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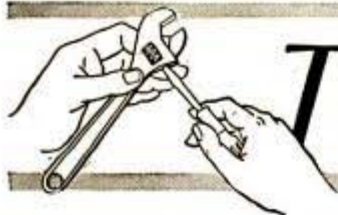
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TOOL NOTES

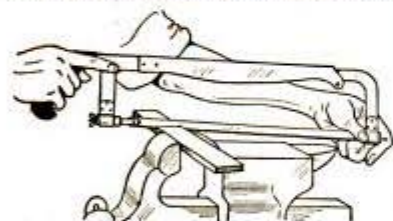
Maintenance
and Repair
Suggestions to
Prolong Tool Life

No. 6 NOTES ON USE AND CARE OF CRESCENT HACKSAWS

Hacksaw Blades are made in two general types: those hardened all over, and those having only the teeth or cutting edge hardened. In the latter type the teeth can be left harder in manufacture and therefore superior cutting qualities result.

Blades are made with a varying number of teeth per inch ranging from 14 to 32. Selection should be based upon material to be cut. Blades having 18 teeth are best for general, all 'round service including solid stock and structural shapes. For pipe and conduit, light angles and ornamental iron, a blade having 24 teeth is preferable. For thin sheet metal and light tubing, use a blade with 32 teeth to the inch.

INSERTING BLADE IN FRAME. Insert the blade with teeth pointing away from the operator and tighten so the blade is well strained, but not to the point where the pins will shear or loosen. Be sure blade is square and true in the frame. Since edge-hardened blades are flexible,



they should be strained tighter than those that are *hardened all over*. After the first few strokes it is good practice to retighten a new blade.

HOW TO CONSERVE HACKSAW BLADES. Breakage necessitates blade replacement much more frequently than does wear. Many blades are broken because too much pressure is applied when cutting a small surface. The concentration of pressure at a single point on the blade causes it to buckle and break. This failure occurs more readily when blade is weakly strained.

Cramping and binding causes considerable breakage that can be avoided by sawing with straight-line strokes, taking care not to tilt or cant the saw frame.

Insecurely held work, likewise, is a frequent cause of blade breakage. If the work becomes loose while cutting, the sudden binding and distortion of the blade is practically sure to cause breakage.

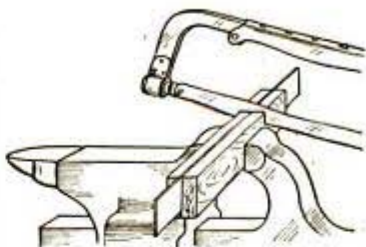
Repair Parts are available for Crescent Hacksaws.

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HINTS ON HACKSAW USE.

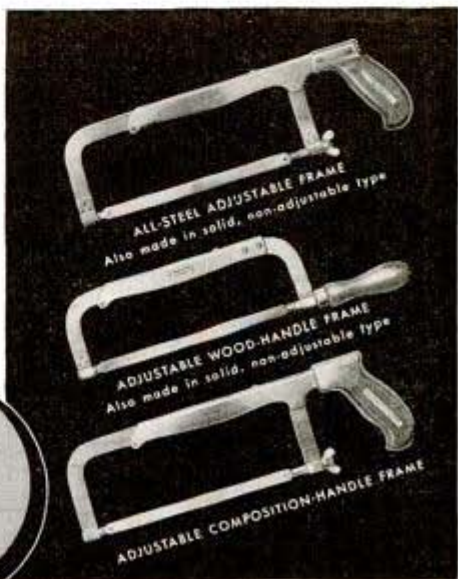
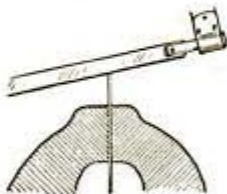
Use normal care in handling the hacksaw. Don't use the frame as a hammer or pry. Make sure the material to be cut is held rigid and so placed that the maximum number of teeth engage throughout the cut. At least two teeth should be in contact with the work at all times.



Begin the cut carefully but with sufficient pressure to make the teeth cut...not merely *rub* on the metal. Lift the saw slightly on the return stroke to avoid dragging the teeth and thus dulling the cutting edge. Forty to fifty strokes per minute is about top speed for efficiency. For faster cutting, increase the pressure...not the speed.

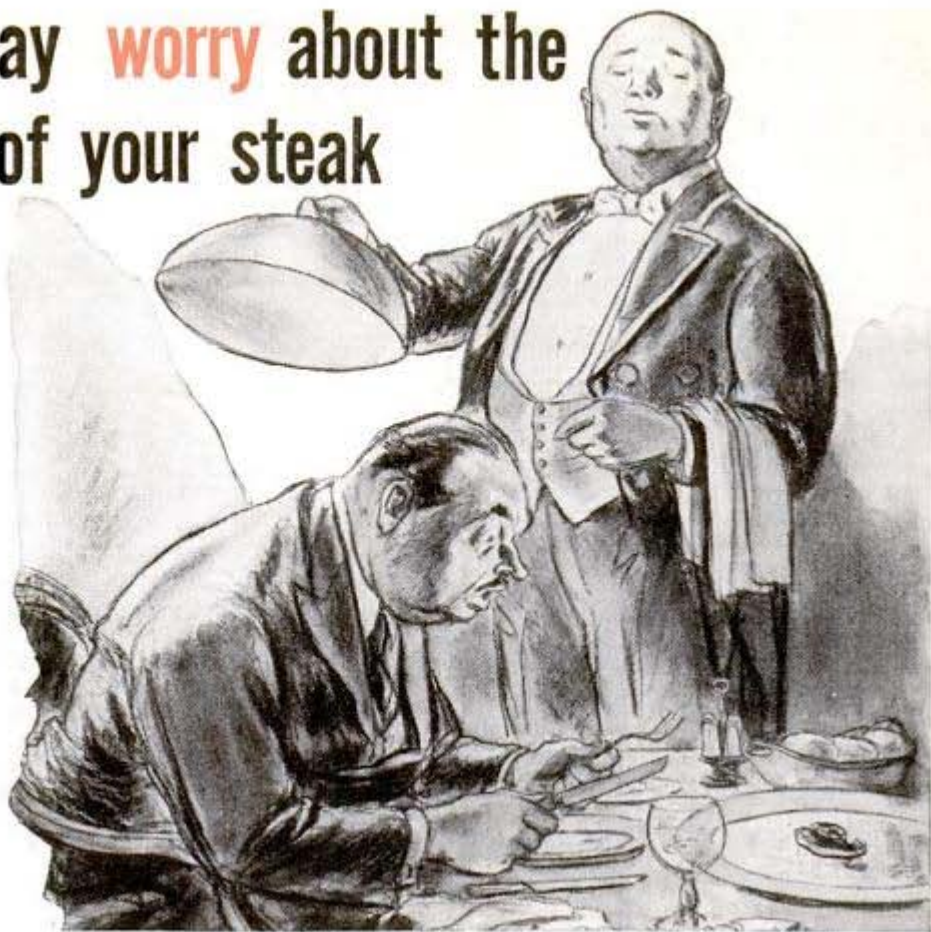
When cutting very thin stock, a good method if conditions permit, is to clamp it between two pieces of wood and saw through the whole assembly, as illustrated above.

Never permit a condition wherein the teeth of the blade "straddle" the work. Stripped teeth are bound to result. Keep as many teeth in contact with the work as possible by changing angle of contact between blade and work; using a blade of finer pitch, or by "sandwiching" as explained above.



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May, 1943

Vol. 79, No. 5

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Rough Riders of the Desert

EVER wondered what it would be like to ride into battle on the desert inside a big 30-ton tank all buttoned up for war? The roar of the engine is so loud you don't hear the heavy cannon beside you; dust bites at your eyes, and it's hot as an oven. Dive bombers swoop from nowhere raining bullets on a desert alive with rolling tanks and battle din. Tunisia? No, sir. Right here in the U. S. on the army's big desert "campus." So put on a crash helmet for a ringside seat at desert maneuvers in a June article—"America's Desert Legion."

Soda Pop Works for Uncle Sam

SAVING lives at sea, snuffing out fires in airplane motors or pushing open bomb-bay doors is all in a wartime day's work for carbon dioxide gas—better known as the fizz in pop. It will inflate a life raft in a few seconds or keep your ice cream bar from melting and it can even be made in your own kitchen. Read "Soda Pop to the Rescue" next month.

Next Month

PUTTING the props under the headlines is just one of the jobs of crack Navy photographers who are at home on ships, planes or subs. Remember the picture through the periscope of a Jap destroyer going down? Even Hirohito couldn't laugh that off. And who hasn't seen a picture of a Jap Zero exploding as it hits the sea? Sometimes the boys in blue who hold the cameras have to lay them aside for guns. There are thrills aplenty in the exploits of these "Seagoing Shutterbugs" told in an outstanding June article.

"Blimp Sights Sub"

HUNTING subs by lighter-than-air craft is an exclusive American military sport—and a profitable one, as the Nazi pigboats are finding out in the Atlantic. Those big blimps roving far at sea look easy going, but they pack a death wallop. They can hover for hours over an oil slick waiting to drop a depth charge. Protector of convoys, they can ride out a storm. Meet the Navy "K" ship in a June story—"Gas Bags on Patrol."

Good-by to the Rivets

FOR some time now there has been a quiet revolution going on within war plants. Behind the revolution are new applications of an old method that rushes ships to completion in a matter of days, and turns out tanks by the score. Some of the mystery behind production figures for planes and guns is brushed aside next month in "Welding for War and Peace."

