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POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU

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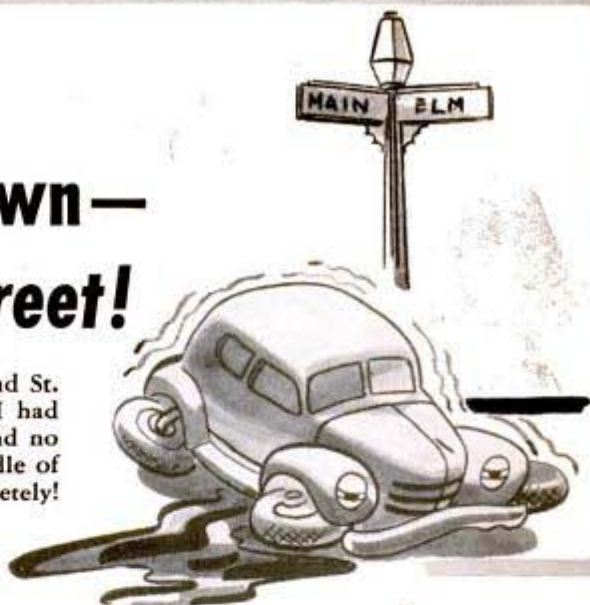
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SEE PAGE 60



I had a Nervous Breakdown— right on Main Street!

"I was just a bundle of shakes, shudders and St. Vitus! Besides jerking all over the road, I had about as much horsepower as a cricket—and no pep at all. Then one day, right in the middle of all the traffic on Main Street, I collapsed completely!



"They towed me to a Packard Certified Re-Wiring station, where a quick but thorough examination disclosed my frayed nerves. 'This wiring is badly worn—it's throwing the whole electrical system out of kilter,' said the mechanic.

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H. H. WINDSOR, Founder

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

September, 1941

Vol. 76, No. 3

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Tuning Up the Defense Machine

REALISM in everything but bullets and gas is the rule in the current war games of our army. Bombers attack a supply train with bags of confetti, and emergency provisions must be dropped to the isolated troops by parachute. Gallon cans of smelly molasses compound simulate mustard gas, and buried mines are represented by wooden boxes containing bottles of liquid smoke, released when truck wheels crush them. Mobile radio loops triangulate the positions of enemy radio centers. An intimate picture of our war machine at work is presented in an October feature.

Crossroads of the Skies

PLENTY of room in the air? Take a look at the sky above Chicago's mile-square airport and you wonder. Three big air liners racing in at three miles a minute, sightseers and private planes buzzing around, more liners ready to take off. "Stop-and-Go at the Crossroads of the Skies," in our next issue, shows you the picture from the control tower.

Next Month

THINGS will be very, very hot for the enemy that approaches our shore. Even if the U. S. Navy and the Air Force should let a hostile ship slip past, there is a "ring of steel" around the continent. From big guns, fixed or mounted on rails or truck-drawn, a deadly hail can be flung upon a foe 25 miles at sea. Electrically controlled mine fields, too, will guard our harbors. "Our Coastline Wall of Steel," an October feature, tells how our shores are protected.

Science on Wheels

PEOPLE ask why the railroads didn't go streamline years ago. They did. The first streamline train was built 40 years ago, but the rails weren't ready. Since then there has been a steady evolution backed by millions of dollars in research. Electric detectors that see through rails, treatments that add 20 years to the life of a tie are part of the picture. Read the October 8-page Coloroto story, "Science Rides the Rails."

Make Your Films Pay

YOU amateur moviemakers can turn your hobby to profit by filming "shorts" for the movie slot machines. One amateur who doesn't even own his camera produced and sold five films in a couple of days! There's a demand for 3-minute shorts, and a good one may bring \$25 to several hundred dollars. Take a tip from an article next month, "Make Money With Midget Movies."

Published monthly by POPULAR MECHANICS COMPANY, 200 East Ontario Street, Chicago, U. S. A. Single copy in the United States, 25 cents; subscription rates in United States and possessions, and countries of the Pan-American Postal Union including Spain, \$2.50 a year, \$4.00 for two years, \$5.00 for three years. Single copy in Canada, 30 cents; subscription rates, \$3.00 a year, \$5.00 for two years, \$6.50 for three years. To all other countries add \$1.00 a year over United States prices for overseas postage. Changes in address must be reported to us immediately to eliminate delay. Entered as Second Class Matter, Sept. 15, 1903, at the Post Office at Chicago, Illinois, under Act of March 3, 1879. Entered as Second Class Matter at Post Office Dept. Canada. Copyright 1941, by Popular Mechanics Company, Copyright under International Copyright Union. All rights reserved under Pan American Copyright Union. Printed in the United States of America



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Floyd Davis (co-winner), "Pyroil helped keep my engine working great!"

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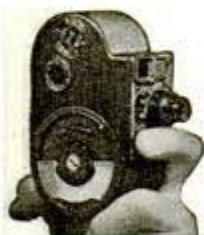
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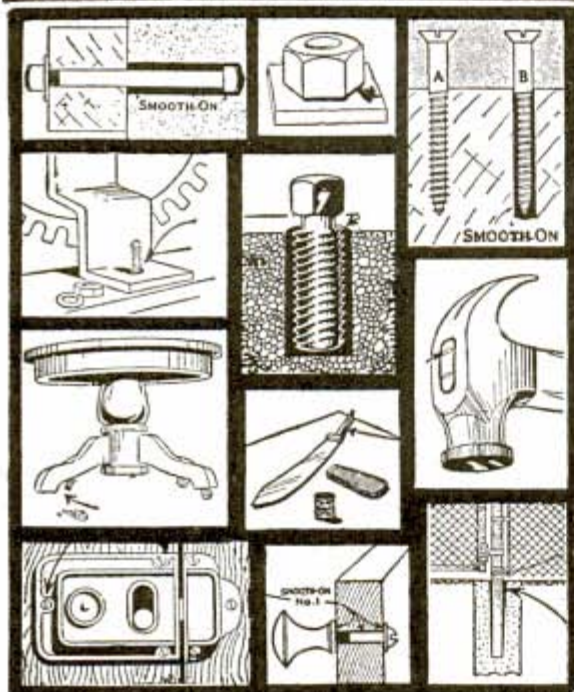
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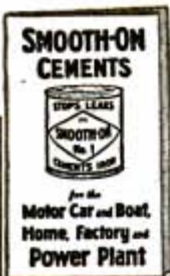
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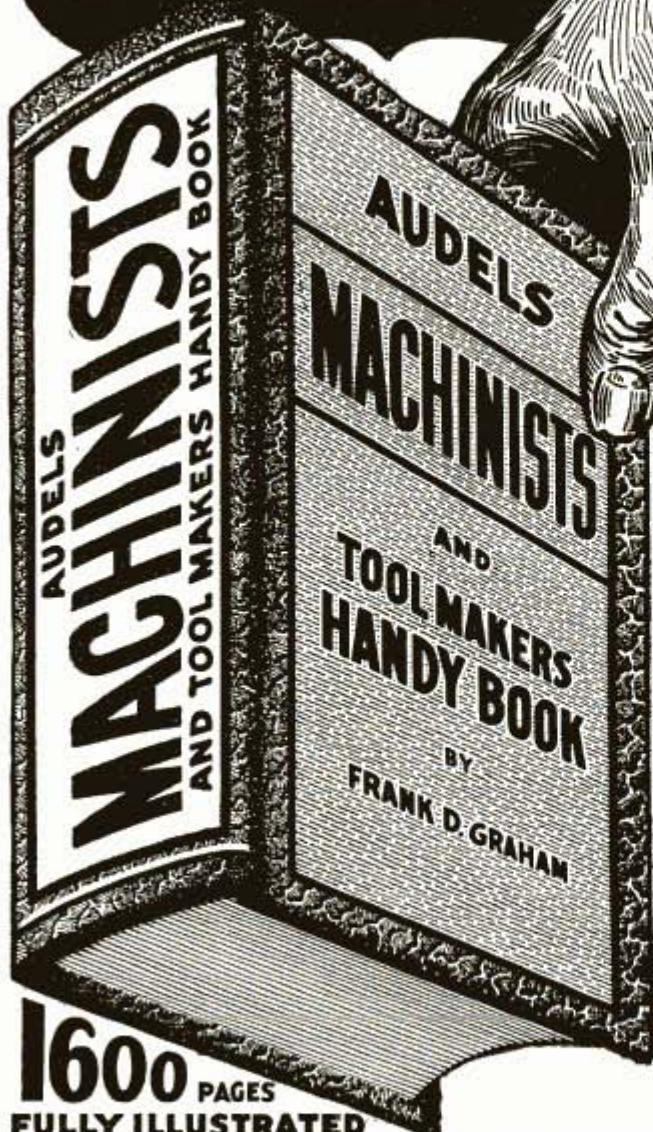
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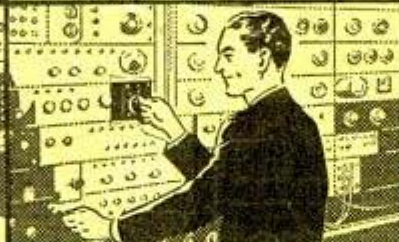
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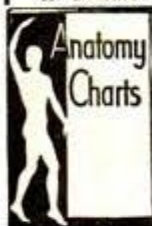
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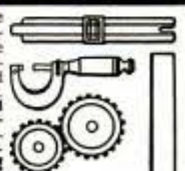
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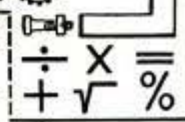
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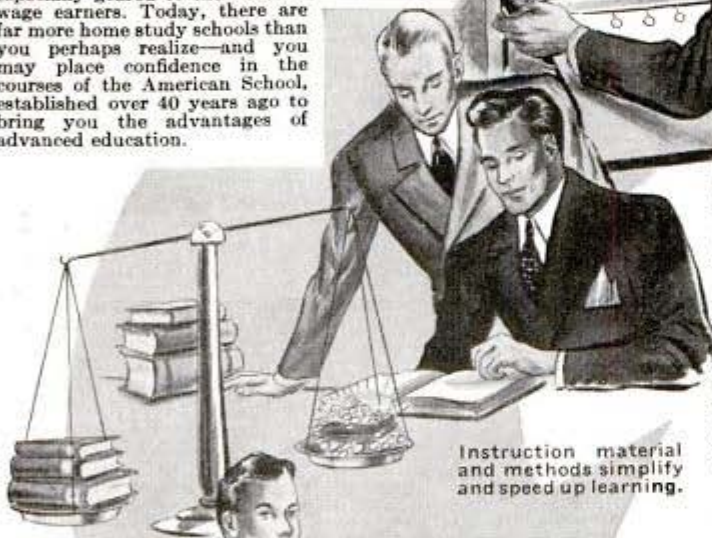
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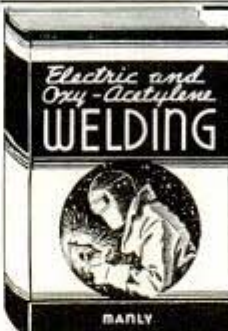
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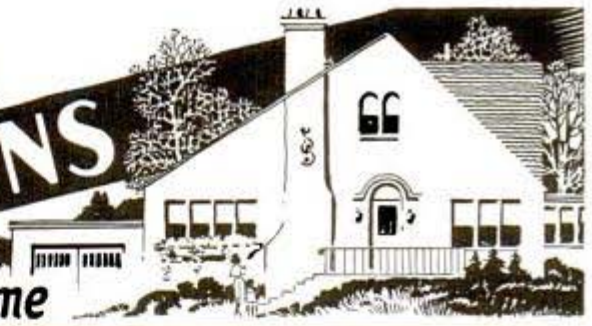
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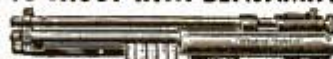
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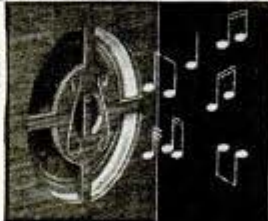
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EIGHT Sample application letters to help job hunters. 25c coin. Richard Service, 4340 Maple, Dallas, Texas.

BIG Money taking orders: shirts, ties, hosiery, underwear, pants, jackets, raincoats, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-BG Lincoln, Chicago.

BIG Uniform manufacturer seeks man to contact restaurants, beauticians, doctors, nurses, factories, offices, homes, others. Offer exclusive, patented styles; unsurpassed workmanship. A special assortment Peggy Parker bargains. Leads furnished. Permanent. Outfit free. Hoover, 251 West 19th, Dept. XK-10C, New York.

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MAKE Money! Show exclusive Christmas cards with customer's name, 50 for \$1, up to 100 designs. Also 21-card "Wonder Box" assortment \$1. You make 50c. Samples on approval. James Art Studio, 910 Anson Place, Rochester, New York.

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MAKE Extra money easy. Show smart personal Christmas cards with name, 50 for \$1, up to Outstanding values. Also 21-card assortment, \$1; others. Big profits. Samples free. Wetmore & Sugden, 749 Monroe, Dept. 79, Rochester, New York.

MERCHANTS Wall cards—Cost 1c, sell 10c. Details. Eugene Collins, Biltmore, N. C.

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HIGHEST Quality blades. Wholesale catalog free. Bulger, 132 Rindge, Cambridge, Mass.

YOU'LL Like resilvering mirrors, tableware, making chipped glass nameplates, signs. Write Sprinkle, Plater, 128, Marion, Indiana.

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CHRISTMAS Card leaders bring you quick cash earnings. Name-imprinted Christmas cards, 50 for \$1, up. Sensational "prize" 21-card assortment sells \$1.00. You make 100% profit. 14 fast-selling assortments. Samples on approval. Chilton Greetings, 147 Essex, Dept. G-2, Boston, Mass.

CHRISTMAS Cards—America's finest assortment. Big profits. Write for samples. Robinson Cards, Dept. 106, Clinton, Mass.

SELL Nylon hosiery and give fine silk hose for half price in combination order. Guaranteed against holes, snags, and runs or replaced free. Hose for your own personal use given with large outfit. Rush name and hose size today. Wilknit, Desk BK-37, Greenfield, Ohio.

CALL On gas stations, garages, stores. New chemical sponge, whirlwind seller. Cleans auto like magic. Samples sent on trial. "Krustee," Dept. 127, Akron, Ohio.

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CALL On friends with sensational lowest priced personal Christmas cards, stationery. Names imprinted. Also big-value 21 card \$1.00 assortment. Profit, 50c. Experience unnecessary. Samples on approval. Wallace Brown, 225 Fifth Ave., Dept. C-34, New York.

SELL Christmas cards. Outstanding selection smart designs with name imprinted—low as 50 for \$1. Amazing values get orders easily—pay quick cash profits. 14 lovely assortments. Up to 100% profit. Experience unnecessary. Samples on approval. Hertel, 305 Adams, Dept. 919, Chicago.

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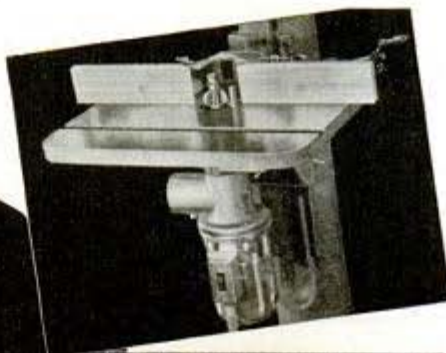
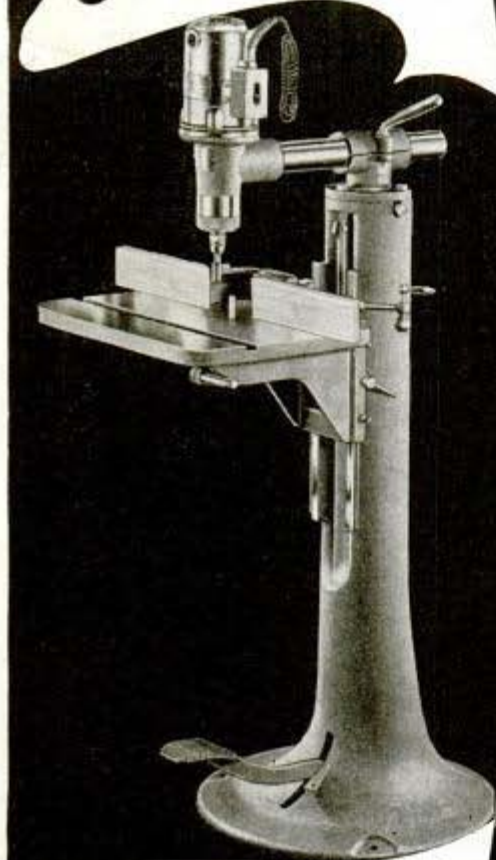
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Vol. 76

SEPTEMBER, 1941

No. 3



Motorcycle platoon of U. S. 1st armored division carries submachine guns

CHATTERING 50-caliber machine guns and 37-millimeter cannon pour a hail of bullets and shells against two thin-looking steel plates 100 yards away. But scarcely a dent appears and observers nod in satisfaction, for the plates are identical with the armor protecting Uncle Sam's new light tanks.

Thirteen-ton land destroyers operated by crews of five, these tanks are rolling from assembly lines at a rapid rate to equip America's armored divisions.

To the observers, both military and civilian experts, the firing test means that the light tank can take it, shaking off any shell fired from a weapon smaller than a 75-millimeter gun. And even the "75" shell is ineffective if it strikes a glancing blow on the tank's ar-

A plane swoops down in simulated attack on combat cars of First Cavalry

UNCLE SAM'S IRON FIGHTERS



SEPTEMBER, 1941

2720



Atop one of the medium tanks of our fast-growing mechanized army, a gunner of the 67th Infantry takes sights on an "enemy" plane during maneuvers of the Third Army

mor—hardened steel plate along the flank and in front. Coupled with that fact is the difficulty of training the cumbersome "75" on the swift-moving, fast-turning tank.

But a tough hide is not the only thing remarkable about these light tanks. They carry a real sting—a 37-millimeter, quick-firing cannon and four machine guns operated from the inside and an anti-aircraft gun fired from the outside. Their gun power is greater than that of comparable tanks developed in Europe and their speed higher. Rated at only 35 miles per hour, they reach 50 easily, making them hard to hit, even at an angle, and even harder to stop.

Backing up the speedy light tank is the slower medium—M-3—but tougher, bigger and more formidable. A 28-ton land cruiser operated by a crew of seven, this tank carries a 75-millimeter cannon, a 37-millimeter cannon, four 30-caliber machine guns and one submachine gun, making it the deadliest machine of its size ever built. Its armor, too, is supe-

rior to that of comparable tanks in service across the Atlantic.

Production of the M-3 is not as fast as that of the light tank, but factory wheels are turning at an ever accelerating pace, and it seems safe to predict that enough tanks of both types will be available within a short time. About 400 tanks—290 light and 110 heavy—are needed to outfit an armored division, in addition to other types of vehicles used.

As the iron fighting machines rumble off the line, U. S. Army officers are busy train-



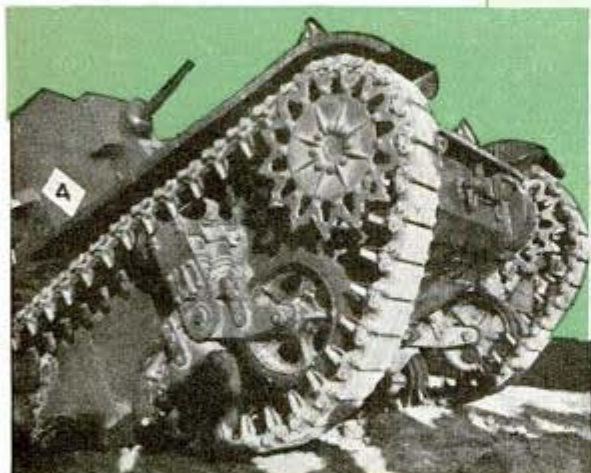
Here is one of the new trackless tanks, a tough steel monster whose independent wheels roll rapidly on rough terrain

ing crews and experimenting with ways to make the tanks more useful and the crews more efficient. One effort is said to involve the transportation of tanks by air, with a transport plane carrying small, lightly armored machines in sections for assembly when the plane lands. These baby tanks weigh about half as much as the new light tank.

Eager to get the most out of their mounts, tank crews are discovering odd things, such as how to fire around a corner. As demonstrated by gunners of the Second Armored Division, it really



Hundreds of these "jeeps," the bouncing babies of the force are rolling from the factories to the U. S. Army training camps
At the left, a tank crawls out of shell crater in 66th Infantry maneuvers. Vulnerable spots are being heavily armor-plated



works. A vulnerable spot of a tank is the rear, the deck above the motor. In an attack, it is possible that enemy soldiers in a hole might be missed by the hundreds of bullets fired by a tank and might toss grenades or bombs at the rear of the tank. To protect against such an attack, the Second Division has attached rectangular-shaped armor plate, heavy enough to deflect 50-caliber machine gun bullets, just aft the tank's tracks. In this position, the plate deflects a hail of bullets downward in the manner of a water wagon flushing a



Cavalry motorcycle scout above has run into an enemy patrol and dismounted for action. These motorcyclists lead the advance
Below is the new M-3 tank, a formidable 28-ton cruiser manned by a crew of seven, its biggest gun a 75-millimeter cannon



2720



Top, a swarm of light tanks. Firing tests indicate anything less than a 75-millimeter shell will bounce off the tough hides of new type light tanks

Below, a fighting line of mobile forts crosses a stream. The gun power of the American tanks is greater than that of comparable European tanks, and ours are faster

street. The gunners find they can bank their shots against the plate and pick off enemy soldiers hiding in holes or approaching to bomb the rear of the tank.

Of perhaps the greatest significance—so far as defense against enemy tank divisions is concerned—is the possibility of employing “jeeps,” the speedy little blitz buggies now coming off assembly lines by the hundreds, to knock out slower-moving tanks, in the manner of ants attacking a beetle. In addition to the ability of the jumping jeeps to tow antitank guns, some army experts propose to mount antitank weapons in the rear seat of the jeeps. Out on the west coast, one officer has made a great stride in that direction by installing a 30-caliber air-cooled machine gun on a



Below, Infantry scatter from army transport trucks and concentrate their fire on an “enemy” plane attacking the advancing convoy of tanks and troops



L720

L627

tripod in the rear seat. With a speed of 60 miles an hour over rough country, jeeps armed in this manner would be able to swarm around a tank, dashing in at angles to attack the most vulnerable spots.

In time, the jeeps probably will replace motorcycles as a means of reconnaissance and carrying messages. The fast, low-slung cars, driven by small but powerful engines, are getting their first big test in the 1941 war games.

Experimental work is going forward on another fighting machine, a tank equipped with wheels instead of tracks. The wheels are so arranged that each acts independently while the tank is in motion, one dropping into a hole while others may remain on higher ground. An ingenious suspension tends to preserve equilibrium of men inside the machine, making for greater accuracy in firing, as well as greater comfort.

Of importance are the tests being made on bulletproof tires. Such a development, reported to be near a state of perfection, would lend impetus to the tank-on-wheels. Scout cars, jeeps and other military vehicles also would be equipped with bullet-resistant rubber.

Within less than a year, the U. S. Army expects to have six or eight armored divisions, each outfitted with 400 light and medium tanks and each containing 12,000 officers and men. At present each division also has about 300 scout cars, 400 motorcycles, 200 motor tricycles, 1,000 trucks, 500 machine guns, 25 37-millimeter antitank guns, 35 105-millimeter howitzers and 40 mortars. Changes are being made constantly and more may come as the year's maneuvers reveal points at which fire power may be increased.

In contrast to the American armored division, the German "panzer" division contains about 14,000 officers and men and 3,000 tanks and other vehicles. The organization usually includes: one shock echelon consisting of 450 tanks; one ground-holding echelon consisting of a motorized infantry regiment of two battalions—each battalion having five companies armed with light and heavy machine guns, antitank guns and a regiment of 105-millimeter howitzers; one antitank battalion of three companies armed with 12 37-millimeter guns; a motorized engineer battalion, and one signal unit. The German division is more than 60 miles long when on the march.

(Continued to page 172)

SEPTEMBER, 1941

Automatic One-Hand Reel Retrieves Line After Cast



Automatic reel permits line to be cast and retrieved with one hand. Pressure on lever starts it winding

One-hand operation of a casting rod is possible with a self-winding reel that retrieves 70 to 90 feet of line without cranking. Following a cast, the line is brought in by pressing a release lever mounted near the fingertips. Being a free-stripping reel, it requires no brake manipulation in casting, according to the manufacturer, since the line feeds out automatically as needed. The reel weighs less than nine ounces.

L669

Cutter Clips Paper or Cloth With Blade in Plastic Box

Mounted in a box-shaped plastic holder with a convenient handle, a paper cutter is handy for making clippings from newspapers or magazines. The side walls of the transparent plastic mount hold the paper firm while clipping. The blade will cut paper, cardboard, Cellophane, rayon, silk, woolen or cotton cloth or oilcloth.



The blade will cut paper, cardboard, Cellophane, rayon, silk, woolen or cotton cloth or oilcloth.

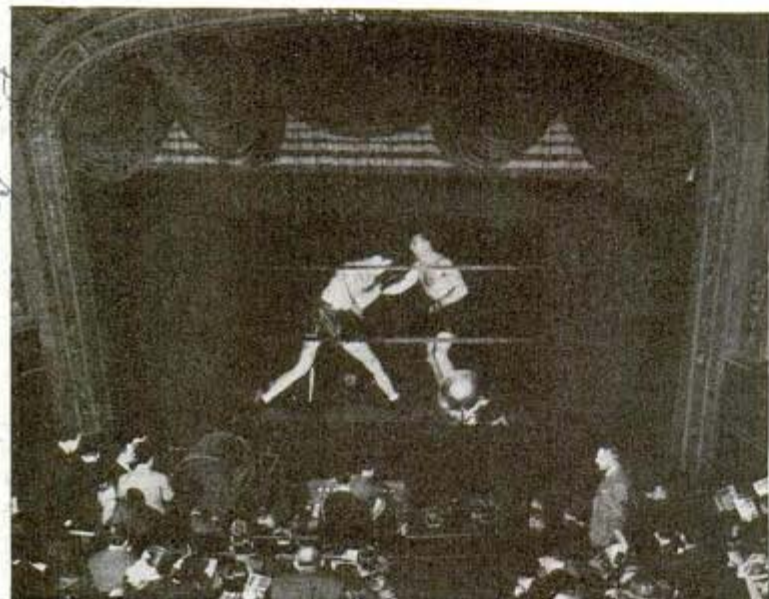
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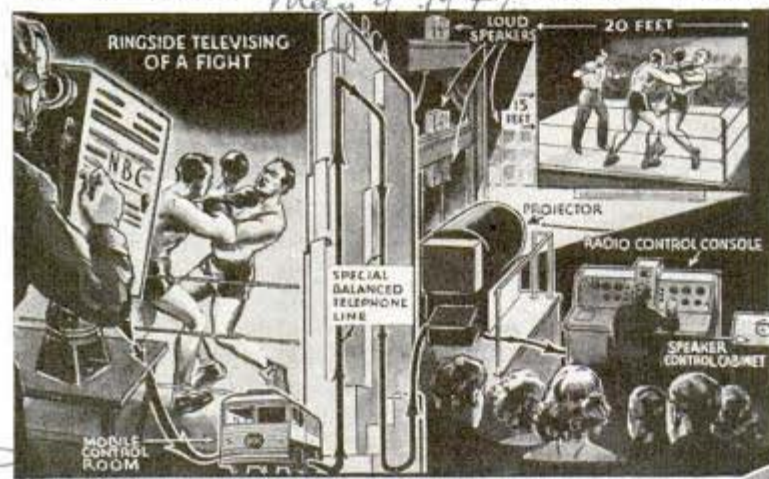
Theater Audience Attends Fight by Television

Cont. RCA with G. J. Candide



Here's how the championship fight appeared to the audience of 1,200 on the 15 by 20 foot television screen in New Yorker theater. Diagram below traces path of sound and image from the ringside to the theater

Willy Rose - Al Green
May 9, 1947



New Yorker.

In a New York theater an audience of 1,200 recently enjoyed a foretaste of the day when television will bring to neighborhood movie houses the big football and baseball games, races and other events as they are happening. From their theater seats they saw and heard a television presentation of a championship boxing match, the closeups projected on a 15 by 20 foot screen offering better than a ringside view. At Madison Square Garden, where the fight was in progress, television cameras and long-range parabolic microphones picked up the picture and sound, and a mobile television unit shot the impulses over a balanced telephone wire to the NBC

studios in Radio City. Thence they were relayed, again by wire, to the New Yorker Theater where the signals were split, the light impulses traveling to a big steel drum-like projector and the sound going to a battery of 16 loud speakers set up throughout the auditorium. Control consoles in the balcony permitted the operator to distribute the sound to various speakers to give the effect of three-dimension sound. Inside the 34-inch projector was the kinescope, the television tube to handle 60,000 to 70,000 volts. From a 30-inch mirror back of the projector, televised images on the face of the tube were shot through lenses to the screen. Telephone lines carrying the sight and sound were a miniature of the system engineers predict will some day make television available in theaters throughout the country.

Inserting the kinescope, the large television tube on which picture is formed, into projector



L607

Robert Starnents, Commentator

Science Circus Hits the Road in Poleless Tent



See-o. Home
Up goes the poleless "big top" of the science circus, its synthetic-impregnated silvery canvas hung from metal girders

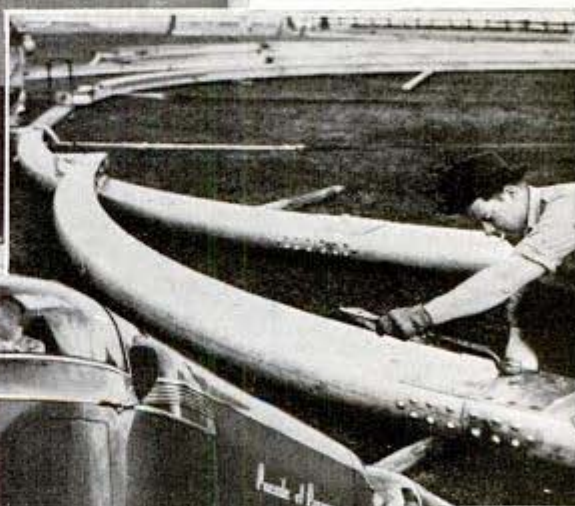
Left, television-telephone demonstration, highlight of show

Below, bolting together a section of the tent, which, 153 by 81 feet, houses science stage show and seats 1,500 persons



Broadway and 57th Street

Playing the big American circuit is a "Parade of Progress" sponsored by General Motors Corporation, a caravan of 22 streamline automobiles and semi-tractors presenting the wonders of science to the public. Some of its features were taken from exhibits at New York and San Francisco world's fairs. Its huge tent has neither internal poles nor external stakes or guylines, consisting of aluminum alloy girders suspending a silver-colored synthetic "skin," which it is suggested might serve as a mobile hangar for warplanes. Domed cabins (right) resemble that of an air liner



Designed by Dr. in Technical Exhibits and styling Section. Built in: Detroit, Michigan

SEPTEMBER, 1941

Futurliner transports 7

L680



Geiger counter detects radioactive atoms of sodium in subject's hand within two minutes after he drinks solution

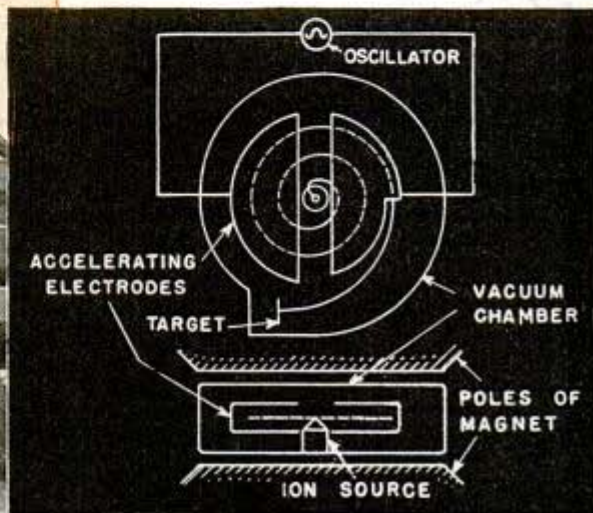
Beveling two-inch steel plates with oxy-acetylene cutting machine to fit them snugly in magnet of super-cyclotron



SIEGE GUN of SCIENCE

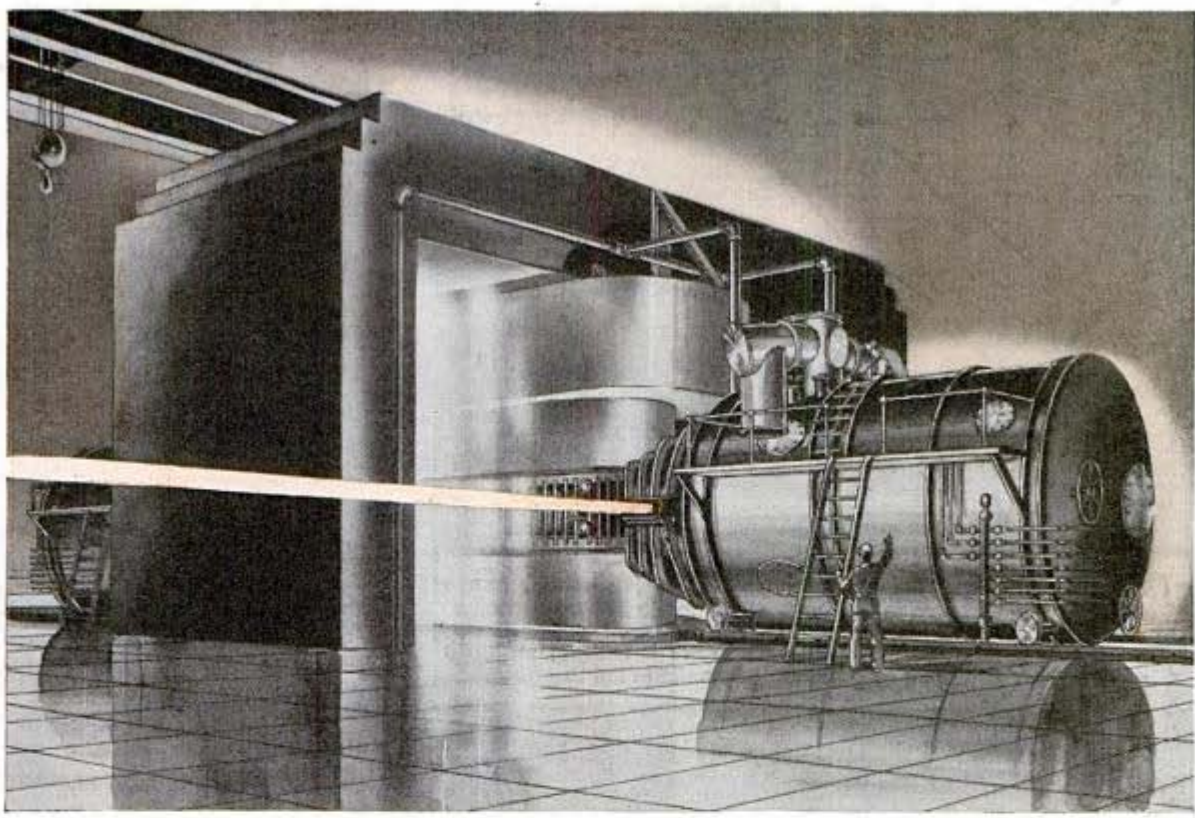
SCIENCE'S biggest siege gun, a monster steel descendant of a little glass instrument, is under construction at the University of California. It is Professor E. O. Lawrence's newest atom-smashing cyclotron.

Weighing 4,900 tons, this new atom-smasher will make other cyclotrons, of which there are 20 in the United States and several more in foreign countries, look like pea-shooters. The largest of these other cyclotrons weighs 225 tons and has been in operation at the University of California several years. It hurls a five-foot beam of atomic bullets of energies of 16-million electron volts and more, uses 200,000 watts of power and has 192 tons of steel in its magnet. But the new monster will



Above is a "blueprint" of the atom-smashing cyclotron, which also goes by the name of the magnetic resonance accelerator

Emb. Dean Wilkes, New Service, U. of California, Berkeley, Calif.



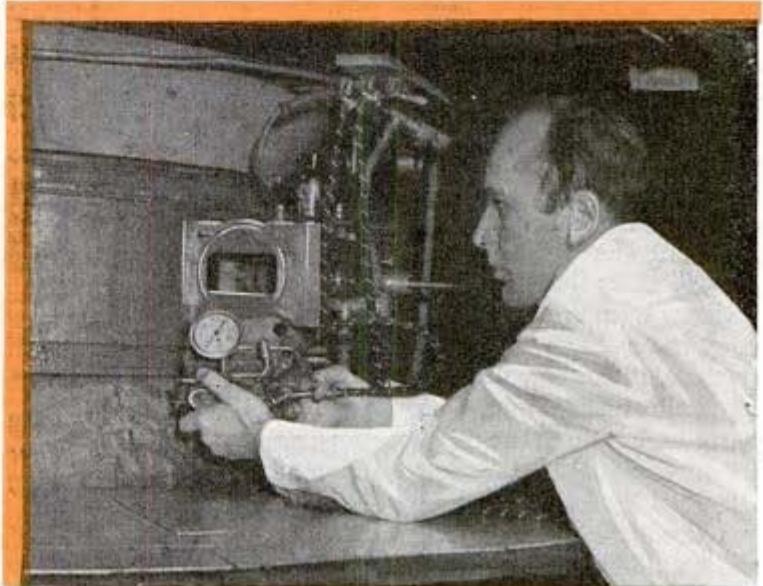
Here is an artist's conception of the finished cyclotron, with its beam of atomic bullets, seven feet above the floor, traveling with energies of 100 million electron volts and more, equal to 60,000 miles per second

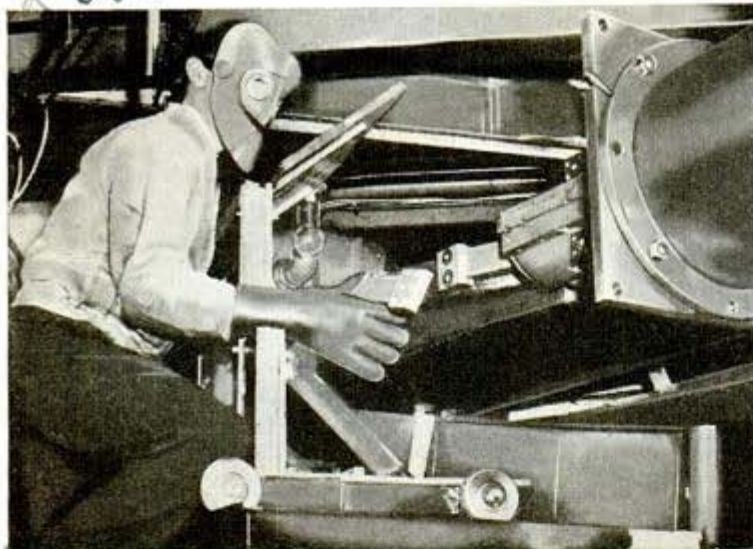
hurl a 140-foot stream of projectiles of energies of 100 million electron volts and more, equal to a speed of 60,000 miles per second. Radio equipment five times as powerful as the most potent broadcasting station will provide its 2,500,000 watts of power. Into its electromagnet will go 3,700 tons of steel, enough for one of Uncle Sam's cruisers. It will cost \$1,400,000, of which \$1,150,000 is donated by the Rockefeller Foundation.

Today a giant crane is swinging 13½-ton steel plates into place in the magnet, which will be 30 feet high, 56 feet long. When the magnet is finished a 90-foot high, 24-sided building will be constructed around it. And while the magnet is being welded together engineers pore over diagrams of cooling towers

and electrical equipment which will dwarf the largest similar equipment now in existence. A crane with a 30-ton capacity, needed to repair the cyclotron, will be installed on a rail running around the building. A wall of water at least 10 feet thick, possibly 20, will be placed around the machine to protect workers from rays produced in atom smashing. The control room

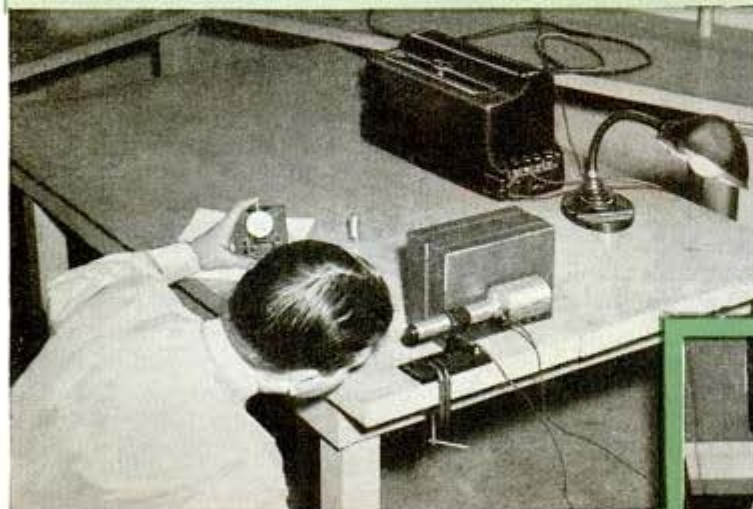
Scientist clamping the target over window of the cyclotron from which atomic bullets will emerge, smashing atoms in their way





Placing a new deflector, which lines up atomic bullets as they escape from speed-up chamber, in University of California 225-ton cyclotron

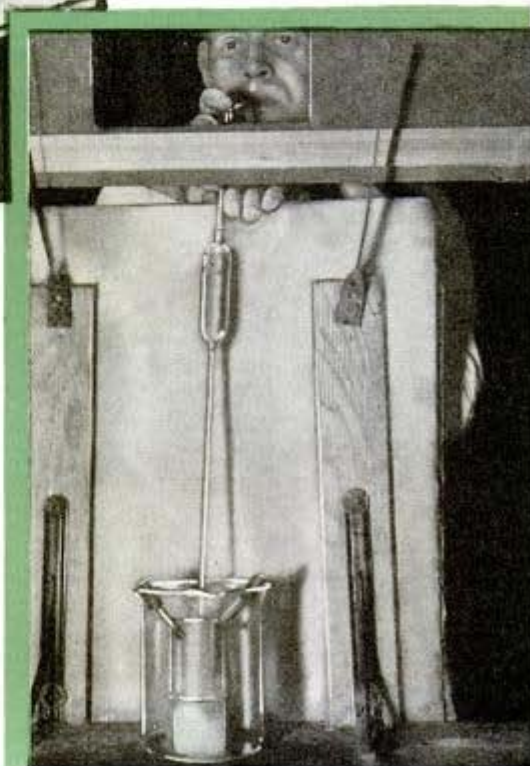
Quartz fiber electroscope into which researcher is looking, measures strength of rays emitted by radioactive material in the tiny "bomb"



But why such a huge cyclotron? The truth is, the atom has never been smashed. Chips have been knocked off, but its center core has never been fully conquered. A larger cyclotron is needed to produce more powerful atomic bullets.

To understand why the atom is such a tough nut to crack, let's look at its structure. The atom is a tiny universe beyond the visible range of the microscope, with a central sun, called the nucleus, and smaller "planets," called electrons revolving around it. The nucleus is apparently made up of two kinds of particles of nearly equal mass: protons, which have a positive charge, and neutrons, which have no charge. The number of protons determines the type of

Below, a scientist peers from behind lead shield that protects him from dangerous radiation



may be placed over the brow of a hill from the machine, to give workers added protection.

All this equipment will be used in an attempt to smash the core, or nucleus, of the atom, the tiny universe which is as much smaller than an inch as an inch is smaller than the sun. Professor Lawrence built the first cyclotron 11 years ago—a little glass flask four inches in diameter, made airtight with sealing wax. Since that time bigger cyclotrons have revolutionized physics; given doctors, biologists, biochemists, industrialists and agriculturists a tool said to be the most valuable since invention of the microscope; provided promising treatments for some of mankind's most deadly ills; and brought man closer to realizing his dream of driving steamships across oceans with the atomic power from a cupful of fuel.

atom. In this tightly bound nucleus most of the energy of the atom is locked. It is a law of electricity that oppositely charged particles attract each other. So the electrons and the positively charged nucleus are attracted to each other, and thus form a tight unit. It has not been difficult to detach "planets," or electrons, from this atomic universe, and it has been possible, using cyclotrons, to change one atom into another by knocking protons off its nucleus. But never have scientists been able to demolish a nucleus. Why it has been so difficult to conquer has been a scientific puzzle.

Scientists now believe an atomic thunderbolt called a mesotron binds the nucleus, and makes it a strong fortress. The mesotron is really a secondary cosmic ray. Mesotrons are released when the nuclei of atoms in the earth's upper atmosphere

Welding huge 13½-ton steel plates of the cyclotron's electro-magnet in place; probably 100,000 electrodes will be needed to weld the magnet



Using a tiny tube of radioactive yttrium to take pictures of steel, in search of hidden flaws

"Radioautograph" at left shows distribution of radioactive phosphorus in plant leaves and stems

are smashed by original cosmic rays, which are produced in outer space beyond the sun and its planets. After their release these mesotrons streak into the earth with energies of as much as 10 billion electron volts. They have a lifetime of a millionth of a second, and have been found deep in mines under a third of a mile of hard rock surface.

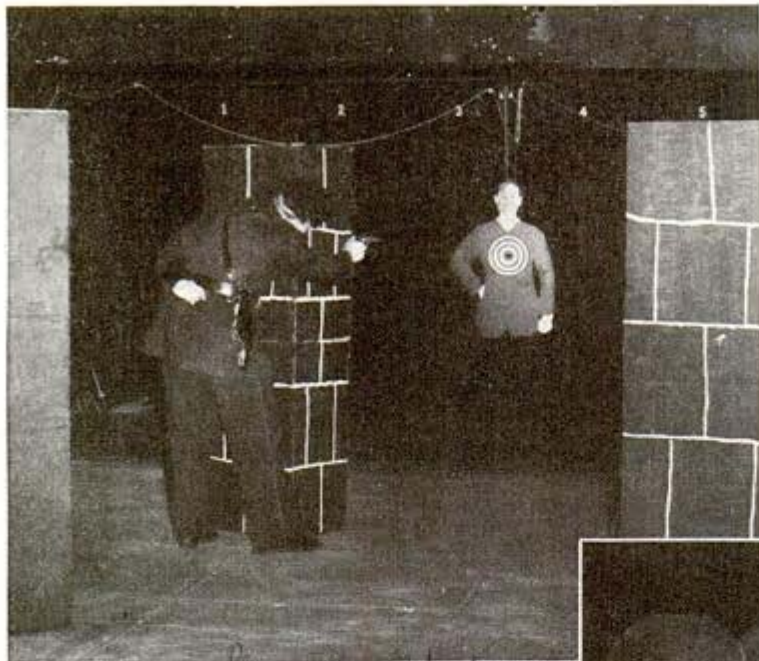
Research men have observed mesotrons, freed in the upper atmosphere, smashing nuclei in a cloud chamber. Mesotrons of about 75 million electron volts and more will do it. Professor Lawrence believes, therefore, that the 100-million electron volt bullets from his new cyclotron should turn the trick. If the nucleus is thus smashed atomic power might be re-

(Continued to page 184)



2655.

Armed Target Mimics Bandit by Shooting Back



gun flashes and shadows in the dim light, and he has the benefit of two walls and a tree behind which to conceal himself as he creeps up on his adversary. In front of the figure is a circular target with a hole in the center. This is the bull's eye, which rings a bell when struck by a bullet.

Left, policeman sneaks up on target as in duel with bandit in a dark alley. Below, gun at back is fired by remote control

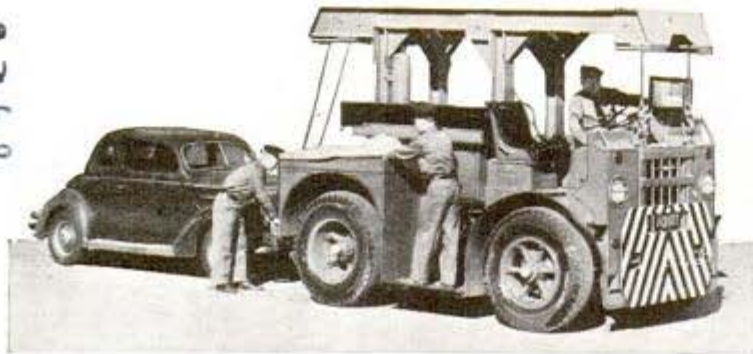


Free Lance Photo.

Police at Wilmington, Del., improve their marksmanship by "shooting it out" with a mechanical-bandit target that hides in the shadows and shoots back if the officer exposes himself. The target, a life-size figure of a bandit, teaches self-defense in a shooting battle under adverse conditions. Cut from quarter-inch steel plate, it hangs from a trolley permitting it to be moved from side to side across the range by remote control. Details of its construction were supplied by The International Association of Chiefs of Police, Washington, D. C. A revolver mounted at the back of the "bandit" fires a blank cartridge when the concealed operator pulls a rope. As in a dark alley, the policeman's aim is guided by the

The White Motor 842 E 79 th Cleveland Ohio 2688

Trouble Tractors in Tunnel Rush Aid in Traffic Tangles



Fire truck, tow car and wrecker are combined in this emergency tractor

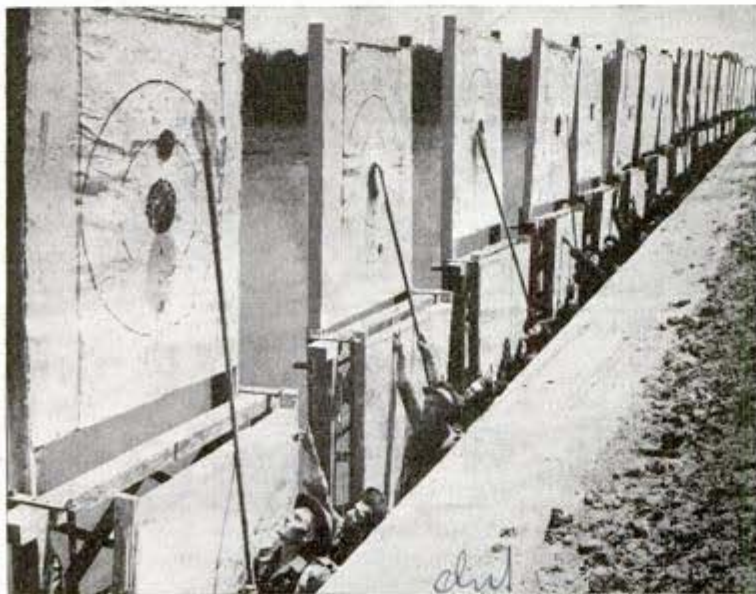
Traffic jams in an underground thoroughfare could be pretty serious, and to keep the Queens-Midtown tunnel in New York from stagnating there are "trouble tractors" stationed at each end, awaiting emergency calls. At the signal, one of these units rushes into the tunnel and hauls out the stalled car. Power

L 703

steering and an extremely short wheelbase permit these trucks to turn around in the tunnel with one backing and forward cut of the wheels. Double drum winches and cable devices with hooks are provided for lifting and drawing out disabled cars quickly. The tractors are equipped with fire-fighting apparatus in case an automobile bursts into flame. Tests proved the emergency units could race to any part of the tunnel, turn around and haul out a disabled car in three to five minutes.

'Pin Boys' Score Hits On Rifle Range From Trench

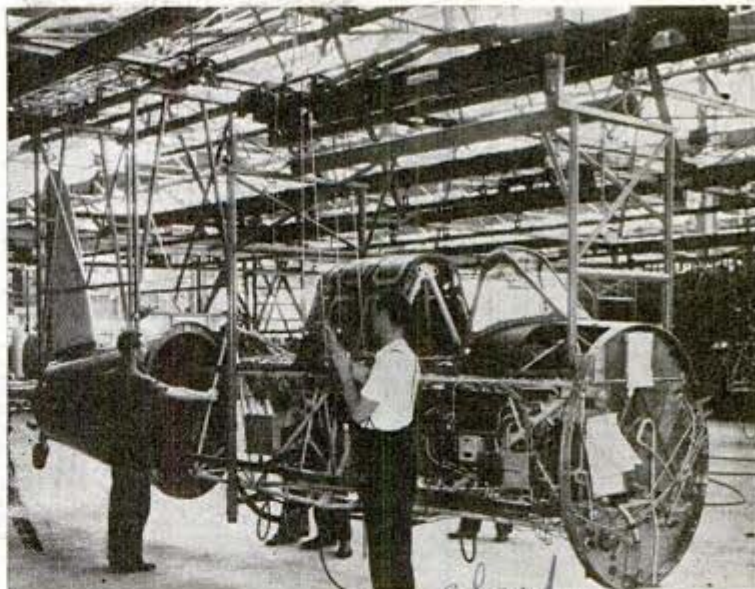
While the "rookies" at Camp Forrest, Tenn., sharpen their eyes with target practice on the rifle range, the army "pin boys" keep score on the hits from a long trench beneath the targets. After each shot they thrust up a long pole to show where the target was hit.



Poles thrust up from the pit show the riflemen where their shots scored

SEPTEMBER, 1941

Power-Driven Assembly Line Steps Up Airplane Deliveries



Overhead conveyor transfers finished fuselage to assembly line of tail section, where one man adjusts height, another joins them for bolting

Production of military airplanes at the Vultee Aircraft plant in Downey, Calif., has been stepped up fourfold by installation of a power-operated final assembly line, said to be the first of its kind in the entire industry. For example, at the stage illustrated here, the completed fuselage and the finished tail section meet, an overhead transfer bridge carrying the fuselage across from its conveyor line to the line where tails are assembled. The operator in the foreground then adjusts the level of the fuselage so that it lines up exactly for three-point bolting to the tail piece.

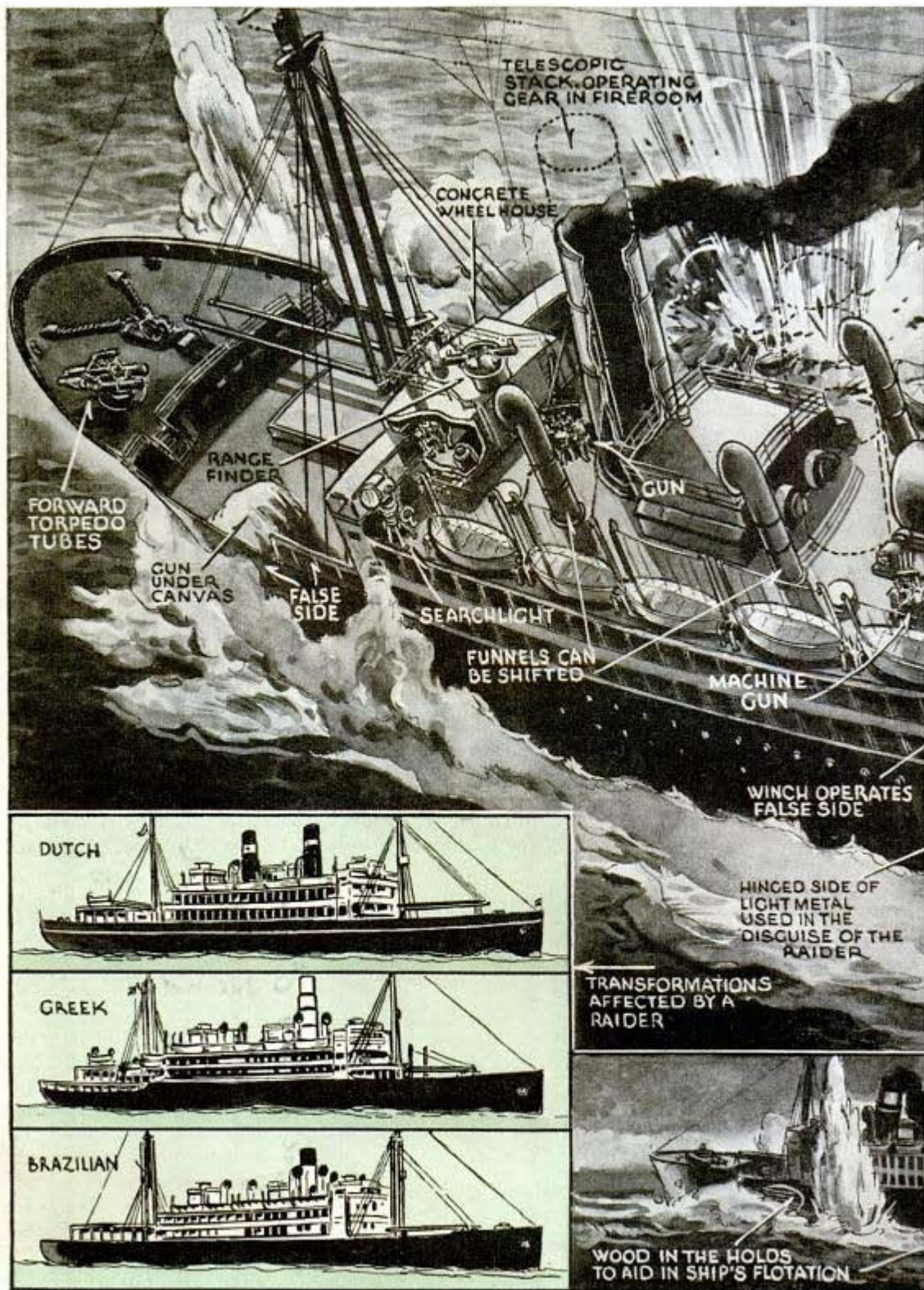
Tiny Wooden Sticks Feed Vitamin B1 To Flowers

Little wooden sticks impregnated with Vitamin B₁ are offered as a stimulant for potted plants. The stick is thrust into the soil near the roots, and each time the plant is watered a small amount of the vitamin is released into the soil. There is said to be sufficient "B₁" in a stick to provide stimulating food for the average flower for a month. Large plants may require two sticks.

Handwritten notes:
2689
club.
2616
pend.
magne koren drage
Smyles Laboratories, 108 Pennsylvania Ave
Washington, D.C.

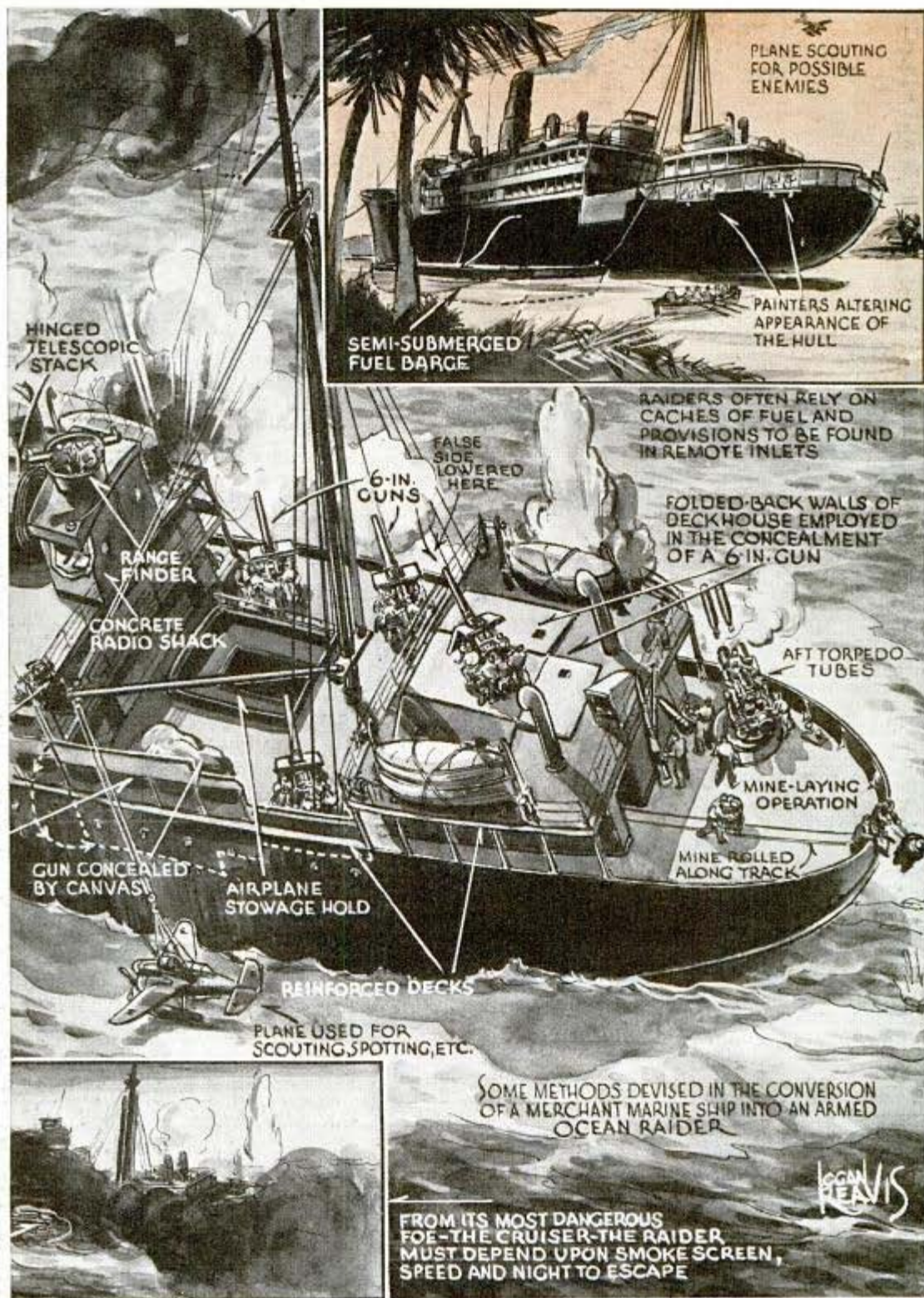
350 hard 13

Merchant Ships Converted Into War Raiders



Merchant ships of the warring nations have been converted into raiders that are preying on enemy commerce. On this and the page opposite are drawings of a typical raider. Bottom, this page, how raider may assume various disguises

Paint and False Structures Provide Disguises

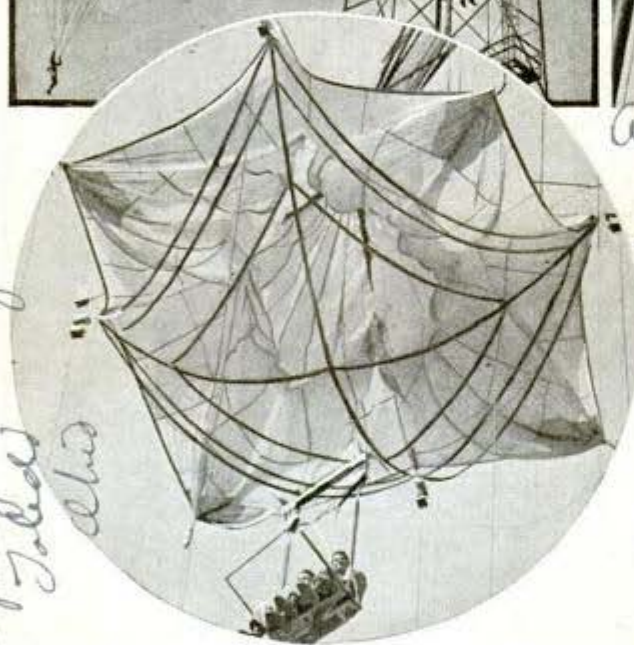
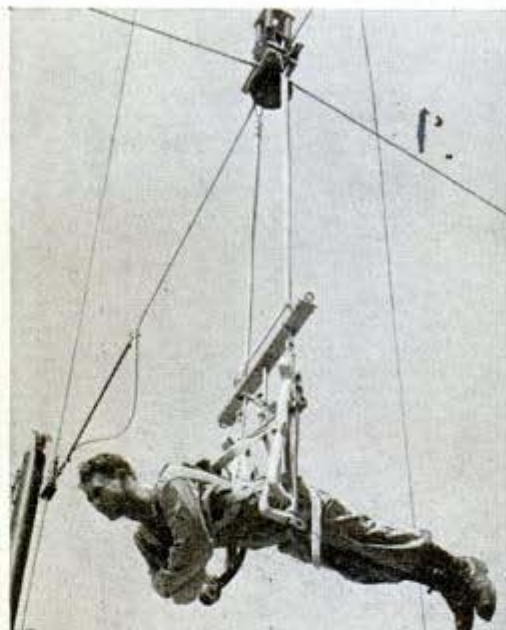


Upper right, how a raiding ship takes on fuel while plane keeps watch for enemy warcraft. Between raids, the crew may alter the entire appearance of the ship with paint and changes in superstructure, thus confusing the enemy

Logan H Keavis, 145 W. 45 St. New York

2705

Parachutists Make First Jumps in "Suspenders"



Acme

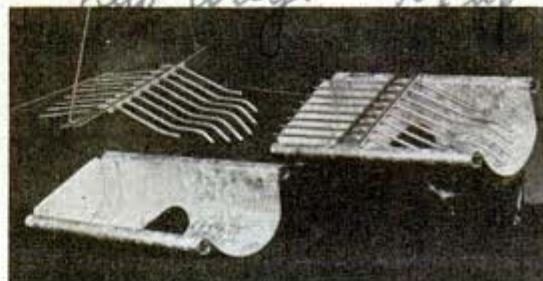
They take it in easy stages at the parachute training grounds at Fort Benning, Ga. Not until the "rookie" parachute troopers have tried dropping from the skies in a variety of safe ways are they permitted to make an actual jump from a plane. The first step in tower training is a controlled descent in which two trainees come down in a seat like that familiar to New York World's Fair visitors. Later the regulation parachute harness replaces the seat. In another stage of practice the pupil, in a prone position, is lifted 150 feet and then on signal from his instructor he pulls the ripcord and drops 15 feet to be jerked upright. This simulates the sensations of an actual jump.

Upper left, Ft. Benning parachutists drop from 250-foot tower; right, pulling ripcord gives trainee a 15-foot "captive" drop. Below, the first lesson, controlled descent in seat

Wire Shield in Eave Trough Keeps Leaves Out of Drain

Clogging of downspouts with leaves and debris can be prevented by installing a new rustproof wire shield in the eave trough. As water flows under the leaves they float up the curved, slanting shield and are washed over the top of the trough, or remain stranded on the wires.

☐ The output of electric power in the United States reached an all-time record of 144,984,565,000 kilowatt hours in 1940.

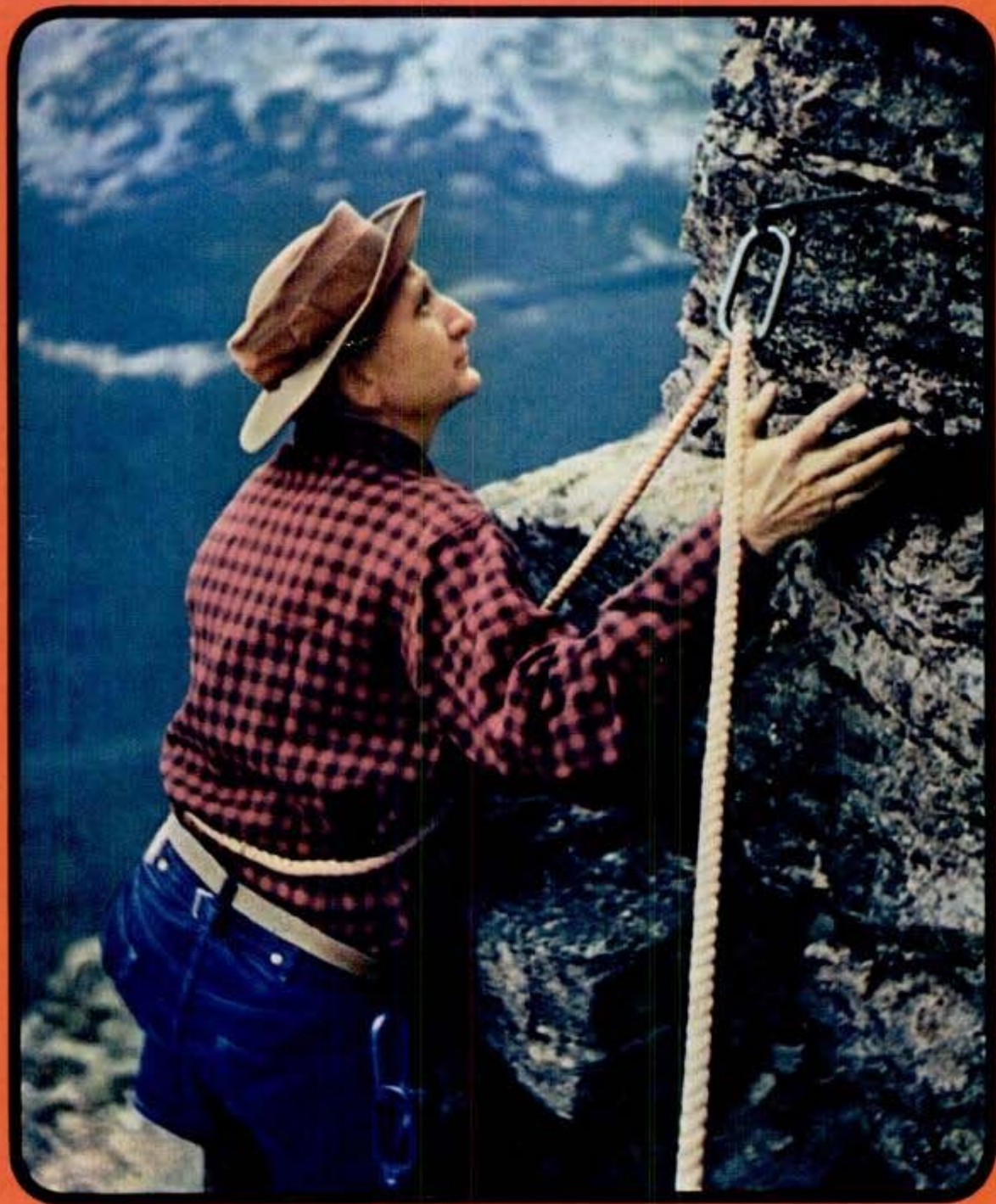


Water washes leaves and debris up the curved wires, keeping drain clear and letting water flow under

Tribune, June 23, 1940

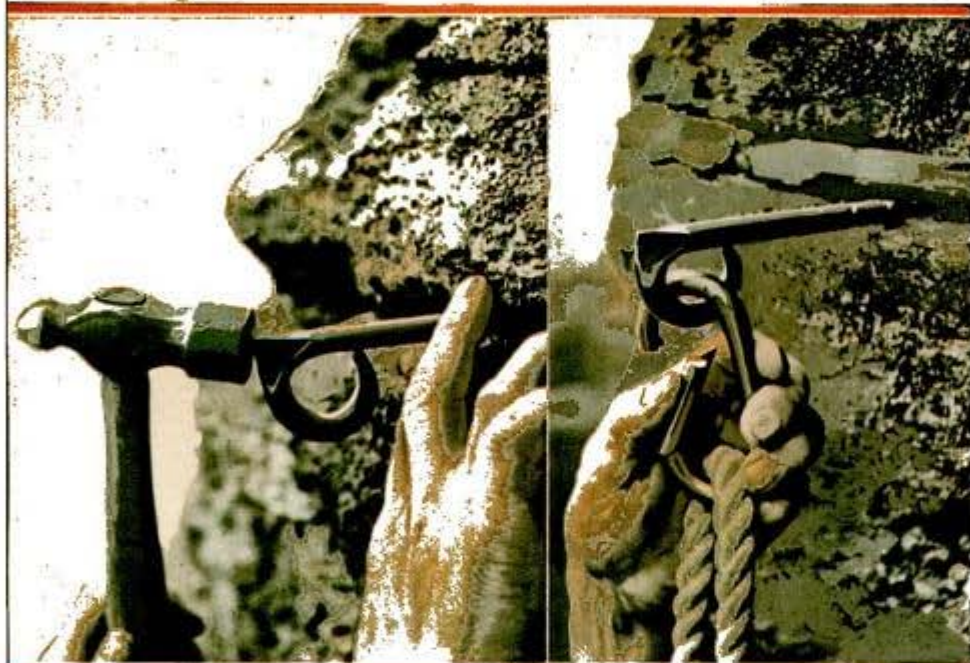
*Right. Way
955
Shield Co
Putzger Bldg
Tulsa*

CONQUERING AMERICA'S HIGHEST PEAKS



Roped to a piton driven into the rock, Carl Blaurock of Denver, author of this story, climbs the face of a peak in the Rockies

see Oct. 1940 546



Two climbers, roped together and using axes to cut steps in the ice, follow their leader up the snow and ice slopes at the head of a glacier

The two photographs at left show how a piton is hammered into a crack, then the rope is attached to it by means of a snap ring. Will it hold? The mountaineer gives it a careful test before proceeding, for life will literally depend upon it

L 398

By Carl Blaurock

Past President, Colorado Mountain Club

522 Mack Bldg Denver

TOPPING off the ascent of one of Colorado's highest mountains with a siesta on the summit, we were discussing the various spectacular climbs we had made. Several of our party, counting over their conquests, discovered they had already climbed half of the fifty 14,000-foot peaks in the state.

