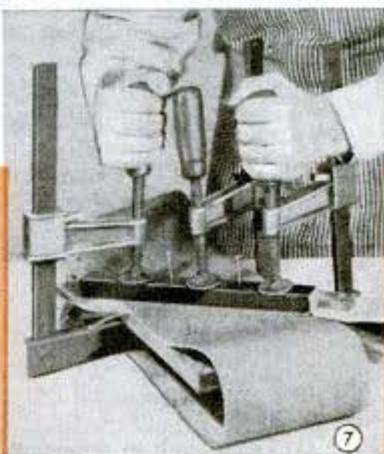
up over a backing board having a straight edge, Fig. 2, and nail to prevent shifting. Slip a sheet of newspaper under the joint, apply glue, and then clamp as shown in Fig. 7. Use hot glue or casein. Avoid quick-drying flexible cements and most other cold glues as they dry stiff or lack strength. Fig. 6 gives average joint dimensions. The double skive (abrasive removed from both ends of belt) is recommended for all belts except 50-grit or coarser. These roughing belts can be made with single skive (abrasive removed from one end only) since a smooth-running joint is not essential.

$\frac{3}{8}$ " FOR BELTS 8" TO 20" LONG, $\frac{1}{2}$ " FOR BELTS OVER 20" LONG AND WIDER THAN 3"



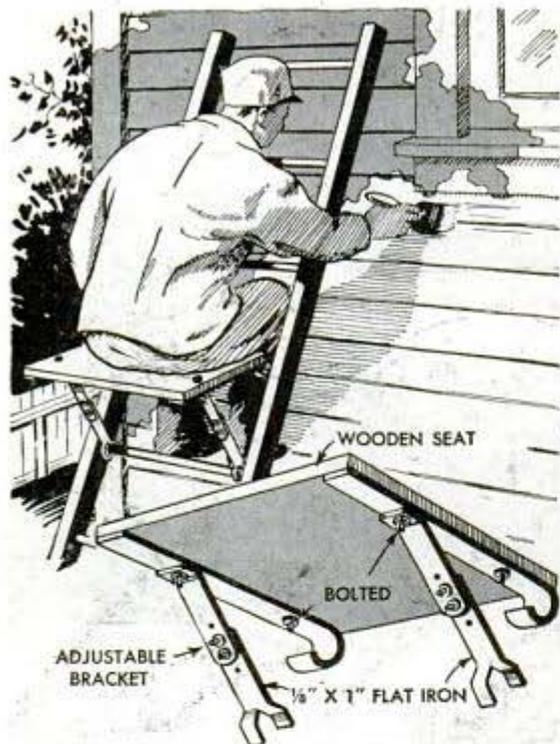
60" FOR BELTS 3" WIDE
45" " " OVER
3" WIDE

6 DOUBLE SKIVE BELT JOINT



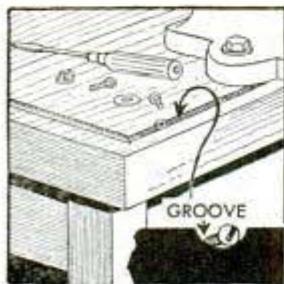
7

Ladder Seat Is Held Horizontally By Adjustable Brackets



Two adjustable brackets on this ladder seat permit it to be supported in a horizontal position regardless of the angle at which the ladder must be used. The seat has two flat-iron hooks that slip over one rung and two brackets that fit over the next rung below the hooks. The brackets can be shortened or lengthened to level the seat.
—F. Farmer, Huntington Woods, Mich.

Shallow Groove in Bench Top Retains Small Parts



Small parts such as screws, nuts and tiny bolts will not roll off your assembly bench if a groove is cut in the top near the edge as indicated. The groove will not interfere with your regular work, and is better than nailing a cleat to the edge of the bench to retain the parts.
—Ronald Eyrich, Milwaukee, Wis.

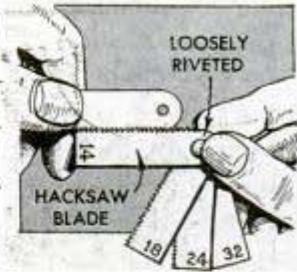
Tar Paper Embedded in Concrete Reduces Sweating of Floors

A simple precaution when pouring concrete floors will reduce their tendency to sweat, and do much to prevent mildew for-

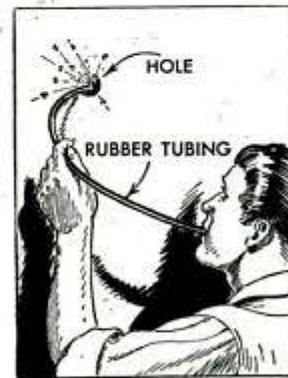
mation. After the cinder base is ready, lay tar paper over it, then pour concrete about an inch thick, followed by another layer of tar paper, then the rest of the concrete. This suggestion is especially applicable to granaries and meat houses where an accumulation of moisture may cause food spoilage.—H. W. Swope, Danville, Pa.

Teeth Per Inch of Hacksaw Blade Shown at a Glance by Gauge

Instead of counting or guessing at the number of teeth per inch in a hacksaw blade, when one of a certain type is required, make and use this gauge. It consists of short pieces of blades of the different teeth spacings which are loosely riveted together, and have the number of teeth per inch stamped on them.



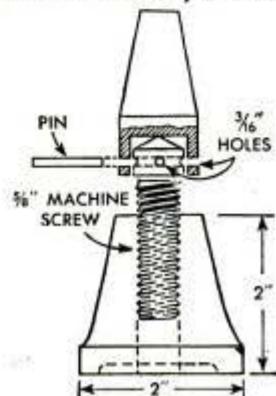
Keeping Hole Clean Saves Time When Using a Star Drill



You can save both time and labor when using a star drill if the hole is cleaned frequently to remove chips broken off by the drill. It takes energy to pulverize these small pieces when drilling a hole in the usual manner. Blowing into the hole through a length of small tubing will clean it, and also permit you to keep your face far enough away to avoid getting dust in your eyes.

Tiny Screw Jacks Have Many Uses

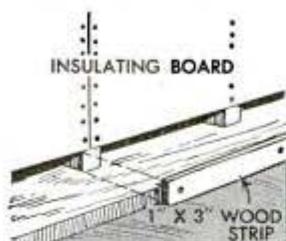
Layout men and operators of milling machines will find these little screw jacks handy in their work. The top and base can be made of scrap steel and the screw can be a machine screw or bolt, the head of which is turned to



the shape indicated. The screw and base should be casehardened to give the jacks long life. If desired, the range of the screws can be increased by providing extensions to fit over the tapered tops, the extensions being made in the sizes most used in your particular work.

—H. D. Chapman, Mount Rainier, Md.

Removable Strip to Clean Chaff From Between Double Walls

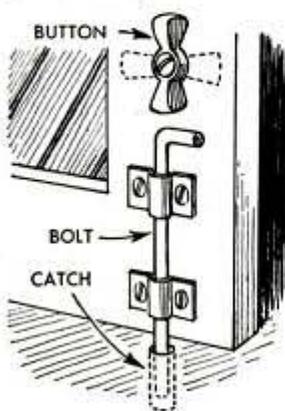


When sheathing inside walls of outbuildings and barns with insulating board, one builder fits a 1 by 3-in. strip on top of the sill and attaches it to the studs with screws.

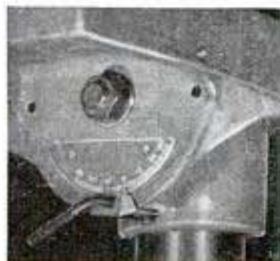
Then the insulating board is placed on top of the strip and nailed to the studs in the usual way. The strip can be removed and replaced any time it is desirable to clean out dirt, dust or chaff that falls between the walls and collects moisture.

Turn Button Prevents Raising Of Sliding Bolt Lock

A garage door locked on the inside by a bolt which engages a hole in the floor sometimes can be opened from the outside. To avoid this, screw a turn button above the bolt high enough to allow the bolt to clear the hole when the button is horizontal.



Tilt Scale Improves Drill Table



A scale on the underside of your drill-press table can be used to advantage for various jobs, such as drilling holes at an angle. Any standard machine scale reading to 45 or 90

deg. at each side of the center can be used. A ten-cent protractor is excellent. The index pointer can be cut from sheet metal and fastened to the column clamp.

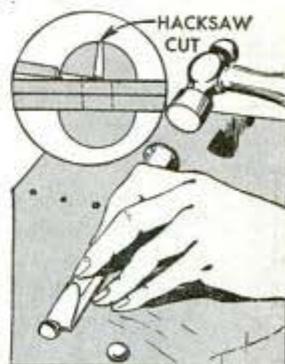
Easy Method of Cutting Bridging Used in Bracing Floor Joists



Here is an easy way of getting both the right bevel and the correct length when cutting bridging stock for use between joists. First, nail two short lengths of the bridging stock together at one end. Then place these in position between the joists about 1 in. above their lower edges, as indicated, and saw about two thirds of the way through them, using one of the joists as a vertical guide for the saw. Complete the cut with the work laid on a plank so the severed pieces will not fall out of reach.

Slotting Heads of Large Rivets Makes Them Easy to Remove

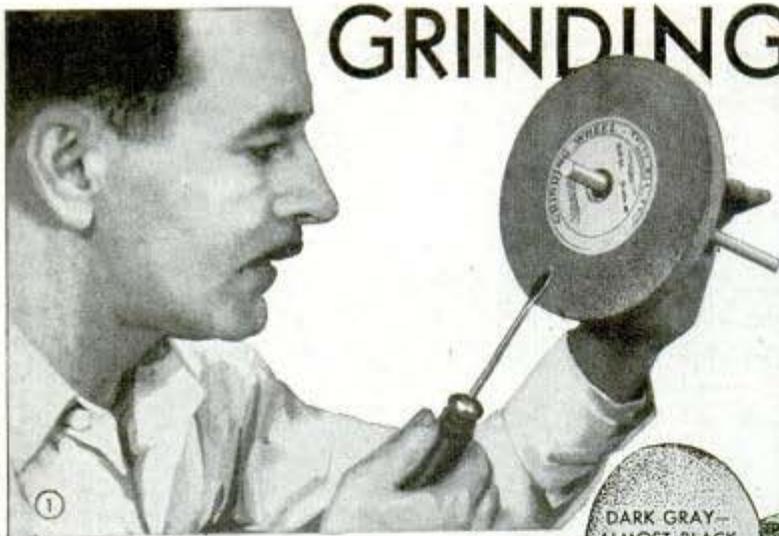
The next time you have a number of large rivets to remove, slot the heads with a hack saw and then use a cold chisel in the usual way. You will find that the slot permits the chisel to break off half of the head easily, after which the other half is cut off, thus making the job of removing the head much easier than when you cut off the entire head in one piece.



☐ A noisy Ford clutch often can be cured by tightening the nuts on the two strut rods which fasten to the flywheel housing.

GRINDING WHEEL

By Sam Brown



Above, checking wheel for hidden cracks by tapping it lightly with a screwdriver. A good wheel will produce a metallic ring; a cracked wheel, a dull thud

A KNOWLEDGE of grinding wheels pays out in better grinding. This is true even in home shops with limited selection, since the "know how" enables the workman to manipulate or dress the wheel to get the desired result.



KIND OF ABRASIVE	Abrasive	Character	Use
	There are two artificial abrasives used in making grinding wheels — (1) Aluminum Oxide, (2) Silicon Carbide. Each is made in a regular and special type	Regular Aluminum Oxide	Hard and tough
Special Aluminum Oxide		Not as tough as regular	High-speed steel tools
Regular Silicon Carbide		Hard and sharp but not tough	Cast iron, brass, copper, aluminum
Special Silicon Carbide		Very hard but brittle	Glass, marble, cemented carbides

GRAIN SIZE	8 OPENINGS PER INCH	GRAIN SIZES					
		Very Coarse	Coarse	Medium	Fine	Very Fine	Flour Sizes*
Indicates number of abrasive grains per inch. There are 25 common grain sizes or "grits"		8	12	30	70	150	280
		10	14	36	80	180	320
			16	46	90	220	400
			20	60	100	240	500
			24		120		600

* Water floated for classification

GRADE (Hard or Soft)	WHEEL GRADING	
	Norton System	Carborundum System
Grade indicates strength of bond. It has nothing to do with the hardness of the abrasive grain	Very soft	Very soft
	Soft	Soft
Structure indicates spacing of grains. This is a special feature. Most wheels are not made to structure	Medium	Medium
	Hard	Hard
	Very hard	Extra hard

STRUCTURE	GRAINS RELEASE EASILY			GRAINS ARE HELD FIRMLY			
	CLOSE	MEDIUM	WIDE	WEAK POSTS	SOFT	STRONG POSTS	HARD
Structure indicates spacing of grains. This is a special feature. Most wheels are not made to structure	Norton	0-1-2-3	4-5-6	7-8-9-10			
	Carborundum	D3-D2-D1	FA-F1	F2-F3			

KIND OF BOND	VITRIFIED—Used for 75% of all wheels	
	Bond is material used to hold grains together. There are five main kinds of bonds	SILICATE—Generates less heat
RESINOID—For high speed		
RUBBER—For high speed, especially cut-off wheels		
SHELLAC—For high finish		

Norton system runs alphabetically from soft to hard. Carborundum system is alphabet in reverse

FIVE CHARACTERISTICS OF GRINDING WHEELS

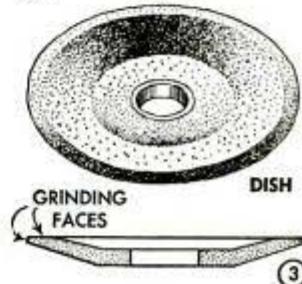
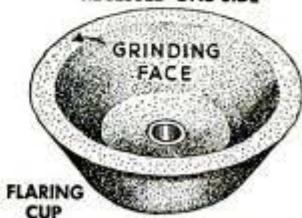
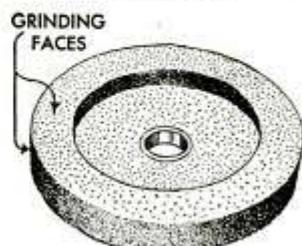
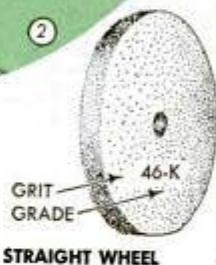
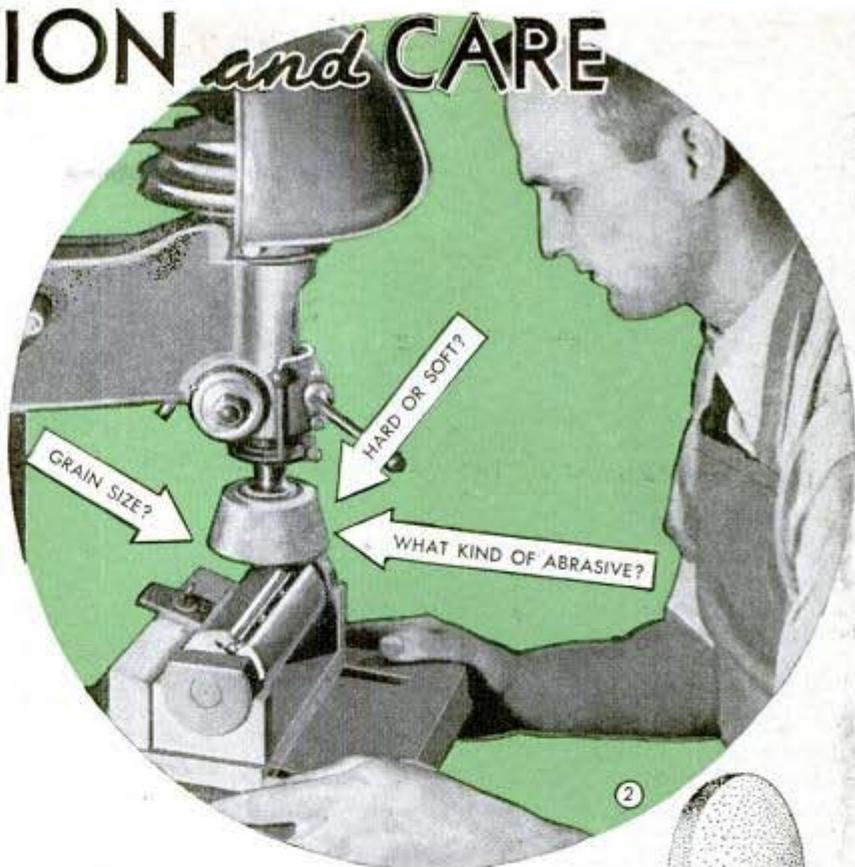
SELECTION *and* CARE

Anatomy: What you might call the "bare bones" of grinding wheels is pictured in the tabular diagram shown below Fig. 1. The two types of abrasive grains—aluminum oxide and silicon carbide—are sold under various trade names, such as Aloxite, Alundum and Borolon for aluminum oxide, and Carborundum, Crystolon and Car-silon for silicon carbide. Color is a good means of identification, silicon carbide wheels being almost black, while aluminum oxide wheels run from light to medium gray. A white wheel indi-

cates aluminum oxide with a special porous bond and with the grain itself treated so that it is not as tough as regular. Red wheels are aluminum oxide with regular vitrified bond and the same treated grain used in the white wheel. A green wheel is a very hard type of silicon carbide. The nature of other physical characteristics—grain size, grade, structure and bond—should be plain enough from the diagram. Fig. 3 shows a few shapes in which wheels are made.

Selecting the abrasive: When the material to be ground is hard and tough, the right abrasive to use, Fig. 2, is hard, tough aluminum oxide. If the work is extremely hard, such as glass or cemented carbides, it must be ground with silicon carbide. In addition to being very hard, silicon carbide grains have sharp corners, which make the wheel ideal for grinding soft metals and nonmetallic materials. As long as the material being ground is not tough, silicon carbide does excellent work. When you get up to metals with a tensile strength of 50,000 lbs. per square inch or more, the silicon carbide wheel begins to wear away fast without doing much cutting because the brittle grains break down against the tougher material. Hence, the general rule that all high tensile strength materials (this includes all of the steels) can be ground best with aluminum oxide. On the other hand, aluminum oxide is not so good for low tensile strength materials such as brass, plastic, wood, etc. These materials are not tough enough to fracture the tough grain and each grain simply wears to a dull, noncutting edge with resultant loading, glazing and burning.

The special types of aluminum oxide feature a grain somewhat less tough than regular. These wheels are excellent for grinding carbon and high-speed steel tools because the ready fracturing of the grain keeps the wheel continually sharp, fast-cutting and cool. The obvious drawback is rapid



Learn These Simple Rules ...

The Selection of ABRASIVE depends on the material to be ground

Use aluminum oxide for all hard, tough materials of high tensile strength

- Carbon steel
- Alloy steel
- High-speed steel
- Hard bronze
- Wrought iron
- Steel castings
- Stellite
- Malleable iron
- Tungsten

Use silicon carbide for low tensile strength materials and most non-metals

- Cast iron
- Brass
- Soft bronze
- Aluminum
- Plastics
- Glass
- Hardwood
- Marble
- Rubber

The Selection of GRAIN SIZE*

Soft materials require coarse grain; hard materials require fine grain

Rapid removal of stock requires coarse grain

A fine finish requires fine grain

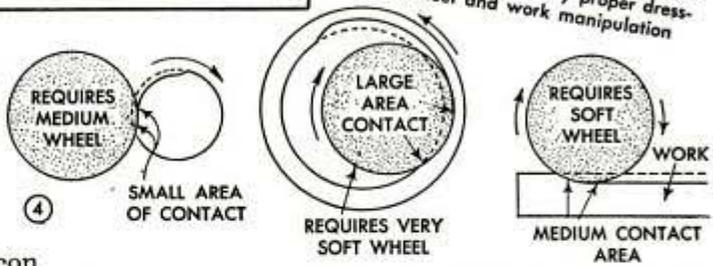
The Selection of GRADE*

The harder the material being ground, the softer the grade

Large area of contact requires a soft wheel. (See drawing)

High wheel speed and low work speed require a soft wheel

* Both grit and grade can be controlled to a considerable extent by proper dressing of wheel and work manipulation



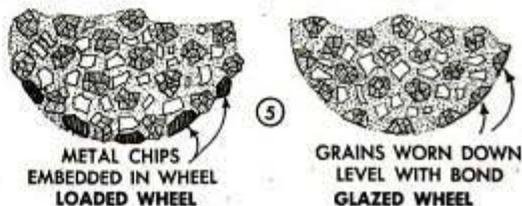
wheel wear. Special (green) silicon carbide is the only abrasive other than the diamond hard enough to cut cemented carbides.