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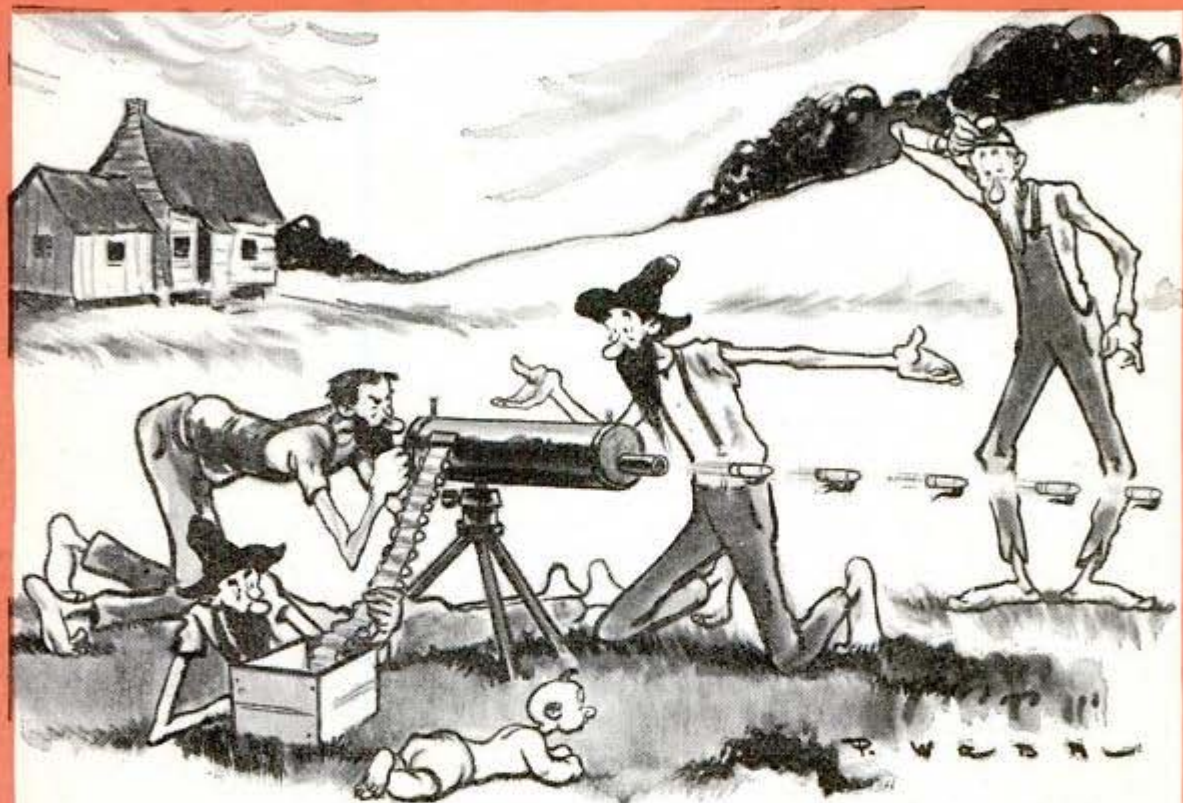
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| <input type="checkbox"/> Concrete Engineering | <input type="checkbox"/> Machinist <input type="checkbox"/> Inspector | <input type="checkbox"/> R. R. Signalman <input type="checkbox"/> Refrigeration | <input type="checkbox"/> Woolen Manufacturing |
- BUSINESS COURSES**
- | | | | |
|--|--|--|---|
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| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Commercial | <input type="checkbox"/> Foremanship <input type="checkbox"/> French | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Business Correspondence | <input type="checkbox"/> Commercial Illustrating | <input type="checkbox"/> Good English | <input type="checkbox"/> Secretarial <input type="checkbox"/> Spanish |
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| <input type="checkbox"/> Cartooning <input type="checkbox"/> Civil Service | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> Managing Men at Work | <input type="checkbox"/> Traffic Management |
- HOME ECONOMICS COURSES**
- | | | |
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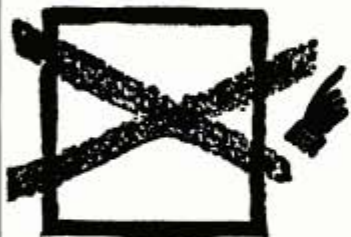
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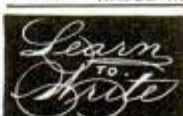
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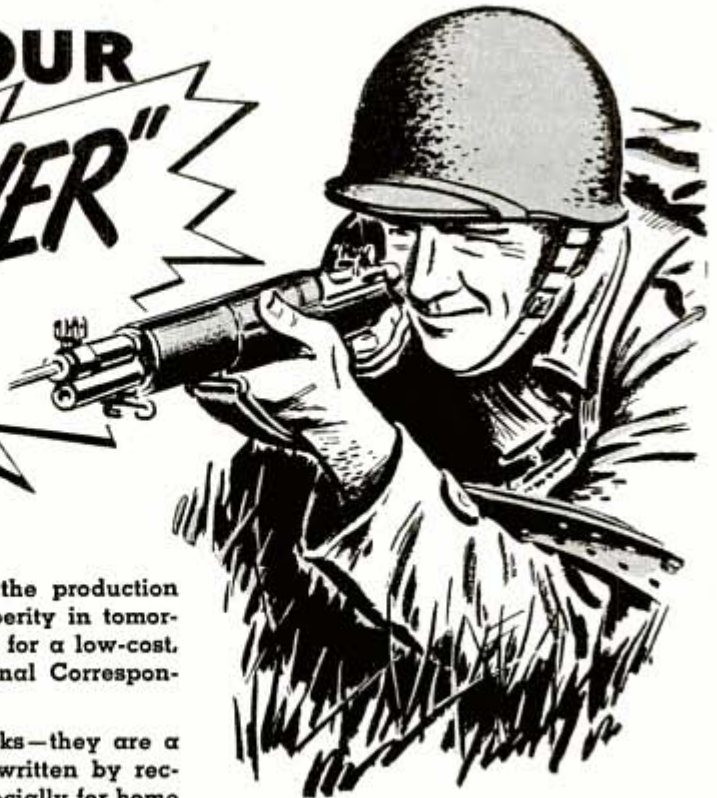
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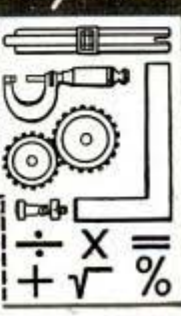
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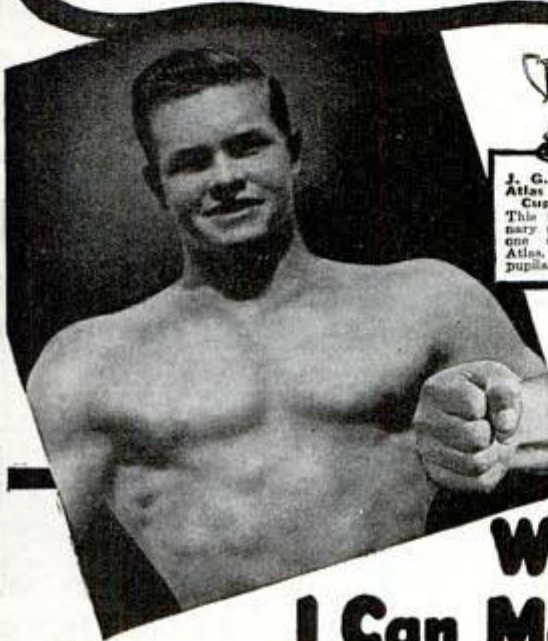


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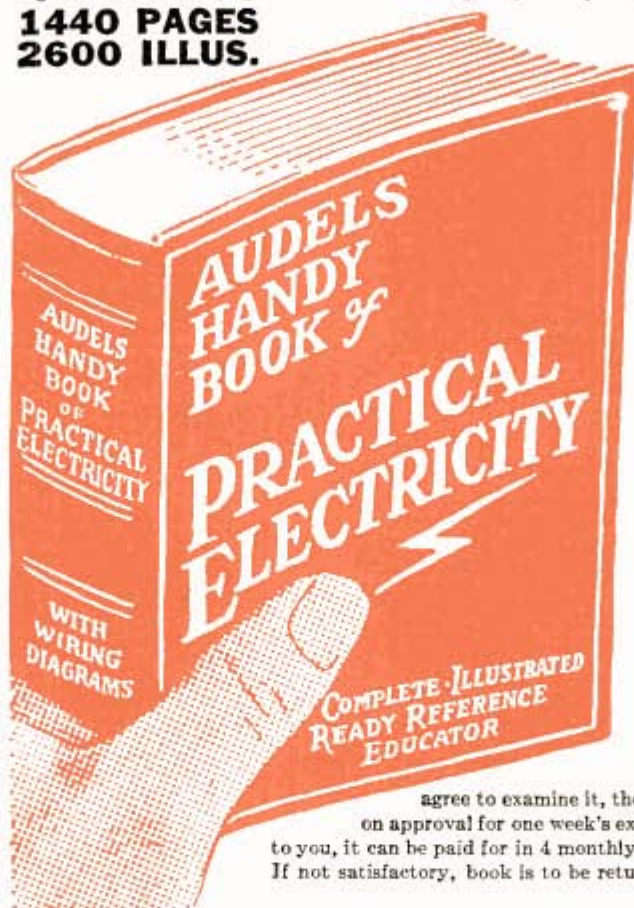
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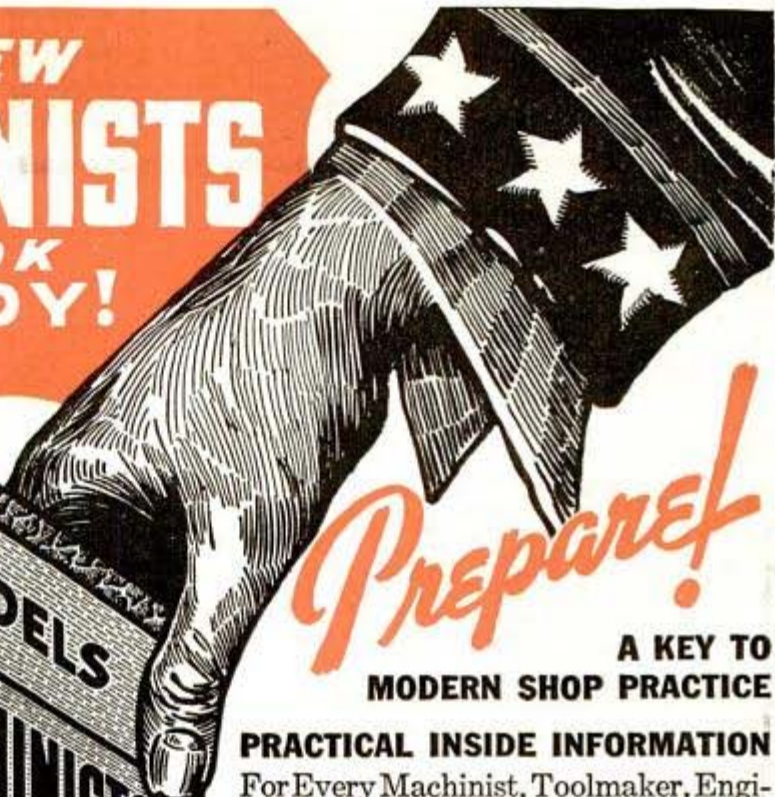
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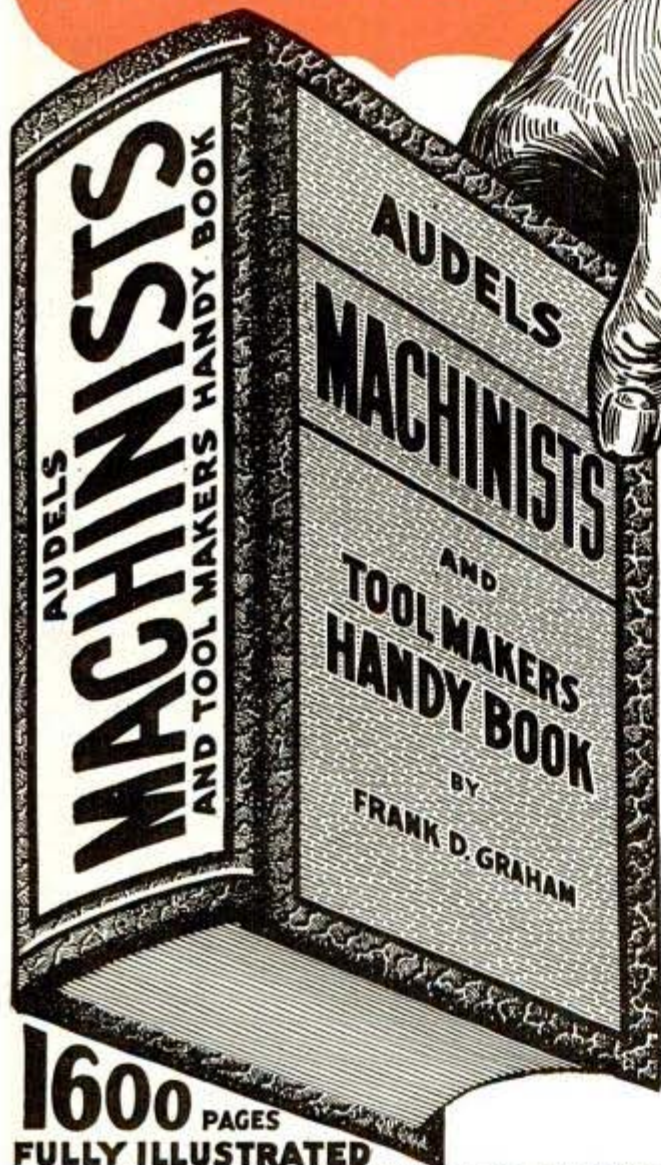
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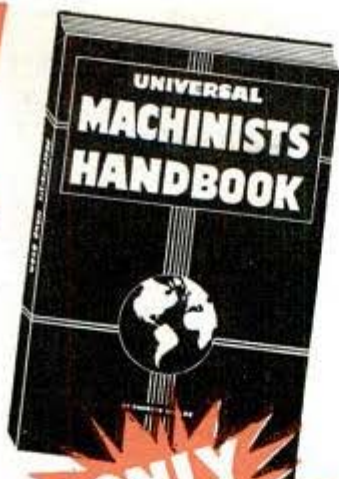
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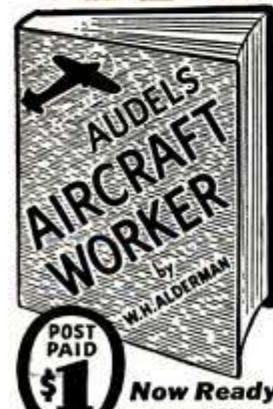
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night, the search goes on in our laboratories and engineering departments to find still more effective ways of bringing victory nearer and surer.

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WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 79

MAY, 1943

No. 5



TWO years ago the home gardener leaned on his hoe and said:

"It's a hobby."

Last year he surveyed his first Victory Garden with pride and said:

"It's patriotic."

This year he is in deadly earnest when he looks up from his planting and remarks:

"It's a necessity."

Secretary of Agriculture and Food Administrator Claude R. Wickard has reminded him that one-fourth of our total food production this year will be needed for our armed forces and our Allies. This includes one-half of our total commercial production of canned vegetables. Added to this sharp curtailment at the source of supply are the mounting difficulties of transportation and distribution of fresh and canned vegetables to civilians.

Uncle Sam isn't fooling when he calls for 18,000,000 Victory Gardens in 1943—12,000,000 in cities and suburbs, 6,000,000 on farms. Half of the civilian population must depend on home gardens for their year-round supply of vegetables. That's why 18,000,000

This coarse soil should be pulverized before planting

Sowing small seeds evenly → by tapping folded package





The pictures on this page show the evolution of a Victory Garden starting with early spring planting (above) on firm, level seedbed
Photos courtesy National Garden Bureau



A few weeks later cultivator is introduced to garden—weeds are dug out to die in sun. Care is taken not to disturb plant roots. Below, the model garden 60 days after planting supplies the table



gardens are the barest minimum because if each garden supplies a family of three, or a total of 54,000,000 persons, that is well under half the population.

Last year several million Victory gardeners tried their wings. This year the government asks them not only to fly but to enlist several million recruits to assure a healthy nation of war workers.