Right then one of my friends and I decided to climb all the remaining peaks of that altitude that we had not yet tackled. We'd take the Colorado mountains first, and planned our vacations for the next two years with that as our object. Eventually we'd climb every mountain in the United

States that's 14,000 feet high or better. To the man who hasn't tried it, mountain climbing may seem an empty sport entailing great physical exertion and hardship, possibly a good deal of danger, without compensations in proportion to the effort.

There are risks in climbing ice walls and crossing hidden crevasses and rappelling down a bare precipice. There are narrow escapes and there are accidents, of which I shall tell further on. But the human animal is a creature of queer contradictions. Some like to race in automobiles, boats or planes, some like to perform on aerial trapezes high above crowds, some prefer

L 398

19

milder forms of satisfaction—baseball, golf or swimming—while still others would rather sit before a fire and read a book than take any risks or exertions. A few of us like to pit our skill and resourcefulness against nature in climbing mountains.

Well, in a couple of seasons our campaign to climb all the 14,000-foot peaks in Colorado was concluded successfully. But that wasn't the end. Our next project was to find more difficult routes up some of the high peaks and to hunt up other interesting mountains that had never been climbed and be the first to conquer them. Usually we were successful, but occasionally a climb would prove beyond our ability.

One such failure was a winter attempt to climb the 2,000-foot precipice forming the east face of Long's Peak. We started up early one bright November morning,

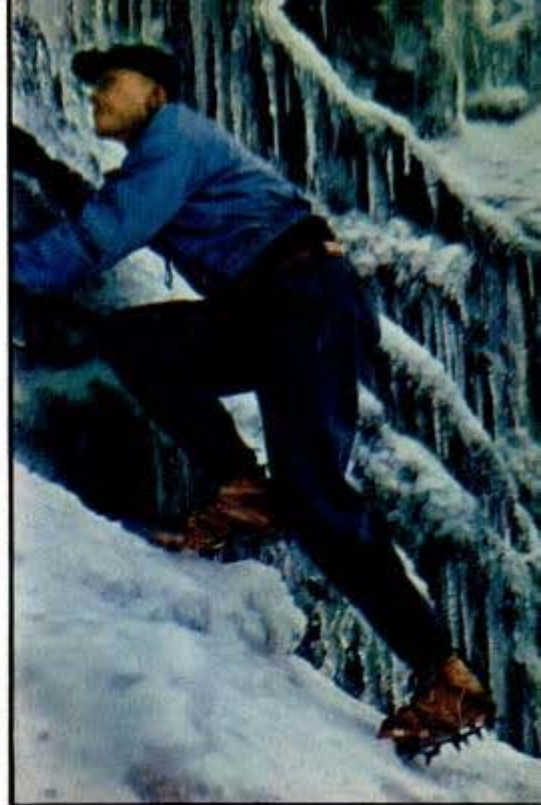
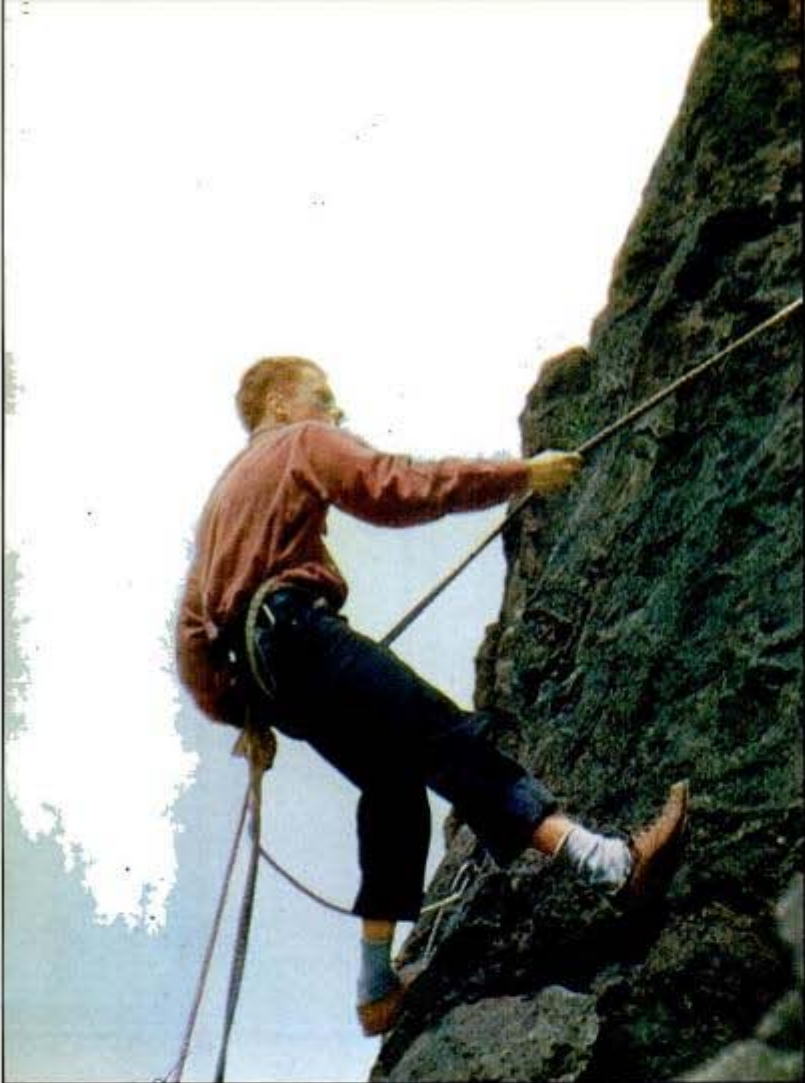


Injured in a fall, one member of a party comes home lashed to a stretcher. Often the rescue calls for heroic efforts on the part of his companions



climbing up chimneys (vertical cracks) from ledge to ledge, working our way toward the summit, finding the climbing difficult in spots, due to ice under the snow which required tedious cutting for footholds and handholds as we worked upward. Finally, just about sundown, we were within fifty feet of the ridge leading to the summit when we found the last section was a blank wall without sufficient cracks or ledges to afford holds. There was nothing to do but turn back and descend the cliffs that we had been climbing all day. Soon darkness came on and in the poor visibility we missed some of the cracks by which we had climbed up. To make matters worse, a cold wind came up which whirled snow up the chimneys and before long we found ourselves marooned on a ledge about half way down, which

Nearing the summit of a snow-covered mountain



¹³
Above, climbing an icy wall with the aid of crampons, spiked irons harnessed to the soles of the shoes for a safe grip when walking on hard snow or ice

Left, swinging around a corner with a rope, which passes through a hook on a piton driven into rock beyond. Here, on bare rock, crampons are not needed

2398
seemed to have only one chimney leading to the next ledge 300 feet below. Each time we attempted a descent, the swirling snow blowing up in our faces would blind us so that we could not see where to place our hands and feet for secure holds. Realizing then that it was too dangerous to attempt proceeding under these conditions, we sought an alternate route.

In the dim light of the stars against the snow-lined cliffs we finally noticed a ledge about 100 feet above us leading off to the left to a snow tongue, which appeared to continue unbroken down the face of the mountain to the bottom of the cliff. After some difficulty in finding a route to this ledge, we succeeded in climbing up and following it along to the snow tongue which we then descended without further trouble to the valley, and found our trail of the morning back to camp.

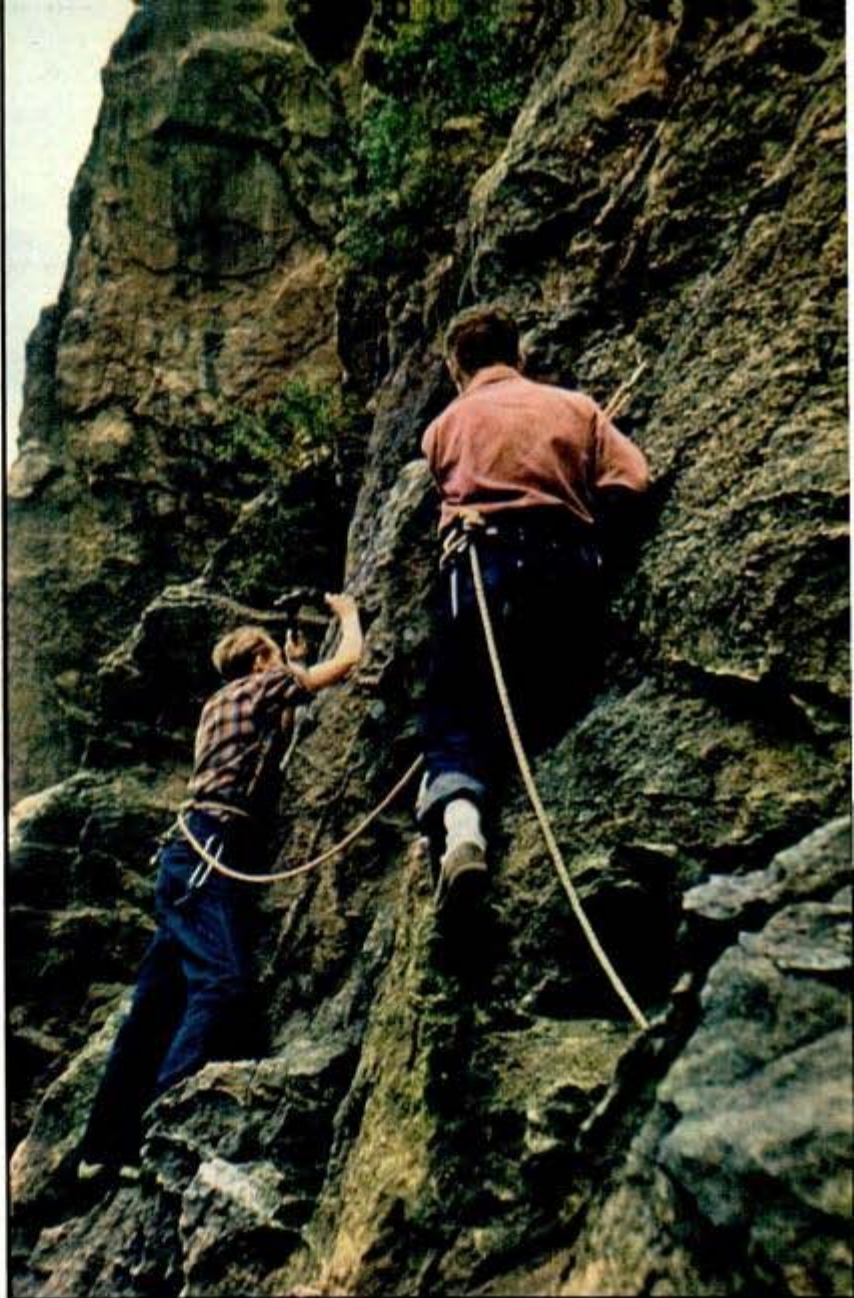
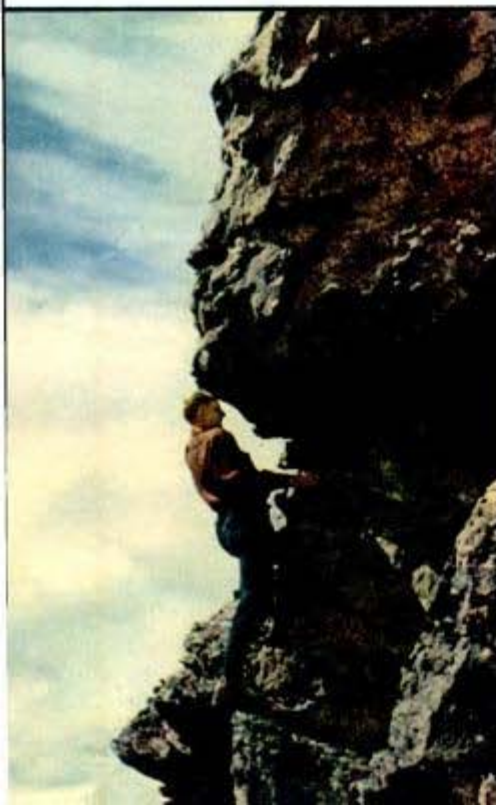
Returning from another climb one day, we came to the head of a glacier which looked like a good shortcut to the valley and camp, provided it was safe to slide down. About 800 feet below where we

20
stood we could see a transverse crevasse in the snow, which was a definite hazard to attempting a glissade from the top. But we observed that by working along the top of the glacier another 200 feet we would be beyond the end of the crevasse and it appeared to be safe to slide from that point clear to the bottom. We started kicking steps in the snow to reach our starting point. None of us had crampons, the spiked irons which are harnessed to the soles of the shoes for walking on hard snow and ice fields. Kicking steps in hard-packed snow is a tedious process, as well as giving a much less secure foothold than with crampons. Apparently I got a little careless in making steps. At any rate, while I was still above the crevasse, both feet slipped and in a flash I was sliding down the steep slope headed directly for the crevasse. I fought desperately to keep from spinning and to keep my feet ahead of me as I slid. In less time than it takes to tell I had reached the crevasse, but fortunately had speed enough that the momentum threw me clear across it and I lit on my



2398
Above, the start of a rappel. In rappelling, a swift means of descending a cliff, rope is passed around the body so its friction can be used to control rate of descent

Finding his way blocked by an overhang, the author (below) feels his way around in search of an alternate route. After conquering a peak by known trails, inveterate climbers often go back to try harder routes



The second climber, above, is belaying the leader as he traverses a cliff. Notice that the man at left is hammering a piton into the wall

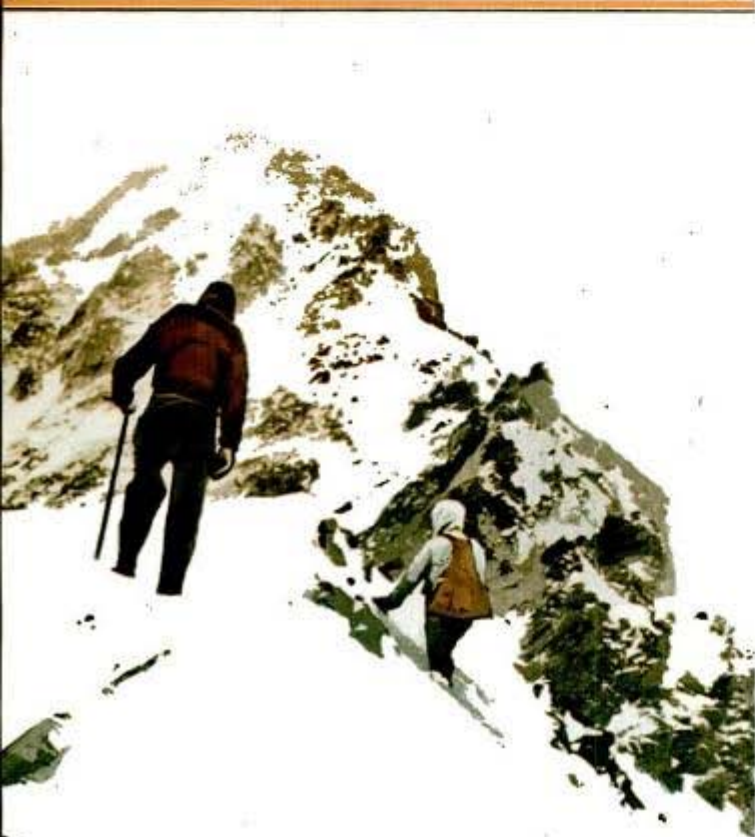
feet on the other side and rammed into the snow to my knees. This made rather an abrupt stop, but no damage was done and I was uninjured. Needless to say, my companions who had observed the mishap, made their steps more carefully and succeeded in passing the danger point before they started sliding.

Once in a while climbers are not so fortunate. This was the case last summer when a party of us were climbing the Maroon Peak, a 14,000-foot mountain of loose sandstone formation, not at all the firm rock that granite is. Two boys in the party, for variety, attempted a different route, and in climbing a vertical spot from one ledge to another, the leading climber took hold of a rock which gave way under his weight, and both came tumbling down. He had just grasped the rock preparatory to pull-



Above, lowering the rope for the rappel from the summit

Below, snow whistles around two climbers on icy peak



ing himself over it to put in a piton for safety so that the following climber could come up to his position, when it gave way. A piton is a short spike of iron with an eye formed at one end, which can be driven into a crack and a rope fastened to it by means of a snap ring, to tie a pair of climbers together for safety in case one slips.

In this instance the climber slipped before he had put in a piton and fell with the rock nearly 25 feet vertically. He lit on his back on his knapsack which cushioned the fall somewhat, and as the ledge sloped at a 40 degree angle, his body pinwheeled over several times for another 25 or 30 feet and would have dropped over another cliff at the edge of the ledge, had not his companion with presence of mind pulled on the rope and checked his spinning about 10 feet from the edge. As it was, the fall was severe enough to stun him, and then he found he could not arise and had no control of his legs.

His companion made him as comfortable as he could, then called for assistance from the rest of the party. As the accident occurred in the afternoon, several boys were detailed to spend the night with him on the mountain, while others hurried to the valley and on to town for a stretcher. The next morning they returned with the stretcher, and by that afternoon he had been carried down the mountain to a hospital where examination showed a fractured pelvis. Since then he has recovered completely and will be able to climb again.

Accidents are the exception and not the rule in mountain climbing. Most mountaineers worthy of the name are exceptionally careful persons who weigh and consider every move they make in doing a severe climb. They safeguard themselves as much as possible with all the aids in climbing that have been developed down through the years. There are ropes, pitons, and snap rings, which when skillfully used on difficult cliffs take considerable hazard out of the climb. There are rubber or rope-soled shoes for certain types of smooth rock climbing, and heavy nailed boots for other kinds of rock

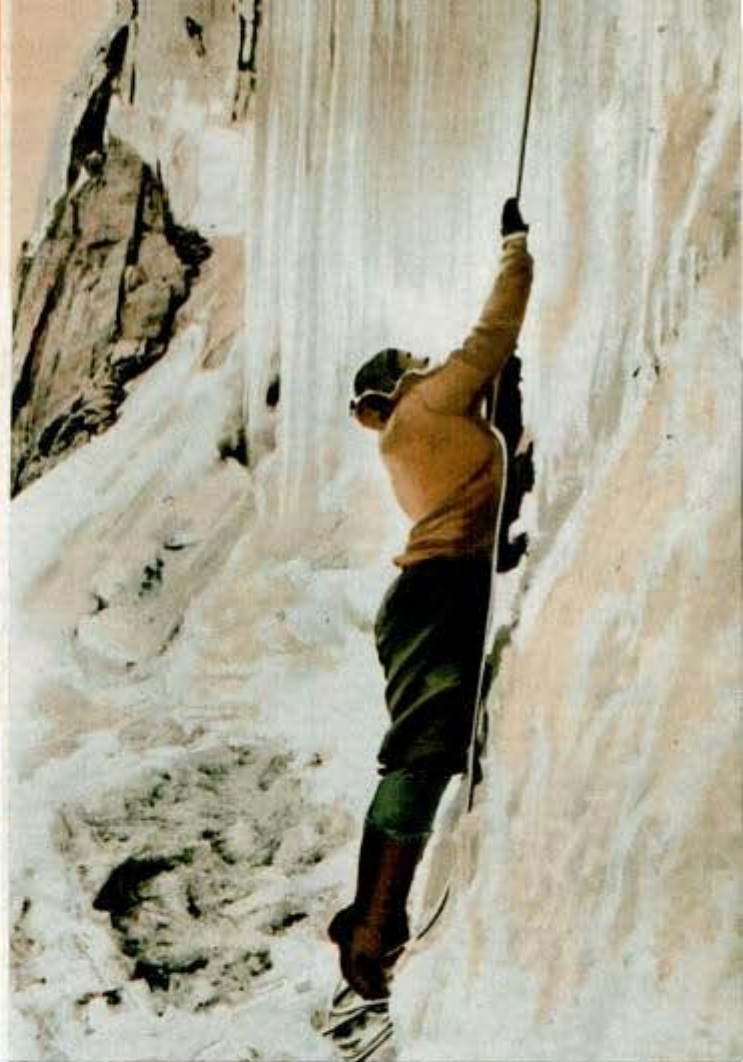


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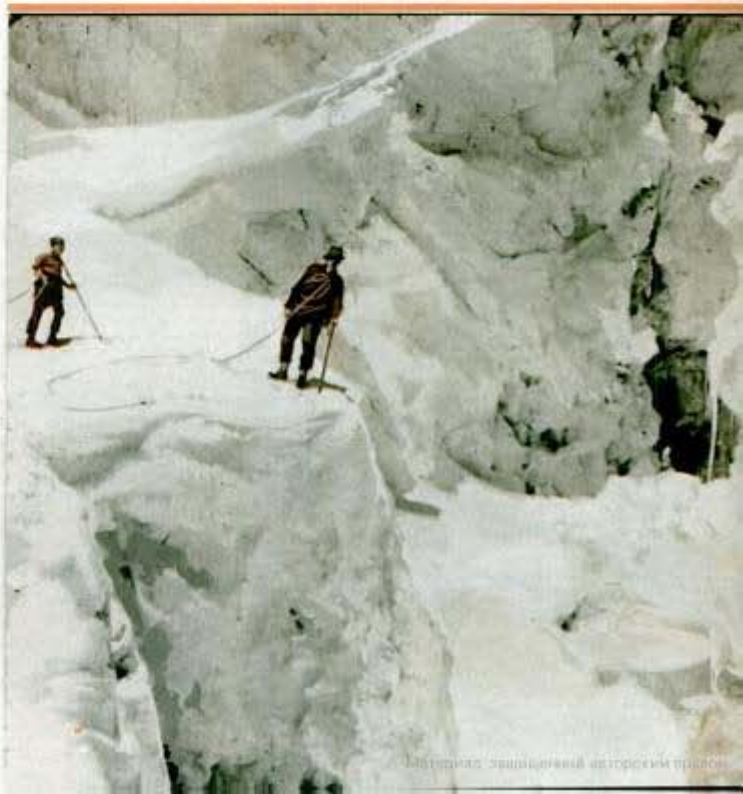
Playing follow the leader, you get a view of the hobnailed shoes worn in rock climbing

work. For snow and ice, crampons, rope, and ice axes are used. The rope is used for safety in climbing, and as a rapid means of descent by rappelling in descending a cliff. In rappelling, the rope is passed around the body in such a way that the climber can slide down it rapidly, using the friction of the rope around his body to check and control the descent.

At Colorado Springs some years ago a group of climbers organized a club whose sole purpose is to climb Pikes Peak each New Year's Eve, and to usher in the coming year with a grand show of fireworks. On a clear night the display is easily visible in all directions for 80 miles or more. For each trip a prominent mountaineer is invited to be a candidate for the club's membership, to make the climb and be initiated into the club at midnight ceremonies on top of the peak. This custom of inducting only one new man into membership each year was the inspiration for naming the club the AdAmAn Club (Add-a-man). Some of the climbs have been made under mild weather conditions, but often they are made in the face of severe bliz-



It's tough going on the ice wall of a glacier, but with a rope it can be done. Below, a crevasse on Mt. Rainier





24 There may be a 3,000-foot drop below, but the experienced alpinist hangs his faith on a rope. Among the experts, accidents are rare

It took the author and two friends over four hours to climb 100 feet up the narrow "chimney," left, to reach a pinnacle where the Forest Service wanted to establish a fire lookout

zard and subzero conditions, from which members sometimes return with souvenirs in the form of frost bitten ears, noses, and other extremities. No matter what the weather conditions, the climb is unfailingly made each New Year's. The fireworks are cached on top during the late summer to be available when the climbers arrive on the year end.

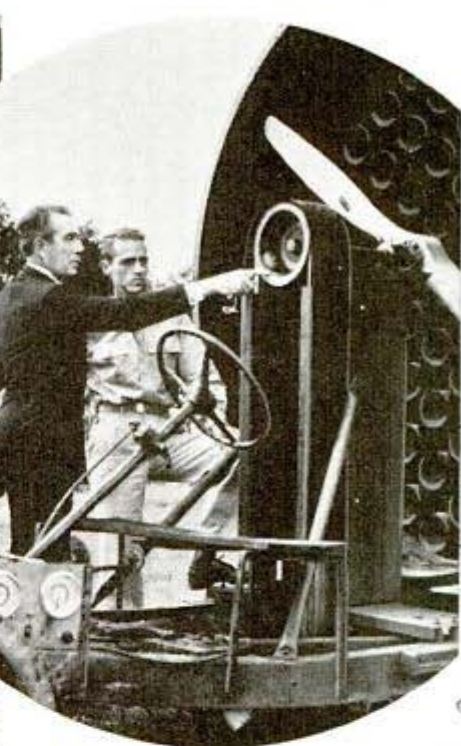
It is not only the highest peaks that hold adventures. A year ago the Forest Service asked me whether I could lead a party to the top of Chimney Rock in southwestern Colorado. It is a sandstone formation on top of a shale ridge, rising about 1,500 feet above the valley floor. The rock pinnacle itself is about 50 feet wide and 200 feet long, and rises sheer on all sides for nearly 200 feet above the shale base.

The Chief of the U. S. Forest Service in Denver showed me a picture of it and said the Service would like to use it as an emergency fire lookout, but could not figure any way to climb it. The picture intrigued me. It looked like a first class climb, and others who had attempted to reach the top had failed. I gathered a cou-

(Continued to page 176)

2753

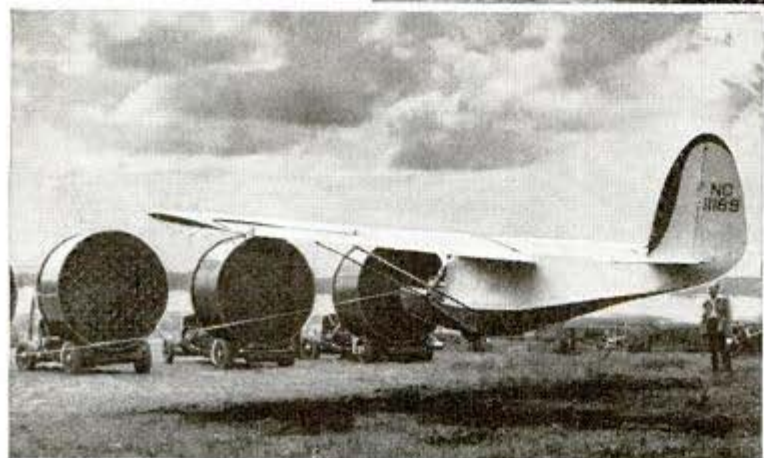
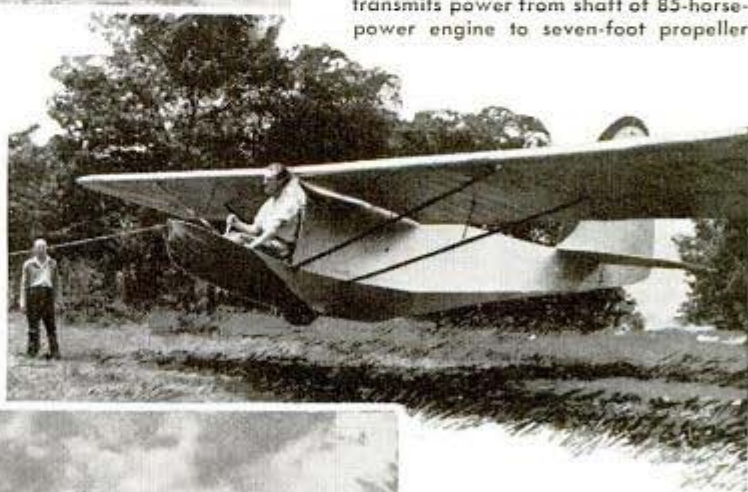
Wind Buggies Blow Rookie Glider Pilots in Air



↑ Commander E. F. McDonald, Jr., inventor, points to five-belt pulley that transmits power from shaft of 85-horsepower engine to seven-foot propeller

*Genah Radio Corp Chicago
6001 Stockton*

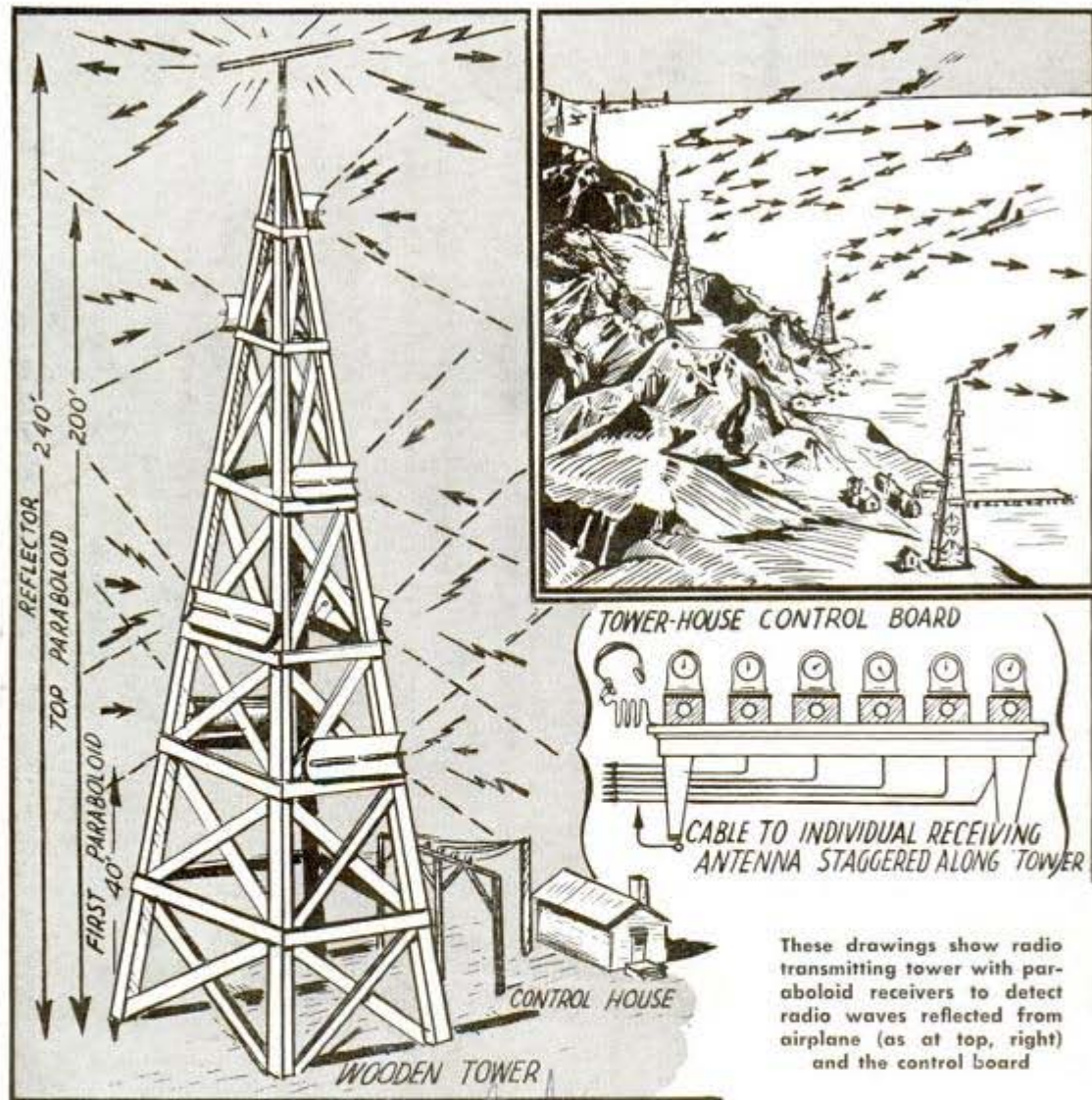
↑ "Wind buggies" that fan "captive" gliders into the air are giving student fliers a chance for practical instruction and solo experience without the risks of free flight. The "buggy" is a stripped Ford chassis with differential removed; propeller shaft four feet above drive shaft is driven by five V belts and fans a 45-mile wind through tubular vanes that reduce turbulence. The truck itself can be driven either backward or forward by propeller



↑ Flying a glider on man-made wind. Two novices who had never touched controls were able to fly successfully after less than 30 minutes instruction. Glider rises from six to 10 feet

← Behind a battery of four windcharger wagons a glider, anchored by ropes from nose to ground, flies in 35-mile wind, responding to controls as in free flight. Pilot can raise craft until wing reaches top of wind stream

Towers Flash Radio Beams to Detect Warplanes



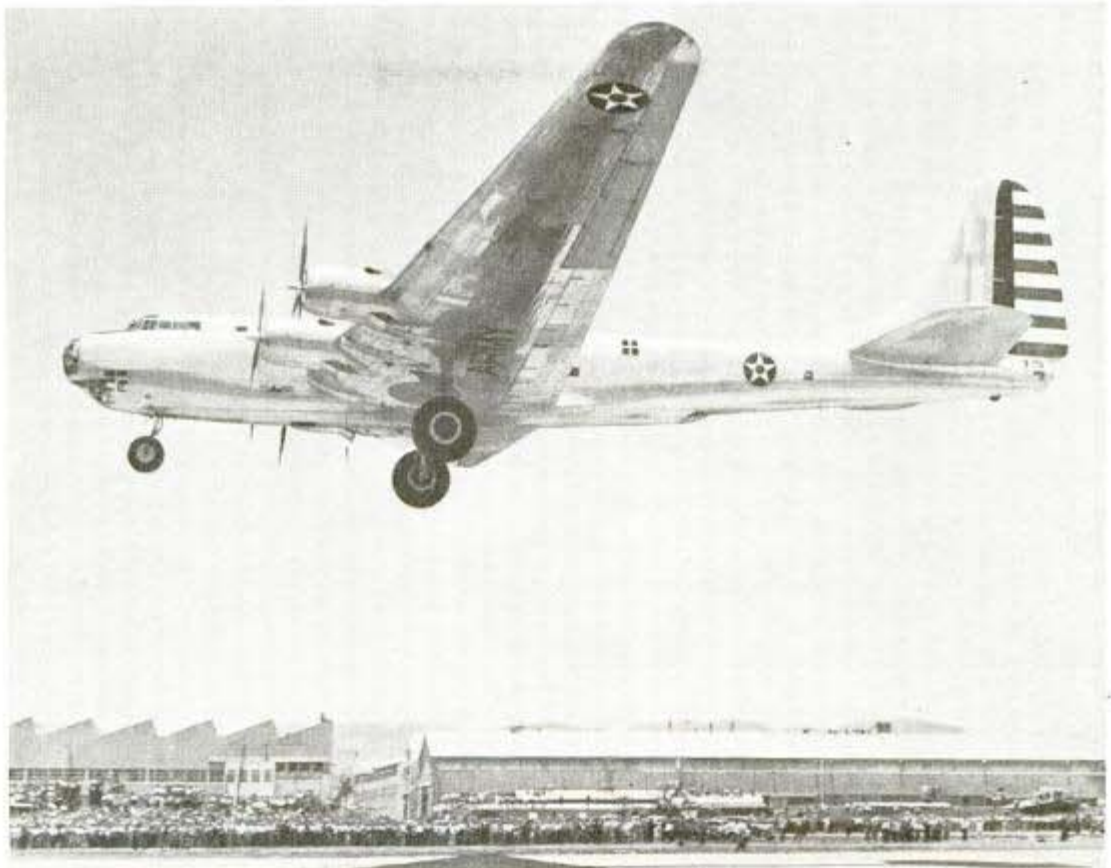
These drawings show radio transmitting tower with paraboloid receivers to detect radio waves reflected from airplane (as at top, right) and the control board

Around the coast of Britain stands a chain of radio sentinels probing the skies with short-wave beams to locate approaching enemy warplanes by night or day, in cloud, smoke or fog. Technical details of the radio detector are a major war secret, but its existence was made known when the British air chief marshal called for radio technicians to man the listening posts. Dr. Lee de Forest, American radio inventor, believes the beams are projected in a conical path toward the sea and sky from the top of 240-foot towers dotting the coastline. When a plane comes within that cone, the radio signals are reflected back to the tower and received by instruments installed on the tower at various altitudes and pointing in all directions. Within these

receivers, with paraboloid reflectors and dipole antennas, the rebounding beams—radio echoes—register their intensity according to distance, direction and altitude. This information is relayed by wires to the instrument table at the base of the tower where a technician, wearing earphones, translates the data and sends it instantly to the anti-aircraft command posts. Such a radio-echo alarm system would be a further development of the terrain clearance indicator announced in 1938 by the Bell Laboratories and United Air Lines. In that instrument the time elapsed in projecting a signal from plane to earth and receiving its echo was measured, and from that time the actual altitude of the plane above ground was computed instantly.

2800

Monster Warbird "B-19" Tries Out Its Wings



Mighty army bomber, America's largest military plane, on its trial flight while cheering crowd looks on

After four years of building, the gigantic "B-19"—largest military aircraft the world has ever seen—has tried out its own element, the air. Its four 2,200-horsepower engines roaring music to the ears of the engineers and mechanics who built it, the monster silver ship lifted from the runway at Clover Field, Santa Monica, Calif., and flew low past the throngs gathered outside the Douglas plant where it was developed. The fledgling warbird performed creditably on the first trial of its wings. It was off the ground in nine seconds, after rolling across 1,500 feet of runway; flew out to sea,

circled to salute the Douglas workers and then headed for March Field, the army base, 75 miles away. A smooth landing was made after 56 minutes in the air. Maj. Stanley H. Umstead, army test pilot, was at the controls for the historic flight. Six other army and Douglas men were aboard; the normal operating crew will consist of ten men. Less than one-fifth of its 11,000-gallon fuel capacity was carried. The plane, with 212-foot wing spread and 132-foot fuselage, is rated at 41 tons empty and 82 tons fully loaded, including several tons of bombs.

Calls for Aid From Stalled Motorists Multiply Despite Better Cars

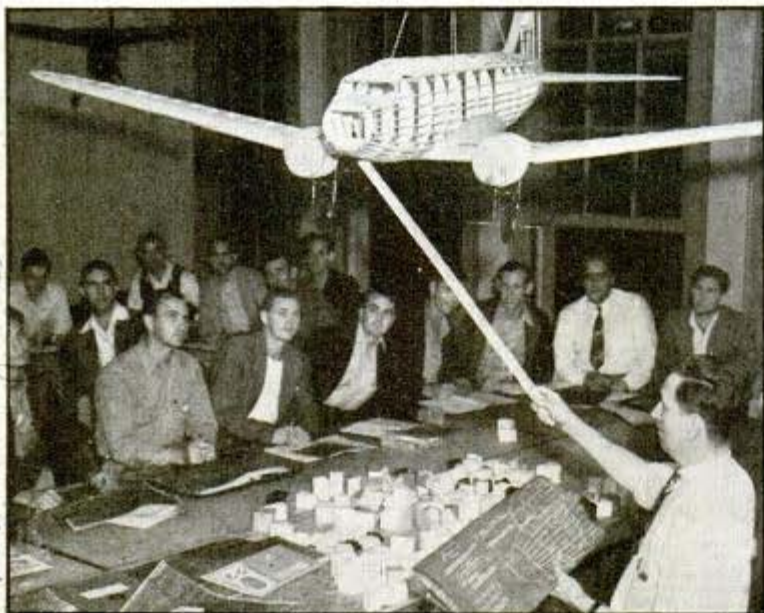
Last year motorists stalled on the road called for emergency help on an average of about 1 1/4 times each, which, notwithstanding the fact that better cars are being driven, is 13 percent more calls than were made during the previous year. These figures are based on a survey of 27,300,000 registered passenger automobiles which

the Illinois Automobile Club reveals were rescued 35,000,000 times by garage men. Tire failure was the largest individual cause of breakdown, accounting for 9,667,823, or 27.6 percent, of the calls. Battery trouble held second place, being responsible for 5,034,960 calls. There were 1,520,000 calls from motorists who ran out of gas.

R1287

TEST-FLYING PLANES

Capt. Andrew Hamilton, 10997 Wellworth Ave West Los Angeles

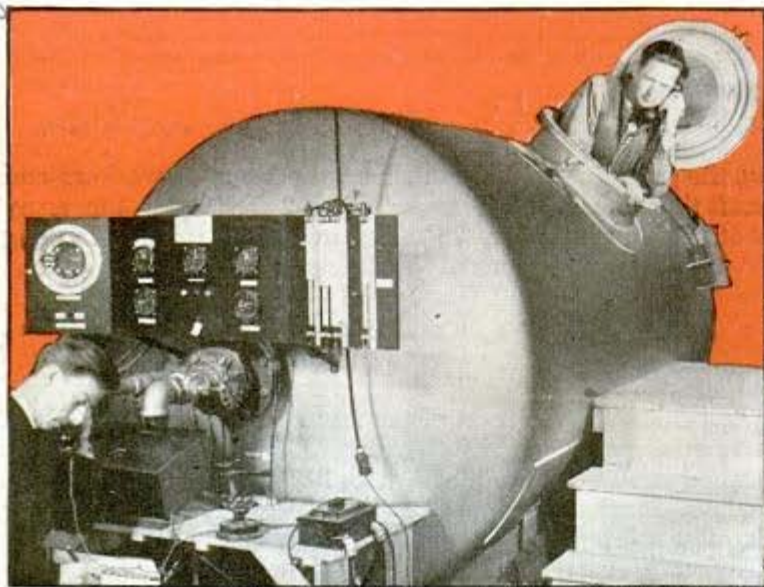


Top, Douglas engineer demonstrates at Santa Monica vocational school how blueprints are translated into construction of airplanes

plane, every fighter and bomber and civilian fence-jumper.

Research is little publicized for most of it is secret. But it is becoming more important each year. Last year American plane, propeller and engine manufacturers spent more than \$15,000,000 in research, and this year's bill will be higher. This means that while American aviation has stepped up into mass production with a goal of 50,000 planes a year, it is not neglecting quality.

Some phases of research are dramatic stuff. A "hard-as-nails" pilot diving a silver test ship straight down at 575 miles an hour and pulling out in a blinding nerve-racking "7-G" dive is



Sub-stratosphere tests are conducted in this tank, which can reproduce almost any kind of atmospheric conditions

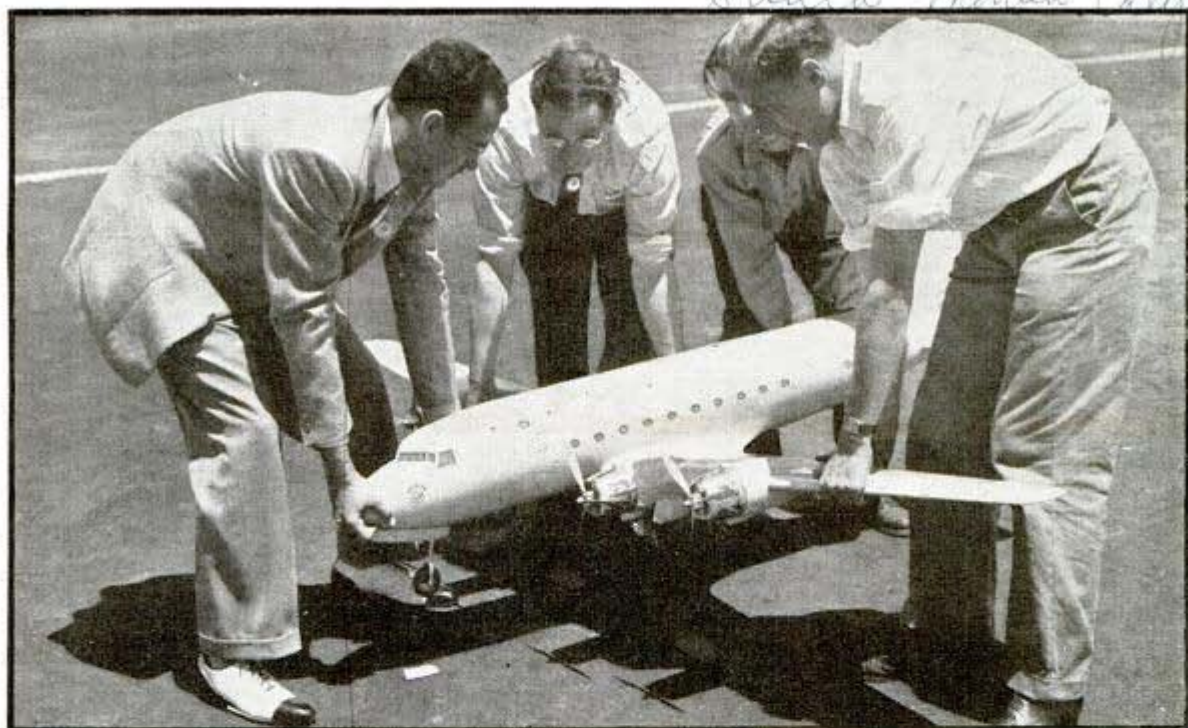
AMERICAN planes are rolling out of the factories and into the air at a rate beyond the maddest dreams of aircraft builders two years ago. But that is not what they boast of today—they boast that our planes fly faster and safer and maneuver with greater ease than any other ships in the sky.

Why? Because thousands of hours and millions of dollars in research lie back of every transport

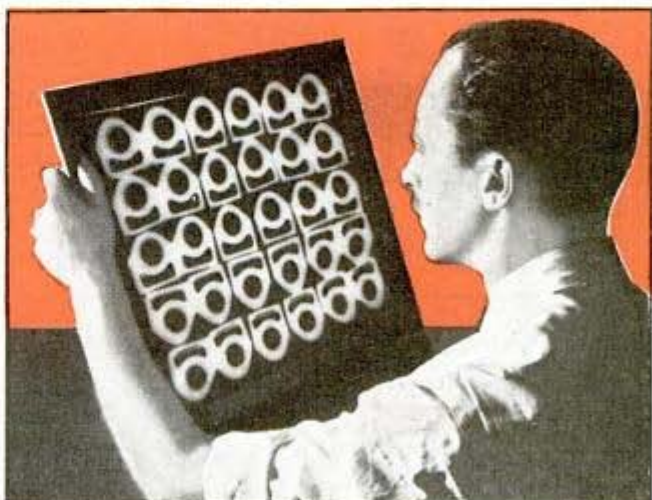


Above, part of the huge machine used to test landing gear. This gear must withstand violent shocks without impairment

Douglas Aircraft factory
K 1287
BEFORE they are BUILT
Santa Monica Calif



Built to pre-test the Douglas DC-4 transport, the wind tunnel model has four electric motors, each developing nearly 15 horsepower at 16,500 revolutions per minute. It weighs over 400 pounds, cost \$20,000



Hidden flaws in metal which might result in failure at a critical point are discovered by the X-ray. At left, an engineer prepares metal parts for the X-ray inspection; at right, examining an X-ray plate

dramatized by the movies and the fiction magazines. But the major part of research is slow, patient, cold and scientific. It consists of engineers over drafting boards, of craftsmen building models, of skilled mechanics with delicate testing machines. Planes and parts are subjected to "torture tests" to prove their dependability. Some

of these tests are performed in the air, but for the most part they take place in the laboratory.

Ten years ago airplanes were built on the general principles of a bridge or a skyscraper. Engineers knew approximately what load a certain type of structure could carry. A few minutes figuring with pencil,

K1287



Above, assembly line at Douglas Aircraft plant where more than 15,000 men work around the clock

paper and slide rule would give the answer.

That was when planes were built with an internal skeleton—an endoskeleton as the biologist would say. When sheet metal replaced fabric on wings and fuselage there came a revolution in the methods of building. The weight-supporting structure was no longer on the inside but on the outside of the plane—the exoskeleton. This gave birth to a host of new engineering problems.

Old formulas for stresses and strains were not enough. New kinds of structural and aerodynamic engineering were needed and this fund of knowledge could only be created by testing to see what would happen. Right then the research departments of America's airplane companies began to develop.

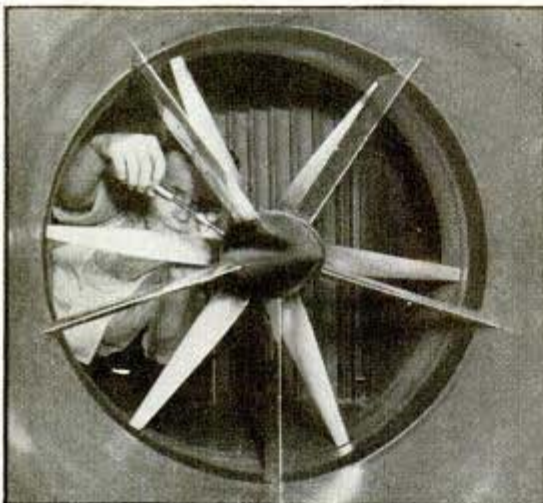
The engineer is always on the lookout for ways of decreasing weight and increasing horsepower; of reducing landing speeds, since wing flaps seem to be approaching the limit of their usefulness. He thinks of high-altitude flying with its problems of "pressure cabins" and supercharged motors.

One of the most closely guarded divisions of any aircraft plant is the shop where small-scale models are constructed. The model is subjected to every test engineers can think up. In the wind tunnel every

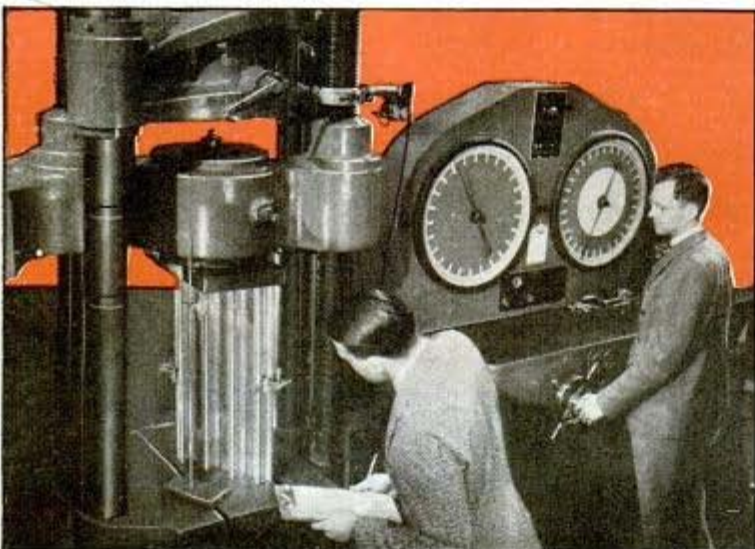
type of air condition is duplicated so a plane's take-off, maneuverability and landing can be checked. Wind tunnels are costly and there are not many. Among the best known are those at California Institute of Technology, University of Washington, University of Michigan and Massachusetts Institute of Technology. The National Advisory Commit-

Huge machines like that at left tell engineers how metal parts will stand up under the severe torture of actual operation

Burbank, Calif.



The small wind tunnel propeller, above, is part of Lockheed Aircraft company research laboratory



K1287

P567

tee for Aeronautics maintains wind tunnels and research facilities at Langley Field in Virginia and Sunnyvale Field in California. The U. S. Army has extensive laboratories at Wright Field. And finally, several of the large aircraft manufacturers have their own wind tunnels.

Test piloting still has its place in the development program, but today's test pilot is not the legendary daredevil. He has to be an engineer because he must know not only what a plane will do but why.

The old-fashioned way of testing was to build a new plane and see what happened in the air. Today the engineers tell how it will perform by looking at the laboratory statistics. That's why "torture tests" are more important today than test piloting. Static testing utilizes vast machinery and delicate instruments. Wing sections are pulled apart in huge presses, fuselage sections are twisted and landing gears are dropped. Gasoline tanks are shaken until seams split. Rivets are broken, metal is twisted like rubber. Whole planes, sitting in jigs, are loaded as if power diving in a tornado.

If the planes "can take it" in the laboratory, the engineers know they will stand up in a storm over the Rocky Mountains or a dogfight over London.

Full-sized sections of planes are attached to huge test columns capable of withstanding 2,500,000 inch-pounds of pressure. With a complex set of hydraulic jacks the section can be put under compression, torque, shear and tension—each stress being recorded simultaneously on a set of dials and gauges. New sections are tested with their normal load, then overloaded until something gives way.

Since vibration might cause failure of certain parts, vibration tests are important. Special machines have been developed to determine the natural frequencies of various parts to make sure that these frequencies will not correspond with each other or with frequencies of a moving part such as the engine or propeller. Every structure has a frequency at which it will vibrate violently with very little force being exerted upon it—like a piano string which vibrates if a tuning fork of the same pitch is struck nearby.

Many airplane parts are given fatigue tests—alternately loaded and unloaded many times until they break, just as a wire

(Continued to page 186)

Back-Seat Awning for Taxi Shields "Fare" From Sun



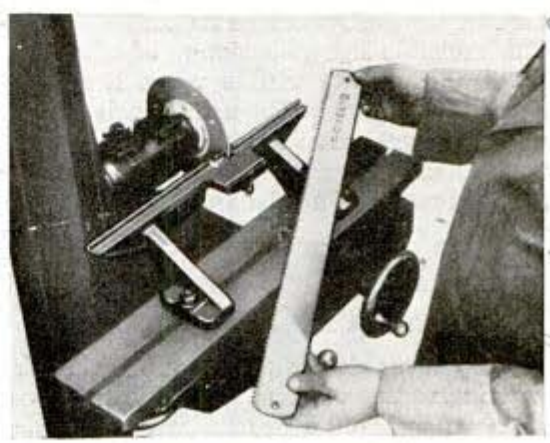
Taxi awning shades passenger in "open air" seat

Taxicabs sporting open roofs over the rear seats have been fitted with awnings for the comfort of passengers in summer. The hot noontime sun beating down on the seat and passengers gave rise to complaints which the cab companies in New York and Chicago decided to allay with the new gaily colored awnings.

L525

Sharpener for Hacksaw Blades Reduces Replacement Costs

Hacksaw blades can be sharpened repeatedly with a powered grinder now on the market, saving as much as 80 to 90 percent in blade cost. The cutting efficiency of even some new blades can be doubled by sharpening them before use, according to the manufacturer. An index pawl, to which the blade is attached, assures even tooth spacing, and it is possible to grind blades with broken teeth.



Hacksaw-blade sharpener has guide for spacing teeth

Yellow Checker
Muncie, Ind.
Industrial Engineering Co. Inc.
430 1-Herzberg Dr.

2689

New Center Bldg
Detroit, Mich

Invisible Lamp for Blackout Illuminates Road Signs



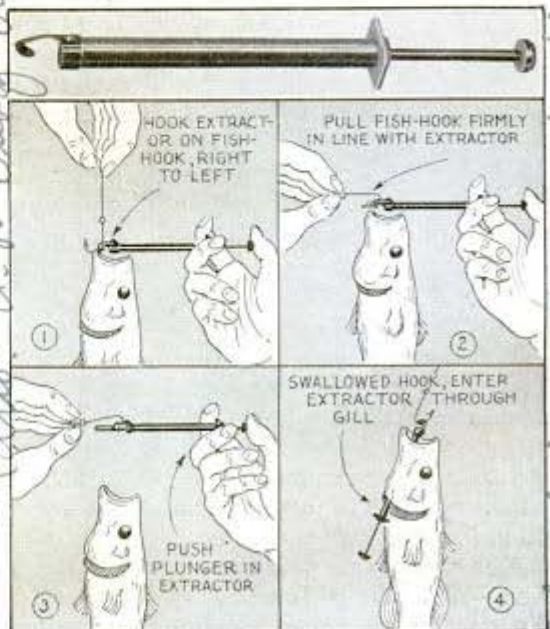
Invisible rays from this lamp make road signs readable at night. Reflector points visible rays downward

Suitable for use during blackouts, a new lamp demonstrated by engineers of the General Electric Company, Schenectady, N. Y., gives off invisible rays which will help motorists and pedestrians read road signs, but will not help enemy planes. The lighting unit is a 3-watt Argon (gaseous) lamp which also emits faint visible light of about one candlepower, compared with 4,000 from a modern street light. To prevent detection of stray rays by aviators, the lamp is designed like an admiral's hat. The invisible light, consisting of ultraviolet rays, becomes visible when it strikes fluorescent paints. By using such paints on road signs and illuminating them with the invisible rays, they could be seen by auto drivers, but not from a plane.

ers Association. Besides the several thousand pounds of iron and steel it requires, a 2½-ton military truck, for instance, which weighs about 9,500 pounds, uses 450 pounds of natural rubber, 8 ounces of synthetic rubber, 32 pounds of lead, 30 pounds of zinc, 70 pounds of copper, 20 pounds of aluminum, 55 pounds of manganese, 8 pounds of nickel, 86 pounds of paints, 200 pounds of cotton, 1 pound of wool, 2 pounds of curled hair, 300 pounds of wood, 40 pounds of glass, 18 pounds of paperboard, 4 pounds of plastics, 64 pounds of grease and oil and more than a pound of castor oil for brake fluid. Some magnesium, molybdenum, chromium, platinum, tungsten, tin, asbestos, cork, sulphuric acid, jute, shellac, graphite and other materials are used.

Safety Extractor for Fish Hooks Protects Fisherman and Fish

Fish can be taken from the hook without handling either the hook or the fish, by means of a tubular brass "pencil" just introduced. The fish hook is engaged by the hook of the extractor, then the line and extractor are pulled taut in opposite directions while the brass plunger is pressed with the thumb. The fish drops off into the boat or the water, as desired. There is no danger of pricking or even soiling the hands, and the extractor is described as an aid to conservation since undersized fish can be returned to the water unharmed.



Pressing plunger releases fish from hook unharmed

Forty Different Raw Materials Used in Military Trucks

Into the making of each scout car, truck, reconnaissance car and other military vehicle go some 40 different raw materials, according to the Automobile Manufactur-

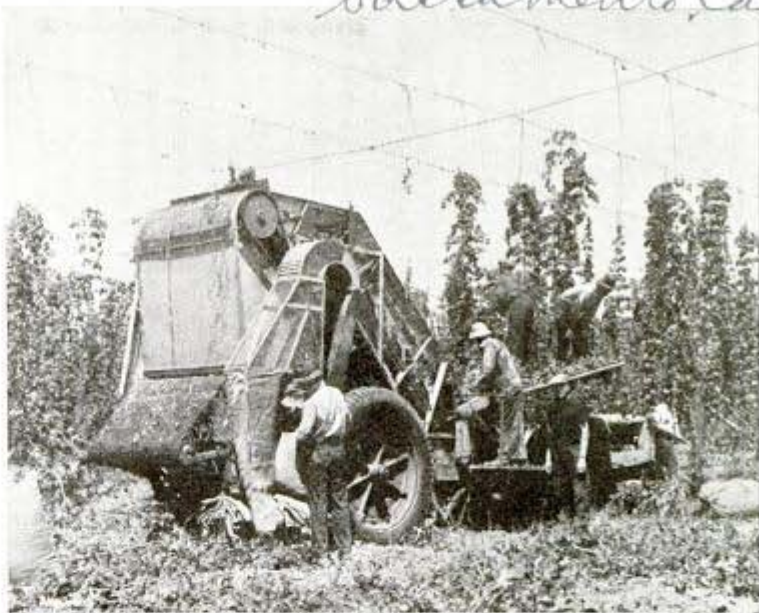
New York Times
April 5, 1941

Subs, 617-12th St. Wash, D.C.

*L629. Thys & Muller
Route 2, Box 650
Sacramento, Calif*

Eight Men on Hop Picker Replace 100 in Field

Following last season's successful tests with a tractor-drawn hop picking machine in the state of Washington, 27 of the mammoth machines are being used on approximately 1,000 acres in the Yakima Valley hop lands to replace hand labor. Eight men operate the "moving stairway on wheels," accomplishing as much as 100 hand pickers. One man walks ahead of the tractor and cuts the vines about three feet from the ground. The "pullers," stationed on the platform, pull the vines from the trellises and pass them to the "feeders," who stand facing each other waist high to the platform. The feeders, in turn, clamp the lower ends of the vines to moving parallel bars extending crosswise, which drag the vines upward over a moving bed of wire picking



Mechanical hop harvester, drawn through the field by tractor and fed by eight men, does work formerly requiring the services of 100 hand pickers

fingers. At the top of the incline the vines disappear into a maze of moving belts, fans and brushes. There they are again combed to remove all the hops, which are shaken and sifted free of leaves, stems and dirt.

"Pilot Buggy" Trains the Reflexes of Fledgling Airmen

Ten thousand fledglings of the U. S. Army air corps may make their first "flights" on the ground in a "pilot buggy" developed

at Wright Field, Dayton, Ohio, and already in experimental use at Barksdale Field, Shreveport, La. This pre-flight reflex



Cockpit of the "pilot buggy" banks and tilts in response to standard airplane controls, giving the pilot effective "flight" training on the ground

trainer is a motorized scooter equipped with regulation airplane seat, controls, joystick, rudder pedals, throttle, brake, and .22-caliber gun firing blanks. Its cockpit is suspended so that it responds to the controls, banking, nosing up and down and simulating actual flight conditions while taxiing over the ground. A horn connected with a bank indicator sounds if the student commits an error.

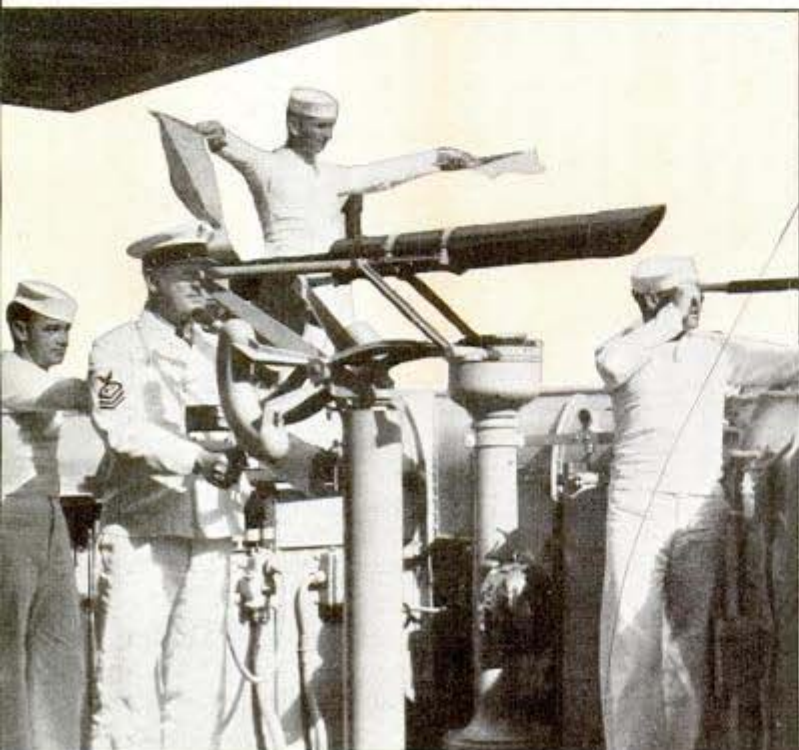
American petroleum companies produced 3,500,000 barrels of oil daily in 1940 from 375,000 wells.

*Charles F. Bauer
Klaxon Journal*

BUILDING TOMORROW'S NAVY



Planes fly above the fleet to spot enemy and drive off bombers
One man signals with semaphore while another watches reply



By
Lt. Franklin G. Percival

U. S. Navy, Retired

RACING against time to build a navy supreme over two oceans, the United States is learning lessons swiftly from the war in the Atlantic, the North Sea and the Mediterranean. For the first time naval observers have seen the ocean raider challenged by the aircraft carrier, the battleship challenged by the bomber, the plane itself challenged by the anti-aircraft cruiser.

Changing methods are multiplying the new forms of specialized craft. Navies are built for tomorrow, not for today, and America—with long seacoasts to defend and wide oceans to cover—must look far ahead to design her navy against the weapons of the future.

Battleships must be bigger

than ever to provide superiority in either armament or protection, preferably both. The tragic consequences of sacrificing armor to gain speed were shown in the destruction of the British Hood, and in the heavy losses among thinly-armored Italian cruisers. Superiority in striking and resisting power can best be obtained by reducing the designed speed, for the battleship is built to fight, not to run. Its primary task is to damage the enemy and make him retreat. Subsequent pursuit can be executed better by light surface vessels and aircraft, as was seen in the crippling and sinking of the Bismarck. Her loss further illustrated the need for improved underwater protection, especially around rudder and propellers.

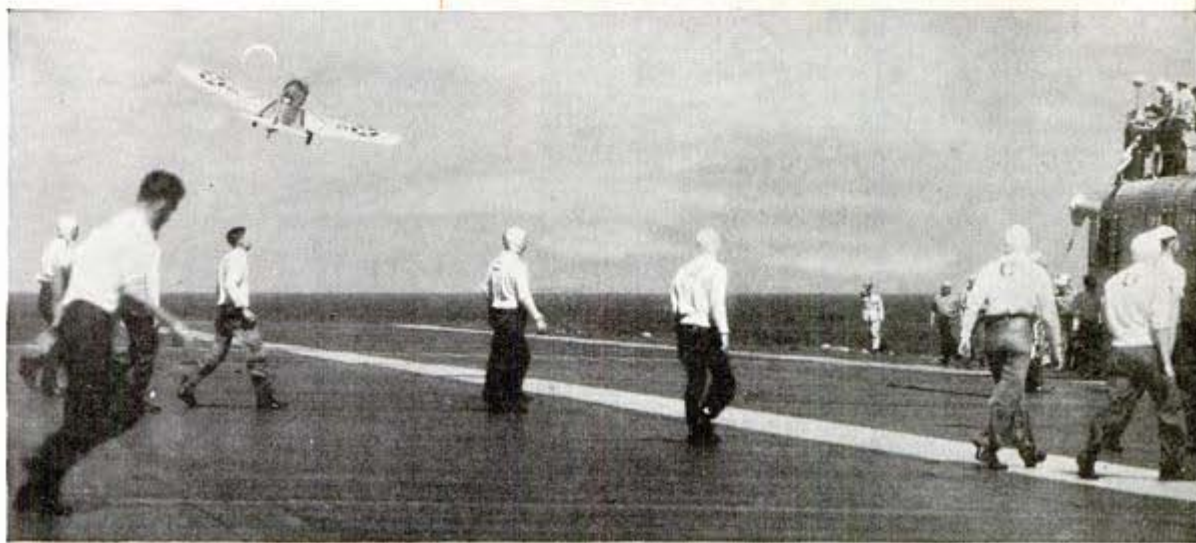
In our case the demand for ship-for-ship superiority is especially great, because no enemy is likely to cross an ocean to attack us without marked superiority in numbers. To offset this, we need not

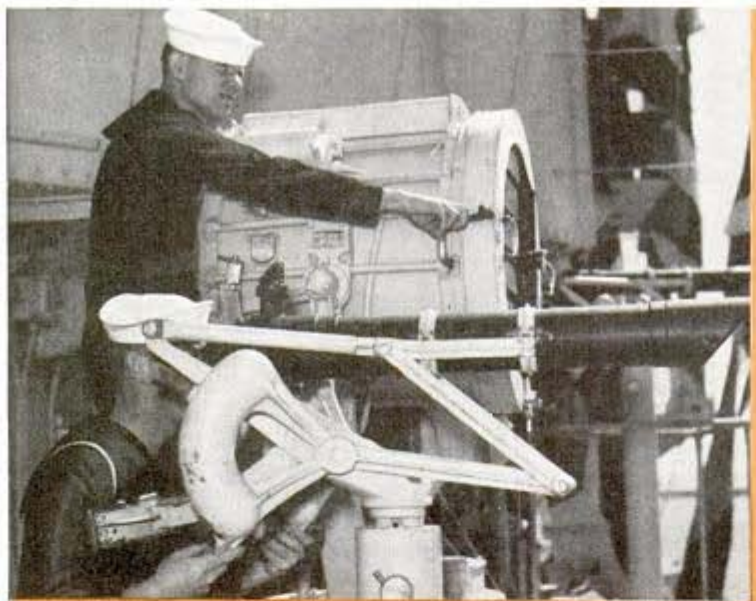


Feeding shells into the "pom poms" of a Polish destroyer with the British fleet. These multiple rapid-fire guns can fling a tremendous weight of metal into the sky to drive off enemy bombing planes



Looming above are the 14-inch main turret guns of the battleship Pennsylvania, completed in 1916 and long the flagship of the fleet. Below, a plane climbs away from deck of aircraft carrier Lexington





Signaling with a blinking searchlight aboard an American naval vessel

only units of greater striking and resisting power but also strategic bases from which light forces and aircraft can reinforce our fleet. In this respect our greatest need is for bases from which we could intercept any thrust from Africa to South America.

Our battleships must also be tough enough to face the air fleets of 10 and 20 years hence, and so must carry perhaps double the anti-aircraft guns and ten times the anti-aircraft ammunition of present vessels to withstand a week-long attack by enemy planes.

The outstanding innovation in naval design during this war has been the anti-

aircraft cruiser, a specialized ship whose every gun is an anti-aircraft gun. Its major task is to defend merchant vessels and aircraft carriers against air attack. It can also be used for reinforcing destroyer flotillas or other especially vulnerable units.

First vessels built from the keel up as anti-aircraft cruisers are those of the British "Dido" class, 5,450-ton ships mounting ten 5.2-inch guns, sixteen 40-millimeter automatic guns in octuple mounts and two triple torpedo tubes. The 5.2-inch guns are formidable weapons against the high-altitude bomber, and especially effective for breaking up destroyer attacks. They might be slightly out-ranged by six-inch guns of a light cruiser, but the disadvantage is largely theoretical, for the brilliantly fought battle of smaller British cruisers against the Graf Spee showed how smoke screens can be used to compel an enemy to come to close quarters if he wishes to fight. Then, at close range, the higher rate of fire of the 5.2-inch guns more than offsets the lighter weight of their shells.

No fire-control instruments, however, have yet been devised to overcome the dif-

Sub chaser PC 449 has greater freeboard, cleaner lines than similar world war boats

Three 1,350-horsepower motors drive the torpedo boat PT-10 a mile a minute in calm water, 40 knots against 15-foot waves



L. 35.2

Right, on the bridge of one of Uncle Sam's newest destroyers

difficulties of hitting so small and mobile a target as the airplane. Despite progress since the world war, a tremendous weight of metal is still thrown into the air for every airplane destroyed. Ten planes are shot down by fighters for every one downed by anti-aircraft guns. How to direct more accurately the tremendous fire of anti-aircraft guns is an urgent problem for American inventive genius.