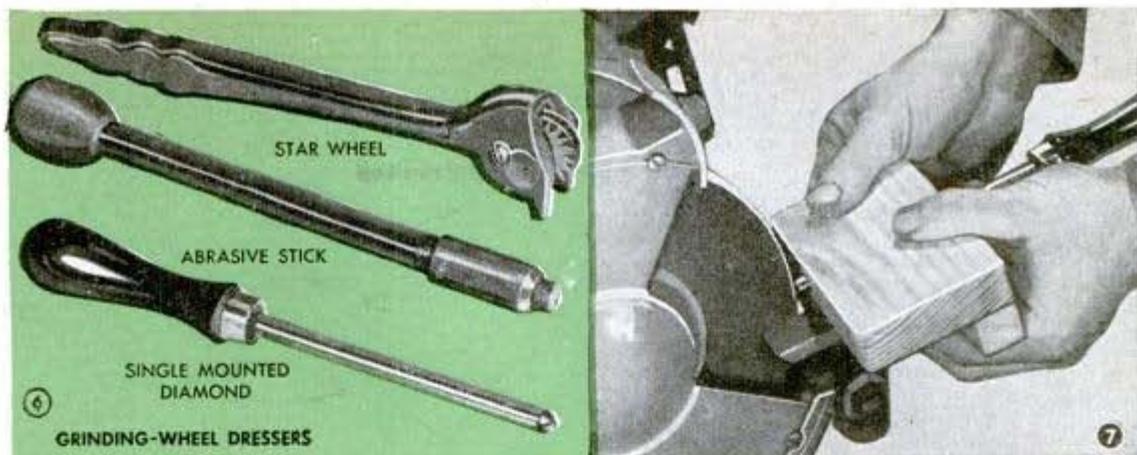
Selection of grit and grade: Follow the simple rules given in the table below Fig. 1. The key to selecting grade is: The harder the material, the softer the grade. Hard, dense materials resist the penetration of the abrasive grains and cause them to break down quickly. When the bond is weak (soft grade), it releases the dulled grains quickly, exposing new, sharp grains. The second rule—contact area—can be explained by the fact that a wide contact area, Fig. 4, spreads the stress over a considerable number of grains. The bond, therefore, must be weak (soft) so that the lessened force against each grain can break it loose when it becomes dull. When the contact area is small, as in cylindrical grinding, all of the stress comes on a very few grains. In this case, a hard grade (strong bond posts) is needed to hold the grains so that they will not be torn away before doing their share of cutting.

Wheel recommendations: Specific recommendations can be used to advantage whenever the wheel specified is available. The table below Fig. 4 gives a condensed version of tabular matter supplied by all manufacturers of grinding wheels. Obviously, very complete hair-splitting tables are useless to the

Material or Operation	Abrasive	Grit		Grade
		Rough	Finish	
Aluminum	S. C. ①	30 ②	40	Soft
Brass	S. C.	36	60	Soft to Med.
Cast Iron	S. C.	30	46	Soft to Med.
Chisels (wood)	A. O.	—	60	Medium
Copper	S. C.	36	60	Soft to Med.
Cork	S. C. ①	36	46	Soft
Duralumin	A. O. ①	30	46	Soft
Drills (H.S.S.)	A. O. (wht.)	—	60	Medium
Glass	S. C. (green)	80	220	Medium
Grinding (general)	A. O.	46	60	Medium
Mal. Iron (annealed)	A. O.	30	46	Hard
Mal. Iron (not annealed)	S. C.	30	46	Hard
Plastic	S. C.	46	120	Medium
Rubber (soft)	S. C.	24	46	Soft
③ Rubber (hard)	S. C.	36	46	Soft
Saws (gumming)	A. O.	—	60	Medium
Steel (soft)	A. O.	46	60	Medium
Steel (carbon)	A. O. ①	46	60	Medium
Steel (hi-speed)	A. O. ①	46	60	Soft
Welds (smoothing)	A. O.	24	46	Med. to Hard
Wood (hard)	S. C.	24 ②	30	Soft
Wrought Iron	A. O.	30	46	Med. to Hard

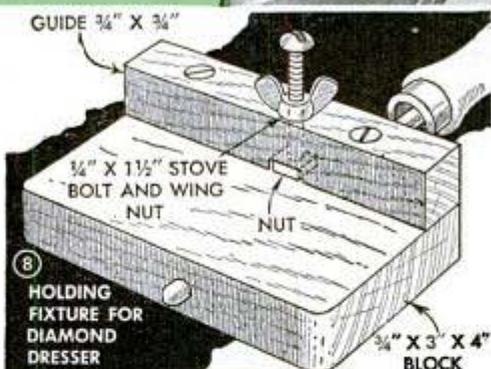
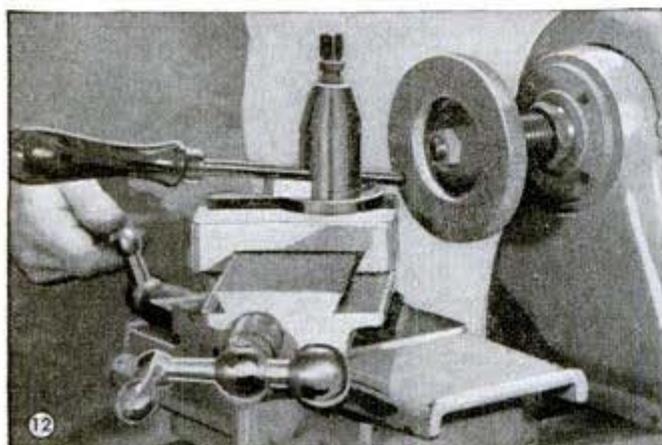
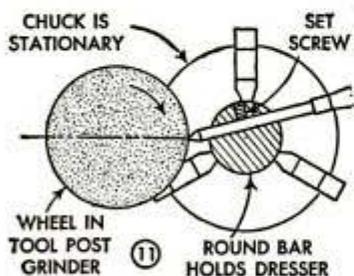
1 White or red aluminum oxide also used
 2 Tends to load if fine grit is used
 3 Resinoid bond preferable
 * All wheels vitrified bond. Structure is not considered



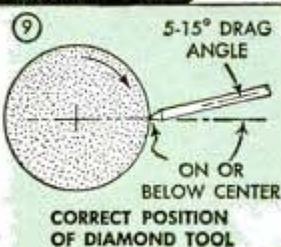


average worker because he does not have the wheels. The best system of selection is to know why a certain wheel should be used, and then manipulate such wheels as are available to get the desired result.

Dressing and truing: When a wheel becomes loaded or glazed, Fig. 5, it is necessary to press some hard object against it while rotating to restore the cutting edges. Simplest device for this is the star-wheel dresser, Fig. 6. The metal disks and wheels are actually much

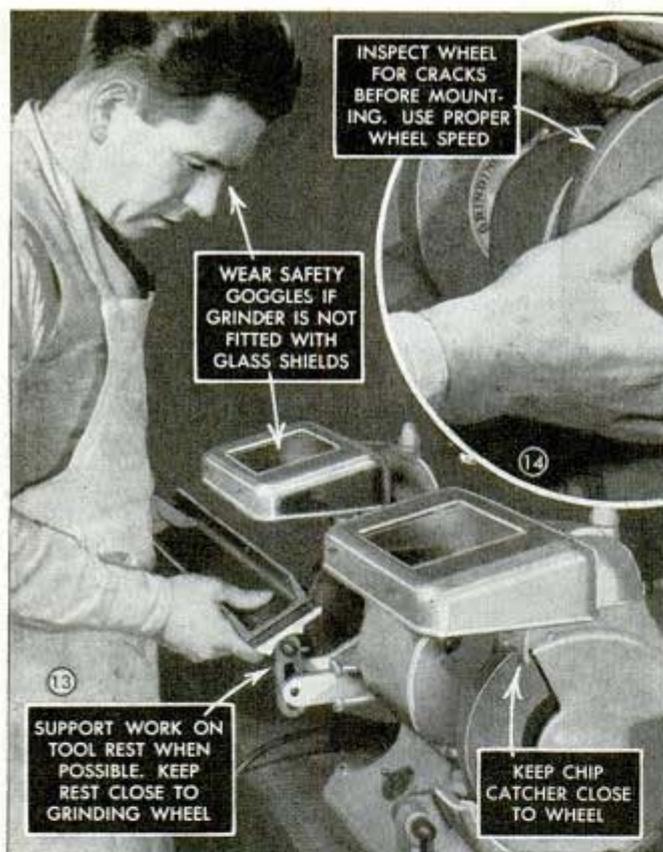


Dressing removes the outer dulled layer of abrasive grains and exposes new sharp grains. Truing is precision dressing so that the wheel runs perfectly true. Proper manipulation of the dressing tool can alter the wheel's cutting action within reasonable limits



softer than the grinding wheel, but by using firm pressure the faulty abrasive grains can be torn loose. This dresser is worked freehand, but always supported on the tool rest. It should not spark. Sparking is an indication that the grinding wheel is cutting the dresser and therefore, the dressing tool should be pressed harder against the wheel. The stick-type dresser is inexpensive and efficient. It is a very coarse, silicon carbide abrasive, which readily cuts the finer grain of the grinding wheel. Best of all is the diamond, especially for precision dressing (truing). It should be used only for precision work. If dressing requires removal of embedded metal chips or heavy shapping, the star-wheel or stick dresser should be used first, and can then be followed by the diamond. Use a simple jig like the one shown in Fig. 8 to hold the diamond dresser. Always contact the wheel on or below center and always at a drag angle, as in Figs. 7 and 9. Fig. 11 indicates how the dresser can be held when dressing the wheel of a tool-post grinder. Fig. 12 pictures the dressing of a recessed wheel mounted and used on the lathe.

An important feature of dia-

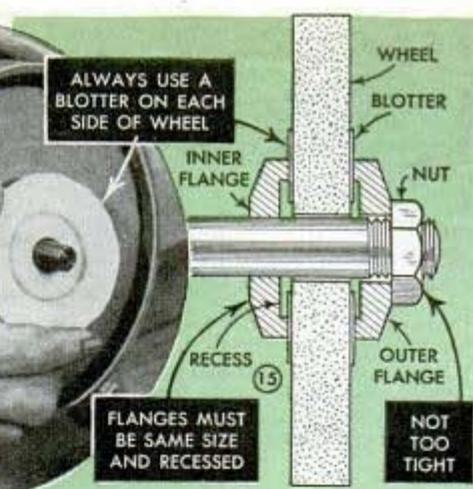


INSPECT WHEEL FOR CRACKS BEFORE MOUNTING. USE PROPER WHEEL SPEED

WEAR SAFETY GOGGLES IF GRINDER IS NOT FITTED WITH GLASS SHIELDS

SUPPORT WORK ON TOOL REST WHEN POSSIBLE. KEEP REST CLOSE TO GRINDING WHEEL

KEEP CHIP CATCHER CLOSE TO WHEEL



ALWAYS USE A BLOTTER ON EACH SIDE OF WHEEL

FLANGES MUST BE SAME SIZE AND RECESSED

NOT TOO TIGHT

Safety First!

mond dressing is the depth of cut and the speed rate at which the diamond is moved across the wheel. In all cases the cut must be very light, not over .001 in., as shown in Fig. 10. A fast traverse opens up the wheel, making it, in effect, a coarser grain and a softer grade than it actually is. A slow traverse makes the wheel, in effect, finer grain and harder grade. For open dressing you use a maximum depth of cut, and the diamond is pushed just once, and quickly, across the wheel. When dressing the wheel for fine finishing, the depth of cut is held to a minimum, and the traverse is made slowly and repeatedly until the cut sparks out. By applying these rules, a wheel can be made coarser or finer, harder or softer.

Wheel safety: A lot has been said about wheel safety, and, while we pass over this quickly, simply by referring you to Figs. 13, 14 and 15, it is of prime importance and should not be neglected. Always check a new wheel for cracks by striking it with a screwdriver as in Fig. 1.

Trouble-shooting: Some of the common faults encountered in grinding are listed in the table shown below Fig. 13. Observe how the work and wheel can be manipulated for hard or soft effect. This can be used to advantage in making one or two wheels do a wide variety of work.



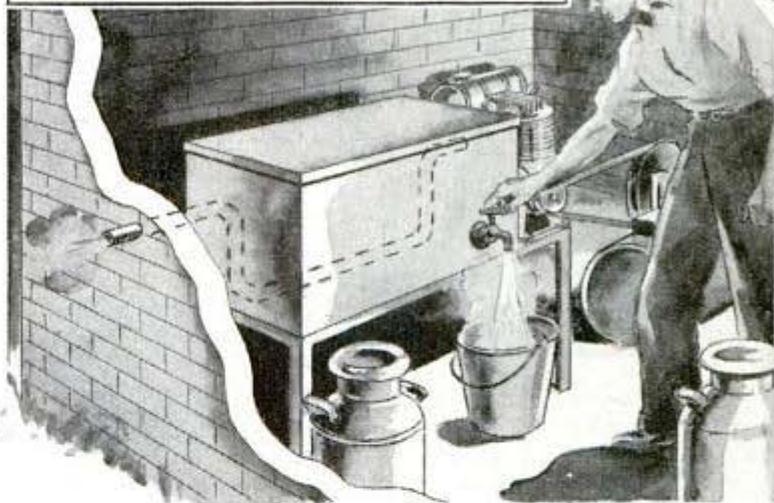
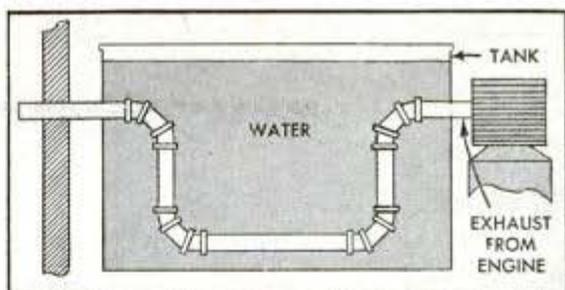
Trouble Shooting

FAULT	CAUSE	CORRECTION
WHEEL LOADING (Metal chips embedded in wheel)	Wrong wheel	Use coarser grain or open structure wheel
	Faulty dressing	Dress with rapid traverse
	Faulty operation	Use slower wheel speed and faster work speed or traverse
WHEEL GLAZING (Slick, shiny appearance—does not cut)	Wrong wheel	Use coarser grit, softer grade
	Faulty dressing	Use faster traverse with deeper penetration
	Faulty operation	Use more pressure. Increase work speed
WHEEL DOES NOT CUT (Glazes and burns)	Wheel is too hard	Use coarser grit and softer grade
		Open up wheel by fast dressing
		Decrease wheel speed, wheel diameter and width
		Increase work speed and pressure
RAPID WHEEL WEAR	Wheel is too soft	Use harder wheel
		Dress with slow traverse and very little penetration
		Increase wheel speed, wheel diameter and width
		Decrease work speed and pressure
ROUGH WORK	Wrong wheel	Check abrasive, grit and grade
	Wheel out of round	Dress wheel
	Machine fault	Check bearings and wheel mounting

Engine Exhaust Heats Water Used in Milkhouse

Utilizing the exhaust from a small engine, one farmer heats water inexpensively for use in his milkhouse. The exhaust pipe is run through a small tank as indicated and, after operating the engine at chore time to pump water and run a cream separator, there is plenty of hot water for washing the separator, buckets and other utensils. The exhaust pipe is best shaped from seamless tubing, but if this is not available, it can be made from pipe and fittings as indicated in the detail. In an exhaust pipe it is better to make slow bends with short nipples and 45-degree elbows than to make sharp bends with 90-degree elbows. Slow bends offer less resistance to the passage of exhaust gases. The tank can be made of sheet metal,

or you can use an old washboiler or other container of suitable size and shape. You can make watertight joints where the pipe passes through the tank by threading



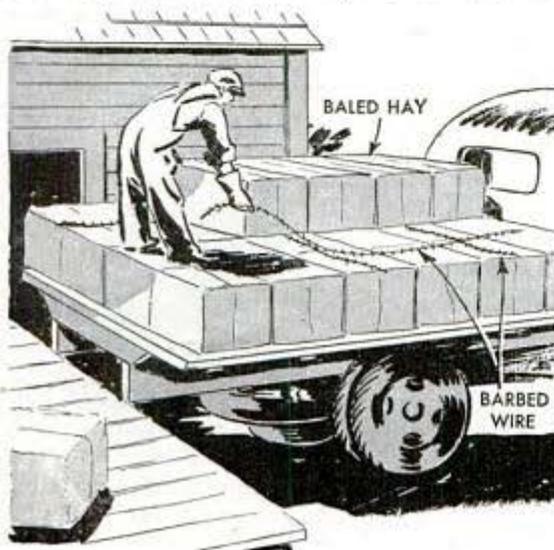
the pipe and using flanges or nuts to squeeze suitable gaskets tightly against the inside and outside surfaces of the tank.

—Charles Swope, Danville, Pa.

Barbed Wire Keeps Hay Bales From Slipping on Truck

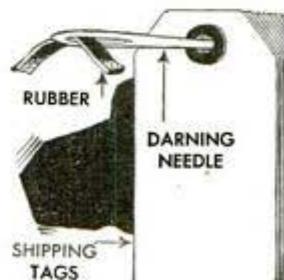
To keep bales of hay, straw, etc., from shifting while being hauled on a truck, one driver uses lengths of barbed wire. These are laid both crosswise and lengthwise of the truck between the layers of bales as

they are loaded. The barbs on the wire dig into the bales and thus help prevent them from shifting out of place.



Needle With Strip Through Eye Holds Tags for Easy Removal

One shipping clerk who had trouble keeping tags conveniently at hand without having them scattered by the wind, used a holder like the one shown to avoid the trouble. The holder was merely a large darning needle having a strip of inner-tube rubber run through the eye. The rubber permitted the tags to be slipped off the needle but was resistant enough to keep them from being blown off by the wind.



—Dana French, Fitchburg, Mass.

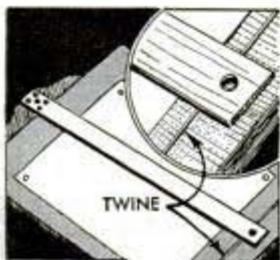
Waterproof Cover for Memo Pad Kept Outside Office Door



Men who operate small businesses alone and have to close their offices when away for an hour or two, will find this memo pad located on the wall outside the office door handy for their customers to leave messages and orders. The pad is kept on a sloping shelf nailed to the wall and is covered by a cake pan, which is hinged to the shelf at the back. In this way, the pan must be held up by the writer and there is no possibility of it being left off the pad. The latter is raised on a wood block so that it will not be damaged by water running under the pan in case of rain.

—Charles Brownold, Woodmere, N. Y.

Twine Facilitates Use of T-Square



A piece of twine tied around or otherwise fastened across the top and one side of a drawing board near the edges, helps in moving a T-square along different levels of the drawing. The

twine also lifts the square sufficiently to keep the edges of the drafting paper clean and unfrayed.

Glass Tubes Cleaned Safely With Hydrofluoric Acid

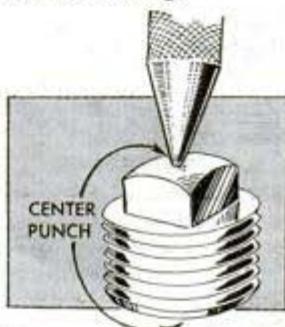
Hydrofluoric acid, which attacks most substances, including glass, can be used in a very dilute solution to clean boiler

gauges, retorts and other glass objects whose shape makes internal cleansing difficult. Immersion in a 5 percent solution for 15 or 20 min. is usually sufficient, after which the glass must be rinsed thoroughly in running water to be sure that all traces of the acid are removed.

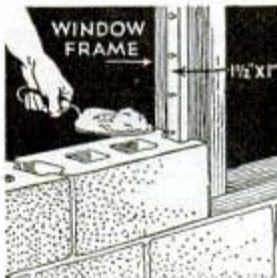
—W. F. Schaphorst, Newark, N. J.

Screw Plugs Are Center-Punched To Prevent Leaking

If a leak develops around a small screw plug used in a tank or pipe and it is impossible to pull it up tight enough to stop the leak, remove the plug and center-punch both ends. In most cases, this will spread the metal enough to make the plug fit the hole tightly, even though the threads may be worn slightly.