There are many bright spots in the 1943 war garden. First, there's plenty of seed with thousands of pounds to spare for our Allies; second, there's unlimited garden space with the minimum six hours of sunshine, and third, expert advice is free for the asking.

The National Garden Bureau, which is co-operating in the Victory Garden campaign along with thousands of garden clubs, advises the home gardener to bear in mind the necessity for an all-year yield when he is planning his garden. This means a surplus for canning to carry his family through the winter when the grocery store shelves will have but a sparse supply of rationed canned goods.

The primary tools for making a practical war garden are not a spade and hoe, but a pencil and paper, according to James H. Burdett, director of the Garden Bureau.

"Many persons plot their gardens from the pretty illustrations in the seed catalogues instead of from figures showing the food needs of their families," he says.

Last year too many Victory gardens had wasteful surpluses—such as enough radishes for the entire neighborhood for 10 days and none for the family the balance of the summer. The badly planned garden had unnecessary barren periods. Most Victory



Hotbed plants selected for transplanting are adjusted to outdoor conditions by lifting top of frame to give them more air

mean you must provide for 34 servings of beans (two times the 17 weeks in the period). You then consult the chart and learn that one serving of snap beans for your family of four requires one foot of planting; therefore, your planting of beans should total 34 feet.

The inexperienced gardener will rush out at this point and plant his 34-foot row of beans. The wise gardener will first consult the harvest chart (or remember his

experience with surpluses last year). The chart shows that the average bean harvest is four weeks. That means three successive plantings four weeks apart with rows about 11 feet long. The surplus required for canning can be gauged accordingly.

A four-month supply of fresh vegetables can be grown for a family of four on a sunny plot 24 by 50 feet. Widening the garden to 30 feet assures space to grow a surplus for canning. A garden this size would not include "space eaters" like sweet corn, potatoes, melons or cucumbers. Some gardeners, however, have trained cucumbers to climb a fence and have had excellent results with small varieties.

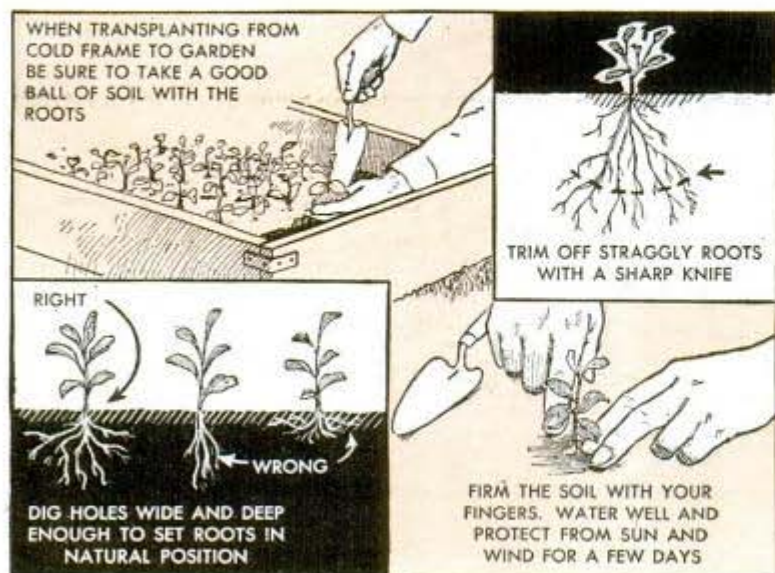
A garden can be a winter storehouse as well as a summer food factory by planting "freezeproof" vegetables. Three favorites are parsnips, kale and salsify, the latter popularly known as oyster

plant. These plants can be left in the garden and gathered as needed during the cold months, for freezing improves their flavor.

The foresighted gardener will maintain a continuous yield by succession planting. Late crops often can be planted in rows used for early vegetables. This is a boon to the small-plot gardener who hasn't space to give each vegetable a special section. For best results root crops should not be followed by root crops or plants of one

family with members of the same family. A few combinations that work well are late peas followed by celery; early peas followed by late cabbage; early lettuce followed by summer squash; spinach, lettuce and radishes by bush lima beans; early beets by string beans; early string beans by fall beets; early carrots by endive or winter radishes; early onions (from sets) by kale; and

Care in transplanting of seedlings saves them from shock and insures yield of good quality



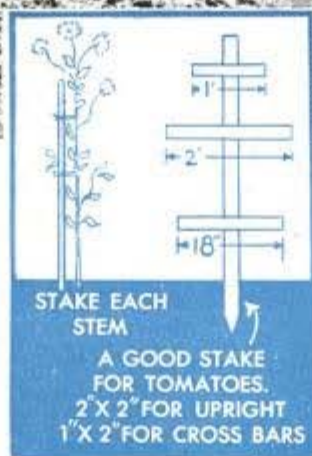


peas by turnips or carrots.

Where space is limited, tomatoes may be set between rows of peas to get started while the peas are maturing; cucumbers may be planted for pickles after the early lettuce, spinach and radishes are harvested.

Inexperienced gardeners often worry needlessly about the quality of seeds, fertilizers and insecticides. They are inclined to blame the seed company if the radishes or carrots have bushy tops and little root growth. The No. 1 mistake most Victory gardeners made last year, according to experts at Cornell University's Agricultural Experiment Station, was planting too much seed. Carrot seed planted a hundred or more to the foot starts a hundred little plants growing where only six or eight are needed. Many firms treat seeds with chemicals that prevent common diseases and treated seed does not have to be sown thickly.

An excellent source of reliable and free information for the Victory gardener is his State College of Agriculture. For example, the University of Illinois in co-operation with the U. S. Department of Agriculture provides a complete garden guide—from selection of site to planting and insect control



Long-row garden (above) is ideal for farms where space is plentiful and the entire family can take a part in the operation

Sturdy stakes (left) are easily made and keep garden orderly, also protect plants from wind. Coat of green paint hides them

Below, loading up with ammunition to rout Victory Garden's "fifth column" — insects and disease. Frequent spraying pays off
U. S. Department of Agriculture photo





Dusting beans to kill the insect eggs under leaves. Right, handy yield chart

—for residents of that state.

The problem of fertilizer is simplified this year because there is only one commercial fertilizer available for the home gardener. Stable manure and compost are just as valuable, however, for they not only supply fertilizer but help the soil hold water.

Coal ashes can be applied to the garden at any time to make the soil easier to work, but they do not add to its fertility. Wood ashes contain much lime and should not be used unless you have first determined that your soil is acid.

There's an old saying that a garden will do well wherever weeds will grow. However, it is best to pick a spot not too low or wet and that is not full of tree roots or shaded by their branches. Crops usually thrive on dark-colored soil, but any soil that is not too stony or wet or hard can be built up.

The American gardener is lucky in regard to insecticides for we have a plentiful supply of the nicotine sulphate that kills hoppers and aphids. Don't wait until your cabbage, cucumbers and beans are

attacked by these "fifth columnists." The old saw about an "ounce of prevention" works one hundred fold in the garden.

The Department of Agriculture estimates that every city garden planted this year will produce at least \$10 worth of vegetables, every farm garden at least \$50. At these figures, the nation's 18,000,000 Victory Gardens should yield a \$420,000,000 crop.

Here are a dozen rules compiled by experts after reviewing mistakes made by victory gardeners last year:

1—Fit the garden to the family by careful planning—not the family to the garden.

2—There is no such thing as a shady vegetable garden—six hours of sun is the minimum.

3—If you can't spare the time to care for a garden adequately don't waste the seed.

4—Never work wet soil—make sure first that it will crumble in your hand.

5—Mix small seeds with sand for sowing—a good rule for small seeds is 15 to the inch.

6—Firm the soil after planting—don't pound it down.

7—Don't sprinkle your garden, soak it thoroughly or the roots will tend to grow up instead of down. (Section of canvas

hose to be placed along the row is recommended.)

8—When you hoe, stir only the top of the soil between the rows—it's weeds you are after, not vegetable roots.

9—Beginners should depend on their local plant grower for "transplants" such as tomatoes, cabbage, eggplant—if you try a window box you'll probably end up by buying the plants anyway.

10—Thin out ruthlessly in accordance with directions on the seed package.

11—Stick to dependable varieties and save your experimentation for the post-war garden.

12—Remember your seed catalogue is the Book of the Year for 1943 with which you will help win the "battle of food."

PLAN YOUR VICTORY GARDEN YIELD

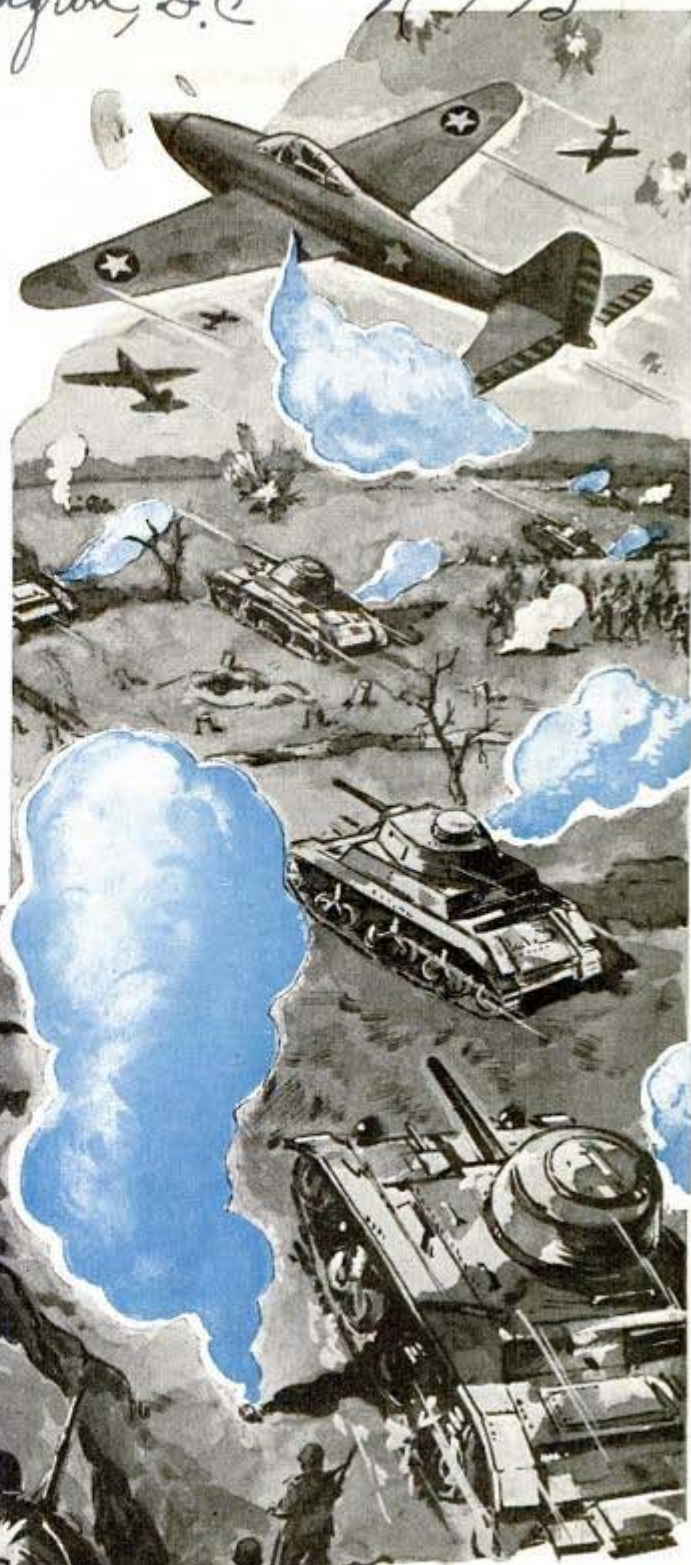
This table shows the length of garden row required to produce one serving for a family of four

Snap Beans	1 ft.	Kohlrabi	2 ft.
Lima Beans	2 ft.	Leeks	2 ft.
Beets	1 ft.	Lettuce, Leaf	1 ft.
Broccoli	1 ft.	Spring Onions	1 ft.
Brussels Sprouts	1 ft.	Parsley	½ ft.
Cabbage	2 ft.	Parsnips	2 ft.
Chinese Cabbage	1½ ft.	Peas	3 ft.
Carrots	2 ft.	Peppers	1 ft.
Cauliflower	2 ft.	New Zealand Spinach	½ ft.
Celery	1 ft.	Radish	1 ft.
Collards	1 ft.	Rutabaga	2 ft.
Sweet Corn	4 ft.	Salsify	2 ft.
Cucumbers	2 ft.	Spinach	3 ft.
Egg Plant	1 ft.	Squash	3 ft.
Endive	1 ft.	Swiss Chard	½ ft.
Kale	1 ft.	Tomatoes	½ ft.
		Turnips	1½ ft.