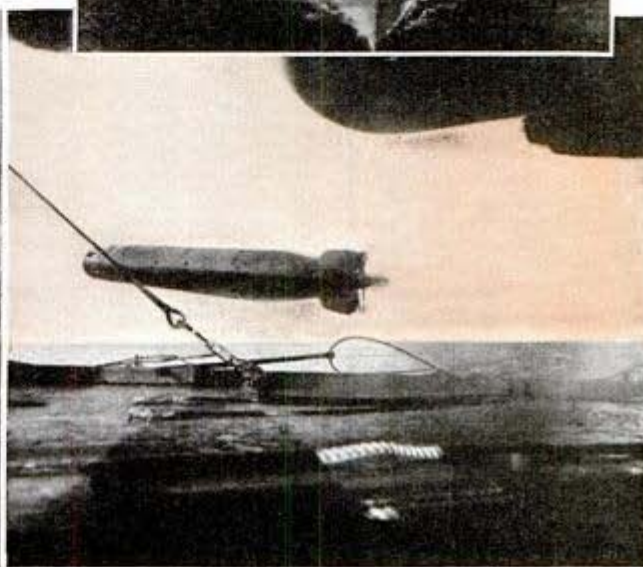
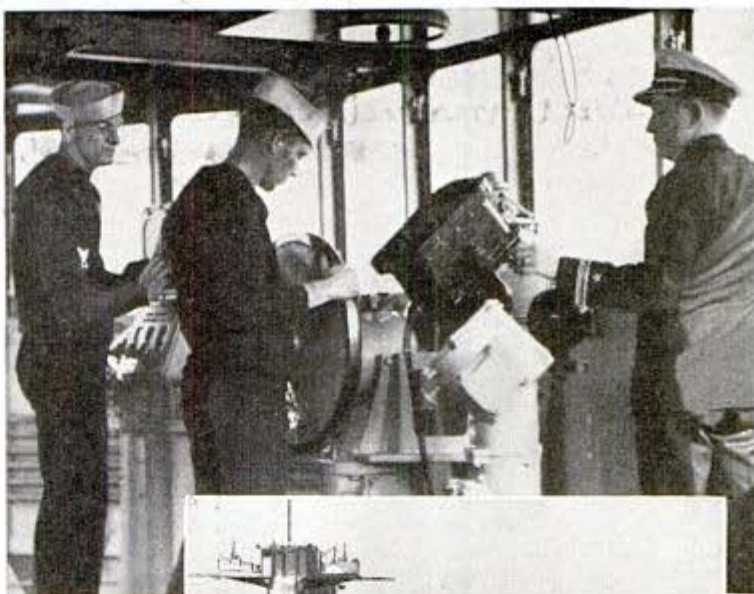
It was primarily to offset this inaccuracy that the British developed octuple mountings for 40-millimeter automatic guns—eight guns with bores slightly diverging to deliver a cone-shaped stream of two-pound shells. This is more effective for the same reason that a shotgun is better than an air rifle for shooting ducks. If enough eight-gun mountings had been available on the ships which encountered

(Continued to page 164)

Right, a view from just off the bow of a carrier, its flight deck crowded with planes

At lower right, a torpedo launched from a Polish destroyer starts out on its deadly errand

U. S. heavy cruisers churn the water in white arcs as they maneuver in battle formation



2685
 "Bug House" Is G. H. Q. for the War on Insects



Flies buzz busily in the lethal chamber above until a scientist comes along with an air gun and shoots insecticides through the ports. Later the results are evaluated

Brasselli
 Apples on a merry-go-round receive a dose of spray in a test of the effectiveness of chemicals on eggs of the codling moth. This is one detail of a research program under way in a new laboratory of the du Pont company at Wilmington, Del., devoted to study of insecticides, fungicides and equipment for control of pests—termites and algae, rodents, barnacles, the Japanese beetle, bacteria, weeds and worms. Bugs are reared in incubators to be slain experimentally. Controlled light, temperature and humidity are provided in chambers where chemicals are tested



Carbon-arc lamp in greenhouse of pest-control laboratory is science's nearest approach to sun



Flies are raised in captivity in "fly farm," left, to be sentenced to death in the interest of science

2426 Capt. Thomas E. Stinson Jr.
3872 Franklanes

PUTTING the MOVIES to WORK

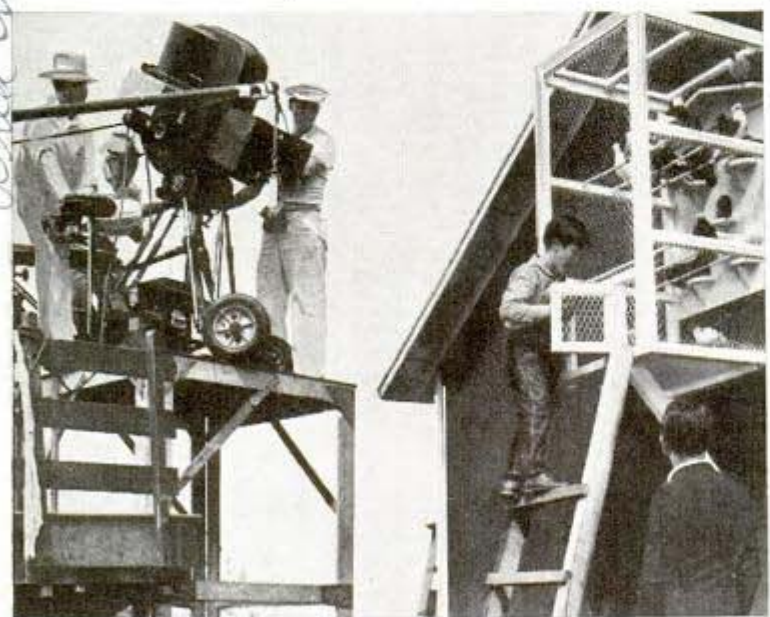
Clair Booth
Washington
D.C.

Los Angeles



With an 8-millimeter Filmo camera equipped with 16-inch lens surmounted by telescopic rifle sight, this amateur shot "closeup" movies of the moon

Efficiency in modern mass production is attained by time-motion studies. Here camera records actions of worker gathering and wrapping packages



Shooting an exterior scene with sound movie camera enclosed in a "blimp"

forming operations and these delays increase the time that patients spend on the operating table. Motion pictures of operations, made by Allan H. Mogensen of New York, revealed the lost motions and pointed a way for surgeons to work faster, reducing the mortality rate.

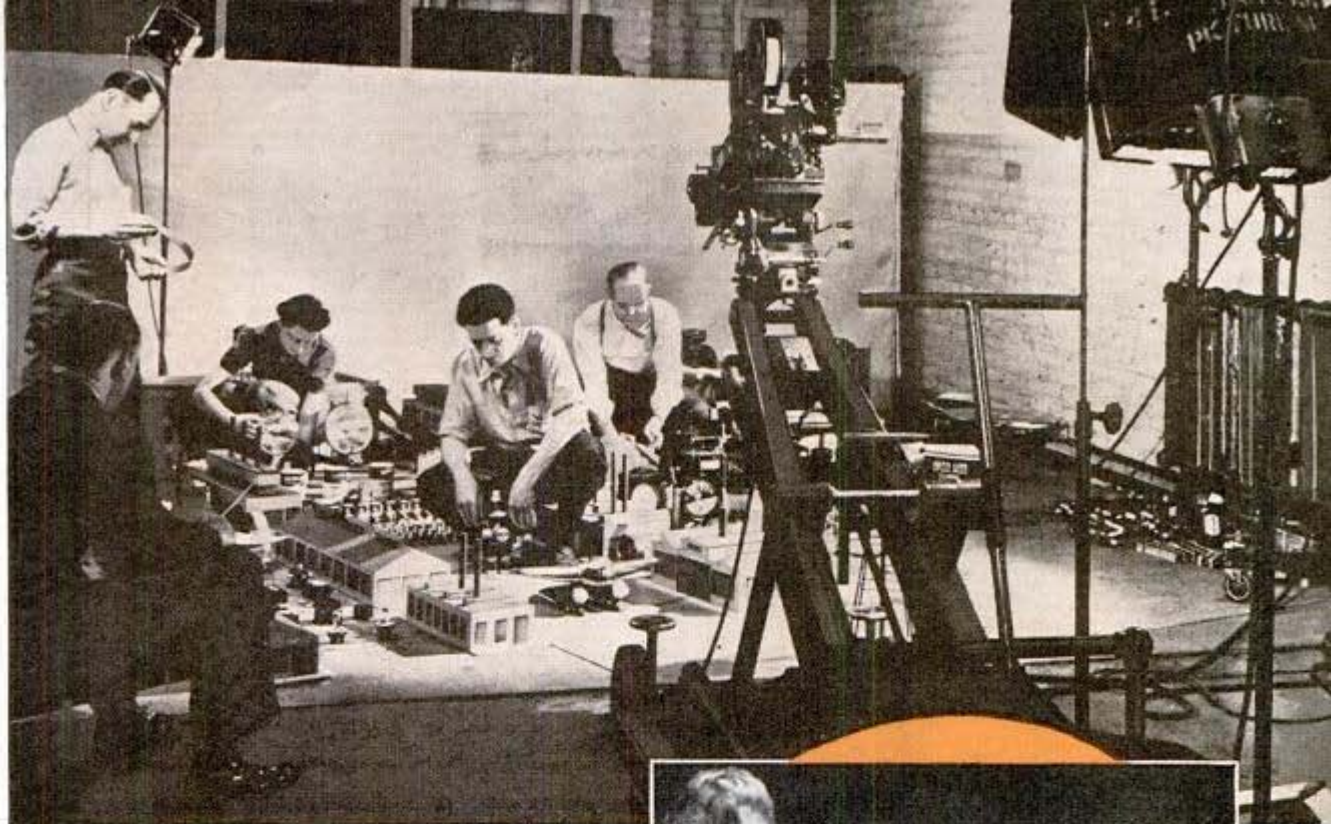
Motion pictures made of paralysis victims are studied by doctors so that the right correctional exercises can be worked out, and progress pictures that record the improvements that such victims are making, shown to the patients, buoy their morale and confidence.

MILLIONS of dollars a year are being spent on motion pictures that will never be exhibited in theaters—movies that are saving lives in hospitals—training the Army, speeding up national defense, and selling goods for manufacturers.

Surgeons unknowingly make unnecessary motions with their hands while per-

The "bottleneck" of an important defense industry lay in a handwork department but nothing could be done about it because the employes were already working at top speed. Slow-motion pictures of the process showed that the workers were using one hand more than the others; this led to a new technique in which both hands

Ref: Don Weed, Bell-Howell Co. 716 N. 1st St. Los Angeles, Calif. Area Cal.



2926
 Miniature set is animated by moving objects an infinitesimal amount before each frame is exposed

At right, a tennis professional makes slow-motion pictures with his Filmo to correct his pupil's errors

are employed equally. Production was stepped up and the work was made easier at the same time.

Another defense industry was faced with the problem of creating skilled mechanics out of thousands of untrained workers in the shortest possible time. By ordinary training methods this would take more than half a year but now employees who have been on the job only a couple of months are earning full pay. They "crammed" by studying motion pictures that show in detail everything that they were to do and these pictures were run off time after time until the beginners were letter perfect. Nearly every mechanical procedure has a knack to it that had to be learned by experience alone before the camera was adopted.

To help sell tractors, a movie of the machine at work is made with a Bell & Howell professional camera mounted on top of a truck which serves as darkroom



every 10 cmc





One company uses industrial movies to dramatize selling of shoes. Here is a production scene in a shoe store

Production of everything from typewriters to airplanes is being stepped up by time-motion studies made with motion pictures. The purpose of the research is to make an employe's work easier so that he accomplishes more while using up less energy. One unexpected conclusion reached from micro-motion studies is that the keys of the standard typewriter could be rearranged much more efficiently, although this probably will not be done because hundreds of thousands have already learned to use the present keyboard.

Whenever one concern that has numerous branches throughout the country develops at one of its offices a new and better way to do something, it makes a motion picture of the process and rushes prints to all its other branches. That way, each unit can adopt the new method at once. The camera sits in when a new product is being designed and time-motion pictures are made and compared so that the most efficient design from the manufacturing standpoint can be determined. Movies are likewise used to help estimate the probable production costs so that the manufacturer can decide selling prices.

In many processes the hand is quicker than the eye and it takes the camera, set at slow motion, to pick up the action. Research based on motion pictures has led to the designing of better tools, to laying out work in the most logical manner, and to changing the height of working tables and equipment to more comfortable levels.

At the California Insti-

Mounting camera for an exciting closeup of a speedboat race



L426

tute of Technology, Prof. Robert Gray has adopted the camera for time-motion research and for industrial training in the defense engineering classes that have been organized to stimulate production of essential war materials.

Educators have been using motion pictures to supplement book instruction for a long time and they have been dreaming about the time that "motion picture books" could be used in the class room. This ideal is closely approached in a new course of instruction that is being used to train airplane pilots and ground crew personnel. Produced by the Jam Handy organization of Detroit, the course consists of 2,000 photographs and drawings, accompanied by explanatory sentences, that are arranged on slidefilms and thrown on a screen one at a time from a small projector. The films give a pilot's-eye view of aerial traffic, explain the new radio procedure, and show the inner workings of flight instruments. Each phase of aviation is covered and students who have been trained by the method average higher grades than those given ordinary instruction.

Industrial films that explain how such substances as glass or soap are made and that are intended to promote good will as well as to educate have grown in scope and importance in the last few

(Continued to page 177)

Filming a surgical operation with special lighting arrangements for use in medical education

Bell & Howell photo



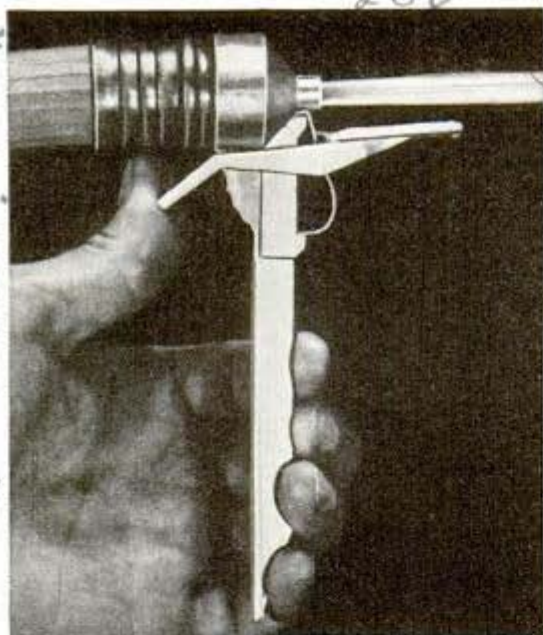
California Institute of Technology films time-motion study; arcs on table show worker where he should use each hand. Below, war canoes in tank for miniature shot; wires will be invisible in after-dark scene



L 522.

Baffle Varies Hose Stream At Touch of a Lever

256



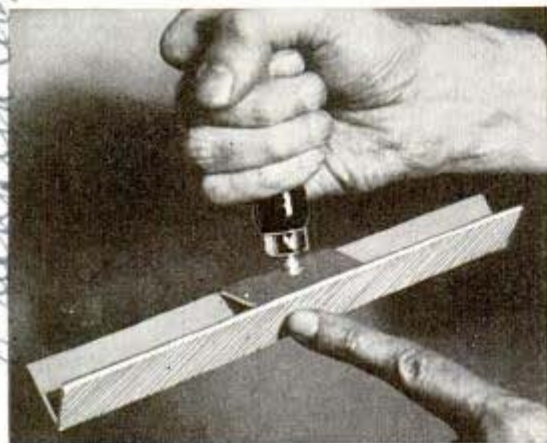
After adjusting spray with thumb lever, hose can be set in place by thrusting upright post into ground

Fingertip control of a hose nozzle varies its water delivery in five positions from a forty-foot stream to an eighteen-foot spray for sprinkling. Pressure on a lever adjusts the front plate to intercept the stream at various angles, changing the degree of the spray. The nozzle can be held in the hand or stuck in the earth.

Hand File With V-Shaped Blade Smooths Welded Angles

L 409

Made in one piece, a V-shaped file with cutting faces set at right angles is designed



V-shaped file cleans inside angles of welded pieces

to smooth the inside angles of metal parts. It is particularly useful in cleaning out weldings where two metal pieces have been joined at right angles.

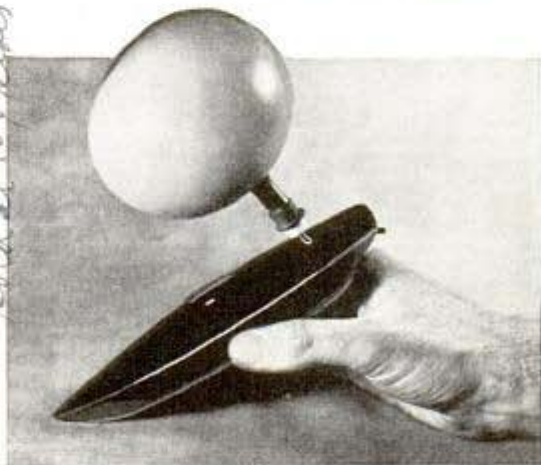
L 498

Electricity as Latest Anesthetic Causes No Ill Effects

Conducting research with animals at University of Chicago, Dr. Maurice L. Silver and Dr. Ralph W. Gerard have produced anesthesia by electricity, without the help of chemicals and without the after effects usually experienced. Application of direct, uninterrupted electrical current to the spinal cord rendered frogs, rats and dogs completely unconscious. The current is of extremely low amperage, and can be administered in a way to cause little or no sensation. Microscopic examination of the nerve tissues showed no damage and blood pressure, pulse rate and breathing were not affected. While no attempt has been made to produce complete anesthesia in human beings by means of electric current, it has been used locally, as in the forearm for operations on the hand.

L 468

Toy Balloon Propels Tiny Boat By "Compressed Air" Blast



Air from toy balloon is ejected from tiny pipe at stern, thus propelling the little boat over the water

Compressed air of a toy balloon is used to drive a toy boat to which the balloon is fastened by means of a wooden fitting. The tiny speedboat is placed on the water, the balloon connected to a small brass pipe near the stern, and as the balloon deflates, air is forced out the pipe at the rear of the boat, sending it speeding over the water.

List: Butler Bros.

Ballard Co. 1141
Franklin Ave. Columbus
Ohio
Thomas Product Co. 1547
Indiana Ave. Elkhart, Ind.

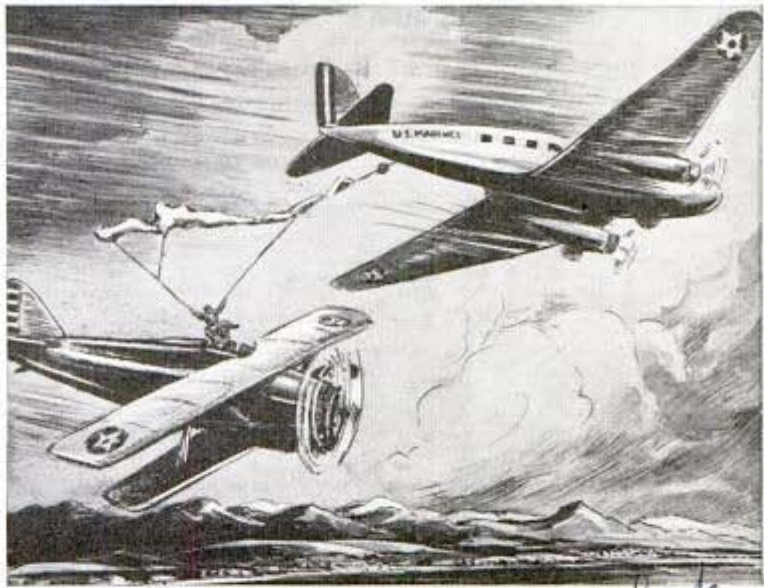
Chicago Daily News 1/18/47
L 409
L 468
L 498

Jerry City, Mo.

2641.

Pilot's Skill Saves Parachutist Dangling in Air

Precision flying by a navy pilot was all that stood between life and death for a marine corps lieutenant recently as he dangled, head down, in midair, his parachute fouled in the tail assembly of the marine transport plane from which he had bailed out. In the dramatic rescue, a "Hell Diver" bombing plane served as life saver instead of an instrument of death. Lieut. Walter S. Osipoff of Akron, O., had jumped from the big transport near San Diego, Calif., in parachute exercises of the marine corps. Tangled in the shrouds, he could not be hauled back into the plane and its pilot flew over North Island naval station to attract attention. Navy Lieut. W. W. Lowery of Dallas, Tex., and a machinist's mate took off in a dive bomber, and Lowery maneuvered the smaller craft upward until the mate, J. R. McCants,



After dangling head down for a half hour, caught by the shrouds of his parachute, the marine lieutenant is pulled into cockpit of rescue plane

could seize the helpless Osipoff and drag him partly into the cockpit. Skillful flying was necessary to avoid striking Osipoff with the propeller, then Lowery had to climb within two feet of the transport to cut the shrouds with his whirling blades. Then he landed safely.

"Low Bridge" at Entrance to Zoo Halts the Grown-Ups

There's a special zoo for the youngsters at Bronx Park in New York. Grown-ups are not absolutely forbidden, but they're

officially discouraged and if the old folks insist on coming in they'll have to look out for themselves. At the entrance there is a "low bridge" under which children can walk easily, but five-foot giants must do considerable stooping to get past. Inside, the children make the acquaintance of guinea pigs, dogs and cats and pigs, and learn how to pet them. Among other amusing exhibits is a hickory dickory dock clock, and a mouse actually runs up it.



Youngsters romp through gate to children's zoo, but grownups must stoop if they enter

clut.

Mr. Raymond F. Gates 190 Windmere Road
Lockport, N.Y.

DINNER TABLE SCIENCE

Below, "Props," two ordinary water glasses and a match. The glasses are telescoped and given a slight twist, which will insure that one remains within the other when they are inverted. By slightly warming the outer glass with the heat of a match, it expands sufficiently to let the lower glass drop to the table. A simple after-dinner trick!



Borrow an egg from the kitchen and drop it into a glass of water. It will sink to the bottom. By adding sugar to the water, however, you can bring the egg to the surface and make it remain there or float it halfway between top and bottom, according to the amount of sugar dissolved. About three teaspoonfuls suffice to bring the egg to the top

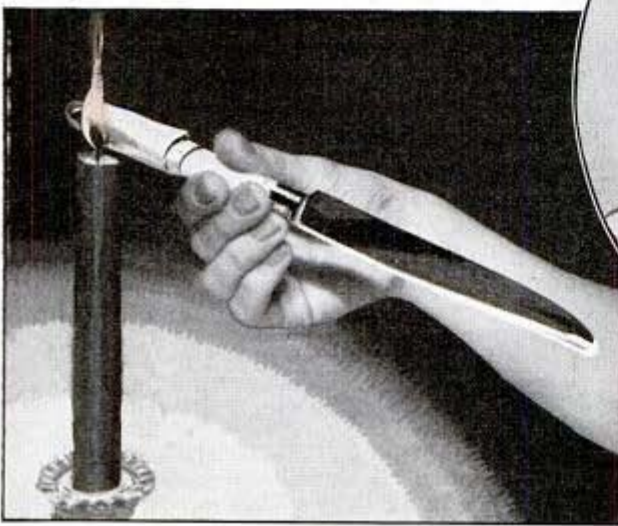
Inertia is sometimes described by physicists as the "laziness" of matter, its resistance to sudden motion. It can be demonstrated at the table by placing a coin on a napkin laid over a glass turned bottom up. Holding the other end of the napkin and striking it sharply near the glass, with one finger, the napkin is removed without disturbing the coin



A lump of sugar will suck water upward contrary to gravity because of capillary attraction. However, when two pieces of sugar are held in contact in the position shown, the water will rise through the bottom lump which touches the water in the glass, but it refuses to pass the border line between the two even though they are held tightly together. The tiny air space arrests the upward progress of the liquid



The amateur scientist can fascinate and instruct his friends by conducting a variety of dinner-table experiments in physics that require only the simple materials within his reach—knives, glasses, dishes and candles. Each of the simple experiments suggested on these two pages demonstrates some well known principle of physics. They call for no particular skill, and they offer a bit of entertainment for a few moments after dinner. In the two upper pictures, hot wax from a burning candle is dropped in center of a dish and a lighted candle set on it. Butter is smeared on plate to engage lip of a glass placed over candle. The flame soon dies, having consumed oxygen in glass and created partial vacuum. Then you can lift plate from table, using glass as a handle. Below, paper napkin is wrapped tightly around handle of knife and brought in contact with flame. The paper will neither char nor burn as metal of knife dissipates heat



The glass is filled to overflowing or to the point where, due to surface tension, water rises above lip of glass. Heat applied near lip makes it overflow.

L560

Space-Saving Bed Has Desk And Drawers for Bedding



Writing desk, drawers and shelves built into bed save space that would be taken by extra furniture

Where rooms are cramped for space, as in a small apartment, this bed takes the place of extra pieces of furniture by providing a desk, and drawers underneath for bedding and wardrobe. Made in striking Swedish modern style, it is a single bed, but its size may be increased by placing two units together. The desk includes a pull-down panel that serves as a writing surface, and there are several small compartments for stationery and other supplies. Above the desk are shelves for telephone, radio and clock.

L696

Door Bolt of Breakable Plastic Solves "Locked-In" Problem



Chicago. Carsons

That recurring problem of rescuing children who have locked themselves in a room is solved by a bolt made of a plastic material which can be shattered by a blow from the outside of the door. It can be installed easily on bathroom, bedroom or any inside door where security is not a question. A

Imperial Brass Inc
1200 W. Harrison

metal piece screwed to the frame has a slot into which the plastic bolt fits when the knob is turned. Strong enough to assure privacy, it breaks if the door is shoved vigorously. Two additional replacement knobs are furnished with the set.

L386

Safety Outlet for Gas Connection Fits Flush Against Wall

Fitting flush with the wall, a neat gas outlet, with safety shut-off valve, is now available to take the place of the protruding gas valve. With the new unit, space heaters and other gas appliances can be "plugged in" like an electric cord. The shut-off valve can be opened only by raising the handle, making it virtually impossible to turn on the gas accidentally by striking the handle with a mop or carpet



It's as simple to connect gas stove to this outlet as to plug in electric cord. Note valve handle

sweeper or shoving furniture against it. The unit is housed in a steel outlet box and is connected permanently to the piping system. A hinged cover hides the 3/8-inch connection. Adapters are available for use with rubber gas hose.

USE THIS TIME SAVER

In these busy times people want to get things done in a hurry. That is one reason readers like our new Where-to-Buy-It index. To obtain additional information about any commercially available product described in Popular Mechanics, note the page on which the article appears, turn to the index, starting on Page 4-A, and find the name of the manufacturer or distributor listed under the indexed item. Write directly to the firm listed and to be doubly sure of a quick reply —Say You Saw It in Popular Mechanics.

L612 Cml. Charles G. Bauer
c/o Dayton Journal Dayton Ohio

Air Photos Are Printed in a Gas-Ribbed Tent



Ribs inflated with carbon dioxide support the aerial cameraman's darkroom tent

Its light-tight door flaps are opened to show the photographer developing films

Five minutes after exposed film has been dropped by parachute from an army photographic plane, the finished prints can be handed to a dispatch rider and rushed to the field commander. This "blitz" photography depends upon a portable darkroom developed by the U. S. Army air corps at Wright Field, Dayton, O. Weighing only 50 pounds fully equipped, this unique darkroom is a tent supported by ribs which are inflated with compressed carbon dioxide gas from a flask about the size of a quart bottle. The operator spreads the tent on the ground, applies the flask to the valves of the "inner-tube" ribs, and up goes the darkroom. It has a light-sealed door, and its equipment is also light-sealed. The operator develops and prints the film in the dark. Special tanks, rollers and waterproof paper make drying unnecessary. By this speedy delivery, development and



dispatch of aerial photos field commanders can direct fire at mechanized concentrations before they are out of range.

2553 Racing Cars Burn Charcoal In 250-Mile Swedish Event



Charcoal burner on rear drove this car to victory

At the finish line of a 250-mile automobile race the other day the checkered flag waved down a strange-looking winner. Strange, at least, to Americans, for it was a charcoal burner. The event was the Uppland race in Sweden, where, as in most of wartime Europe, gasoline is precious and substitutes are used in automobiles. On the back of the winning car, a Studebaker, was mounted the charcoal gas generator from which the gas driven off during incomplete combustion is fed to the cylinders. About 12 pounds of charcoal are the equivalent of a gallon of gasoline. There is a loss of about 30 percent in efficiency as compared with gasoline.

*Swedish system
Lara Gao*

see Aug 1941 - 0-42

290

Co Chase and
Milwaukee, Wis.

Nordberg Mfg.
Chicago, Ill.

Waukesha
Motor - C. Waukesha, Wis.



In the engine room of a Santa Fe Diesel-electric locomotive, above, the maintainer removes caps to insert fuel filters. Newest thing on rails is the transcontinental Diesel freighter

Twice as big as a man, the huge connecting rod, right, gives an idea of the size of 12,375-horsepower Nordberg Diesel plant at the Panama Canal. Its crankshaft is 57 feet long

One 60-horsepower Waukesha engine, below, pumps 22 oil wells at a time; rotating eccentrics at central pump are connected to rods running to wells sometimes a half mile away



The AGE of PACKAGED POWER

Part II

By Roderick M. Grant

DROP back a fraction of a second in civilized times to the "gay nineties."

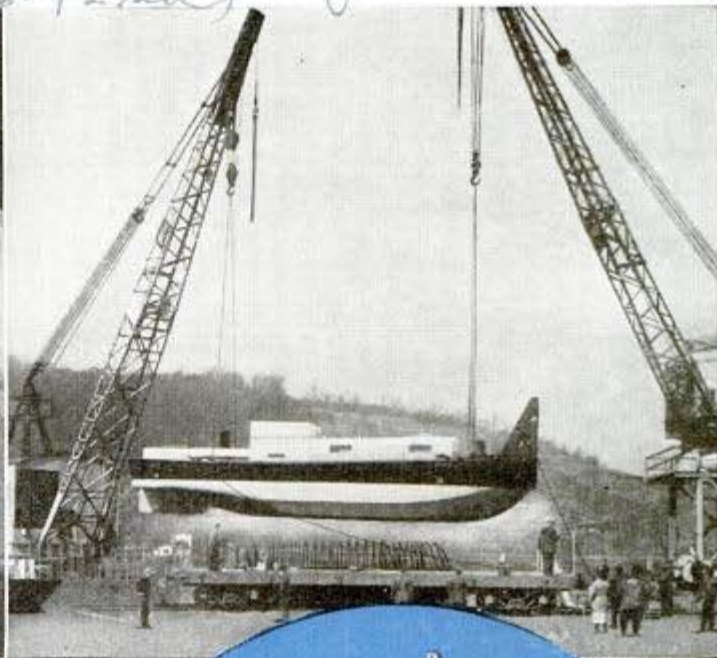
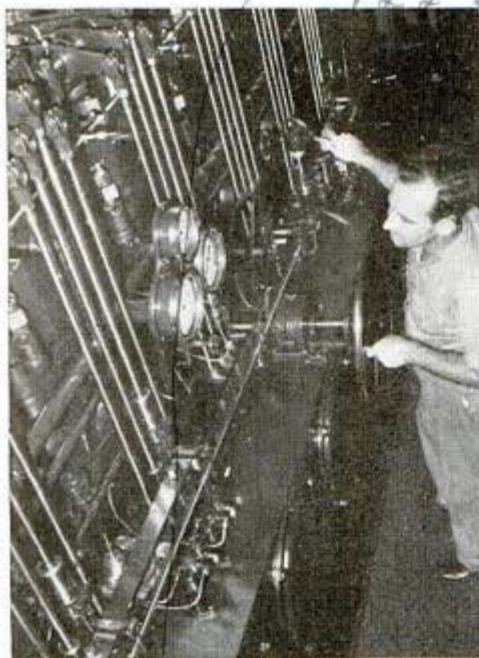
Gay, indeed, but how primitive an existence just fifty years ago! The internal combustion engine was something you read about, but it had not begun to change your world. Stages still rocked across the Bad Lands. Eight-horse teams dragged paddle-wheel reapers through the wheat fields. Kerosene lamps flickered in dim-lit farmhouses, and a trip to town over the mud pike was an adventure. Hard-bitten explorers quested toward the Poles in sailing ships and dog sleds. Submarines were 300 years old, but they scarcely went near the water. Wars, happily,

were penned within the range of a steamship's cruise, an infantryman's endurance, a cavalry trooper's raid. And the conquest of the air still awaited some power plant whose steady, reliable throb would vanquish gravity.

It was in the nineties that the Duryeas built and drove the first American gasoline automobile, and that Rudolph Diesel invented the compression-ignition engine.

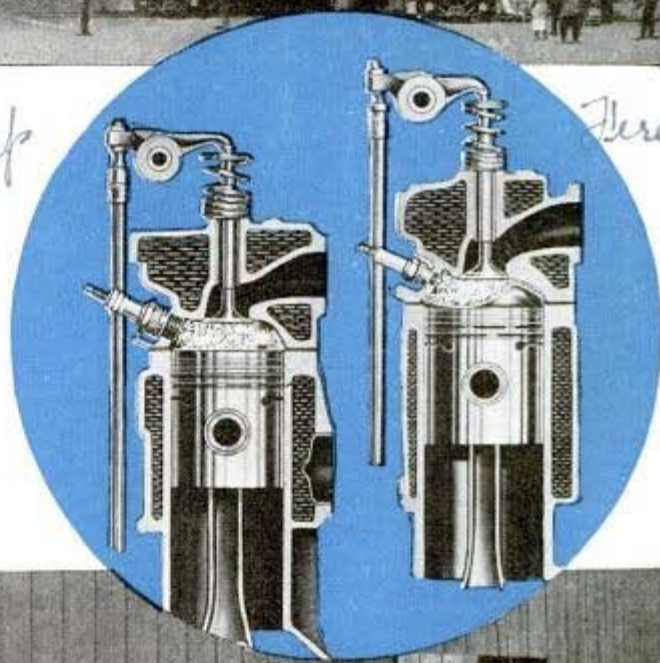
Only a fraction of a sec-

Transport Co. New York 122 E 42nd St. 190.



Above, controls of a Pan American Petroleum tug driven by Atlas Imperial Diesel Tough little towboat (top right) with 125-hp. Waukesha motor rides to job on flatcar

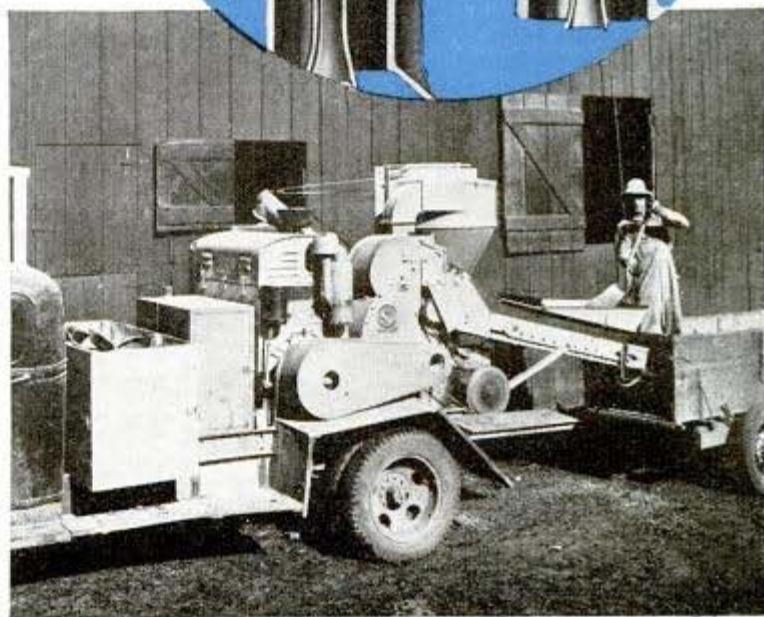
Cross section of conventional piston (left) and new Buick design (right) in which recessed top of piston improves combustion



end of history, but time enough for a revolution in our ways of living. The internal combustion engine has made peace more livable, war more universal, the Poles and the Antipodes neighbors.

Is there any field this explosion engine has not invaded? Railroads are still primarily steam-operated, yet it is the Diesel-electric streamliner that has streaked into the public fancy at 100 miles an hour and recaptured some of the passenger traffic usurped by 26,000,000 automobiles and 55,000 buses and 450 air liners and 14,000 other commercial or private planes. Diesel switch engines, purring steadily at work with only two percent of

Farmers no longer need to haul their feed to the mill for grinding—mobile mills driven by gasoline engines come to the farm



Waukesha Motor Co. 51 Waukesha Wis.



So big is the Boeing 314 Clipper that each of its four Wright Cyclone engines has its own room, accessible during a flight

their time out for repairs, are pushing the old steam kettles right off the calendar.

And the newest things on rails are the gigantic 5,400-horsepower Diesel-electric locomotives, pioneering the long-haul freight business for their breed; and the "pancake-engined" rail cars making their debuts on the Susquehanna and the Illinois Central. The latter introduce the Hesselman engine, invention of a Swedish engineer and built in this country since 1931.

A blend of the gasoline and Diesel engines, it burns anything from gasoline down to tar oils, achieving the overall economy of Diesel operation but having a spark-plug ignition system. Operating at moderate pressure, it need not have the weight of a Diesel; starts as easily as a gas engine and is reliable for high-speed operation. In

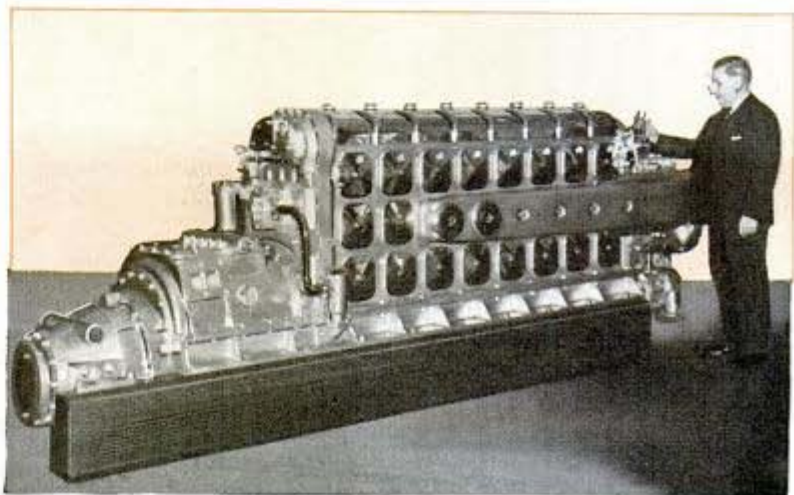
Welding and special steel have halved the weight of this new two-cycle, 8-in-line Diesel for yachts. Weighing 9,000 pounds, it delivers 600 horsepower at 1,350 r.p.m.

these new rail cars the Hesselman twins of 225 horsepower each are mounted beneath the floor. Getting under way, power is transmitted through a hydraulic torque converter—fluid drive, if you like—until, at about 45 miles an hour, there is an automatic shift to direct mechanical drive. Many highway trucks are being equipped with Hesselman power plants.

Railroads have turned to the internal combustion engine for other jobs, too. In many a small freight-yard or siding a bull-dozing tractor, independent of rails, is put to work shunting cars. And you can thank an invisible engine for the air-conditioned comfort of modern travel that has made you forget, already, the stifling heat and smell and grit of a midsummer rail trip a decade ago. In a "drawer" under your car is the neat little butane burner that cools and cleans the air; in another is the auxiliary plant that lights the car.

The America of the Wright Brothers is a far different America from that of today, with its million-mile transport pilots, its aeronautical map so freckled with seaplane bases you can fly from coast to coast in a pontooned plane with perfect assurance, and with its aviation industry bustling over a \$4,000,000,000 backlog.

The sensation of the first transatlantic flight seems no longer ago than yesterday, but records are no longer sensations. Bombers ferry to England in a steady stream. A Stratoliner hops from Chicago





Red Lake, Ontario

Across 145 miles of Ontario wilderness a Caterpillar Diesel drags a 37-ton snow train of mine supplies 24 hours a day. The big Consolidated plane below is powered by two Wright 2,000 horsepower engines, "tops" in aircraft power today

to New York in 168 minutes. Pan-American Airways starts 48-hour service between Miami and Rio de Janeiro. A Lockheed is delivered from California to Florida in 9½ hours. An army interceptor climbs a mile a minute. Wright builds an air-cooled 2,200-horsepower engine. Pratt and Whitney takes an order for 17,000 engines. A new military plane beats 400 miles an hour; too fast to test-divide to its terminal velocity of probably 700 miles an hour, it would hit sea-level from 30,000 feet in less than half a minute.

Biggest things with wings are the 80-ton Douglas army bomber and the Martin 84-ton navy flying boat, which could hop to Europe, dump a load of bombs and romp home for a 6,000-mile round trip. But even those 8,000-horsepower realities are dwarfed by the colossus already conceived on paper.

This super-super monster of the air would weigh around 165 tons, carry 20 tons of bombs on a transoceanic mission or as much as 50 tons on a shorter cruise. Its 28,000 horsepower plant would consist of four 7,000-horsepower engines al-

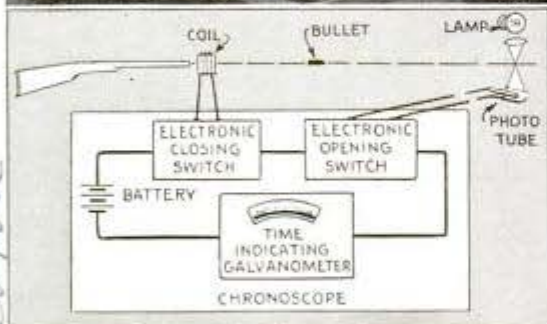
(Continued to page 178)

Inspector watches as propeller spins on engine test stand at American Airlines hangar, New York municipal airport



2531

Bullet Speed Is Measured To 1,000th of Second



Bullet speed measuring apparatus and, below, drawing showing principal parts

Bridgeport Conn.

Split seconds that are ages to a bullet or camera shutter are measured as easily as a wrist watch measures the time of day by a new device called the chronoscope, developed by the research division of Remington Arms Company. The device, built into a small portable cabinet, splits the second 1,000 ways, and will measure from one up to 200 milliseconds with less than one percent of error. It already has proved its value in studying the effect of velocity and flight of time of bullets on accuracy, range, trajectory and hitting power, but its use is not confined to ballistics. Many of the important operations in science and industry performed in less time than is needed for the flick of an eyelash can be

clocked by the chronoscope. The measurement of a time interval is indicated from the quantity of electricity which passes through a galvanometer while the measured event is occurring. A vacuum tube switching circuit starts the current at the beginning of an interval and stops it at the end. A photo-electric cell can be used to obtain start and stop impulses. A single scale from which readings are taken actually serves as five scales. The selection is made with a switch which converts scale to one of five time ranges. Ranges are 10, 20, 50, 100 and 200 milliseconds. The chronoscope can be used in any location, since the filaments of the tubes can be energized with batteries where 110-volt alternating current is not available.

2431

Felt Coating Applied on Metal With Inexpensive Kit

Coatings of felt can be applied by anyone without experience, to the surfaces of phonograph turntables, dials, cabinets and other small objects with the aid of a simple kit that requires no expensive spray equipment. Brown, taupe and blue finishes are available. The kit consists of a can of liquid undercoat, a brush to apply it, a can of undercoat thinner, and a supply of felt, or flock, finish in a sifter-top box. After the undercoat has been spread evenly on the cleaned surface, the flock is sifted over it until completely covered. A few taps on the bottom of the object will help the flock stick firmly to the undercoat, and after a few hours' drying time the excess flock may be shaken or blown off.



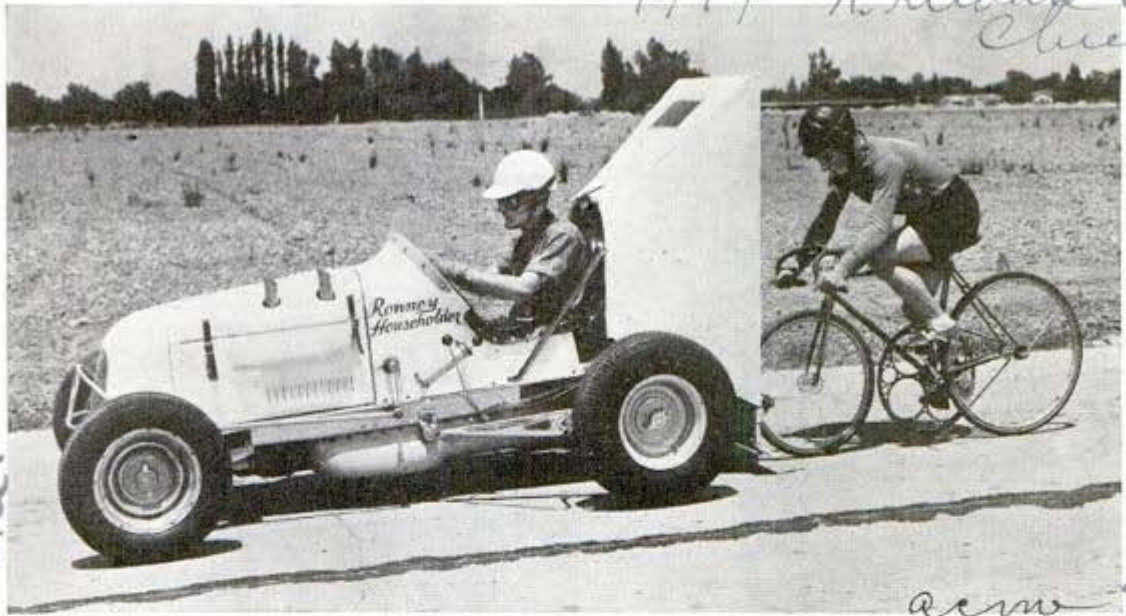
Sifting flock onto surface that has been painted with undercoat. This puts coat of felt on surface

2644

Made by Arnold Scheinbein & Co.

Bike Pedaled Behind Auto Sets World Record

1917 N. Kilday Ave Chicago



Paced by midget racer equipped with large shield as a windbreak this cyclist set a new world record

In a speed test at Bakersfield, Calif., Alfred Letourner, winner of several six-day bike races, pedaled his specially geared bicycle at 108.92 miles per hour to break the world's record for paced runs. Wind resistance was minimized by riding behind

a large shield attached to the rear of a midget racing car driven by Ronney Householder. The bicycle had an oversize sprocket to step up the gear ratio to 9½ to 1. The test was timed officially by the American Automobile Association.

Kennedy Service Tools & Machinery Co.

Wedge-Lever Tool Loosens Tire Without Use of Hammer

2293

Requiring little physical effort to operate, a two-piece tire tool removes the tire quickly without hammering, and does not

mar the finish on wheel or rim. The two parts consist of a wedge and lever that make it easy to dislodge even tires that have been "frozen" by rim rust. It is suitable for removing the new safety-bead tires, and handles all sizes from the smallest automobile to the biggest tractor tire.



Twin-handled prying tool supplies powerful leverage to remove tires from wheels without using hammer

Transparent Shield Over Mixer Keeps Food From Spattering

1577

Food will not spatter from the electric mixer when the bowl is covered with a washable, transparent shield. Made to fit on the shaft of the food mixer above the dashers, it spreads out to cover any bowl up to 15 inches wide. When the mixer is not in use it keeps the bowl clean.



San Francisco Calif

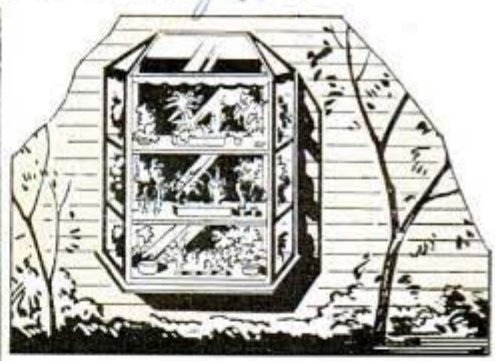
Spatter Saver Co 22 Jordan Ave

Материал, запатентованный авторскими правами

374.

Israel Bldg. Pittsburgh Plate Glass Co. Pittsburgh, Pa

He's Test Duplate



Sketch of flower window with shelves of polished plate glass, an attractive addition to the home

Left, this shows how much punishment the new automobile safety glass can take; it doesn't shatter

Sketch of bookcases and plate glass mirror, the latter seeming to make the room more spacious



NEW WONDERS of GLASS



Big polishers, like the one shown above, are used to put a high polish on safety plate glass produced for automobiles at the Ford factory

GLASS so strong that it can withstand 4,000 pounds of air pressure to the square foot, delicately tinted glass that lends color to your home without obstructing vision and a woven glass that gives privacy yet allows light to come through are just a few of the latest wonders coming from the glassmaker's laboratory.

One plant not long ago completed a two-year continuous run that produced enough 51-inch glass to stretch 2,305 miles—from Detroit, Mich., to Los Angeles, Calif.—and a new world's record for uninterrupted glass rolling. The total weight of that glass was 55,868 tons.

In a different field, glass is being converted into cloth and used for covering airplane



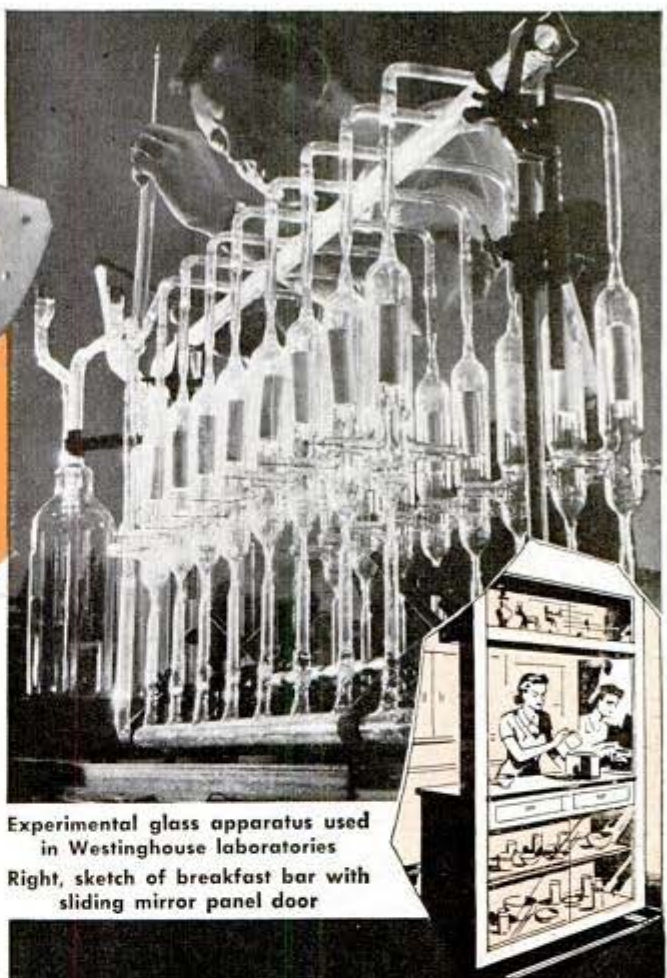
Flexseal is made of plastic sandwiched between two pieces of glass

wings and other surfaces. Such coverings are fireproof, thus introducing a new safety factor.

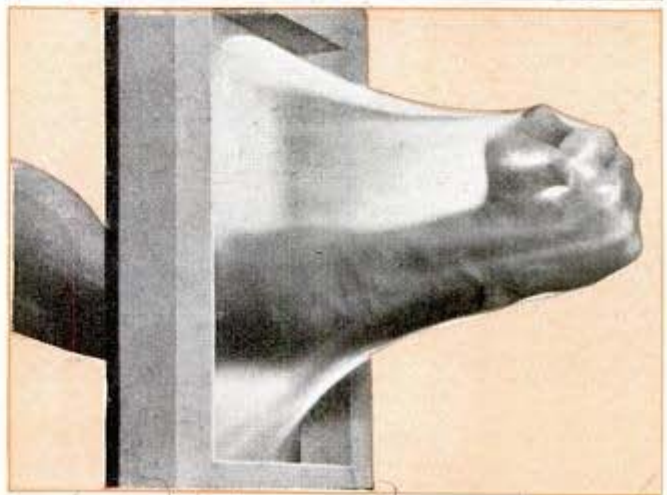
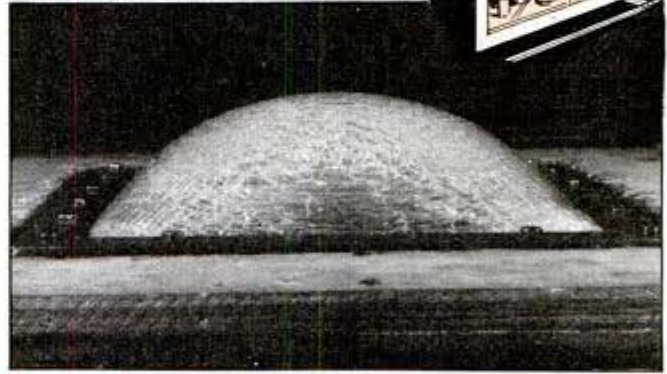
But the most amazing thing about glass is the miracle which the home owner can perform by properly using the various forms of glass now on the market. In the small home, especially, is this true. Plate glass mirrors will make the rooms seem larger, decorative glass partitions will make one room seem like two, "picture windows" of blue, green, peach and gold tints will enhance the beauty of furnishings and will enrich exterior scenes viewed through the colored panes, and at night the polished surfaces of these same windows will have a sparkle and coloring that will add much to the attractiveness of any room in which they are used.

Colored plate glass has widened the field of usefulness of mirrors,

Photo, center, Pittsburgh Plate Glass Co.'s Flexseal under two-ton air pressure test. Bottom, demonstrating "stretchability" of vinyl resin plastic used in safety glass



Experimental glass apparatus used in Westinghouse laboratories
Right, sketch of breakfast bar with sliding mirror panel door



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Workman blowing test flask taken from 900-ton furnace for analysis

Sketches show (top) long mirror placed between two windows and (below) breakfast nook with table top, panel and shelves of glass. All sketches courtesy Libbey-Owens-Ford Glass Co.



too. No longer is a mirror merely a looking glass. After silvering, colored plate glass is turned into a remarkably beautiful blue, flesh-tinted or gold-colored mirror which can be utilized decoratively in many ways while still serving its original purpose.

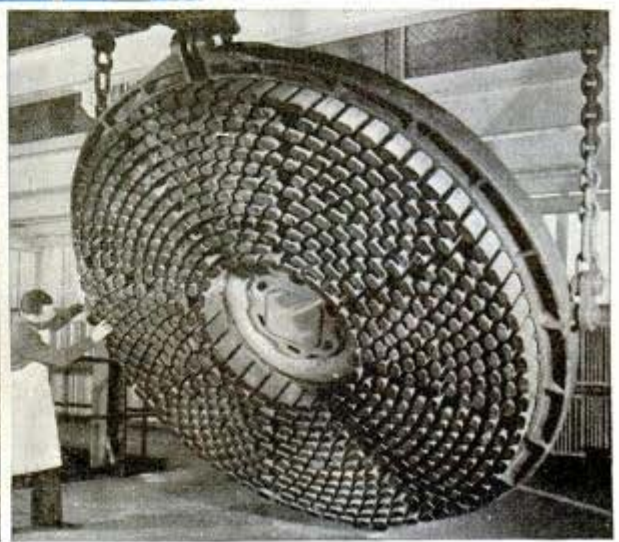
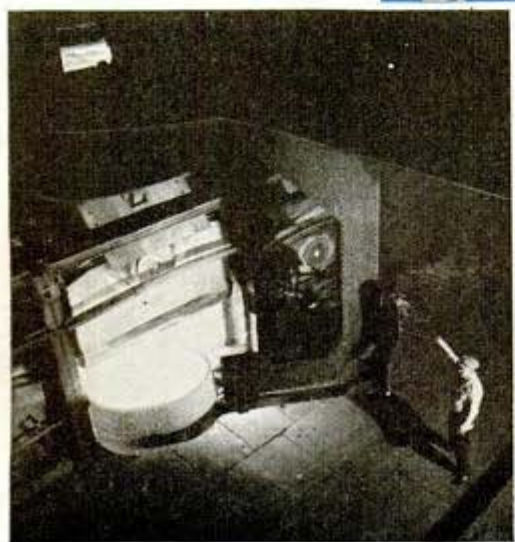
Earthen pot of molten glass used in making glass building "stone"

One new flat glass product is known as Thermolux. Made by Libbey-Owens-Ford Glass Company, it is gaining favor for partitions in the home to separate various rooms, either completely or partially. Consisting of two panes of clear or colored plate glass or decorative flat glass, with an inner layer of glass fabric, it is a woven glass that permits well-diffused light to come through, yet provides complete privacy. The fibrous glass mat also provides thermal and sound insulation.

Many new ways of using glass in the home have been worked out. For instance, some architects have created a mirrored door hole-in-the-wall for small homes. An opening is designed in the partition between the dining room and kitchen to permit easy serving of food. The door of this opening is covered with a mirror on the dining side so that when it is closed the mirror creates an attractive wall area. This idea may be employed in homes already constructed.

Another idea not limited to the home just being planned is the built-in plate glass mir-

12-ton "runner" used to grind glass for auto windshields and windows



2394 2657

ror over a bookcase. It results in the illusion of pushing the wall back and of increasing the size of the living room besides forming a focal point of interest. Similarly a mirror over the mantel seems to enlarge the room and colors of the decorative scheme are brought out delightfully by repetition in the mirror. A translucent partition or screen of double-glazed glass may be used to conceal some part of the room, or to achieve privacy without sacrificing light. At the same time, it adds a pleasant touch of brightness to the room.

In the dining room, desirable effects may be obtained by installing a large mirror over the buffet and mirror or plate glass tops on the table and buffet. One idea for the old or new home is in the breakfast bar or serving counter that may be built in between the kitchen and dining room. On the dining room side, this partition has glass door compartments at the bottom for dishes and glassware, then two drawers for silverware and finally, at the top, glass doors. Closed, these doors form a mirrored panel that brightens the dining room. Open, the doors disclose a handy counter at which the housewife may prepare and serve breakfasts or refreshments to guests.

Bedrooms offer many opportunities for using glass, either during construction or after. A circular boudoir mirror helps to create the effect of more space than the room actually contains; full-length mirrors attached to closet doors grouped together permit the user to view herself from any angle in dressing, and when not in use for that purpose the mirrors become part of the wall and brighten the room; a full-length mirror attached on the inside of the closet door is a convenience and a smaller mirror installed above the drawer cabinet inside the closet seems to create extra depth. One handy installation for the new or old home is a disappearing dressing table and mirror attached to the inside of a closet door, thus saving space in the small bedroom. It consists of a half-length mirror above a semi-circular shelf on which toilet articles may be placed. The shelf, or "table" is covered with an attractive fabric that also hides the lower half of the door.

An attractive flower window may be attached to the new or old home at low cost. Any carpenter can prepare the frame into which are placed glass panes and glass shelves. Flower boxes and pots are sup-

(Continued to page 174)

SEPTEMBER, 1941

Angler's Belt Carries Lures In Easy-to-Reach Pockets

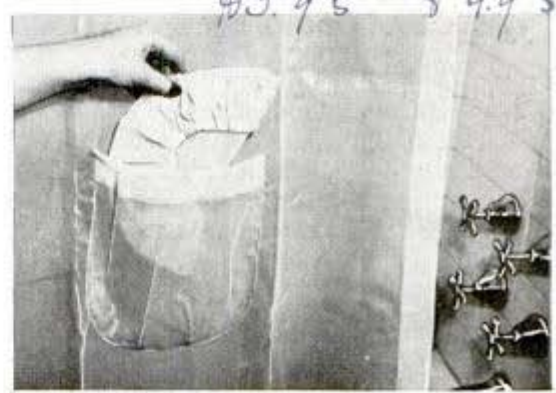


Lure is easily removed from belt pocket or replaced

Fishermen who like to wade into the stream to cast are now offered a handy belt fitted with pockets in which to carry bait and lures. Worn about the waist or chest, the belt contains six compartments, all in easy reach. It is also useful when casting from a boat as it saves time usually spent in digging into the tackle box each time a different lure is wanted.

Shower Curtain Has a Pouch For Tucking Bathing Cap

There is a handy pouch in one of the new shower curtains where you can tuck away the shower cap. The curtain itself is made of a mildew-proof fabric that will neither stick nor crack. It is available in various colors and types, tailored or frilly.



Bathing cap is kept in a pocket of shower curtain

John Wanamaker 59 Broadway at 9th New York

I have - I've Can't - 8700, Waltham, Pa

\$3.95 \$4.95

2654

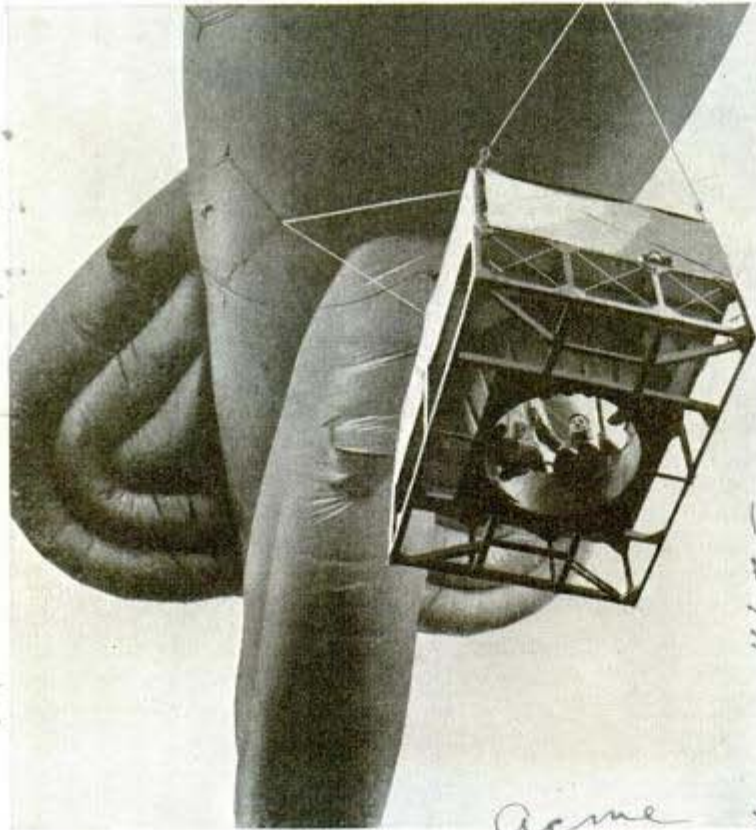
"Paratroops" Make First Jumps From a Captive Balloon

sible to keep the plane balanced correctly against both gravitational and centrifugal forces, according to the inventor, Lieut. Norman Lee Barr of the United States Navy, who has authorized manufacture and use of the instrument by the government. When the nose of the airplane is falling, warning is transmitted through the handle of the device that a backward pull of the stick is imperative.

7494

Pen for Decorating Ice Cream Uses Milk and Color

Colored designs and names can be written on ice cream slices with a decorator that works like a fountain pen. The pen is filled with milk, to which any vegetable coloring can be added. With the decorating pen comes an assortment of molds for outlining various designs, such as a heart, bell, shamrock, and Christmas tree. Four packets of colors are also supplied with the outfit.



Fledgling 'chutists, seen through opening in bottom of basket just completing ascent to captive balloon, prepare to make their first leap

Following a preliminary ground course, England's parachute troops get their first taste of an actual parachute jump by "taking off" from a basket attached to a captive balloon. The budding 'chutist is hoisted aloft, and upon reaching the right altitude he steps out into space through a hole in the bottom of the basket which simulates the opening in the fuselage of a plane.

Pendulum Helps Pilot Keep Level While Flying "Blind"

Airplane pilots soon may be offered a new "blind flying" aid in the form of a pendulum device, which is interpreted by feeling rather than by watching, as in the case of other instruments. It consists of a relatively simple pendulum arrangement, having a handle projecting upward which the pilot holds with his left hand, while he holds the control stick with his right hand. By following the motions of the left hand with similar motions of the right, it is pos-



These are some of the designs that can be written on ice cream slices with the pen using colored milk

Science Service
April 17, 1941
2505

Acme
subscribers \$5.00/48-75

Princeton, d.h.

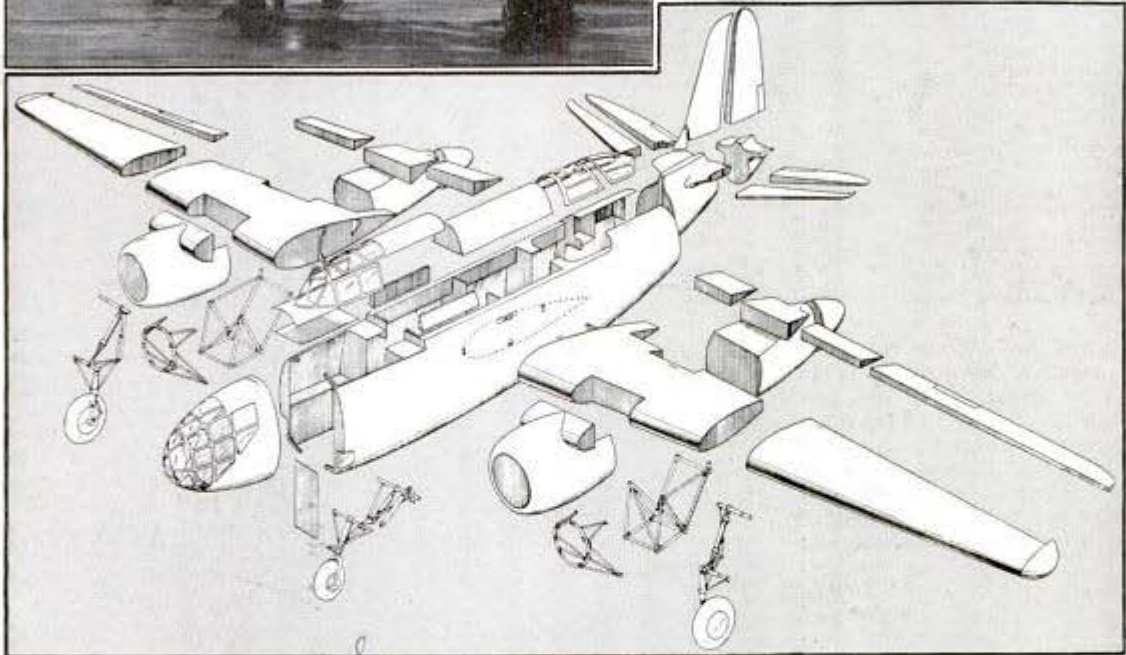
19568 Comb. Stinson

Cutaway Drawings Speed Aircraft Production

A-20a Bombers



At the left is a line of finished Douglas planes awaiting shipment; below, the three-dimensional drawings of principal parts which help workers in aircraft factory visualize their part of the assembling



Three-dimensional drawings that give each workman in the aircraft factory a clear view of the manufacturing details are helping to speed airplane production at the Douglas plant. These cutaway drawings show at a glance the principal features of the plane and how they fit—like a three-dimensional jigsaw puzzle—into the finished product. This saves the time required in reading and fathoming the blueprints,

and speeds up considerably the planning and operation of assembly lines. Since the aircraft industry is absorbing thousands of new employes in its rapid strides toward mass production, this simplification is of vast importance. The phantom drawings prepared from original plans are placed before assembly-line workers so each has an easily understood diagram of his part of the work and how it fits into the whole.

Peters mfg. Co. Cleveland, O.

Reversible Screwdriver Blade Fits Two Types of Heads

To handle either standard slotted screw heads or the Phillips recessed-head screws, a screwdriver has a double-ended blade that may be withdrawn from the handle and reversed, changing from one tip to the other. The square shank of the blade fits snugly in a square brass sleeve built into the screwdriver handle, a compression spring helping to hold it firmly. Made of plastic material, the handle is unbreakable, non-chipping, non-splitting, shockproof and is unaffected by oil, water or grease.