W.T.M. Concrete How to Anchor Window Frame In Concrete-Block Walls

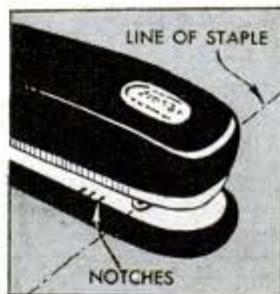


When walls are made of concrete blocks, window frames can be held securely and made more draftproof if 1-in. strips are nailed to the frames as indicated. The strips will fit into the ends of

the blocks at the window opening and, if the heads of some of the nails holding the strips are allowed to project about $\frac{1}{4}$ in., the mortar around the frame will adhere to it better.

Guide Notches Improve Stapler

If you use a stapler of the type on which the head covers too much of the paper to position the staples accurately in the work, file one or more notches in the edge of the bottom plate to serve as guides



when inserting the paper. Filling the notches with red paint or nail polish will make them easy to see.

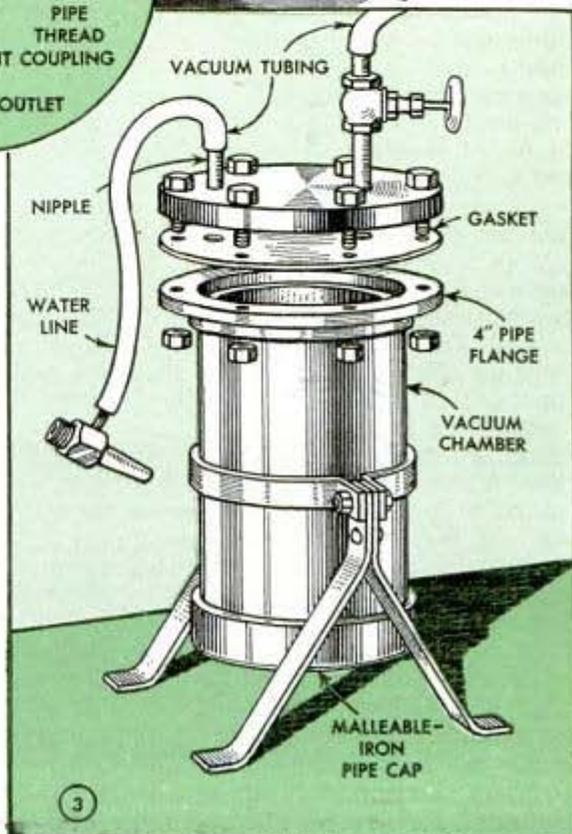
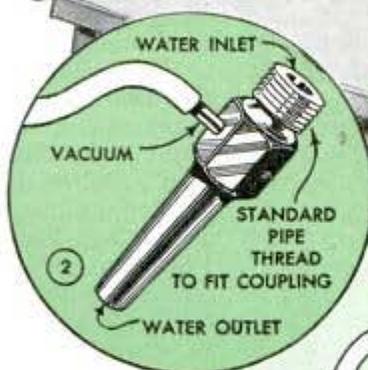
IMPREGNATING WOOD *in a vacuum chamber*

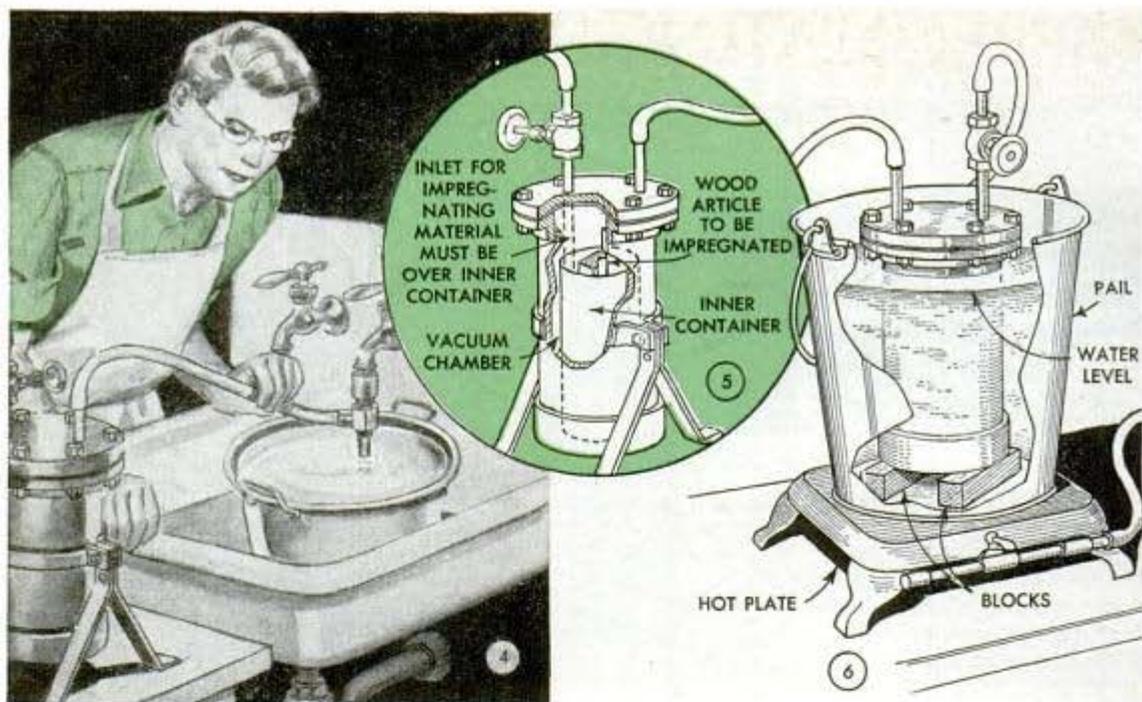
How wood is toughened and hardened with resin plastics; also preserved, flameproofed, water-proofed and dyed

By J. B. Mullen

SOFTWOOD, inexpensive and easy to work with ordinary tools, offers many unusual opportunities in craftwork, as it can be substituted for items normally made of glass, plastics or metal, if it is impregnated in a vacuum chamber. For example, ash trays can be made of flameproofed softwood, and toys can be given a color penetration instead of a surface coat of paint which chips off. Although the equipment described here is intended for small items only, larger units of the same general type, but using vacuum pumps, can be built for larger work.

For small work, all that is needed to vacuum-impregnate softwoods, such as white pine and balsa, is a small water-jet vacuum pump obtainable at any laboratory supply house for about a dollar, and a few pieces of pipe and fittings. A 4-in. pipe nipple, 6 in. long, will serve as a vacuum chamber. One end of this is sealed with a pipe cap, and the other is fitted with a standard flange over which a gasket and cover plate $\frac{1}{2}$ in. thick are secured with bolts. Two holes are drilled and tapped in the cover to take $\frac{1}{4}$ -in. pipe nipples, one of which is fitted with a globe valve, Fig. 3. The unit is supported by flat-iron legs. A hot plate or a water bath, as shown in Figs. 1 and 6, should be provided to heat the unit when required. For a permanent installation, the water jet, Fig. 2, can be screwed into a valve over the sink, or, for a temporary installation, it can be attached to a faucet with an adapter as in Fig. 1. Heavy rubber tubing,





such as vacuum or pressure tubing, should be used to connect the water jet to the vacuum chamber. Another length of the hose is run from the globe valve to a pail containing the impregnating solution.

Waterproofing: Softwood articles such as toys can be waterproofed with melted paraffin to which is added powdered white shellac, about 5 percent. Balsa and white pine are best for impregnation because of their porosity. Before impregnation, the parts should be cut to finished size because frequently it is difficult to impregnate all the way through a piece, and if much cutting is done after impregnation, the raw wood may be exposed. If the vacuum chamber is to be used for more than one type of impregnation, it is best to use an inner can or pail to hold the wood and impregnating mixture as shown in Fig. 5. A large tin can with the top cut off will serve for this purpose. In use, pieces to be impregnated are placed in the vacuum chamber or in the inner container, after which the gasket and cover are bolted in place. Then, the valve is closed tightly and the water turned on to evacuate the chamber. In the meantime, the wax-shellac mixture is heated ready for use when the evacuation is complete, and the vacuum chamber also is heated, as in Fig. 6, so that the wax mixture will remain fluid. Evacuation of the chamber will take only a few minutes if all connections are tight. If in doubt, hold the outlet jet in a pan of water as shown in Fig. 4; bubbling indicates incomplete vacuum. Pumping should be continued for several minutes after bub-

bling ceases to remove air from the pores of the wood.

When the chamber is fully evacuated, the intake hose is submerged in the melted wax-shellac mixture, Fig. 1. Then the globe valve is opened slowly and enough of the molten mix is sucked into the chamber to submerge the wood completely. After this, the valve is closed, the intake hose removed from the wax mixture, and the unit allowed to remain hot, under vacuum, for a few minutes to permit the hot mixture to penetrate the wood. Then the valve is opened slowly, the water pump shut off, and the cover removed. The saturated wood now can be removed and allowed to drain and cool, and the remaining wax mixture removed from the vacuum chamber before it chills and sets.

Flameproofing: The flameproofing process used on ash trays and similar articles is the same as used for waterproofing, except that no heat is required. The flameproofing solution is made by dissolving ammonium phosphate, dibasic, 7½ oz.; ammonium chloride, 5 oz.; and ammonium sulfate, 5 oz.; in water, 100 fl. oz. After saturation, the wood is removed from the vacuum chamber and allowed to dry.

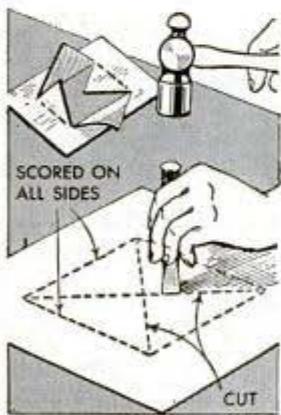
Preservation: Vacuum impregnation is suitable for preserving small articles exposed to water or weather, such as stakes for marking plants. For this purpose, hot creosote is widely used, though any of the common preserving materials are satisfactory. Another method is to saturate the wood with a concentrated solution of zinc chloride or zinc sulfate. Besides preserving

wood, the zinc sulfate will flameproof it.

Coloring: Toys and decorative articles can be colored by impregnating them with a water solution of dye of any desired color. Dyes soluble in gasoline or alcohol can be used if the swelling action of water on the wood grain is undesirable.

Hardening: Softwoods can be hardened and toughened somewhat by impregnating them under vacuum with a synthetic-resin mixture, which then is heated to harden it. Novelties such as bracelets, toys, small wooden ornaments and model-airplane parts can be treated beneficially by this method. The resin as received is a thick liquid. To thin for use, liquid resin, 10 vols., should be mixed with denatured alcohol, from 5 to 10 vols., so that it pours freely, and stirred thoroughly with a paddle until the mixture is uniform, using as little alcohol as possible. To this mixture is added a hardening solution, 1 vol., made by dissolving c.p. (chemically pure) hydrochloric acid, 1 fl. oz., in water, 3 fl. oz. The impregnating solution should be mixed fresh before use. After the wood is saturated, it is removed from the chamber and allowed to drain, and then is placed in an oven at a temperature of about 150 deg. F. for half an hour. Complete hardening will require about 2 hours.

Easy Method of Cutting Openings In Thin Sheet Metal



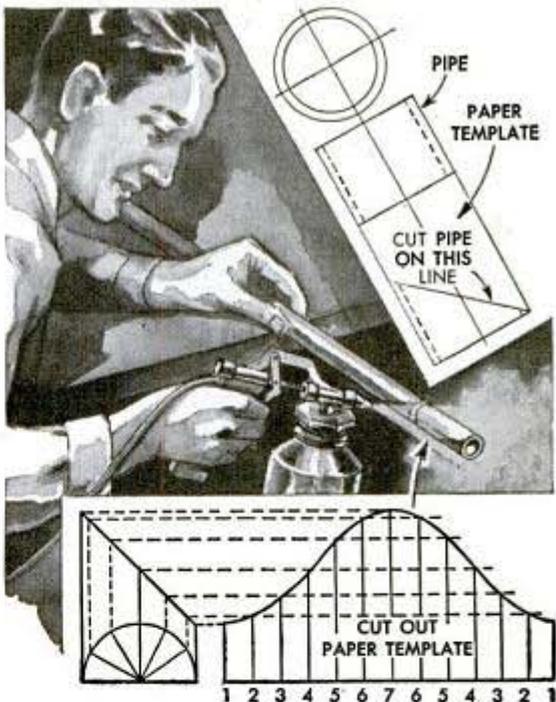
resulting tabs can be broken off by bending them back and forth.

Soap Aids in Mounting Tires

In order to facilitate the mounting of new or stiff tires, one service station attendant keeps a small jar of liquid soap and a brush handy on his tire bench. A light application of this on the tire bead will allow the tire to slip easily on the rim. No oil or any kind of petroleum product should be used on tires as it rots rubber.

—Corp. Darrell Roberts, Flora, Miss.

Guide Line Spray-Painted on Pipe To Cut It at an Angle

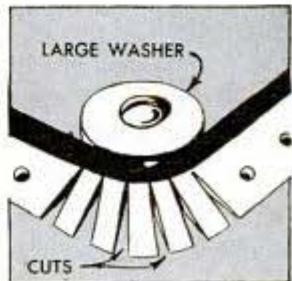


In one shop where paper templates were used to mark bevels on a number of pipes that had to be cut off at various angles, the edges of the templates often were damaged after marking two or three pipes and new ones had to be made. To avoid this extra work, the template was wrapped around the pipe and paint was sprayed lightly on both the pipe and edge of the template. When the latter was removed, the paint left a sharp guide line. Since the paint did not tear or otherwise damage the edge of the template it could be used indefinitely.

—William Chlebeczek, Minneapolis, Minn.

Shaping Metal or Plastic Edging To Fit Around Corners

Straight lengths of metal or plastic edge molding can be shaped to fit neatly and snugly around sink rims and other rounded areas by bending them around washers having the same radius as the rounded area.



Nail the washers to a flat surface and then slit the flat portion of the molding where it is to be formed, leaving only the beaded portion intact. The slits will not show on the finished job as this portion of the molding is hidden by counter or cabinet covering.

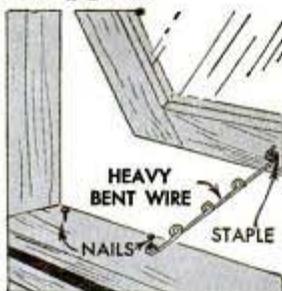
Clamp Holds Work on Sawhorse For Edge-Planing



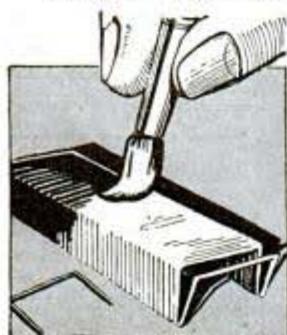
When you wish to edge-plane short boards on a sawhorse, you can hold them with a C-clamp which is kept handy in a keyhole slot cut in one end of the horse as indicated. The clamp may be raised, dropped out of the way or removed from the sawhorse easily when desired.

Hinged Windows Held Open By Wire Support

Holding a hinged window open at any angle is a simple matter if you use a wire support like the one shown. Pivot it to the sash frame with a heavy staple or screw eye and drive a couple of nails into the window sill over which to slip the looped wire to get the degree of adjustment desired.



Painted Staples Identify Papers From Various Departments



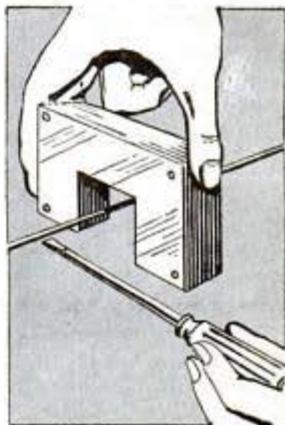
In one office where it was desirable to identify instantly the department in which papers had been stapled together, the staples were coated with lacquer before putting them in the stapler, using a

different color for each department. In this way, a glance at the staple in the papers instantly identified the origin.

—Kenneth Murray, Baltimore, Md.

Detecting "Live" Electric Wire

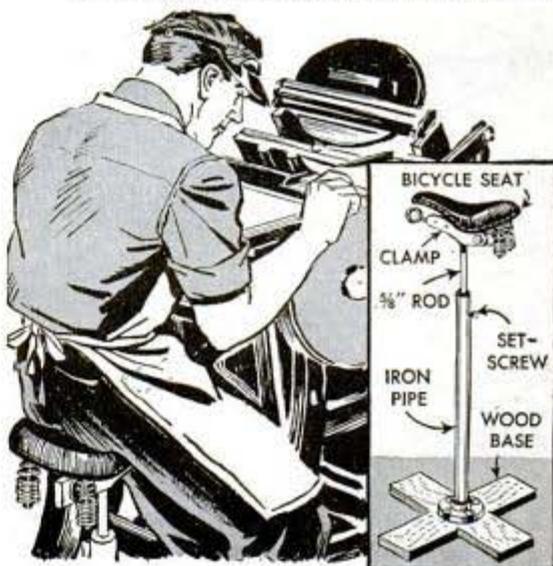
When you are in doubt as to whether or not an electric wire is carrying current, it can be tested safely with a laminated core from an old transformer or other electrical device. In use, hold the core over the wire without touching it as shown, and then place a screwdriver or other piece of iron across the poles of the core. If there is current in the wire, the core will attract the iron like a small magnet.



Adjustable Seat Eases Strain On Job-Press Operator

The strain of standing at a job press during long periods of operation was avoided by one printer, who used an adjustable seat like the one shown. It consists of a bicycle seat mounted on a pipe standard, which is supported on a wooden base. The standard is attached to the base by means of a pipe flange, and the seat is clamped to a rod which telescopes into the pipe where it is held by a setscrew. The latter is tapped into the pipe and holds the seat at the desired height.

—Robert W. Knight, Jr., Riverton, N. J.





Radio

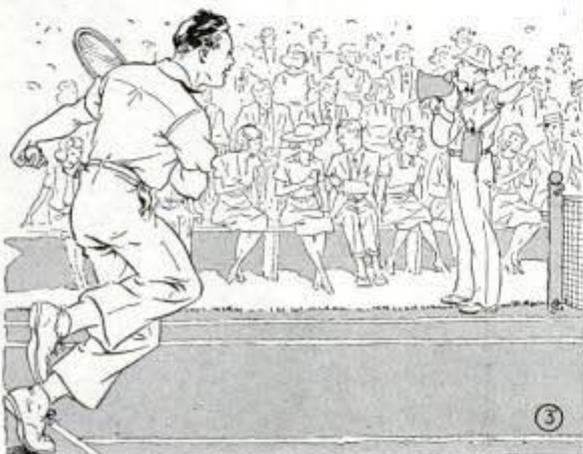
Electronic Megaphone

ORIGINALLY developed for use on board ships where high noise level makes speech reinforcement necessary, this combination megaphone and portable amplifier is equipped with a carrying strap so that the operator's hands are free except when the megaphone is being used.

Two types of amplifier units have been provided; the portable battery-operated unit is shown in sketches 1 and 3. This is 8½ in. high, 6½ in. wide and 3½ in. deep, and weighs 8½ pounds. For applications in which the operator needs only limited movement, and a commercial source of power is available, the megaphone can be operated at a higher output volume by using a larger fixed amplifier connected by means of a 40-ft. extension cable. This will provide three times greater output volume than the portable amplifier.

Because of its light weight and compact size, the portable amplifier provides a versatile combination, as it is ready for instant use wherever a man can walk. The megaphone unit with microphone and cable are shown in photo 2. It will be noted that the operator has unobstructed vision in the direction his speech is transmitted.

Applications of this electronic megaphone are not limited to shipboard use; it is also ideal for drills, landing operations and field maneuvers as well as at warehouses and loading docks. Peacetime uses will include sports and other applications wherever a megaphone is required.



RADIO WORKBENCH

By S. A. Johnson

DESIGNED to meet the needs of the average radio student and experimenter, this sturdy workbench has definite advantages over the commonly used kitchen table, or an ordinary bench. Easy to build from scrap materials, it includes a number of special features that radio workers have found helpful in assembling, wiring and servicing radio and electronic devices.