Douglas Parmentier, Major, U. S. Army, Chief, Publications Branch, War Dept. Bureau of Public Relations, Washington, D.C. 7-173

Grenades developed by the Army Chemical Warfare Service throw off a dense colored smoke which can be used to identify and control army units in the confusion of battle. The grenades are made to produce red, purple, green, orange, blue, white and black smoke that hangs in a cloud for several minutes. They were developed at the request of officers of tank units who have difficulty in recognizing their own tanks in the dust of desert fighting. The grenades can be attached to a tank or tossed to the ground and can also be dropped from planes to explode in the air. Troops surrounded by the enemy can set off different colored grenades to indicate to observation planes that they need food, medicines or various types of ammunition. Planes hunting enemy concentrations can adjust time fuses and drop the grenades on targets to point them out to following bombers.

whittaker



Airmen challenge unknown tanks by tossing color grenades and tank units reply by exploding grenades of pre-arranged color. Ground troops get color signals



FLYING BATTLEWAGONS

on 11/9/6
THE P-38 fighter pilots were getting their instructions at an African field.

"Remember, fellows," their leader cautioned, "German pilots always turn to the right in coming out of a dive. They have to, because of engine torque. So head them off instead of chasing them, and don't waste shells. Wait till you get the cockpit or engine in your sights."

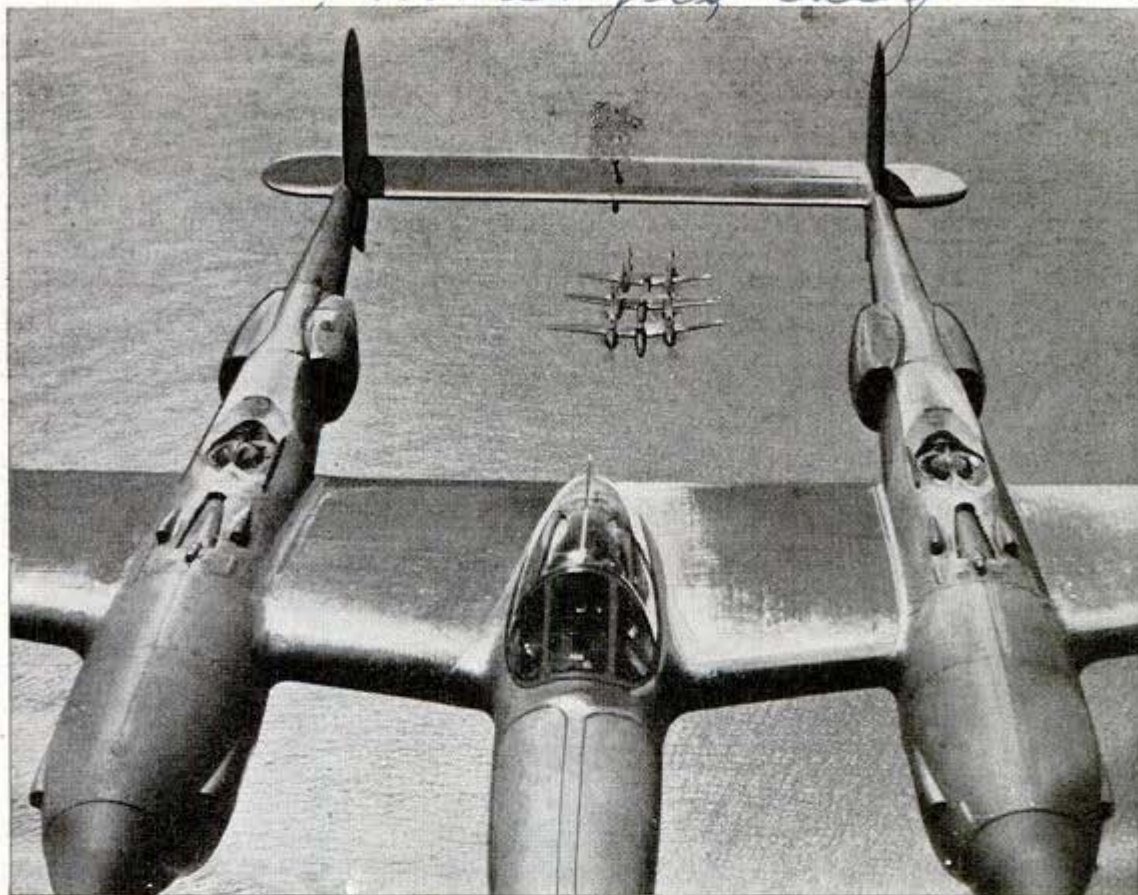
The pilots hardly needed this reminder. They knew a few stray bullets rarely knock out a modern plane. Some had already returned from flights with patches of wing ripped off and splatter marks of bullets on their cockpit armor.

In some respects, American fighting planes were

The bombardier of a Flying Fortress, left, sights his second threat, an auxiliary machine gun. Below, the heavily gunned Lockheed "Lightning" interceptor



Mr. C. Stinson, Jr. 3872 Franklin
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behind the times when war began. Our fighters had only a few guns of small caliber, and no armor. Now American designers have taken the lead, and the airplanes we are building today are literally flying battleships, bristling with long-range guns and heavily protected by armor plate in vital spots.

More and more, military airplanes are being designed primarily as battle planes and secondarily for special duties in battle. Thus some of our fighter planes are now equipped to carry bombs, and some of our bombers have been called "four-engine fighters" by the Japs. Unable to get close without being shot out of the sky, the Japs have even tried to bomb big "Flying Fortresses" from above.

For a look at one new type of battle plane, let's consider the P-38, the Lockheed Lightning that was kept under wraps until enough of them could be flown abroad to take the enemy by surprise. About its only resemblance to pursuit planes

America leads the world in design and production of interceptor and pursuit fighters like the P-38 "Lightnings," flying in formation above. Below, the bombardier poised over canvas-shrouded bombsight in the greenhouse of a Flying Fortress



Lockheed Aircraft Corp
Burbank Calif



Side gunners of Boeing bombers dispense death with these .50-caliber machine guns projecting from windows

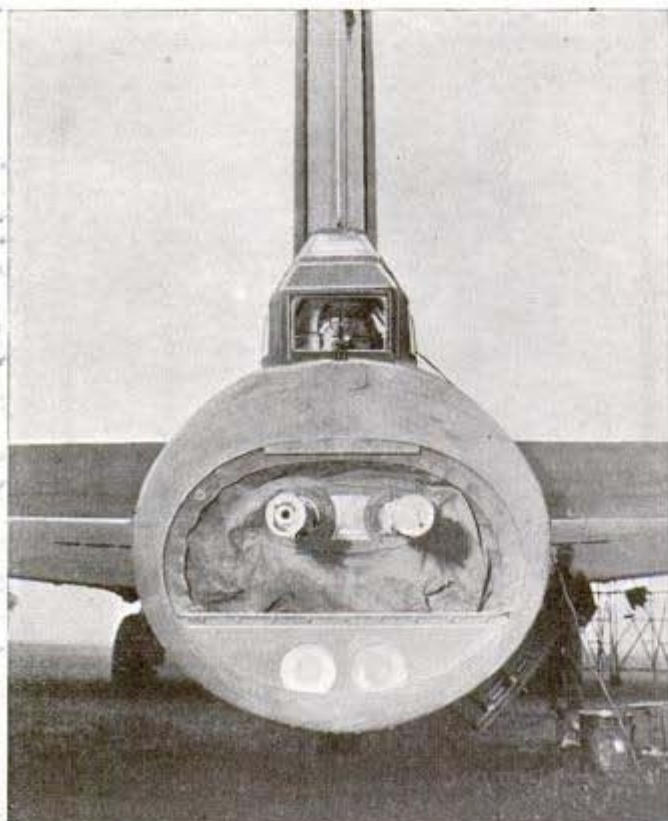
of the past is that it is a single seater.

The P-38 is a big (52-foot wingspread) and heavy (several tons) twin-boomed, twin-engined (2,300 horsepower) fighter that can climb half again as fast as a Jap Zero. Its top level speed (400 miles plus) is so fast the pilot has to lower his flaps to

slow down for a dogfight. Otherwise he would become unconscious from the centrifugal pull in tight turns. The plane can dive so fast a special way had to be devised to measure its speed. The ordinary air speed indicator falters when it encounters the "shock wave" that is below the P-38's full diving speed. The plane can hedgehop so close to the ground that its slipstream tears at the treetops like a hurricane, and it can fight well in air so thin the pilot as well as the engines must be supercharged.

This description sounds like an engineer's dream of what a fighter plane should be, and in effect that is just about what the Lightning is. Part of the secret of its performance is in its complete streamlining. In the air the big plane has less drag than would be set up by an ordinary 27-inch square card table.

In the past, fighter planes had short range because not much weight could be spared for extra fuel. The P-38 overcomes this handicap by carrying reserve fuel. With this, the plane can be ferried under its own power to any part of the world. As a bomber, the



Few Jap pilots live to remember this view of the "stinger" in the tail of a Fortress



plane is able to lift thousands of pounds. P-38's have returned to their bases on one engine, with holes in the wings, booms and tail group. The pilot's cockpit and vital parts of the engine nacelles are protected by heavy armor plating. It was built to take punishment, but principally to give punishment. Four big machine guns and cannon project from the nose. The fire power is so effective that during a "preview" engagement in the Aleutians, a flight of P-38s shot down five Jap Zeros and one Jap flying boat during a single dive. In Europe, German pilots stayed away from the P-38s until they could install heavier guns or figure out maneuvers that would give them a more nearly equal chance in combat.

Our big bombers are now in the real battlewagon class. Flying Fortresses and Liberators have been bombing Europe night and day, their gunners knocking down

Beautiful and peaceful as it looks, the Boeing B-17 bristles with over a dozen machine guns. Notice transparent nose

20 German fighters for every bomber lost. Nazi pilots used to like to come in close for the kill but now they hang on half a mile away and try to duck in for hurried attacks.

The invulnerability of the bombers to fighter attack lies in their fire power. As many as a dozen machine guns are mounted on a Flying Fortress. All the guns are maneuverable, some by hand and some by hydraulic controls. The machine gun nests



This is the upper gun turret of a 4-motored British "Lancaster" Douglas Aircraft Co. photo



A Douglas engineer tests the controls of a "Lancaster's" belly guns, his left hand on trigger. He is leaning past periscope used for sighting guns

of bombers are marvels of complex machinery fitted into small spaces. The tail gunner of a British Lancaster bomber, for instance, slides into his position feet first, then sits up and closes the sliding doors behind him. His seat turns in unison with the machine guns that he points by turning handles that also carry the gun triggers. The "belly" gunner on this same plane sits inside the ship and fires his guns by remote control, aiming through an upside-down periscope. To avoid delays in reloading, many yards of belted ammunition feed into each gun, and this ammunition lies on long slides like miniature railway trackage inside the fuselage.

Battle planes of all types are still in a state of flux. Boeing has announced that even after seven years of manufacture, more people are working on the design of its Flying Fortresses than ever before. No more than five Flying Fortresses in a row have been built to identical plans. One slight change may be merely to alter a control so that the man using it won't skin his knuckles. Another may radically increase the bomber's fire power. Recent improvements include a longer Plexiglas nose for the bombardier compartment, wide-blade propellers for a better bite at high altitudes, a hydraulic system independent of the four power plants, dust filters for des-

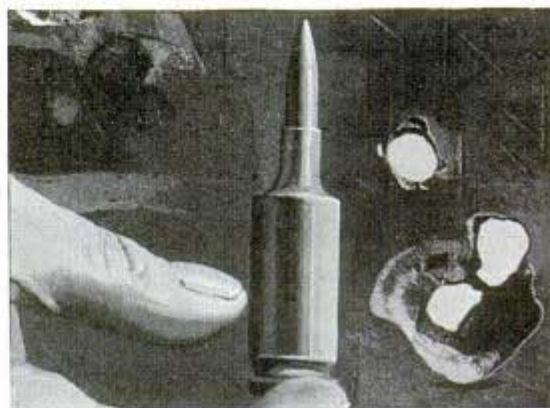
A .30-caliber cartridge is shown against rear of $\frac{3}{4}$ -inch armor plate pierced by high-velocity bullets

ert operations, and special cold-weather fixtures for the Aleutians. Supercharger improvements gave the B-17 its present high ceiling, which in turn led to redesigning the rudder and fin to their present large sizes to provide bombing and gunnery stability at altitudes even above 35,000 feet. Heavier guns are anticipated.

Recoil of heavy guns is a present problem, as is the weight of the large shells. One proposed solution to recoil is a low-velocity bullet that uses the rocket principle, a shell that increases its speed and flies straight after it leaves the gun. More probable is better use of the high velocity principle.

Ralph Waldo Miller, nationally known gunsmith, has designed special loads that have muzzle velocities of around 5,000 feet per second. Miller's new MVF .30-caliber bullet, an armor-piercing and explosive projectile, can burst through the heaviest tank or destroyer hull. Bullets of this type might be superior to anything now used in the air.

"Flying tanks" are being talked about for the future, heavily armored craft that would act as protective escorts for convoys of transports or bombers of many times the weight-carrying capacity that we know today. Reports have been published of 10-ton bomb loads or better for 1943, so the day of the aerial dreadnaughts that would accompany bombers may not be so far in the future as one might suppose.