Screwdriver with reversible blade can handle either slotted or Phillips type screws shown in foreground

Neutral

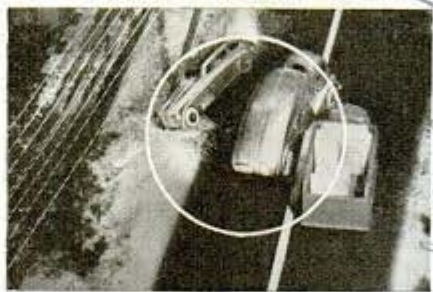
The Berrowell Products Co. Cleveland, Ohio
6523

"RIGHT-OF-WAY STEALERS" 2,000 LIVES

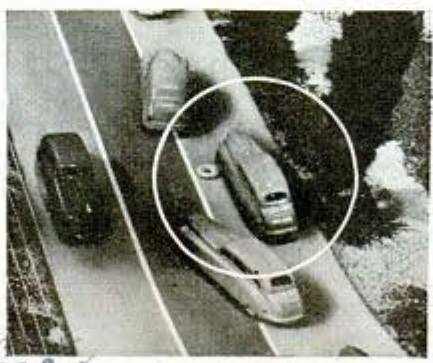


The DEATH TOLL of DUMB DRIVING

Most of the 34,000 persons killed in motor vehicle accidents in the United States during 1940 lost their lives because of too much speed, too much liquor, unsafe road conditions—wet or icy pavements or poor visibility—or poor mechanical conditions of the car involved. However, one big cause of highway accidents was just plain, stupid driving. Analyzing these mishaps blamed on a "fool at the wheel," the National Safety Council found the list headed by the driver who steals the right-of-way. Included in this foolhardy category are the U-turners, the crashers who ignore traffic circles and similar flow separators, and the line jumpers—illustrated at top by a car sneaking past a white line. Toll of these right-of-way stealers was 2,000 lives

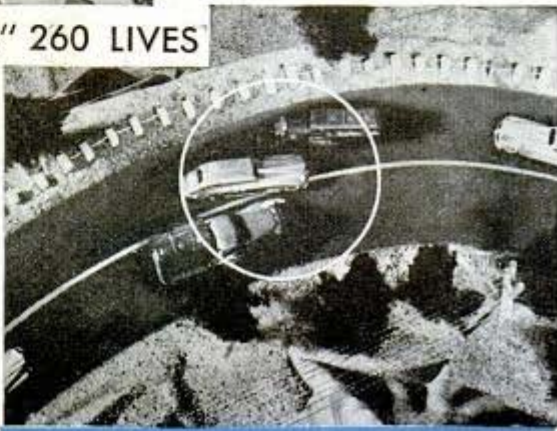


"WEAVERS" 350 LIVES



Highway collisions make a pretty grim picture, and the picture usually shows crumpled remains of what were nice automobiles whose occupants are being lifted onto stretchers. That's the result, but what about the cause? Photographers aren't on hand to "shoot" an accident about to happen, so, to dramatize the cause and educate the motorist, the American Mutual Liability Insurance Company posed tiny automobiles on miniature models of highway scenes. Here, then, you see some of the things dumb drivers do to kill or cripple themselves and the other fellows. Trying to beat the train to the crossing or ramming into its side cost 1,350 lives in 1940. Other stupid stunts are weaving in and out of traffic lanes, parking on the pavement and passing on curves

"FOOLISH PARKERS" 260 LIVES

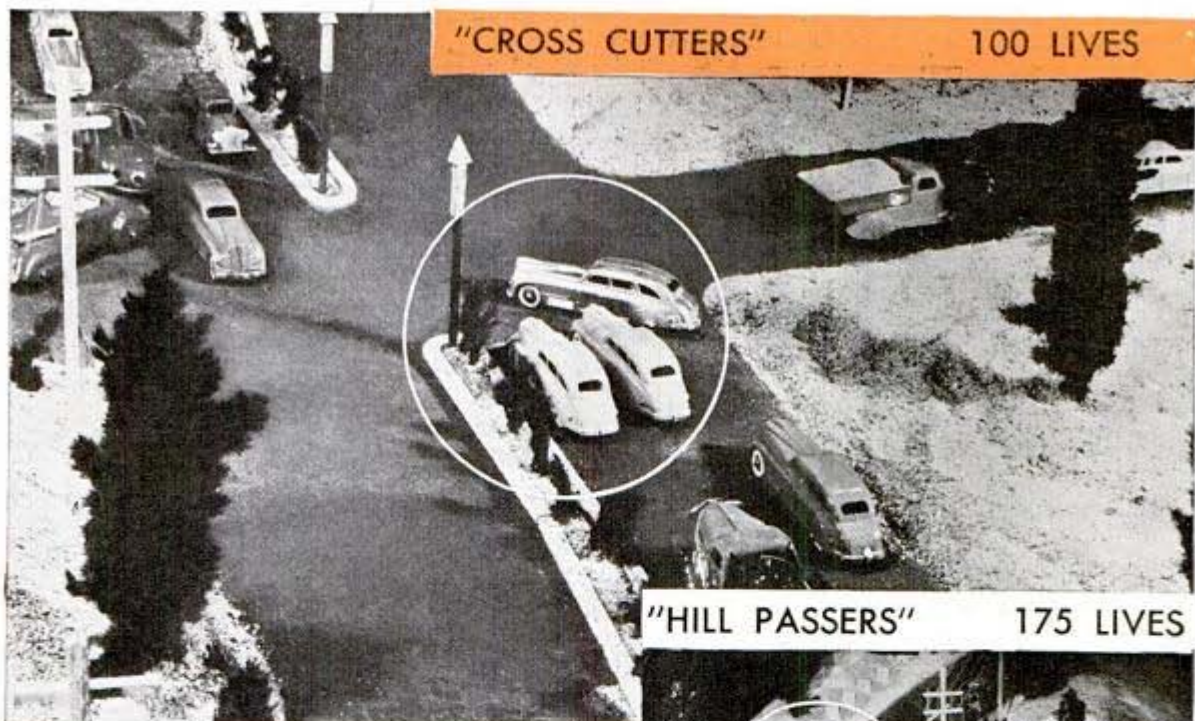


"CROSSING-CRASHERS" 1,350 LIVES

"CURVE PASSERS" 100 LIVES

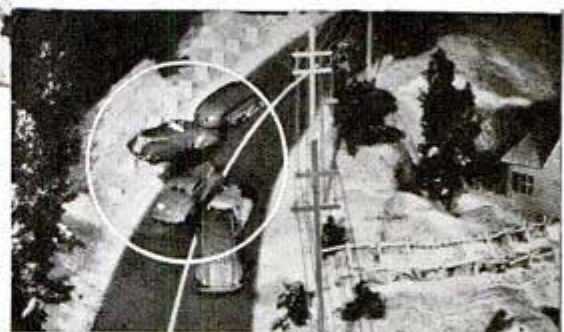
*Cent. Allen Warren Elliott
343 33rd New York*

one car on wheel



"CROSS CUTTERS" 100 LIVES

Britain's death list in the first 20 months of the war is not much different from the 1940 death list of American motorists. But in addition to lives lost, there were 1,200,000 persons injured—a veritable national disaster. Stupid drivers who find themselves on the wrong side of the road when they take a notion to turn, like the car at top, are responsible for 100 of last year's deaths. Hill passers, who ignore danger signs and dividing lines and attempt to pass a car on the way up a hill, are blamed for 175 deaths. The "come outer" is the dope who dashes out of his driveway into a main thoroughfare without bothering to stop and look; he collected about 100 lives during the year. The road hog is that familiar pest who straddles the center stripe at a leisurely pace, jamming and menacing traffic in both directions

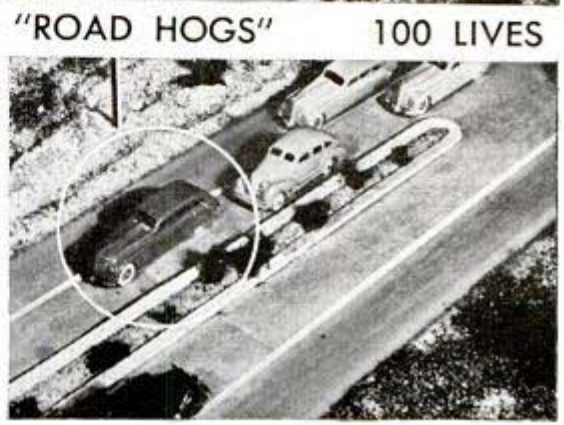


"HILL PASSERS" 175 LIVES

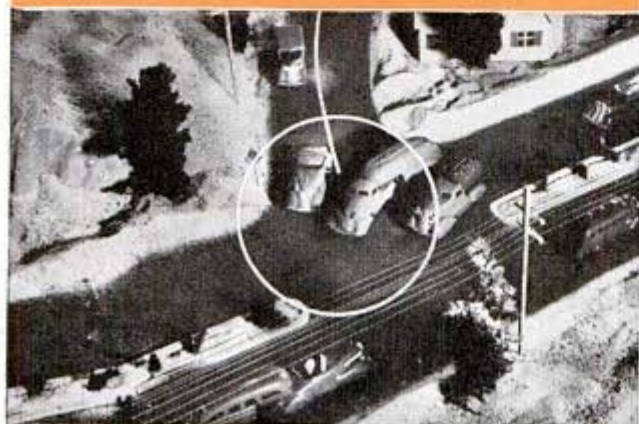


"COME OUTERS" 100 LIVES

"NON-STOPPERS" 850 LIVES



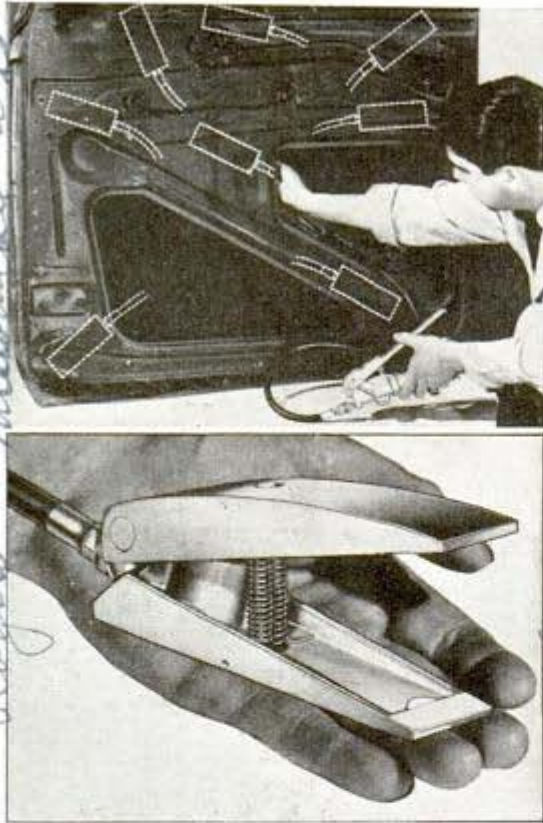
"ROAD HOGS" 100 LIVES



In a motoring land where virtually every important street and highway is protected with STOP signs it is almost unbelievable that 850 persons were killed in a year, hundreds more injured, by dumb drivers who failed to heed the signs. Yet there are the figures

L 524

Small-Size Hydraulic Ram Reaches Tight Places



Top, right hand extends ram into working position, as left operates pump. Bottom, tool fits in palm

So tiny that it may be held in the palm of the hand, a midget sheet-metal shaper, designed primarily for automotive work, has a hydraulic ram built into its jaws. Attached by a four-foot hose to a scissors-action pump, the ram, which is a combination dolly and spreader, can spread, straighten or dolly inside panels, doors, cowls and other similar parts hard to reach with ordinary tools. The jaws measure $\frac{3}{8}$ inch at the top and open $3\frac{3}{4}$ inches to exert tremendous pressure. The tool measures 2 by 2 by $6\frac{1}{2}$ inches.

Autos Can Store Up 12,000 Volts Of Static Electricity

Your automobile, traveling along a dry road, may accumulate a static electrical charge amounting to 12,000 volts or more, it has been revealed by Prof. Robin Beach, of the Polytechnic Institute of Brooklyn, N. Y., who made actual measurements in his own car equipped as a traveling lab-

Scientific Service
May 19

oratory. And unless the charge is dissipated by a direct ground, several hours might pass before it vanishes completely. A "drag" chain, like that which dangles from the rear of a gasoline truck, had no noticeable effect in carrying off the charge, since the dry pavement probably served as an insulator instead of supplying a ground. The charge presents a possible fire hazard in the event a spark is discharged near gasoline vapor. It is explained that the charge apparently comes from the transfer of electrons in two materials that seem to be in contact but really are separated by 1/100,000,000 inch or less. The same thing occurs between one's shoes and a heavy carpet when the body may accumulate as much as 10,000 volts, sufficient to make a sizable spark when a finger touches a grounded metal object. In the case of gasoline passing through pipelines, voltages up to 75,000 have been recorded.

Bed Switch Turns On Night Lamp When Sleeper Rises

An automatic night lamp now available lights as soon as the sleeper rises from bed, and turns off upon his return. It is operated by a switch installed between the spring and mattress. The sleeper's weight keeps the switch in the "off" position.



Night switch, installed as in bottom picture, keeps light out until sleeper arises. Inset, complete unit

Blackhawk Mfg Co 53250
Chicago, Ill

Electrical Engineer

Photo
3348 N. 1st St
Chicago, Ill

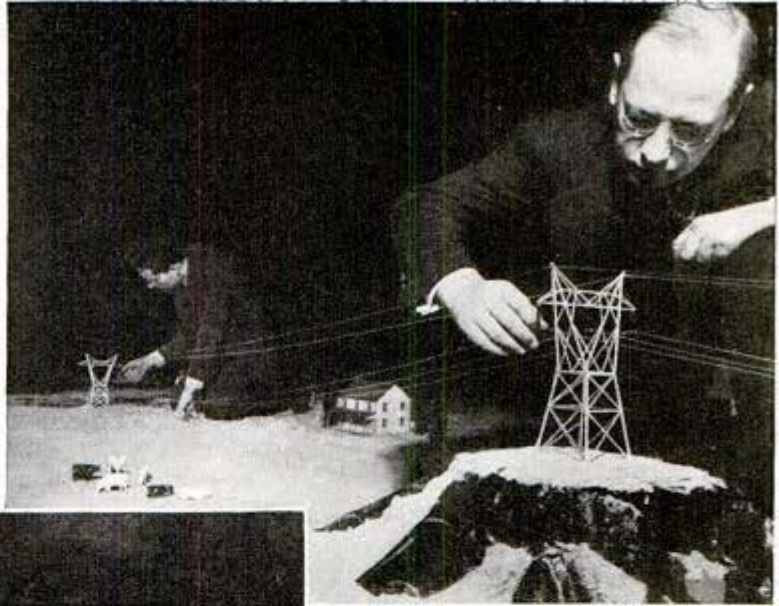
Inoreland Mfg Co

2514.

*Charles F. Wagner, Consulting
Transmission Engineer
Robert H. McCann*

Toy Power Line Helps Find Lightning Guard

Hurling bolts of man-made lightning at a midget power line is the routine work of two Westinghouse engineers in search of new ways of guarding the nation's high-tension systems against damage by lightning. During three years of research, they have discovered that 20,000-000-volt natural lightning can be made harmless to power cables by the proper placement of



Two research engineers inspecting miniature power line to determine effects of man-made lightning upon cables protected by two "lightning rods" strung above them

At left, 3,000,000-volt lightning strikes one of the upper protective cables which is grounded to towers. Tests like this led to the development of a protective system

wires, designed to act as lightning rods, between towers at the uppermost points. These wires do not carry any electric power, but are only protective, being connected to the ground to lead the lightning away from the lines. In the tests, the toy power

line is struck from all angles, the force of bolts varying from 100,000 to 3,000,000 volts. After about 10,000 tests, it was revealed that the grounded wires must be spaced at an angle of 30 degrees from the power carriers to obtain maximum protection.

2592.

One-Ton Bomb Is Ready to Start on Air Journey Abroad

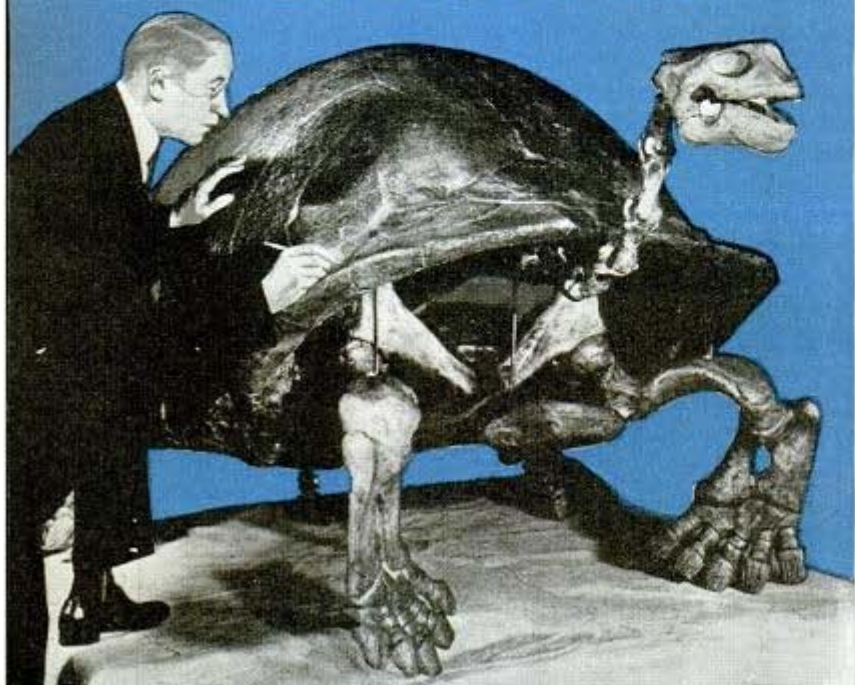
British pilots returning from air raids over the continent have told of seeing whole buildings lifted into the air by the new high-explosive bombs, then subsiding in a red glow seen for many miles. Here is the immense aerial bomb, lying in wait at a Royal Air Force station to be loaded aboard the Whitley bomber in the background. The bomb weighs a ton.



On the rack waiting to be taken aboard the Whitley bomber is one of the huge 2,000-pound high explosive bombs introduced recently by the British



DINOSAUR DETECTIVES



Top of page, mounting a *Itracosaurus borealis* skeleton at the American Museum of Natural History. This is meticulous work

That prehistoric giant whose dome-like back is being restored by the paleontologist was a land tortoise, *colossochelys atlas* by name

66

*Cont. Allen Warren Elliott
343 E. 33rd New York*

283
IN AN investigation of life as it existed millions of years ago, a group of scientists is employing all the elements of a crime mystery story—footprints, the victim's body, significant objects found near the scene and a large number of apparently unrelated circumstances and bizarre facts which finally fit together into a clear picture.

In addition, the scientists employ such mechanisms as moving pictures, airplanes, aerial cameras and microscopes. They dig into the past with excavating tools ranging from tiny buzzing dentists' drills, through pounding pneumatic chisels and up to huge clanking excavating machines. They build cofferdams in rivers and camps in the desert. They operate X-ray machines in laboratories. They test clues with chemistry. They check deductions with mathematics.

A line of conjecture drawn from the past through the

POPULAR MECHANICS

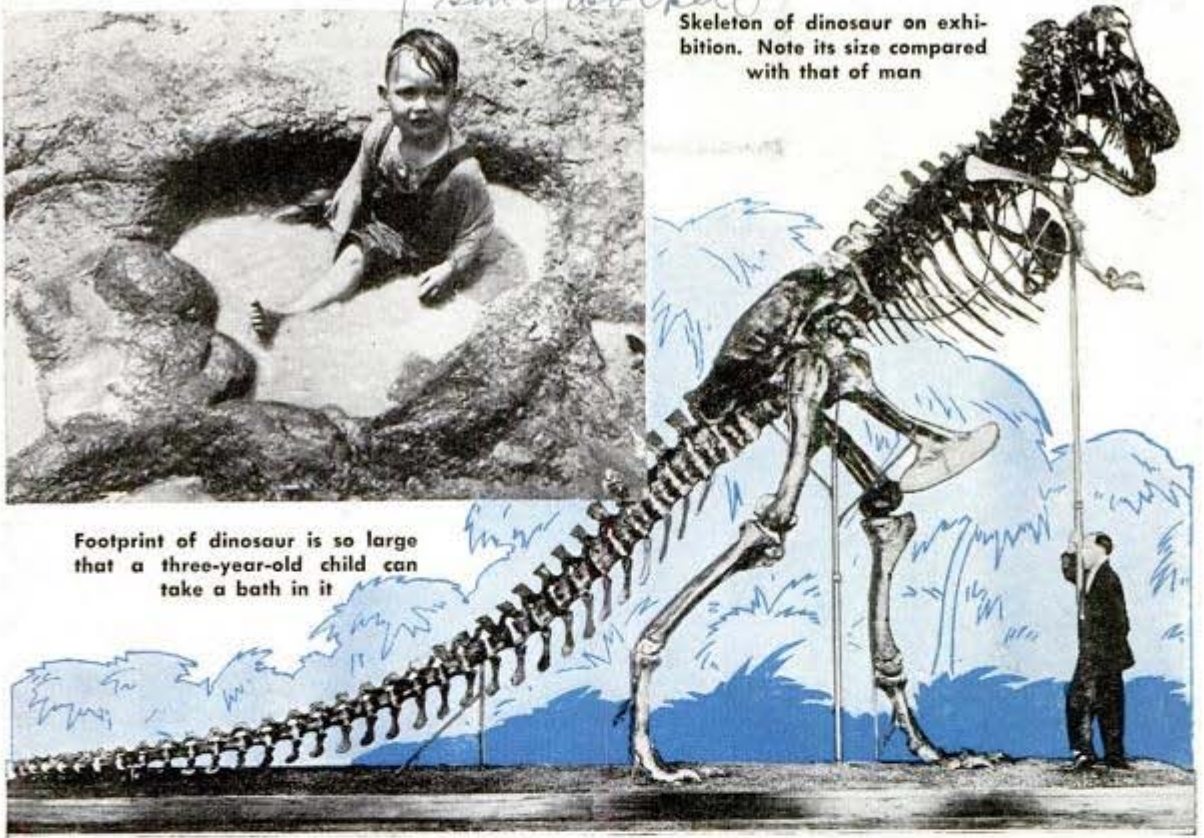
*Johnny Pendley
son of worker*

L 383



Footprint of dinosaur is so large that a three-year-old child can take a bath in it

Skeleton of dinosaur on exhibition. Note its size compared with that of man



present may indicate a trend toward the future, so these research experts with headquarters in the laboratories of the American Museum of Natural History in New York City, are busy throughout the world. Operating under direction of Dr. Barnum Brown, Curator of Fossil Reptiles, who has spent 45 years in fossil investigation, the scientists have learned that much of our own United States was once a fearsome, prehistoric tropical jungle.

Right now, Dr. Brown and his associates are preparing and preserving their latest dinosaur fossil finds, including discoveries in Texas which indicate that there certain of the larger dinosaurs continued their existence much later than elsewhere. Their deductions on time were drawn from a sound scientific basis, the age of the rock formation in which the remains were encased.

Cutting around slab containing footprints of prehistoric monster



In the Big Bend area of the Lone Star state, these dinosaur detectives, operating as the American Museum-Sinclair Dinosaur Expedition, examined thousands of dinosaur bone fragments. They brought back what is probably the largest backbone ever found, a single neck vertebra 46 inches high and 36 inches wide, about as bulky as an office desk and weighing about as much

*Paluxy River, Comert
County, near Belton, East Texas*

*Central Post West
at 79.11*

2083 Haplosaurus



Dr. Barnum Brown and assistant working on dinosaur fragments, a cross-word puzzle job

M. Schlaikjer, Instructor in geology and paleontology at Brooklyn College and Roland T. Bird of the American Museum, proved it was not always a hot semidesert inhabited principally by jackrabbits, tarantulas and lizards. Once the area was lush with semitropical vegetation and abundant water. It was also overrun with hordes of duckbill, horned and armored dinosaurs, as

well as huge alligators. One of the crocodile specimens brought back was a skull and plates with teeth about as long as a man's index finger and twice as thick. Tracks showed that the area in distant ages after the dinosaurs disappeared was traversed by the mesohippus or three-toed ancestor of the modern horse, the camel and—in case you thought they were a strictly modern nuisance—rats and mice. In the semidesert rock and sand they chiseled out oyster shells 14 inches long and six inches wide. A clam shell larger than the top of a bridge table was another find.

The deduction which might be made from these discoveries has a bearing on nature's puzzling practice of building up a species and then

Humerus of large sauropod dinosaur being prepared by Dr. Brown at quarry southwest of Glasscocks, Tex.



Dr. Brown

Home-made cart is used in transporting heavy blocks dug up in the badlands

as four average men, more than 600 pounds. They are still at work calculating the size of the reptile which is certainly larger than the largest mounted dinosaur in the museum collection, the gigantic brontosaurus or "thunder lizard," 66 feet long and 15 feet high.

Chipping away in the ancient lake deposits in the Chisos Mountain district of the Big Bend area, Dr. Brown, Dr. Erich



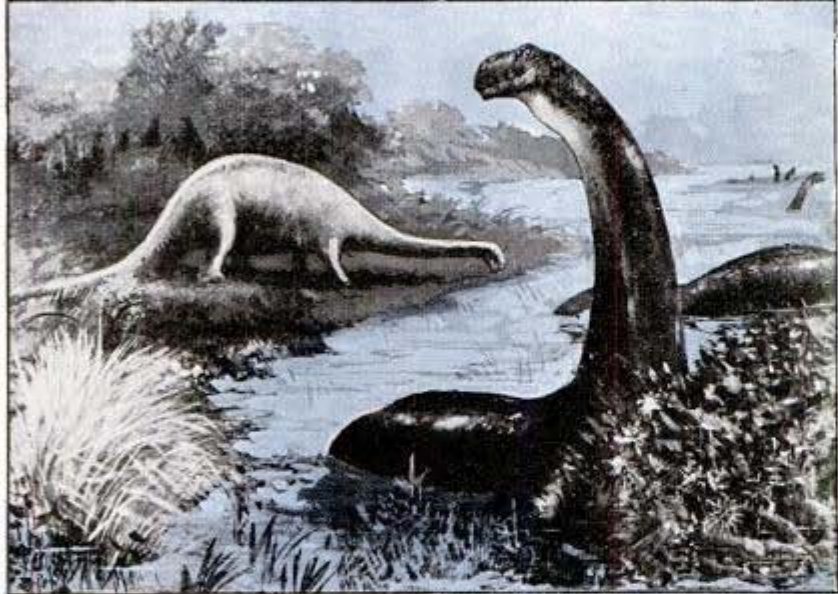
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wiping it from the face of the earth. The horse and camel still exist; they are so efficient that they often excel man at his tasks. Rats and mice still flourish; they are so clever and agile that they live in spite of man, stealing a living from him. Oysters and clams have held their place; so have alligators and crocodiles, but they are reduced in size.

And the huge reptiles which dominated this land for millions of years



Single footprint of prehistoric animal reassembled as a check for any missing blocks



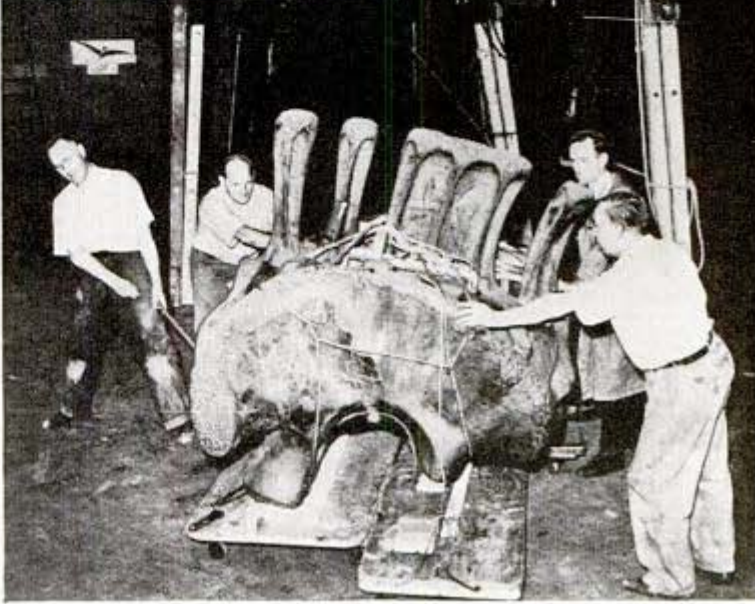
Left, painting that is restoration of scene similar to that which once existed in Texas area where Dr. Brown found footprints of "Thunder Lizards," pictured feeding

Four men with ropes have all they can do to roll this section of the skeleton of a sauropod dinosaur into preparing room of the American Museum of Natural History

are gone. Gone, too are gargantuan mammoths, and great, waddling birds that grew too big to fly. Going rapidly is our own familiar elephant who was even too clumsy to escape the caveman's pit trap, let alone modern man's rifle.

An even more important second find during the same expedition turned up in the Glen Rose region of Texas and tended to shed more light on the mystery of nature's whimsies.

(Continued to page 168)



2674.

*E. du Pont de Nemours & Co
Wilmington, Del*

Swimmers Take Air at Undersea Observatory



When a swimmer goes under water at Wakulla Springs, Fla., there's no telling when he'll come up. Down at the bottom is a "filling station" where swimmers can sit down for a bit of rest and fresh air. The undersea air station has a roof of Lucite, transparent plastic, which offers a good observation window. Divers enter through the open door and then sit upright with head and shoulders above water in the chamber to which air is pumped.

His head above water in the air chamber of submarine observatory, a swimmer relaxes and watches undersea life while others swim down to join him in the "air station"

2628.

Three-Motored Racing Car Seeks Four Speed Records

To win four speed records is the task assigned to the "Golden Eagle," which is expected to be the fastest automobile in the world. The car will use three different engines, ranging from 200 horsepower to 1,200 horsepower, which will permit it to compete in the different cubic-inch divisions. The smaller engine, a straight eight, which already has shown speeds of 175 to

200 miles an hour in test runs, will be used in trying for the 152 mile-per-hour record established seven years ago by Harry Hartz and Fred Frame at Muroc Dry Lake, Calif. A larger straight-eight engine, developing 350 horsepower, will try to break the 24-hour non-stop record of 158 miles per hour set by Ab Jenkins, as well as the 48-hour non-stop record of 148 miles per

*Cont. sleek white
Pinto Strong Body.
Los Angeles*

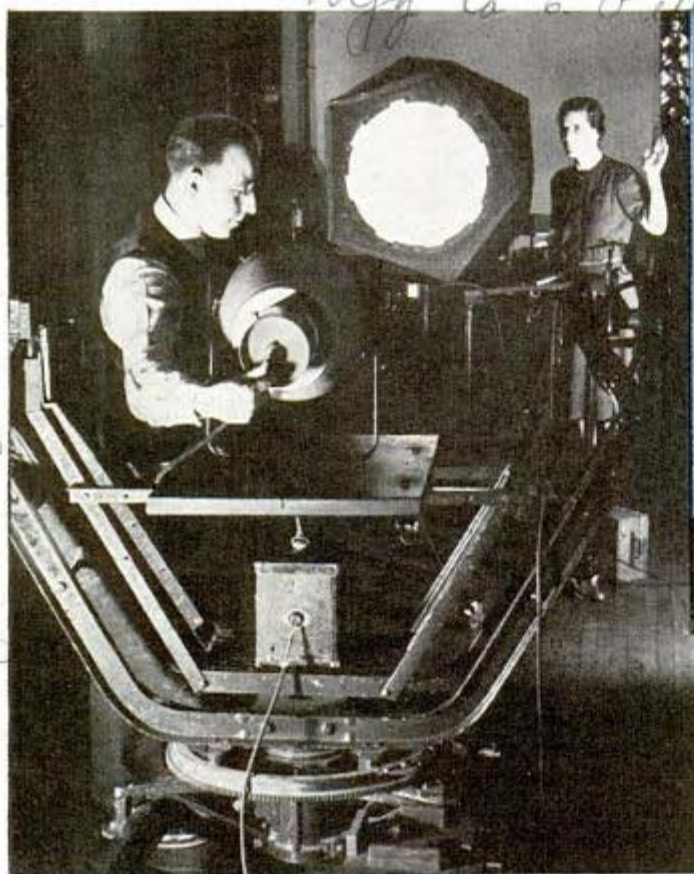


Racing car 26 feet and 3 inches long will change engines in trying to beat various speed records

*2199 General Electric Co Schenectady, NY
Westinghouse Electric
mfg Co & Pittsburgh*

MORE LIGHT for YOUR

Westinghouse Lamp Co. Bloomfield, N.J.



Engineer inside a 20-sided testing device equivalent to a 10-foot sphere which was built by Westinghouse illuminating experts
Lamp div. Bloomfield, N.J.

FOR 25 cents in 1932, you could buy and burn a 60-watt electric lamp for about 15 hours; for the same sum today, you can buy and burn a 60-watter for approximately 55 hours and, at the same time, enjoy a 16 percent increase in light output.

Day-and-night research in America's lamp laboratories has made this possible and, over a longer period, has brought these results:

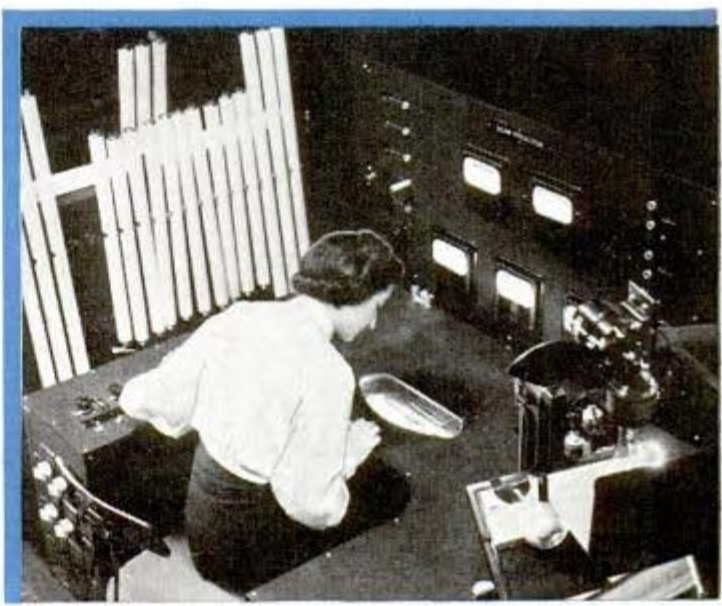
Ten times as much light from today's popular household lamp as from the first incandescent lamp—and at one-tenth of the lamp cost.

Twenty-seven times as much light for the lamp dollar from today's ordinary tungsten-filament lamp as from the first tungstens of 1907.

Development of 10,000 different types of lamps and electronic tubes, among which are: the tubular fluorescent lamp, nearest practical

Color comparison of fluorescent lamps is measured accurately at this control panel

approach to the long-sought "cold light;" the infrared lamp, which performs industrial drying operations in a fraction of the time required by older methods; the ultra-violet lamp from which you can get a





Engineer studying expansion of coils in 1,000-watt lamp by inspection of greatly enlarged image of lighted filament projected on wall

"summer tan" any time you want it; the water-cooled capillary mercury lamp, which produces light one-fifth as bright as the sun, yet is so tiny it can be hidden in a fountain pen, and others.

Even since the first fluorescent lamp went on the market a relatively short time ago, this "baby" of the ever-growing lamp family has felt the touch of the scientist many times. Its life has been increased from 1,500 to 2,500 hours, or 66 percent, its efficiency has been increased about 40 percent and its cost has been reduced about 50 percent. The fluorescent lamp, which is widely used in factories, offices and stores and which is finding many applications in the home, delivers an average efficiency two to two and one-half times that of an incandescent lamp of the same wattage. Its cost exceeds that of the incandes-

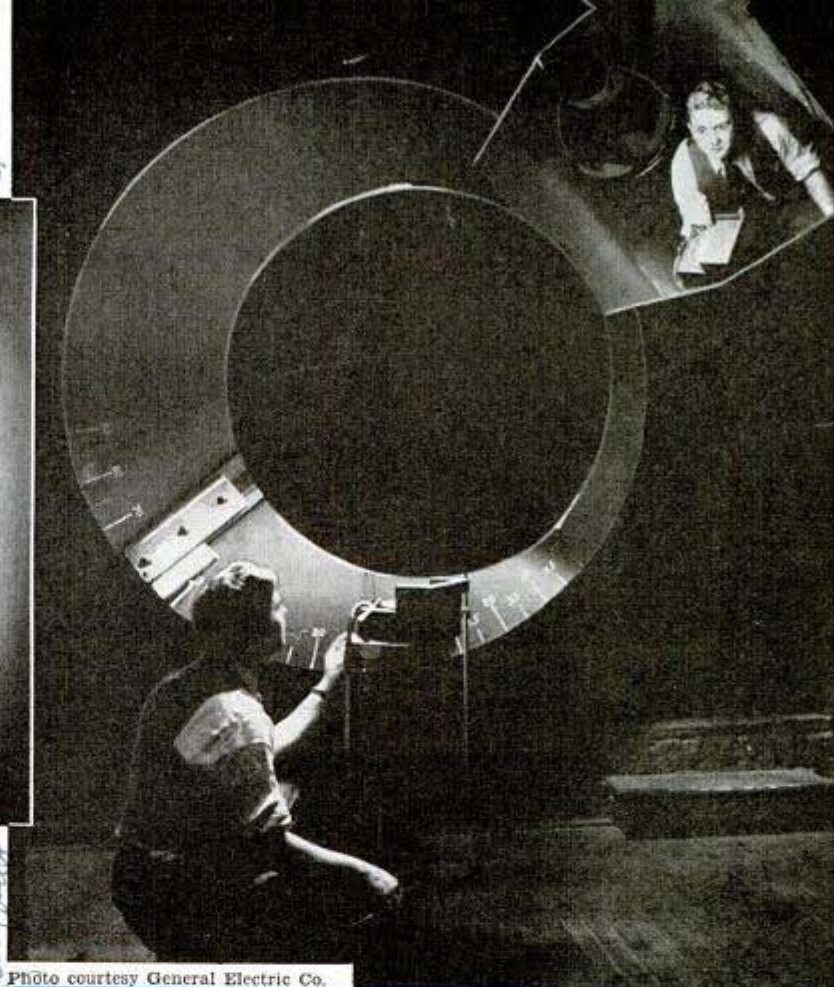
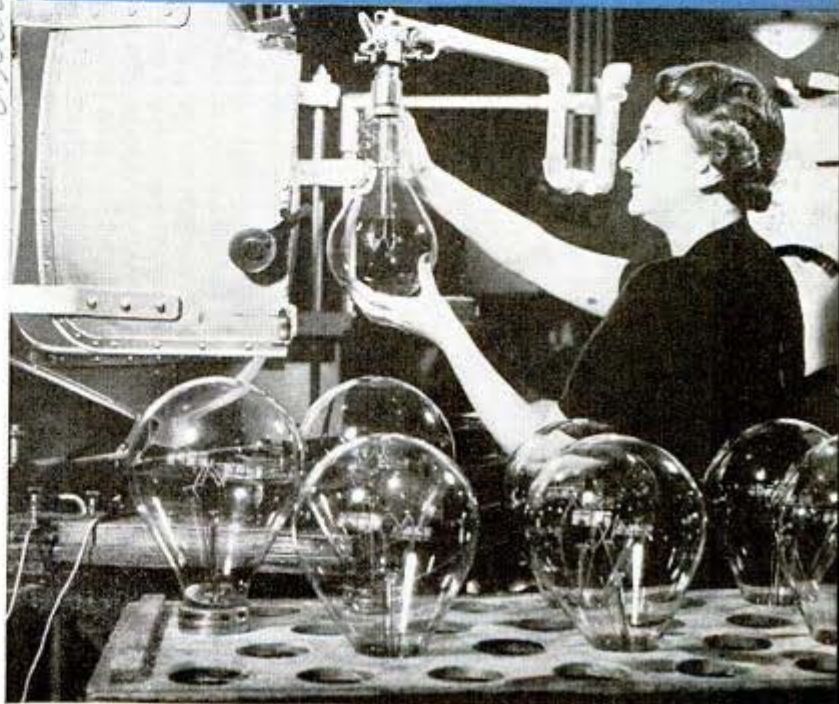


Photo courtesy General Electric Co.

In a light distribution test of street lamp, mirror at upper right reflects light to photocell at end of room where reading is taken

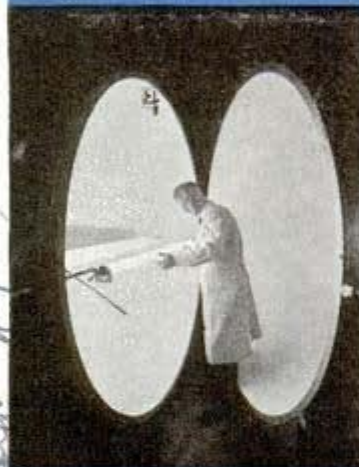
Below, a 1,000-watt general lighting lamp undergoes one of the periodical tests in 60-inch photometer to determine its light output



Leggett used
 Westinghouse
 Cleveland, O.
 1919
 Es E Mazda
 Westinghouse Lamp Div.
 Columbus, Ohio



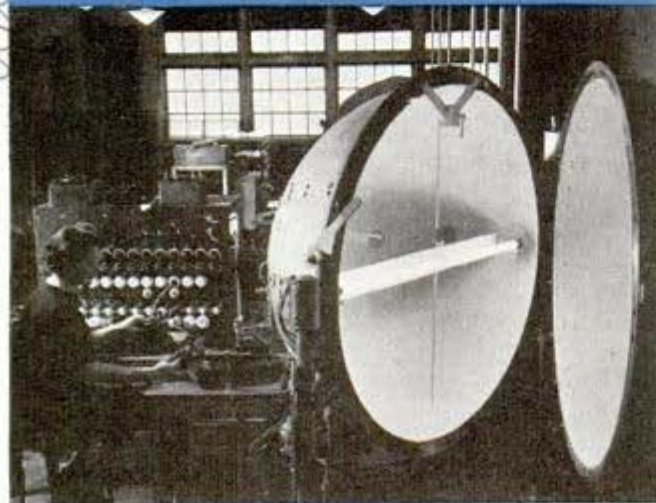
Top, charting light distribution from plastic luminaire
 At right, below, batteries of bulbs undergo life tests



Above, at left, an engineer places a 100-watt lamp in a giant "electric eye" that will measure its light output



Below, a 40-watt fluorescent tube lamp is preheated preparatory for its light output measurement by photometer



cent, but its light output is far greater.

There has been little or no increase in the life of incandescent lamps in recent years. Manufacturers take advantage of their increased knowledge of lamp design, resulting from research, not to prolong the life of a lamp, but to hold that factor constant and increase the light output. It is a relatively easy task to prolong the life of an incandescent lamp, by decreasing the temperature at which the filament operates. This step, however, also reduces the amount of light emitted. And since the cost of lamps is a small percentage of the combined costs of lamps and electricity, that is, the

cost of light, it is more economical to maintain the life of a lamp constant and, at the same time, to increase its light output. The few pennies which might be saved by purchasing a long-life, low-efficiency lamp are more than compensated for in the savings in current cost resulting from the use of a lamp of shorter life, but having a higher light output.

Research has played a major role in increasing the efficiency of lamps, while the reduction in costs may be attributed to improved machinery and manufacturing techniques. As a result of research, better filaments and materials were obtained for incandescent lamps. Improved starters, cathodes and fluorescent paints

L199

L475

have all added to the life and efficiency of fluorescent lamps. All in all, the combination of factors has given the public more light for less money.

The scientist delving into the mysteries of the electric lamp's behavior under every conceivable condition of usage works with strange-looking machines, some of which are employed in measuring light output. "Lumen hours" is the term he uses in describing the amount of light given by a light source during a certain period of time. Thus, he tells you that a one-candlepower source produces 12.57 lumens. Again, he reveals that in 1932 a dime would buy about 1,900 lumen hours and that today a dime will buy about 3,300 lumen hours, an increase of light approximating 75 percent, if you take home the popular 60-watt filament lamp.

The research man further informs you that much of this increase in the amount of light that you now get for your money should be attributed—strangely enough—to a host of little improvements, almost none of which was considered significant enough to warrant publicity. For instance, a new improvement might spring from a slight change in the method of coiling a filament or from a change in the quality, quantity or pressure of gas in the bulb. But taken as a whole, these little improvements add up to lighting progress that is definitely significant—giving users an annual lighting bonus worth millions of dollars, yet at no extra cost to the consumer.

One of the unusual measuring instruments you find in the lamp laboratory is known—to some of the research crew, at least—as the "goon." One of its jobs might be the charting of the distribution of light from a new plastic luminaire. The lighting unit is mounted on a special type of photometer so that its light strikes a photoelectric cell—electric eye—located on an arm near the floor. The photocell actuates a projector, in which there is a microammeter, causing it to cast the pattern of light on a large disk mounted vertically on the photometer. The laboratory engineer charts the light pattern, following the image with a piece of crayon.

Over in another part of the laboratory you may see another engineer studying the expansion of coils of a 1,000-watt lamp by inspecting and measuring the greatly enlarged image of a lighted filament projected

(Continued to page 172)

Massager Irons Away Pain With Electric Heat

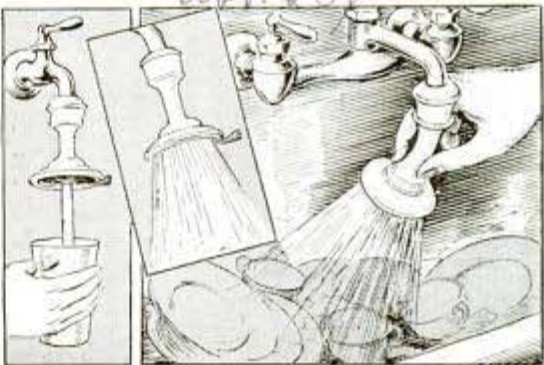


Treating a facial pain with the electric massager

Pains amenable to heat treatment may be relieved by an electrically heated massager. It warms up within a half minute, and is thermostatically controlled to prevent overheating. The manufacturer intends it to be used for "ironing out" pains and for applying beauty preparations and oils to the face, scalp, hands and cuticle.

Spray Head With Flexible Neck Fits Faucet of Any Size

Made to fit on any size or shape of faucet in common use, a spray head with a flexible neck facilitates kitchen work. The metal face is adjustable for a spray or full stream. Combined with the spray head are an anti-splasher and strainer. The flexible neck and rim are of rubber.



Flexible neck throws stream or spray where needed

The March Int'l Co. 22 W. North Bank Ave. Chicago
L478
Faucet given to N. Rivenway by 45 St. N. Rivenway Chicago

2556

Scene Series
April 3, 1944

Pistol-Grip Handle on Putter Permits a Better Swing



Pistol-grip club designed to help golfer's putting

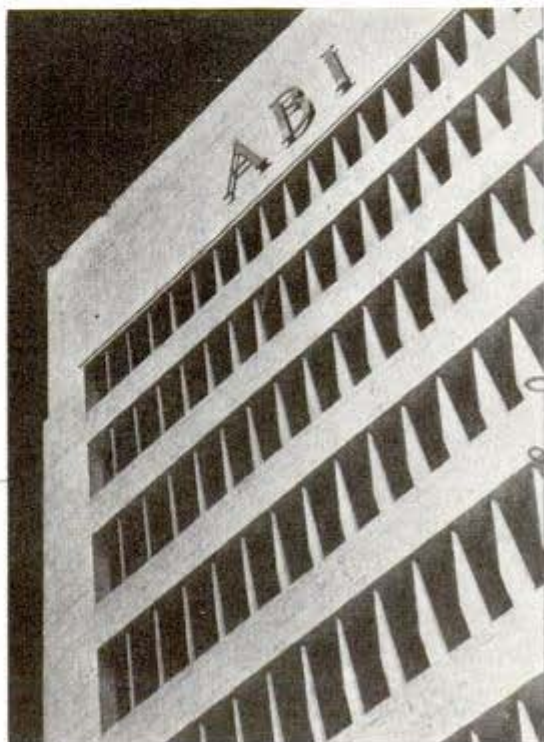
Balanced so perfectly that the shaft remains upright by itself if the club head is placed on the ground, a new golf putter designed by Al Espinosa has a pistol-shaped handle. Use of the club is said to overcome a tendency to push instead of strike the ball when playing on the green.

see May 1940-648
Cleveland, Ohio
Akron
acne

and the heavier hydrocarbons are frozen, but the lighter ones get through. At 278 degrees below zero, the ethane, butane and propane are frozen out and at 300 degrees below zero methane is detected. In this way the concentration of the gases, in parts per billion by weight, is determined and plotted on a map of the region being studied. Since investigations indicate that the hydrocarbons leak principally from the edges of the deposit, the pattern sought is one in which a zone of low hydrocarbon values is surrounded by a band of higher concentrations. By a similar soil analysis of cuttings collected during the drilling of wells, it can be predicted whether the accumulation will consist of gas or oil.

Concrete Slabs Set at an Angle Shield Windows From Sun

Headquarters of the Brazilian Press Association at Rio de Janeiro are marked by a distinctive new architectural feature. Concrete slabs set at an angle of 30 degrees, 20 inches apart, shield the windows from the full rays of the sun. Openings between the slabs afford cooling cross ventilation and subdued light. The scheme was tried out for the first time by a French architect in Algiers.



Vertical concrete "blinds" shut off the tropical sun

Soil Gases Analyzed by Freezing To Find Oil and Gas Deposits

Prospectors now are locating underground deposits of oil and gas by freezing gases sucked out of samples of soils, and then detecting the hydrocarbons present in proportions of a few parts in a billion. As described by Leo Horvitz of Houston, Tex., the principle upon which the method is based is that minute quantities of hydrocarbons leak from the deposits to the surface of the earth, leaving some of these hydrocarbons in the soil. Soil samples collected from a 12-foot depth are under reduced air pressure to drive out gases, which then are passed through traps and cooled to very low temperatures. At 204 degrees below zero, Fahrenheit, pentane

see May 1940-648
438
see May 1940-648

Esperson Bldg.
Houston, Texas

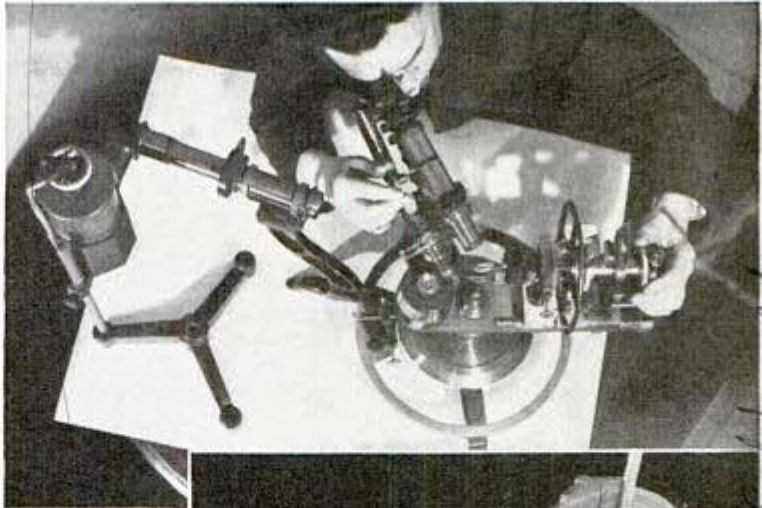
2576
Cheery
Hazel St.
Cm. L. Jacobi, 4520

2571

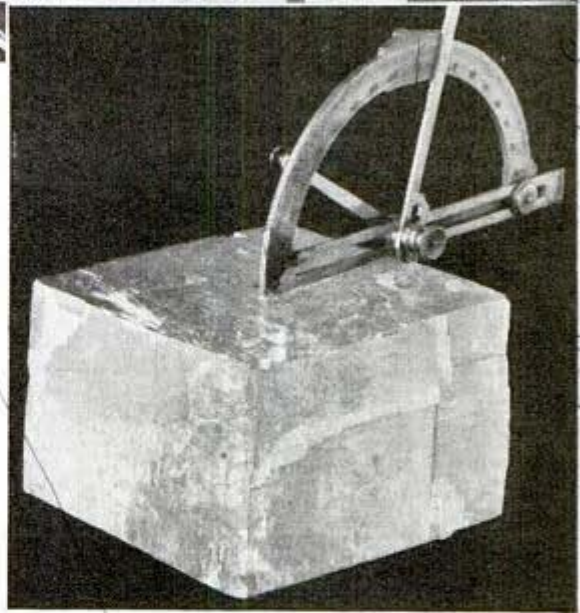
Curator of Minerals

Mineral "Fingerprinted" by Its Crystal Facets

Identification of minerals has been speeded by the development of an expensive apparatus known as a goniometer for measuring the angles of single crystals. All minerals in the natural state have distinctive forms, just as birds, animals, plants and insects have distinctive forms. The mineral forms are known as crystals, and a single crystal may have 50 faces or even more, but they are always related. Since there are more than 1,600 kinds of known minerals, only about 200 of which are known by sight, their identities must be established by close inspection. With the aid of the goniometer, this identification can be made as certain as the identification of a criminal by his fingerprints. The ordinary crystal, smaller than a pinhead, is placed in the instrument, and the operator charts the facets as a navigator charts places on the earth by shooting the sun. When all angles have been charted, they are checked with an "almanac" of minerals, published by The Academy of Natural Sciences of Philadelphia, Pa., to learn its identity.



Goniometer, above, includes microscope for measuring angles of specimens 1/5,000 inch in diameter. Right, simplest form of goniometer used on larger crystals



Photos courtesy Academy of Natural Sciences

Col. George H. Eckhardt
 2647 N. Park Ave Phila

589 Samuel C. Isardoni

Ten 200-Pound Assault Boats Are Nested on Army Truck

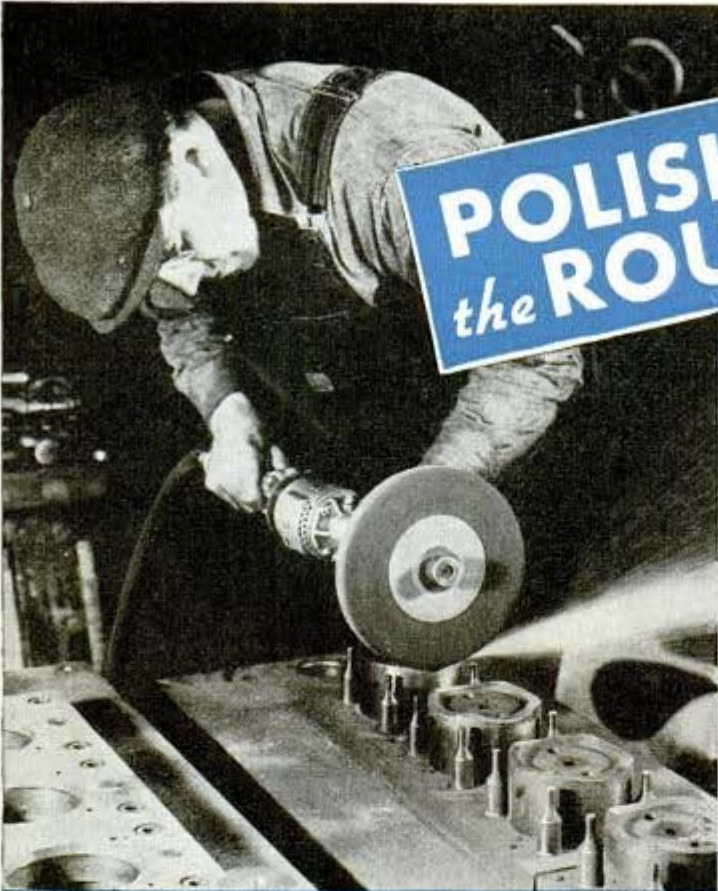


Assault boats weighing 200 pounds, which are used by the 20th Engineers stationed at Fort Benning, Ga., can be nested and stacked 10 to a truck. At a selected point of crossing these boats, each manned by a crew of eight, carry soldiers across the river to establish a bridgehead and prepare to protect the engineers who follow to complete the construction of a pontoon bridge.

Removing an assault boat from army truck on which ten can be stacked

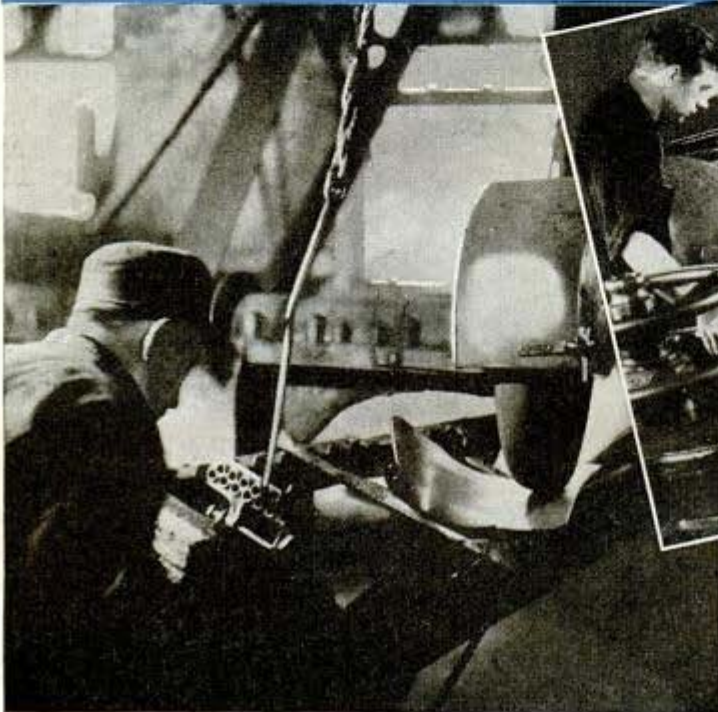
Chevrolet Motor Co.
 Chevrolet

POLISHING OFF the ROUGH SPOTS



Portable grinding wheels (above) are commonly used for finishing dies. Here, cool-cutting qualities are essential
Polishing plowshares (below), requiring high finish at high production rate, with aluminum oxide abrasive grains

THERE'S one common tool that brings the planets nearer, keeps the airplane in the air longer, turns trees into pulp for paper, makes your automobile ride more smoothly. It's the grinding and polishing wheel. A half century ago industry knew only natural abrasives. Gems were cut with diamond dust. Tools were sharpened with sandstone wheels, later with emery and corundum. But none of these natural abrasives performed precision work; irregular in composition, the emery wheel produced a fine polish that often hid an in-



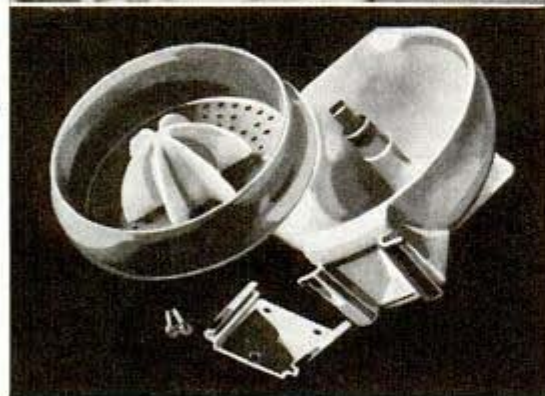
Rolls, such as are used in rolling mills (above) must be ground to exceedingly accurate dimensions and with a surface as nearly perfect as possible to insure uniform thickness of rolled sheets

L. 492

Science Service
April 9, 1941

Wall Bracket Holds Juicer Made of Colored Plastic

rubber juicer



Hand-cranked fruit juicer installed on kitchen wall with the standard bracket shown below it

Made to fit a standard wall bracket that holds a number of other kitchen tools, a fruit juicer just brought out is made of a plastic material. The bowl and reamer are white, the handle and strainer—which catches all pith and seeds—may be red, black, green or yellow. No metal touches the juice. The reamer has a sunken top to accommodate the fruit core.

Plastic in Non-Glare Screen Filters Light Efficiently

A new-type glare-eliminating screen for automobiles, camera filters, optical instruments and other purposes, claimed to be 99.99 percent efficient, has been patented by Edwin H. Land, of the Polaroid Corporation, Boston, Mass. It uses submicro-

scopic molecules, instead of crystals, to line up light waves so they all vibrate in the same direction. One of the new synthetic, rubber-like plastics known as polyvinyl alcohol is used in its manufacture. This is stretched out from three to eight times its original length, which arranges its molecules all parallel with each other; then it is exposed to an iodine solution, which renders the molecules able to filter the light into one-way, or polarized, waves. Called Type H Polaroid, this sheet is said to transmit one-third more light than earlier types of polarizing sheets, and yet when two sheets are turned completely at right angles to each other, practically no light can get through.

Supercharger for Tiny Engines Increases Power and Speed

It is now possible to step up the power of midget engines that drive model airplanes, race cars and boats by equipping them with a real supercharger that weighs only 2¼ ounces. A rotor driven by a pulley running on the flywheel creates pressure on the air intake, and special baffles whirl the air and gas to make a better mixture, thus increasing the speed and power of the engine. The supercharger is easily attached to class B and C and larger class A engines.



More power to the midget engine is given by installing this supercharger to produce a better gas mixture

Patd by Land. # 2,237,565,16
Stacey Chern, Mfg Co. Inc
Warwick, Rhode Island

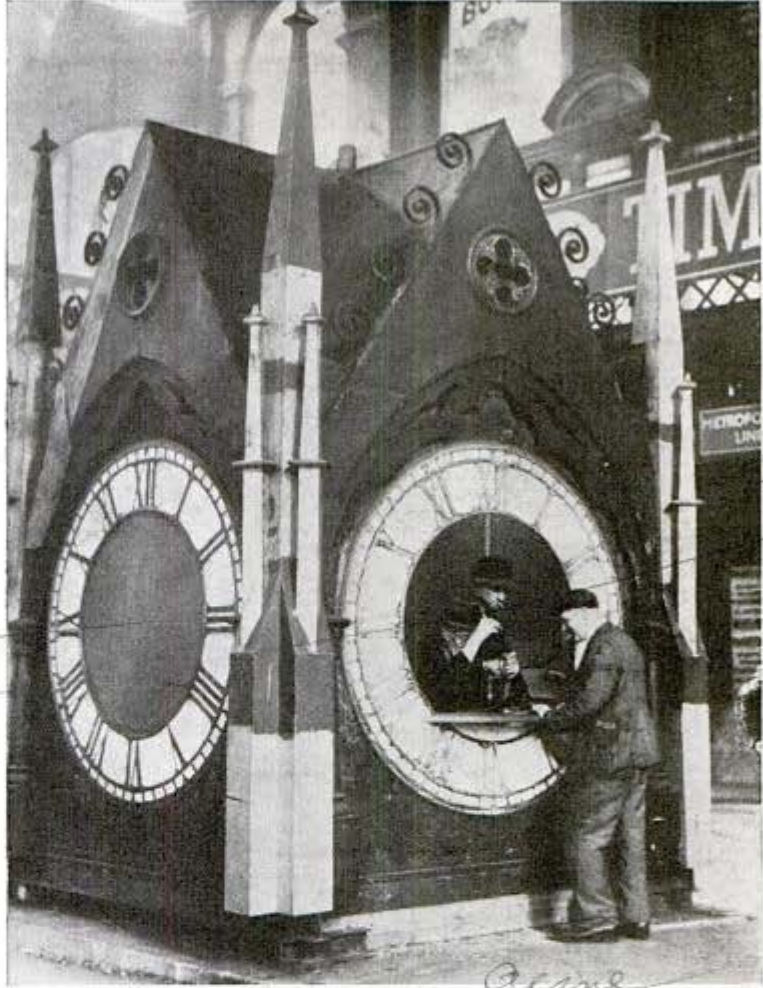
Plus 2 oz
Efficiency improvement Co. 7-11
Des Moines, Iowa

80 730 main St
Boston Mass

2591.

London Clock-Tower Now an Information Post

The huge clock that was once a landmark atop the Liverpool Street station in London has found a new job. Its tower is down on the street, now, the "works" have been removed and the face of the clock is used as an information bureau.



This old London clock has come down in the world. No longer marking the hours above Liverpool Street station, it has become an information post

New York Times April 20

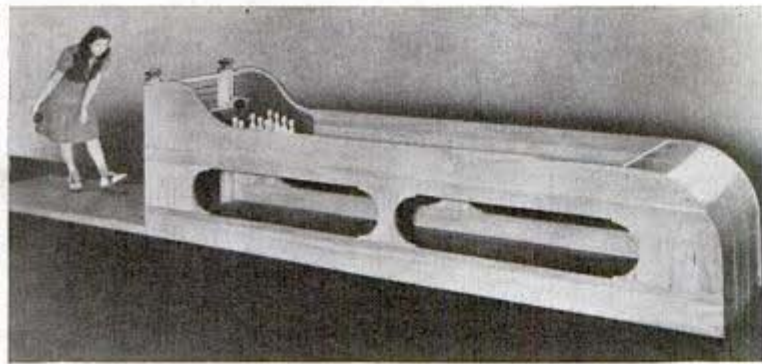
2523
Nonmagnetic Plant Contains no Iron Or Steel

Because it will be used for the assembly and adjustment of magnetic compasses and precision instruments for aircraft, a nonmagnetic building recently completed at Elmhurst, Queens, N. Y., is without a trace of iron or steel anywhere in its structure. In place of these metals, brass, copper, aluminum and wood are used for conduits, pipes, nails, bolts and girders. Some of the pipes are terra cotta instead of cast iron. Brick was used for the outside.

2584
Bowling Alley Built in U-Shape Has Pins on Upper Tier

Needing little floor space for its installation, a portable bowling alley requires a roll of 31 feet to strike the pins, yet the

bowler can reach out and set the pins himself. The alley, measuring three by 20 feet, is built in two tiers, and the ball executes a "U" turn to rise into the upper tier and strike the pins on the return trip. Scores are counted in the regulation manner. Made in seven sections, the alley can be removed and set up in another location.



Ball rolled on portable bowling alley rises at the far end and returns on the upper tier to strike pins set above the starting point

Rollman's Instrument Co. 85-08 Forty-fifth Ave. New York Square

☐ Demonstrations in big cities show that the average motorist in downtown traffic shifts gears or depresses the clutch 360 times an hour.

SEPTEMBER, 1941
Tilly. O'Neal mfg Co 1351 Washington, Boston

Rollman's Auto Club 81
Моторист, энциклопедия автостроения

L189 Cont. Leon Black
1901 Spayer Ave
Los Angeles



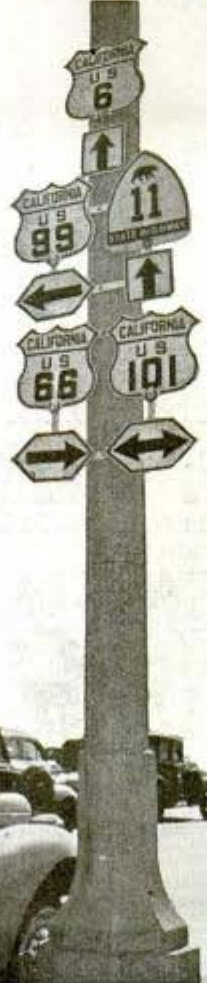
Underground crossarms are bolted to post (left) to keep it from twisting. Right, lining multiple highway lanes



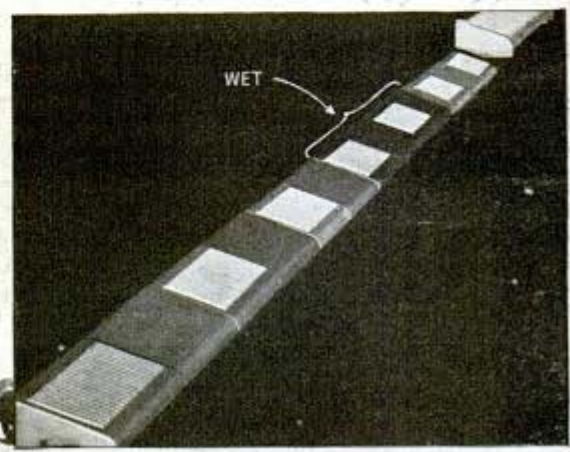
SIGN LANGUAGE for MOTORISTS

TODAY you can motor from coast to coast with no more trouble in finding your way than in locating an unfamiliar street address in your home city. All you need is a good road map, a nodding acquaintance with our national system of road signs—and sufficient gasoline. With a thorough understanding of modern sign language, you could dispense with the map and still reach your destination quickly and by the most direct route.

There are 48 varieties of traffic laws, speed regulations



and street signals, but, with very few exceptions, on the open road you encounter uniform route markers, warning signs and symbols and pavement markings. They are the same in every state, in sections of Canada, Mexico, and many Central and South American countries. Nevertheless, few drivers have adequate knowledge of road signs, their systematized placement, uniform significance, color schemes



Photograph above demonstrates increased visibility of reflecting curb when wet

Left, motorist pulls up for bearings at important road intersection in California

and varying shapes. You know a stop sign when you see it but can you tell me its distinctive color and shape? Without reference to a map can you tell me in what part of the country is "U. S. 395," in what general direction it runs, and whether it is a main highway or lateral and feeder route?

Just as you find odd numbers on one side of a city street and even on the other, so is there method in numbering U. S. highways. Those running north and south have odd numbers, while transcontinental thoroughfares are numbered evenly. Odd-numbered highways begin on the Atlantic coast with No. 1, reaching from Maine to Florida. All principal federal roads have only two digits to the number, with one exception—101.

Working westward from U. S. 1, the next important federal highway north and south is U. S. 5.



In less than 15 minutes the sand blaster removes all old paint from a New Jersey road marker. This is a regular "spring cleaning" routine. Below is a strip of the 160-mile Pennsylvania Turnpike and some typical road signs. The advice to "use both hands" is on a Missouri road



Lamp above is "normally out," letting main road traffic flow until car on side road lights it



2189



Top, a new type of "Slow to—" reflectorized warning signs that are now being installed along western routes
 Right, an assortment of familiar signs. The shapes of "Stop," "Slow" and regulatory signs are standardized
 Road to Ensenada, Mexico, from California border is outlined on map sign with distances in miles and kilometers



The next is U. S. 11, then 15, then 21 and so on to U. S. 101, the exception, which runs from Canada to Mexico down the Pacific Coast. So you know that any two-digit odd-numbered highway with a U. S. shield is a north-south road, that U. S. 55 would be somewhere near the center of our country and U. S. 85 in the far west.

Transcontinental highways are nine in number, beginning with U. S. 10 nearest the Canadian border and ending at Seattle. South from this key route, highways are numbered from 10 to 90, in multiples of 10. Because of the Rocky



mountains, the Cascades and Sierra Nevada ranges which twice bar these routes, there again is a notable exception—U. S. 66. Between U. S. 50, which surmounts the Sierras near the southern end of Lake Tahoe, and Bakersfield, Calif., this range towers to more than 14,000 feet in altitude and there is, as yet, no way for U. S. 60 to get through. Midway between where it should pierce the range, however, and U. S. 70, which hits the California line at Blythe, there is Cajon Pass, only 4,000 feet high, guarded by 11,000-foot peaks on either side. Here's where U. S. 66, the historic Santa Fe Trail gets

L 189

L 520

through to Los Angeles and the coast. In summer it is one of the main traveled highways; although open the year around, most winter travel to the far west is by U. S. 80, near the Mexican border.

U. S. 97 and U. S. 99 are also exceptions among the north-south routes, the former running from Canada to the base of Mount Shasta, Calif., and the latter the principal California-Oregon-Washington highway.

Federal roads of three-digit numbers are important feeder or lateral routes. The figure is derived from the highway of origin, with a third digit in front to indicate the road's approximate location with reference to the state or states. Thus U. S. 395 originates from U. S. 95. State highways conform generally to the federal system, supplementing it with intermediate routes bearing intermediate numbers so far as topography will permit.

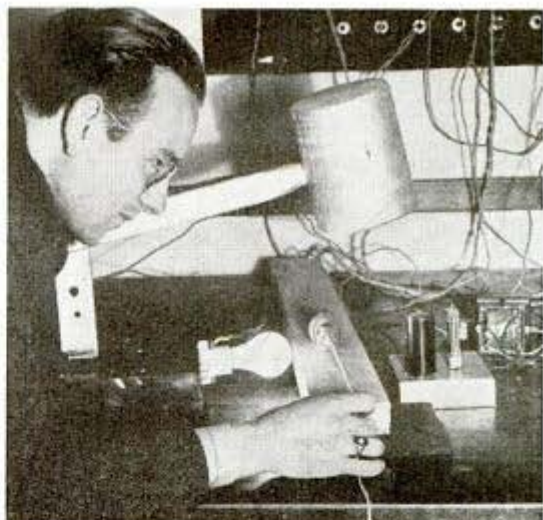
Let us assume that you are now on tour and, following your pre-determined route by the numbered federal and state markers, come to the outskirts of a strange city. Here's how to thread your way through a maze of unfamiliar streets with assurance and dispatch. As you approach every important intersection watch on your right for your identifying route marker. It will be found in advance of the crossing by at least one city block, perhaps two. Any shift in direction will be indicated by the letter "R" or "L," for right or left turn, beneath the marker shield. At the intersection itself will be a second route marker, with arrow. Absence of an "R" or "L" on the advance intersection marker is your cue to continue straight ahead. In that case your confirmatory marker awaits you not more than 100 feet beyond the crossing.

Principal destination signs at an intersection avoid more than four names, as a rule, two in each direction. The top name should be that of the ultimate principal city to the right or left, the other that of the first town of importance. Although route markers have greatly lessened dependence on destination signs, the latter often are essential to short-trip travelers without map or route number knowledge, particularly for mileage information.

Highway signs perform three essential services in safeguarding and expediting traffic. As outlined by the United States Bureau of Public Roads, these are (1) regulatory, (2) warning and caution, (3) guide.

(Continued to page 171)

Electric Eye Trips Mallet To Execute a Mouse

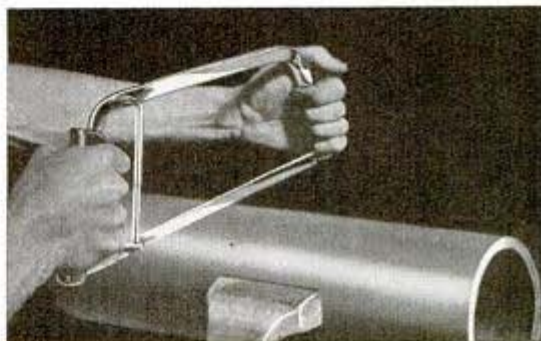


As the rubber mouse is drawn past the electric eye the interruption of light beam causes mallet to drop

Just to show its versatility, an electric eye took over the role of mouse executioner the other day. It was a rubber mouse, but the effect was the same. In the demonstration, at California Institute of Technology, the mouse was pulled along a board, and as it interrupted the beam from a lamp to a photocell, the electric eye set the machinery in motion to trip a large mallet which dropped on the mouse.

Hand Guard on Hacksaw Frame Prevents Skinned Knuckles

Injuries to the hands while using a hacksaw can be avoided with a patented frame having a built-in guard that keeps the hands from striking the work. The saw also has an automatic tension lock that holds the blade tightly in place by means of a cam action, yet permits a quick change.



Bumper keeps sawer's hand from striking the work

Mr. Thomas J. Linn...
3877 Franklin Ave.
Los Angeles

✓ Pasadena, Calif.
L 116

W. D. ...
Mendota, Calif.

2588 *Wester & Merchandise Mail*

Three End Tables Nested as One Are Handy for Serving



Three end tables nested at davenport are handy for guests

Los Angeles

Fitting snugly against the end of the davenport when not in use, three nested end tables may be brought forth singly when a snack is prepared for guests. Instead of balancing plates on their laps, guests have individual tables on which to set cups and dishes. A complete unit consists of six tables, three for each davenport end.