A 2-ft. by 4-ft. top provides ample space for work; tools are racked on a panel mounted on the back of the bench so that they are within easy reach at all times. Complete construction details appear in Figs. 1 and 2; the dimensions and materials specified may be changed to suit the builder's stock on hand. It will be noted that the bench is unusually high; this is one dimension that will have to be changed to meet the requirements of the individual builder. However do not make the mistake of building it too low as the penalty is an aching back. A good rule of thumb in determining the correct height is to make the top of the bench come about even with your hip pocket. This is usually higher than the average 30-in. table, which is too low. The back panel can be made from 1-in. lumber of any practical width, if a single piece of 5-ply plywood is not available. This back panel is supported by cutting and extending the rear 2-by-4-in. table legs as detailed in Fig. 2. The top can be made from well sanded lumber either 6 or 8 in. wide.

Small radio parts, coils of wire, solder and similar materials are kept in the par-

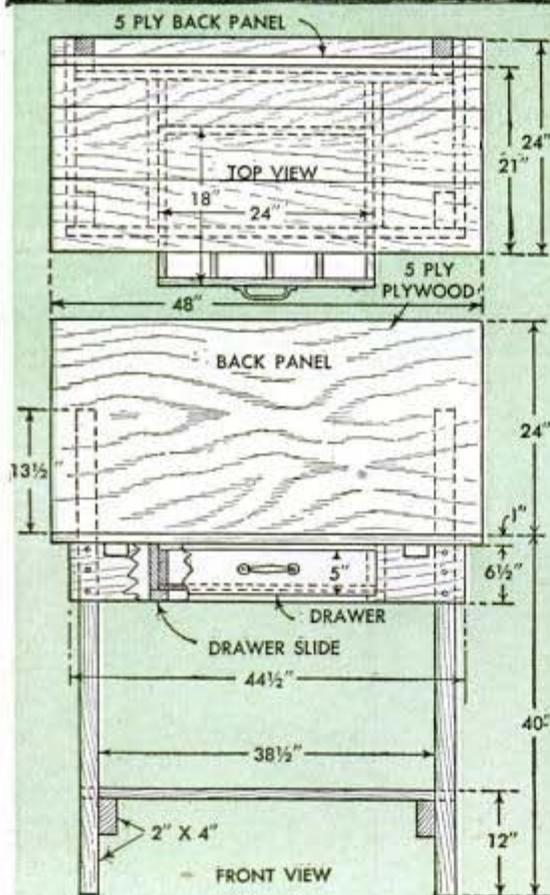
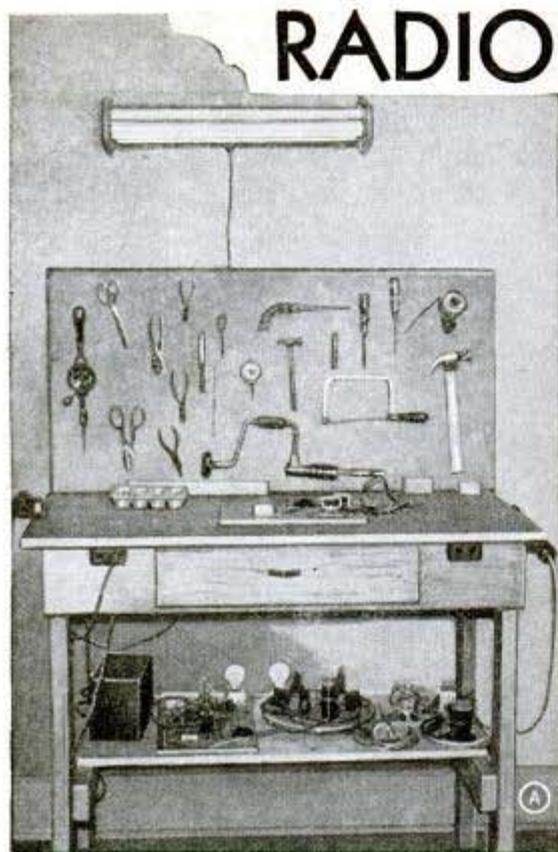
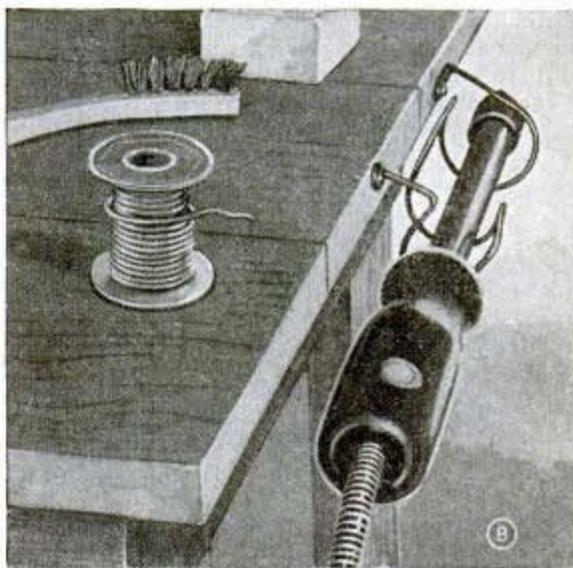


Fig. 1



for EXPERIMENTERS

tioned drawer where they are easy to find. Nuts, screws, washers, spring clips and other small hardware may be placed in muffin tins having 8 or more compartments; a good substitute would be the bottom halves of cardboard cartons in which eggs are packed. Two double receptacles on the front of the bench are wired in parallel and connected to an extension cord. The tools are held on the back panel by means of nails. Roofing nails with large flat heads are used for pliers, screwdrivers, etc., hand drills and similar larger tools are best supported by longer finishing nails. After the various tools are mounted on the back panel, draw a line around each tool, with a large black grease crayon, to outline it so that each tool will be returned to its proper place. The lower shelf provides storage space for testing instruments, loud speakers and other large parts.

Photo A and sketch C show the completed radio workbench. A small vise is mounted on one end of the bench and a heavy wire rack for the soldering iron on the other; photo B shows a closeup view of this handy rack. No radio workbench is complete without a stool of proper height, and a good light. The fixture shown in photo A may be hung on chains and fitted with snaps and rings so that it can be taken down and moved to a position over a test bench or radio operating table.



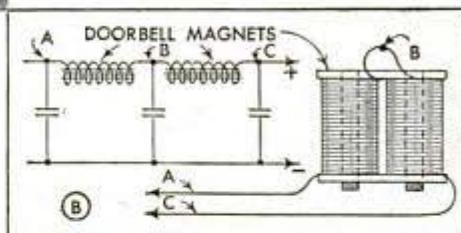
Helpful RADIO HINTS



(B) Common door bell or buzzer magnets may be used as a substitute for a small filter choke in experimental power units. Either one or both can be employed; the diagram shows both magnets used in series with filter condensers inserted between the magnets at each end. Use largest capacity at output end C.



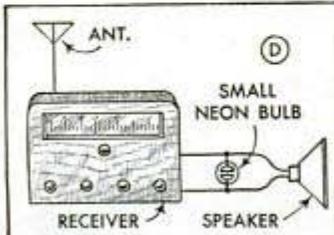
(A) Local radio station kilocycle listing pasted on a piece of white paper is used to replace the 100-0 dial plate to simplify tuning a tiny midget set. As stations are identified lines are drawn to proper position at the pointer knob



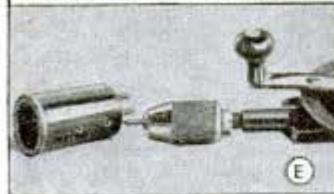
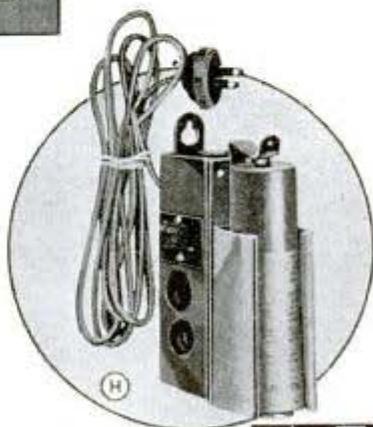
(C) Plug-in type dry electrolytic condensers as easily replaced as tubes; (D) Small neon bulb across speaker output terminals, in old style receivers having low output voltages from 135 to 180 volts, used to "peak tune" signals visually



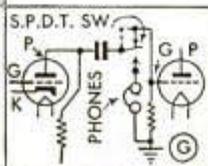
(H) Rechargeable flashlight battery designed to replace two size D standard flashlight cells. When fully charged, the voltage is claimed to be about 2.2 volts; the charger unit shown with cell operates on 115-volt 50 or 60-cycle a.c. line



(E) Shingle nail with head removed provides substitute bit for drilling coil forms; (G) Headphones added to receiver; circuit shows phones across grid resistor of power stage. Preceding tube may be first audio or duodiode detector. Switch cuts phones in or out; dotted connection energizes both speaker and phones



(F) Small lightweight electric soldering iron has replaceable heating element; draws only 17 watts and comes to full heat in 90 sec.



(I) Simple device for tracing "live" a.c. lines without tapping into line is made from an old choke stripped of its casing and top laminations removed. Choke and condenser may be mounted in a small box or can, leaving top open. Place device against conduit or BX cable; hum indicates a "live" line





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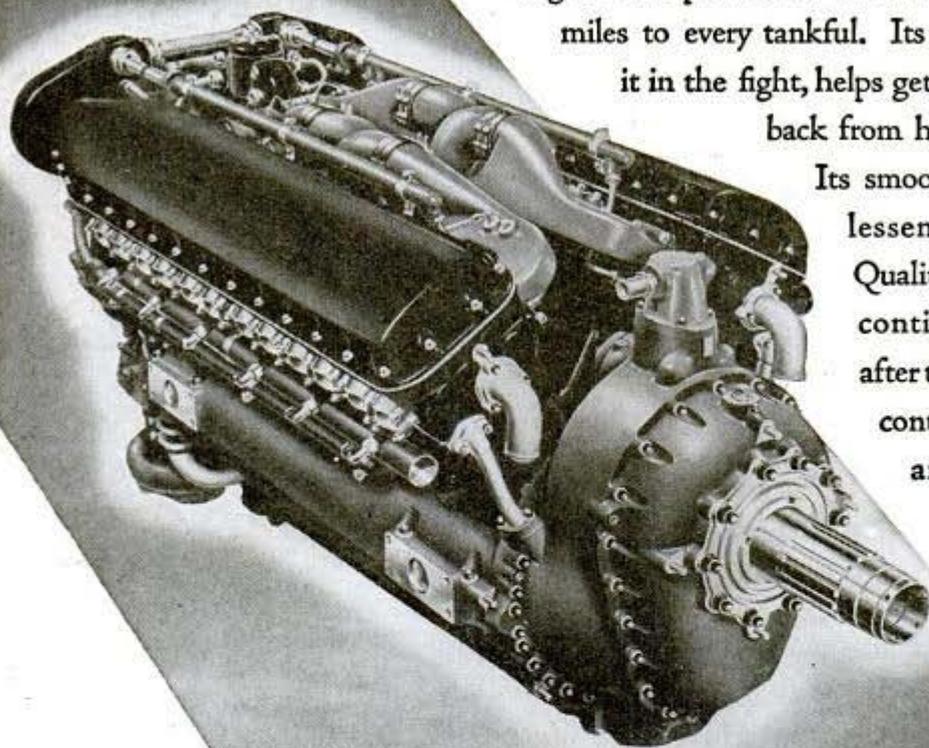
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Speeding Them Back to Get Them Well

(Continued from page 87)

speedy and efficient transportation of the wounded. The Coast Guard plays an important part in the evacuation of wounded from beachheads. During the invasion of France, the Coast Guard operated a fleet of fifty 83-foot rescue cutters, formerly used for U-boat patrols and called the "match box fleet." These craft are credited with saving some 750 lives on D-Day.

In beach landings, both the Army and Navy send medical battalions ashore. Beach evacuation stations are set up and "ambo-jeeps" and trucks help gather the wounded, the jeeps being fitted with special racks to carry four stretchers. Several types of amphibious craft, including DUKW's, under Army control, are equipped with litters and carry the wounded to hospital and other ships near shore. As soon as positions ashore become more firmly established, a well-defined chain of evacuation is set up by the Army which the Navy links with embarkation craft.

Tricks of the Dog Trainers

(Continued from page 53)

when he responds to a command. This simple lesson in teaching the dog to respond and come when called should be taught along the street as well as in the backyard so that the dog becomes accustomed to obeying you in any surroundings. Carry several lengths of chain in your pocket and try not to let the dog see you throw them.

These short lengths of chain, incidentally, are useful in teaching a dog not to eat casual scraps of food that he happens to find. You can start out by dropping food scraps around the yard and then tossing a chain at him each time he discovers a bit of the food and begins to pick it up. No commands should be given because the whole purpose is to let the dog discover for himself that something unpleasant happens whenever he eats scraps that he chances upon. Half-buried mouse traps, with weakened springs and baited with scraps, will also discourage him after the traps have snapped at his nose a few times. This training should be kept up for a couple of weeks and repeated occasionally.

The chains, too, will cure a dog of chasing chickens or other domestic fowl. Walk him on a long leash toward some chickens, and hit him with a chain the instant he prepares to spring at the birds. Shortly he will have learned his lesson so thoroughly

(Continued to page 152)

HE HAS YOUR BATTERY



Deadly flamethrowers are blazing the road to Victory! Each of these efficient weapons depends upon dry batteries to spark the flame for instant action. The batteries you do without mean more fire-power for frontline fighting men. Use your available batteries sparingly . . . keep them cool and dry . . . rest them as often as possible. For Free Battery Hints—Write Dept. E-4, Burgess Battery Company, Freeport, Illinois.

At least one extra for the SIXTH!



BURGESS BATTERIES

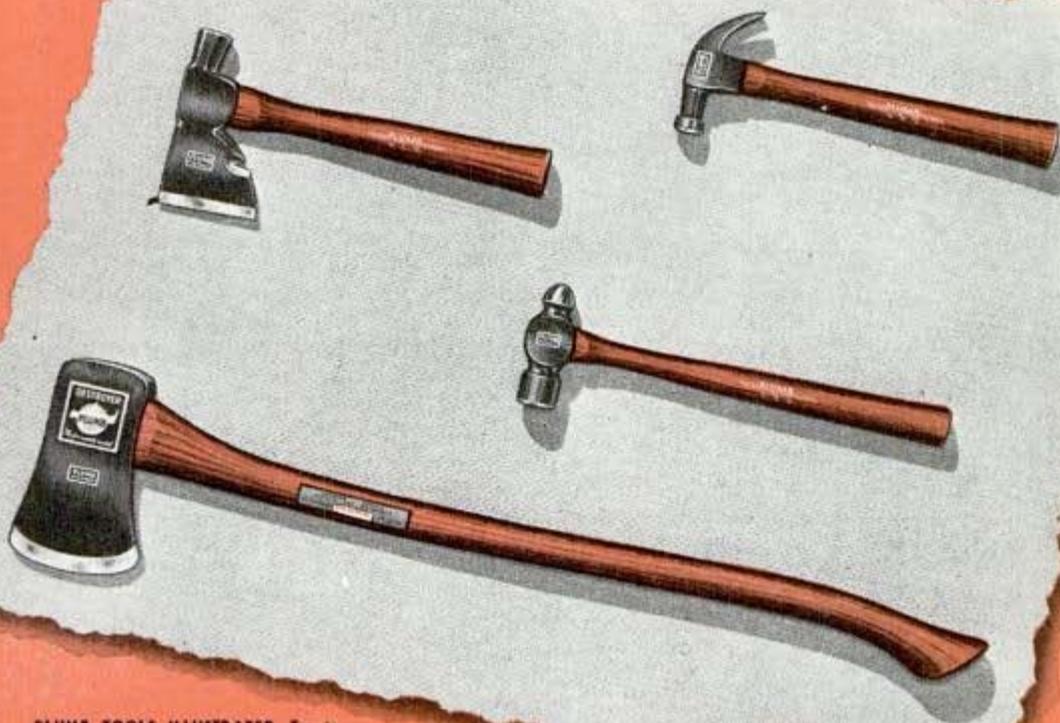
IN THE NATION'S SERVICE



THE CHAMPION, TOO, LOOKS DIFFERENT NOW

Remember the roaring motor, the cheering crowds as the champion sped around a breath-taking curve. Today he drives to a newer, greater kind of victory wearing a service uniform. He looks less colorful, yes, as do the champions in every line. Plumb, too, has donned a service uniform.

Because of Government limitations some of the finish is gone from Plumb tools. But you'll recognize Plumb quality by the hang, the perfect balance, the long life of the tempered steel head and the snug comfortable grip of the handle—and, above all, the untiring ease with which it works. These features are part of every Plumb tool. Fayette R. Plumb, Inc., 4837 James Street, Philadelphia 37, Pa.



PLUMB TOOLS ILLUSTRATED, Top to Bottom: Nail Hammer, Half Hatcher, Ball Pein Hammer, Single Bit Michigan Axe.

Quality Comes **FIRST**
PLUMB
is **FIRST** in Quality

PLUMB

HAMMERS • HATCHETS • AXES • SLEDGES

To keep the home fires burning — and factory wheels turning — and war goods moving by train and ship — tens of thousands of motor trucks are busy day and night, hauling vital coal. **AC Spark Plugs**, chosen for utmost reliability, play an important part in this work, keeping truck power up and fuel costs down. A convincing majority of truck owners save gasoline and lengthen spark plug life by having plugs cleaned and adjusted every 3000 miles. To save money for yourself and vital materials for the fighting forces, have your plugs cleaned regularly, and replace worn plugs promptly with new AC's.



**CLEAN PLUGS SAVE
UP TO ONE GALLON
OF GASOLINE INTEN**

AC
SPARK PLUGS

**BUY WAR BONDS AND BRING
VICTORY QUICKER**

that he pays no attention to the chickens when you walk him past.

If you are in the habit of walking your dog on a leash and if he growls and tries to fight other dogs along the street, the chains are a sure cure for his bad manners. Ask some other dog owner to toss a chain at your dog as soon as the barking begins. If each dog tries to spring at the other, each owner should throw a chain at the other's dog, then hurry them apart. After a few such lessons the dogs will pass each other without making a scene. Each discovers for himself that an unpleasant happening occurs when he goes after the other animal.

Here's a tip on how to stop a dog fight, provided there are two spectators. It's safe and harmless. Each spectator should pick up one of the dogs by his hind feet and hold them in the air. A dog feels lost when only his front feet are on the ground and so he stops fighting at once. If the dog tries to turn on you and bite when you have his hind feet in the air, whirl him around in a circle a few times and he'll change his mind.

The Toy That Grew Up

(Continued from page 59)

erally horizontal plane despite deviations of the mast from the perpendicular. Cyclical pitch control will cause the rotor to incline, at the will of the pilot, with respect to the artificial horizon established by the stabilizing bar, instead of with respect to the mast, as in other machines.