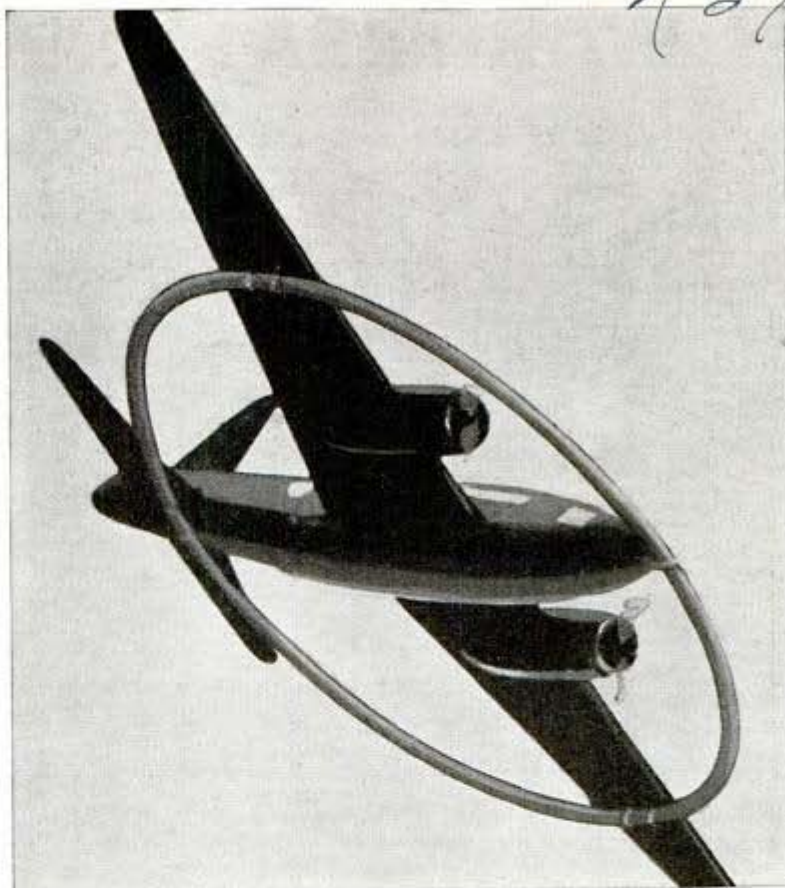


*Intl News photo notes 326 W Madison
Chgo*

"Flying Hoop" Explodes Mines by Magnetism

7-37

When magnetic mines threatened the sea lanes around England late in 1939, the menace was met by equipping British bombers with a hoop device, holding a magnetic coil to which current is supplied by a Ford V-8 engine inside the hull. The magnetic field created within the ring is sufficient to explode the Nazi mines, which Hitler considered a prime "secret weapon." Existence of the ring-equipped bombers, long a secret, was revealed in the British Air Ministry's book, "Coastal Command."



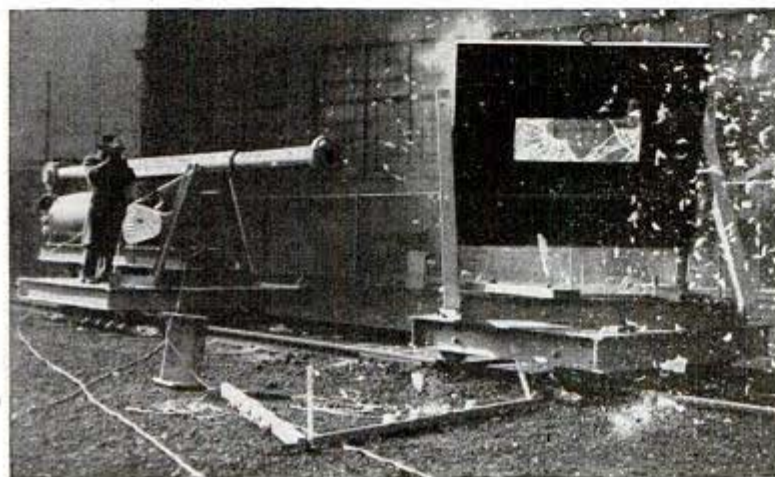
When Hitler sprang magnetic mines as a secret weapon, Britain countered with a secret of her own, a plane that exploded them from the air

Air Gun Fires Bird Carcasses to Test Plane Windshield

Aircraft windshields that will protect pilots against collisions with birds in flight and against accumulations of ice are being developed through tests in which actual birds—turkeys and hens weighing up to 15 pounds, freshly killed by electrocution—were fired at experimental panels. Many

airplane injuries have resulted when planes, flying as high as 8,000 feet, crashed into flying ducks, geese, eagles, seagulls and other birds, especially in the migratory seasons. Westinghouse Electric and Manufacturing Company developed a "cannon" 20 feet long which fires the bird

carcasses by compressed air at speeds in excess of 400 miles an hour. After the tests, the Civil Aeronautics Administration termed "promising" one windshield which includes a front pane of 1/4-inch tempered glass, separated from an impact-resistant panel by an air space through which hot air can be circulated.



High velocity of big air gun is shown by way it shattered a plane windshield in tests

E. Pittsburgh, Pa.

Ref: State Div. of mines, Ferry Bldg.
San Francisco, Calif

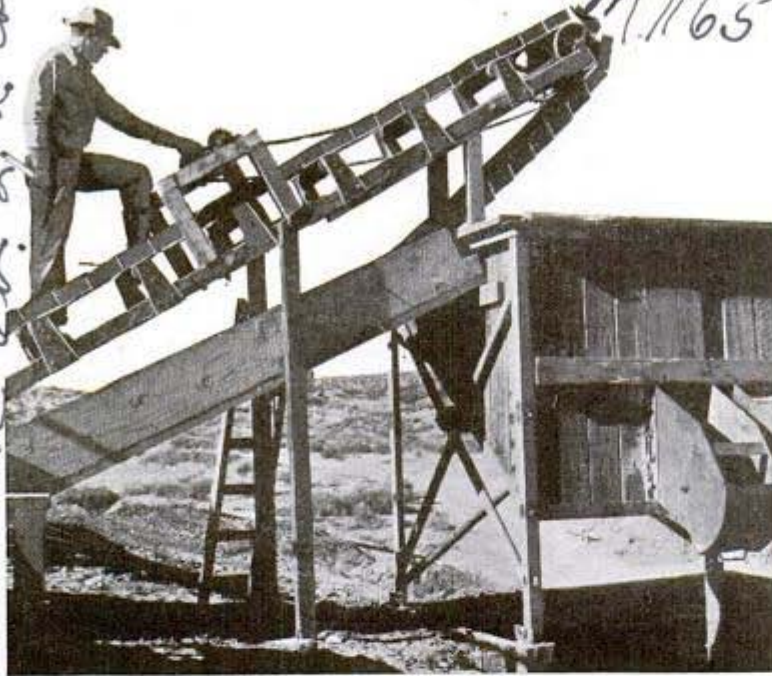
DIGGING for WAR TREASURE

SIDE by side, giants and midgets of the mining industry are producing the metals with which America is forging its weapons.

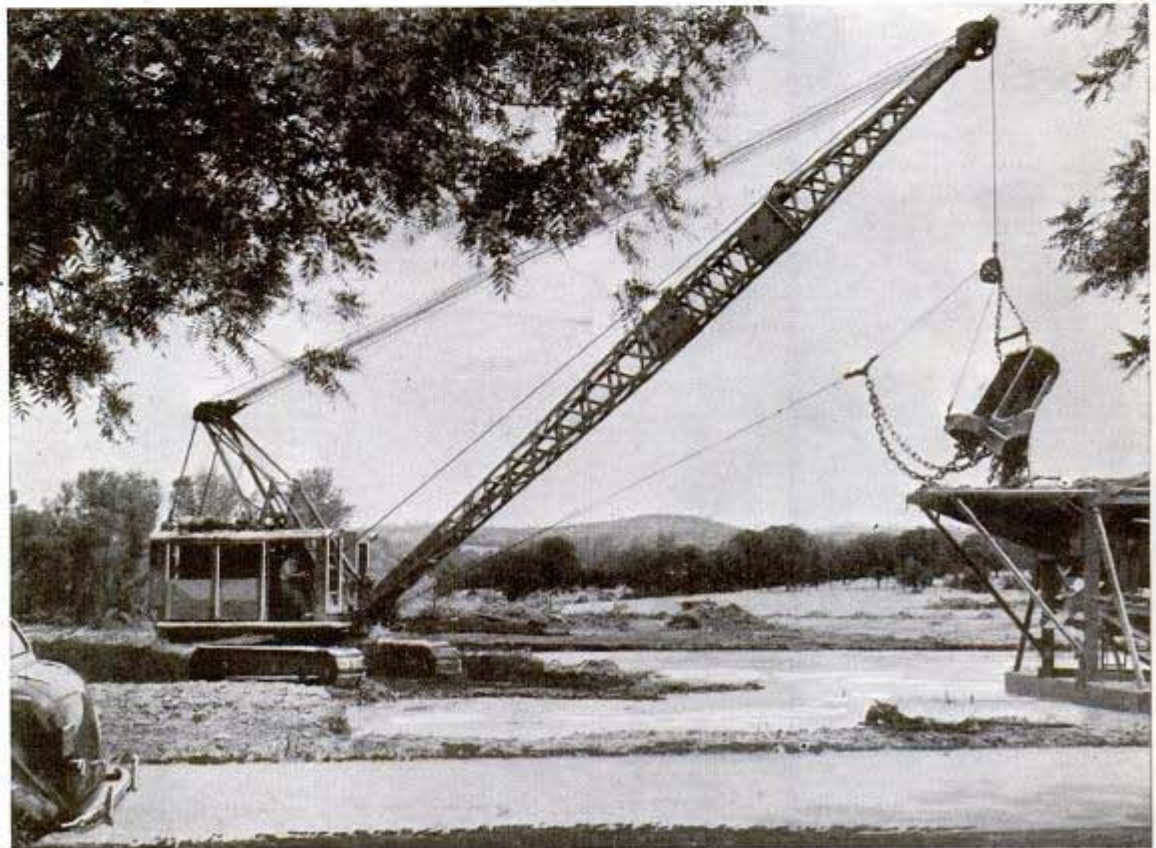
Out in the shimmering heat of Nevada lies mammoth Basic Magnesium, a brand new \$100,000,000 plant that is producing untold thousands of tons of featherweight magnesium every month.

Pecking away at a California hillside, "Pop" Williams is mining tungsten, a handful at a time. "Pop's" mine is one of the midgets, yet the concentrated ore that he sacks and hauls down the mountain in his car every week is badly needed, too.

In Arizona the giant of all copper operations has sliced the whole top from a mountain near Morenci. After that was done, at a



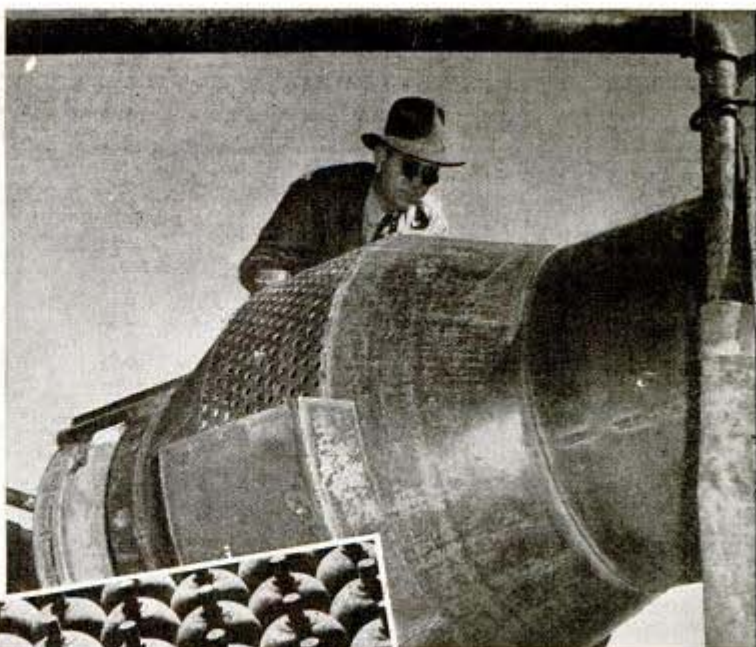
Davids, as well as Goliaths among miners, are probing for metals of war. Above, small-scale operator's equipment; below, big-scale dredging work



Thos. E. Stinson Jr
3872 Franklen av. L.A. Calif

cost of \$35,000,000, low grade ore that contains only a pound of copper in every 200 pounds of material was found. That, however, is what the engineers were after and now they are working the stuff on such a vast scale that more than 100,000 tons of the red metal are being added to our supplies each year.