2407

Car's Share of a Trailer Load Adjusted by Turning Crank



By turning the crank of a trailer attachment now available, the automobile owner may adjust the hitch load of the car from zero to 100 percent of the trailer tongue weight and thus find the point at which the car will run smoothly at

all speeds. It also prevents the trailer from bumping or weaving, and stabilizes it so it

will follow the car in a straight line. Mounted on two wheels to allow shorter turns, the unit makes a handy support for parking the trailer when detached from the car. It is designed to carry a weight of 800 pounds.

2445

Robot Clock for Navigator Shows Position of Plane

Combining a clock with other adjustable dials, a watchmaker in a California aircraft plant has devised an instrument with which the navigator of an airplane, after setting a problem in the chronometer, can obtain the plane's position in fifteen seconds. The instrument is expected to be of great value on long flights, as on bombers where success depends on exact calculations of position. A vernier at the top of the clock records minutes and seconds of time with the corresponding conversion of arc during elapsed time of observation. Calculations and corrections are set by movable dials, the navigator "shoots" the sun or stars and by checking the vernier against the clock reading, he can read his position to the second.



This device plots a plane's position in 15 seconds

L-4 201

Milton Berry, Jr. 30

Cont. Thomas E. Stearns by Los Angeles 38727

"Duck" Shoes and Braces Train Paralyzed Legs

Victims of spastic paralysis, heretofore doomed to spend their lives in bed or in wheelchairs, now are learning to walk and to be physically independent at the Milton Berry Foundation at Encino, Calif. The new treatment, or course of instruction, involves the use of large "duck" shoes resembling wide wooden platters, and special braces that support the legs and body. Spastic paralysis victims have the strength to walk but are unable to coordinate their muscles. The wide shoes keep them from falling while learning to walk; the braces prevent their legs from moving the wrong way. Step by step the student learns to move his muscles, and in one month to a year he can walk across a room with the mechanical assistance. The size of the duck shoes is reduced as he improves. Similar apparatus is being used to restore victims of industrial and infantile paralysis to more active lives.



Articulated braces, top, are fitted to each person to prevent undesired motions. "Duck" shoes, right, are made in graduated sizes.

1507

Tiny Chisel Driven by Electric Shaver Speeds Taxidermist's Work



Tiring of the tedious hammer-and-chisel work involved in roughing down plaster casts, Adrian Hines, a sculptor taxidermist of San Antonio, Tex., converted an electric shaver into an automatic hammer to do the rough sculpturing, and found that it reduces the working time by three-fourths. To make the tool, the blades were removed from a \$3.00 electric shaver, leaving only the eccentric knob. A small hole was drilled into the chiseling head to fit it over the eccentric knob. To hold the chisel head in place on the eccentric, an aluminum strip was fastened on the side of the case and bent flush over the head. For fine work, a small guide may be placed on the back of the blade.

9123 Hays St

are increasing the valuable contents of herbs, and the perfection of labor-saving harvesting machines are two factors that suggest important herb crops for farmers.

But beware of any get-rich-quick schemes in growing herbs. There are many pitfalls for the inexperienced. Seed may be of a variety that has a low drug content. The value of flowers, leaves and roots may be diminished if they are dried improperly. Herbs are susceptible to a number of plant diseases and they must be cultivated with the same care given other valuable crops.

If you are interested in raising herbs the first thing to do is to obtain Farmers' Bulletin No. 663 from the U. S. Department of Agriculture and study the harvesting and marketing hazards involved.

(Continued to page 162) *64*

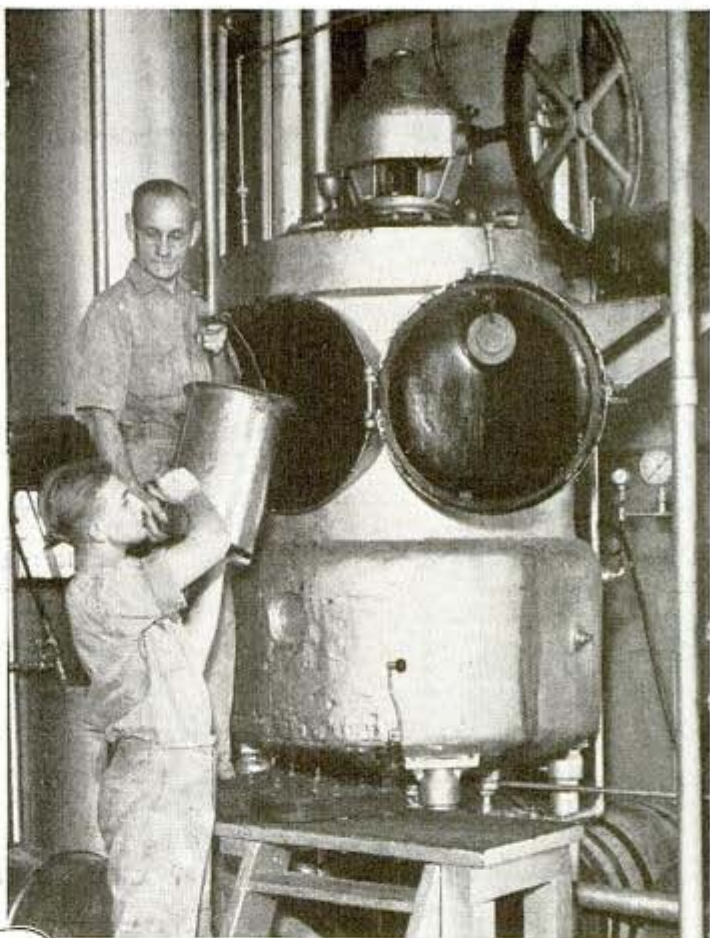
Below, scoop suitable for harvesting flower heads of large size



Still in which extracts and concentrates from leaves and herbs are obtained

Bottom, left, lavender bush from which many pounds of flowers are taken annually

Below, receptacle in which medicinal herb tablets are sugar-coated and polished



Tadpole Models Made of Plastic Render Life Transparent



Top, painting model of frog made of plastic. Bottom, two plastic tadpoles; note leg developing on tadpole held in left hand

Enlarged plastic models of tadpoles in natural colors, said to be the first of their kind, have just been completed at the Field Museum of Natural History in Chicago, under direction of Frank H. Lett, staff preparator, and Joseph B. Krstolich, sculptor. The models are part of a group that eventually will tell the life history of the frog from the egg to maturity. Since the plastic is translucent, it permits naturalists to portray interior organs and other details, which are carved intaglio fashion. After the model has been carved it is colored with natural hues of the subject to give a lifelike appearance. In its raw state the plastic is virtually colorless and pours like water. The first task is to pre-

pare an accurate plaster model of the desired size, and from this a rubber mold is made into which the plastic is poured. The mold is then sealed and placed in a thermostatically controlled electric oven where it is baked approximately ten days at a constant temperature of 160 degrees Fahrenheit. Length of baking depends on the size of the model. The material is impervious to changes of temperature, is not affected by light, is highly fire-resistant and not subject to attack from insects. Properly baked plastic lends itself to carving with knives, electric drills and other tools. It is tough and does not crack easily, nor shatter. A small model of the solar system is also nearing completion, and plans are being made to reproduce many other objects in this material.

Automatic Battery Fillers Show Condition of Acid

Easy to attach in place of the vent caps, a combination gauge and automatic battery filler slowly adds water to the automobile battery, constantly maintaining a correct liquid level. It also serves as a battery gauge, since the acid solution circulates from cells into the reservoir bottles, carrying with it any sediment or discoloration caused by wear or disintegration. Discolored sediment can be readily seen in the bottle and this indicates the condition of the cell.



Glass fillers take place of battery caps

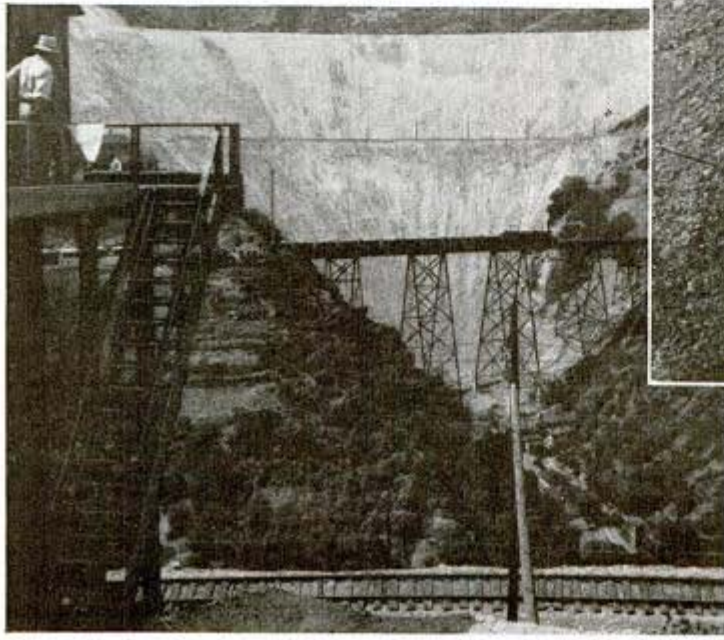
POPULAR MECHANICS

2,547 Kennecott Copper Corp
120 00 roadway level!

Hundred-Mile Railroad Rings Vast Copper Pit



In the vast amphitheater of Bingham Canyon, west of Salt Lake City, is the largest open-pit copper mine in America, from which Utah Copper company moves 150,000 tons of ore and waste daily. Electric shovels load ore into what appear to be toy trains (above), but they run on standard-gauge electrified railway. There are nearly 100 miles of track on the level tracks, dump tracks and terraces



Photos by W. M. Rittase
Above, miners trim the face of the pit after blasting. They use 5,000,000 pounds of dynamite a year. Left, the waste pile reminds visitors of Boulder Dam. Over a ton of waste must be dumped for every ton of ore mined. There are 36 working levels, rising 1,700 feet from pit bottom to mountain top.

Cent. William. Rittase 247 S.
15 N. N. Phil.

L 269 Cont. Marshall Perham
1125 Stearns Ave. La



Precariously perched on the transmission towers, trouble shooters perform their hazardous duties

Beating TROUBLE to the PUNCH

TROUBLE shooters would have no jobs if their bosses could achieve their ultimate goal. That goal is to eliminate trouble before it happens, and to that end, new electric conduits, telephone lines, gas mains and water pipes being installed today are of the most weatherproof and erosion resistant materials obtainable. Eventually one can visualize a foolproof network of transmission lines.

But this ideal situation isn't here yet and meanwhile trouble shooters are doing the best job in history in the busiest times the power companies have experienced. Stoppages, delays, and breaks in utility service are at an all-time minimum.

Let's view the water department first: Suppose a leak is traced to a hilly section where the water runs far under-

At instrument in circle, operator checks efficiency of thousands of miles of telephone line

Bottom, machine to detect weak spots in paint inside water pipe





Before they go down to repair damaged electric conduits, workmen test the manhole for carbon dioxide gas

ground. Seems like a needle in a haystack search but trouble crews have the job down to a fine art. They start their search by drilling two or three small holes, several feet apart, into the water main. Pneumatic equipment is used. Into these holes they insert a steel rod, to which they bend an attentive ear.

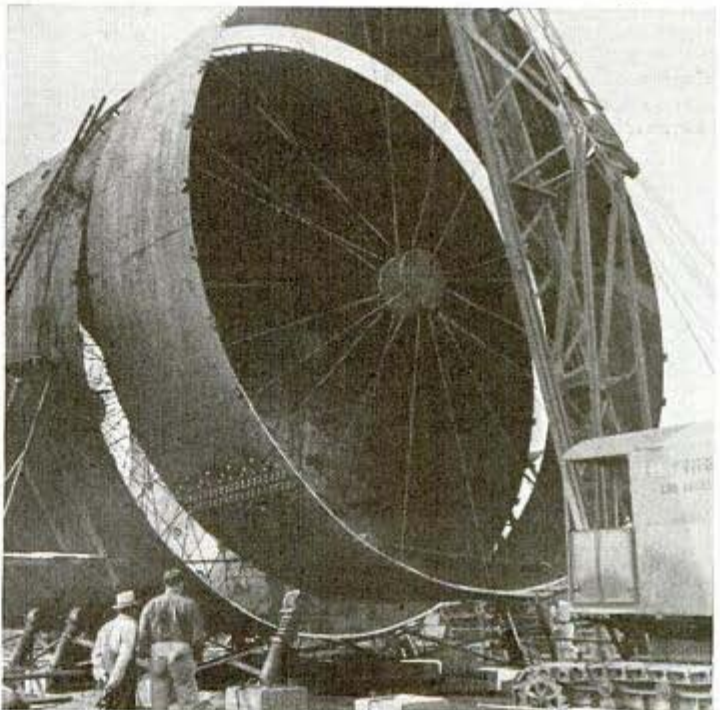
Contact with the water main carries an audible hum, the sound diminishing or increasing with proximity to the point of leakage. Within a few minutes the exact spot is determined.

A refinement of this simple device known as the Lundin Fault Analyzer and Locator is used to check power leakage. It is the legendary divining rod in modern guise. Power cables are hidden many feet in the ground and in the event of a disturbance the Lundin "X-ray" ear is brought into play. Wires from the outfit are attached to the cable in the trouble zone and a flashlight indicates the individ-



Working in a maze of wires, the power company trouble shooter can spot a faulty line immediately by employing his Wheatstone Bridge

Below, erecting a huge storage tank, as part of the program to prevent any emergency shortage of gas for the homes of Los Angeles





Above, hunting leaks in power line with a detector that sets up a buzz near the trouble site

ual wire that has broken or short-circuited.

Once the faulty wire is determined the Lundin machine operator runs low-voltage currents through the wire and also into the ground. A motor interrupter on the ma-

Cannon below fired a line across 600 feet of water to establish communication between banks



An emergency cable car ferries trouble shooters across a river, over a pipe line slung well above high water



long life. A circular steel brush, electrically wired, establishes contact against the pipe surface and throws off sparks when a bare or thinly coated spot is encountered.

The plant growth known as algae also receives trouble shooters' scrutiny. Ultraviolet ray activity, scientists find, materially increases this growth, which is a threat to the purity of reservoir water. After extensive experiments, these scientists found they could fight

Atlas Electric Devices Co

361 W. Superior Ave. Chicago

North Birmingham Ala

the algae with copper sulphate, blasted from a gun on a boat. The gun actually is a gasoline-engined blower mounted on a swivel. It shoots the chemical from 75 to 100 feet, dispersing it evenly.

One unique piece of apparatus in the Los Angeles laboratories is the Weather-Ometer, which makes weather to order so that the best materials may be selected for protecting equipment from the elements.

At the turn of a switch the Weather-Ometer manufactures rain, fog or sunshine. Sunlight, the most deteriorating agent of these, is reproduced by suspending an enclosed violet carbon arc in the center of a revolving metal drum on the sides of which in special holders are mounted the samples under test. Temperature and humidity of the surrounding air are regulated by automatic controls and a ventilating fan operating in conjunction with a water pan and spray. By combinations of stationary and revolving sprays, samples may be subjected to a drizzle or a driving rainstorm.

Gas companies learned their great lesson in trouble shooting during a cloudburst over southern California. Thirty-five miles north of Los Angeles the raging Santa Clara river tore out a 26-inch gas main from natural gas fields 200 miles upstate. Then out went a second pipe and the panic was on. Only a 12-inch pipe stood between safety and disaster. The public knew only that gas pressure was extremely low. The area uses gas for practically all of its heat, most of its cooking, and some refrigeration.

Only gas men, praying for the 12-inch line to hold, visualized what might happen if it didn't—disease sweeping through Los Angeles' 1,500,000 inhabitants; patients in unheated hospitals; perhaps an outbreak of plague because flood-polluted drinking water could not be boiled.

Trouble shooters scurried to the spot where the Santa Clara river inched higher and higher toward the remaining pipe, undermining the banks that supported it.

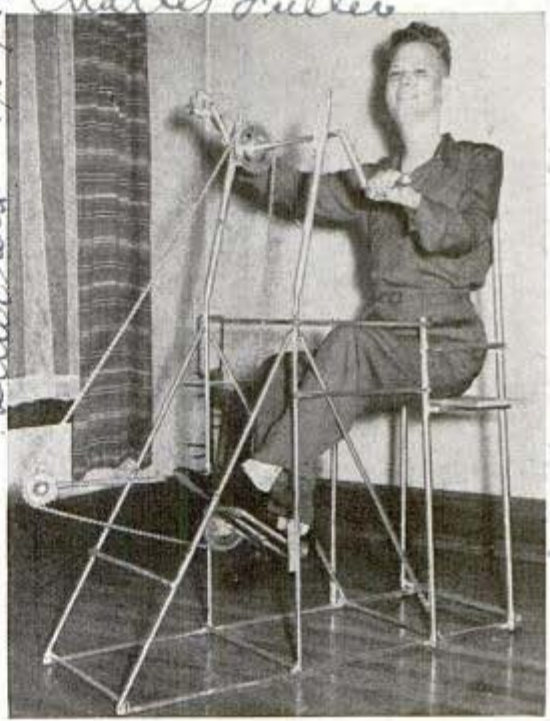
Four men volunteered, then took turns swimming the river, carrying a line on which an emergency pipe might be suspended. One by one they failed and narrowly escaped drowning. Luckily the 12-inch pipe held and disaster was averted.

Out of the episode has come a \$1,000,000 job of trouble shooting—one that insures that never again will a fuel supply cutoff be possible. Recently, under almost iden-

(Continued to page 166)

Paralysis Victim Uses Cycle For Exercising Limbs

Charles Muller



Seated on this cycle exerciser, paralysis victim operates pair of hand cranks and pedals simultaneously

Aided by a homemade exerciser built by his father, one youth stricken by infantile paralysis has regained sufficient muscular control to remain outside his "iron lung" all day long. The machine, finished in bright aluminum paint, was made of odd lengths of pipe, three sprockets, a chain, foot-pedals and hand-holds. The stationary cycle is pedaled by the boy's feet while he grips the hand-holds. This helps develop arm muscles weakened by the disease.

Chemical Pencil Helps Detect Counterfeit Coins

Counterfeit coins can be detected quickly with a chemical pencil just introduced. After scratching the surface of the "silver" coin with a knife, the pencil point is moistened and touched to the coin. If it is counterfeit, a dark spot will appear at once.



Wey
1933
Allstate Co. Birmingham

Hand Operated Belt-Lacer
Easily Carried to Job



Belt lacer on stand of convenient height is light enough to be carried to the job by one man

Despite its lightness which permits carrying to the job, a portable belt lacer developing 30,000 pounds of pressure is so powerful that it embeds the hooks flush with the surface of the belt. In one operation it clinches the points so that they cannot pull loose, and it will lace one end of any belt up to six inches wide. Wider belts can be handled by repeating the operation.

Snap Gauge Measures Diameters
With Speed and Accuracy



Speed of operation and a high degree of accuracy are combined in a hand-type snap gauge for measuring diameters. There are two opposed anvils, the lower one being adjustable, and the upper one being held by spring

tension to insure constant and uniform pressure on the work. The backstop is conveniently adjustable so it may be set to correspond with various diameters. Measurement of diameters is shown on an easy-to-read dial that registers from a fraction of an inch to five inches, plus or minus.

Breath Is Made Visible in Cold Air
By 200,000,000 Particles

In every breath a person exhales there are 200,000,000 particles that help make the breath visible in very cold air, according to a recent discovery made by Dr. George R. Wait, of Carnegie Institution of Washington. The majority of the particles are electrically charged, some positively and others negatively. On a cold morning, the moisture in the breath condenses around these particles. Such particles are common in the air over chimneys and the exhaust of automobiles. If the particles were not exhaled, the breath would not be seen in an open, snow-covered countryside, where the air is free of them.

Shaving Brush Is Held Upright
On Three-Pronged Stand

Shaving brushes should last longer and retain their shape if kept on a three-pronged stand which holds them in an upright position. In this way the bristles dry in a natural straight position, the excess water and soap draining into the concave base of the stand.



Prongs that hold brush upright are shown at the left

Federal Products Corp. 1147 E. 11th St. Chicago, Ill. 2600

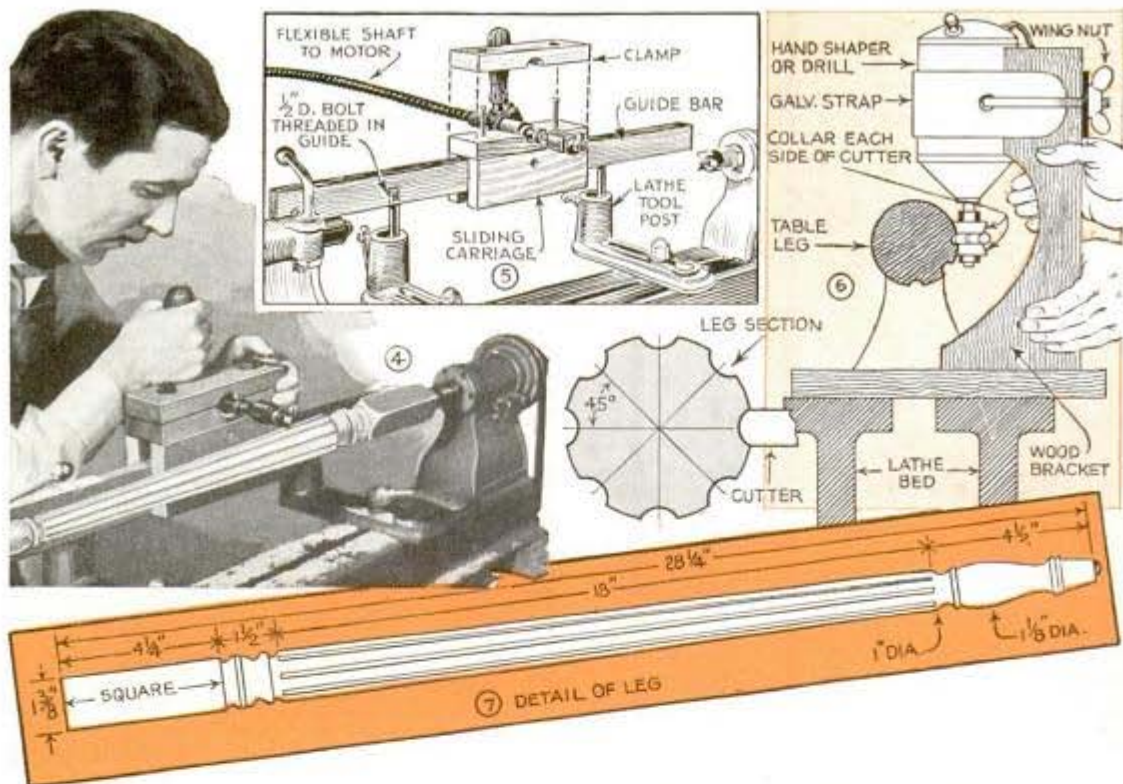
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116

Dept of Terrestrial Magnetism

2528



is clamped to a wood bracket made for the purpose. This is set on the lathe bed and moved back and forth with the hands. Collars are used on each side of the cutter to serve as depth gauges. After one groove has been cut, the work is turned and the lathe spindle is locked before cutting the next one.

The perspective drawing in Fig. 2 gives a clear picture of the assembly. The front legs are joined by the strips above and below the drawer front. These are mortised into the legs as shown in Fig. 3. The rear legs are joined by a single 4-in. piece, which is mortised into them and glued. Care should be taken to wipe away the excess glue to prevent spots when finish-

ing. The drawer slides join the two pairs of legs together, after which the three-sided end compartments are built on. Note that these have spline joints, the ends of the members being cut at a $22\frac{1}{2}^\circ$ angle. The pieces are first rabbeted for a $\frac{1}{4}$ -in. plywood bottom. The table top is made of $\frac{3}{4}$ -in. material and is secured in place by means of steel fasteners mortised into the apron strips as shown in Fig. 3. The lids for the end compartments are pivoted to the table top with hinges of the invisible type. Small lift-out trays fit in the end compartments, and can be made of plywood. The drawer is made in the usual manner, and has a molded front with a drawer pull of the same material.

Straightedge on a Wheelbarrow Is Hedge-Trimming Guide

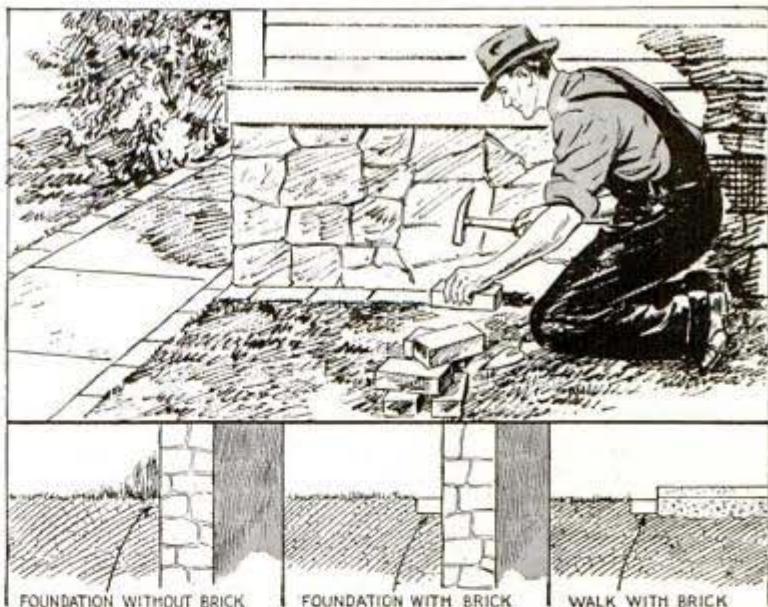


Attached to your wheelbarrow by means of wood strips, a 10-ft. straightedge provides a portable gauge to aid in trimming hedge. If metal guides are provided on the wheelbarrow to take the supporting strips of the gauge, it can be removed or replaced quickly.

☛ When removing grease from a child's sensitive skin, work a small amount of lard over the spot to soften the grease so that it can be wiped off with a dry cloth.

Bricks Laid Along House Aid in Mowing Grass

Laid end to end in rows around the foundation of a house, along the sides of a sidewalk or driveway, bricks will keep grass from growing at these points where it cannot be reached with a lawnmower. The bricks eliminate almost all of the cutting which usually has to be done with hand clippers. If the bricks are laid flush with the ground, they provide a level place on which the lawnmower wheel will ride so that you can cut the grass close to them. — Earl Bowers, Athens, Ala.



Steel Porch Mat Protects Grass in Front of Lawn Swing



Sharp heels of children's shoes cannot dig up a lawn in front of or under a lawn swing if the grass is protected with an old galvanized-wire porch mat as shown in the photo. The mat permits light to reach the grass, which grows up through the mesh with little interference. The mat and swing can be moved around to different parts of the lawn or they can remain in one place throughout the season. In either case, the grass will not be damaged.

—John C. Burtner, Corvallis, Ore.

Small Brass Grommets Are Spread Easily by Using Hinge Pin as Driver

When putting small brass grommets in a tarpaulin or other cloth a round-head hinge pin makes a good tool for spreading them. Used as shown, the pin is given a couple of light taps with a hammer to spread the grommet, which is then clinched down over the cloth by a final tap of the hammer.

—Peter B. Horsley, Calgary, Alta., Can.

☐ Cypress, cedar or redwood are best for making window boxes as they stand moisture better than many other woods.



Solving HOME



Radiator cleaned by covering it with a damp cloth and blowing dirt onto the cloth with a vacuum cleaner



Buttons are cut off garments easily with a razor blade or knife without damaging the cloth by holding an ordinary comb under the buttons



When cutting corn off the cob, use an ice pick in one end as a handle and rest the other end on a cake tin



Left, a piece of cretonne tied to the back of a high chair forms a pillow pocket that can be removed for laundering when soiled

If you keep your clothespins in a pail, you can also store the line with the pins by bending the bail to provide a reel as below



Set a scrub brush over the strainer of your sink while washing vegetables under a faucet to avoid clogging the strainer with leaves and stems



PROBLEMS



WOOD STRIP BATH SPONGE

A rubber bath sponge attached to the lower end of a door to contact the floor provides a friction-type stop that is always ready for use without stooping

Lay the edges of bathroom linoleum over a 1/4-in. wood strip placed under the quarter-round molding. This raises the edges of the linoleum to keep out water

Sheet rubber cut as below and tacked inside a cabinet door provides a pot-lid holder that holds them snugly to avoid rattling

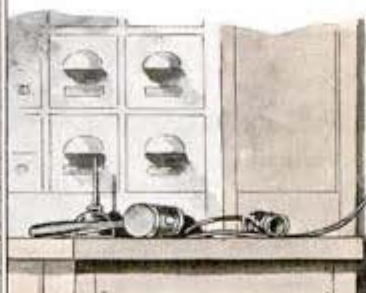


CUT ON DOTTED LINES

INSIDE CABINET DOOR LIDS

INNER TUBE

Taped near the plug end of a long extension cord, a length of stiff wire bent as shown below provides a handy reel on which the free end of the cord can be wound when not in use



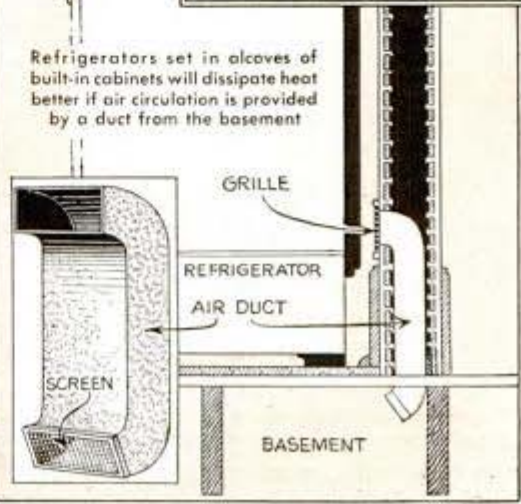
RUBBER GLOVE

Keep an old rubber glove handy in the kitchen to wear when opening fruit jars. It provides plenty of friction to grip a lid tightly



BASEBOARD MOLDING LINOLEUM WOOD STRIP FLOOR

Refrigerators set in alcoves of built-in cabinets will dissipate heat better if air circulation is provided by a duct from the basement



GRILLE

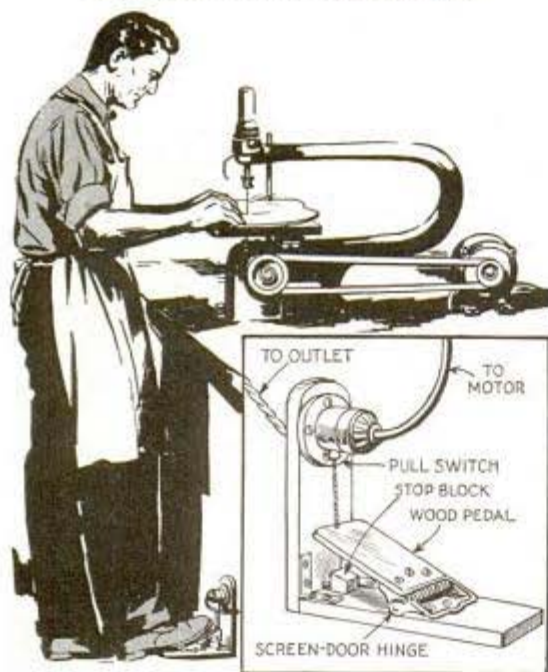
REFRIGERATOR

AIR DUCT

SCREEN

BASEMENT

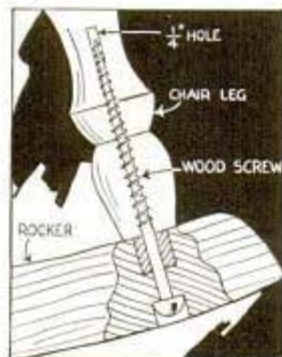
Foot Switch for Power Tools From Socket and Hinge



Desiring foot switches to control my home workshop machines, I made some inexpensively from pull-chain sockets or switches and spring-type door hinges. Each switch consists of a socket and a hinge mounted on a right-angle frame, the pull chain of the switch being fastened to the hinge so that a press of the foot on the latter starts or stops the machine.

—D. C. Nicholson, Webster Groves, Mo.

Broken Leg of Rocking Chair Repaired With Long Screw



If the tenon at the lower end of a rocking-chair leg breaks off, you can repair it with a long, slender wood screw. First, be sure that the broken portion of the tenon is firmly glued in the rocker. Then drill a pilot hole through

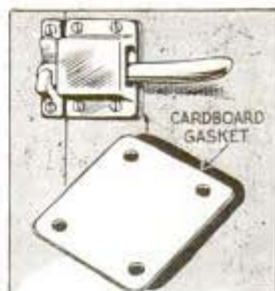
the rocker, tenon and leg, counterboring it on the underside of the rocker. Now force glue into the hole and then drive in the screw. If a suitable screw is not available, score the sides of a nail and use it as a sub-

stitute. When a nail is used, it is best to clamp the joint until the glue dries. This repair can be used on chair rungs by plugging the hole over the screw.

Latch of Ice Box Shimmed To Take Up Play

If the catch on your ice box has worn so that it does not keep the door closed tightly, shim the portion of the latch on the door with a piece of cardboard placed behind it.

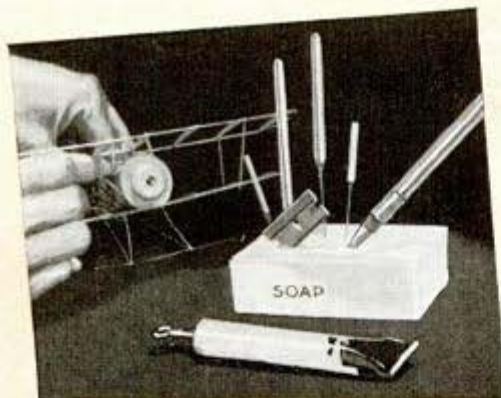
This will compensate for the wear between the latch bolt and the catch so that the door will fit tightly.



Bulb-and-Tube "Mallets" to Play This Table-Croquet Game

Children will have a lot of fun with this table game, which is played similarly to lawn croquet; but instead of using a mallet to drive the ball, it is blown through the wickets with a blast of air produced by a rubber bulb through a length of tubing. One squeeze of the bulb is considered the same as one stroke with a mallet. Plywood or pressed wood will do for the court, and the balls are made of cork.



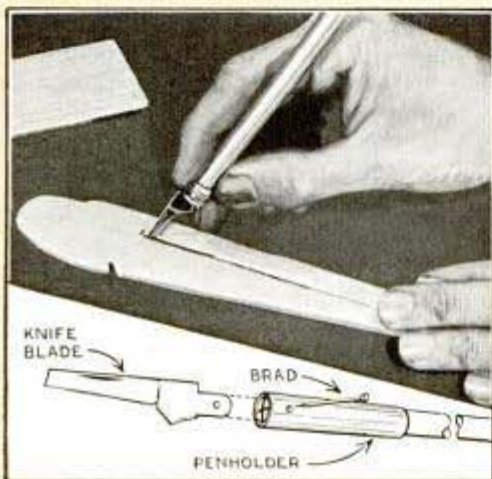


AIRPLANE MODELER

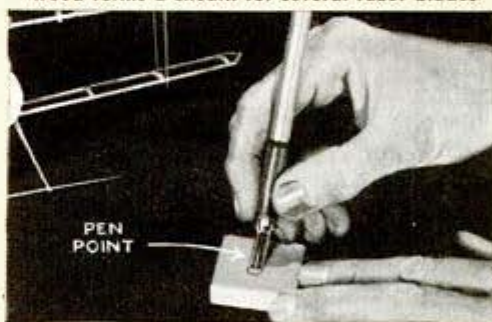
uses these simple tools



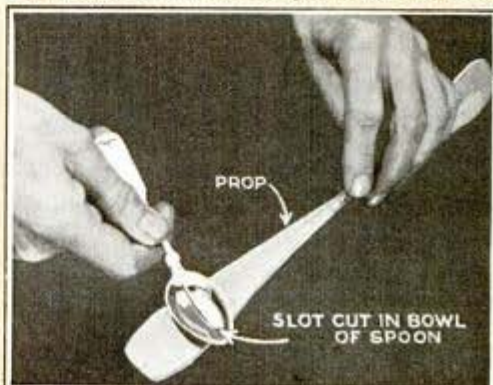
Made from a section of a razor blade as shown above, or from part of a knife blade as shown below, either of these two simple tools is splendid for cutting out parts from sheet balsa. One type is cemented and bound in a slotted stick, while the other is shaped to fit in the end of a penholder



Possible injury to the model builder can be avoided if holders like the ones shown in the photos above are provided to guard sharp-edged tools. A cake of soap, besides offering an excellent soft surface in which to thrust the tools, also keeps the cutting edges lubricated, while a slotted block of wood forms a sheath for several razor blades



Above, the rounded end of a pen point, sharpened on an oilstone and inserted in a penholder, forms a tiny gouge which will be found handy especially in fitting nose blocks and similar small parts. "Dishing" the blades of model props can be done easily with a slotted teaspoon as shown below. The sharp edges of the slot produce a hollow as the bowl of the spoon is scraped across the wood



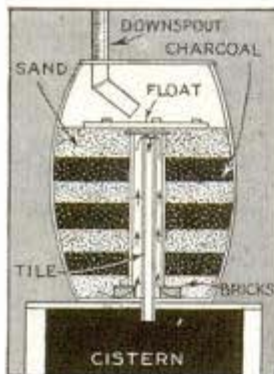
Underground Tank Cools Water Coming From Faucet



A tank buried underneath the basement floor directly below the sink assures a supply of cool drinking water from the faucets in our home. With this arrangement, it is unnecessary to drain a long line of pipe to get cool water. A 10-gal. hot-water tank was used, and it was connected into the water line as indicated.

—R. Boettinger, Englewood, N. J.

Inexpensive Filter for Cistern



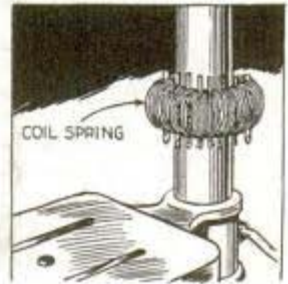
Anyone can make this filter at practically no cost to clean water from a roof before it enters the cistern. It consists essentially of a keg filled with alternate layers of sand and charcoal through which the water must pass.

An outlet pipe in the bottom of the keg projects well up into it and is covered with a tile. Water first passes through the sand and charcoal, then flows up inside the tile where it enters the outlet pipe. This tile-and-pipe arrangement serves as a trap to keep sand from entering the cistern. A

wood-disk float placed on the top layer of sand under the downspout from the eave-trough serves as a splatter shield to prevent disturbing the sand.

Bit Holder From Coil Spring Fits Drill-Press Standard

Drills are held firmly within easy reach if you keep them in the coils of a spring stretched around the standard of your drill press. The spring used for this purpose should not be too stiff; just stiff enough to grip the drills and yet have them easy to remove.



Carbon Paper Aids in Stamping Letters on Wooden Articles



When using lettering or numbering punches on wood, you can make the indentations stand out clearly by using a piece of carbon paper. This is placed between

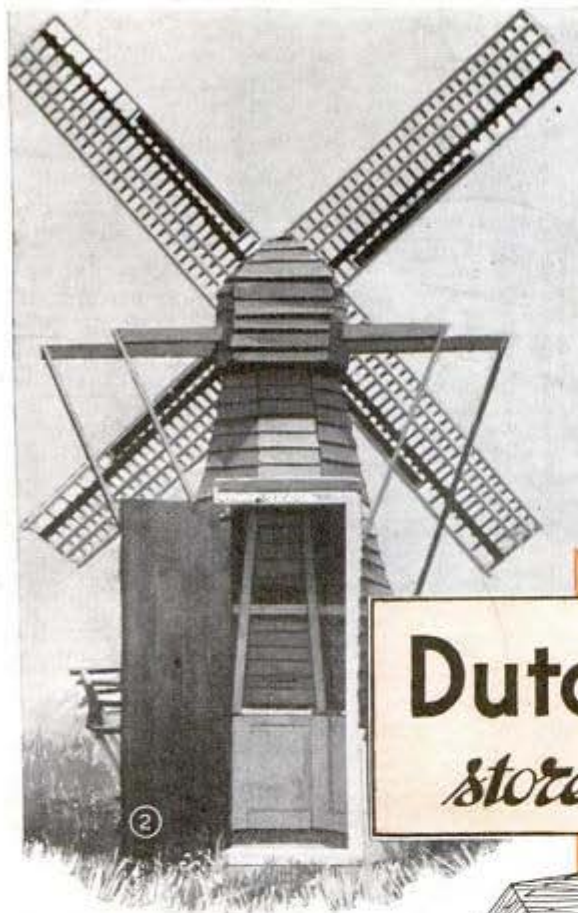
the work and punch before making the indentation.—T. G. Sutherland, Chicago.

Drafts Under Baseboard Stopped By Felt Weatherstripping

In many houses that are ten to twenty years old, tests have shown that cold floors are sometimes caused by air entering under the baseboard and quarter-round molding from the outside walls. A good way to stop this trouble is to glue felt weatherstripping to the underside of the molding. When replacing the latter, press it down firmly to compress the felt and make a good air seal.



—John W. Schulz, Bay Shore, N. Y.

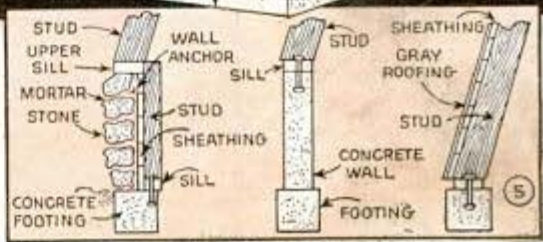
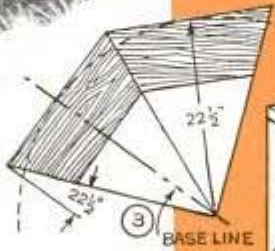


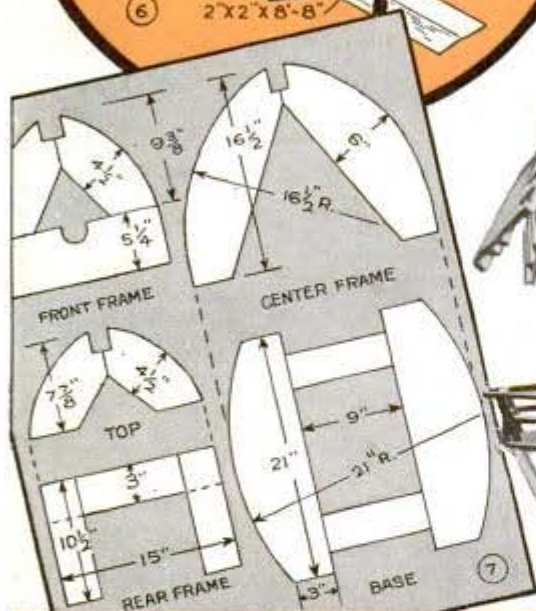
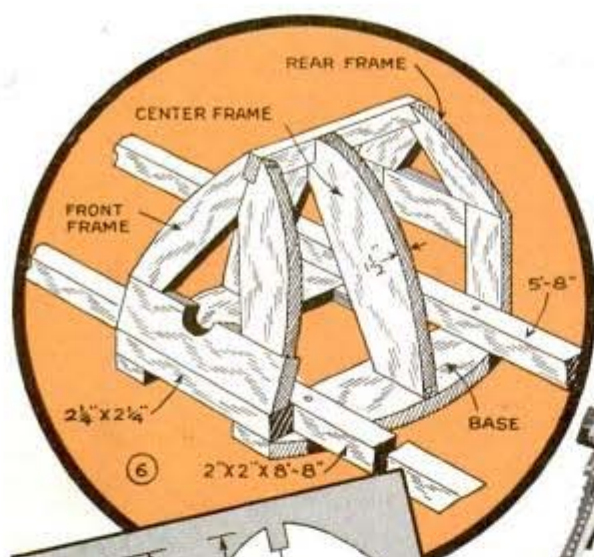
Dutch Windmill

stores garden tools

By R. W. Madden

ADDDING a picturesque touch to any garden, the Dutch windmill shown in Figs. 1 and 2 provides space for storing garden tools. If the mill, when fitted with the sail, is too large for your yard, it can be made smaller by reducing the dimensions proportionately. Fig. 5 gives a choice of three types of foundations upon which to erect the framework for the full-size mill as dimensioned in the drawings. The wall type, while requiring more work, simplifies construction of the doorway and the framework. Bolts embedded in the concrete are used to anchor the sill. After a suitable form has been set up, and the wall is poured and allowed to harden, an octagon-shape sill of 2-in. stock is cut as in Fig. 3, toenailed together and bolted in place on the top of the wall. Then standard 2 by 4-in. studs are cut to length and nailed over each joint of the sill. A 13-degree cut on each end of the studs will give the framework the correct slant. The position of



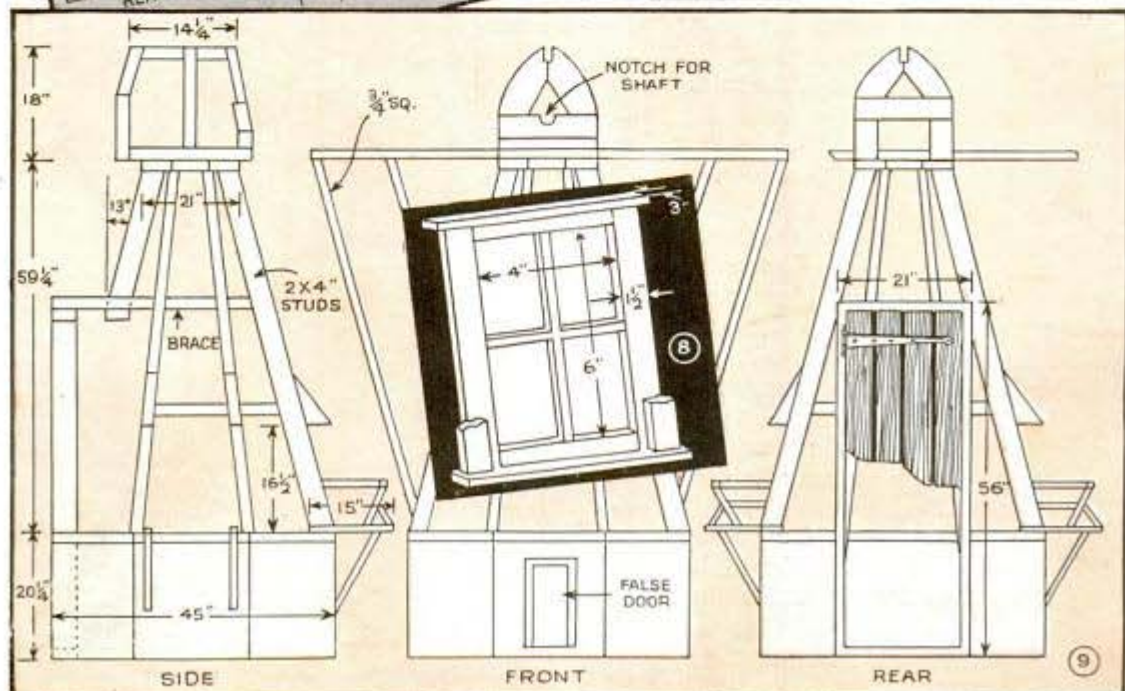


CLAPBOARD



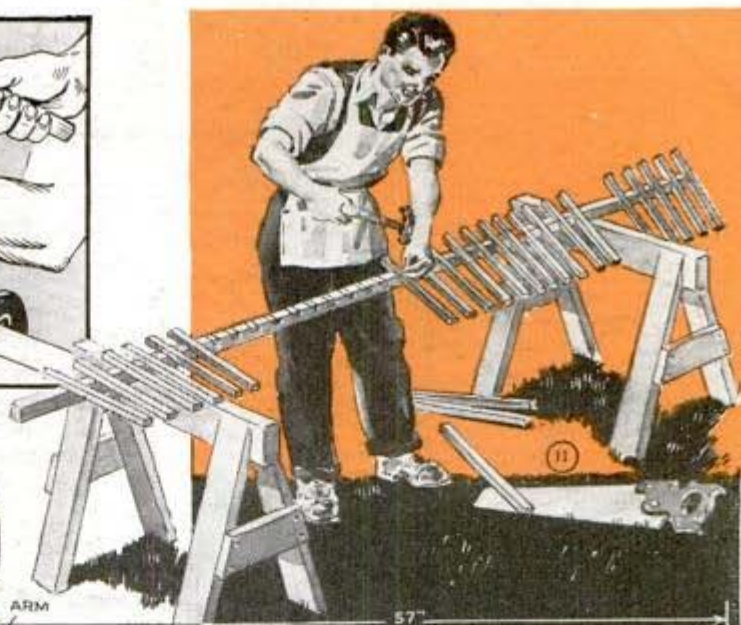
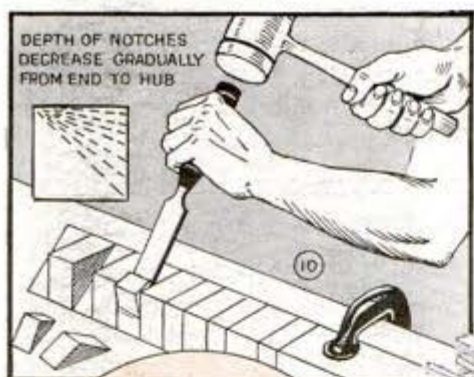
O-G NOVELTY SIDING

The side view at the left shows the position of the bridles which extend downward from the cross bars



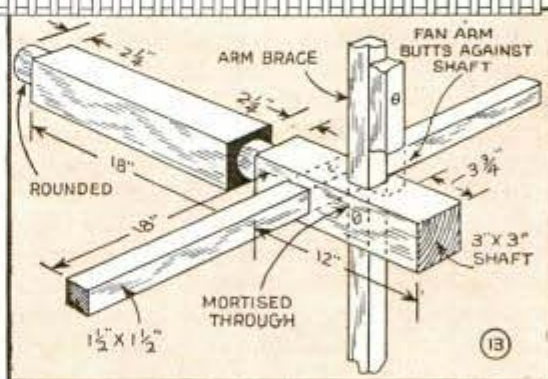
the various braces and headers between the studs is given in the side, front and rear views in Fig. 9. At the top, a plate corresponding in shape with the sill is fitted and upon this the head-and-sail assembly is set. Follow Fig. 7 in cutting the parts to make the head, which when assembled should look like Fig. 6. The lower ends of the braces that

support the gallery joists can be set in the wall when it is poured, Fig. 4, or they can be fastened to the wall with nails made for the purpose. Half-inch stock is used to floor the gallery, after which the railing is added. The top rails



are half-lapped where they meet at the corner posts, allowing the ends to extend in a cross. Clapboards, O-G novelty siding or wood shingles may be used to cover the tower and head. If shingles are used, first cover the framework with sheathing boards. False doors and windows are added to the front, the latter being made up of narrow strips assembled as in Fig. 8. Then the back opening is fitted with a door of batten construction.

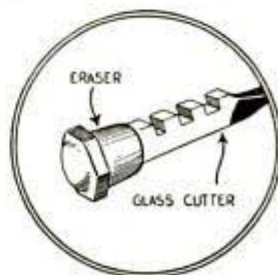
Now to build the sail. Fig. 13 shows what the shaft looks like. This is shaped with a tenon at one end to engage a wood bearing fitted inside the head as shown in Fig. 12, and rounded near the center to bear at an angle in a concave groove at the front. After this, mortises to receive the arm braces are cut through at right angles. To the face of these braces are screwed the arms carrying the blades of the sail. Each blade has a twist or pitch. This is obtained by cutting $\frac{3}{4}$ -in. notches in the arm an equal distance apart to receive the strips forming the latticework blade. Beginning at the outer end, the first notch is cut from corner to corner or 45 degrees. See Fig. 10. The next one is cut at a slightly less angle and so on until the last notch at the opposite end becomes nil. In other words, the strip next to the hub is nailed to the face



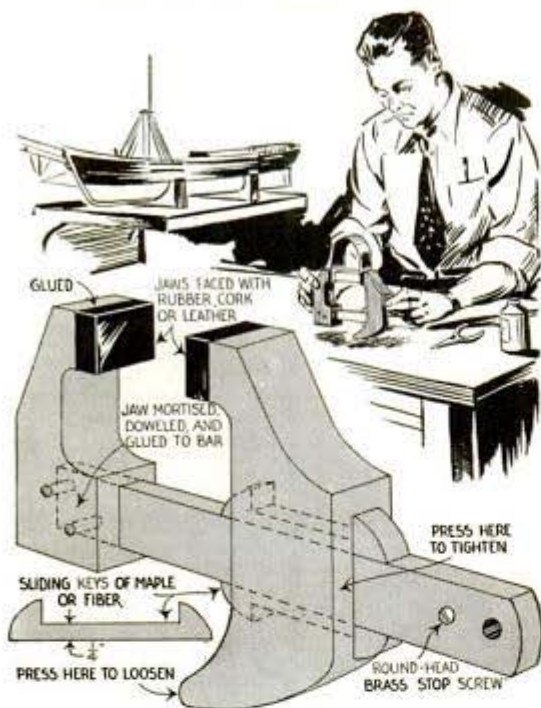
of the arm as in Fig. 11. The arm of each blade is attached to the brace extending through the shaft with $2\frac{1}{2}$ -in. screws.

Eraser Protects Glass Cutter

Instead of throwing a glass cutter in a box with other tools where the cutting disk is likely to be damaged, protect it with a pencil eraser of the slip-on type. The eraser also helps prevent the cutter from rusting, especially if you put a drop of oil on it before putting the eraser in place.



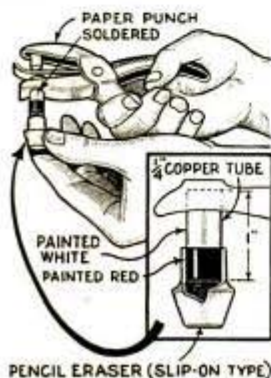
"Squeeze" Clamp Made of Wood Useful on Delicate Work



A favorite with violin makers, this wood squeeze clamp is especially useful for model work, particularly when using cements that hold best with moderate pressure maintained steadily. A jaw opening up to 18 in. is practical with this type of clamp. Red fiber is excellent for the jaws in the smallest sizes, with maple or hickory the choice for the larger sizes. The mortise in the sliding jaw should be larger than the bar, and it should be fitted with keys, either of maple or fiber. All wood parts should be sanded smooth and finished with two or three coats of shellac rubbed down well with fine steel wool.

—Clyde Baker, Kansas City, Mo.

Receiver on Punch Catches Waste



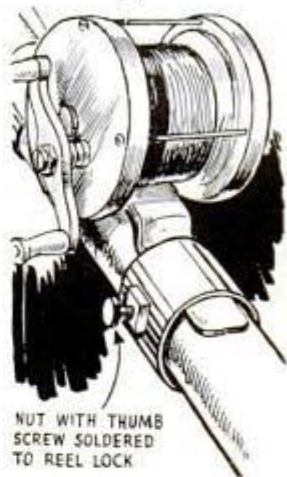
To avoid scattering waste punchings on the floor when using a paper punch, solder a $\frac{1}{4}$ -in. copper tube to the punch, cap it with a pencil eraser and paint the tube as indicated. When full, the punch

forces the eraser cap down and brings the red portion of the tube into view, indicating that the receiver should be emptied.

—Axel E. Ogren, Chicago.

Thumbscrew Locks Reel Slip Ring In Place on Fishing Rod

Have you ever had your reel loosen and become wobbly, or even drop off when playing a fish because the seat slip ring worked loose? If so, you can avoid this in the future by fitting the ring with a thumbscrew. Drill a hole through the ring and solder a nut over it. Then turn the screw into it and against the rod.



—G. L. Beck, Tacoma, Wash.

Lawn Rake With Striped Handle Easy to Identify in Grass

As a safeguard against accidents caused by stumbling over a lawn rake left lying on the grass, one home owner painted the handle of his rake as shown. Black and white paint was used to stripe the handle and make it more noticeable.



Casting Rubber Stamps for fun and profit

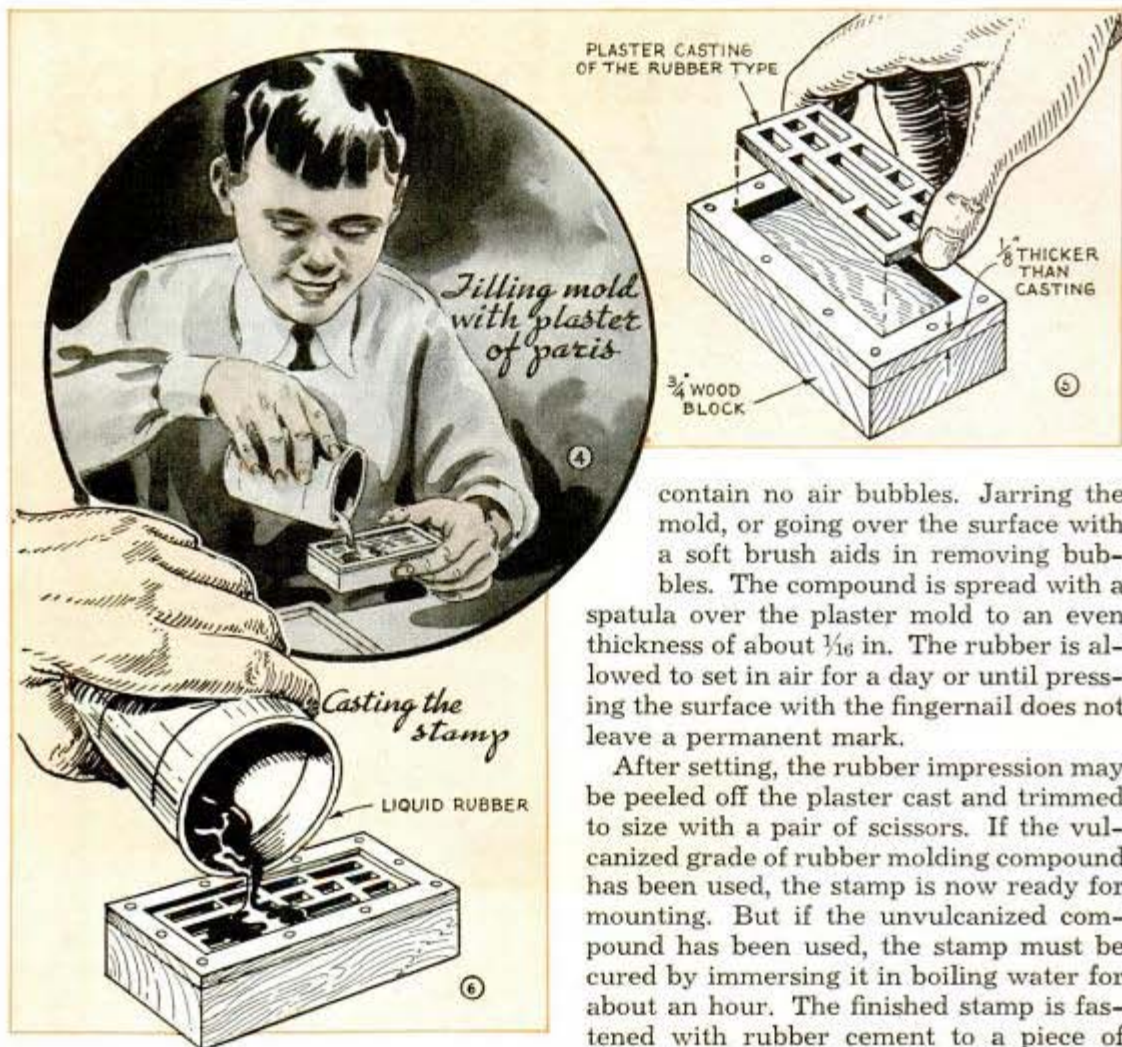
ANY BOY can make spending money and gain valuable business experience by casting rubber stamps for business men and for his friends. Little equipment is required. Just a toy printing outfit, plaster of paris and some flexible rubber molding compound. To begin, first set up the type for the stamp in the holder, Fig. 1, taking care to space and center the lines. Then screw the holder to a molding board, which is a thin piece of wood nailed to margin strips, Fig. 2. These are just wide enough to be type high when nailed in place as indicated in Fig. 3.

Using wood spacers, fill out the ends of each line to the margin strips. Fit the spacers in place rather tightly, as a close fit helps to keep the letters in place and tends to make a neat plaster cast. Even up the type by placing a wooden block over the assembly and tapping with a mallet. Small cracks and irregularities that may show between the spacers, holder and the margin strips, should be filled and smoothed out with paraffin.

Next, a retaining form for the plaster of paris is screwed in place on top of the margin strips. This is beveled and is coated lightly with machine oil before assembling, after which the entire assembly is greased lightly all over preparatory to filling with plaster of paris. If it is desired to make more than one rubber stamp at a time, a multiple molding board should be set up, using several type holders. In this case the plaster retaining form is clamped on the outside margin boards and the whole assembly is handled as a single unit. For the first attempt, however, it is advisable to make only a single rubber stamp.

As sharpness of the letters and clearness of the details are very important, only a very good grade of dental plaster of paris, absolutely





free from lumps and large particles, should be used. Add enough plaster to water to make a thin mix, and pour into the mold, Fig. 4. Immediately after being filled with plaster, the assembly should be picked up and jarred by tapping on the under surface of the molding board to remove any air bubbles that might form in the plaster. Allow the plaster to set thoroughly. Remove the retaining form, and very carefully lift the finished cast from the mold. Turn the cast over and brush off bits of plaster or other material. To prevent the molding compound from sticking to the plaster, grease the impression lightly.

Rubber molding compound comes in two types, vulcanized and unvulcanized, both of which are ready for use. To make the rubber stamp, the plaster cast is placed face up inside a molding frame, as shown in Fig. 5, and the molding compound is poured over the impression, Fig. 6, taking care that all small spaces are filled and

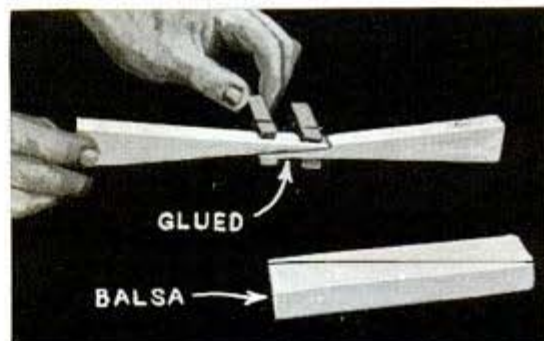
contain no air bubbles. Jarring the mold, or going over the surface with a soft brush aids in removing bubbles. The compound is spread with a spatula over the plaster mold to an even thickness of about $\frac{1}{16}$ in. The rubber is allowed to set in air for a day or until pressing the surface with the fingernail does not leave a permanent mark.

After setting, the rubber impression may be peeled off the plaster cast and trimmed to size with a pair of scissors. If the vulcanized grade of rubber molding compound has been used, the stamp is now ready for mounting. But if the unvulcanized compound has been used, the stamp must be cured by immersing it in boiling water for about an hour. The finished stamp is fastened with rubber cement to a piece of sponge rubber and the whole mounted on a wooden block with a handle.

Built-Up "Prop" for Model Plane

Long propeller blanks for model airplanes can be made from short blocks of balsa wood by cutting diagonally across the stock and then cementing the two pieces together. After the glue has dried, the blank is shaped in the usual manner.

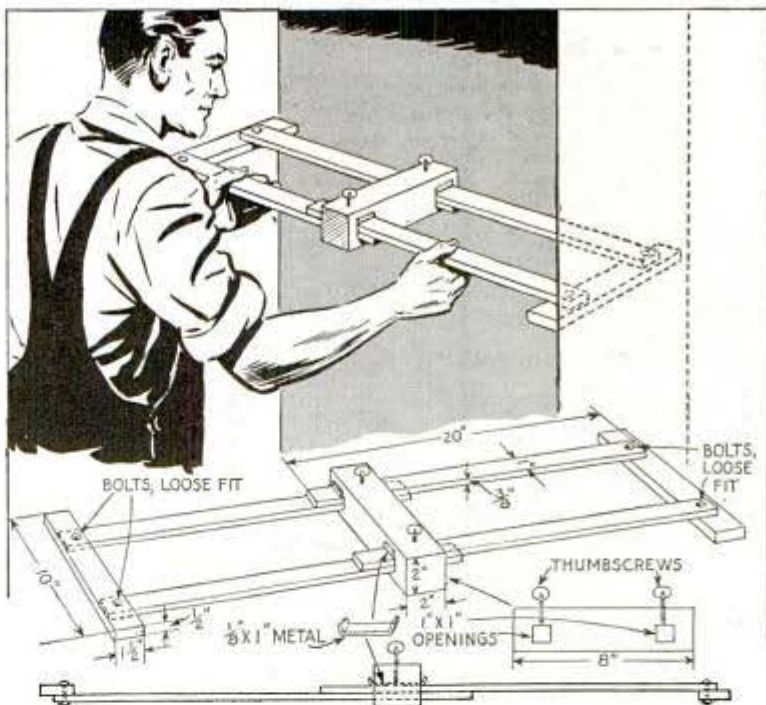
—Ray J. Marran, Kansas City, Mo.



Wall-Angle Gauge Aids in Building Cupboards

As very few plastered walls form a perfect right angle, it is rather difficult to fit cupboard and closet shelves accurately. Rarely can a shelf board be cut square across the ends and be made to fit snugly. This gauge will assist in getting the exact length of the shelf boards, and at the same time, secure the proper end cut. In use, expand the gauge until it fits snugly into the shelf space and the end pieces conform to the angles of the walls. Tighten the thumbscrews, and place the gauge on the work to be cut. Mark both ends and cut on the lines.

—A. L. Kaser, Niles, Mich.

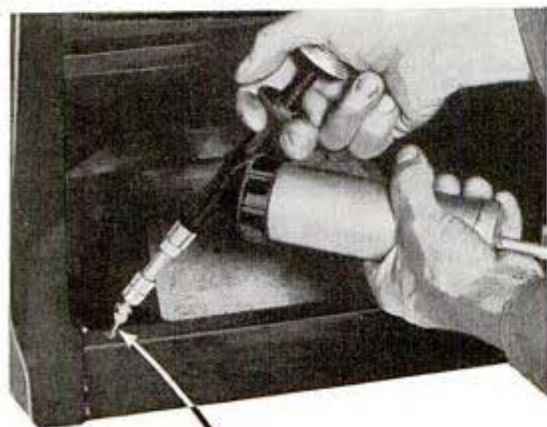


Grease Gun and Altered Fitting Used to Reglue Furniture

With this fitting and a clean grease gun, glue can be forced into a loose joint of a piece of furniture without taking the joint apart. The fitting consists of a wood screw having a pinhole drilled through it and then soldered to a regular grease fitting. In use, a pilot hole for the screw is drilled into the joint to be repaired, after which the

fitting is driven and glue forced into the joint with a gun. Then the fitting is removed, the hole plugged and clamps applied to the joint until the glue dries. All glue must be washed from the gun and fitting before it dries or the gun is laid away.

—Benj. Nielsen, Aurora, Nebr.



Screen Wire Removes the Skin From Can of Paint

When I have to set a partly used can of paint away for a while, I suspend a disk of screen wire about $\frac{1}{4}$ in. below the surface of the paint. Then, if a skin forms on the paint, lifting out the disk of wire removes it in one piece. Two lengths of fine wire tied to the disk with their upper ends under the lid will hold it in place.

—C. W. Colburn, North Weare, N. H.



Picnic Tablecloth Held Down By String and Clothespins



It is not difficult to keep a tablecloth laid for a picnic dinner from blowing up if you use four clothespins and a couple of lengths of string as indicated. In use, the clothespins are pushed into the ground at each corner of the cloth.

Fishing Fly and Plug Improvised From Easy-to-get Materials

In an emergency, try one of these fishing lures. The cork bug is simplicity itself, yet has proved very effective. It is made from half a cork, feathers and strong linen



thread. The cork is slit to take the hook, which is tied tightly to the cork. The feathers or bucktail can be worked in and tied to suit. The plug shown in the lower detail is made from a clothespin. The head is cut off at an angle, and the legs are shortened, the spacing between them being widened by whittling. A small screw eye is put in the head end and a treble hook is pivoted between the legs with a small screw.—Roy F. Kaiser, Milwaukee, Wis.

This Simple Drawing Table Folds Into a Small Space

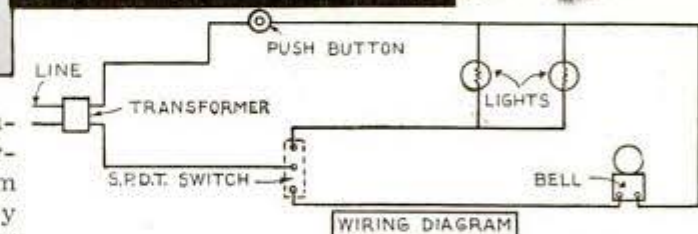
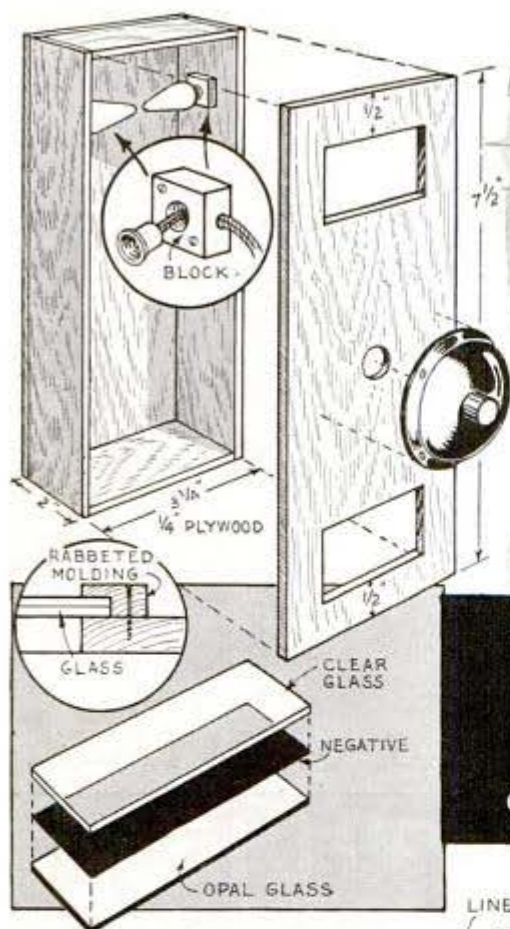


For the artist who needs a drawing table only occasionally, this leaning table is just the thing. When unfolded it can be leaned against a wall for support, or a chair can be used to support the free end of the board. The braces can be adjusted to any desired angle, and are not even essential when the table is used with a chair. Slots in the legs permit rapid adjustment of the table braces, which are locked with bolts and wingnuts.

—C. C. Caswell, Clarinda, Ia.

Ⓞ A piece of adhesive tape stuck on the underside of an oilcloth where the table corners are rubbed will double the life of a new cloth.