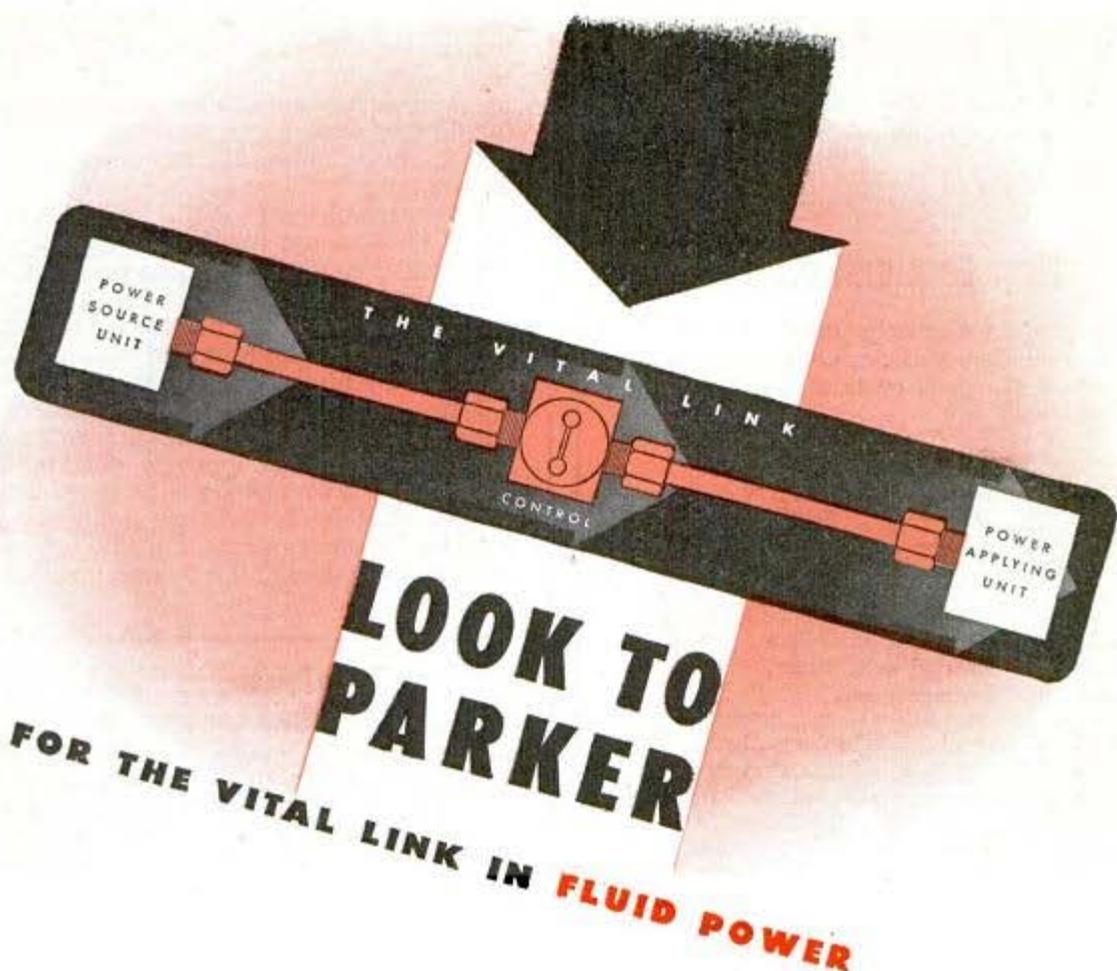
The inventor points out: "This is the fundamental concept of the stabilization action, which recognizes that to stabilize any unstable system, it is necessary to establish an agent that is independent of the system."

The main rotor blades are just under 16 feet in length and taper in width from 12 inches at the root to 9 at the tip. They weigh 65 pounds each, and are of solid wood with a steel strip inserted in the leading edge to aid in mass balancing.

This machine will do all the things that set this type of aircraft apart from other flying machines — moving sidewise, forward or backward, straight up or down and hovering. This was demonstrated in dramatic fashion when it was flown inside an armory at Buffalo.

The Sikorsky helicopter was the first to prove itself. Another recent entry into the helicopter field is that invented by Stanley Hiller, Jr., of California, and now sponsored by Henry Kaiser. It has a 12-foot fuselage, a 90-horsepower Franklin engine and 100

(Continued to page 154)



Think of fluid power as the three-link chain: Source—Circuit—Utilization.

The Circuit is the *key link*. It may go around corners and into tight places. It may even be vulnerable. Too often it is just taken for granted.

The success of fluid power depends on the engineering of the Circuit. That is Parker's business.

We do the engineering from design through to installation. We build the valves and fittings and the tools to handle them.

Our specialized know-how distilled from twenty years' experience with Fluid Power System is at your command.

The best way to get this know-how applied to your problem is to ask a Parker engineer. Or write direct to The Parker Appliance Company, 17325 Euclid Ave., Cleveland 12, Ohio.

PARKER SELECTED TO DISTRIBUTE SURPLUS WAR STOCKS OF PRECISION VALVES AND FITTINGS

Recognizing that users of precision valves and fittings would be served best by having war surpluses made available through an organization with broad application experience, Metals Reserve Company has appointed Parker to be a distributing agent. For details on type, quantity, specifications and application of this very large stock, write, wire or telephone

PARKER SERVICE AGENCY

17325 Euclid Avenue Cleveland 12, Ohio

agent for

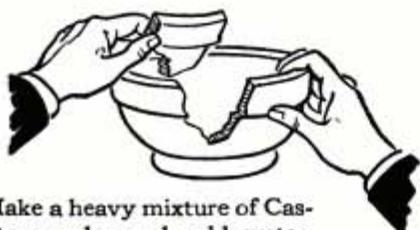
METALS RESERVE COMPANY

THE
PARKER
APPLIANCE COMPANY
CLEVELAND · LOS ANGELES

WORKSHOP WISDOM

How to mend crockery

ALTHOUGH Cascamite Plastic Adhesive is a wood glue, you can use it to make cold-water-proof repairs on thick, porous crockery. Here's how:



1. Make a heavy mixture of Cascamite powder and cold water. See directions on container.

2. Apply glue to broken edges and let stand a minute or two until glue starts to get tacky.

3. Press adjoining edges together tightly and apply pressure with rubber bands or clamps if possible. Let dry 8 hours or more.

Get these three wood-gluing advantages with Cascamite:

Waterproof. Ideal for joints to be exposed to weather, water, or continued dampness.

Stronger. By actual test, joints made with Cascamite are as strong as the wood itself.

Stainfree. Cascamite can be extended with ordinary household flour to make a low-cost, water-resistant glue that will not stain or discolor light wood or thin veneers.

You can get Cascamite Plastic Adhesive—and Casco, the all-purpose household glue—in 10¢, 25¢, and larger sizes at all hardware stores.

Send for free Gluing Guide containing helpful gluing hints, also free Casco Project Booklets. Drop a post card today to

CASCAMITE

Plastic Adhesive

350 Madison Ave., Dept. P-4, New York 17, N. Y.



miles per hour top speed, 75-80 cruising. Perhaps its outstanding feature is its superimposed contra-rotating two-blade rotors of 25-foot diameter. Control of the Hiller machine is reported to be extremely easy. The inventor claims a novice can fly it in two or three hours. No torque is required on the tail.

Commercial uses for the helicopter will come first, in the opinion of the experts. Forest fire control, pipe line patrol, Coast Guard work, rescue, short hauls for passengers and mail, short hauls for rush cargoes, geological surveys and similar activities seem suited for the craft.

Later will come the use of 'copters by sportsmen and pleasure seekers with a fatter purse than our average citizen. The helicopter for everybody—the true air flivver—with controls so simple it can be operated by anyone capable of driving an automobile, is further in the future, but not out of sight.

Battlewagon Steel

(Continued from page 63)

poultice of coal dust to the white-hot surface of the slab. This forms a sandwich filler as another huge steel slab is laid on top. The sandwich is then baked for about three weeks in the 2,000-degree heat of an annealing furnace while carbon from the coal dust seeps slowly into the "pores" of the two slabs.

When the white-hot sandwich has cooled, it is split. An icy water-blast strikes the surface of each slab of armor steel, sluicing off excess coal dust and "freezing" the carbon absorbed in the pores of the steel, thereby hardening it. Though carbon determines maximum hardness attainable, depth of hardening is largely determined by the amount of chromium previously melted into the steel.

The tremendous operation necessary to produce one slab of armor plate for a battlewagon gives some inkling as to why it takes years to build one of these great ships, requires 10,000,000 or more manhours and costs some \$70,000,000.

To get 1,000 tons of armor plate, 1,360 tons of coal, 1,885 tons of iron ore and 388 tons of limestone are used to produce 1,092 tons of pig iron. The addition of 1,213 tons of selected scrap, plus tons more of alloys, fluxes, etc., results in an ingot of 2,520 tons. The first forging operation brings this down to 2,010 tons. Other forgings reduce it to 1,860 tons. At this stage, two months have elapsed since the pig iron and scrap went into the open hearth furnaces.

(Continued to page 156)

Don't let a Weak Battery
put you on

THIN ICE!



Buy the Battery Experts Choose

Be guided by the experts who choose batteries for the world's toughest transportation services. For example, the million-mile trans-ocean flying record was established by a Pan-American Clipper equipped with Auto-Lite batteries.

Auto-Lites are specified,

AUTO-LITE BATTERY CORPORATION
TOLEDO 1, OHIO

Manufacturing Plants at: Niagara Falls, Atlanta, Indianapolis, Oakland, Oklahoma City, Toronto

too, for service with our fighting forces in tanks, half-tracs, jeeps . . . wherever dependable power counts.

Get the long life . . . the extra power you need. Buy an Auto-Lite battery—specified as original equipment by leading automotive engineers.



Tune in 
AUTO-LITE'S
GREAT RADIO SHOW
STARRING
DICK HAYMES
IN
"Everything for the Boys"
Every Tuesday Night . . . NBC Network
Featuring stars of stage, screen and radio and men and women at the fighting fronts

AUTO-LITE BATTERIES

Some things haven't changed!

LHS STERNCREST STERLING

Every pipe produced from genuine imported Mediterranean briar of pre-war quality, and shaped by the skilled hands of master craftsmen to be "A thing of beauty and a (smoking) joy forever". Sterling Silver band; solid rubber bit. Every pipe numbered, and registered by LHS, as your guarantee of pipe perfection.

\$5

Smooth and
Antique
Finish.

Many hand-
some models.



"Perfection ... in a Pipe"

LHS STERNCREST 14K

The custom craftsmen of LHS select the very choicest grains for these patrician pipes. They finish them by an exclusive process that brings out the full beauty of the briar,—circle them with a band of solid gold. Truly, "Perfection—in a Pipe"

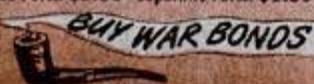
\$7.50

L & H STERN, Inc., Stern Bldg., Brooklyn, N.Y.

Makers of the famous

LHS Ultra-fine \$10 Certified Purex \$3.50 Superfine Purex \$1.50

Put this in your
pipe and smoke it:



The slab loses weight as it is sheared, cut and processed, but takes on strength and shape steadily week after week. It is carburized, annealed, heated, cooled, "soaked" in hot pits, cleaned, trimmed, chipped, bent, straightened—the object being not only to shape the piece, but to arrange the crystalline pattern of its molecules in certain "flow lines" in which each supports the other, giving the whole piece resistance to shock.

Again and again, during the process, small sections of the slab are cut out for tests and inspection and even before the tailor-made plates for a certain battlewagon have been shipped, one of them is certain to have been hauled down to the Navy's proving ground at Dahlgren, Va., where it is tested by gunfire from naval ordnance. The Navy takes no chances where the life of a battleship or cruiser and the lives of the crews are at stake.

Science Knocks at Your Door

(Continued from page 25)

After-dinner entertainment might include playing of recordings off spools of magnetized wire, each spool holding wire more than two miles long. A spool will deliver an hour's program without a break.

This item, like some of the others mentioned in the hypothetical postwar home, may prove too expensive for mass production. Some of the known planned and proposed innovations will not get out of laboratories soon enough for the postwar market. But in their places are hundreds of scientific gadgets and devices, off-shoots of wartime research, which are being perfected secretly to get the jump on competition. Some are based on radar.

Science will have some remarkable things ready when peace opens the door of your postwar home.

Tilting the Scales Toward Victory

(Continued from page 47)

parts. Plane springs, wires, cables, textiles used in parachutes and fabrics for safety belts all have special test scales. Consolidated-Vultee has a 400,000-pound hydraulic testing machine to "weigh" the breaking point in pounds and ounces of metal airplane parts.

In the airplane industry as in other mass-production lines, the counting scale is saving millions of manhours tallying thousands of tiny parts. The Bulova Watch Company in New York has an ingenious counting system for small watch parts. The

(Continued to page 158)

These Days Will Come Again

This is a message to our fighting men everywhere. Even though the war has cut into your normal way of living—back home, the things you cherish most remain unchanged. America's broad highways, its woods, rivers, mountains and wide stretches of open country are as inviting as ever—waiting for you. They are as constant as your yearning for the thrill of enjoying them again — on a Harley-Davidson!

Yes, thanks to you, the days will come again when red-blooded motorcycle fans can take in race meets, hillclimbs, endurance runs, pleasure trips and all other fun-packed motorcycling events. Plan to be riding with the rest of the gang on a brand new Harley-Davidson Motorcycle!

HARLEY-DAVIDSON MOTOR COMPANY
Dept. P, MILWAUKEE 1, WIS.

HARLEY-DAVIDSON MOTORCYCLES

HARLEY-DAVIDSON MOTOR CO.
Dept. P, Milwaukee 1, Wisconsin

Please send at once free copy of 24-page
ENTHUSIAST MAGAZINE, filled with motor-
cycle action pictures and thrilling stories.

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Address.....

City..... State.....



SEND COUPON
NOW



"MISTER, THAT'S
A CRAFTSMAN'S
TOOL"



When a good craftsman uses a quality tool — the workmanship shows it.

We know only one trade — how to make tools — good tools. We see to it that you get the best.

Building tools for craftsmen has been Millers Falls' job since 1868.

Be sure of quality.
Choose Millers Falls
tools.



**MILLERS FALLS
TOOLS**

SINCE
1868

MILLERS FALLS
COMPANY

Greenfield, Mass.
U.S.A.

method is to take a scale with even ratio on both sides and divide a given series of parts between the two sides. When the balance is perfect it naturally means there is exactly one-half of the series on each side of the scale. One-half is then taken and divided again evenly so that a quarter remains on each side of the scale. This process is continued until the original series has been broken down to one-sixteenth. One-sixteenth is then counted and multiplied by sixteen to get the total number of parts in the original series.

The Department of Agriculture has a special scale for eggs which dooms the hen whose eggs are a gram or two below standard weight. Scales also test milk for unwanted sediment, determine the efficiency of sprayed insecticide by the ratio of bugs killed to the weight of dispensed poison, disclose the strength of paper and cardboard by finding how much weight it takes to make a puncture, count pharmaceutical pills into bottles and keep nylon fibers standard in circumference.

Using photoelectric cells, a unique master-minding device made by General Electric weighs, dumps, batches and mixes cosmetics in proportions down to one-fiftieth of one percent, opening and closing valves so that only the flick of a switch is needed to start the factory operating.

Perhaps you wouldn't connect a scale with the flavor of ham, but it is thanks to a new corrosionproof, liquidproof calculating scale that the modern ham is cured. The taste and stability of ham depend upon the amount of fluid injected into it during quick curing. An operator puts the porker's hind leg on the scale and reads the dial which indicates how much liquid should be injected into a piece of pork of the size resting on the scale. Then he gives it the quick-cure injection.

Radio Trouble-Shooters With Wings

(Continued from page 16)

had to stick our hands in our armpits to warm them. We covered the Aleutian chain three times that trip. Each time we finished up, a new modification would come along."

First Radio has even had to set up impromptu "assembly lines." Last year, for instance, Master Sgt. Claude D. Kennerly, of Klamath Falls, Ore., and a crew of fifteen arrived in India to install a new device in some 300 planes. While the equipment was on its way aboard ship, an improvement had been worked out by Patterson Field

(Continued to page 160)

"THANKS FOR YOUR
LEAKPROOF BATTERIES!"



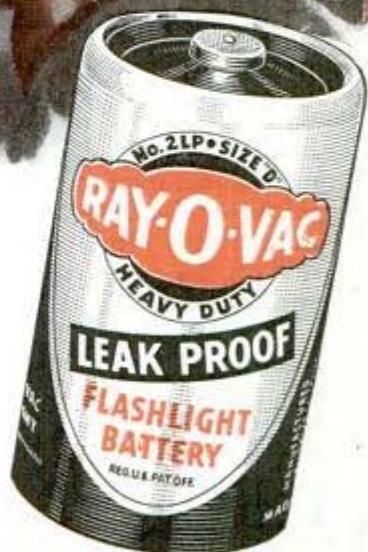
... They helped knock over this enemy tank

These little batteries you haven't been able to buy for your flashlight have been powering tank-busting bazookas, flame-throwers, field telephones, flashlights, and hundreds of other war weapons. You miss these Leakproof batteries, of course, but remember, millions of our fighting men thank you for giving them up.

THE FLASHLIGHT BATTERY THAT
STAYS FRESH FOR YEARS

BECAUSE IT'S **LEAKPROOF**

Ray-O-Vac is the only flashlight battery that's sealed-in-steel. This means it stays fresh far longer than ordinary batteries... that vital power is there when you need it. It's the only battery guaranteed never to cause corrosion damage to your flashlight. Watch for Ray-O-Vac LEAKPROOF'S return to the consumer market after Victory.



FLASHLIGHTS **RAY-O-VAC** BATTERIES

RAY-O-VAC COMPANY, MADISON 4, WIS.; Other Factories at CLINTON, MASS.; LANCASTER, OHIO; SIOUX CITY, IA.; FOND DU LAC, WIS.; MILWAUKEE, WIS.

WHERE PERFORMANCE REALLY COUNTS...



**... COUNT ON DEPENDABLE
CHAMPION SPARK PLUGS**

Add to our own vastly increased requirements for food, those of untold millions who desperately need it, but cannot now produce it, and the burden on the American farmer is staggering. Yet with the characteristic vigor of the home-front soldier that he is, and the aid of power farming equipment which multiplies his ability to produce many fold, he is meeting the need with magnificent fortitude. His car, truck, tractor, stationary engines, and the implements used in conjunction with this power equipment are literally the farmer's "strong right arm." Dependable Champion Spark Plugs, long-time favorites of farmers everywhere, play their vital part in keeping engines smooth, economical and dependable. Realizing their importance, most farmers inspect, test, and clean all spark plugs at regular intervals — install new Champions when necessary.



**Finish The Fight With War Bonds
Buy More Than Before NOW!**

engineers. So the first thing the sergeant and his squad had to do was rebuild the 300 units. They set up a miniature production line.

"The first fellow," Kennerly explains, "took the cover off the machine. The next took off a resistor. The next performed another operation. And so it went until the last guy put the cover back on again. We changed over all these machines in three or four days. Then we installed them in the planes."

Sgt. Kennerly's crew at least had their equipment and tools. Some of their squadron mates have not been so lucky. Early in the Solomons campaign, Tech. Sgt. William Metreyon, of Nederland, Tex., and Pvt. Abraham Braunstein, of Brooklyn, flew to Guadalcanal to make a series of installations. The day before there had been a Japanese raid and the one ship sunk contained the equipment they were to install. They had to wait until new equipment arrived and then work by flashlight; the planes were needed by day and during the night there were strict blackout precautions.

Another First Radio group got its dosage of frustration from transport difficulties. En route to India, one of their two planes developed engine trouble over Nigeria. The pilot ordered everything loose to be jettisoned. Out went clothes, tools, cigarettes, even the brief case containing the men's service records and orders. Lightened, they made it safely, but when they reached Karachi they had the problems of satisfying intelligence officers as to their identity, replacing lost papers and rounding up new tools. A few weeks later, re-equipped, they set out in another transport. Along the Brahmaputra, this craft developed engine trouble, too. Again, out went everything not bolted down, including the new tools. Nevertheless, they had to make an emergency landing and were stranded.