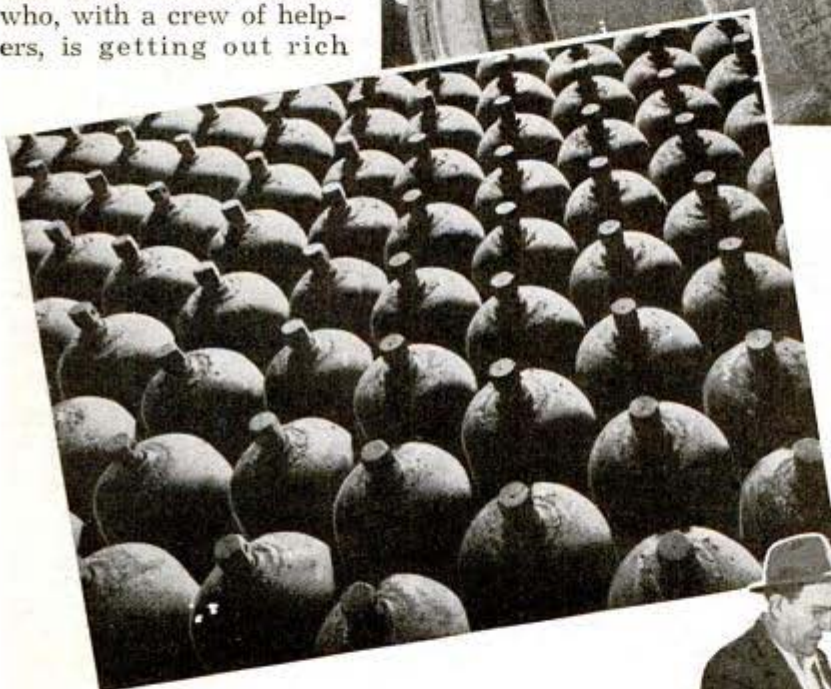
In northern California, the old post office of an abandoned ghost town is serving as the headquarters of a woman miner who, with a crew of helpers, is getting out rich



In war much marginal ore may be mined at a profit. Classifier above is at a small tungsten mine, and separates ore from waste

Left: Stacked like finless aerial bombs, these iron flasks each contain 76 pounds of mercury, vital to mechanized warfare

Techniques used in search for gold now are applied to mine metals more useful to war. "Dry washer" below sifts out tungsten



chrome ore for which the mills are waiting.

The vast operations in the Lake Superior iron mines are enabling finished steel to be produced at the rate of eight and a quarter million tons per month. Fear that our iron reserves might be used up by the strain have been lessened by the recent discovery, across the border in Canada, of upwards of half a billion tons of high grade iron ore under a lake. The lake is to be drained and

(Continued to page 173)



Vought-Sikorsky Co Stratford, Conn.

Helicopter Joins Army as Courier, Ambulance



Top view of first two-seat helicopter shows vertical tail rotor. Left, the army craft hovers as a parcel is handed up

Adopted by the Army Air Forces after nearly a year of experiments, the Sikorsky helicopter has been placed in production and will be tried out in the field as a courier and rescue craft. The army model is the first two-seat helicopter built, accommodating pilot and passenger or crew member side by side. Its ability to land in an area no larger than that described by its big main rotor, and to take off vertically without a runway, makes it ideal as a liaison and message carrier at the front. Any clearing about 40 feet in diameter will accommodate the ship. With low-pressure floats it could operate from land, water, snow, marsh or thin ice. If landing is impossible, a telephone line dropped from the helicopter to a headquarters post on a mountain top or in a dense forest would permit personal delivery of messages. Equipped as an aerial ambulance it could

bring injured men out of a jungle or inaccessible area—and there have been recent instances where victims of bomber crashes could have been rescued by helicopter in hours rather than the days required to reach them by pack train. The army points out, too, the possibilities opened up by the ability of the helicopter to alight on a ship's deck. The Army-Sikorsky helicopter is a simplified and improved model of the single-place craft which Igor Sikorsky first demonstrated in 1940. Like its prototype, it can rise or descend vertically, hover, move forward, backward or sidewise, or spin like a top, and in case of motor failure can windmill down safely. Its main three-bladed rotor of 36 feet diameter operates above the fuselage; a 7½-foot rotor in a vertical plane at one side of the tail is for steering and torque compensation. A seven-cylinder radial engine drives both rotors by gear and shaft transmission. The helicopter weighs 2,400 pounds gross, and is about 38 feet long by 12 feet high. In one of its tests at Wright Field a ladder was let down to the ground while the helicopter hovered motionless above, and a crew member climbed down, completed an errand on the ground, then climbed the ladder again to the still waiting craft. In another demonstration the passenger slid down a rope to the ground from the helicopter while it "parked upstairs."

Dayton Q.

POPULAR MECHANICS

*Quit for Standard Oil Co of Ohio, Ontario
Prospect Cleveland Ohio*
Mississippi "Streamliner" Carries Pipeline Oil

7130



Old Man River, going modern, presents his first streamliner, a Diesel-powered towboat to transport oil

Far cry from Mark Twain's era of glittering, wood-burning floating palaces are the rugged Mississippi River boats of this generation, newest of which is the Sohioan, first streamlined towboat in active service on the inland waterways. Powered by

three 800-horsepower Diesel engines, she goes into service to transport petroleum products from the oil fields of the lower Mississippi valley to pipelines on the upper stretches, for refineries in the northern and eastern states.

Seven-Man "Fortress" Life Raft Carries Sail, Radio Sender

More space and more stability are accomplished in a life raft for Flying Fortress crews downed at sea, which features a square-rigged sail, wooden oars, a fishing kit, repair and signal kits, first-aid equipment, concentrated rations for 30 days and, in some boats, a radio sending set—all in waterproof containers secured to the floor of the boat so they will not be lost if it overturns. Two 10-foot lengths of rope on

opposite sides of the boat are to help right it if it inflates wrong side up, or overturns. A bulkhead forms a false bottom, so that the boat will remain inflated though pierced by a shark or other object from below. The top is orange-yellow, to attract rescuers, the bottom blue to avoid attracting sharks. Those boats with radios carry a box-kite antenna, and the kite itself would be useful in attracting attention

of rescuers. Carrying seven, the boat is 12 feet long, 5 feet 8 inches wide, and, complete with equipment, weighs only 70 pounds. It was designed by the Equipment Laboratory of the Army Air Forces Materiel Center at Wright Field, and made by the United States Rubber Company.

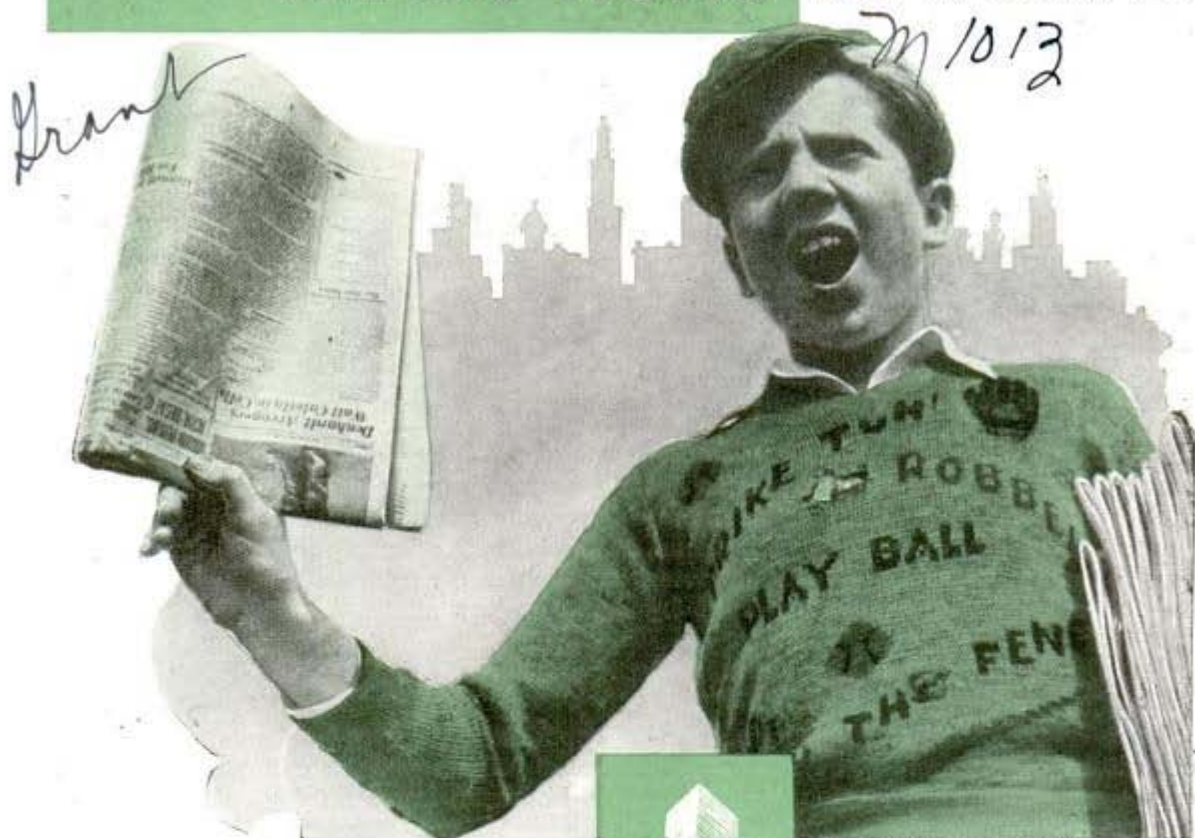
munsey. Bldg

Box kite in Flying Fortress life raft carries aloft the antenna for a radio transmitter to send distress messages

washington D.C.



From Confetti to Battleships — PAPER RUNS the WORLD



By Roderick M. Grant

YOU TAKE a tree, chop into easily digested pieces, steam to a pulp in pressure cookers, add 99 parts water to one part fiber, drain and let dry, and slice to desired size.

What's cooking? One of the most vital things in your life—paper: the stuff of birth certificates and diapers, history books and tax bills, timing gears, war maps and confetti.

Without paper, the war would end. In fact, an authority in the industry said recently that if all the world's pulp and paper mills ceased work tomorrow, the war would end in less than 60 days.

For there is usually just a 60-day supply of paper in the warehouses of the world. After that, no more paper for army orders and navigators' charts, for requisitions and records, for food cartons and shell wrappings, no more pulp for gunpowder, no more folding money

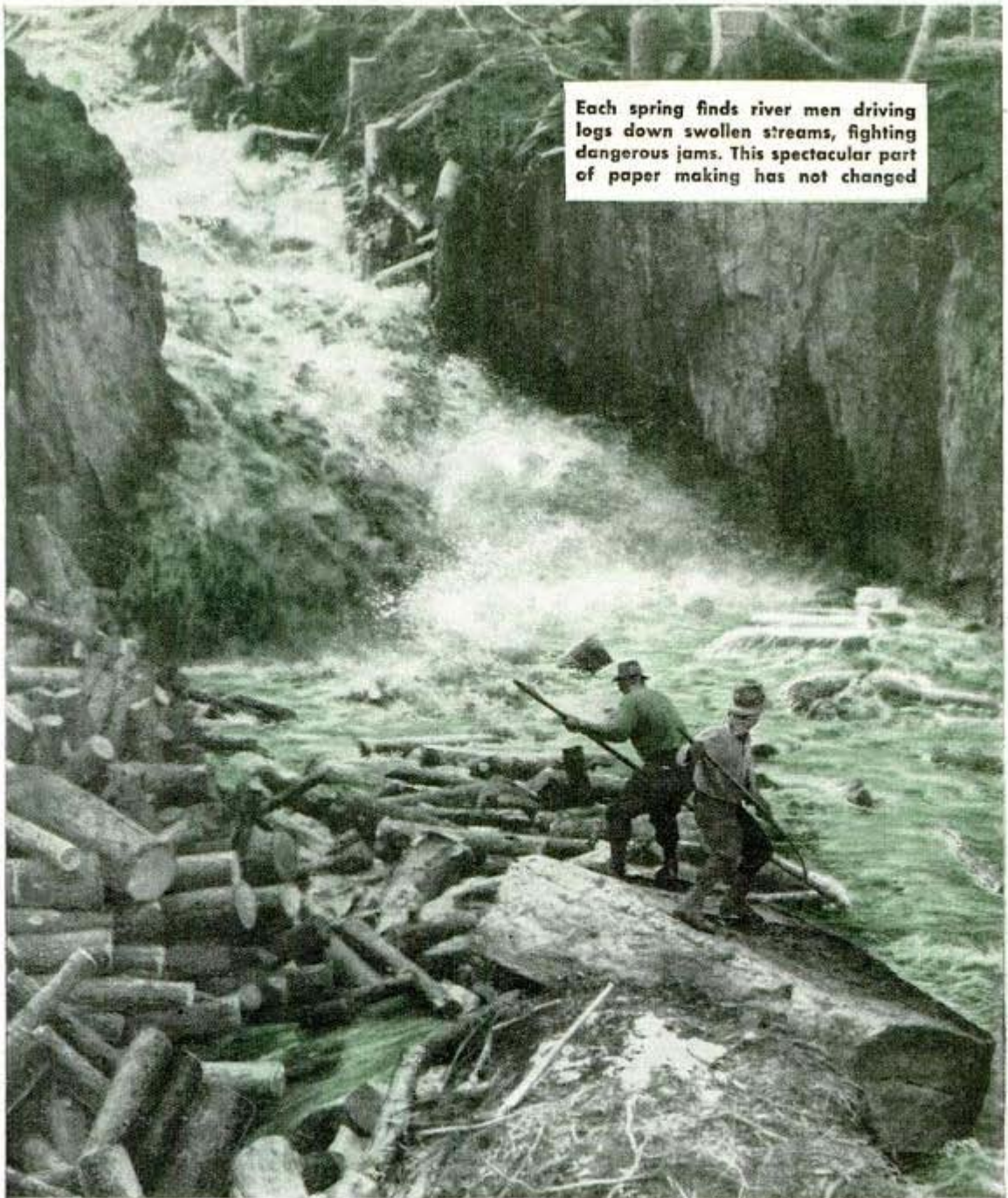
Courtesy International Paper Co.