Silent "Butler" Informs Callers of Your Absence

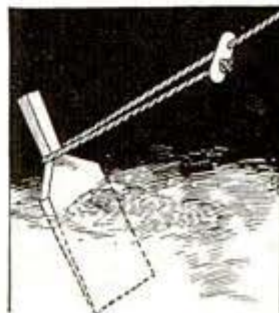


By putting a single-pole, double-throw switch in your door-bell circuit, it is possible to inform callers immediately when they push the bell button that you are not at home. Before leaving the house, merely throw the switch and when the button is pushed, instead of the bell ringing a light will outline your message on a photographic negative. The negative, two lamps to illuminate it, a pushbutton and your nameplate are all assembled in a small box as shown. The method of wiring the lamp and bell circuit is given in the lower detail. To make the negative, letter the message on showcard stock about 24 by 30 in. with 1-in. letters in black and then photograph it. The exposure should be such that the letters will be clear with the contrast between black and white as great as possible on the negative. Sandwich the finished negative between two pieces of glass—opal glass at the front and a clear glass at the back. Then install the lamps in the box and assemble. Series-

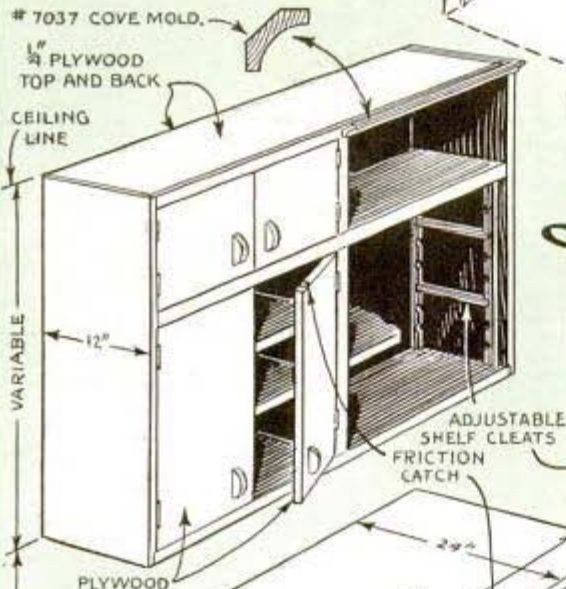
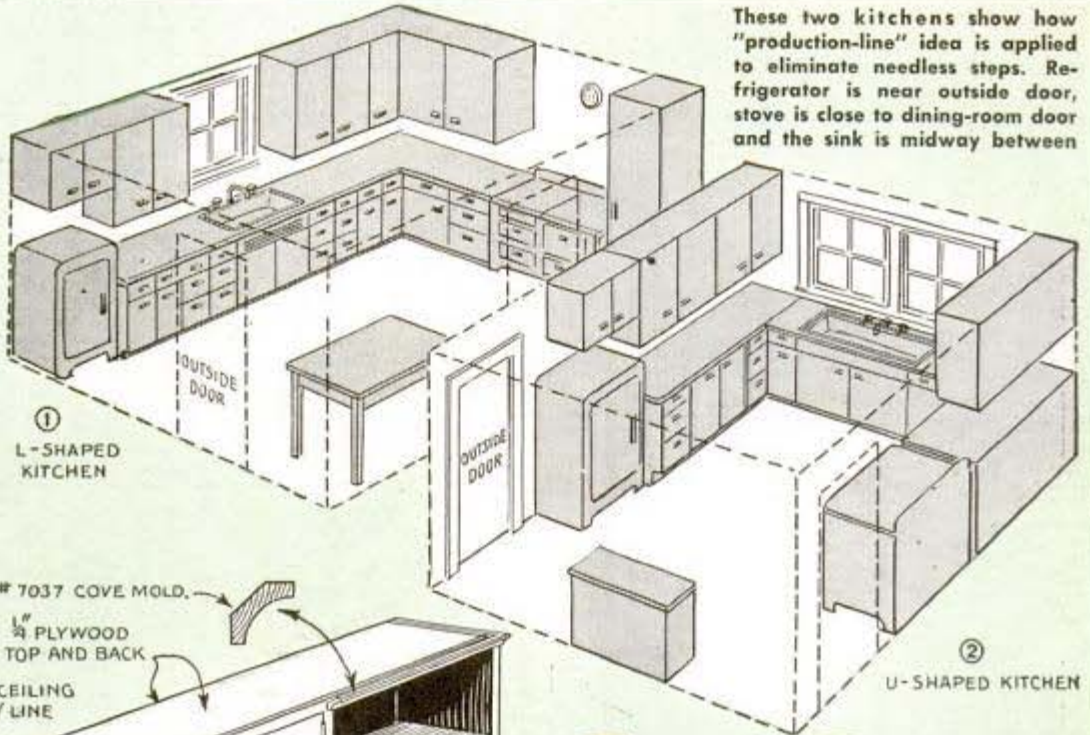
type lamps and sockets used on Christmas trees will do if your door-bell transformer delivers 12 volts. The nameplate can consist of your name lettered on cardboard and placed behind clear glass in the other window of the box.

Flat Pegs Anchor Tent in Sand

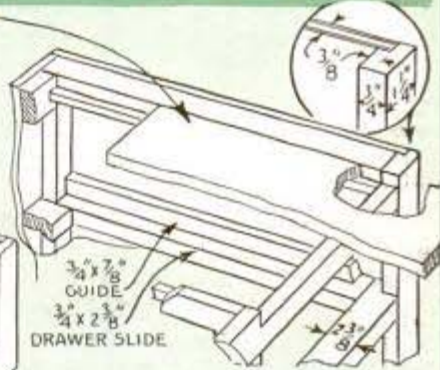
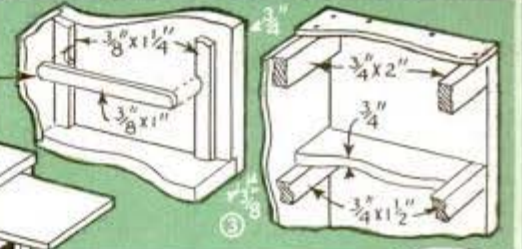
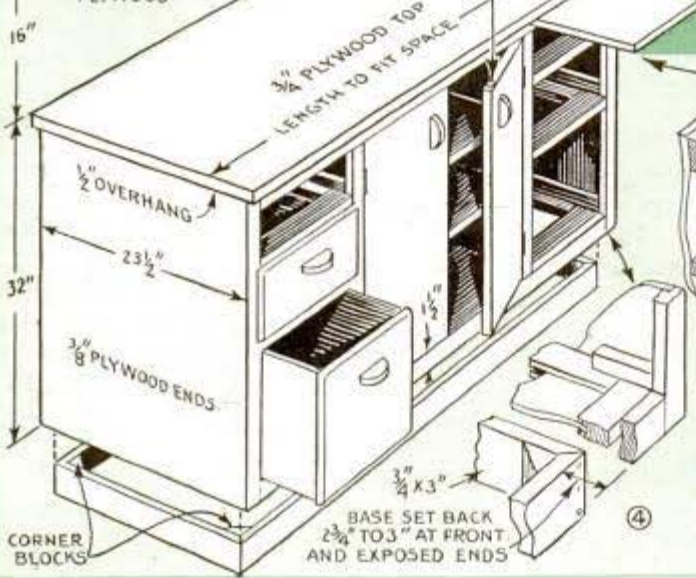
When you pitch a tent on the beach, paddle-shaped pegs like the one shown will anchor it securely. The broad surface of these pegs will stand considerable strain without pulling out.



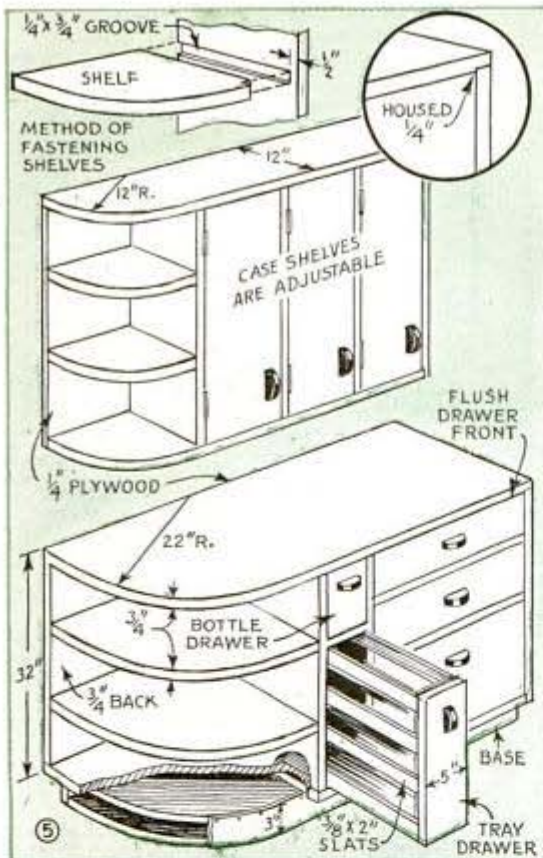
These two kitchens show how "production-line" idea is applied to eliminate needless steps. Refrigerator is near outside door, stove is close to dining-room door and the sink is midway between



Step-Saving UTILITY



Typical base and wall cabinets include many drawers, adjustable shelving, friction catches on doors and sufficient toe room at the base



For more light in a large kitchen, part of an outside wall is removed and glass bricks substituted—all the way from the level of the cabinet counter to ceiling



Photo courtesy Pittsburgh Plate Glass Co.

KITCHENS

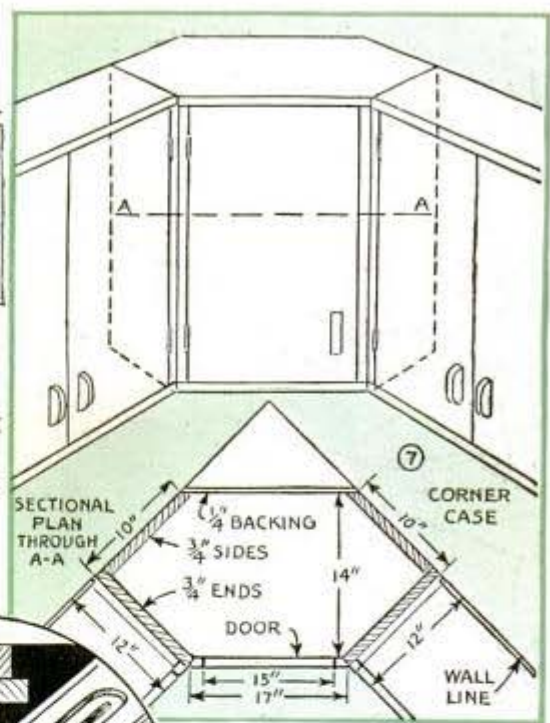
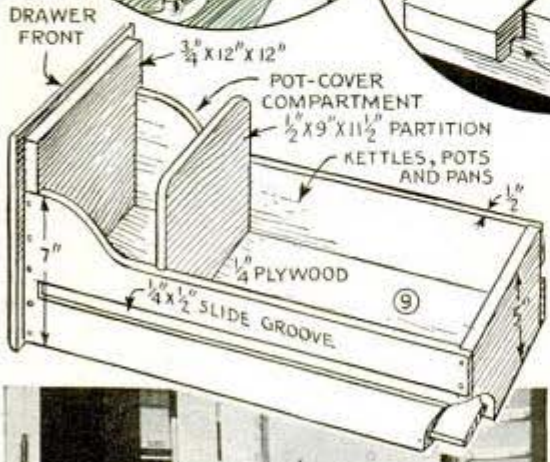
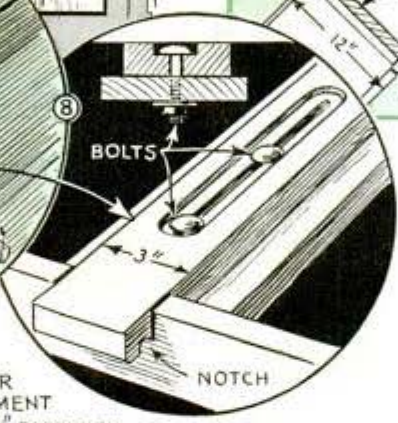
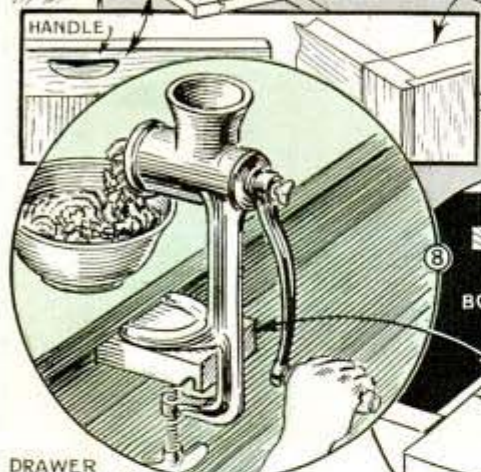
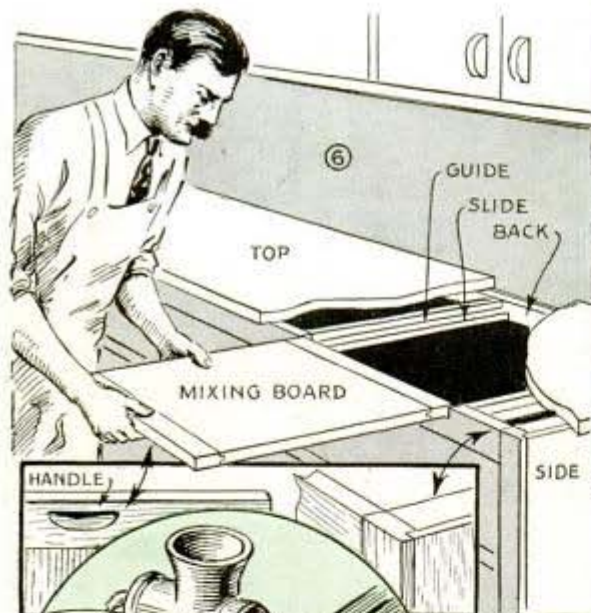
**CABINETS AND BENCHES
ARRANGED TO AVOID
NEEDLESS WORK IN HOME**

By R. O. Buck

MODERN kitchens are designed not only for appearance but also for the purpose of effectively reducing unnecessary movements and needless steps in storing delivered food; in preparing it for the table; in having dishes, cutlery and utensils arranged within easy reach from the place they are used and also within easy reach from the place they are cleaned. It's surprising how much less tiresome it is to anyone who has a kitchen in which work can be accomplished efficiently with minimum effort. In a well planned kitchen the basic idea of arrangement is somewhat similar to the idea of a production line in modern industry—the raw material comes in at one end and the prepared food goes out at the other. With this in view, the ideal kitchen has the refrigerator near the outside entrance, with a counter or table near by on which delivered foods may be placed before storing them in the refrigerator or cabinets. The stove should be

located near the dining-room door for convenience in serving, and the sink should be set about midway between refrigerator and stove. Figs. 1 and 2 show two layouts of efficient kitchens. Although the shape of your kitchen, the location of doors and windows, etc., may not conform to either of these examples, the basic "triangle" arrangement between refrigerator, sink and stove should be maintained.

Most kitchen cabinets consist of base units provided with counters and wall units spaced from 15 to 18 in. above the counters. Wall units may extend clear to the ceiling and the upper sections are used for storing articles seldom needed. In case the wall units do not extend to the ceiling, the space above them is often boxed in for appearance. Dimensions of cabinets depend to a great extent upon the space you have available although the basic construction is shown in Fig. 4. The details in Fig. 3 show adjustable shelf cleats and

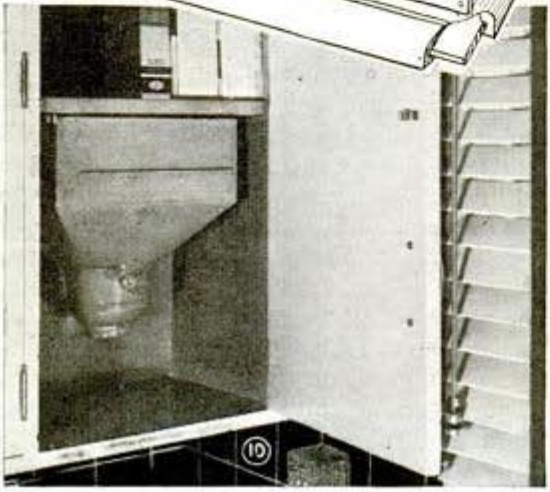


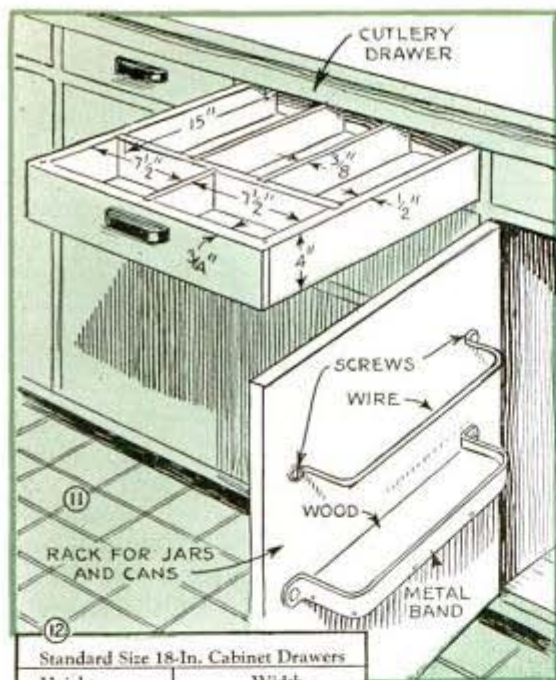
framing of the upper portion of a cabinet if it is extended to the ceiling. Base cabinets should be from 34 to 36 in. high and not less than 24 in. deep for greatest convenience. Wall and ceiling cabinets are generally 12 in. deep. Drawers of several sizes

give the greatest convenience and should predominate in the base sections. A recess under the front of each base cabinet provides toe room.

When wall units end at a window a square corner is more or less objectionable because of the "box-like" effect, and therefore an open shelf arrangement as shown in Fig. 5 is preferable. Base units next to doors may be arranged likewise to avoid the menace of sharp corners. Wood cases should not be located over gas or oil stoves because of fire hazard and because the cabinets in such a location are hard to keep clean. In designing your kitchen you may find it necessary to build cases around corners, in which case the arrangement in Fig. 7 can be followed. The back of the cabinet may be set diagonally across the corner to prevent pushing articles out of reach.

Deep trays, bottle drawers and other conveniences may be built into base cabinets if there is sufficient space. Fig. 6 shows



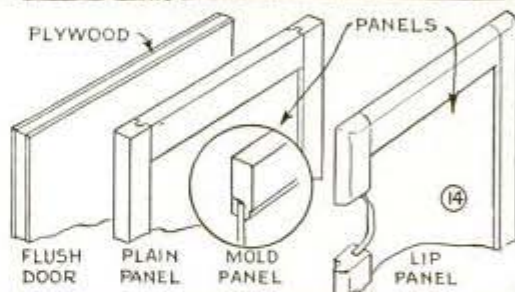


Standard Size 18-In. Cabinet Drawers	
Height	Width
4 in. - - - -	14, 16 and 18 in.
6 in. - - - -	14, 16 and 18 in.
9 in. - - - -	14, 16 and 18 in.



how mixing and cutting boards may be made to slide under the top and Fig. 8 pictures a convenient slide for clamping a food chopper or other similar equipment. A deep drawer for pots and pans is shown in Fig. 9. The partition provides a separate compartment for covers. Racks to hold jars, cans, and many other articles may be attached to the inside of cabinet doors as in Fig. 11. This drawing also shows how cutlery drawers are divided with partitions. Articles placed in deep cabinets are often difficult to reach without kneeling, but this is avoided if shelves are made to slide as in Fig. 16. For many small articles, such as spices, an intermediate, half-width shelf is convenient. A special metal bin may be installed for flour as shown in Fig. 10. Such a bin slides on metal strips fastened to the underside of a shelf so that it can be removed for filling. Space on counters under wall cabinets may be utilized for keeping motor-driven mixers and juicers as shown in Fig. 13.

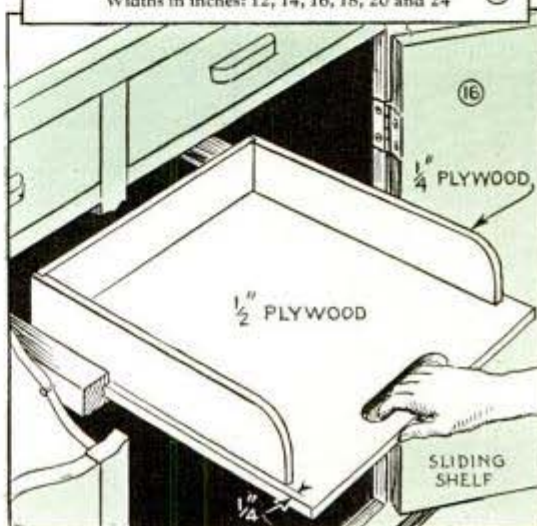
Types of cabinet doors are shown in Fig. 14. The flush type is popular because of the ease with which it can be cleaned, although many people prefer the panel type. If you do not care to make your own doors, you can purchase them from millwork dealers. Standard sizes of panel-type cabinet doors are given in Fig. 15, which also



STANDARD SIZE 3/4" PANEL CUPBOARD DOORS

12 x 18 in.	16 x 30 in.	20 x 24 in.
12 x 24 in.	16 x 40 in.	20 x 30 in.
12 x 30 in.	16 x 48 in.	20 x 36 in.
14 x 24 in.	18 x 24 in.	20 x 40 in.
14 x 30 in.	18 x 30 in.	24 x 30 in.
14 x 36 in.	18 x 36 in.	24 x 36 in.
16 x 24 in.	18 x 40 in.	24 x 40 in.
	18 x 48 in.	

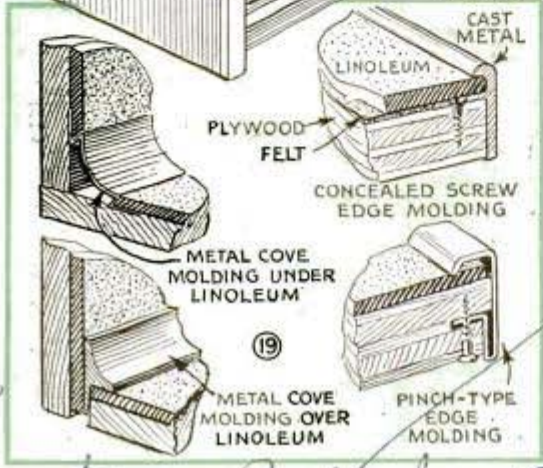
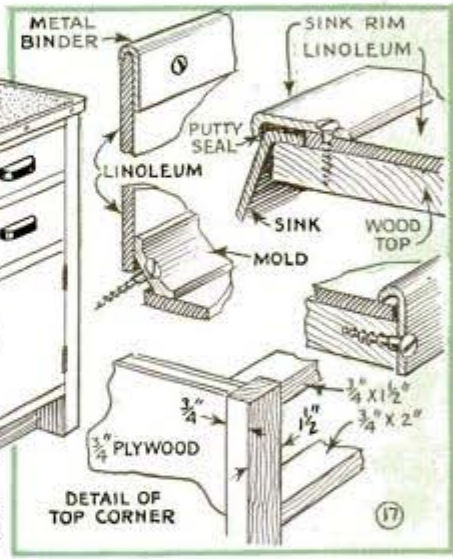
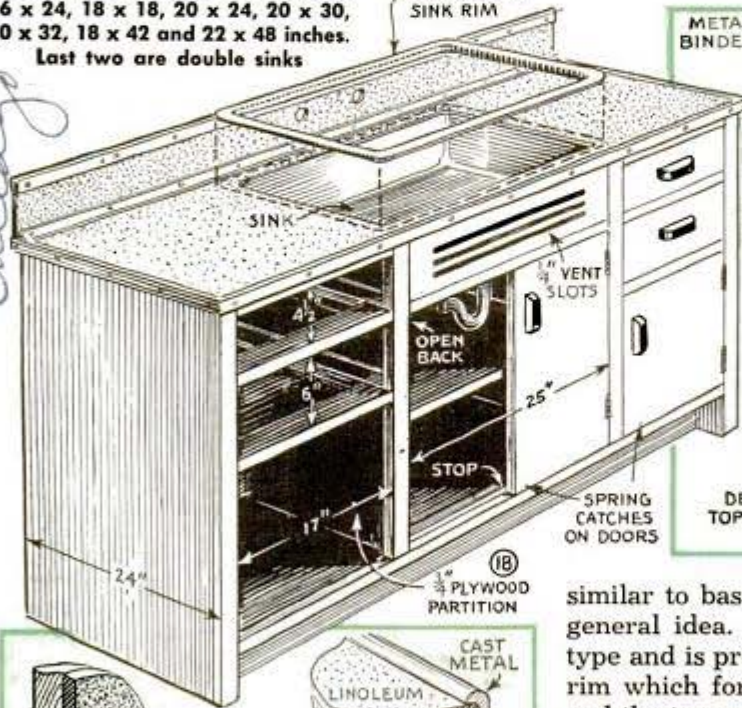
Flush-type Plywood Door Stock
 3/4 in. thick, 7-ft. lengths
 Widths in inches: 12, 14, 16, 18, 20 and 24





Cabinet-type sink sizes are: 14 x 20, 16 x 24, 18 x 18, 20 x 24, 20 x 30, 20 x 32, 18 x 42 and 22 x 48 inches. Last two are double sinks

WHITE-METAL SINK RIM

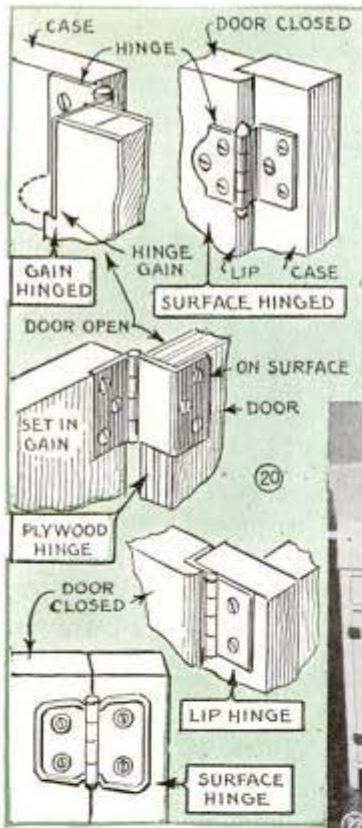


similar to base cabinets. Fig. 18 gives the general idea. The sink is of the flat-rim type and is provided with a polished metal rim which forms a seal between the sink and the top material.

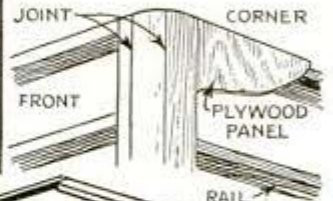
The top or counter surface of base cabinets and the top of the sink cabinet may be covered with linoleum or other hard-wearing, waterproof covering material. Stainless metal moldings shown in Figs. 17 and 19 are used to give the finishing touch to counter and sink tops.

As walls around sinks, stoves and counters are subjected to splattering of water and grease, they should be protected with tile board, linoleum or a suitable wall covering. On the floor you can use linoleum

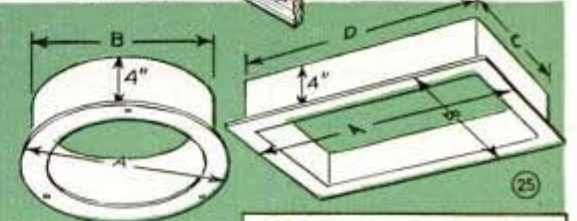
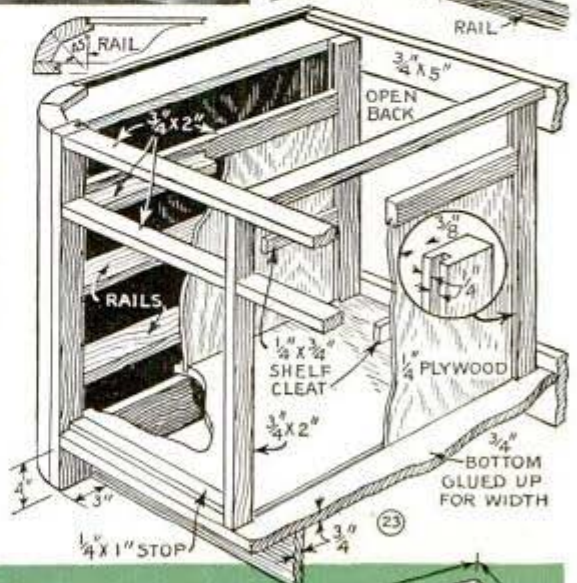
Pyramid Metals Co. 1335 N. York



Often an old-model sink can be fitted with a cabinet as in Fig. 22, framework of which is shown in Fig. 21

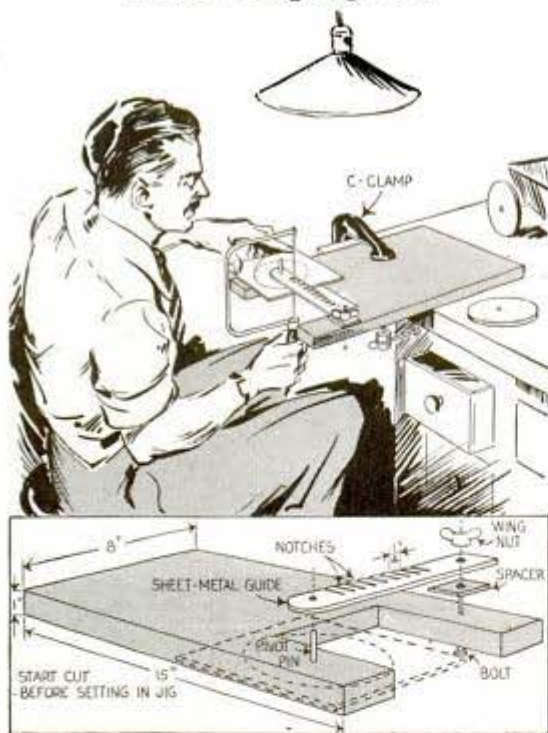


or rubber floor tile. Adequate lighting in the kitchen is also essential. Counter lights attached to the underside of wall cabinets, as in Fig. 24 should be of the tube type, controlled at the light. Flush ceiling lights over the sink are available in the types shown in Fig. 25. Besides these, a centrally located ceiling light and a light over the stove plus a number of flush type receptacles to attach electrical appliances should be provided at convenient places.



ROUND TYPE		OBLONG AND SQUARE TYPES			
Type	A	B	C	D	
1	8"	8"	6 1/2"	6 1/2"	
2	12"	8"	6 1/2"	10 3/4"	
3	10"	10"	8 3/4"	8 3/4"	

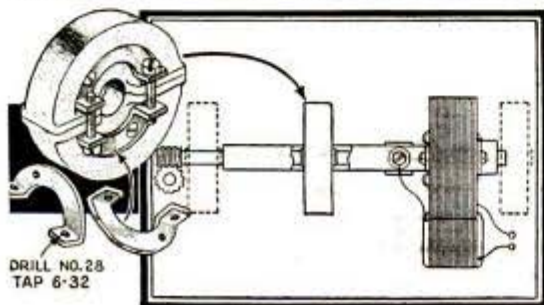
Jig Aids in Cutting Wood Disks With a Coping Saw



Cutting of wooden disks with a coping saw can be done quickly and accurately with the aid of this jig. It consists of a large wood block cut out at one end and fitted with a sheet-metal guide to take the saw blade. The work is pivoted at one side of the block and is rotated against the saw, which is held in one of the notches in the guide.—Stephen Kramerich, Detroit, Mich.

Flywheel Improves Operation Of Model Locomotive

Use of flywheels on my worm-driven model locomotives has improved their operation as there is no sudden locking of drivers when the power is turned off, and the running is smoother on long stretches of track. Ease of operation on curves due to the torque of the wheel is also obtained.



The type of motor drive as well as the interior and track clearances will govern the placing of the flywheel. In many cases, it will be necessary to use split wheels in order to get them in place. The details show how such wheels are clamped to the shafts. The wheels can be cast from lead and turned to size. Small gyroscopes and other toys are also sources of flywheels suitable for this purpose.

—Earle T. Orchard, Providence, R. I.

Soil Bands From Open End Cans Permit Easy Transplanting

To avoid interrupting the growth of seedlings when transplanting them, start the seed in containers or soil bands made by cutting out both ends of small tin cans and placing them in a shallow cake tin. Fill the cans with rich garden soil, adding a 1/2-in. of soil in the bottom of the cake tin. Plant two or more seeds in each can and then thin them later to the most vigorous

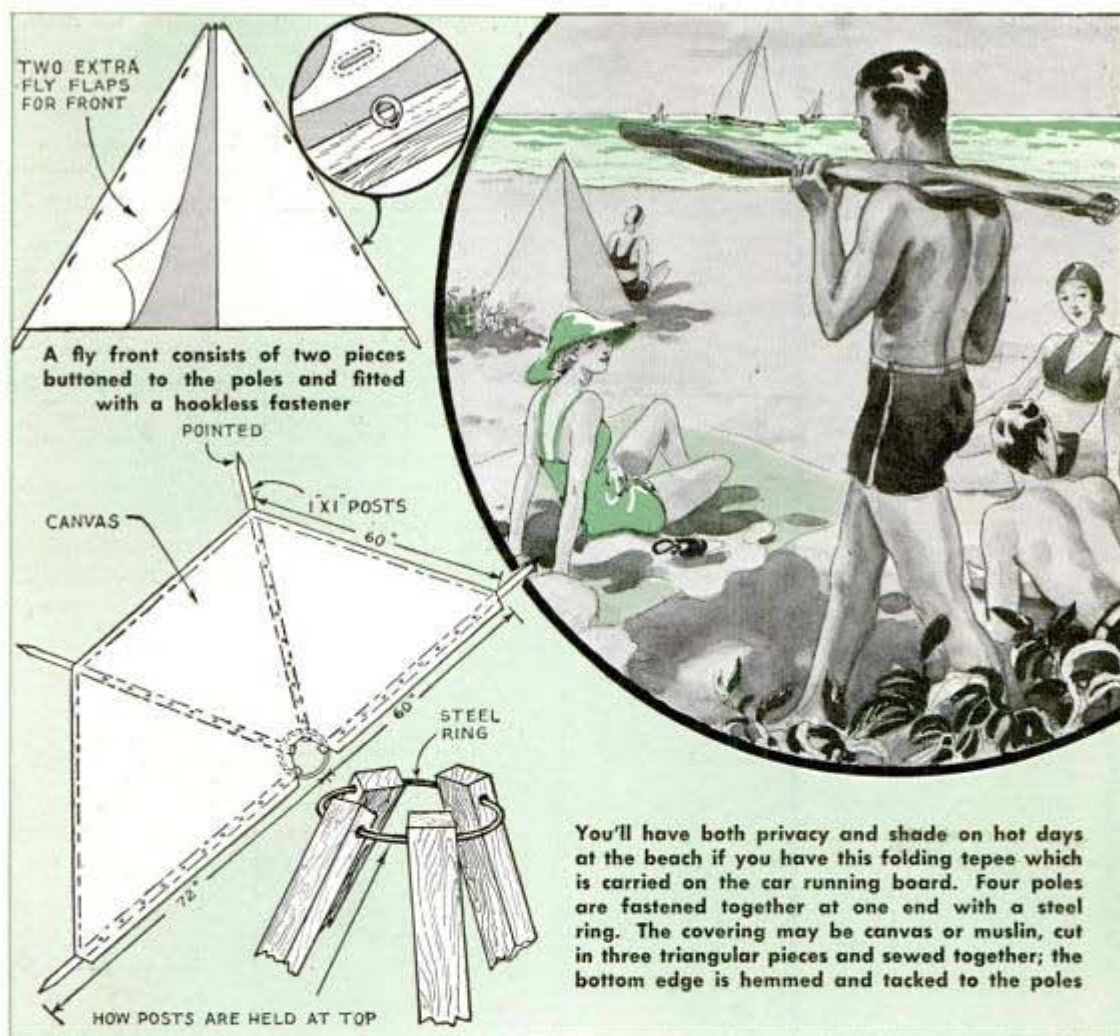


seedling. Water regularly, but pour the water in the cake tin and not on top of the soil in the cans. A week or so before transplanting, set the tray outdoors for an hour or two each bright day. When you transplant, dampen the soil in the cans and you can push soil and plant into a hole in the ground without disturbing the root system.

—W. C. Lammey, Naperville, Ill.

☛ A mouse trap attached to the inside of your cupboard door or on the pantry wall makes a good holder for folded paper sacks.

Folding Cloth Tepee Gives Privacy at Beach



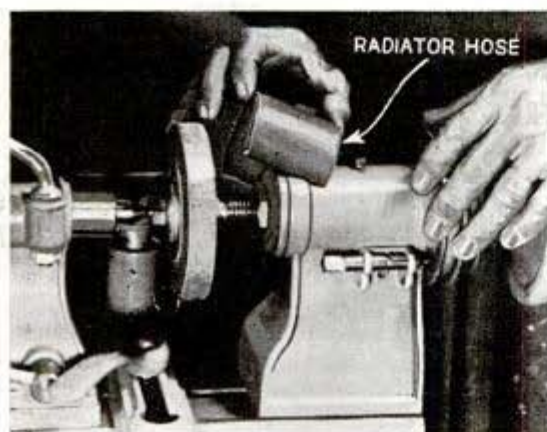
You'll have both privacy and shade on hot days at the beach if you have this folding tepee which is carried on the car running board. Four poles are fastened together at one end with a steel ring. The covering may be canvas or muslin, cut in three triangular pieces and sewed together; the bottom edge is hemmed and tacked to the poles

Shield Protects the Bearings When Using Grinder in Lathe

If you use a grinding wheel in your lathe, a piece of hose slit along one side and placed over the headstock as shown, will keep dust thrown off the grinder from get-

ting into the bearings. A 2½-in. length of 2-in. radiator hose will provide a good shield on most lathes.

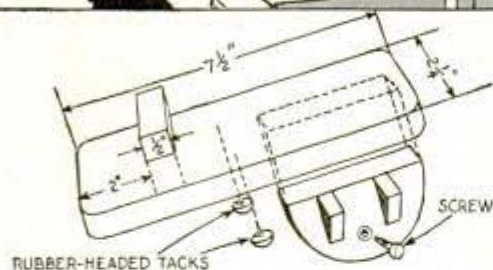
—F. Hegemeyer, Monterey Park, Calif.



How to Make Library Paste

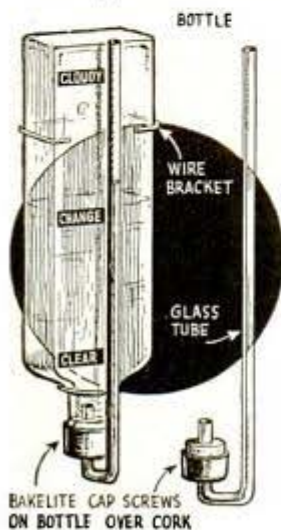
An inexpensive paste can be made as follows: Work wheat flour, 2 lbs., into an even paste with cold water, 1 qt. In a separate container, alum, 1 oz., is dissolved in hot water, 4 oz. To complete the mixture, slowly pour the flour-paste solution into boiling water, 3 qts., while stirring vigorously. If the paste does not thicken immediately to the consistency of mucilage, continue boiling, while stirring, until it does. Then stir in the alum solution.

Handy Shoe-Shining Foot Rest Folds Into Dresser Drawer



Pivot this simple foot rest to one side of the lower drawer in your bedroom dresser and it will always be handy to shine your shoes. When not in use, the foot rest folds down inside the drawer out of sight.

Simple Homemade Barometer



All you need to make this simple barometer is a glass bottle fitted with a screw cap, and a length of glass tubing about the size of a lead pencil. First bend the tubing over a gas flame to fit into the neck of the bottle and extend up the outside its full length. Then drill the cap to take the tubing loosely. Also drill a cork to take the tubing, and fill the bottle about half full of water. Now start the cork into the bottle and screw the cap on part way. Insert the tube and turn the cap up tightly. Provide a hanger to hold the

bottle in an inverted position and the job is done. Paint the word "cloudy" near the top of the bottle; "change" at the center, and "clear" near the bottom.

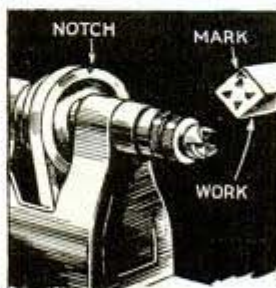
—Merle Jeronimus, Duluth, Minn.

Kinks in Hoop of Minnow Net Protect Mesh From Rocks

Damage to your minnow net caused by continually scraping it on rocks in shallow streams can be avoided by placing the hoop in a vise and bending sharp kinks in it. The net loops will then slip into these notches when pulled in the water and thus be protected from sharp edges of rocks.



Notch in Lathe Pulley Is Guide In Replacing Turning



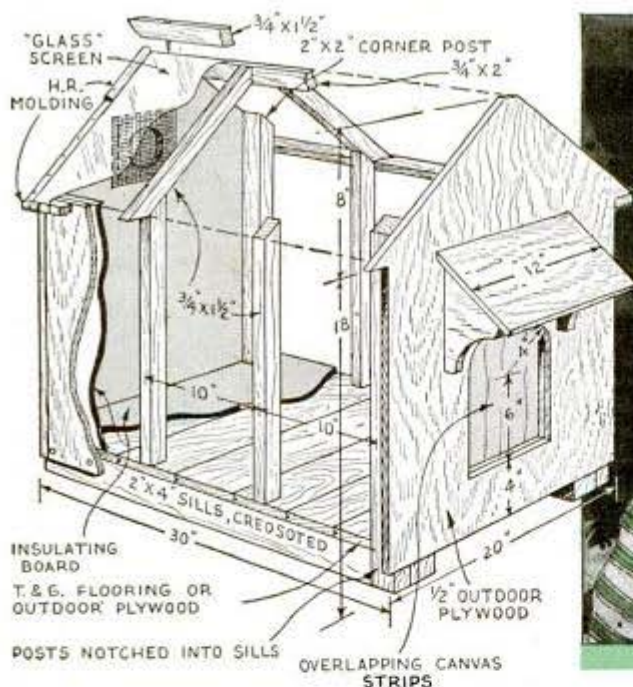
Filed in the flange of the belt pulley, a notch serves as a guide in replacing a piece of turned work in exactly the same position after it has been removed from the lathe. Before removing the work, the pulley is turned to bring the notch on top, after which the upper spur indentation is marked on the work with a pencil.

Erasers Provide Tips on Cues

When a new tip is needed on a cue of the type used with toy pool tables, a slip-on eraser will serve the purpose nicely. Sand or grind off the end of the eraser to the shape shown, and then glue it on the end of the cue.—R. M. Dunbar, Monroe, Mich.



This Insulated Dog House Has a "Skylight" Roof

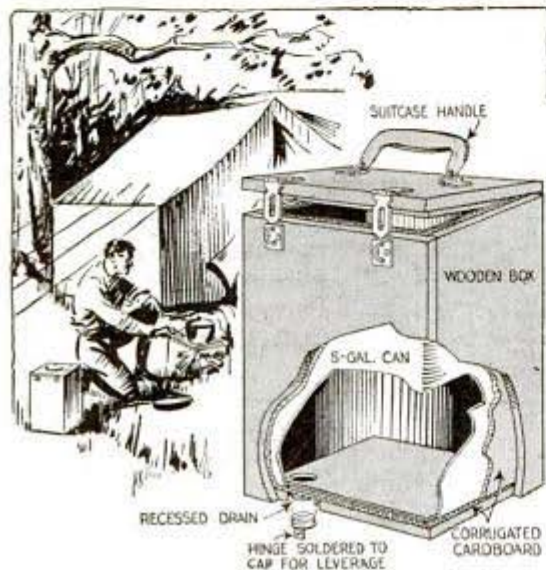


Cool in summer and warm in winter, this insulated dog house is like a sun room with a transparent roof. If located in direct sunshine, the roof can be covered with a canvas shade. In extremely cold weather a quilted pad is laid under the canvas. Outdoor plywood simplifies construction

and adds rigidity because the sides and ends are single pieces. A circular vent in the rear wall has a pivoted cover for adjusting ventilation, and is screened on the inside. Strips of canvas on the inside of the door permit easy entrance, yet keep out insects and prevent drafts.

Lightweight Ice Box for Camp Has Cardboard Insulation

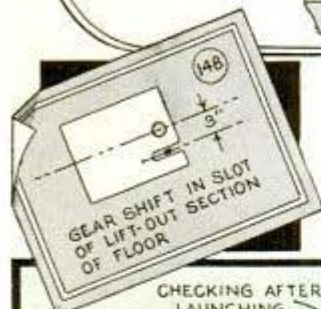
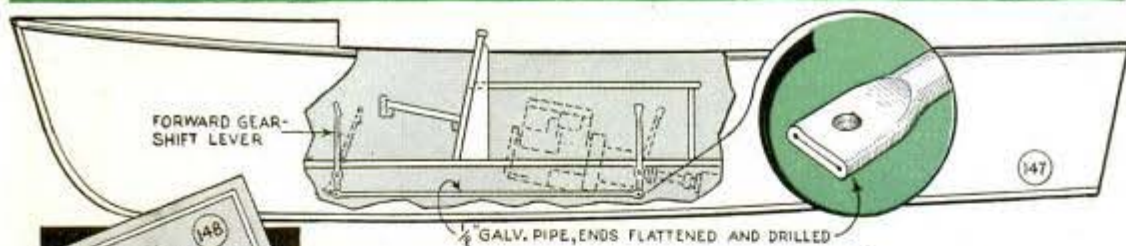
Here is an ice box that is easy to carry on camping trips, and it will keep fish or other food fresh on a very small amount



of ice. It consists of a square 5-gal. oilcan inside of a wooden box with corrugated cardboard packed in the space between them. A clean, shiny can is best as it will tend to reflect heat. The bottom is cut out and the can inverted so that the filler hole is on the bottom where it serves as a drain, which can be closed when carrying the box in a car. A piece of hard-pressed board inside the can reinforces the bottom. The top of the box is hinged and it has a thin piece of wood on the underside to fit down in the can to provide a good seal. A suitcase handle completes the job.

—N. E. Davis, San Antonio, Tex.

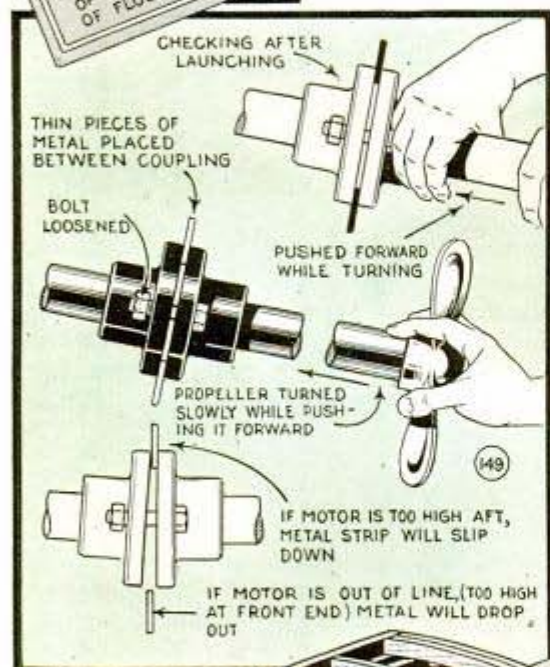
☞ Peanut butter may be kept fresh when it is stored by standing the jar upside down in the cupboard so that the oil will go to the top. Then, if the jar is turned right side up a short time before using the oil will again seep through the butter.



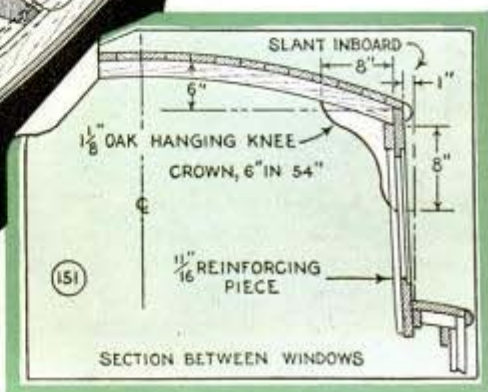
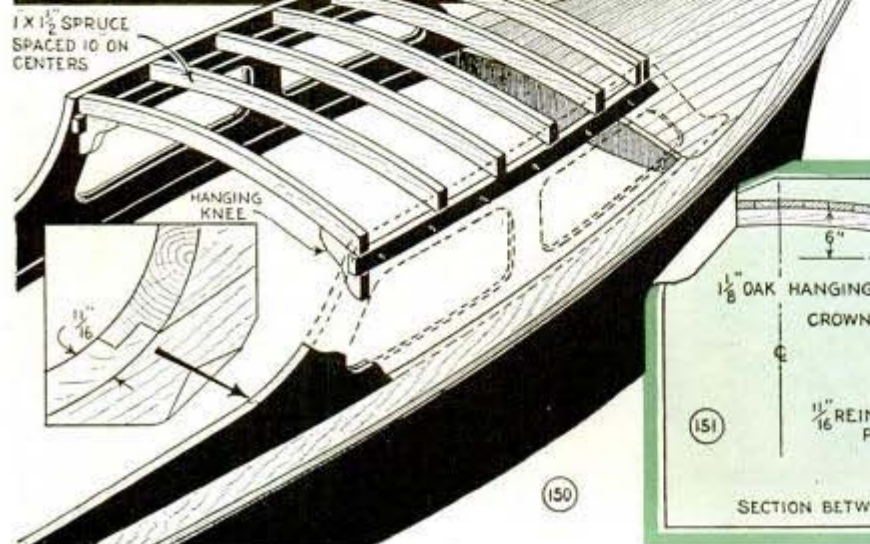
Above is shown a tandem arrangement for controlling the gear shift either from the engine or the forward cockpit

Part VI—Conclusion Converting the Runabout Into a Cabin Cruiser

WHETHER your boat is to remain a runabout, or is to be made into a cabin cruiser, there are one or two final things to be done, in either case, before it is launched. First a means must be provided by which the gear-shift lever on the engine can be controlled from the forward cockpit as well as aft. The cutaway view in Fig. 147 shows how this may be done by linking the engine lever with a second lever pivoted below the floor boards in the forward compartment. If you wish, a duplicate of the engine gear-shift lever can be cast in bronze, using the original as a pattern, or one may be shaped from cold-rolled steel. A lift-out floor panel like the one shown in Fig. 148 makes it handy to get at the forward lever when necessary.



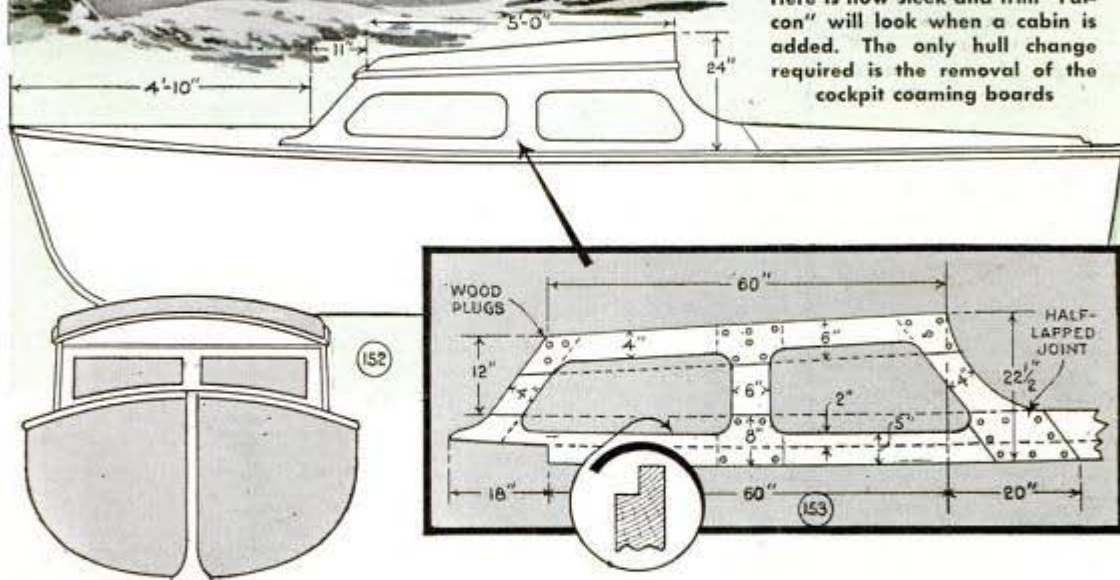
The alignment of the engine and propeller shaft can be checked at this time, or it may be done later if a cabin is to be added. About the simplest way to do



Sturdy 18-ft. Inboard



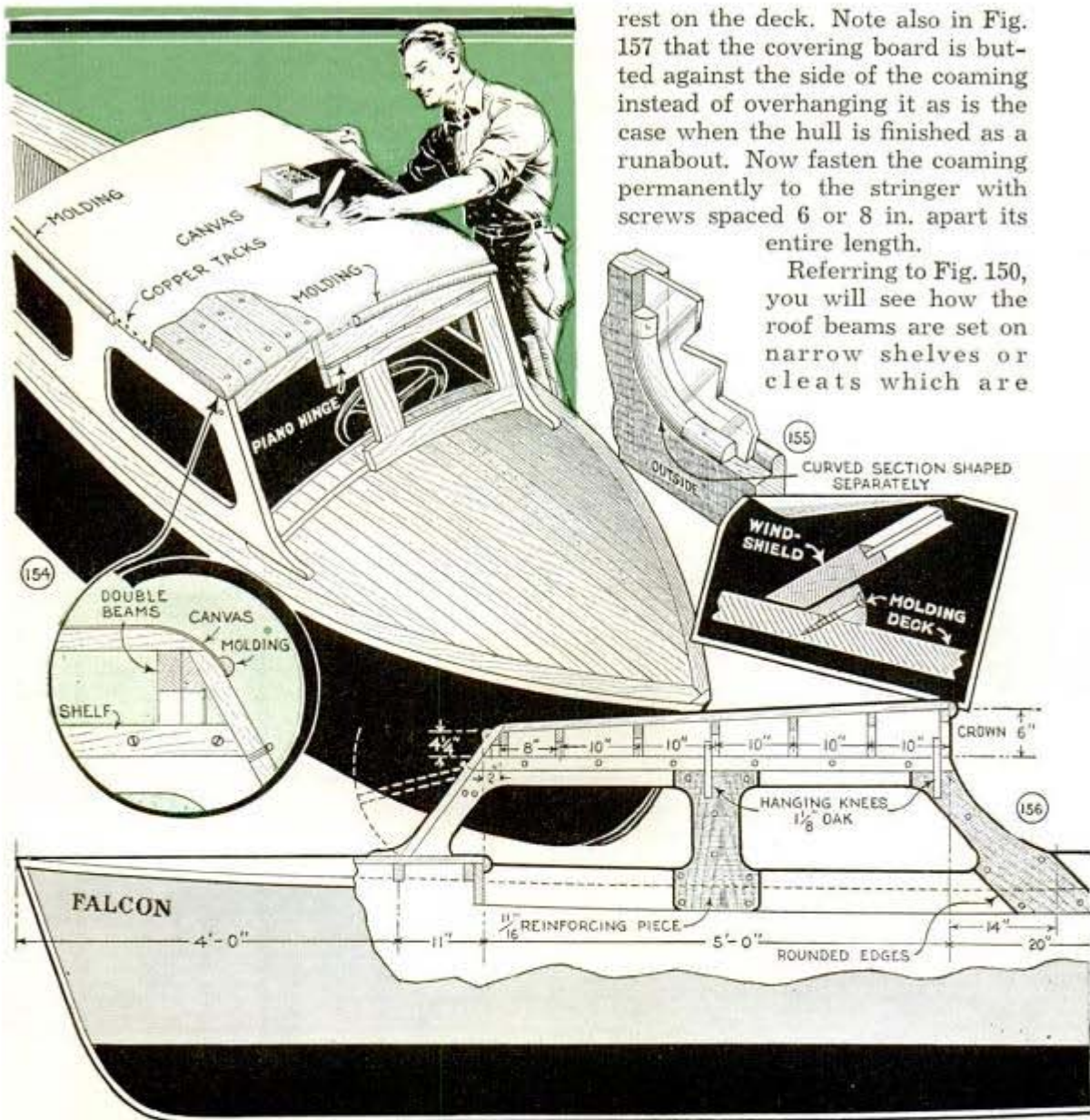
Here is how sleek and trim "Falcon" will look when a cabin is added. The only hull change required is the removal of the cockpit coaming boards



this is to loosen the bolts in the coupling to permit four metal pieces of equal thickness to be inserted snugly between the flanges as in Fig. 149. The test is made by watching the pieces as the propeller shaft is turned slowly by hand. If the metal pieces remain in place, both the engine and propeller shafts are in perfect alignment. If they fall out or shift, it means that the engine is too high or too low and must be shimmed accordingly to bring both in line. The same procedure is used in making a final check after the engine has been run in the water. As a runabout, your boat is now completed.

If you prefer "Falcon" as a cabin cruiser, here is how you go about fitting her with a cabin. From the profile and front

views in Fig. 152 you can get an idea of how the cabin will look when in place. Except where otherwise stated, Philippine mahogany $1\frac{1}{16}$ in. thick is used throughout. You'll have the best luck in building up each side assembly to the required shape if a full-size pattern is laid out over which the work can be placed from time to time for comparison. As you will see in Figs. 153 and 156, the lower piece of the side which serves as a coaming aft, is shaped from a single plank 8 or 10 in. wide and is recessed on the inside face to receive flush the upright pieces forming the window openings. Take pains in cutting the half-lapped joints. You'll find a dado head about the quickest means for making these cuts. When satisfied with their fit, assem-



rest on the deck. Note also in Fig. 157 that the covering board is butted against the side of the coaming instead of overhanging it as is the case when the hull is finished as a runabout. Now fasten the coaming permanently to the stringer with screws spaced 6 or 8 in. apart its entire length.

Referring to Fig. 150, you will see how the roof beams are set on narrow shelves or cleats which are

ble the pieces, without glue, and mark out the shape of the window openings for cutting. When this is done, the joints first are coated with marine glue and clamped, after which short brass screws are driven into slightly countersunk holes spaced as shown and later capped with wood plugs. Finally, reinforcing cleats are added to the inside faces of each upright to strengthen the joints. See Fig. 156. After rabbeting the outer edges of the window openings for the glass, the sides can be attached to the hull. At the transom they are screwed to the coaming stringers 2½ in. above the covering boards as shown in Fig. 157, while at the forward end the work is notched to

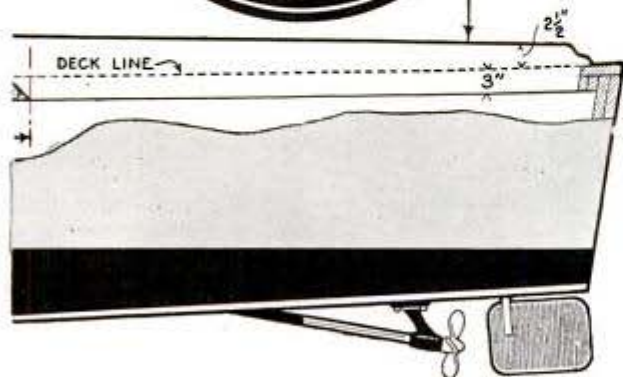
screwed to the sides 1½ in. down from the top. Each beam is laid out separately in the same manner as previously explained for obtaining the crown of the deck beams. See Part IV. These should be cut from 1-in. spruce to a length which will give the sides a 1-in. inward rake as indicated in the section view in Fig. 151. Beginning at the aft end of the cabin, the beams are spaced 10 in. on centers and are fastened to the sides with screws driven through into the end grain. Notice in the circular detail in Fig. 154 that a double beam is placed at the forward end of the roof, the foremost one being beveled to accommodate the upper portion of the windshield which fits

between and flush with the slanting edge of the sides. The windshield itself is made slightly oversize so that it can be trimmed later to fit the opening perfectly. Then it is glazed and hinged to rest against a stop strip screwed to the deck.

Before the roof is covered, the oak knees should be fitted. Four of these cut to the shape shown in Fig. 151, are required and are located at each side of the center and aft beams. See Fig. 156. Trim the knees to butt against the side and fasten with screws



Planking above the waterline, including the deck, should be given a coat of stain mixed with filler, and then followed by three coats of spar varnish, the first two being rubbed down when dry with very fine sandpaper

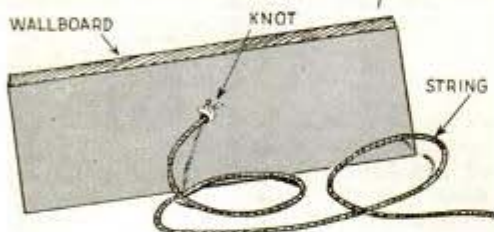


driven through from the outside. At the top they are screwed to the face of the beams. The roof of the cabin is planked with narrow strips of $\frac{3}{4}$ -in. stock, fastening each one to each beam with a single brass screw. By beveling the edges slightly the strips will conform to the crown of the beams better than if left square. The sides and aft edges of the roof are rounded with sandpaper to remove the sharp corners, while the front edge is planed to produce a nicely rounded contour like that shown in Fig. 154. Now to cover the roof with canvas. First apply a priming coat of paint and when dry, add a heavy second

coat. The canvas is laid on the paint while it is wet. Use a 10-oz. duck and stretch it out smoothly so that no wrinkles appear. It's a good idea to roll the canvas to make sure that the cloth is adhering in all places. Fasten the cloth along the edges with copper tacks spaced about 1 in. apart. Finally the tack heads are concealed with strips of half-round molding applied in line along the lower edges of the roof beams. Several applications of paint, sanded lightly between coats, will give a smooth finish to the canvas. Running from the cabin aft, a similar molding of brass is attached to the top edge of the coaming to protect it from wear. Your final job is glazing the windows. Fig. 155 shows how quarter-round molding is used along the straight edges and joined at the corners with separate inserts.

On the inside of the hull a sealer is applied to the planking and ribs, while on the outside, below the waterline, copper bottom paint is applied after filling the calked seams with white lead. Above the waterline, mahogany "seam seal" is used and then stain, filler and three coats of spar varnish are applied.

Backing to Hold Soft Plaster While Patching Hole in Wall



The next time you have to patch a hole in a plastered wall where an electrical fixture has been removed and there are no lath to anchor the soft plaster, try the following method: Cut out a piece of wallboard that will slip through the hole edge-wise. Tie a string in its center, push it through the hole and then use the string to hold it against the rear side of the hole while applying the patching plaster. After the plaster sets, cut off the string and put on the finishing coat.

—O. A. Freeman, Bay City, Mich.

Hose Used Without Removing It Entirely From the Reel



When winding a garden hose on a reel, allow a few feet of the cock end to project into the center of the reel and it will not be necessary to unwind the entire hose when only a portion of the length is needed.

The projecting end is coiled inside the reel, and is removed and connected to the cock after the desired length of hose has been unwound from the reel.

Old File Used as Foot Scraper On Lower Rung of Ladder

To avoid tracking mud on the rungs of a ladder, a workman provided a scraper on the lower rung to clean his shoes. The scraper is merely a piece of broken file with the tang driven into the ladder rail so that the file projects on top of the rung at one end.



Tab Pasted Inside Book Cover Serves as Page Marker



A neat book mark that is not unsightly and is always at hand, consists of a paper tab pasted to the inside surface of the book cover. When not in use the tab is folded down against the inside of the cover

where it is out of sight and out of the way.

—Philip E. Rimer, Homer, Ohio.

Tack Puller Stores the Tacks

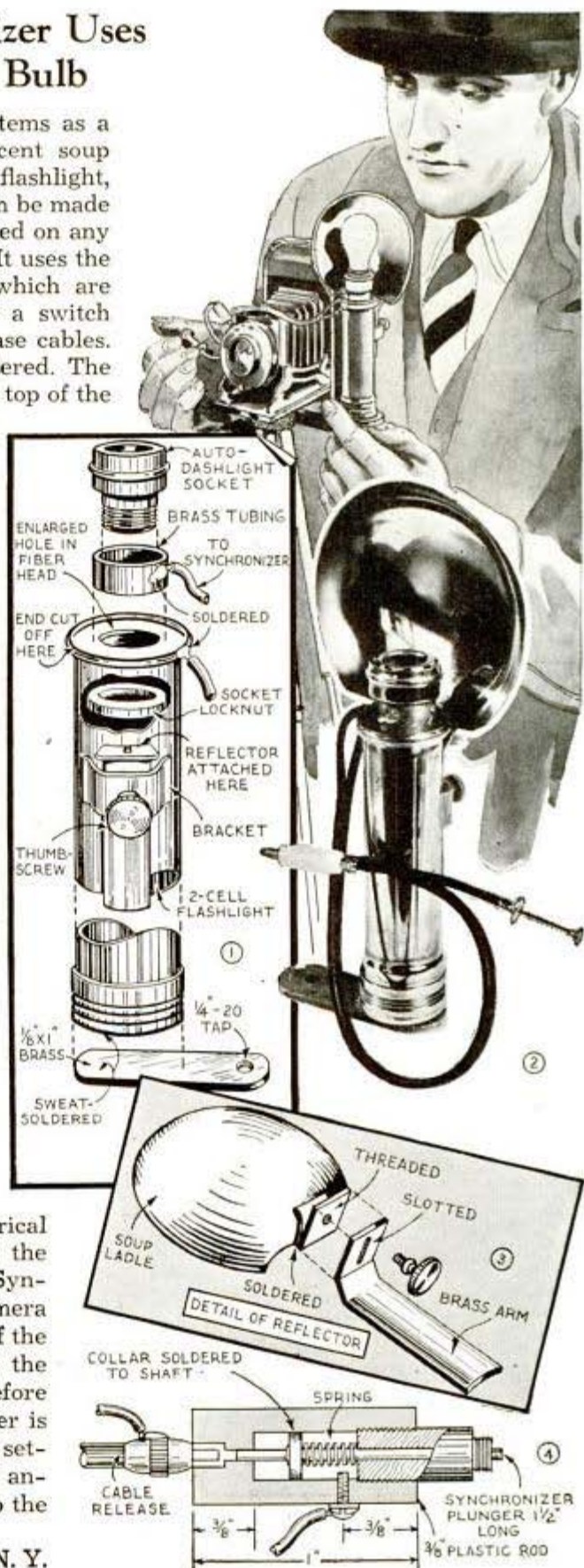
Made from an empty lipstick container, this thumbtack puller also stores the tacks after removing them from the work. Just notch the bottom of the container as indicated so that it can be slipped under the tack heads. When you want to use the tacks again, they can be removed by taking off the cap of the container.



Split-Second Synchronizer Uses Midget-Type Flash Bulb

Assembled from such common items as a Ford model-A dash light, a ten-cent soup ladle and an inexpensive two-cell flashlight, the synchronizer shown in Fig. 2 can be made for less than a dollar and can be used on any camera fitted with a cable release. It uses the new midget bayonet base bulbs which are synchronized with the shutter by a switch comprised of the parts of two release cables. Fig. 1 shows how the flashlight is altered. The switch is removed and the threaded top of the case is cut off just above the fiber head fastened to the reflector. This fiber disk is reamed to receive the dash light and bushing which are held in place with a locknut on the inside. The dry cells make direct contact with the locknut. A bracket for the reflector, Fig. 3, is soldered over the switch holes in the case, while across the end cap an arm is sweat-soldered for attaching the flashlight to the camera. Fig. 4 shows a sectional view of the switch, which is made of plastic or Bakelite. It is drilled centrally with a No. 55 drill, after which one end is counterbored and tapped to receive the threaded end of the camera cable release. The opposite end is bored to house the metal tip which is cut from the end of a second release and threaded to fit the hole. Next the plunger of the discarded cable is removed from its casing. Upon doing so, you will find it to be about $1\frac{1}{2}$ in. long, having a shoulder against which you solder a tiny collar that will slide freely when inserted in the switch. This collar makes electrical contact with a setscrew and trips the shutter almost simultaneously. Synchronizing the bulb with the camera shutter is done by carefully filing off the end of the plunger until it makes the flash occur about $\frac{1}{100}$ of a second before the shutter opens. The synchronizer is wired by running one wire from the setscrew in the switch to the case and another wire from the cable release to the dash-light ring.

—Stuart Roberts, Woodside, N. Y.



Lighting and Composition



Though unsuccessful as a black-and-white photo owing to lack of contrast, this threshing scene is ideal for a photo in colors. The average camera fan can get good color photos of such scenes whereas the same shots are often failures in black and white. One reason is that the average person cannot readily tell just what shades of gray are produced by various colors. Similarly, Fig. 3 shows another type of snapshot which is at its best in color but not in black and white



Here is a type of photo that is good in black-and-white values and very successful in color. At a well-selected viewpoint, the white costume and sun-tanned skin contrast beautifully against the deep blue of the cloudless sky while the little red circles on the archery targets at the right give just the needed dash of relief against the yellow sand background

FACTORS that you must consider in getting good color photos differ considerably from those that are kept in mind for good black-and-white photos. For the latter type you distinguish between colors only insofar as they become different shades of gray in the photo. For instance, red will photograph dark while blue becomes light gray, and therefore it will be a great help to examine a scene through a monochromatic (one-color) filter. Relative brightness and shadows in a scene are highly essential in black-and-white photos and the camera viewpoint must be chosen accordingly. However, the color photographer chooses a viewpoint that gives the least difference in relative brightness—all colors being as equally bright as possible.

As a black-and-white photo, Fig. 1 is not successful. The ground, stacks, and sky are too nearly the same shade, while the figures and machines produce a jumbled pattern. In color, however, the ground is strewn with yellow straw and this color is repeated in the loaded wagons and straw stack beyond the threshing machine. The coal and the engine contrast with the blue sky and the white clouds while the barn provides a spot of red.

In most color photos you use the old formula of sun-behind-the-camera to get flat lighting in which shadows are minimized

for COLOR PHOTOS

as is apparent in Figs. 2 and 4. A well selected viewpoint makes Fig. 2 a good picture even in black and white, but beautiful in full color. A deep blue sky is a perfect background for the sun-tanned skin and white costume. Facial shadows accentuate the modeling, yet occupy minimum space—both extremely important in color pictures. This photo may be termed a kindergarten type of color picture since it is as easy to take as it is effective; four out of five good color pictures are made with flat lighting.

However, you cannot photograph all scenes with flat lighting. Partial side lighting, Fig. 5, must be used cautiously with color film as shadows become more or less dense. Therefore shadows should not cover a large part of any object which is important to the picture. Fig. 3 is typical of snapshots at their best in color. Although the trees are a disturbing background in the black-and-white photo shown, yet in a color photo they contrast effectively with the string of fish and the figure. Backlighting, Fig. 6, is seldom used in color photography because backlighted objects are almost certain to be so underexposed as to lose all color. However, you may use backlighting for special effects as in a sunset scene when foreground trees or objects are to be silhouetted, or when objects are very small in the picture yet easily recognized from their outlines.

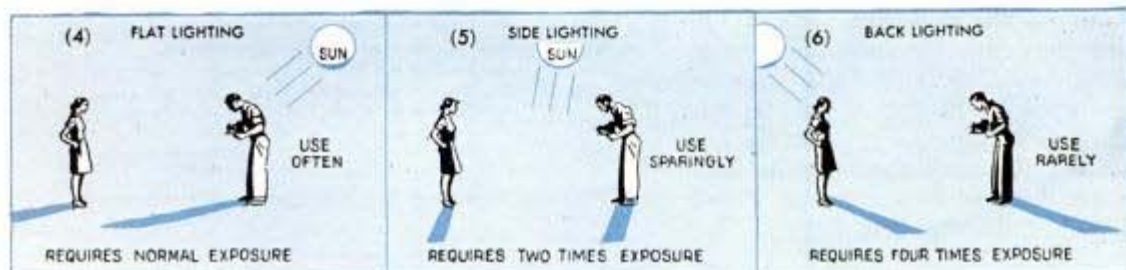
With the aid of a photoelectric exposure meter, proper exposure can be given to parts of the picture that are most important. Take readings of the darkest and the brightest portions of the scene, not including any white or black objects which will photograph satisfactorily regardless of slight variations in exposure. If the brightest portion is not more than four times as bright as the darkest portions, the scene



will record with good color. If the range of brightness is greater than this, you must choose which is most important, and either allow the bright portions to be overexposed or the dark portions to be underexposed. Some scenes allow a compromise exposure. Generally the latitude of exposure on color film is two full stops on the lens diaphragm.

In Fig. 1 the coal and shadowed engine were underexposed slightly to avoid overexposure of the sky. In Fig. 2 the sky was slightly underexposed to give correct exposure to the figure, which reflected much light. Overexposure produces thin and washed-out colors, while underexposure produces dense or dark colors.