(Continued to page 162)

**Model Builders
Attention!**



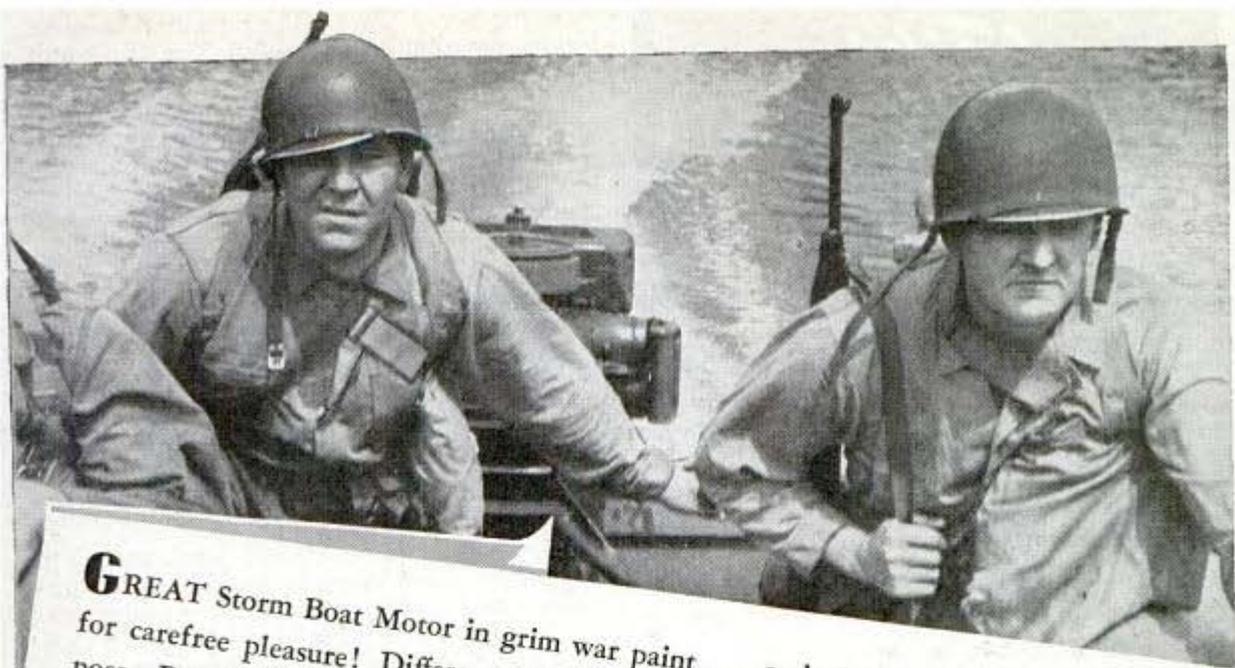
	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	7/32
Weight, Grams	8	3 1/2	2 1/2

Actual Size V-Plug

Champion spark plugs for model gas engines give the same dependable performance as regular Champions. Silliment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

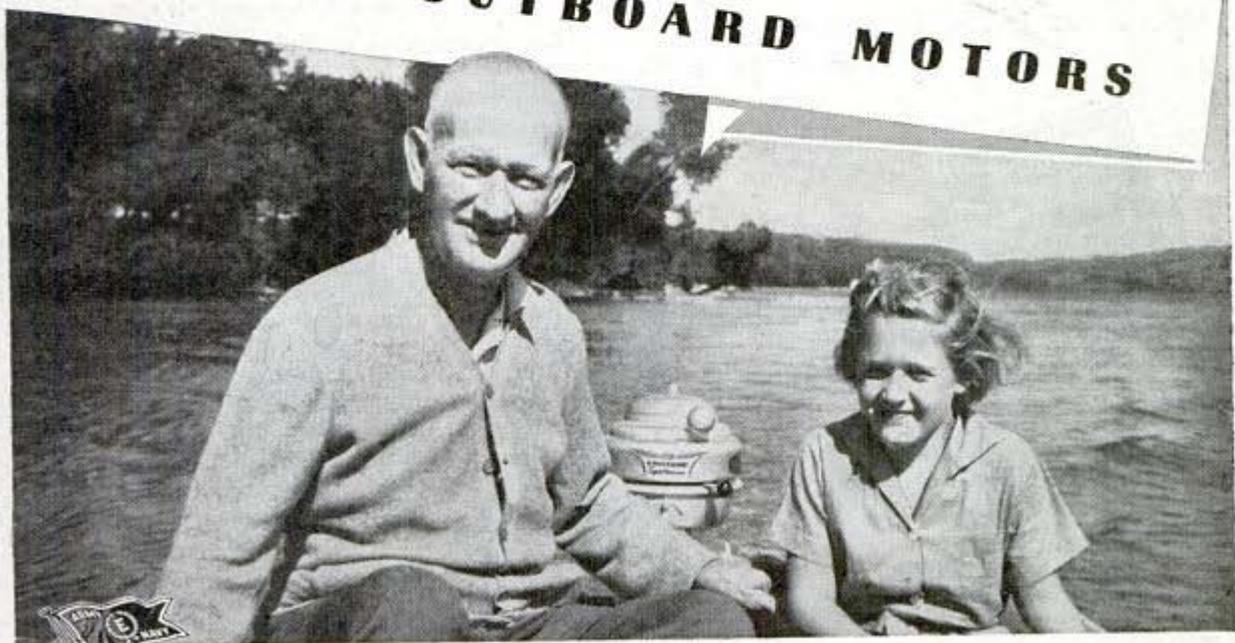
CHAMPION

SPARK PLUG COMPANY • TOLEDO 1, OHIO



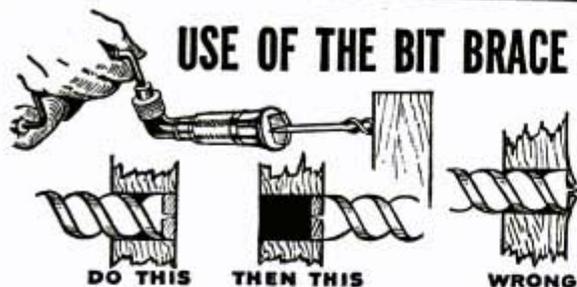
GREAT Storm Boat Motor in grim war paint . . . and sparkling little outboard built for carefree pleasure! Different as night and day they are, in size and power and purpose. But *both are Evinrudes* . . . as alike in basic characteristics as peas in a pod. Each reflects the advancements achieved during more than three decades of outboard pioneering, intensive research, tireless engineering. Above all, each is built to deliver the *top level of unfailing reliability* in every phase of performance. And nothing else is so important . . . either in a motor destined for relentless combat duty . . . or in the new outboard you look forward to owning when motors for happy peacetime service are again available. *Evinrude Motors, Milwaukee 9, Wisconsin.*

EVINRUDE OUTBOARD MOTORS



EVERY DOLLAR YOU INVEST HELPS SPEED VICTORY . . . BUY MORE BONDS

Tool Tips by STANLEY



USE OF THE BIT BRACE

To produce a clean hole with brace and bit, bore into the wood until screw point on bit barely emerges on the second face. Remove bit from hole and, centering bit in small hole left by screw point, finish hole from second face. This method avoids splintering wood and assures a neat job.

LEARN DOZENS OF EXTRA TOOL OPERATIONS WITH THE STANLEY TOOL GUIDE

With few exceptions, all tools are capable of many different operations. This authoritative guide book gives practical instructions on dozens of tool methods used by master carpenters and cabinet makers. More than 200 illustrations show operations in detail. Send for your copy today—just 25¢ postpaid.



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Enclosed find 25c. Please send me the Stanley Tool Guide, postpaid. (In Canada: Send coin or stamps to Stanley Tool Co. of Canada, Roxon Pond, Quebec.)

Name.....

Address.....

City..... State.....

ed for three days. They finally reached their destination in Assam. The other half of their party had arrived meanwhile in the other plane and had some tools. The whole group immediately set to work with what it had. In spite of the delay, in spite of the fact that a dozen instead of two or three men had to use a single "energizer" (a gasoline-powered electric generator for tools), in spite of breakage of their only electric drill and other overworked tools, the job was finished on schedule.

Many of First Radio's men had radio experience prior to Army induction. All have attended the famed Scott Field, Ill., Army radio school, and are qualified radio operators. When they are not in the field, they attend school at headquarters, keeping up with the newest developments.

To meet unusual situations, squadron members have often invented new equipment and tools, especially in the servicing field. The most important is a "continuity checker" by which loose connections, short circuits and the like can be located without dismantling or removing radio sets from the plane and which is saving hundreds of hours of work.

First Radio men have been bombed in Sicily and the Pacific, caught malaria in Africa, been sniped at, and gone along on bombing missions. They've endured forced landings, monsoons, williwaws. But they get their work done, and they do it without medals or fanfare.

Bat Pilots of the Night Fighters

(Continued from page 11)

Gen. MacArthur said, "no command in the war has excelled the brilliance of these operations."

All of these aircraft, however, are modifications of types that were designed for other duties. None completely fulfills the specifications of an ideal night fighter. Such a plane should be unusually stable. A pilot needs to be able to handle it after dark with a minimum of effort. It should be able to take off after a very short run and to land at low speed so that it can be flown from blacked-out landing strips. It should be heavily armed and have high performance as well as long range.

The P-61 Black Widow, designed and built by Northrop Aircraft in California, fulfills all specifications and is now in action in all parts of the world. In Europe some 400 German aircraft fell prey to the Black Widows during the two months following D-Day. At the same time the night fighters tracked down and destroyed in

(Continued to page 164)

EXCITING AS THE RACE IN "BEN HUR"!

There was an expectant hush. Then, out of the darkness of this June night in 1908, flashed a scene of breath-taking action.

A "spectacular" sign had been erected on the old Wonderland Building, to give Detroit its first glimpse of the Model "T" Ford.

"Watch the Fords go by!" the message read. And in the light and color of 2000 twinkling electric bulbs, a Ford touring car appeared to race along the Grosse Pointe shoreline. The wheels turned, scuffing up clouds of dust. The scenery shifted constantly. The veils of the women passengers streamed in the breeze. The

crowd in the square began to cheer. "It's exciting as the race in 'Ben Hur'," said an onlooker. The newspapers thought so, too.

"Hour after hour," wrote one reporter, "the auto hurried, defied speed and natural laws alike, every instant seemingly on the verge of tipping into space down in the street below."

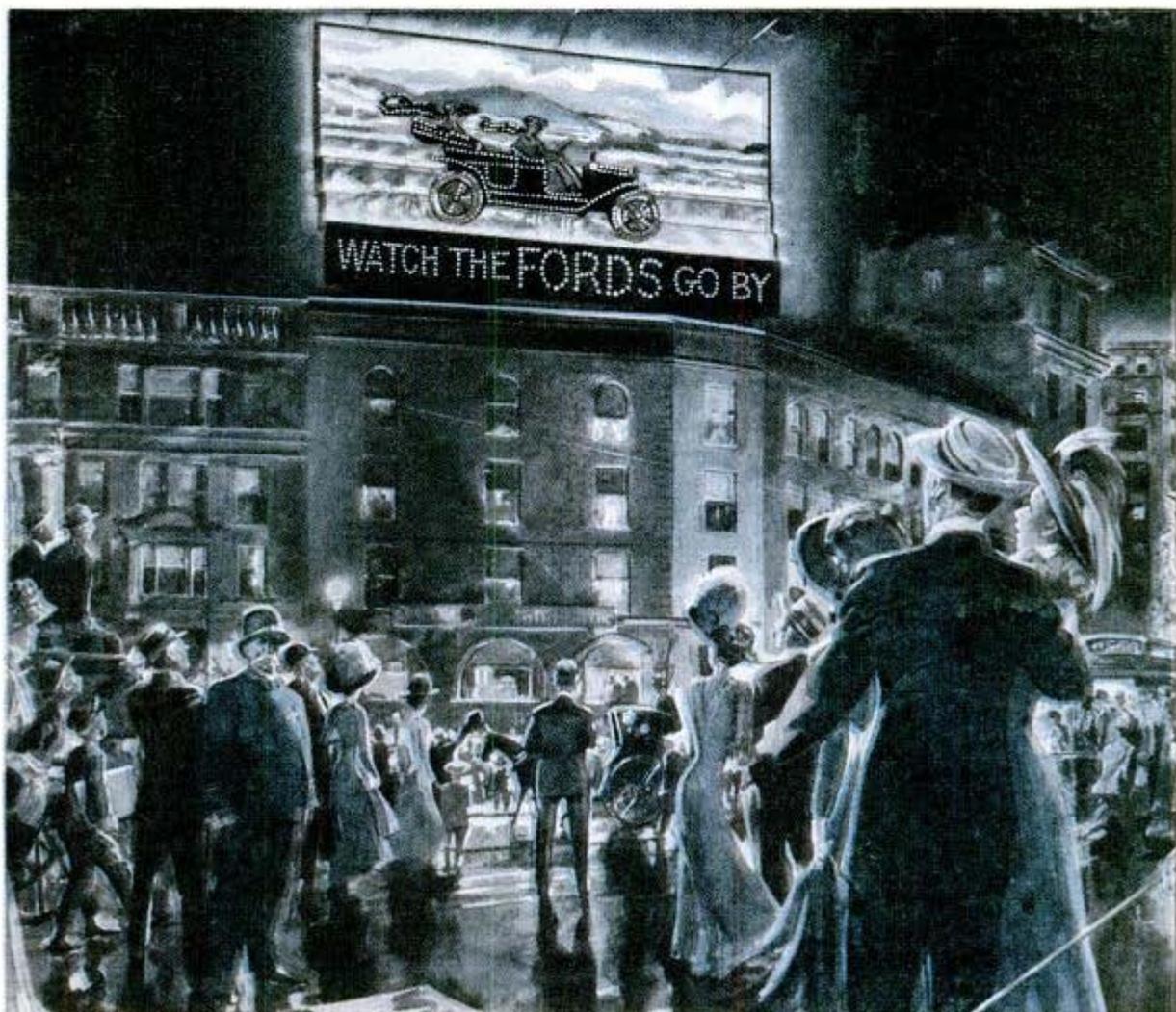
From that far-off day to this, people have continued to "watch the Fords go by". They have watched the total mount to 1 million in 1915—to 15 million in 1927—and on up to 30 million.

They have seen these Ford cars and trucks shrink distances and

help increase the productivity of the nation. They have seen them wipe out the traditional barriers between city and country, between mountain and plain, and help spread the advantages of American culture and opportunity.

One day, there will be new Ford, Mercury and Lincoln cars. Like their predecessors, they will benefit by the energetic skills and resourceful engineering which are a Ford trade-mark. They will be exceptionally comfortable cars, reliable and economical... priced within reach of the greatest number. *Their styling will be so advanced that it will be a perfect match for their quality leadership.*

FORD MOTOR COMPANY





New tools are hard to get these days. So if your old saw is a Disston—or some other good brand—make it *last!*

To help conserve tools during wartime, saw repair shops and many hardware stores offer a reliable saw sharpening service. You'll get good service where you see this sign.



If you *must* have a new saw for *essential* work, see your Disston dealer. He'll do his best to meet your needs. But remember that Disston tools are made to give you *extra long* service. Now is the time to make them serve you longer...to help you serve your country!



HENRY DISSTON & SONS, INC.

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● FREE BOOK ON CARE OF TOOLS!

Ask your Hardware Retailer—or write us—for your copy of the Disston Saw, Tool and File Manual. Shows right way to use and care for tools.



flight a number of robot bombs. Although it does most of its work after dark, the P-61 is a useful daytime fighter as well.

In the Pacific, the king-sized fighter gets a variety of assignments. Sometimes the Japs, prevented from sending reinforcements and supplies to some island by surface craft, have tried sneaking them in after dark in large flying boats. The Black Widows bring a complete halt to most such attempts.

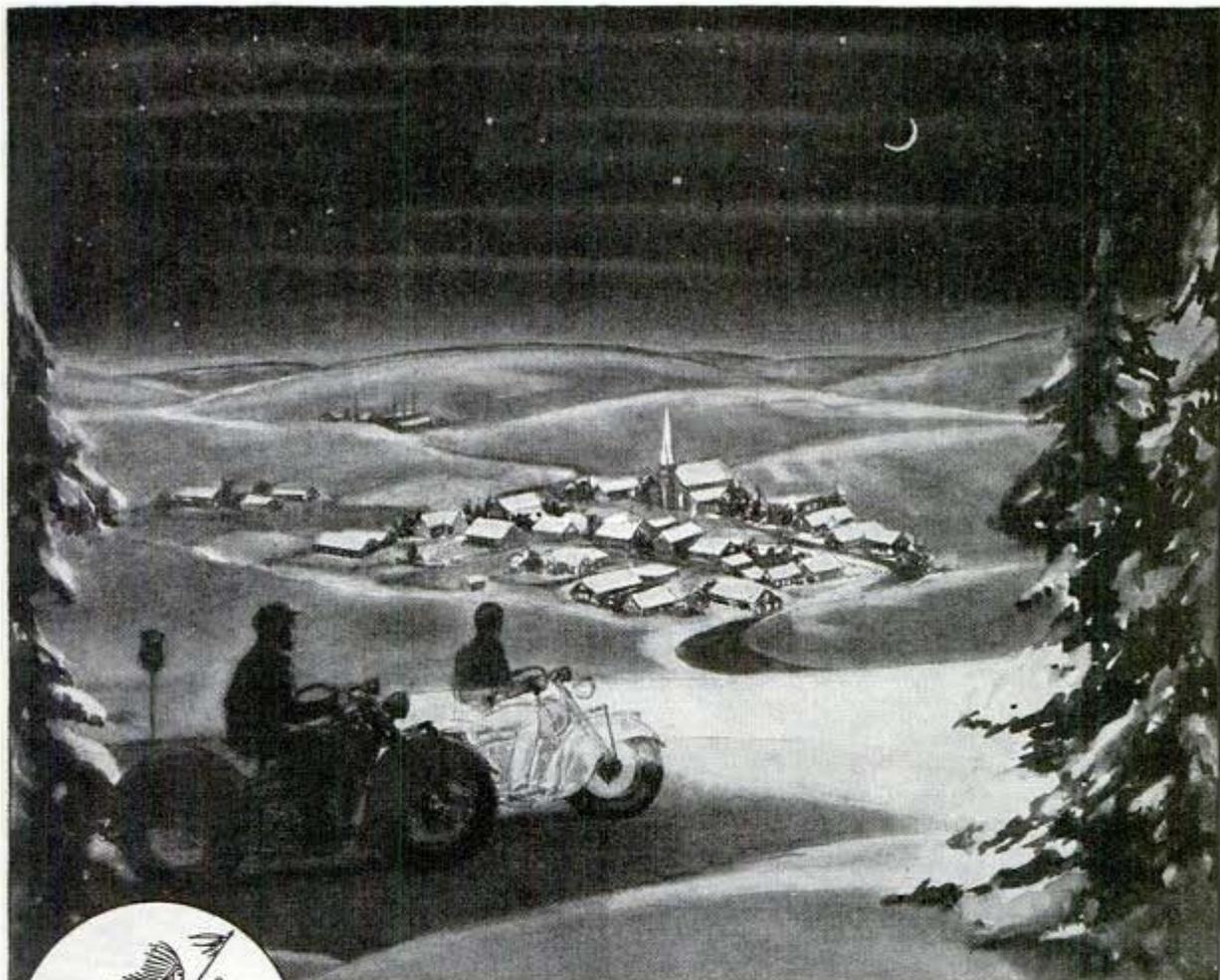
Too, when the Japs are forced back from one of their airfields, they often bomb that field at night to trap any of our aircraft that might be using it. But the Jap bombers get trapped in turn—by the Black Widows.

The P-61 is twin-engined and twin-boomed and resembles a large, fat P-38. Its weight of more than 12 tons almost puts it in the medium bomber class and yet it performs like a pursuit. It has such great acceleration that it is one of the few aircraft in the world whose wing tips can create vapor trails while the plane is still making its take-off run on the ground. Its two 2,000-horsepower Pratt & Whitney engines develop as much power as do most railroad locomotives. The plane carries a crew of two or three, who are protected by armor plate, bullet-resistant glass plates, and deflection plates. Ammunition boxes for its .50-caliber and 20-mm. guns are also armored. Each crew station is supplied with heat and oxygen. Exhaust stacks have flame dampers that eliminate all traces of light, making the plane completely invisible at night.

One of the novel features of the Black Widow is its retractable ailerons. To provide a slow landing speed for the plane it was necessary to design a landing flap that extends nearly the whole length of the wing, leaving room at the tips for only tiny ailerons of the conventional type. The action of these ailerons is boosted by means of long, scoop-shaped metal strips that are housed in the wing and that are raised into the air automatically with aileron action. The effect of each of these strips is to spoil the air flow, eliminating the lift of that wing, and thus serving the purpose of an aileron. With this arrangement, aileron response is so immediate that the heavy airplane can make sharp turns in full flight without excessive stalling tendencies.

Many other details of the Black Widow are still secret and can be told only after the enemy discovers them the hard way.