The town crier of today is your paper boy. But paper is also the stuff of battleships—for it takes 37 tons of blueprints just to plan one ship

or checks or War Bonds, no more blueprints. And there are 37 tons of blueprints in the making of every 35,000-ton battleship.

Oh, you could get along without it. There are still some savages who do. You could write home to mother on animal skins or cloth, and you could give up newspapers and magazines. Some of the boys on Bataan had to, and other boys floating on rubber rafts; and they missed books and magazines almost as much as they missed home cooking. Mental starvation sets in early on a paperless diet. In the





Each spring finds river men driving logs down swollen streams, fighting dangerous jams. This spectacular part of paper making has not changed

Photo by courtesy of the Brown Company

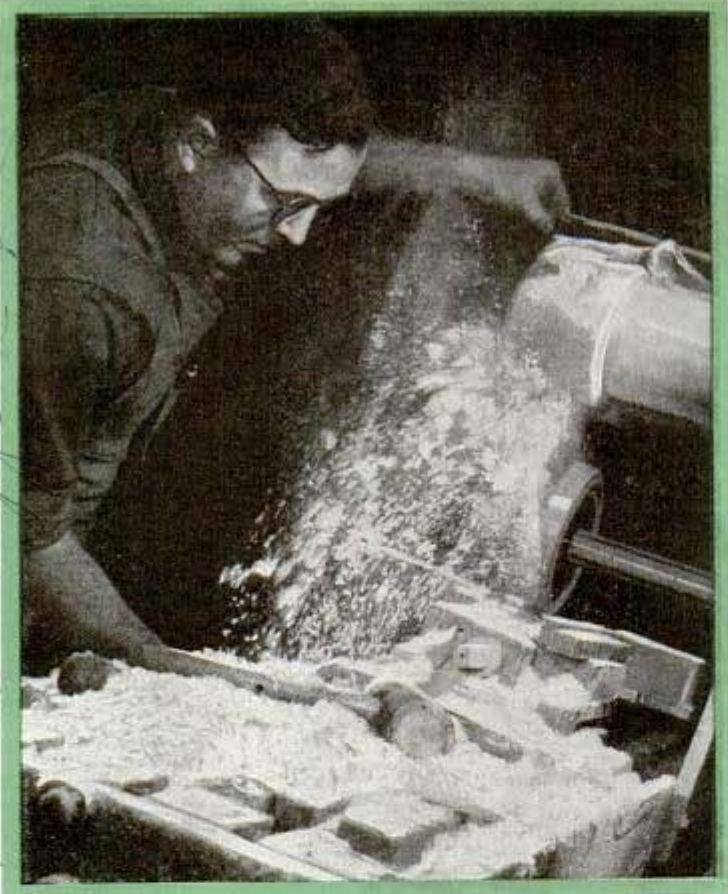
Ship no 9-105

days of parchment and of handmade paper, they chained the Bible to the pulpit to prevent its theft. It became the world's best seller only with the advent of machine-made paper. Indeed, paper is a measuring stick of education, and so of civilization; and by that standard America leads the nations. For each year the average American uses over 250 pounds of paper—more than twice as much as a Briton, three times as much as a German, 12 times as much as a Japanese.

Most versatile of substitutes, there is no

substitute for paper. In the last war it got its big start in the disposable tissue and towel business. In the strange and unaccustomed disguises it is called upon to assume in this war, its own mother would not recognize it. Your last Sunday's "funnies" are chewed up and digested and molded by superheated air pressure into clock cases and flashlights and vacuum jugs. The molding takes just 26 seconds. The same machines that rolled out tin cans by the million a year ago now turn out fiber containers from sheets of paperboard.

Westinghouse Elec. & Mfg. Co.
Dept. A, Trafford Pa.



Westinghouse photo

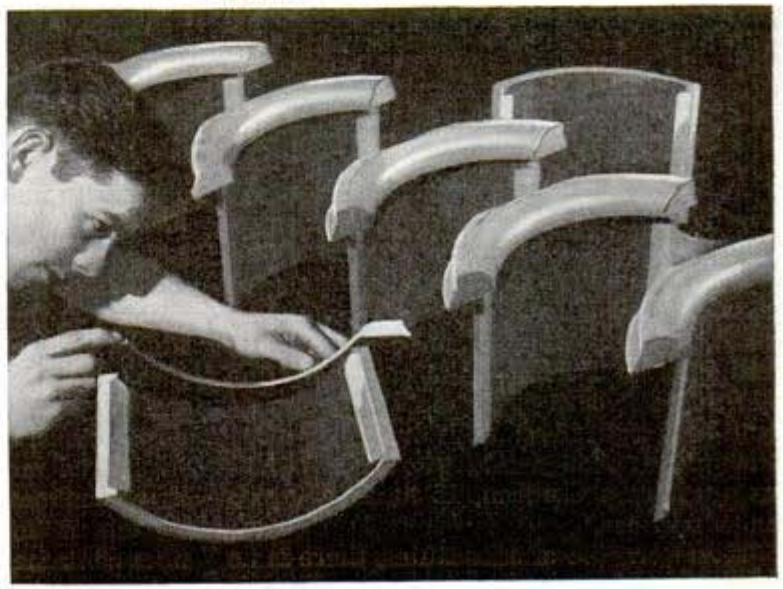
Micarta plastic, made of resin-treated paper, flies like powdered snow from milling machine

Even paint is packaged in these specially impregnated fiber cans with parchment-paper linings. Easy-opening cardboard covers have been developed to replace bottle- and jar-sealing caps. Metal toys vanish from Santa Claus' shelves and paper drums and three-dimensional paper playthings parade in their place—and a prewar manufacturer of aluminum utensils becomes the sales agent for kits of cut-out paper toys. A lipstick manufacturer enlists in the more warlike enterprise of shaping bullets and shells with the same machinery, and lest the lipstick disappear from our civilization, a paper



maker makes a paper lipstick. One inventor is trying out an auto tire of paper five inches thick, weighing 160 pounds. A Chicago company twists paper into acidproof gaskets as a substitute for rubber gaskets to seal grease drums and paint buckets. A paper factory in Sandusky offers a paper jacket for hot water tanks, with patented air-cell insulation.

The list is endless. The need is astronomical, but not too great so far as raw materials are concerned. A year ago there was a paper scare. Less than eight years ago we were importing more than 50 percent of our pulpwood requirements from Finland, Sweden and Canada. The war cut off Scandinavian sources. Canada is called upon to supply wood to Great Britain. And along comes war to the United States and a skyrocketing of demand for paperboard for shipping. Britain, of course, has been saving chewing gum wrappers and old bus tickets from the start, and people assumed that the same shortage of paper would soon hit here. Word got around that there would



Bearings made of this plastic, Micarta, outwear 20 to 40 times metal bearings previously used

Westinghouse

Материал, защищенный авторским правом



Photo by Margaret Bourke-White, courtesy Fortune Magazine



Newly finished paper is wound on giant reels, later to be slit to the desired widths. Below is a cleverly contrived world "globe" made of two paper disks

be a 30 percent shortage of paper; Christmas boxes were carefully put away and shoppers started carrying their purchases home without wrapping. The government requirements for cartons to ship canned tomatoes to Australia and machine guns to Egypt, and spare tank parts to Murmansk and cigarettes to Africa and Ireland and the Solomons swelled the demand to vast proportions. With pulpwood imports nearing the vanishing point the requirements seemed impossible to meet. What was overlooked in the excitement of the first months of war was that civilian manufactures would go down the escalator as war goods went up. There are no more radios and electric stoves and automobile parts to wrap up for the folks at home. Manufacturing capacity is quite equal to the job set for it by war industries, army and navy. However, the government has restricted production. Last year about 16,500,000 tons of paperboard and



The H. M. Kanaoka Co.
536 N. Lake Shore, Chicago

paper were produced in the United States. This year's production is estimated from 13,500,000 to 15,000,000 tons. Not because the forests are thinning out. Forest reserves are more than adequate; the purpose was to divert power, labor and transportation to other war industries. The paper industry fears the limitation of output will result in a shortage of certain paper products as war demands increase.

While panicky collection of waste paper in anticipation of a shortage has ended, there is still need for scrap—although not so acutely as in England, which depends on imports. A great deal of our paperboard is 85 percent old paper repulped and only 15 percent new material. There never was much fear of a shortage of the finer grades of paper made from new pulp or rags. The finest writing papers, bank notes, engraving papers and the like are made of rags. Incidentally, the Bureau of Engraving and Printing turned 2,158 tons of paper into revenue stamps last year; 1,593 tons into currency, 1,282 tons into postage stamps, 541 tons became War Savings Bonds, and 87 tons went into other government bonds and notes. It takes a lot of paper to run the Treasury.

Eighty-five percent of all paper tonnage is based on wood pulp. And this means almost exclusively coniferous wood pulp. Furthermore, it was only relatively recently that southern pines began to be processed into paper. Now a new method promises to make our tremendous



Courtesy Weyerhaeuser Timber Co. *230 Park Av. NYC*
 Here is where paper gets its start in the world. A "high-climber," ax and saw dangling from his belt, starts aloft to top a giant tree. Below, paper cut-out toys are replacing metal playthings in the stores
 Photo from Container Corp. of America



W. A. Chapman, Jr. C.

stands of deciduous timber available for low-cost papermaking.

Two natural elements, wood and water, are required in great quantities for paper. To these are added labor, heat and power.

Wood is reduced to pulp by one of two principal processes: mechanical or chemical. The new process, just in its infancy, is "semi-chemical," midway between the two conventional methods—one of which, the chemical method, dissolves away a large percentage of the wood while the mechanical grinding process utilizes more of the wood but shortens the fibers. In the semi-chemical method the wood undergoes a preliminary chemical softening, then is ground up to pulp without injuring the long fibers. This method changes 75 percent of the wood, by weight, into paper, and makes it possible to process common deciduous trees such as cottonwood, willow, poplar, elm, and others plentiful in the neighborhood of mills whose original evergreen stands