Fig. 7 shows the result of taking distance pictures with color film. The blue haze reacts so strongly on the color film that distant detail is almost lost. Although a





haze filter will help to produce better results, the most satisfactory penetration of haze is accomplished by using a pola-screen; a filter that blocks passage of polarized light. With this, clean-cut distance pictures like Fig. 8 are possible. At the same time the blue sky is darkened, and a dramatic contrast of cloud formations is produced.

Color pictures give a strong illusion of third dimension, especially when projected. This feeling of depth is increased if you include a foreground in distance pictures, as in Fig. 8, and is still further heightened if a picture includes foreground, middle distance and extreme distance. Good color of illuminating light is also essential. Noon sunlight is con-

sidered white, producing normal pictures on outdoor color film. Early morning and late afternoon light is lacking in blue (in direct rays of the sun), and pictures made in this light tend to be reddish. Then skin becomes ruddy, which is an advantage on an athletic subject but not for a baby portrait where skin is normally white. Incandescent light has less blue than sunlight, so another type of color film with greater sensitivity to blue is used, which produces daylight-appearing pictures. However, with special filters you can use either type of film with the opposite type of light.

If any one color predominates in your pictures, consult the chart below, which will enable you to diagnose the trouble and apply a remedy.

MAKE YOUR OWN DIAGNOSIS

Effect	Cause	Cure
Blue	Taken on indoor color film by daylight	Use indoor-to-outdoor filter
Blue	Distant haze is blue similar to blue sky	Use Haze, 2A, or Pola-screen filter
Blue	Snow in scene reflects blue sky light	Use Haze or 2A filter
Blue	Taken with sun behind cloud by blue sky light	Use 2A filter
Blue	Subject lighted by blue sky	Place in sunlight
Blue	High haze or cirrus clouds	Use Haze filter
Red	Taken by very early morning or very late-afternoon sunlight	Take at other time
Red	Taken on daylight color film by incandescent light	Use outdoor-to-indoor filter
Reddish	Taken by early morning or late-afternoon light	If objectionable, take when sun is higher
Yellow	2A filter used when Haze filter would have been sufficient; Haze filter used when none would have been better	Use lighter filter; or use none
Yellow	Sometimes the result of sunlight passing through rain in the air	No cure
Greenish	Taken by light reflected from or filtered through leaves, etc.	If reflection is unavoidable, use Haze or 2A filter
Dark	Underexposed	Increase exposure 100%
Thin, pale	Overexposed	Decrease exposure 50%
Pale streaks	Light struck	Remove leak

Unwanted Background Is Subdued With Chalk

In small newspaper plants or other places where no air-brush equipment is available, backgrounds of photos can be subdued or "fuzzed out" with chalk before the picture is sent to the engraver. The print must be made on soft, unglazed paper instead of the glossy type usually used. Then the background is gone over thoroughly with the chalk, after which streaks are removed by rubbing lightly with the fingertip. Use a small wad of cotton on a match or an orange stick to remove stray chalk marks from the portions of the print that are to stand out. After the background is satisfactory, a soft lead pencil may be used to outline certain parts. If necessary the chalk can be wiped off with a cloth and the pencil marks erased after the cut has been made.—Art Johnson, Ames, Ia.



Throat Light Handy for "Flashing-In" Portions of Photo

Even after a print has been placed in the developer, portions of it can be made darker by "flashing in." This is done by directing a weak, concentrated light on the portions you wish to darken. An excellent and inexpensive instrument for this purpose is made from a throat light as shown. First the tip of the rod is filed to a point about $\frac{1}{4}$ in. in diameter to give a smaller and more easily controllable light source. Then the rod is given a coat of black paint or wrapped with black scotch tape so that no light escapes except through the tip. Care must be used in "flashing in" to make sure the light reaches only the parts of the print you want to darken and does not fog the other portions.

—Julius Adelman, New York.



Retouching Liquid Rubbed on Back of Print Makes It Translucent

Semi-transparent photographs, for application on lamp shades or other places where they are to be illuminated from the rear, can be made by applying retouching fluid to the back of the prints. This penetrates the paper quickly and leaves it translucent upon drying.

☐ An inexpensive sepia toner is made from liver of sulphur. Dissolve a lump the size of a pea in water, 8 oz., and immerse the fixed and washed prints in this solution until they reach the desired shade.



Photo Accessories Carried Safely In Rubber Lined Tobacco Pouch



Extra lenses, filters and other small photographic accessories can be carried safely and conveniently in rubber-lined tobacco pouches like the one shown. The pouches are not expensive to buy and when the slide fastener is closed, they are virtually dustproof and weatherproof. The soft rub-

ber lining on the inside of the pouch protects the articles carried from being scratched or otherwise damaged.

Fish-Tank Heater in Developer Maintains Proper Temperature

An electric fish-tank heater, like the one shown, keeps my developer at the proper temperature during the winter months when my attic darkroom is rather cool. The heater, costing only about a dollar at any pet shop, is simply plugged in an electric outlet and laid in the tray of solution.—R. L. McColm, Interlaken, N. J.



Build "Falcon"—18-Ft. Runabout or Cruiser



Set of
Ten Plans
Available
for \$2.50



This sleek, roomy, modern craft incorporates the latest developments in boat construction, and the method of building eliminates many troublesome problems that confront the average novice. It is powered by an inboard motor (5 to 20 hp.); makes a speed of 17 m.p.h. with a 20 hp. motor; seats eight passengers; has a 66-in. beam, a 12-in. draft and a total depth of 42 inches.

Construction was completely described in the April to and including September, 1941, issues of Popular Mechanics Magazine. These articles show and tell how to build it as a runabout and how to add a cabin. If you do not have copies of these issues, they can be obtained for 25 cents each or the set of six for \$1.50. Order the plans by number—Nos. 1070 to 1079 incl. These give summary of procedure and the material list. Both plans and back issues sent postpaid for \$4.00 and can be returned if you are not fully satisfied.

"SKIPPER"—1018 to 1023: 14-ft. outboard runabout that can be built for \$30 to \$40. 54-in. beam. Weight about 275 lbs. Carries five passengers. Powered by 4 to 24-hp. outboard. 6 prints \$1.50.

"ROAMER"—765 to 770: Outboard cabin cruiser. 16 ft. long. 66 in. beam. Requires outboard motor of 20 to 36 hp. Set of six prints \$1.50.

"HI-HO," 14-FT. FAMILY RUNABOUT—840 to 845: Powered by 11 to 23 hp. outboard or light inboard motor. Beam 58 in. Set of six prints \$1.50.

"ARROWHEAD" SLOOP—944 to 951: A fast and able sailboat that handles easily and can be built by average craftsman as ribbed hull is constructed over form. Over-all length is 21 ft., beam 5 ft. 11 in. Accommodates up to 10 persons. Weighs about 750 lbs. Set of 8 prints \$2.00.

"SEA SAUCER"—893: Lightweight sailboat. Length 9½ ft. Beam 4 ft. Deck, bottom and sides are 3/16-in. plywood. Just the thing for small lakes. 25c.

15-FT. ROWBOAT—644: Flat bottom, all purpose. Heavy transom provided to carry outboard motor. Covered forward deck. Has three seats. 25c.

12-FT. UTILITY ROWBOAT—707: Flat bottom, four seats. Very sturdy design. Fine for boat livery rental purposes on small lakes. 25c.

CANVAS-COVERED KAYAK—928 and 929: Light framework covered with canvas. 17 ft. in length and weighs about 40 lbs. One-man size. Two prints 50c.

16-FT. CANOE—811 and 812: Canadian type. Has cedar planking covered with canvas. Steady on water and easy to paddle. 33-in. beam, weight 70 to 80 lbs. Two plans 50c.

Address Plan Service, Popular Mechanics Magazine, 200 E. Ontario St., Chicago, Ill.



Radio

MULTI-VIBRATOR SIGNAL GENERATOR

ENTIRELY self-contained, this low-cost unit generates both audio and radio frequency waves for locating trouble in any radio receiver. It consists of a small high-frequency buzzer operated by means of two flashlight batteries, connected in series, and a fixed condenser.

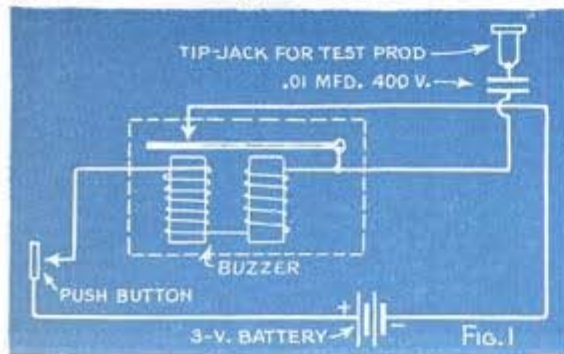
Photos A and B show the simple arrangement of parts in an ordinary celluloid soap box, and the circuit diagram is given in Fig. 1. The test prod is a short length of 7-strand tinned copper wire. A common flush-type doorbell button may be used for the switch.

If the receiver is "alive" a buzzing sound will be heard



in the loudspeaker when the test prod is touched to the antenna post or to the grid or plate of any tube in the R.F. or I.F. stages. In checking the audio section it may be necessary to connect one side of the generator battery to the set chassis or ground of the receiver to produce a sufficiently

loud signal. If speaker and output stage are working properly in a defective set, touch the prod to the grid of the preceding stage and work forward in each stage until the sound ceases, which indicates the trouble lies in the stage that has just been passed. A check of the tube, condensers and resistors in that stage will quickly reveal the defect. For lining up a t.r.f. set, hold the generator close to the antenna and adjust the trimmers on the ganged tuning condenser for loudest sound in the speaker. In supers the prod is held close to the grid of the first detector tube and the trimmers on the I.F. stages adjusted for loudest noise, then follow usual procedure.



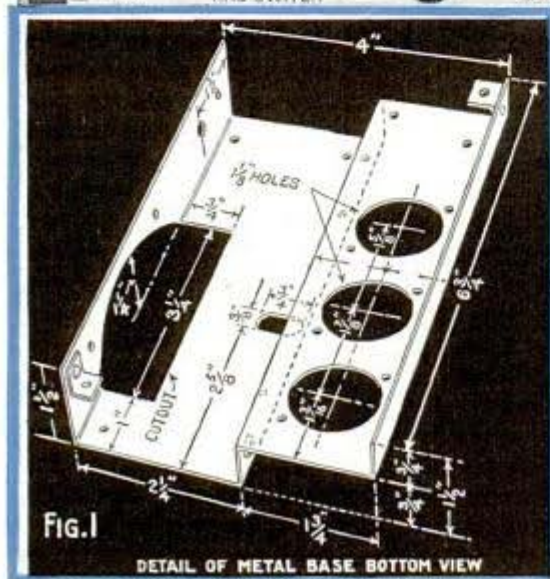
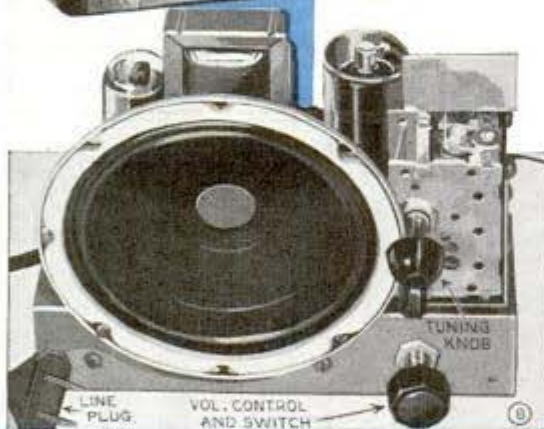
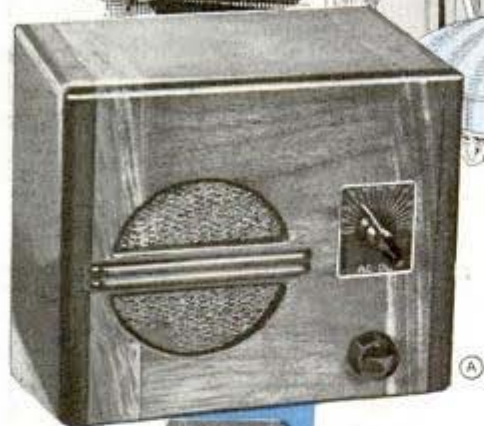
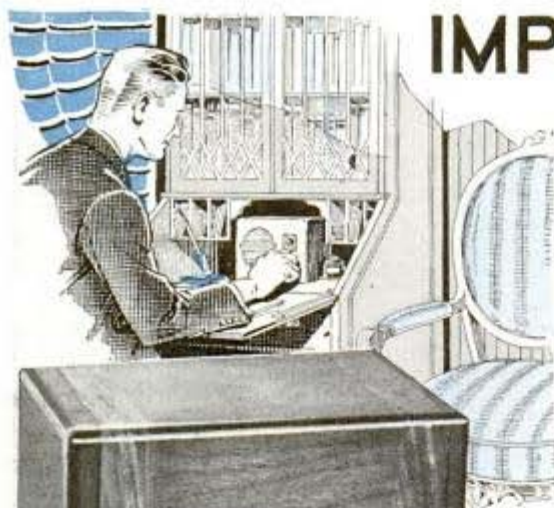
IMPROVED A.C.-D.C.

By Frank M. Lund

UNUSUALLY small for a 3-tube tuned r.f. receiver using tubes of regular size, this improved model of the popular "Pup" set now has beam-power output of $1\frac{1}{2}$ watts, an increase of $\frac{3}{4}$ watt over the previous model, without distortion. Operating either on alternating or direct current, it employs the new high filament voltage tubes that eliminate the line-cord resistor.

Housed in a simple wooden cabinet $7\frac{1}{2}$ in. long, $6\frac{3}{8}$ in. high and $4\frac{7}{8}$ in. deep, it is small enough to slip into a traveler's hand luggage. An excellent low-cost knock-about receiver for the desk or playroom, it covers the standard broadcast band and gets police calls. Although only three tubes are employed, one is a dual-purpose type which gives the set the extra "zip" that equals ordinary 4-tube performance. The construction details are simplified for the beginner, and only a few inexpensive standard parts are required.

The forming and drilling details for the metal base are given in Fig. 1. Although the dimensions should be followed closely, the builder can omit the $\frac{3}{4}$ -in. tube-mounting step and keep the base at the same $1\frac{1}{2}$ -in. height if preferred. The base is formed easily by bending sheet metal clamped between pieces of wood in a vise, or, if you are not equipped to do this type of work, see your local tinsmith. Some of the large mail order radio parts houses supply this chassis base formed and drilled to specifications, if desired.

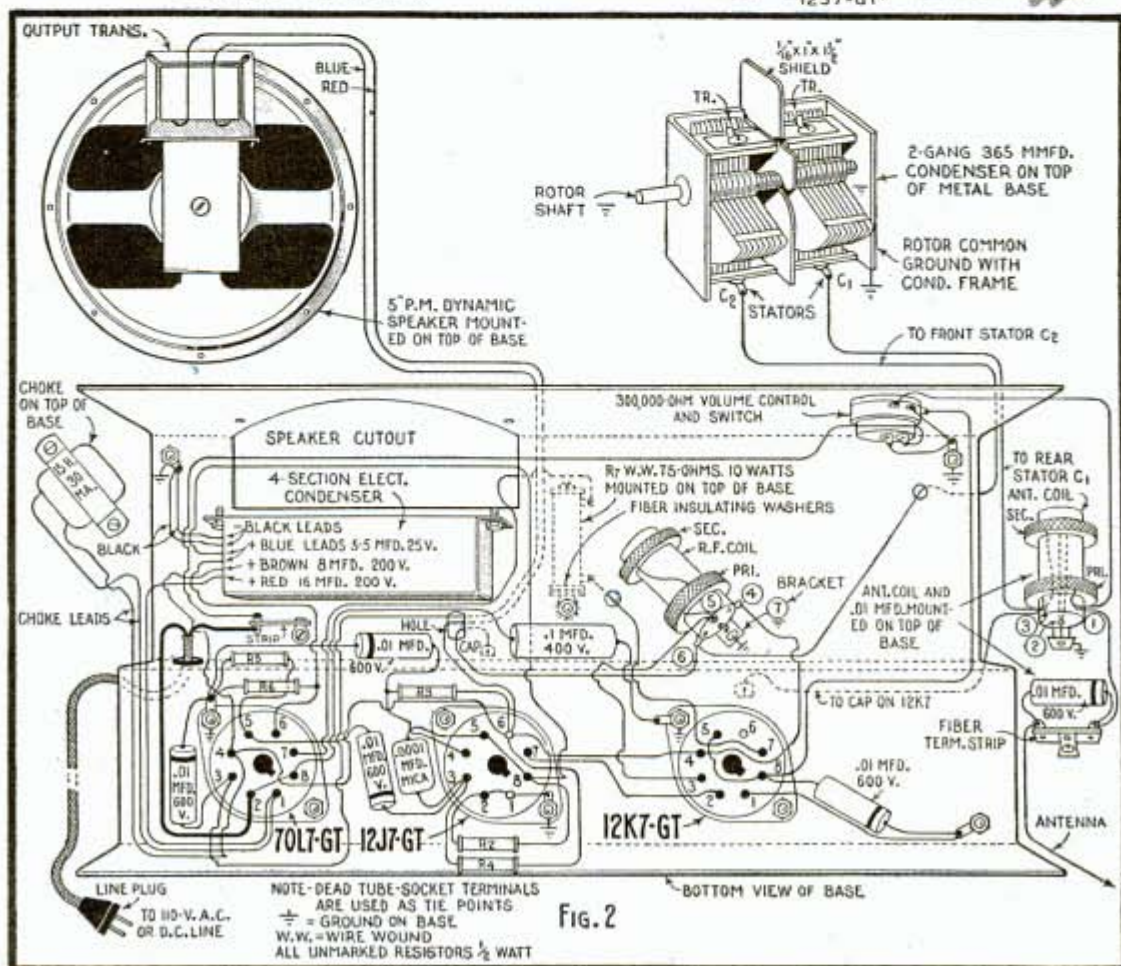


LITTLE GIANT "PUP"

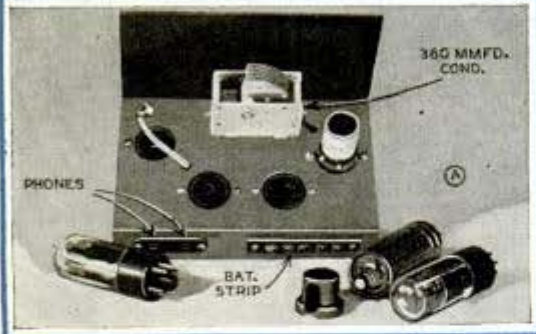
A simplified wiring diagram appears in Fig. 2. This shows an underside view of the base with every connection completed to the various parts mounted on top. Before beginning construction, note the location of all parts above and below the base as identified in photos B, C, D and E. Mount the tube sockets just as shown in Fig. 2, and make all connecting wires as short and direct as possible. Solder every connection carefully with rosin-core wire solder and pay particular attention to chassis ground connections. These should be soldered to lugs placed under tight machine screw nuts and "shake-proof" lock washers, instead of attempting to solder directly to the metal base. Efficient results depend upon good mechanical and electrical connections.

It will be noted that the wire-wound 75-ohm resistor (R_7) is mounted directly on top of the base in a vertical position, and is carefully insulated from the base by means of fiber insu-

(Continued to page 181)



Progressive "Midget" Kit Sets for Students



DESIGNED especially for use in classrooms where radio is being taught, these inexpensive kit sets have a definite value in "objective" teaching. These, and similar kits, are now being used in a large number of vocational schools as the basis of a radio course. Carefully engineered for step-by-step construction, they are not toys in any sense, but real battery-operated radio receivers, employing late type 1½-volt low-drain tubes.

The one-tube set may be assembled by the student or experimenter and, after he has become thoroughly familiar with its operation, he can make a 2-tube set out of it, simply by adding the parts included in the first "add-on" kit. The use of the second "add-on" kit will convert the 2-tube set to a 3-tube receiver. Every part is included in the kits except the tubes, batteries and headphones. A plug-in coil is supplied with each foundation kit to cover the broadcast band from 200 to 545 meters, while additional coils are available for "all-wave" coverage. Detailed instructions are supplied in addition to the diagrams given in Figs. 1, 2 and 3. Photos A and B show two views of the completed 3-tube receiver.

Tuning is accomplished on all three models by a single large bakelite dial. Regeneration control is provided on all three, and a volume control is added when the 3-tube set is built. All are designed for headphone operation, although the three-tuber will operate a small magnetic or P-M dynamic speaker with excellent results. These sets use a single 1½-volt No. 6 dry cell for the "A" battery as tubes are of the low-drain type.

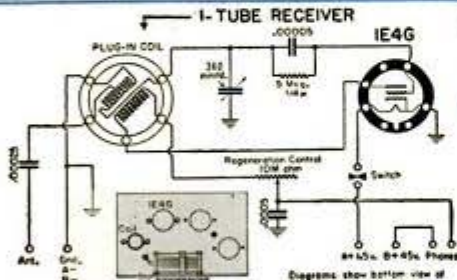


FIG. 1

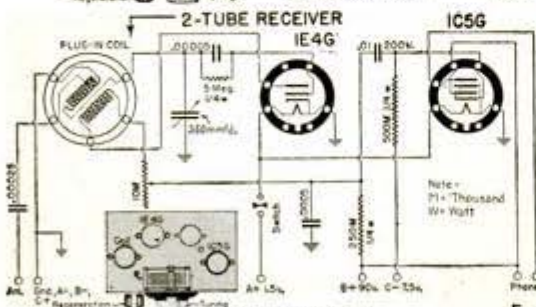


FIG. 2

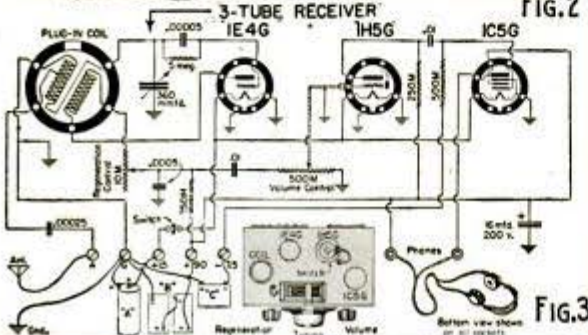
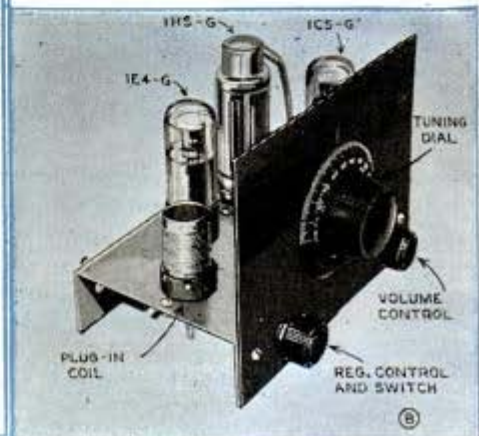


FIG. 3



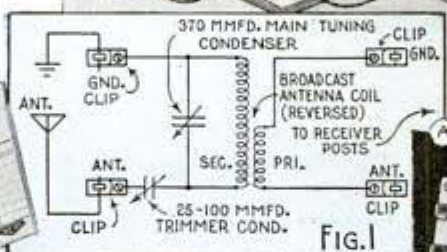
(B)

*Bro. Radio, Inc. Cleveland
5205 Cedar Ave Ohio*

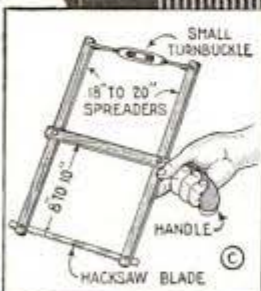
Practical RADIO HINTS



(B) Index file provides a handy means for keeping track of station contacts. It acts as a supplement to the log book when a quick check on details of previous QSO contacts is desired



(A) This inexpensive unit is recommended for increasing the selectivity of any simple 1, 2 or 3-tube broadcast receiver where difficulty is encountered in separating stations. The parts are mounted on a 4 in. by 8 in. piece of plywood. Trimmer is supported by the connecting wires. Connect antenna coil in reverse as indicated in Fig. 1. The trimmer condenser is adjusted with a small screwdriver; its adjustment depends upon the length of antenna used and once set it need not be touched again. The tuning condenser is adjusted simultaneously with the main tuning condenser on your receiver

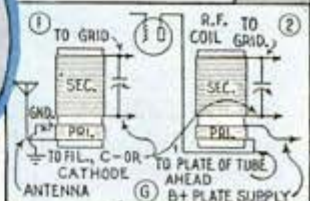


(C) Hack-saw frame for sawing wide panels, made from hardwood sticks and a small turnbuckle. A section of hockey-stick is loosely bolted across the center to provide a handle. The saw blade is held in the bottom holes by means of heavy cotterpins. (D) Sound effects kit adds realism to home recordings made and used by amateur movie makers. (E) Temporary substitute for pilot light socket assembled with a piece of bakelite, 2 machine screws and a length of No. 18 bare copper wire



(F) Sapphire needle for low-pressure phono pickup is claimed to give approximately 12,000 playings, when used at 1 ounce pressure, before it must be replaced

(G) Figs. 1 and 2 show standard connections for homemade antenna and r.f. coils



*Walter Isay Corp
Charlotte, N.C.*

*Electronix Co., 424 Madison Ave
New York*

General Electric Co.
570 Lexington Ave New York

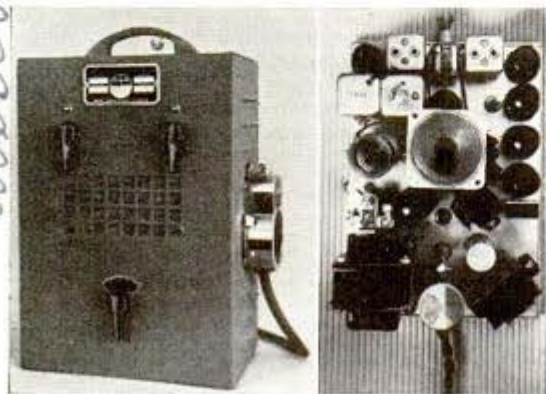
Large Seven-Tube Portable Set Has Increased Power Output



Playable either on batteries or on a.c.-d.c. current supply, and employing 7 tubes including rectifier, this portable superheterodyne uses a broad-band r.f. stage for greater sensitivity and is claimed to have an output of 440 milliwatts, approximately double that of the conventional portable. Battery life is about 200 hours. The antenna is located in the lid and horizontal dial and all controls are on an incline under the lid.

Two-Way Five-Watt Radiophone

Built for complete assembly in one compact unit, this low-cost general purpose 7-tube radiotelephone weighs only 16½



pounds. Ideal for the small boat operator, it consists of a single-frequency transmitter and receiver that can be adjusted to any one frequency. For example: 2638 k.c. for general communication between boats; for the safety frequency of 2738 kc., or, the distress frequency (coast guard) of 2670 kc. It is also suggested for a reserve unit on larger vessels, forestry service, or anywhere that a lightweight portable unit is required that can be operated from a single six-volt storage battery.

Recorder With Record Changer

In addition to a home recorder and public address amplifier, this communication unit includes a playback system with an automatic record changer, all housed in a single airplane-type luggage case. It plays manually at 78 r.p.m. all acetate home re-



cordings or commercial records up to 12 in. diameter. Automatically plays without interruption twelve 10-in. or ten 12-in. records. Will record at 78 r.p.m. on composition and acetate blanks up to 10 in. diameter. Built-in amplifier delivers 3 watts output. Employs 4 tubes and an electric-eye volume indicator; speaker is 6½ in. P.M. dynamic type. Operates on 110 volts, 60 cycles.

Blueprints covering simplified radio construction articles in this and past issues are available for 25c each. Many popular tested circuits to choose from. Original detailed parts lists with names of supply sources, can be obtained from Popular Mechanics Radio Department upon receipt of postage.

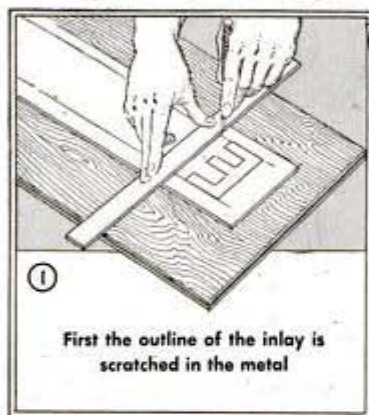
NEXT MONTH—Portable Ten-Watt Sound System Works From Six-Volt Storage Battery or 110-Volt A.C. Line. Engineered for easy low-cost construction and high quality output. A universal sound system suitable for use anywhere in car, home or school, indoors or out. Also—**Condenser Tester** and a **One-Man Antenna Mast.**



SHOP NOTES

ENAMEL INLAYS

baked on metals



①

First the outline of the inlay is scratched in the metal



②

Then the area not to be etched is coated with asphalt varnish



③

The plate is allowed to remain in an etching bath 5 to 15 minutes



④

After etching, the asphalt varnish is removed with gasoline

By C. A. Crowley

BAKING enamel on metal to form a hard, glistening decoration is interesting work and offers many possibilities for you to establish a profitable business. Name plates, ash trays and other novelties are only a few of the articles that anyone can turn out inexpensively in quantities. The enamel can be applied as an inlaid design, or it can be applied as an overlay, and you can even cover the entire article.

For inlaid work, the first step is to etch the design in the metal. This is first cleaned thoroughly, using a solution of soap and water with washing soda added to remove all grease. Then the design to be etched is laid out on the surface of the metal, Fig. 1, and asphalt varnish is painted carefully over all of the surfaces of the work not to be etched, Fig. 2. Any varnish that gets on the surfaces that are to be etched can be removed by carefully scraping it away, or by the use of a cloth soaked in gasoline or naphtha. Small work can be entirely immersed in the solution, but if the article is large, or if only a part is to be etched, a dam can be built around the etched part with paraffin or other wax

COLOR PIGMENTS SUITABLE FOR USE WITH VINYL ENAMELS

Color	Pigment
Blue	"Monastral" fast blue B
Green	"Monastral" fast green G
Yellow	"Lithosol" yellow G conc.
Orange	"Lithosol" fast orange G powd.
Red	"Lithosol" red 2BD powder



PLACE DRY COLOR IN MORTAR

ADD PART OF VINYL LACQUER

GRIND TILL SMOOTH. ADD REST OF LACQUER.

⑥ PREPARING COLORED ENAMELS FOR BAKING



and coated on the inside with asphalt varnish to form a pool to contain the etching solution. This must be handled in glass or earthenware containers, and rubber gloves should be worn to protect the hands, Fig. 3.

Etching Solutions:

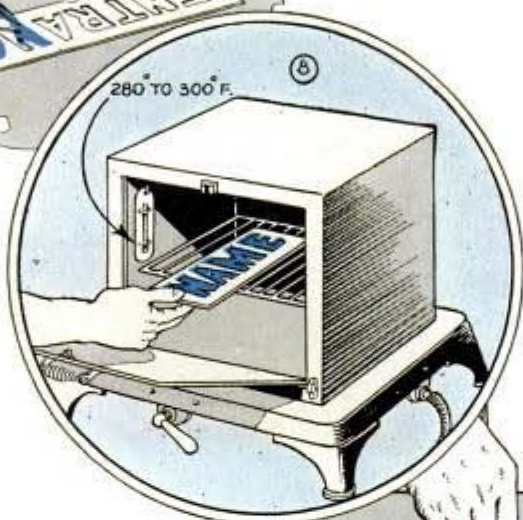
On brass and copper, a solution of nitric acid, 1 fl. oz., in water, 8 fl. oz., will give a rapid etch. On iron and steel, it is best to use a mixture of nitric acid, 2 parts, and glacial acetic acid, 1 part, or a solution of hydrochloric acid, 1 fl. oz., and potassium chlorate, $\frac{1}{2}$ oz., in water, 8 fl. oz. On aluminum, use strong hydrochloric acid. Other etching agents as commonly used can be substituted if desired. The etching will be more rapid if the work is heated, but it should not be heated enough to soften the asphalt varnish. The etch should be deep enough to take about three coats of enamel. Generally, about 5 to 15 min. will be sufficient. If etching is more rapid than desired, reduce the temperature of the work if it has been heated, or dilute the solution with water.

Preparing for Enameling: After the etching has been completed, remove the work and wash away the etching solution with water, and when dry, remove the coating of asphalt varnish by soaking in gasoline or with a brush or cloth soaked in gasoline or naphtha, Fig. 4. Lead-free gas-

oline must be used, and the work should be done outdoors and away from fire. The work should be cleaned with soap and water to remove any remaining grease or dirt. After drying, it is ready for enameling.

The vinyl lacquers that are used in this work come in three forms, a primer for use over certain metals, a white lacquer and a clear one. However, brilliantly colored lacquers can be made by grinding colors into the clear lacquer with a mortar and pestle. Color pigments that can be used are given in Fig. 5. While some dry pigments can be used, certain

pigments are not satisfactory. A glass mortar should be used to prevent possible contamination. To prepare a colored lacquer, place the powdered color in the mortar and add a part of the clear lacquer required. Grind this well, Fig. 6, to remove all lumps and leave a smooth mix. Now add additional clear lacquer to the mix until the color



reaches the desired shade. The quantity of color to use will depend on the intensity of color desired, but rather heavy concentrations must be used.

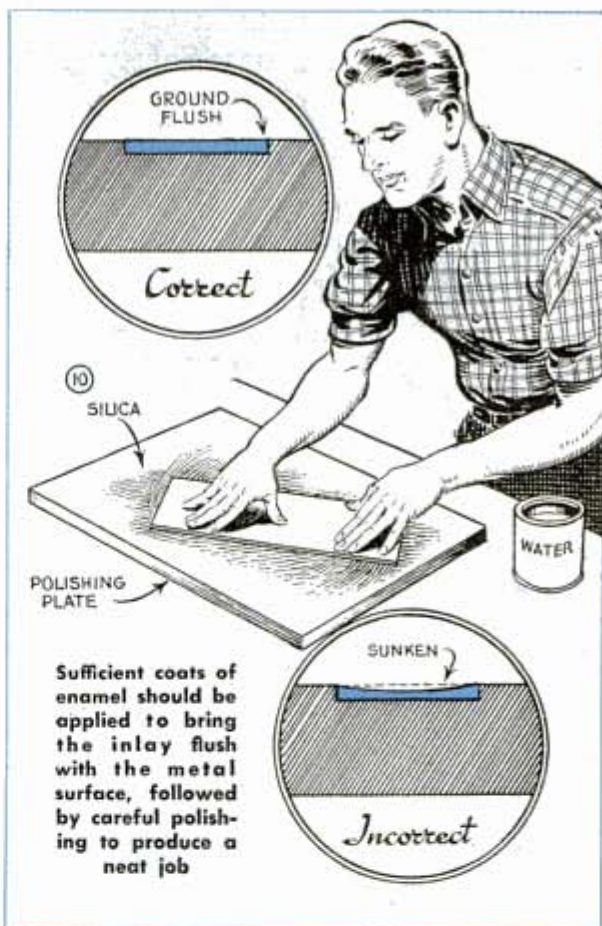
Applying the Lacquer: As many metals cause deterioration of the vinyl film, it is advisable to apply a coat of vinyl primer before any color. The primer, which is not required on aluminum, is carefully brushed or sprayed over the areas that are to receive the enamel, Fig. 7, and is allowed to dry until no longer tacky. If the primer has run over the edges of the designs, they can be trimmed by running a sharp knife or razor blade lightly along the edge and then peeling away the excess primer beyond the knife line. Then the work is put

into an oven, Fig. 8, and baked at 280 or 300° F. for approximately an hour. The time required is longer on heavier articles. A sheet-metal oven that can be purchased at any hardware store for less than a dollar is used. An oven-type thermometer should be used and the temperature controlled carefully to prevent overheating, which may damage the primer film. Do not place the work on the bottom of the oven which is generally right above the flame and where the work will almost certainly overheat. After baking and cooling, the primer should be hard and should adhere very tightly to the metal. If it does not, the baking time should be increased without raising the temperature above 300° F.

After the priming coat has been baked on the work, the colored enamels are applied in the same manner. The enamel should not be applied in too thick a coat as blistering may occur. If, after drying and baking, the surface of the enameled area is below the surface of the metal, a second coat should be applied and baked on. Ordinarily, at least two coats will be required. Two or more colors can be used to give additional decoration. If two colored areas touch with no metal between them, one should be applied and baked on before applying the other, Fig. 9. If it is necessary to thin the enamels, methyl isobutyl ketone can be used. It will also remove spoiled applications of enamel from the metal before baking.

Finishing the Work: Articles finished as described are extremely attractive and no further work is really required. However, for best results, the entire surface should be carefully polished as in Fig. 10, using a flat plate as a polishing surface and fine silica or lime abrasives. Coarse abrasives will scratch the surface. For a fine finish, jeweler's rouge is used. The polishes can be applied as fine powders, using water to make a thin paste.

When corrosive acids are used in work such as this, fumes should not be inhaled. For this reason it is best to set a fan in such a position that the fumes will be blown away through an open window. Also, even if rubber gloves are worn, there is still possibility of splashing acid solutions and accidentally getting some on the skin. If this



should happen, just wash under a stream of running water immediately. A saturated solution of ordinary household baking soda is applied immediately to acid spots on clothes to neutralize the acid. This prevents it from eating through the cloth.

Brush Bristles Kept Straight In This Cleaning Pan

The problem of keeping paint-brush bristles straight is solved by this pan when storing the brushes in solvent overnight or between jobs. The bottom of the pan is low at one end and high at the other with the bristles lying flat in solvent at the low end. The pan is made by cutting out one end and then bending down the sides as indicated by the dotted lines in the upper detail.



"Safety-Pin" Retainer in Clevis Of Hoist Cable Assures Safety

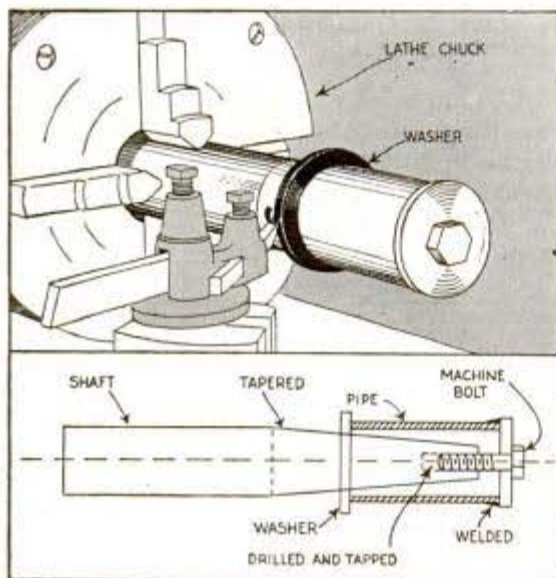


There will be no danger of a large clevis pin slipping out because of jerking or jarring when used on heavy-duty work of construction jobs if a retainer like this one is used. It is easy to insert or remove, and is made by bending a length of spring rod, such as a hayrake tine, to the shape shown.

—Karl A. Paulissen, Indianapolis, Ind

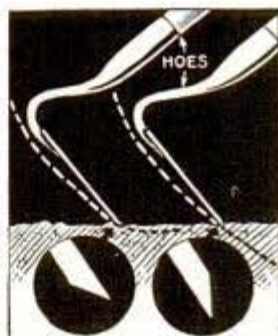
Jig Holds Washer True in Lathe While Turning It Down

Here is a simple jig for turning down washers in a lathe to suit a special job. The jig consists of a length of shafting



tapered at one end and tapped to take a machine bolt or cap screw. A sleeve consisting of a short piece of pipe with a cap or disk welded to one end is made to slip over the tapered end of the shaft, the end of the sleeve being drilled to take the cap screw. In use, the shaft is chucked in a lathe and the washer to be turned is slipped over the tapered end and followed by the sleeve, which is pulled up against the washer with the screw. This forces the washer tightly on the tapered portion of the shaft, the sleeve keeping it in alignment for turning. The taper of the shaft permits washers of different sizes to be turned.—A. M. Chester, Seattle, Wash.

Hoe Cultivates Ground Better When Bevel Is Reversed



A Wisconsin agricultural agent claims that the bevel on a hoe used for cultivating soil deeply should be filed on the front surface of the hoe instead of on the back. In this position, the bevel tends to direct the hoe into the ground for deep loosening of the soil, while if the bevel is on the back, the hoe has more of a tendency to skim the surface of the ground. This action is better, of course, when it is desired to just cut off weeds.

Calling Cards on Brief Case Are Within Easy Reach

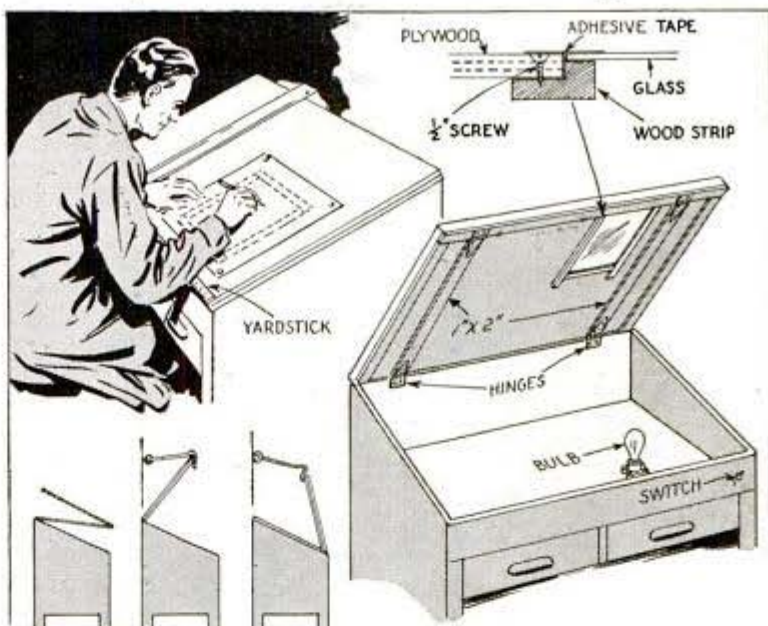
Instead of carrying calling cards in his pockets where he usually had to search in two or three pockets before he found them, a salesman riveted the card case to one side of his brief case. As the



case was usually in his hand or on his lap when talking to a customer, the cards were always within easy reach.

Three Ideas That Improve Your Drawing Table

Here are some simple features that can be applied to a drawing table or bench that will aid greatly in your work. A piece of frosted glass set in one corner with a light underneath it will enable you to do tracing work easily. Another feature is to double-hinge the board so that it can be raised at the front to use the space underneath for storing materials, or so that it can be raised from the back to serve as an easel for airbrush painting, as shown in the lower left-hand detail. A large hook on the wall will hold the lid in this position. A third idea is to brad a yardstick across the lower edge of the table at the front. The stick keeps your



pencils from rolling off the sloping surface, and is always at hand for measuring sheets of paper, plans and drawings.

Band-Saw Wheel Tires Tightened by Cutting and Splicing

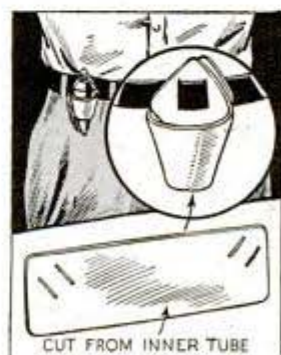
If the tire of a band-saw wheel stretches so that it will not stay in place, it can be tightened by cutting and splicing it. The ends of the tire are beveled to form a lap joint, and a piece of electrician's tape is used in the joint as indicated. Rubber ce-

ment is used as an adhesive, and is handled in the same way as when patching an inner tube.—E. M. Love, Monterey Park, Calif.



Belt Sheath for a Plumb Bob Used by a Surveyor

Because of its weight and pointed end, a surveyor's plumb bob is inconvenient to carry in the pocket. A better way is to use a sheath cut from an old inner tube so that it can be carried on the belt of the trousers. A strip of rubber about 2 in. wide and 7 in. long will be suitable for the sheath, which is slit diagonally at each upper corner to take the belt.



☐ The life of a pencil is much longer than that of an eraser, so wrap a rubber band around the top of the pencil and it is as good as new.

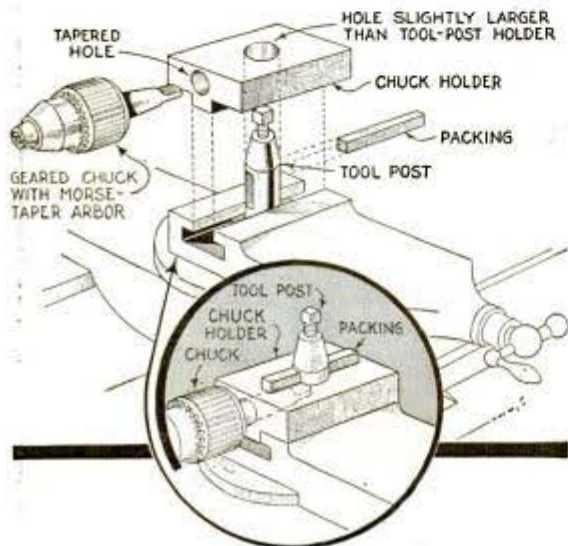
Supports Pivoted in Desk Drawer Hold Files for Reference



File envelopes can be kept conveniently at hand on a desk drawer during working hours by merely attaching two folding supports to the drawer as indicated. Space for the envelopes is regulated by opening or closing the drawer.

Lathe Tool Post Chuck Holder

The fact that a drill chuck can be held only in the tailstock of a lathe, often slows up production on many jobs. Many times a drill with a taper shank must be used too, while the following reamer has a straight shank. This means that both the



chuck and drill must be removed for each operation. This drill chuck holder will make some of this work unnecessary and save time. It is clamped in the tool-post holder and consists of a block of steel drilled to fit over the tool post and milled on the underside to fit the tool-post slot. A tapered hole in the front end takes the chuck and other taper-shank tools.

Hammer Head Kept on Handle By Clip and Screw

A heavy hammer head that has a tendency to slip off the handle can be kept in place by using a clip and a large wood screw.



The clip is shaped from thin flat iron, and is held by the screw driven into the end of the handle. On old handles that have been wedged, use two smaller screws, one on each side of the wedge.

Packing Eggs Correctly in Case

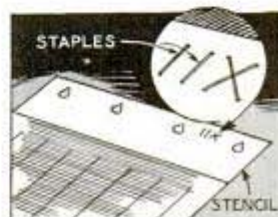


Using a simple precaution in packing, one produce merchant claims that he is seldom docked for broken eggs in his shipments. When filling the crates, he places all eggs

so they lean one way in the fillers which makes the space between layers sufficient to avoid crushing from eggs above.

Staple Numerals Mark Stencils

For permanent identification marks on mimeograph stencils, use a paper stapler to form Roman numerals along one edge. There is no



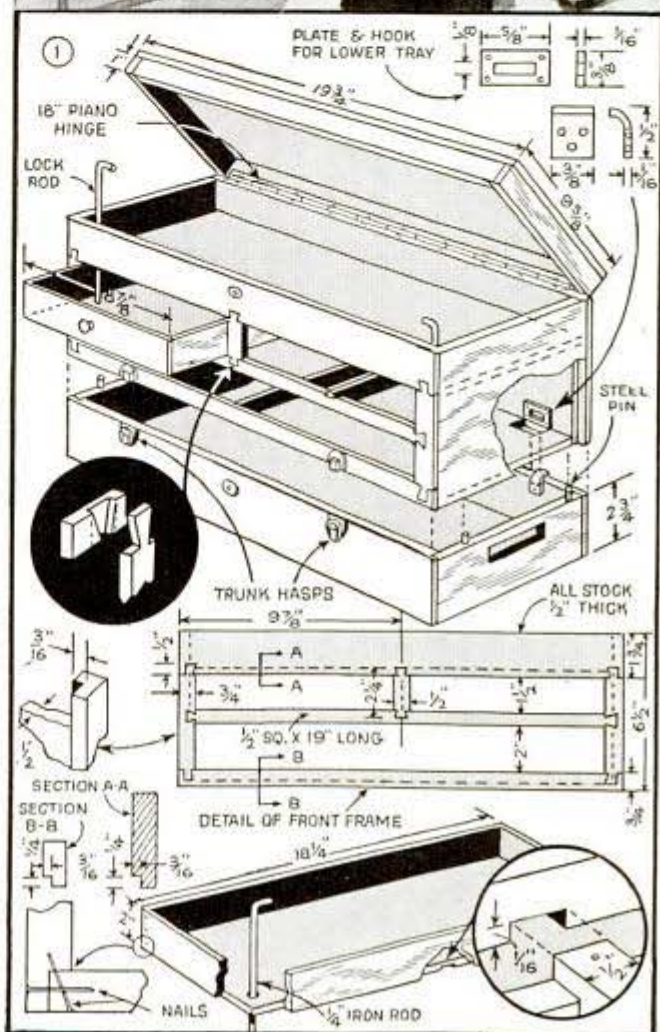
danger of these marks rubbing off or being covered by ink, and the numerals can be recorded on a separate sheet so that stencils can be located quickly.

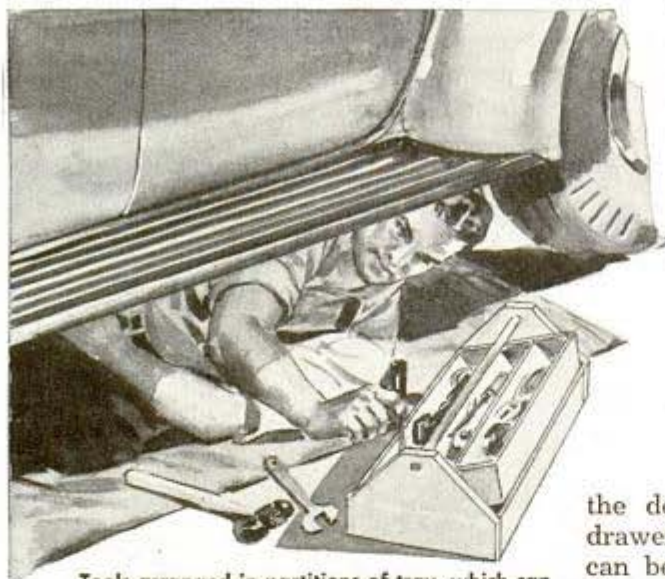
5 HANDY TOOL BOXES

New slants on building tool boxes to increase their usefulness for specific purposes

MACHINISTS, tool and die makers, garage mechanics, servicemen, carpenters and others will find that these substantial tool boxes are easy and inexpensive to make. While suggested dimensions are given in the drawings, and the method of construction is also shown, the craftsman can make such changes as may be most suitable for his purpose. Besides the four designs offered to tradesmen, a simplified type of tool box also is given, which will appeal to the junior mechanic or householder having an assorted number of common hand tools.

Machinist's Tool Chest: Attached to the bottom of the machinist's tool chest shown in Fig. 1, is a tray which can be removed readily. It is fastened to the box by means of two plate-and-hook sets which you can make or buy, and two spring clasps, while four steel pins in the edge of the tray fit into holes drilled in the bottom of the box to keep both units in perfect alignment. The tools required for any job can be selected and kept at hand in the tray while the chest remains locked in its accustomed place on the bench. Half dovetail joints are used for the front framework, both for strength and decorative effect. These are really half-lap joints with the mortise-and-tongue parts V-shaped instead of being rectangular. This method gives considerable surface for gluing, resin glue being used, with the result that the joints cannot pull apart under strain, and therefore

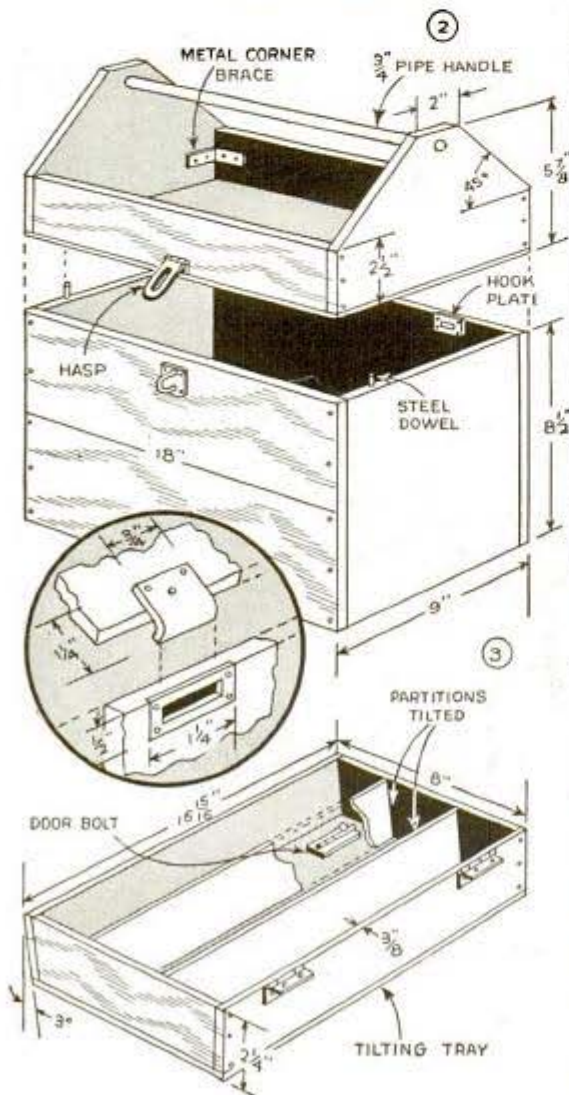




Tools arranged in partitions of tray, which can be set at an angle next to worker under car, are clearly visible and can be removed or replaced conveniently

the open side of the chest where the drawers slide in, is practically as strong as the back. The stock used for the front, back and ends is $\frac{1}{2}$ in. thick, the top is $\frac{3}{8}$ -in. stock and the drawers are made from $\frac{1}{4}$ -in. material except the fronts which are $\frac{1}{2}$ -in. The tray bottoms are $\frac{1}{4}$ -in. stock. Close-grained hardwood is best for strength although you can substitute plywood except for pieces having half-dovetail joints.

Two panel locks of the type shown are required, one for the hinged upper lid, and a second for the detachable lower tray. Individual drawer locks may be used or the drawers can be locked conveniently by means of $\frac{1}{4}$ -in. "lock rods," one at each corner,

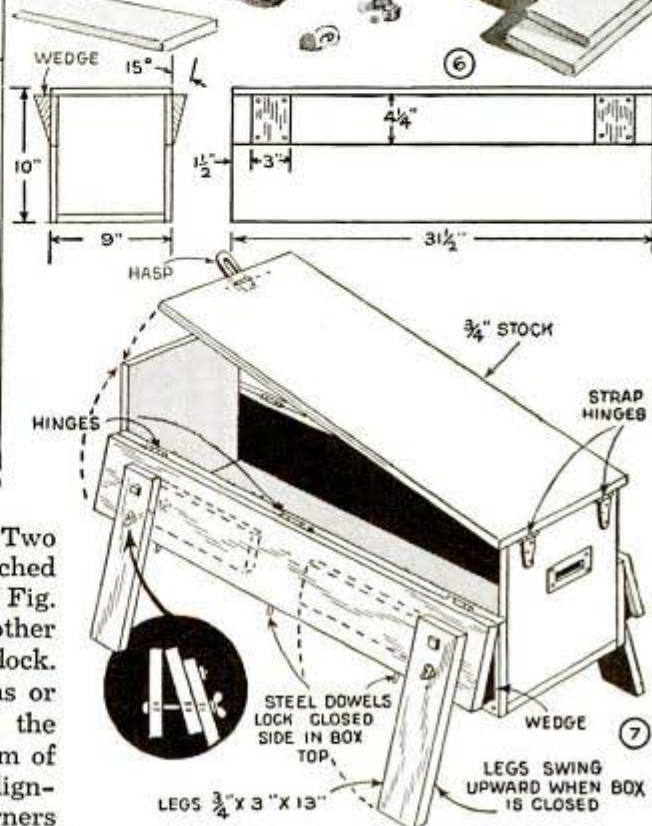
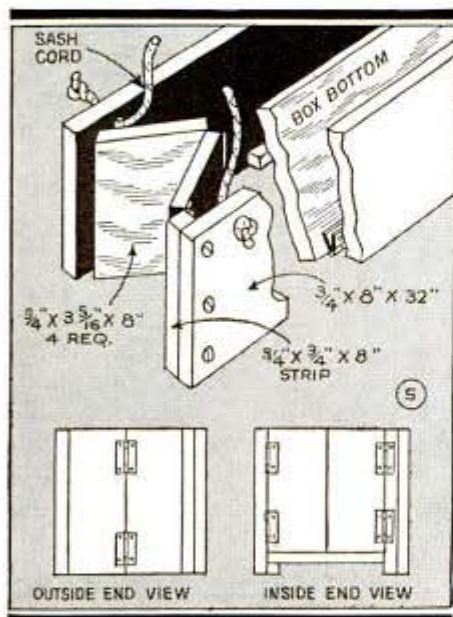
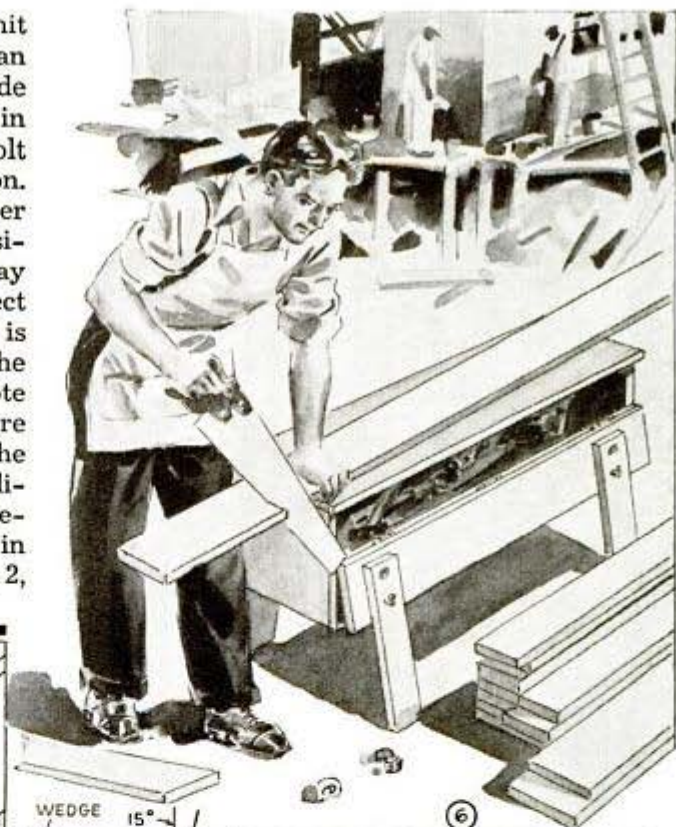


Provided with a strap or rope so that it can be slung from the shoulder when carried, this box folds flat as in Fig. 5, for convenient storage

which are dropped through holes in the drawer bottoms. When these rods are inserted and the top lid is locked, the drawers cannot be opened. Green felt may be glued as a covering over the bottoms of the drawers and tray. A continuous, or piano hinge is best to use for the top. Besides nailing or screwing sides and bottoms together as shown in the lower left detail of Fig. 1, it is advisable to glue the joints also for additional strength.

Auto Mechanic's Tool Box: The outstanding feature of the box shown in Figs.

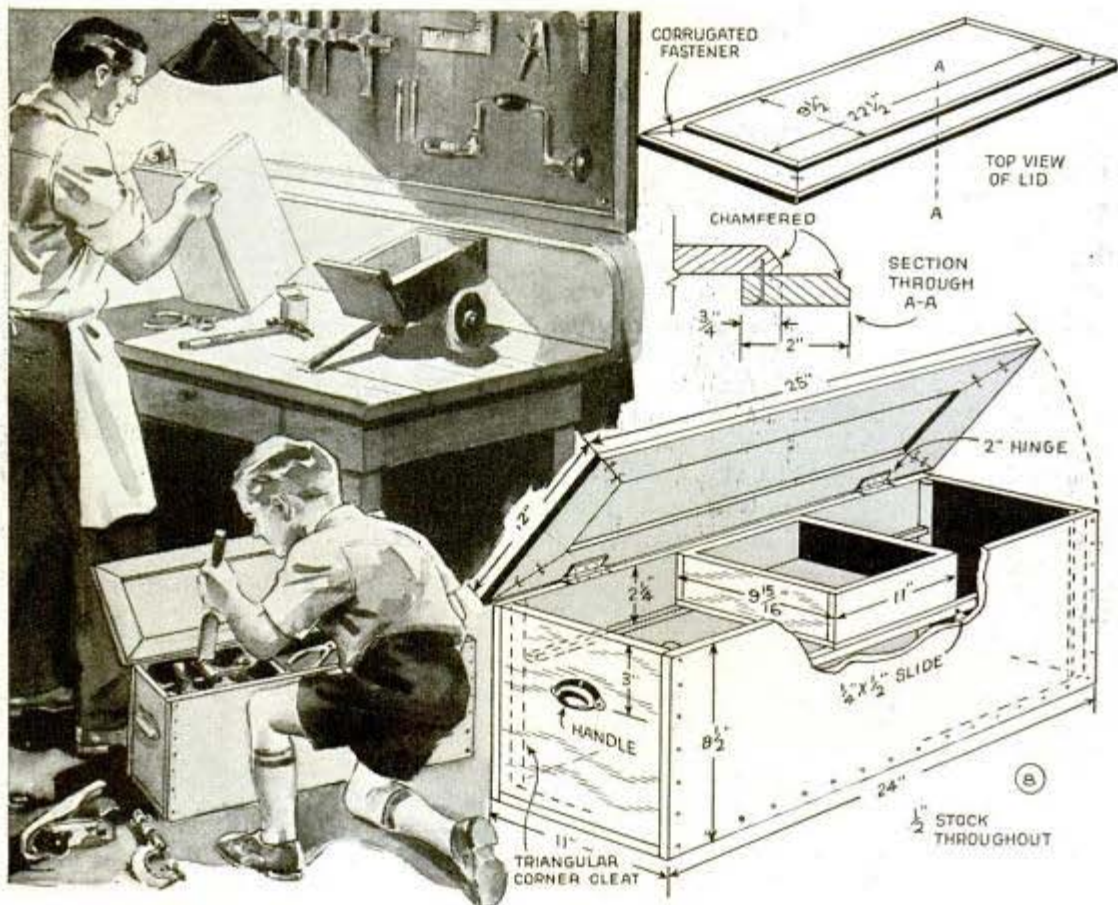
2 and 3 is that the detachable top unit holds a tray, which can be set at an angle. The tray is hinged at one side and is provided with a door bolt as in the lower detail of Fig. 3, the bolt locking the tray in the tilted position. Then, as the worker is lying under a car in a more or less cramped position, he can look over into the tray without difficulty in order to select his tools. Extra space for tools is available on the flat bottom of the unit when the tray is tilted. Note also that the tray division pieces are slanted somewhat to better hold the tools at the tilted position. A simplified locking arrangement assures security for tools, which are placed in the lower unit of the box as in Fig. 2,



the upper unit serving as a cover. Two hook-and-plate sets, made and attached as indicated in the circular detail of Fig. 3, hold one side locked, while the other side is locked with a hasp and padlock. Also note that two small steel pins or dowels are set into the edges of the lower unit to fit holes in the bottom of the upper unit to keep both in alignment. For extra support at the corners you can use metal corner braces of the kind shown in Fig. 2.

Collapsible Tool Box: Next is a carpenter's portable tool box that folds flat and can be stored in a small space when not in use. It can be kept in a large tool chest if

Here is a carpenter's chest of which the top half of each side drops down, and legs pivoted to the drop sides are swung out, after which the whole assembly is locked in this position so that the box forms a sturdy sawhorse at just the right height. Tools are removed and replaced conveniently through the open sides and suitable handholds are provided at the ends



desired. Fig. 4 shows it in use, provided with a strap or sash cord so that it can be slung over the shoulder. The method of folding it is shown in Fig. 5. The bottom folds against one side and the ends, each of which consists of three separate pieces, fold toward the inside. Six hinges are required at each end. No top is required as the purpose is just to carry a few needed tools on the job where it is not desired to transport a large chest.

Combined Tool Box and Sawhorse: With the tool box shown in Figs. 6 and 7, the carpenter will find it unnecessary to "knock together" a sawhorse on the job. The box is provided with four legs that swing down at the proper angle and make the assembly a strong and rigid sawhorse. As the drop sides are opened, large openings are provided through which tools may be removed or replaced in the box. The pivot bolts of the legs pass through wedges, drop sides and legs. In the "open" position, anchor bolts pass through these members as well as through the fixed sides of the box. Provided with wing nuts, these bolts can be inserted and drawn up tightly in a few

moments and they are carried loosely inside the box when it is closed. The box is easily locked; steel pins being driven into the top edges of the drop sides. When these sides are in the "closed" position the pins fit into holes in the underside of the cover. Then the latter is secured with a padlock through the hasp as shown.

General Utility Tool Box for Household- Fig. 8 shows a simplified tool box having hand grips at the ends and provided with a sliding tray, which can be moved toward either end in order to get at tools underneath. Made of $\frac{1}{2}$ -in. stock, the box is assembled either with wood screws or nails and the corners are further strengthened with vertical corner strips as shown, which are glued and nailed in place. In assembling the lid, which consists of a mitered frame fitted with a panel, you can use corrugated fasteners. These may be countersunk and puttied over to hide them and prevent rusting. This method of construction saves work and produces a strong lid. No lock is indicated, but either a hasp or a panel-type lock may be fitted to the chest if desired.

Finishing Cabinet Has a Folding Work Shelf



Used in the industrial-arts department of a large Chicago high school, this paint cabinet provides shelves for storage and has a drop leaf on which painting and finishing of small articles can be done. In this way, workbench tops are kept free of paint smears and stains. Also, the job of taking inventory of the materials on hand is simplified as they are all grouped and not scat-

tered about on the various benches. The cabinet is made of $\frac{1}{2}$ -in. plywood, and has two hinged doors at the front, which open to permit the drop leaf to be lowered. Two lengths of small chain hold the shelf in working position. The front edge of the bottom shelf must be set back far enough to make room for the drop leaf when it is raised.—I. M. Fenn, Chicago.

Electric Tools in School Locked by Box Over Wall Outlet

In a manual-training room, students were kept from operating the electric tools without the authorization of the instructor by using a box over the outlet as shown. Cords from the machines were run through holes in the cover of the box, which could be locked with a padlock. The machines could be plugged in and the cover locked, after which the cords, which were vulcanized to the rubber plugs, could be pulled from the outlets, but they could not be inserted again until the box was unlocked.

Initials may be burned into hammer handles or other wood surfaces by first forming the letters on the surface to be marked with rubber cement and touching a match to them. If they are not burned deep enough, repeat the process.



Steam Fitter Carries Packing For Valves in Flashlight



Maintenance men in factories whose work requires the packing of valves in steam lines will find an old flashlight case a handy container for carrying the packing in their pockets. The reflector and bulb are removed from the case, and the end of the packing is threaded through the bulb hole from the lower end of the case. Then, with the end of the packing projecting through the hole, the strand is wound on a stick to a depth of two or three layers, after which the packing is cut off from its reel or ball and inserted into the flashlight case. In this way, tangling is avoided. The bottom cap of a second flashlight is screwed on the upper end of the case.

Soldering Iron and Pipe Elbow Make Self-Heated Ladle



Using a small amount of molten babbitt metal occasionally, a mechanic made this practical self-heating ladle for the job. It consists of an electric sol-

dering iron having a pipe elbow fitted tightly over the end of the copper, a set screw being used to lock the elbow in place. After the iron has become hot, babbitt is dropped into the elbow and is soon melted, remaining in this state as long as the current is turned on the iron.

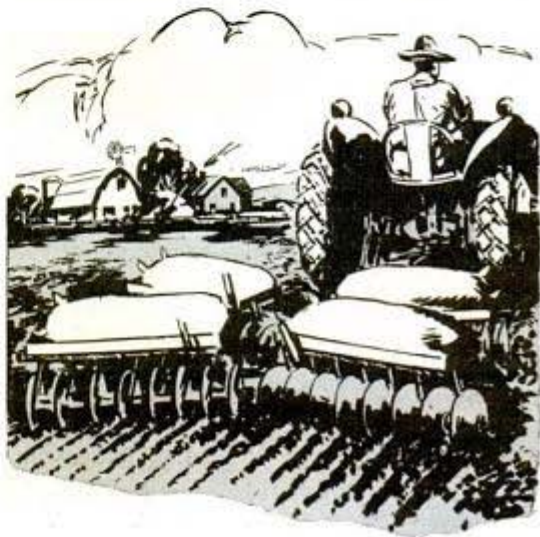
Pump-Type Oilcan Made Easily At a Small Cost

Needing several pump-type oilcans for use in my shop, I made them inexpensively from empty typewriter oilcans and pumps of the type used in cans of liquid glass-cleaning solutions. These pumps can be purchased for ten cents each if none is at hand. They are installed in the cans and triggers provided to operate them as indicated.—R. H. Graham, Gatun, Canal Zone.



Sandbags Weight Disk Harrow When Working Hard Soil

When plowing or disk-harrowing hard soils, or sod and heavy cover crops, it is often necessary to weight the implement to force penetration to the desired depth. Good weights for this purpose are made by filling sacks with dry, fine sand. Such weights will stay anywhere they are placed on an implement without tying them on.



Restoring Antique Furniture

By R. C. Stahler

Part II—Finishing Methods

AFTER you have made all major repairs on your antique piece and sanded it smooth, you are ready for finishing. First comes staining which is very important as you can ruin the appearance of an otherwise beautiful piece by improper use and application of stain. Mix and apply stains in natural light. Acid, spirit and penetrating stains are difficult to apply evenly. Colors in oil, used in oil stains, are not permanent, and in time will fade out. Oil stain is popular because it is easy to apply. Dye, or water stain, is the best and is as permanent as the wood itself. It must, however, be applied evenly with a full-bodied brush, Fig. 18. First, be sure that the piece requires staining. Unless you have had to do some bleaching, mahogany, cherry and maple usually do not require staining. Pine is best finished in its natural color.

Dry, sanded wood usually lacks color, but its approximate tone will be revealed if you brush water lightly over the entire piece. If stain is not needed all over, moisten a small area around defects, which you will fill with colored plastic wood or stick shellac. Match colors to the moistened area. When dry, sand the work and finish by rubbing with No. 00 steel wool.

Parts that have been repaired must now be tinted, Fig. 19. Moisten and test color as you did before making shellac and plastic-wood repairs. Dilute the stain, test on similar scraps of wood until color is right, then apply. Use a medicine dropper to proportion small amounts. Do not sand the stained wood until after the sealer coat is applied. If the piece is to have an all-over stain coat, let the stained repair parts dry first. Woods of more or less uniform grain will take stain without showing much va-



Apply water stains evenly with a full-bodied brush, avoiding sloppy places and "rivers," which are likely to streak the wood





Bring yellow wax to a brown color with a level teaspoonful of dry burnt umber per pound of wax



A clean board with a coat of high-gloss varnish is used for testing dry-dull varnish for brush marks. If marks show after 10 min., thin the varnish with a little turpentine

riation of color. Fancy butt, burl and crotch woods, however, reveal a wide color range. Therefore, repaired parts and all-over stains for such wood should be tested on pieces of similar grain.

If you suspect that a reddish penetrating stain has been used previously, test by coating several spots with shellac. Let stand for a week or more. If a pink "bleeding" occurs, then use a penetrating stain. On walnut, stain to a much darker shade to conceal possible bleeding. If the piece is maple or pine, nothing can be done as there is no suitable bleach or sealer. When staining is necessary the color to use is determined by the color of the wood. The sapwood of walnut, or butternut—often mis-called walnut—usually has a warm color. These woods are found in light to medium-brown shades. Black walnut may be a dark

brown to almost black. If necessary to use this darker wood for light colored repairs, it may be bleached, then tinted.