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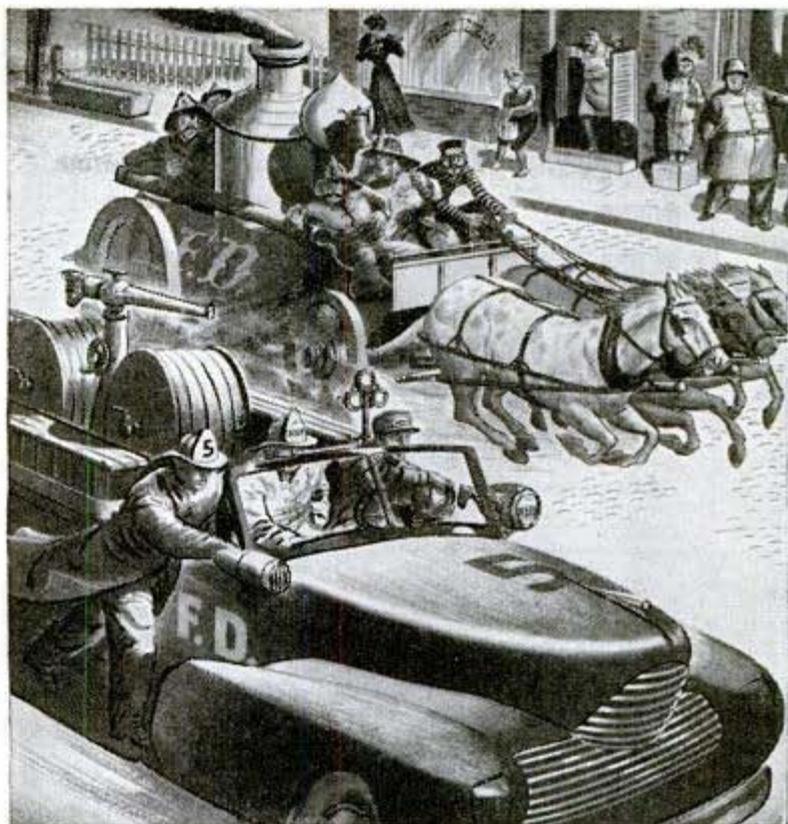
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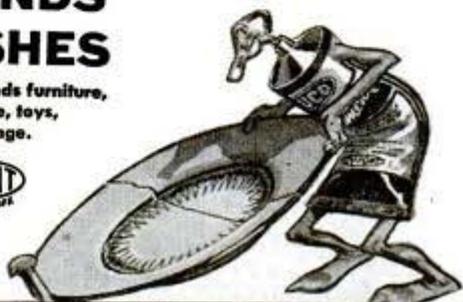
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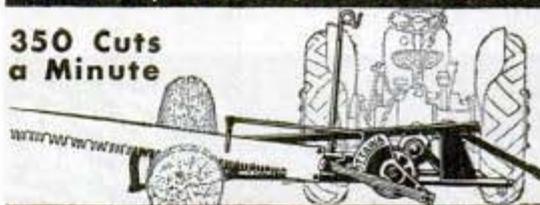
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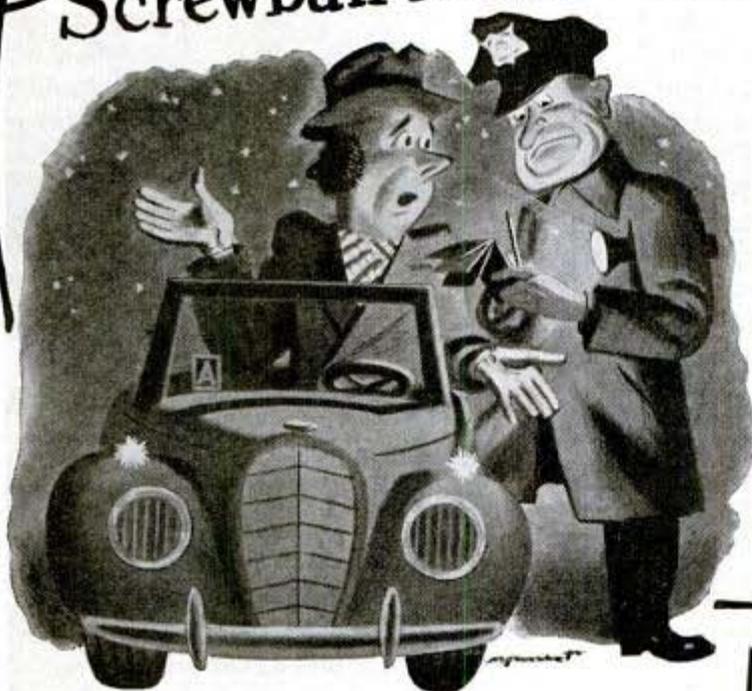
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KLUTCH forms a comfort cushion; holds dental plates so much firmer and snugger that one can eat and talk with greater comfort and security; in many cases almost as well as with natural teeth. **KLUTCH** lessens the constant fear of a dropping, rocking, chafing plate. 25c and 50c at druggists. . . If your druggist hasn't it, don't waste money on substitutes, but send us 10c and we will mail you a generous trial box.

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She's as Lively as a Youngster—
Now her Backache is better

Many sufferers relieve nagging backache quickly, once they discover that the real cause of their trouble may be tired kidneys.

The kidneys are Nature's chief way of taking the excess acids and waste out of the blood. They help most people pass about 3 pints a day.

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in Pipes*



VanRoy



Pipes Illustrated:
VanRoy Dumont \$10

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IN YOUR PLAN for living—remember that a ration of pleasure is every man's due. . . . Among the greatest felicities is the enjoyment of smoking a VanRoy—the pipe with a noble heritage of distinguished quality—preference of discriminating pipe smokers.

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AND FREE FROM "GOO"—no matter
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NEW OTTAWA SAW



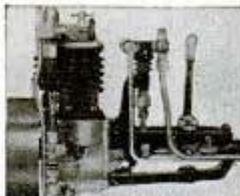
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Saws big logs, small logs, limbs. Pulley for belt work. Easy to handle, weighs less than lower powered units. FULLY GUARANTEED. Cash in on fuel savings. Turn wood lots into cash.

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● Send \$2.50 for 14 pages scale drawings, 2 photos, instructions.

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Drawings and Instructions 1.00

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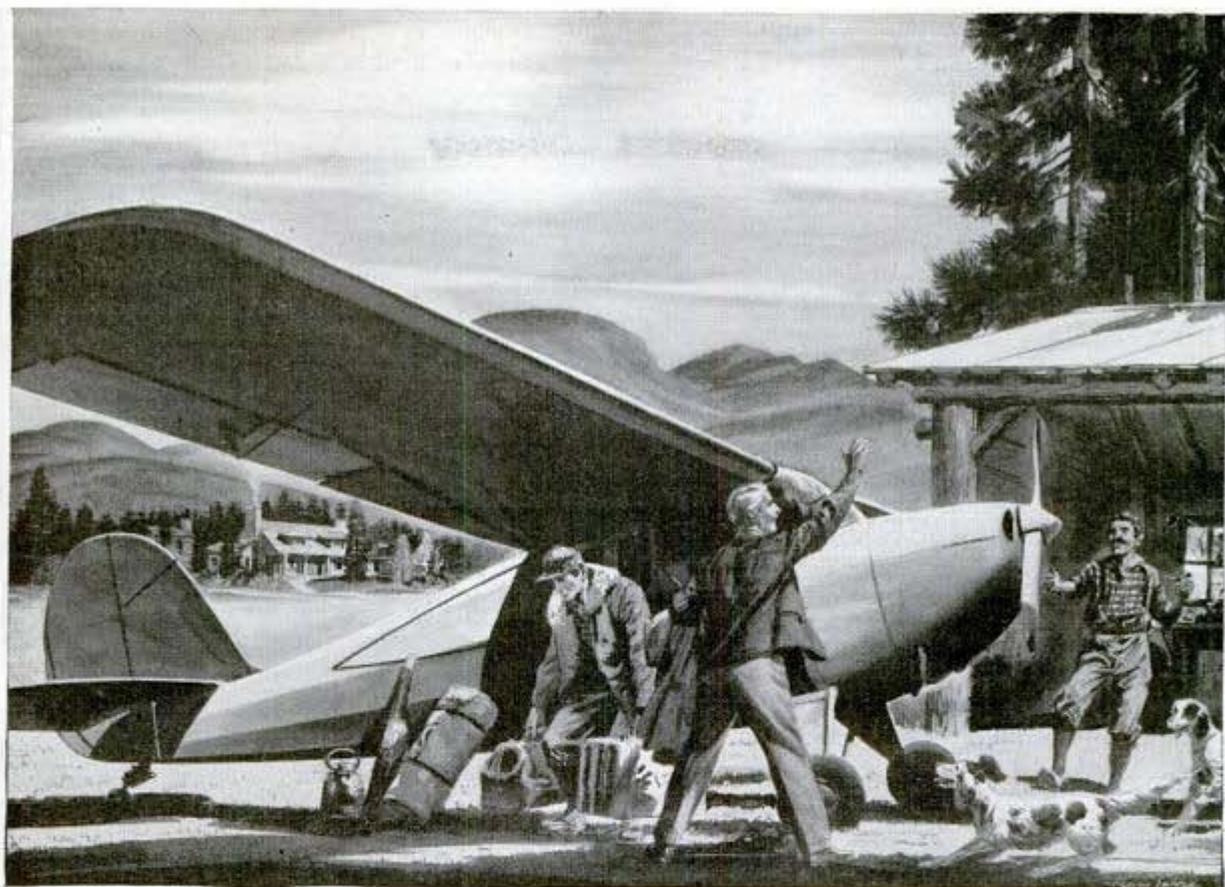
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We can furnish Engineering, Financing, Manufacturing, Selling.

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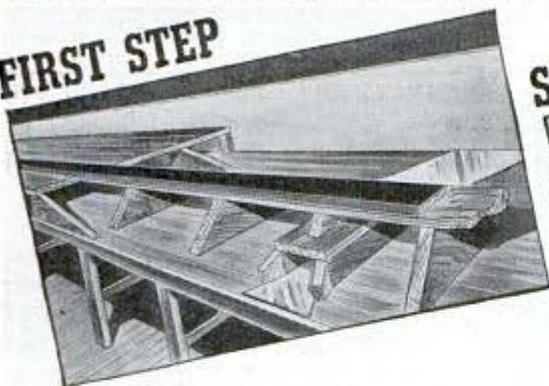
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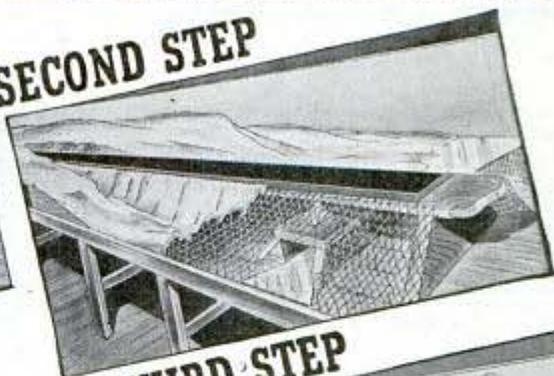
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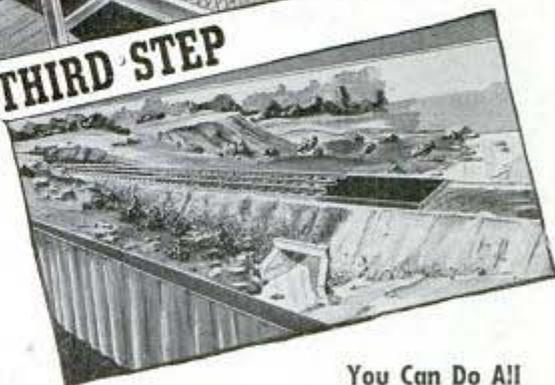
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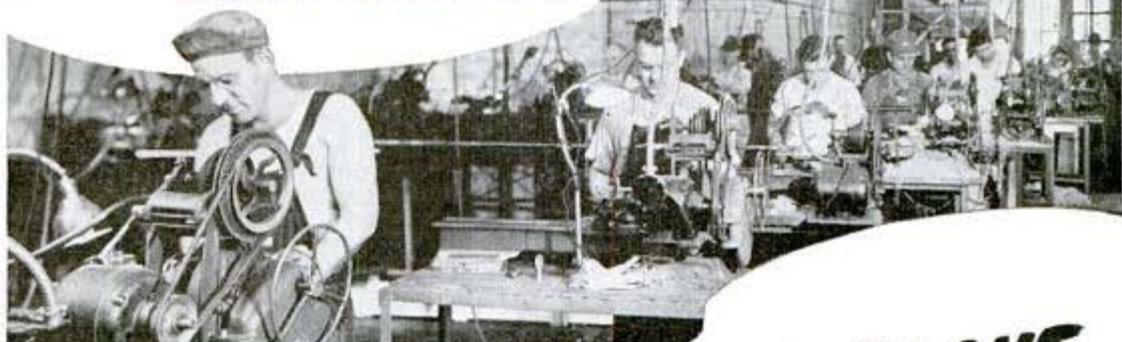
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ATLAS PRESS CO.

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* **CLOPAY**
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*Smart baby. Smart mother, too, for she knows that Clopay Window Shades not only keep out the sun, but look handsome, wear well, cost only 15c up. See them at 5c & 10c, neighborhood and dept. stores everywhere. In plain finish only 15c, in washable finish only 29c, for full 36 in. x 6 ft. size, ready to attach.

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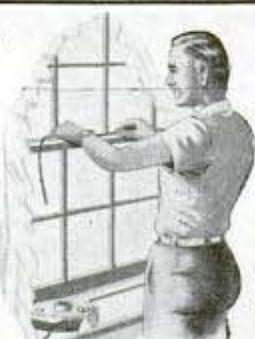
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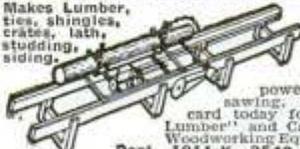
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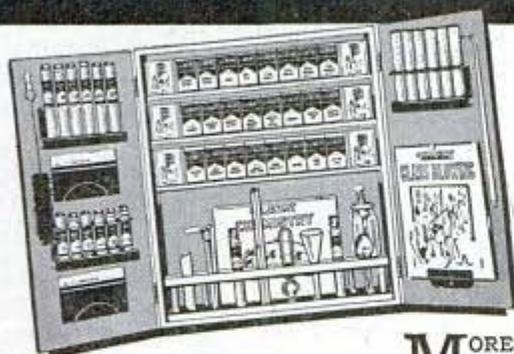
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the kind that make boy chemists famous



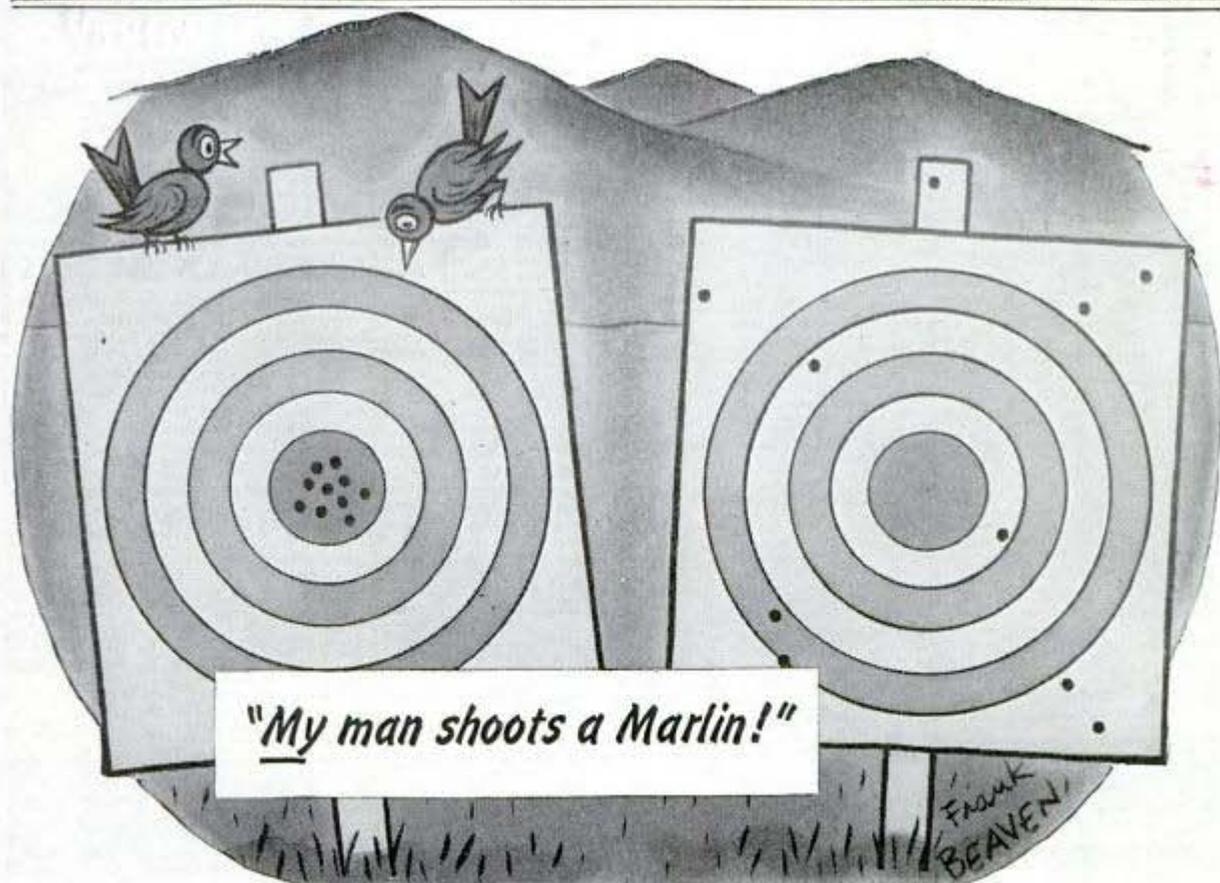
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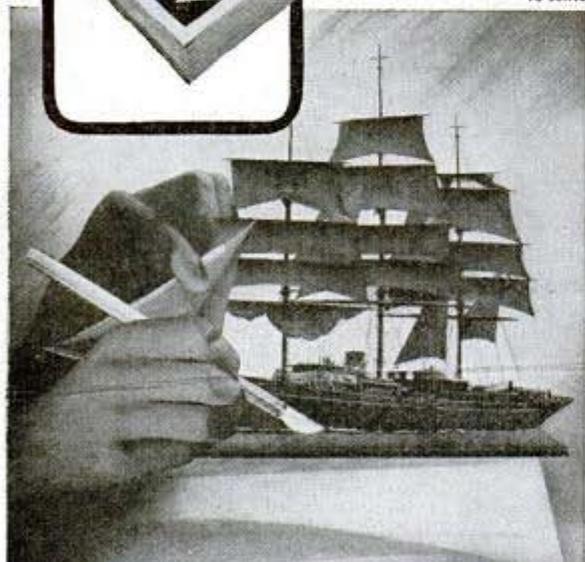
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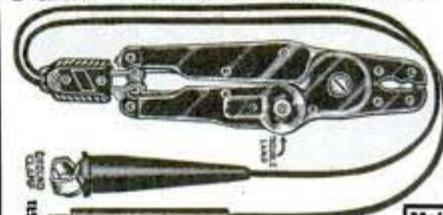


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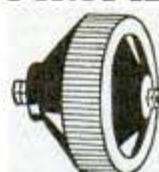
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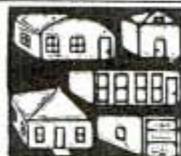
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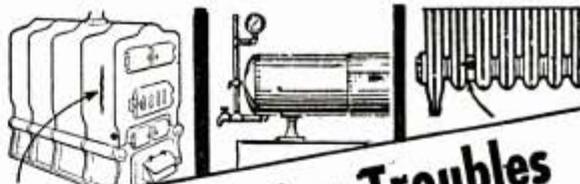
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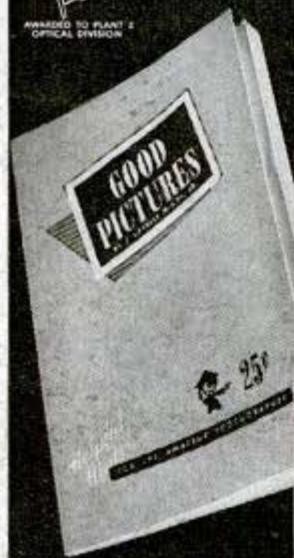
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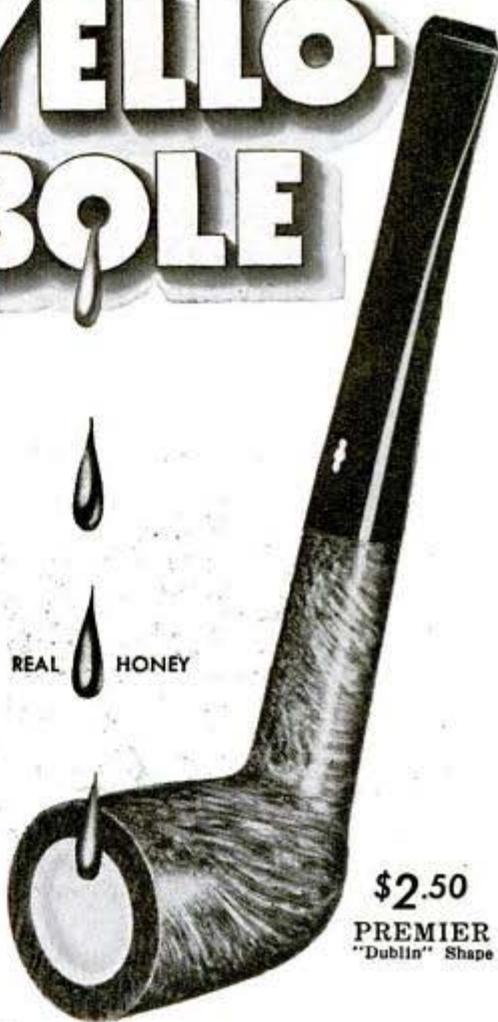
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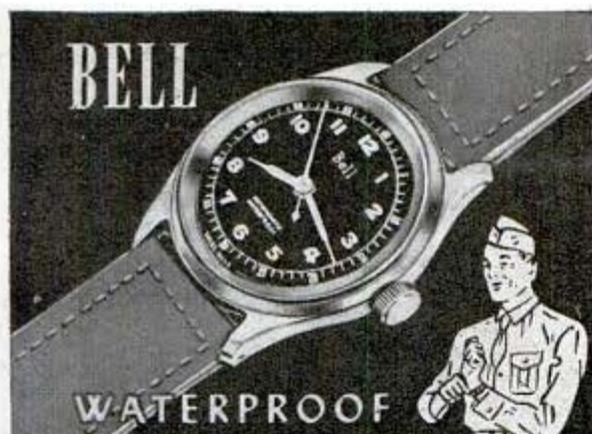
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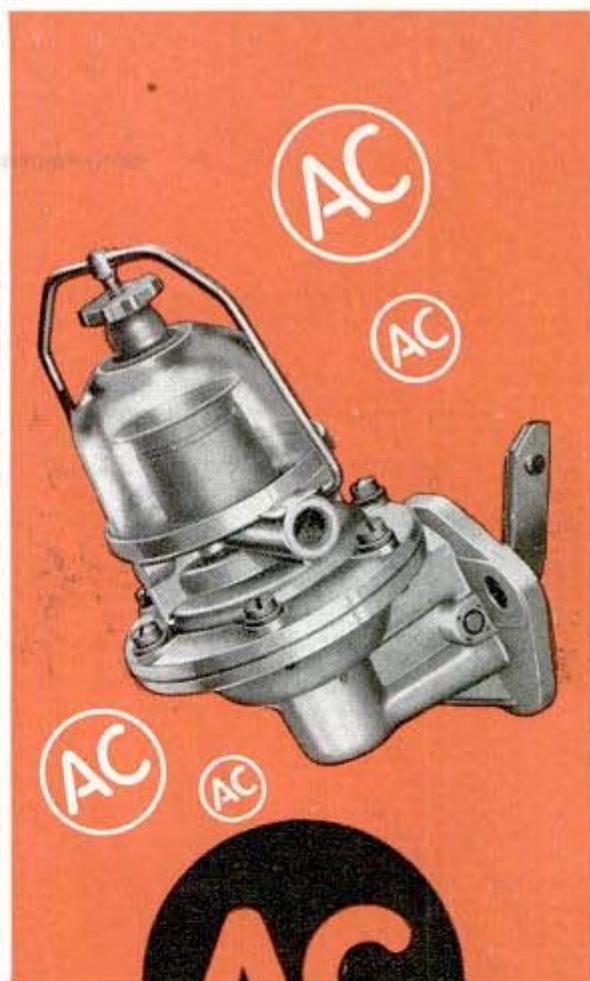
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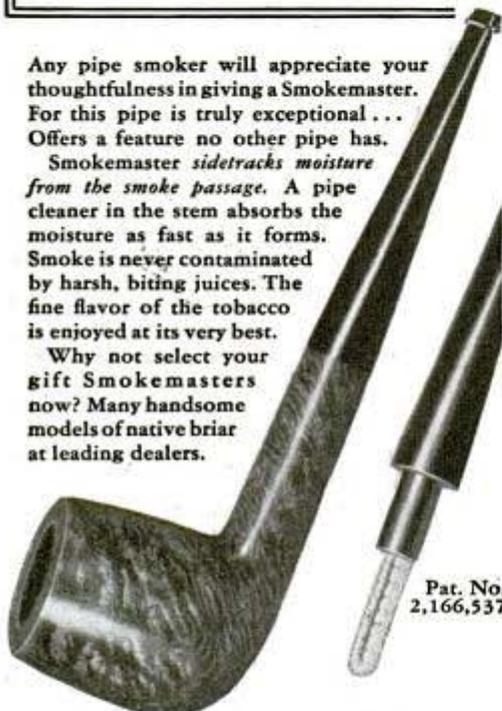
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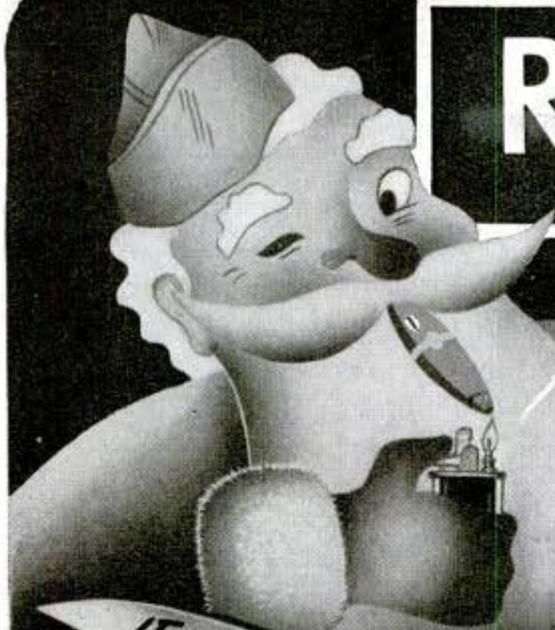
Easy—at home. Spread on So-Lo. It wears like leather. For all footwear, children's and grownups'. Also mends tires, raincoats, boots—anything of rubber, leather, cloth.



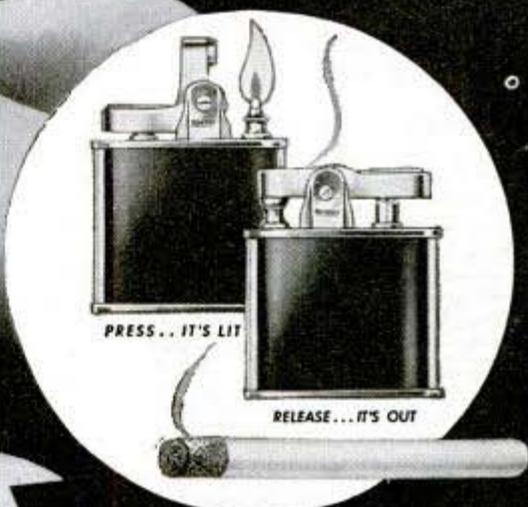
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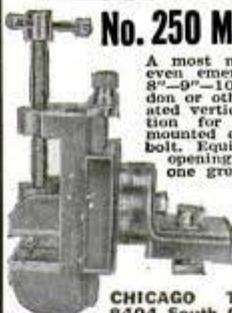
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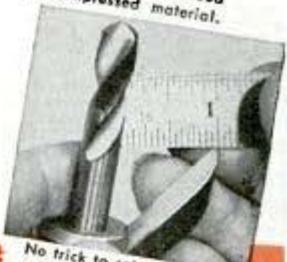
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Ideal for electric drills
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Cut deep holes in wood
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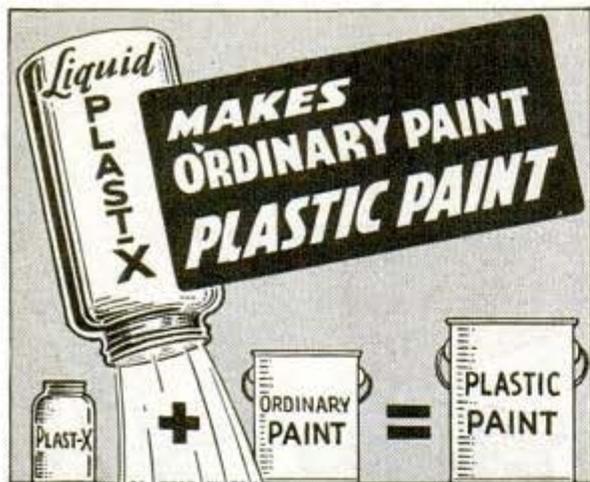
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ONLY \$1.98 complete

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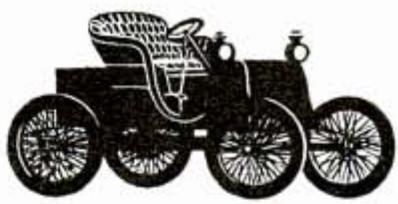
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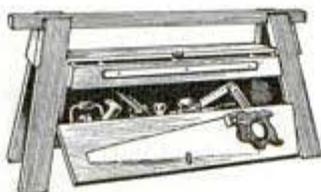
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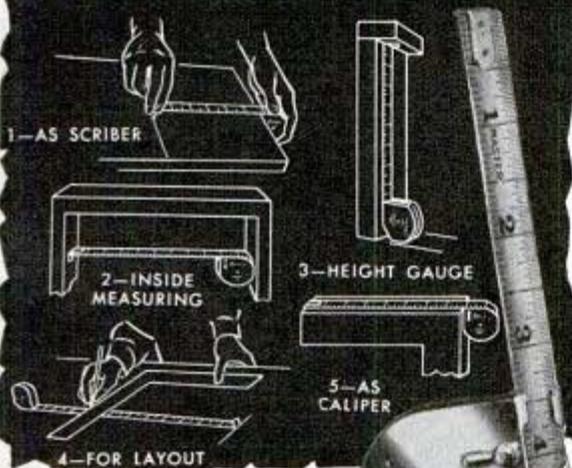
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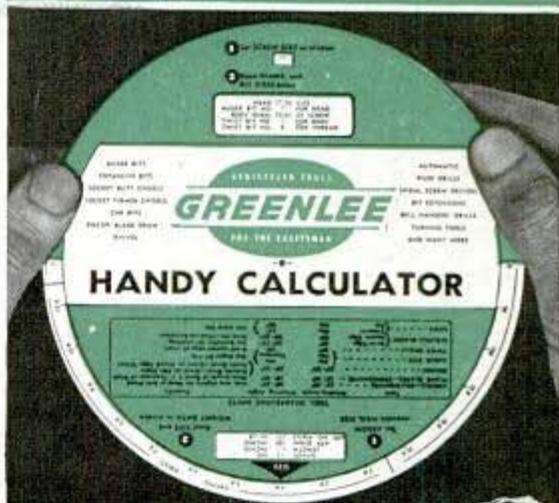
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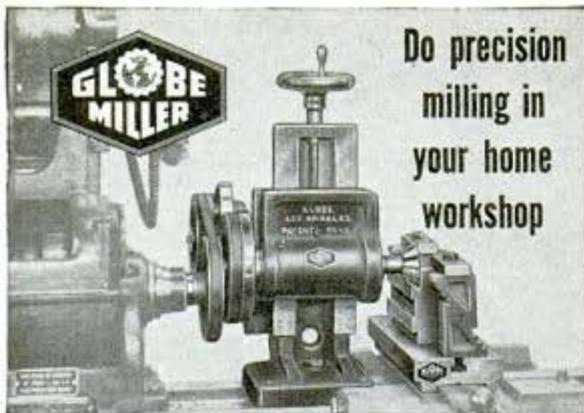


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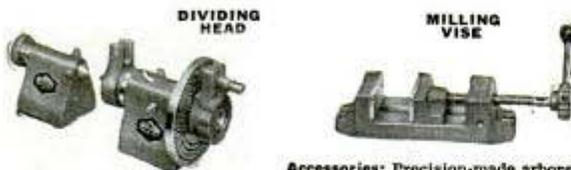
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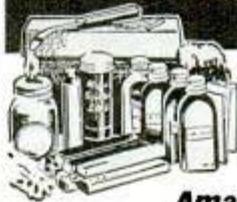
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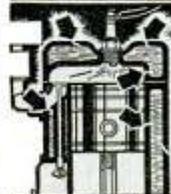
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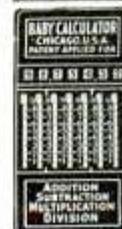
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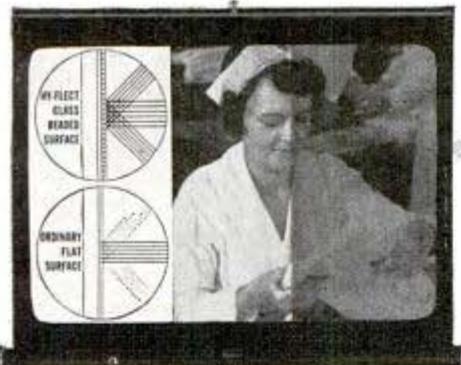
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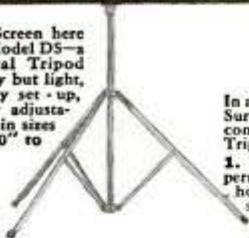
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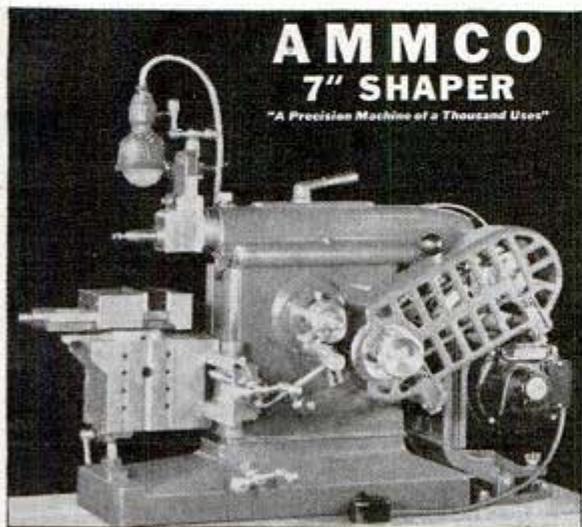
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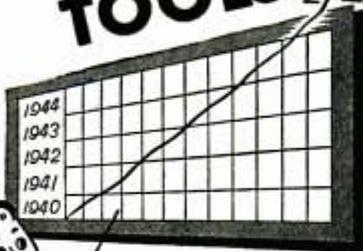
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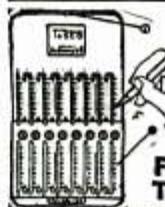


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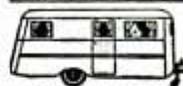
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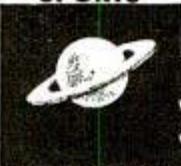
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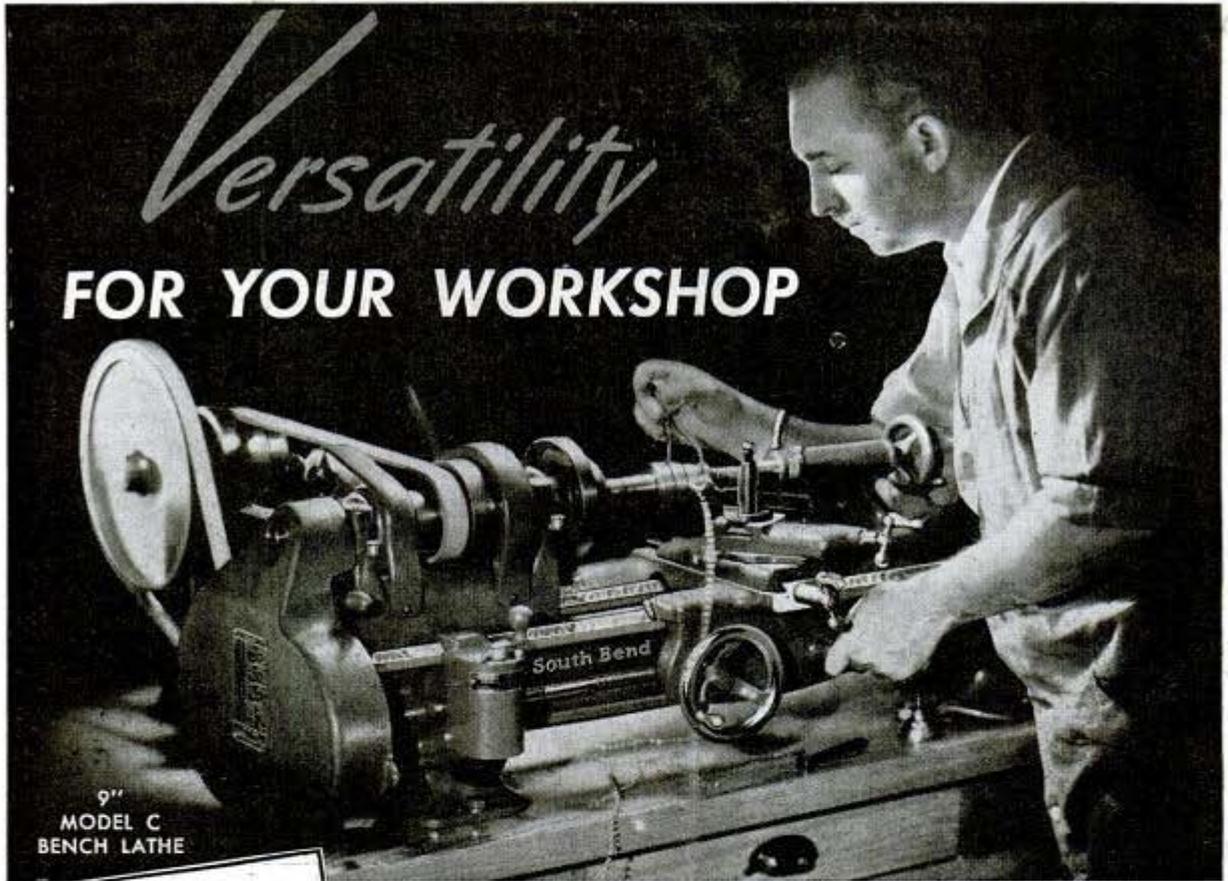
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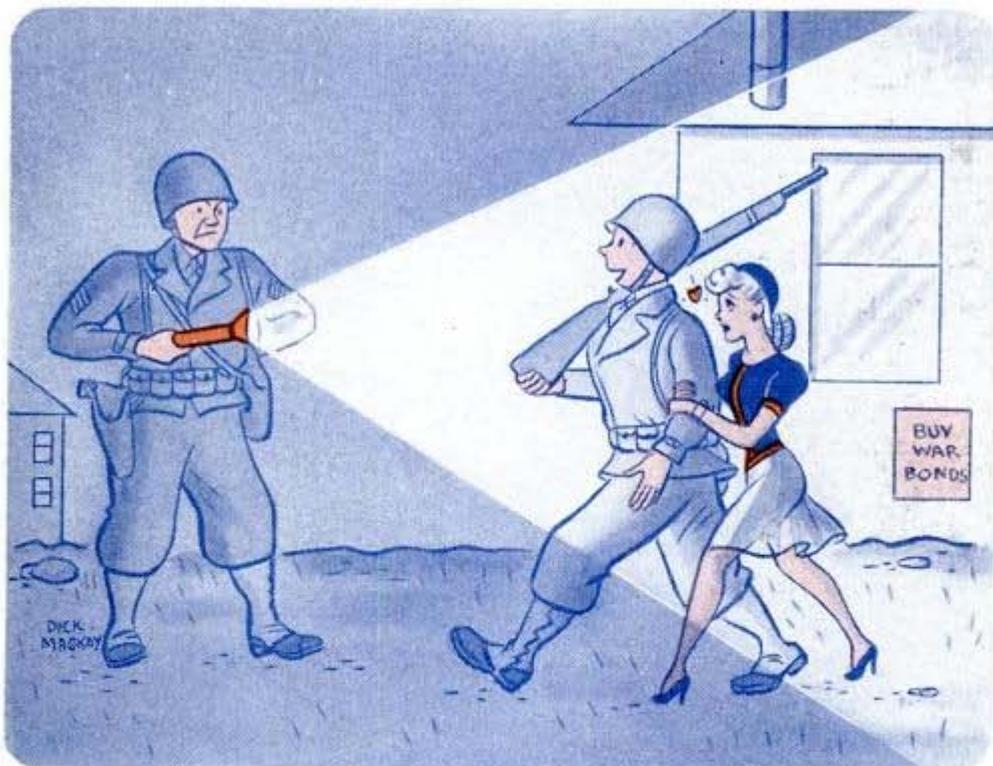
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