Use no oil stain on cherry, as the oil has a too darkening effect. A light brownish-red tone is best. Between a light and dark colored honey shade is about right for maple. Curls will come out much darker, which makes this wood so desirable. Do not stain mahogany too dark, and avoid a too reddish shade. Brown with a hint of red should be your choice. When the stain is thoroughly dry, it must be sealed in.

Usually either shellac, shellac-wax or a varnish finish is best for an antique piece. Shellac dries dustproof in a few minutes, and thoroughly hard in a few hours. White shellac, colored to a very light brown is best. Mix dry burnt umber, 1 tablespoonful, in denatured alcohol, 3 tablespoonfuls. Let stand 12 hrs., shaking it occasionally. Stir this color into white shellac until you get a light brown shade. For a sealer coat, reduce with denatured alcohol, 4 parts, and apply evenly. When dry, sand down the raised grain with No. 7/0 garnet paper. Rub to final smoothness with No. 00 steel wool and brush the dust out of the open pores.

Filling the wood is next. This is necessary usually on mahogany, walnut, etc. However, as pine, maple and cherry are close grained, generally no filler is needed. Buy a filler slightly darker than the stain you are using. Thin with turpentine to a cream consistency. Use a stiff, stubby brush, and stroke with the grain. Do only a small area at a time. Use clean cloths to rub it off across the grain as indicated by the photo below Fig. 23. Be sure to get it all off, as this material dries hard. A cloth over an orange stick is useful to remove filler from panel crevices, carvings, etc., Fig. 20. Linseed oil and colors in oil are part of filler ingredients. These will act as a stain and will further darken the wood unless the sealer coat is applied as herein advised, before filling. Fillers applied over oil stains will require more time for drying than ones applied over water stains. In any event, be sure that the filler in the pores is thoroughly dry before sanding. If it isn't, the filler will come out when sanding. While filling, watch for dull spots to appear and work the filler into the pores with a pad of burlap, or the palm of your hand, using a circular, twisting motion.

When the filler is dry, sand lightly, then coat the piece with shellac cut one half with denatured alcohol. Use this same reduction for successive coats. Two to four coats may be required. Between each coat, sand down the laps, then lightly sand the entire piece. Do not begin rubbing with No. 00 wool until a good gloss is obtained. After rubbing the shellac down, inspect the piece for "high" or glossy spots. Cut these down with wads of discarded worn steel wool, then use the worn wool to again go over the entire piece. By now very little shellac will be left on the piece, which means better wearing qualities and a soft dull finish.

For a shellac-wax finish, proceed as above through the sealing, filling, and sanding stage, then apply one coat consisting of equal parts of shellac and alcohol. Let dry, rub down with No. 00 steel wool. The object now is to have a very thin film



of shellac on the wood. Coat the piece with brown wax, applied lightly particularly on carvings. Yellow wax can be used if it is colored with dry burnt umber, Fig. 21. Instead of waiting the usual 20 min., before polishing with a non-scratching cloth, delay at least 24 hrs. Two or three waxings may be necessary. Shellac and shellac-wax finishes wear well on picture and mirror frames, chairs, corner shelves, and other furniture not subjected to warm food dishes, beverages, perfume, etc. Such pieces are better finished with varnish. An excellent finish, one that closely resembles the dull sheen of old original finishes, is had by using a flat varnish which gives a dull finish upon drying. Coat a clean board with high-gloss varnish and then use this for testing dry-dull varnish for brush marks, Fig. 22. Proceed through the sealing, filling and sanding process as for shellac, but cut the varnish sealer coat only

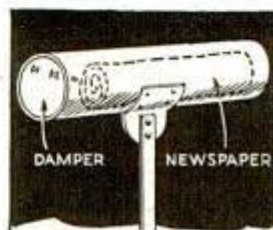


When filling wood, watch for dull spots to appear and work the filler into the wood pores with a pad of clean burlap

one half with turpentine. After sanding, apply enough coats of high-grade floor varnish to produce a high gloss. Sand between coats with No. 7/0 garnet paper, well worn but clean. Inspect the paper frequently for "glazing," particularly when sanding after filling, for glazed paper will surely scratch. After three or four days drying, cut down the high gloss with No. 00 steel wool, and apply dry-dull varnish. One coat is usually sufficient, but give two if necessary.

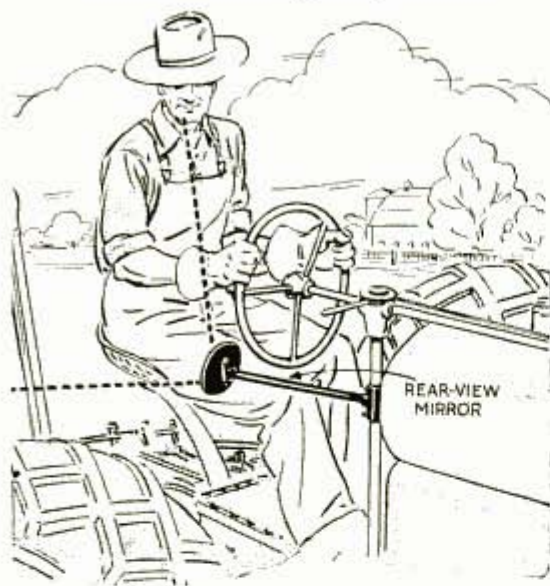
Door for Open-End Mailbox Protects Newspapers

Home owners who live on rural-delivery mail routes and have open-end mail boxes can protect their newspapers against rain by providing a swinging door or damper in the end. This consists of a sheet-metal disk pivoted near the top by running a pin through it in a manner similar to the way that a stovepipe damper is installed. It is not necessary for the mail carrier to open the door; he just pushes the rolled paper against it.



—W. J. Stark, Eureka, Calif.

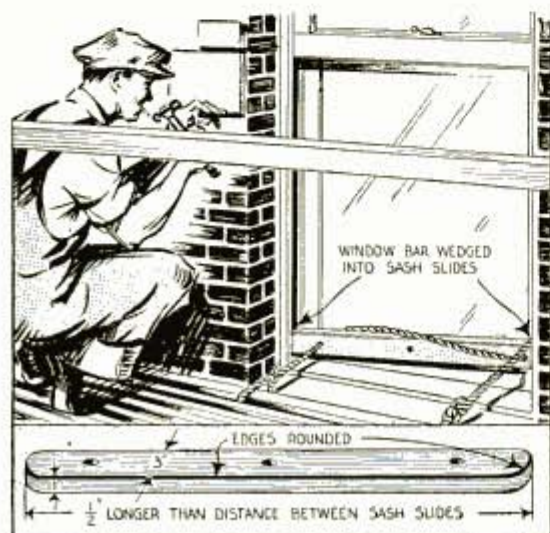
Rear-View Mirror on Tractor To See Trailing Implement



Attached to a tractor as indicated, a truck-type rear-view mirror enables you to see the trailing implement without keeping your head in an uncomfortable position. The mirror is especially helpful when plowing trashy ground or when pulling a corn-husking machine, two jobs where you must watch the trailing implement.

Hanging Scaffold "Tied In" With This Window Bar

Due to a wide projecting cornice, it is often necessary to "tie in" a hanging scaffold to keep it close to the wall of a building, using a short rope, which is tied to the



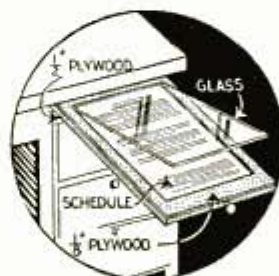
scaffold and to any convenient window hook, awning rod, etc. Often the hooks or rods are unsafe for this purpose because rust has eaten away the anchoring screws or bolts. A better way of tying in the scaffold is to use a window bar like the one shown. This is a sound piece of wood, cut so that it can be wedged between the slides in which the sash move.

Mice Kept Out of Seed Corn By Use of Small Funnel

When ears of seed corn are tied together in pairs and hung over a wire in storage, mice can be kept away from the corn by using two small funnels. One funnel is placed a few inches from each end of the wire as shown.



Schedules and Charts at Hand Under Glass on Desk Slide



Your semi-private papers, such as charts and route maps can be consulted instantly if they are kept on one of the slides of your desk. They can be thumb-tacked to the slide,

but a better way is to replace the slide with one made of plywood, as shown. A piece of glass will keep the papers in place.

Can on Stake Prevents Splitting While Driving Into Ground

Having a number of wood stakes used in anchoring portable equipment, a farmer prevented the upper ends from being split by a maul when driving them, by slipping



tin cans over the stakes. Both ends were removed from the cans, which then served merely as reinforcing bands.

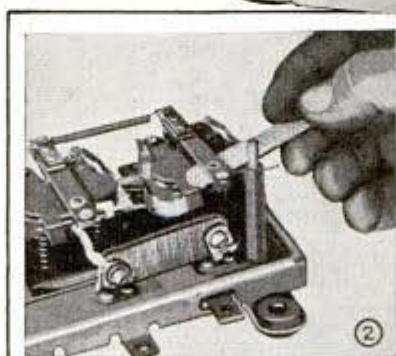
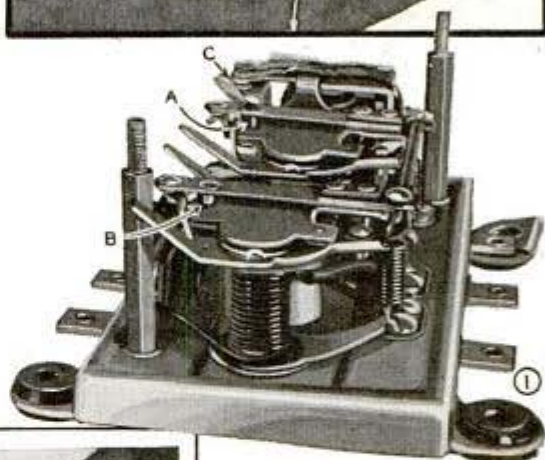
Adjusting Generator Regulators

By C. E. Packer

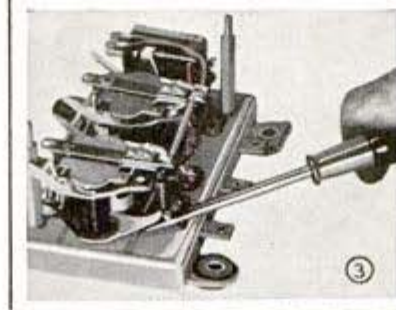
WHEN generator regulators cause trouble first make sure that the contacts are perfectly clean and are properly adjusted. Fig. 1 shows a regulator with the cover removed. Generally, there are three sets of movable contacts. The one designated C is the cutout. The cutout contacts are easy to identify as they are always separated when the generator is not charging, while the other regulator contacts are always closed. To determine which one of the other contacts, A and B, is on the voltage part of the regulator and which is on the current part do this: Run the motor at what would be a road speed of about 12 m.p.h. and disconnect the wire from the regulator terminal marked "BAT." The two that open are the ones that regulate voltage. The other two control current.

When a generator is not charging, or a flickering ammeter needle indicates an intermittent charge, test to determine whether the trouble is in the generator or in the regulator. To do this, speed up the motor and then be sure the voltage contacts are closed. If the generator charges correctly, the trouble is in the regulator. If not, the trouble is in the generator or wiring. To clean and adjust regulator contacts, first smooth them with a contact file, Fig. 2. Never use emery cloth or sandpaper. The spacing when the contacts are fully separated should be approximately .020 in. In operation, all contacts remain closed until the voltage or current becomes excessive. Output is reduced by prying up on one end of the spring anchorage, Fig. 3. Forcing this part down toward the base increases output.

Final adjustment is made with the motor run-



Thin, flat file used to clean contact points as shown above. Prying up the end of the spring anchorage as indicated below, reduces output



ning at about a 20 m.p.h. speed and with all the lights on. Now the spring tension of the voltage portion of the regulator should be adjusted until the ammeter hand stands just to the "charge" side of zero. The current portion of the regulator is next. This part protects the generator against overloads. Holding the voltage points together so they can't separate, speed up the motor. If the hand of the ammeter goes all the way to the "charge" side, reduce the spring tension on the current contacts so that the generator output will be reduced just enough to keep the ammeter hand on the scale.

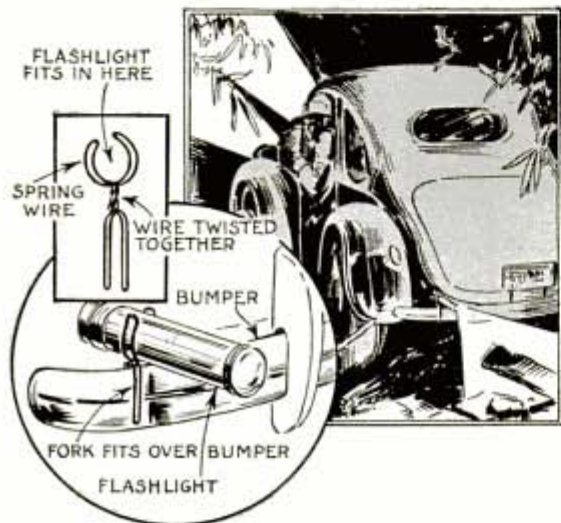
Short Lengths of Copper Tubing Straightened by "Rolling Board"



To straighten short lengths of copper tubing, one garage mechanic uses a rolling board. This consists of a wooden trowel with the underside covered with rubber from an inner tube. In use, the tubing is first straightened as much as possible with the hands, after which it is placed on top of the bench and rolled over and over with the board to complete the straightening job.

Flashlight Aids in Backing Car Out of Dark Places

One motorist who often has to back his car in the dark on fishing trips, uses a simple wire bracket to hold a flashlight on the



rear bumper. It takes only a few seconds to slip the bracket on the bumper, and he likes this arrangement better than a regular lamp mounted at the rear of the car.

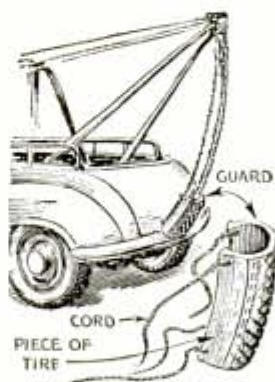
Acid Removes Metal Strip From Window Glass

A good method of removing the metal strip from the lower edge of a broken window glass is to use sulphuric acid. Place the glass on a flat surface and tip it slightly, having the metal strip at the low side. Then pour the acid on the felt strip that is packed between the glass and metal. After an hour or so, the metal can be pulled off easily.



—Lloyd G. Yates, Hubbell, Mich.

Chain of Wrecking Car Covered To Protect Car Behind



If the hoist chain on your wrecking car hangs over the rear end of the car, here is a way to shield the car of a motorist behind you if he should not stop soon enough. Just cut out a section of old tire and fit

it with four heavy cords so that it can be tied around the chain while traveling.

Leakage in Under-Hood Battery Tested by Using Mirror

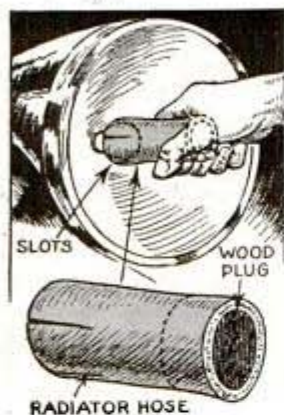
Considerable damage may result to metal parts and insulation when gas from a heavily-charged battery of the under-hood type leaks out into the interior from defective vent-duct



walls or their connections to the vent holes. Leakage at either of these points can be determined by holding a newly-polished mirror over the ducts while the battery is being charged. If fumes are escaping, they will cloud the mirror surface.

—W. C. Wilhite, Carlinville, Ill.

Tool Made From Radiator Hose Removes Headlight Bulbs



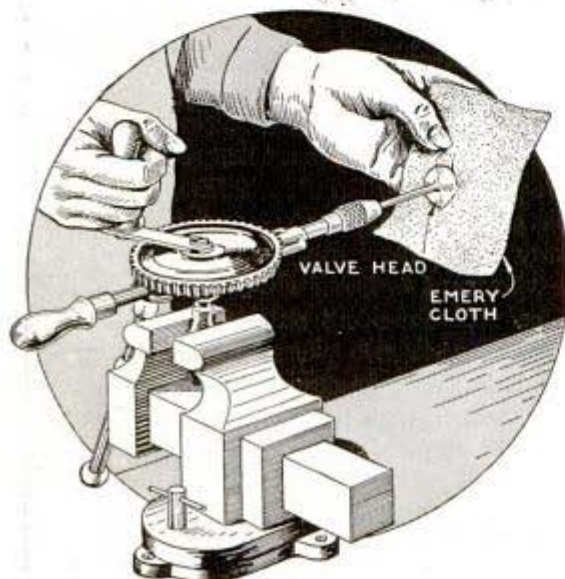
Affording an excellent grip with a minimum amount of pressure, this simple tool for removing auto headlight bulbs is made from a 4-in. piece of ordinary radiator hose. One end is slotted to provide more contacting surface on the bulb while the

other end is plugged to prevent the hose being crushed when pressure is applied.

Breast Drill and Emery Cloth Clean Carbon From Valves

The next time you have a valve job try cleaning the valves of carbon by using emery cloth and a breast drill. After removing a valve, chuck it in the drill and then rotate it against a piece of cloth as shown.

—Ivan J. Stretten, Detroit, Mich.



Skid Chains Put on Wheels Easily With Aid of Cleated Block



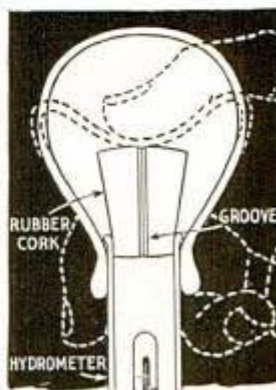
Difficulty of putting on skid chains without jacking up the wheels can be avoided by using a block fitted with cleats as shown. The chain is stretched over the block with the cross links between the cleats. Then the car is backed onto the block and the chain fastened around the wheel. The cleats allow free movement of the cross links under the tire so that the chain can be pulled up by hand and fastened tightly around the wheel.

—Frank Petruzzi, Hazleton, Pa.

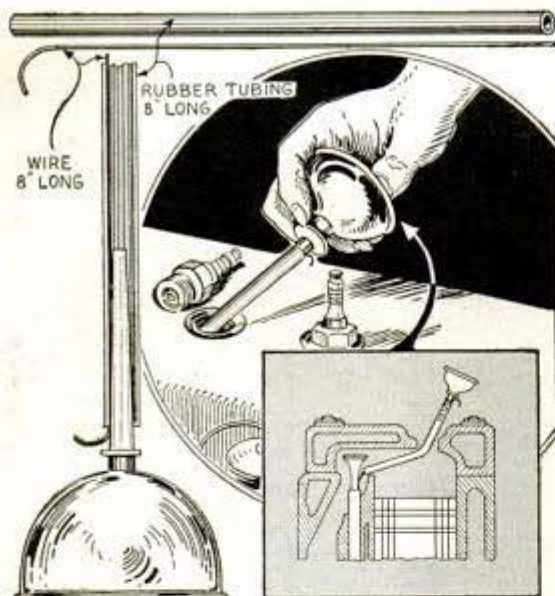
Flow of Liquid Into Hydrometer Controlled by Slotted Cork

In my work I have frequent use for a hydrometer, and usually desire just a certain amount of liquid to flow into the barrel for testing purposes. To control the flow, I found that a slotted cork inserted into the end of the barrel inside the rubber bulb did the trick. The size of slot will depend on the amount of liquid desired in the hydrometer, and will have to be determined by experiment.

—David T. Webb, San Pedro, Calif.



Rubber Tube Extension on Oilcan Lubricates Sticky Valves



It is a simple matter to put penetrating oil on a sticky valve of a motor if you use a length of rubber tubing on the end of an oilcan spout. First insert a length of wire inside of the tube, then slip the latter over the spout. The wire tends to stiffen the tube and helps to make it keep the contour to which it is bent. In use, remove the

spark plug from the cylinder that has the sticky valve and insert the oilcan, directing the tube toward the valve, which should be in an open position as indicated by the lower detail. This is much better than merely removing the spark plug and squirting oil in the general direction of the valve.—W. C. Acker, San Francisco, Calif.

Strap-On Skid Chains Attached Easily With Aid of Wire

Attaching strap-on skid chains to a disk wheel is not a difficult job if you use a piece of wire to pull the chain through the wheel slots. A length of hard-drawn copper wire is best for this purpose. Give it a curved shape at one end so that it can be pushed through the wheel slot and the end will appear above the tire. Form a small hook on the end to engage in a hole punched in the end of the chain strap.—A. T. Lawton, Ottawa, Can.



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Practical Finishing Methods

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Drugs and Perfumes by the Acre

(Continued from page 89)

Medicine, cosmetics, and kindred industries demand large quantities of natural oils, alkaloids and preparations in spite of the substitutes provided by chemistry. Digitalis, the common foxglove, is an important heart stimulant. Belladonna, often called deadly nightshade, is used by eye specialists to dilate the pupils of the eyes. Stramonium, derived from Jimson weed, combats asthma. Orrisroot is used as a scent and flavor.

Pyrethrum, which looks like a daisy and is a member of the chrysanthemum family, is an important insecticide because it is toxic to all cold-blooded life. As much as 14,000,000 pounds of dried pyrethrum flowers have been imported annually with a varying market price of from 11 to 30 cents a pound. Scores of herbs are in demand.

Boneset, blue flag, burdock, cascara bark, dandelion, ginseng, goldenseal and seneca root are among our native botanical drug herbs. These and others are often gathered wild, although incomes are unusually low for the time involved. In the Blue Ridge Mountain section of North Carolina, white pine bark, wild cherry bark, sassafras bark and mandrake root are collected.

Such herbs as aconite, arnica and seneca grow best in the northern part of the country. Belladonna and digitalis, among others, grow best in warmer climates. Ginseng and goldenseal, being forest plants, must be cultivated under shade.

Early this year dried belladonna leaves were selling for \$1.80 a pound as against 38 cents a pound two years ago; dandelion roots were 80 cents a pound, dried, as against a former price of 14 cents; and orris root was 80 cents a pound instead of 11 cents. These wholesale prices are above the prices paid to growers, but they indicate the market.

Goldenseal is being cultivated in Washington, ephedra has been grown experimentally by the South Dakota state college and pyrethrum flowers are being raised commercially in southern California. Nuxvomica, from which strychnine is made, asafetida, which is used in sauces, psyllium seed, henbane and other lesser known drug crops appear to have promise when they are introduced into this country.

Lack of foreign supplies has likewise

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boosted the prices of culinary herbs. Tarragon, shallots, sweet fennel and sweet marjoram are used in sauces and dressings. Sweet basil is a good salad herb, thyme and sage are excellent in soups and rosemary and oregano are used with meats.

Most culinary herbs take up little space and are easy to raise, in fact a window box is sufficient for growing a few varieties of plants. In most cases only the leaves are used and these are picked, dried and put away. Frequently the amateur herb grower finds that his product is better than commercial preparations that may be adulterated with ground-up stalks and other non-essential matter. In some locations it may be possible to raise herbs to sell to restaurants and grocers.

Essential oils ranging from castor oil to oil of lavender flowers and oil of geranium form another sort of crop that appears promising. In some cases the return per acre is greater when an herb or shrub is raised for its oil, although a steam boiler, retort, and condenser for distilling the oils are required. Extensive experiments have been conducted by the Department of Agriculture in raising rose geraniums for their oil and although at present prices as much as \$100 an acre net may be earned from such a crop, prices are subject to fluctuation. Spearmint, wintergreen, wormwood, and peppermint are other "oil" crops tried in the United States.

One grower who raises gardenias for the cut flower market successfully manufactures gardenia oil as a by-product in the off-season. Forty thousand flowers must be handled to create a pound of essence, which suggests that the venture would not be profitable by itself.

In California machines that harvest flower blooms rapidly and economically are being tried out, since if harvesting costs can be reduced the United States would no longer need to depend on France for expensive natural perfumes. A new perfume extraction process in which petroleum ether is used to distill off the essence from flowers is being perfected. This promises to replace costlier methods.

Names and addresses listed in the index, page 4-A, show where to buy manufactured products described in this magazine. Say you saw it in Popular Mechanics.

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Sani-Flush
CLEANS OUT RADIATORS

Building Tomorrow's Navy

(Continued from page 37)

German dive bombers off Sicily and Crete, the British situation in the Mediterranean would be far more favorable. Furthermore, these multiple guns are the best weapon against torpedo boats. Our Navy has secured an appropriation to arm all our ships with plenty of multiple mounts for protection against torpedo planes, dive bombers and speedy surface craft.

Although not new, the aircraft carrier is having its first effective use. The chief consequence of its use by the British is the relative scarcity of such commerce raiders as the Emden and Karlsruhe of world-war fame. This is all the more remarkable since the Nazis, controlling the coastline from Norway to Spain, can send out raiders whenever they choose. Their difficulty is no longer in reaching the open sea—it is staying there; and what makes it dangerous to stay there is the aircraft carrier. Its planes search enormous areas in a day and concentrate an overwhelming force of planes on any enemy ship sighted, as the Bismarck discovered fatally. Consequently the Germans, aside from occasional forays in thick weather, use surface raiders only in remote areas where they have merely nuisance value.

The aircraft carrier, however, has its own defense problem. Offering a big target from the air and easily vulnerable to submarines, since it must steam in a straight line while planes land and take off, it needs an antiaircraft cruiser to ward off bombers and a screen of antisubmarine vessels.

To protect convoys, Britain is building two types of craft, the escort vessel and the corvette. Both are practically unarmored and too slow for service with the fleet. Nevertheless, they have practically the same depth-charge equipment and listening gear as a destroyer; so are highly effective against submarines. A typical escort vessel is 250 feet long, displaces 1,200 tons, can make 19 knots, mounts eight 4-inch antiaircraft guns and a pom-pom. A typical corvette is 190 feet long, displaces about 500 tons, makes 17 knots and mounts only a single 4-inch gun and a pom-pom.

The larger vessel has the advantage of a powerful antiaircraft battery and higher speed. The smaller vessel can be built



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more quickly and cheaply, costs less for upkeep, presents a smaller, more maneuverable target and requires a crew of only 50 men compared with 120 for an escort vessel and 150 for a destroyer.

Another sensational innovation is the greatly improved motor torpedo boat. In the war of 1914-18 it was a fair-weather craft, and threw a bow wave so conspicuous as to render a surprise attack next to impossible. Today's British speedboats are so light and highly powered that they skim over the water. Their two main engines are supplemented by a third small motor. This center engine can drive the boat at about nine knots, at which the bow wave is negligible and propeller noise so slight it cannot be picked up by enemy hydrophones. Thus the boat can creep up on one engine at night, fire its torpedoes and escape at full speed with main engines on.

America is not slow to learn. Already, the Navy is massing a fleet of motor torpedo boats. Typical is the PT-10, powered with three 1,350-horsepower engines, capable of 52 knots or 60 miles an hour in smooth water and 40 knots against 15-foot waves. Specialized antisubmarine patrol craft are also being built, and it is understood the Navy budget plans 400 new escort and patrol vessels, sub chasers and mine sweepers. No battle fleet in dangerous waters is faster than its mine sweepers.

Sending an American fleet into action requires much preparatory organization. It presupposes the readiness of a host of auxiliary vessels, tankers or handy bases for refueling, tugs and repair ships, hospital ships, seaplane tenders and many other specialized vessels. A surprise incursion into enemy waters may depend on taking advantage of fog or rain predicted by the Navy's long-range forecasters. Or the balance between victory and defeat may be weighed by ability of the naval air force to drive enemy planes out of the sky.

American shipyards are turning out warcraft even faster than Navy schedules contemplated. The ships will be the best that American brains and skill can produce—and that best has always been good.

The opinions or assertions contained in this article are the private ones of the writer and not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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Beating Trouble to the Punch

(Continued from page 95)

tical flood conditions, the engineers put their new equipment to the test. In a down-pour, crews of workmen on opposite sides of the same raging Santa Clara went to work. Flares signaled men across the river to stand by.

A cannon flung a line out across the river. There was an anxious minute, then the red glare of a signal fusee showed in the distance. The cross river crew, 500 feet away, had the line. In a few moments communication was set up.

Meanwhile gasoline generators on tractor treads were unloaded and soon floodlights were glaring. Portable "A" frames made of sections of six-inch steel pipe were unslung. Small tractors scooped out shelves to hold the frames, crews dug swiftly to install deadmen anchors and in 15 minutes the frames were in place.

While this was being done, men were welding six-inch pipe sections into 36-foot lengths. As soon as the cable could be tied to "A" frames, men were sent over the torrent in bosun's chairs. At regular intervals they placed suspender rings to support new pipe, high above reach of water.

Now began the task of laying that pipe—500 feet of it—over the river. In darkness the men worked, carrying 36-foot sections across on their high lines, and hanging them from suspender rings. Welders quickly followed to close the joints. By dawn the task was completed, gas was rushing through the emergency pipe.

At the spot where disaster nearly occurred gas officials have built two huge towers which carry new pipe on suspension lines above the river.

The story of telephone trouble shooting must be written around Sir Charles Wheatstone, English physicist, who developed an electrical circuit nearly 100 years ago that continues to play an important part in wire communication. The Wheatstone Bridge provides a means of telling almost exactly where wires are crossed, grounded or broken; where moisture has penetrated cable sheaths, and even where to find birds' nests and kites.

Without the Bridge, men would have to patrol the miles of line until the point of trouble was located. In winter, particularly

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in isolated and mountainous regions, this might mean days of difficult travel.

Trouble shooting aerial cable is accomplished in numerous ways. Simplest of these is visual inspection, in which a man "rides the cables" and checks possible holes by holding a mirror underneath. The "enemy" of all linemen, of course, is moisture. Telephone repairmen find that semi-arid climates, in which long dry seasons are followed by flood conditions, present a peculiar problem. Tiny beetles which bore their holes through the lead sheaths and lay eggs are the culprits. When these hatch the main office inevitably records a decrease in efficiency.

One unique cable protection is the gas pressure method. Nitrogen is pumped into the cable, filling the minute spaces between the wires. When the pressure is lowered due to leakage an electric alarm is set off and the leak is immediately traced.

In underground cable the "enemy" is electrolysis—the chemical decomposition of the lead cable sheath. One important cause is the unavoidable leakage of current from rails of electric railway systems.

In the last few months the Bell system has started laying a 1,600-mile underground cable from Sacramento to Omaha—to cost nearly \$20,000,000. This cable will be the fifth transcontinental telephone line, and the first underground. It will increase the number of available circuits 50 percent and ultimately almost triple efficiency.

Two tractors are working west from Denver, cutting 30-inch furrows, into which a new-type cable with resistant steel armor is laid. When service begins a person will speak over one line and hear over the other, naturally unaware of it.

The theory is that specially treated steel insulated cable, planted underground, will dispense with the trouble shooting now so imperative in pole-strung cable.

The task is a huge one, especially in planting the cable over mountains and rivers. Experience has taught engineers that in flood conditions, the approaches to bridges are most likely to wash away. The possibility of the line going out is removed by fastening the line to piles, planted deep at these points.

This mammoth project represents the trend in trouble shooting—eliminating the cause before the trouble occurs.



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Dinosaur Detectives

(Continued from page 69)

The actual footprints of two varieties of dinosaurs, the sauropod or vegetarian species, and the carnivorous, three-toed, bird-footed type were chiseled out of a river bed where they had been preserved in limestone for an estimated 120,000,000 years. Their mutual relations were approximately the same as those of the oxen and the tiger, or the sheep and the wolf.

In scores of footprints, moving parallel along the river bed, the smaller, more vicious dinosaur can be pictured licking his reptilian chops over the breakfast that the overstuffed sauropod will make.

And this is despite the fact that his prints are not nearly as large as those of the sauropod whose incredible feet left indentations 54 inches long, comparing very well with the inside of an average bathtub.

While the museum scientists would not hazard a guess that the flesh-eater had slain the vegetable-eating reptile they did make several deductions of importance. His body was so huge that he could move with utmost difficulty on land and had become a dweller of brackish marshes and shallow beaches where the water supported his huge bulk.

They also determined that the vicinity, although 500 miles from the waters of the Gulf of Mexico, had once been covered with a shallow water area frequently invaded by the nearby ocean, which accounted for the survival of the sauropod millions of years after it had vanished from its scattered haunts in the more northerly sections of the continent. This was established by the fact that shell-bearing strata were found both above and below the level at which the footprints were indented. And palm leaves indicated a tropical climate.

After building a cofferdam to shut off the flow of water, the dinosaur detectives chiseled out a section of limestone 29 feet long and 7 feet wide which included three full sets of footprints of the serpentine giant. After water had been cleared from the slab, the mechanics of its handling were simple. The footprints were, in many cases, visible even before the filling layer of clay had been removed from the indentations in the stone. It was only necessary to dig this

(Continued to page 170)

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(Continued from page 168)

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clay out, brush the tracks clean, separate the slab from surrounding stone, undermine and allow it to break into pieces, which were shipped to the museum.

After they have been covered with a layer of glass to represent water, they will be placed under the skeleton of the giant 66-foot dinosaur now in the museum, clearing another jig-saw section to the puzzle of life in the past.

Other exploits of Dr. Brown and his associates are just as spectacular as those of the recent Texas expedition on which they removed 44,000 pounds of important specimens. On one occasion they took from Beauvais Creek, near Billings, Mont., some 20,000 pieces of bone ranging in size from pebbles to cocoanuts and when they had completed its assembly, found themselves with the skeleton of a dreadnaught, or armor-plated dinosaur 18 feet long and five feet wide which inhabited Montana, Wyoming and Alberta 120,000,000 years ago. This reptile had three rings of fused plates around its neck, terminating in sharp spines. Its entire body was covered with plates ranging up to two inches thick.

On another expedition, dentists' drills were necessary to clear the birdlike lightweight bones of a miniature dinosaur, not more than 30 inches long, which walked on its hind legs. The stone encasing the specimen was as hard as the bones were fragile.

Dr. Brown uses planes equipped with aerial cameras and motion picture machines to supplement his own trained eyes. He flies over likely fossil beds in the western states where the arid climate has aided preservation and locates the geological formations which are most promising and then sends scouts to examine these places.



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Sign Language for Motorists

(Continued from page 85)

Most important of the regulatory group is the STOP sign. It is the only sign with a distinctive octagon shape. In most states the lettering is black, on a yellow background. California uses a red background, with red reflector elements outlining the letters and red lighting, fixed or flashing, after dark. "Keep to Right," "No Left Turn," "Middle Lane for Passing Only" are other examples of the regulatory group.

Among the warning and caution type, characterized by diamond shape and black letters on yellow, the most significant is the SLOW notice. It is used only where a permanent hazard exists and calls for instant reduction of speed. Curve symbols belong to this group. They are placed only where the speed of approach cannot safely be maintained on the curve itself, either because of high degree curvature, obstructed visibility, narrowing of pavement or lack of super-elevation.

Caution signs call for alertness but not necessarily a reduction of speed. Among these are such signs as Slide Area, Side Road, Drifting Sand, Slippery When Wet, Hospital Zone, Draw Bridge.

Most portable signs, of which "Men at Work" is a familiar example, fall under the caution group. Red flags, indicating that extreme care should be exercised, are used with most portable signs.

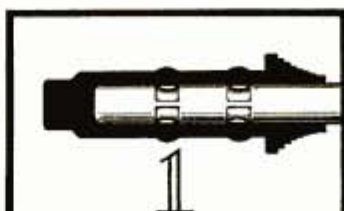
The guide group includes route markers, destination, location, mileage and general information signs. Their functions are obvious.

Because of increasing speeds and ease of driving, most important signs are reflectorized for night travel. This means that words and symbols are studded with colored glass buttons to make them self-illuminated by light refraction from headlamps.

Sign language for motorists fast is becoming an international Esperanto. The first step toward standardization was taken in 1927 by the American Association of State Highway Officials with publication of its Manual on Uniform Traffic Devices for Streets and Highways. By the time the great international highway from Alaska to Patagonia is complete some years hence, it is probable that motorists will be able to travel its entire 9,000 miles guided by a uniform highway sign system.

Stanley Screw Driver

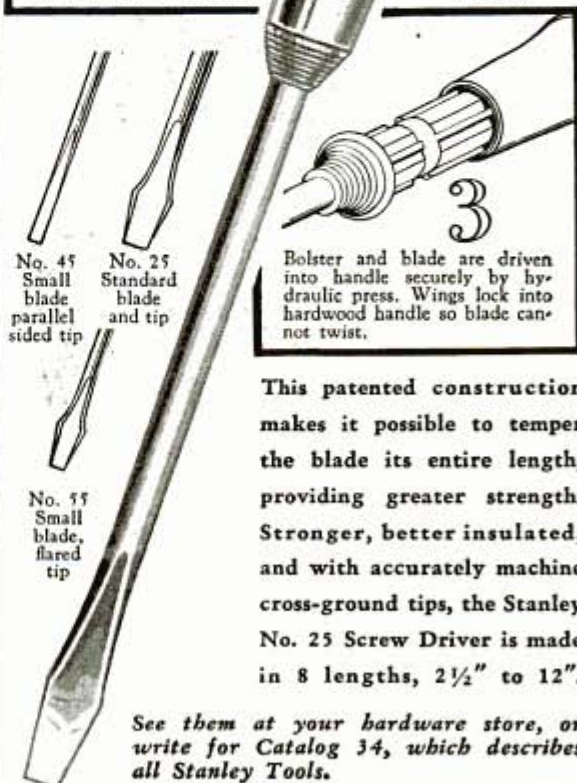
No. 25



1
Blade tempered entire length. Recesses forged into butt end which is driven into steel bolster . . .



2
Bosses are swaged into blade recesses. Four sharp wings are swaged on outside of bolster. Blade is now locked into bolster . . .



STANLEY
Trade Mark



No. 45 Small blade parallel sided tip
No. 25 Standard blade and tip
No. 55 Small blade flared tip

3
Bolster and blade are driven into handle securely by hydraulic press. Wings lock into hardwood handle so blade cannot twist.

This patented construction makes it possible to temper the blade its entire length, providing greater strength. Stronger, better insulated, and with accurately machine cross-ground tips, the Stanley No. 25 Screw Driver is made in 8 lengths, 2 1/2" to 12".

See them at your hardware store, or write for Catalog 34, which describes all Stanley Tools.

STANLEY TOOLS

Division of The Stanley Works, 105 Elm St., New Britain, Conn.

THE TOOL BOX OF THE WORLD

2720

Uncle Sam's Iron Fighters

(Continued from page 5)

Brig. General G. M. Barnes of the Army Ordnance Department says that tanks being built for the U. S. Army are superior to any in the world and he credits the American steel industry with developing the toughest armor at the minimum weight. In addition, he points out that American tanks have a higher horsepower-to-weight ratio than those of any other nation—a feature of significance to engineers. It means simply that the American tank is faster and more maneuverable than other tanks because its engine has a lighter load.

Among the problems encountered in tank design are those of compromises between desirable characteristics—armor with mobility, weight with speed, compactness with necessary facilities for crew and armament, steering with power tracks and others. But America's engineers have overcome these problems and the armored divisions are on the move.

More Light for Your Money

(Continued from page 75)

on the wall. Literally the engineer "steps inside" the lamp to do his work, so much does the filament image dwarf him.

Light intensity is measured with amazing accuracy by another device that resembles an overgrown baseball. It is a spherical photometer, which collects all the light from a lamp placed inside it and delivers a definite part of it through a small circular window to an electric eye. This causes a lumen meter in front of the operator to indicate the intensity and this reading is tabulated. The same photometer is employed during the testing of fluorescent lamp output.

At a control panel you may see an operator measuring fluorescent lamps for color. Sensitive photocells, when used in conjunction with proper color filters, faultlessly respond to the various fluorescent colors. By reading the proper meters, the operator determines at a glance the exact color matching for replacement lamps.

Distribution measurements of incandescent light sources can be obtained easily with the aid of another odd-looking apparatus. Light from any angle is reflected to an indicating photocell by means of a ro-

Atlas

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2190

tating mirror. A somewhat similar device employing a mirror is designed to measure the distribution of street lighting units. A mirror reflects light from the unit back to a photocell at the other end of the room where a reading is taken. Movement of the mirror gives light readings in the vertical plane, while rotation of the lamp unit itself affords readings in the horizontal plane. A circular shield in front of the unit prevents direct light from reaching the photocell.

Then there is the icosahedron, or 20-sided polyhedron, in which lamps larger than 2,000 watts are tested for efficiency and output. This device, large enough for the research engineer to enter and check up on certain features of a lamp under test, aids in measuring lighting units of the size of street lamps.

With an instrument known as the reflectometer, engineers study the transmission of light through the reflection of light from various media. By determining the transmission factors of various substances, they learn to design fixtures which diffuse as much light as possible, so as to reduce surface brightness, yet at the same time, transmit as high a percentage of light as possible. The eyepiece of the reflectometer resembles the familiar stereopticon.

In one lamp laboratory is a 100-foot projection range equipped with apparatus for measuring the candlepower of automotive headlights, locomotive and battleship searchlights, giant airport projectors and floodlights.

From these and many other tests comes the information which makes it possible for the customer to get more light for his money.

Rubber Band Sheathes Fishhook And Keeps Line Tight on Pole

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10c

New Wonders of Glass

(Continued from page 59)

ported by the shelves. For the home with bay windows, glass shelves on which small colorful house plants may be arranged are available for hanging in the windows.

The home owner's imagination can almost run riot in the use of glass in the kitchen, breakfast nook and bathroom. A brilliant panel of glazed glass may be used to screen the kitchen from the breakfast nook, and at the same time to admit light to what otherwise might be a dark spot in the kitchen. Walls of the kitchen and the bathroom may be covered with one kind of glass, resulting in a surface that is easy to clean, and that is impervious to odors and to steam and moisture condensation. This glass comes in a wide range of colors.

And here's a tip to mothers of children who are careless about their clothing; install a full-length door mirror in the boy's or girl's bedroom and watch how quickly he or she becomes conscious of appearance after getting a few head-to-foot reflections.

The new glass having ten times the strength of ordinary automobile safety glass was announced recently by the Pittsburgh Plate Glass Company. It is intended for use in sub-stratosphere airplanes whose pressurized cabins require strong, tightly sealed windows, which, if broken, will not leave the frame or release air pressure from the cabin. Like other safety glass, this new product is a glass sandwich in which one or more thick slices of vinyl plastic serves as the "meat" but in this case the "meat" extends beyond the edges of the glass layers and serves as a flexible, rubberlike edge that can be bolted, screwed or nailed into window openings.

It was at the Ford Motor Company's plant that the world's record for a continuous run of glass was made. Under the Ford operation, ingredients are fed into a big melting furnace on an around-the-clock basis and molten glass pours from the "tank" without interruption. Two large rollers receive the liquid glass, compress it to desired thickness and feed it through a 400-foot annealing oven in a continuous ribbon.

(See index, page 4-A, to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.



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FREE SAMPLE and BOOKLET EXPLAINS ALL

Conquering the Highest Peaks

(Continued from Colorado Section)

ple of other "rock hounds" and we went down to try our skill.

On the north side of Chimney Rock is the crack or chimney for which it is named, running about 100 feet high through the rock vertically and only twelve inches to three feet wide. Up this chimney we made our way, bracing with our feet and hands from wall to wall. It took more than four hours to climb that 100 feet, and a few days afterward my fingertips all peeled off worn down by the abrasion in clinging to the walls. I don't like to wear gloves on a difficult rock climb. At the top we fixed a rope so that the Forest Service men could ascend and attach a permanent cable for future use of the fire lookout. Coming down the chimney again, we tied a 100-foot and 120-foot rope together to make a long enough double rope to rappel down the 100-foot crack. One picture made during the descent is shown in natural color.

In the United States there are sixty-four peaks above 14,000 feet in altitude, and only two persons at present have climbed them all. Several other climbers have ascended at least sixty. Fifty of the peaks are in Colorado, thirteen in California, and one in Washington. As is to be expected with mountains scattered over so wide a territory, there is considerable diversity in the character of the peaks, and hence also in the type of climbing to be found on them. Some are of lava formation, others are sandstone, but the majority are of granite or granitic rocks. Some are very easy of ascent and to climb them is nothing more than an extended stroll; in fact the summits of several can be reached on horseback, while two in Colorado have automobile roads to the tops. Others, however, are real climbs on which ropes and other aids are a necessary safeguard, and one, Mt. Rainier in Washington, is a real snow and ice climb.

Anyone undertaking to climb them all will therefore find extensive use of all his knowledge and ability as a mountaineer. Recently I had the privilege of flying over all fifty of the highest peaks in Colorado in one day, making a Kodachrome record of the flight, which was a most enjoyable experience and a decided contrast to reaching their summits on foot.

L426

Putting the Movies to Work

(Continued from page 43)

years and an "advertiser" may spend \$25,000 or \$50,000 on a single production. Many of the pictures are made on full size 35-millimeter film, some in color, many with sound accompaniment, and some with a three-dimensional effect. Costs are high because the producers are competing with high quality studio entertainment. An industrial picture must hold the interest of its audiences. Trained men who can obtain all the effects of a Hollywood production are employed and they use stop motion, animation, background projection, and every other trick.

Such pictures are sometimes exhibited in theaters but most often in schools, at club meetings, and other gatherings. A dozen studios you never read about on the motion picture page are specializing in industrial movies.

When one of the industrial producers was asked to create a picture that would explain the advantages of insulating an automobile against sound and heat, major studio procedure was followed all the way through. First thing done was to work up an interesting scenario. Then a budget was prepared. The editorial, set construction, wardrobe, property, casting, photographic, sound recording, animation, and cutting departments all had to be consulted. Sets were constructed, gadgets needed for special effects were built, "props" rented, locations were selected.

One of the purposes of the picture was to record and explain different sorts of sound. Some of the scenes had to be made in a "dead" room that was utterly quiet and a "noise microscope" was built up from amplifiers so that ordinarily inaudible sounds could be recorded on the sound track. The impact of a pin crashing on the floor was recorded. The whir of a butterfly's wings sounded like rushing wind in the loud speaker, rose petals crashed to the ground, paper burned with a crackling roar, and the clatter of a hurrying ant was recorded. So sensitive is the apparatus that the work had to be done on a week end when there were no vibrations in the building and the recording was done by remote control to avoid picking up the heartbeats of the recording crew. The

(Continued to page 178)

162,000 WITNESS

Smashing BURD Victory

AT INDIANAPOLIS



Mauri Rose, hero of the 29th annual 500 Mile Race.

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Co-winner Floyd Davis and the victory car.



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"Graf-Flox" rings eliminate the run-in period. Friction is cut to a fraction, fuel is saved and pep and power added.

By now the incidents in the dramatic finish of the 1941 Indianapolis race are familiar to everyone, but the above telegram from the builder of the Davis-Rose and Bergere cars reveals the remarkable feat performed by the Burd "Graf-Flox" piston rings in these two mounts. In spite of the tremendous burst of speed that Rose put on to win, he got 10 $\frac{3}{4}$ miles to the gallon of gasoline and used up less than one gallon of oil. The sister car, in the hands of Hollywood's ace stunt man, turned in almost as remarkable a record. Cliff's gas mileage of 9.61 made it possible for him to become the first driver of a gasoline powered car ever to make a non-stop run at Indianapolis. That is perfect piston ring performance under the most trying conditions of speed, compression and heat... a great tribute to Burd "Graf-Flox" Piston Rings.

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• *United Air Lines' Chief Mechanic at La Guardia Airport, Peter Berger, smoothing the leading edge of a hydromatic propeller with a Nicholson File. Pete, who has been an aircraft mechanic since 'way back in 1917, has depended on Nicholson Files for all the fine work that must be done around airplane engines and propellers.*



The Man with the File

• We as a nation are busy today. We are building as we have never built, in the hope that we can keep the sound of an enemy airplane from sending us scurrying to the cellar.

We often think of this defense effort in terms of great machines and humming motors. But machines can't do everything . . . there is a place for skilled hands all along the line. The man who can handle a file well, for instance, often takes up the job where machines leave off.

And—if he keeps himself abreast of the constant Nicholson developments in files for meeting new demands in every industry, he's that much ahead of "the other fellow" when there's a choice job open or a promotion in order. (For example, Nicholson makes aluminum files and rasps of special design for the aircraft industry.)

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"A FILE FOR EVERY PURPOSE"**

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FILES FOR EVERY
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• It pays to learn — to buy and practice with some of the new Nicholson or Black Diamond Files to be found at mill-supply and hardware stores.

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PROVIDENCE, R. I., U. S. A.**

(Also Canadian Plant, Port Hope, Ont.)

290
2426
(Continued from page 177)

narrator's speech was read from linen squares that would not rustle on the sound track.

When the last scene was shot the picture was far from finished. First it had to be re-recorded to level out the sound volume and to combine several sound tracks on the single film. Then, after editing and approval, additional laboratory work followed before the finished picture was ready for release.

One manufacturer uses motion pictures to increase sales of a new electric iron, another uses animated cartoons to explain the principles of the vacuum tube. Comedians are employed in one picture to stress the do's and don'ts of house painting. What happens in the fire box of a locomotive is graphically illustrated in one film, the value of different kinds of insurance is shown in another.

The proper way to merchandise rugs is the subject of one picture made by a manufacturer to train his salesmen. Another concern keeps its sales agents in all parts of the country interested in the happenings at the home factory by sending them films several times a year. So important are industrial motion pictures becoming that some of the major picture studios, including Paramount, are establishing special departments to produce them.

The Age of Packaged Power

(Continued from page 53)

ready under development. Compare that with the 5,400-horsepower engines of the biggest Diesel-electric freight locomotive. The figures are staggering—but compare the Flying Fortress with the kite the Wrights flew at Kitty Hawk. Project that perspective and anything seems possible.

Present performance may even recede into insignificance if the rocket-type motor just built in experimental size—internal combustion in another form—proves practical. Mixed carbon disulphide and nitrous oxide, exploded cyclically in the cylinder by spark ignition, causes a tremendous pressure and the high-velocity ejection through a stainless-steel nozzle is calculated to thrust the airplane forward. The inventor believes a booster engine of this type would increase a plane's load capacity

190

85 percent and cut its takeoff distance one-third; he predicts a propellerless, jet-reaction plane within the year.

Germany, whence came the Diesel, was first to put that oil-burning engine into battleships and the 54,000-horsepower Diesel plants of the pocket battleships Luetzow, (formerly Deutschland), Admiral Scheer and the scuttled Graf Spee were the first and probably yet the biggest of their kind. They can top twenty-six knots, and can cruise about 10,000 miles on 1,200 tons of fuel.

Modern submarines that prey on ships 600 miles out in the Atlantic owe their range to the Diesel; but the submarine itself is old stuff. 'Way back in the 1600's King James of England risked his royal head in a dip beneath the Thames in the first submersible, a hand-propelled submarine rowboat invented by a Dutchman. The first submarine to participate in war appeared in the U. S. Civil War. In 1877 a petroleum engine was given its first underwater trial, and in 1900 the U. S. Navy commissioned its first gasoline-powered submarine with a 50-horsepower engine. Its latest carry 1,600-horsepower Diesels.

Commercial motorships, too, are growing in importance. Notable among the motor vessels are the German 46,500-horsepower Oranje, Italy's 30,418-ton Augustus, the 28,000-ton Stockholm, Italian-built for the Swedish-American line, the sunken Polish liner Pilsudski of 14,294 tons. Many of America's new cargo ships are motor vessels. Diesel tugs shove barges down the Mississippi and chaperone the U. S. fleet. Mile-a-minute "mosquito" boats zip across the English channel. And down at "Little America" the ancient U.S.S. Bear with its new Diesel engines supplied the Antarctic expedition exploring the polar region by plane and Diesel-electric "snow cruiser."

Lights burning in thousands of cities and millions of homes depend on little gasoline units in the home generating one-cent-a-kilowatt-hour power, or on giant municipal Diesel plants. A few years ago the Panama Canal acquired what was then the largest Diesel power plant, of 12,374 horsepower. A plant at Shanghai today is rated at 51,000 horsepower.

Many an industry has turned to internal combustion plants for independence from

(Continued to page 180)



Why QUEST
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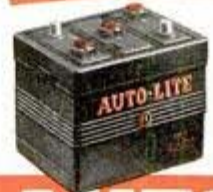


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central power stations. A Chicago laundry is operated by a multi-fuel Hesselman engine burning gas when rates are low and switching to oil when gas is seasonably high. Diesels are considered safest in mines and tunnels because of the negligible quantity of carbon monoxide in the exhaust gas. New farms are cleared by tough bull graders that jerk out boulders and stumps easier than you'd pull a tooth. Gasoline and oil engines run the farm from household generator to tractor, irrigation system and corn picker. One innovation saving the farmer a trip to the mill is a mobile grain mill of 30 to 100 horsepower that comes to the farm to grind feed. Appropriately, gas and oil engines power the oil-well drills and later pump the oil that becomes their own "life blood." So efficient is the internal combustion plant that engine makers themselves are often surprised to find oil engines powering lumber camps and sawmills whose abundance of waste wood could operate a steam plant.

Incidentally, lumbering is one of those industries revolutionized by the automotive age. Once lumbermen dependent on railways cut wide swaths through the forests adjacent to the rail lines. Today they can practice conservation and forest economy, thinning out timber over the wider areas accessible to giant, mobile Diesels.

The internal combustion engine is your slave. Charles F. Kettering, General Motors' research genius, calls it "the greatest thing civilization has had thus far."

"For the first time in the history of the world," says Mr. Kettering, "mankind has had a small mobile, inanimate power device. The greatest factor that has caused the development of all our civilizing devices has been the use of inanimate power. The internal combustion engine has absolutely changed our whole method of living. The city has developed because of its wonderful system of electrical distribution. Back of this is a great power unit. If the power unit stops, the lights go out and the motors stop. But with the internal combustion engine we carry with us the power house. We move it wherever we please."

See index, page 4-A, to find where to buy articles described in this magazine. Say you saw it in Popular Mechanics.

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\$14.50 (Right) Narrow band shaping inside scroll. (Left) Sands acute angles, complex shapes. FOB

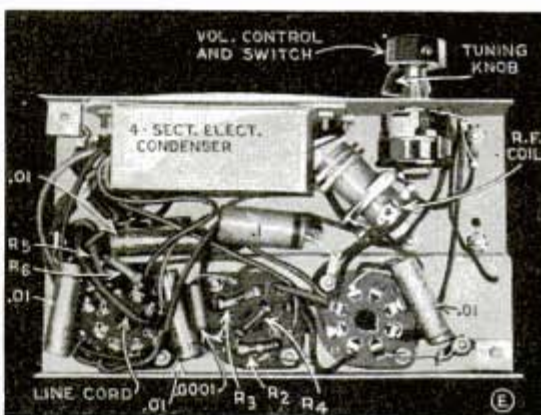
See your Dealer or write today for Free Circular illustrating the all-around utility of this remarkable new tool.

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15 S. Market St., Dept. 291, Chicago

(Continued from page 181)

used is available from Popular Mechanics radio department without charge. Use No. 18 or 20 hook-up wire with push-back insulation for all wiring and check every lead carefully before attempting to test the set.

To balance the receiver: connect a 20-ft. length of flexible "roll-up" cloth-covered antenna wire permanently to the lug indicated on the fiber terminal strip. No external ground is used on this set. With the tubes and shields in position, plug the line cord into any convenient 110-volt outlet and turn on the switch which is combined with the volume control. If your supply line is d.c. it may be necessary to reverse the plug in the wall socket. Permit the tubes to heat and then tune in a fairly weak



station. Now vary trimmer (Tr.) on top of the rear (C_1) section of the 2-gang condenser with a small screwdriver for loudest signal, and adjust the front trimmer if necessary. Another method is to turn the variable tuning condenser about $7/8$ open and adjust the two trimmers for maximum noise at that particular point.

The cabinet is a stock item with some radio supply houses, however it can be built of plywood from the overall dimensions given in photo C. Some builders may have a suitable cabinet on hand, others may prefer to install this small set in a bookcase, smoking stand or end table. The controls are simple for installations of this description. A pointer knob and midget dial plate provide the tuning control, and a single knob is used for the combination switch and volume control. Opening for the speaker grille is 4 in. in diameter. The blueprint number for this article is R-294.

223/

Polishing Off the Rough Spots

(Continued from page 79)

ers at \$880 a pound. First silicon carbide grinding wheels made were the tiny shapes now used by dentists.

Next great discovery was a method of Charles B. Jacobs for making aluminum oxide—chief abrasive constituent of natural emery and corundum—in the electric furnace. Tougher than silicon carbide, it is not so hard and sharp; the two man-made abrasives today do most of industry's grinding jobs.

High-speed rail travel owes its smoothness to the grinding of rail joints, bearings and wheels. Mass production of automobiles is made possible by the ability to grind and polish hundreds of thousands of parts to identical shape and dimension within ten-thousandths of an inch. Once you had to drive your new car at low speed for hundreds of miles until bearings and pistons were "worn in" smooth. Today you step on the accelerator from the dealer's door; surfaces are pre-smoothed. Twenty years ago the valves of airplane motors were reground every 20 flying hours; now they last ten times as long.

In woodworking industries belts coated with artificial abrasive grains reduce the sanding time and produce satin-smooth surfaces that take high finishes. Lenses are ground to microscopically accurate limits with a silicon carbide powder. Knives keen enough to split leather thinner than paper are sharpened with modern abrasives.

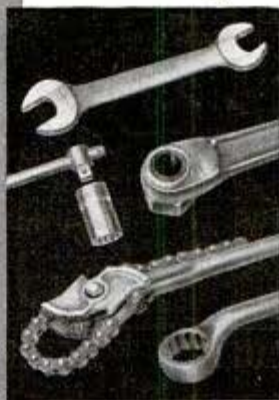
Marble columns, granite facades and terrazzo floors are shaped and surfaced with abrasive wheels, grains and blocks. On the other hand, to make floors and sidewalks slip-proof and safe, manufactured abrasive grains are incorporated in them. Even the Golden Gate Bridge required "tailoring." To make the surface so true that the load would be evenly distributed, the abutments were ground with wheels in a special machine to an accuracy within $\frac{1}{1000}$ inch per foot lengthwise and crosswise.

Add to these tasks the uses of silicon carbide and aluminum oxide as refractories in industrial furnaces, in filters and refractory laboratory ware, and it is apparent that the tiny crystals Dr. Acheson almost overlooked in his crucible fifty years ago have become one of the world's most versatile and indispensable tools.



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Siege Gun of Science

(Continued from page 11)

leased. Mesotrons would be released from each smashed nucleus, and these in turn would smash other nuclei. Each explosion would release huge quantities of power, which could be used to drive engines.

This is the most spectacular job scientists will tackle with the new cyclotron. But there will be many others, some of which will not be known until the big gun is brought into play. The 4,900-ton monster, like other cyclotrons, steps beyond a new horizon. What may be found there when the power is turned on in the fall of 1943 can only be guessed at by taking a look at what has been accomplished with cyclotrons already in operation.

The cyclotron is based on the principle of using a small amount of electric power over and over again to accelerate atomic bullets to energies beyond the range of man-made electrical devices. This acceleration takes place in two hollow half-cylinders mounted in a vacuum chamber placed between the pole tips of a strong electromagnet. Finally the bullet passes through a window, traveling at the enormous energies—in the 225-ton cyclotron—of 16 million electron volts and more. A target to be bombarded is placed over the window, and streams of atomic projectiles crash into it. About one in every million bullets strikes the nucleus of an atom.

Suppose, for example, a strip of iron is placed over the window. The bullets crash into the nuclei of the iron atoms, knocking off one or more protons or neutrons. This changes the character of the atoms. Some iron atoms are changed into atoms of cobalt and manganese. Others are changed into a new kind of iron atom, which is unstable and will sooner or later explode, emitting a radium-like ray. This unstable substance is called radioactive iron. Today all the 92 elements have been turned into one or more of these radioactive substances.

Radioactive, or "tagged" atoms, are the precious new tool for industry, biology, medicine, chemistry, and agriculture. Radioactive elements have all the same chemical properties as their relatives, the ordinary nonradioactive elements. Therefore they are used by animal bodies and by plants just as ordinary elements are, and



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go through the same chemical reactions. For instance, most radio iodine would go to the thyroid gland, a large amount of radio calcium to the bone, and so on. Taken into the body, these radioactive atoms act like beacons for the scientist. The rays emitted by them can be detected and counted by an instrument called a Geiger counter.

Suppose a biologist wants to trace sodium in the body, to know how quickly and how much of it goes to the fingertips. The subject holds a Geiger counter chamber in his hand, and places his hand in another chamber surrounded by lead. The lead keeps radiation from other parts of the body from being counted, and thus radiation in the hand only is recorded. The subject drinks a solution of radio sodium. As soon as the atoms reach the hand their explosions are recorded by the counter. The "tagged" atoms are used in such small quantities that they have no effect on the body. Thus for the first time metabolism of elements in live bodies can be traced.

An experiment that has an important bearing on every American's diet was done with vitamin B₁. Radioactive sulphur was synthesized with vitamin B₁, and its storage, utilization and excretion in the body were traced. It was shown that 10 percent of the vitamin B₁ in the human body is destroyed every 24 hours. Similar experiments on the metabolism of starch, fats, glycogen, proteins and other foods are under way.

Recently two researchers upset an old theory of the manner in which plants feed themselves from the soil. This theory held that plants can draw food from the soil only after it has been dissolved. But they showed that when a root surface came into close contact with a clay particle coated with radio sodium and potassium, these substances were absorbed directly into the root cells. Radioactive carbon has made possible more knowledge of photosynthesis, the mysterious process whereby green plants capture the energy of the sun, water and carbon dioxide, and thus produce fats and starches and other foods.

Scientists even take pictures showing the distribution of radioactive elements in living tissue. Such a picture is called an auto-

(Continued to page 186)

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radiograph. For example, the leaf and stem of a plant which has been fed radio phosphorus are placed on a photographic plate. Exploding atoms from the plant expose the plate, and the developed film shows the exact distribution.

Radioactive yttrium has already provided one outstanding aid to industry. Radio yttrium emits a ray slightly more penetrating than radium. It can easily penetrate steel up to 10 inches thick, and so can be used to detect flaws in thick steel. The object to be "radiographed" is placed between the radiant substance and a photographic plate. Rays penetrate the steel and expose the plate. Flaws are marked on the developed plate by dark areas. Heavy equipment being built in the national defense program, such as big guns, must be tested by radiography before it is put into use.

Scientists are now experimenting on the treatment of diseases of blood cells with radioactive materials. They are also experimenting on the treatment of certain types of radio-sensitive diseases with neutron rays, a treatment similar to X-rays.

K1287

Test-Flying Planes Before They Are Built

(Continued from page 31)

is broken when bent back and forth many times. Seats are loaded and unloaded with bars of lead until the springs break; oil lines are loaded and unloaded with oil until they give way; tires are bounced to simulate landings until they are worn out.

Hydraulic booster systems undergo rigid tests before they are put to work operating the controls, wing flaps, engine cowlings, bomb doors and landing gear. In the Douglas plant, ten times the expected life of the plane is the standard set for hydraulic parts.

In dynamic proof testing (drop tests), landing gear and sometimes whole planes are dropped violently to be certain they retain satisfactory taxiing characteristics.

The research group never knows from one day to the next what problem it may be called upon to do. As a purely routine matter they may run tests day after day to determine the tensile strength of steel and aluminum alloys, fabric, plastics, copper and other materials that make up the mod-

151287

ern airplane. Such miscellaneous items as bushings, tubing, springs, bearings and cables may be on the test machines.

Motors are carefully tested by engine makers. A standard "block test" is to run them for six hours, tear them down for inspection, and then run them for another five and one-half hours. This precaution is necessary to determine if all 5,500 parts of the modern high-speed engine are functioning perfectly.

When Douglas recently built the huge B-19 bomber, one of the four 2,200 horsepower Wright Duplex Cyclone engines (the largest ever built) was tested several hundred hours. This ground testing resulted in several minor changes.

Research has led to the practice of X-raying vital metal parts. Flaws which are not apparent on the surface are quickly detected in the X-ray machine. One of the largest X-ray machines in the aircraft industry was recently installed at Burbank, Calif., to serve Douglas, Lockheed, Consolidated, Vultee and North American plants. X-raying of parts has eliminated guesswork as to fitness of materials to be used. There have been no structural failures in planes that passed X-ray tests.

In addition to constant research and testing on the part of the aircraft manufacturers, each large buyer of planes maintains his own inspectors in the manufacturing plants to see that planes are built according to his standards. Government as well as air line inspectors keep an eye on commercial planes; Army and Navy inspectors observe the production of war-planes.

American aviation has passed beyond the "invention" stage and is in the "improvement" stage of development today. For example, Douglas DC-3 planes, first built in 1935, are better planes today than when they rolled out of the factory. New parts have replaced some original parts which have worn out, yet many of these planes have been running for 20,000 hours, and will see many thousands more hours of service.

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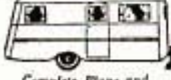
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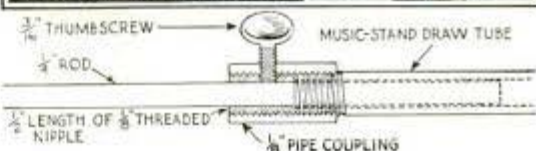
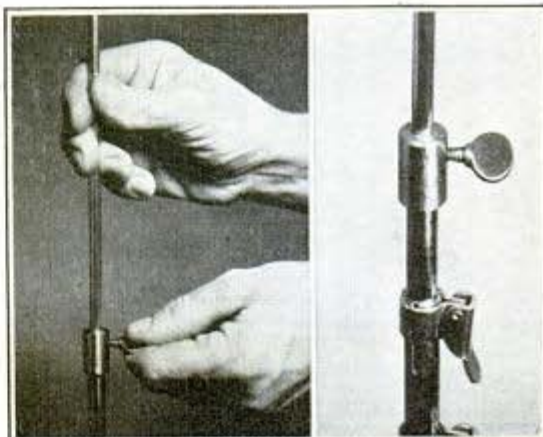
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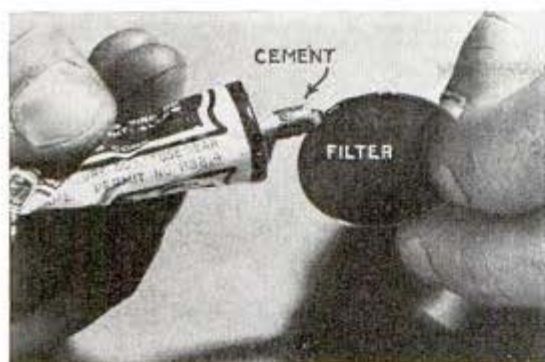


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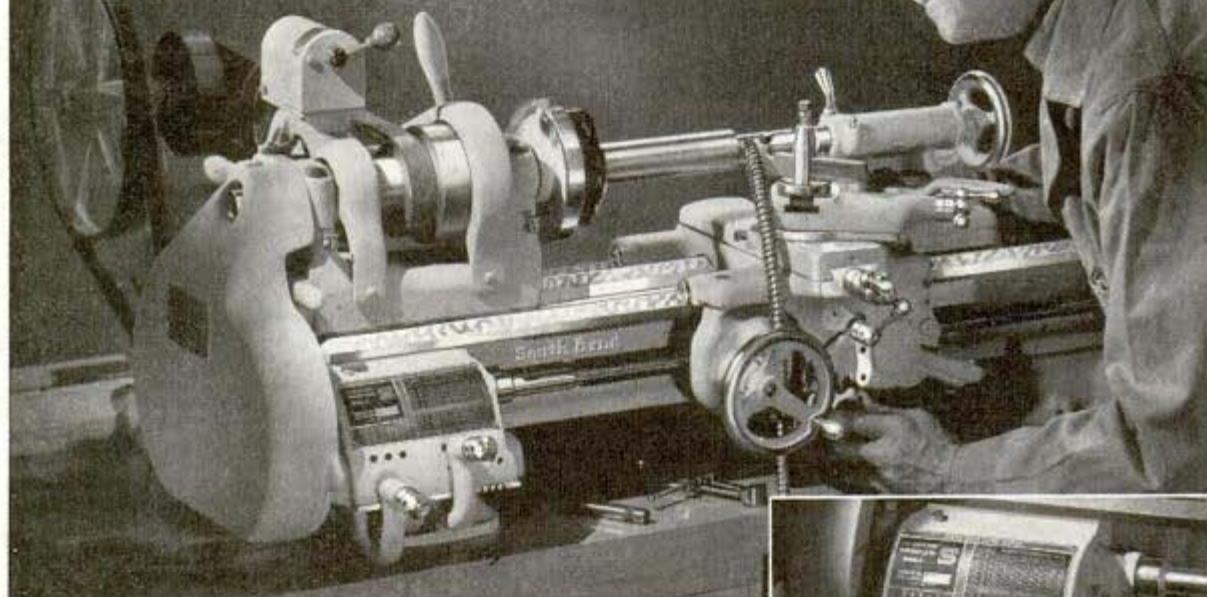
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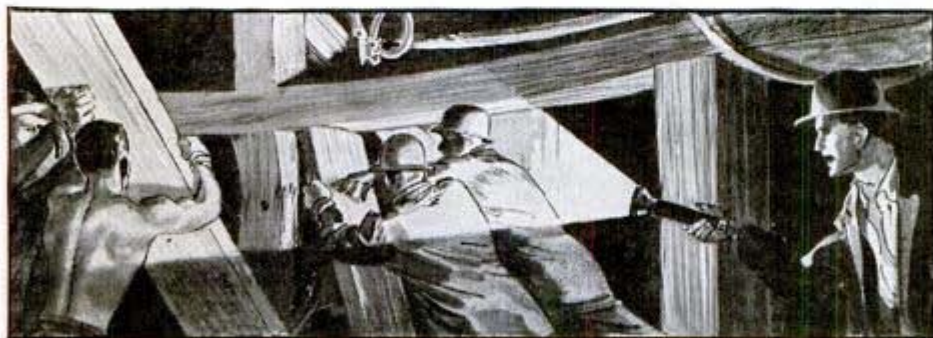
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SIX, SEVEN MILES UP! In air no man can breathe—and live! Motors—now even pilots are "super-charged." On the bicycle (above) Marshall Headle, chief test pilot of Lockheed, breathes oxygen for 30 minutes before a flight in Lockheed's new interceptor.



THEY CALL HER "LIGHTNING." Pilot Headle clambers into the cockpit, switches from a pocket oxygen flask to his cabin supply, and streaks for the stratosphere. He's test-flown 300 different planes. But when he lands, it's always . . . "Now for a Camel."



YOU CAN'T SEE HIM up there. You can scarcely hear the hum of his motors. Then his voice comes into the radio tower: "Headle—35,000 feet—diving now." Seconds later—yes, seconds—he's landing. And here he is (above) cool, calm, lighting up a Camel.



THE SMOKE'S THE THING!



CAMEL'S
EXTRA MILDNESS
IS PLENTY OKAY WITH ME.
I SURE GO FOR
THAT FULL, RICH
FLAVOR

The *smoke* of slower-burning Camels contains

28% LESS NICOTINE

than the average of the 4 other largest-selling brands tested—less than any of them—according to independent scientific tests *of the smoke itself*

"Less nicotine in the smoke means more mildness to me," says test pilot Marshall Headle, as he lights up America's favorite cigarette

THERE may be little traffic at 35,000 feet, but test-diving any new plane is no Sunday joy-ride. No, not even for veteran Marshall Headle (above).

Naturally, cigarette mildness is important to Marshall Headle. And in the cigarette of costlier tobaccos . . . Camels . . . he gets extra mildness—with less nicotine in the smoke. Try Camels. For convenience—economy—buy the carton.



BY BURNING 25% SLOWER than the average of the 4 other largest-selling brands tested—slower than any of them—Camels also give you a smoking *plus* equal, on the average, to

**5 EXTRA
SMOKES
PER PACK!**

R. J. Reynolds Tobacco Company
Winston-Salem, North Carolina

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