Mary St. Meyer

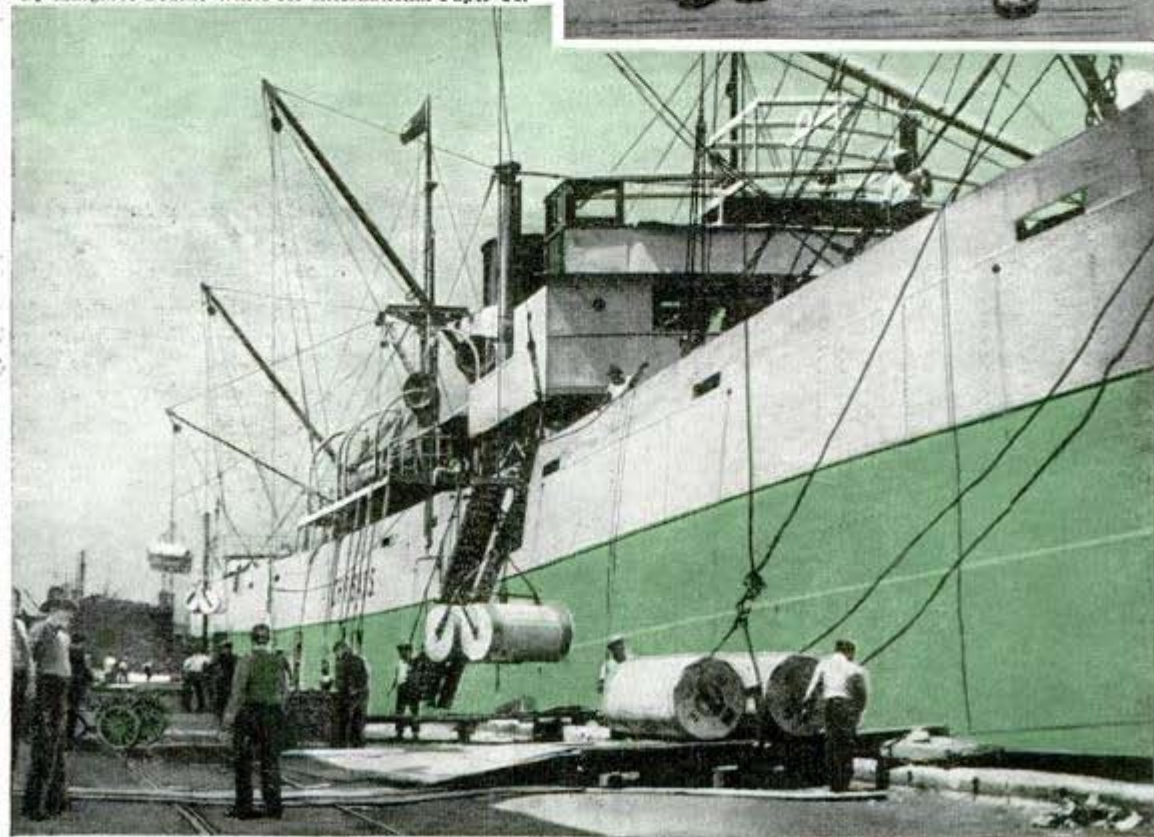
Jimmy St. Meyer

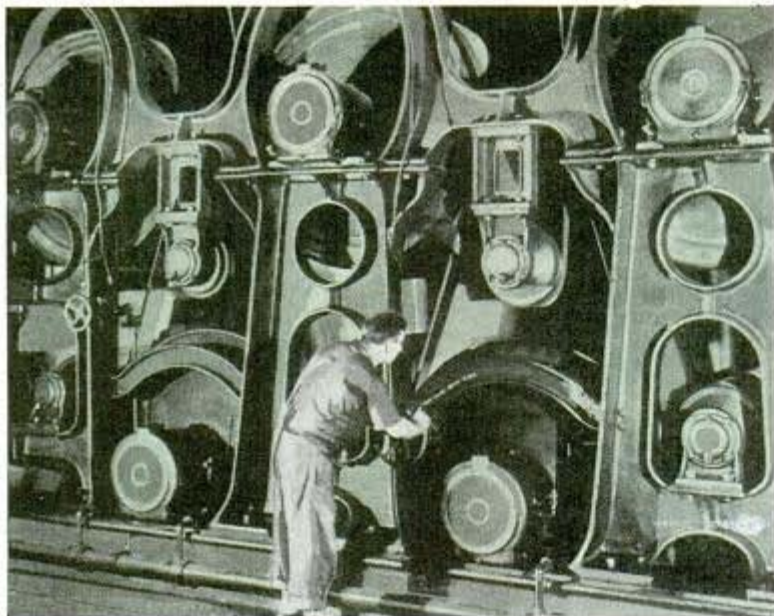


Helen V. Meyer

A Hollywood dressmaker fashioned these dresses of crepe paper. They cost about 28 cents each. Below, paper swings into the hold of a ship

By Margaret Bourke-White for International Paper Co.





By Margaret Bourke-White for International Paper Co.

Paper is carried on felts through suction and compression rolls in mill

have long since been victims of the ax.

But let's start up in the timber country. All through the fall and the bleak, subzero Canadian winter, the tough woodsmen are hewing hundreds of thousands of cords of spruce and balsam, the big brothers of your Christmas tree. Out in our own northwest, the big tree country, high-climbers walk up the sides of giants to top them before the axes attack at the base. Powerful Caterpillar tractors wait to snake the logs out to the mill, while up in white-clad Canada, where millions of acres of

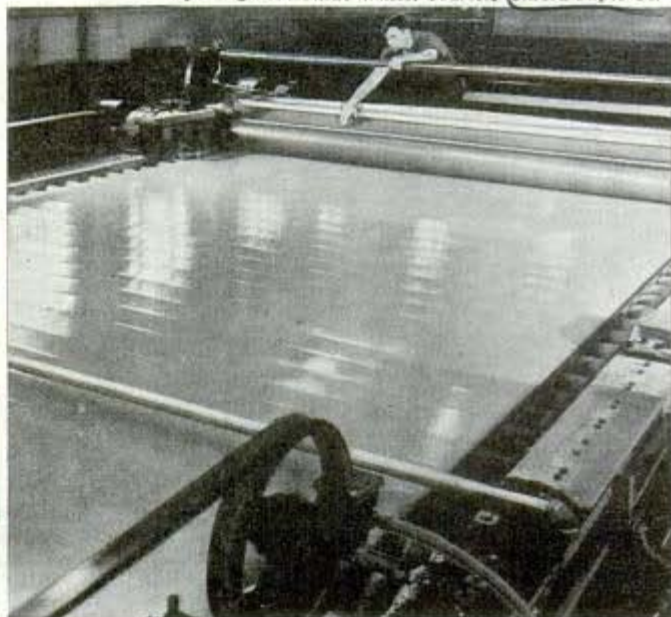
rotating steel drums to strip off the bark, while powerful sprays wash them clean.

Then begins the reduction of wood to pulp. In the chemical process, whirling blades cut the log into chips which are screened for size and carried on endless belts to storage bins over the digester. Here the chips are cooked under pressure with chemical "digestive juices" until "done," then blown into the cyclone and on through a dozen separating, washing, blending, refining processes. In one step the blend reaches a consistency of one part

350 Wackerly - Photo

Left, a paper insulating jacket for hot water tank. Right, water drains through screen as pulp becomes paper

By Margaret Bourke-White. Courtesy Oxford Paper Co.



Price about 2.48 - 3.19
2.98 - 4.07 gal

24 *Hinde & Burch Paper Co*
Sandusky, Ohio

230 Park Av, NYC

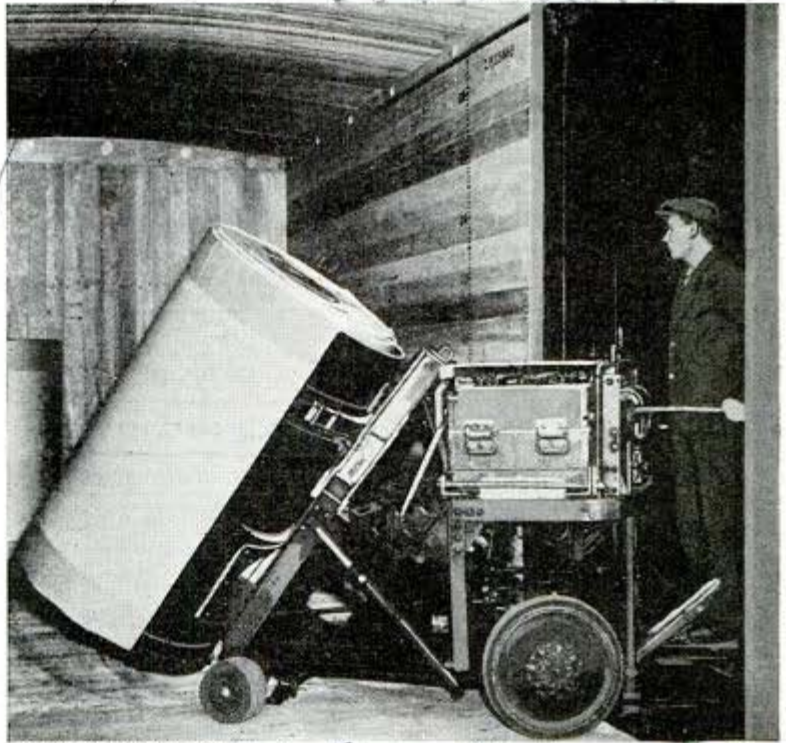
pulp to 400 parts water, in the next it is thickened to one part fiber in 12 parts of water. The volume of water consumed in paper making is almost incredible. One company alone, the West Virginia Pulp & Paper Company, producer of one-seventh of America's book paper, uses more than 150,000,000 gallons of water daily—sufficient for a city of 1,500,000 population.

It is the long-fibered pulp produced by the chemical process that gives newsprint its strength. In the mechanical process, the logs are reduced to pulp by large electrically driven stone grinders under continuous water spray because of the tremendous heat generated. The resulting pulp has relatively short fiber, giving body to the paper, smooth surface for printing, and ink-absorbing qualities. Various qualities are produced by blending different fibers and fillers, sizing, coloring, and final calendering which imparts the desired finish—dull, smooth or glossy.

Pulp finally becomes paper at nearly 14 miles an hour on the Fourdrinier machine. Now more than 99 percent water and the rest fiber, the blend flows out on an endless belt of fine wire screen traveling at 1,200 feet per minute. As it speeds along the water is rapidly drained off, while a side-wise shaking tends to cross the fibers to form paper. As the sheet leaves the Fourdrinier screen it is strong enough to travel

(Continued to page 165)

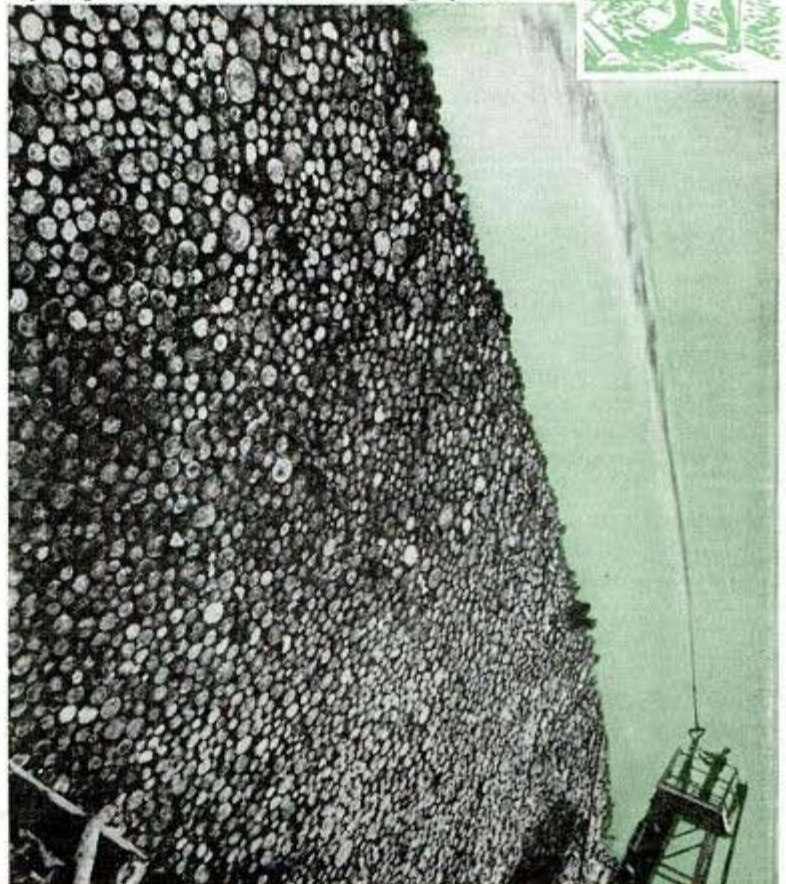
MAY, 1943



International Paper Co. 2206 42 NYC

A big spool of paper rolls from the mill into a freight car, perhaps on its way to your favorite magazine. Below, from the fire tower a hose plays a jet of water over a mountain of logs at paper mill

By Margaret Bourke-White for International Paper Co.



*Republic Aviation Corp
Farmingdale, N.Y.*
**Fighter Passes Speed of Bullet
 In 725 Mile-an-Hour Dive**



Army's Thunderbolt almost kept up with the sound of its own motor

By traveling faster than a bullet, or virtually at the speed of sound, two Army fliers have broken all known speed records for human beings. In diving Republic P-47 Thunderbolts, their instruments registered 725 miles per hour, more than 12 miles a minute—one mile in five seconds. At this speed one would have heard and seen the planes at almost the same instant as they hurtled toward the earth. They were traveling at twice the speed of a cannonball and more than 200 miles an hour faster than the bullet of a .45 service revolver which has a muzzle velocity of 750 feet a second, or about 511 miles an hour. The pilots' diving speed was almost twice as fast as the record for racing cars—369.7 miles per hour. At a speed of 725 miles an hour they were moving at the approximate speed of the outside of a tire on the racing car that made the record run. The pilots retained mental clarity during the dives and reported that their bodies were pushed back against the rear armor plate and that they had the sensation their planes were going to pull away from

them. Both dives were made unintentionally. The fliers had taken the powerful fighter planes aloft for horizontal speed runs at 35,000, 30,000 and 25,000 feet. While diving from the highest to the second level their control sticks froze and the air speed indicators leaped. The pilots had to resort to the cranks which control the elevator trim tabs to bring the Thunderbolts out of the dives. One of the men reported that when his ship leveled off at the end of the dive it shuddered "as though it had been hit by a truck."

Golf Ball Centers Replace Cork In Baseballs

2/13
 When further use of rubber thread to manufacture golf balls was banned, that industry had on hand 720,000 "pills," rubber golf ball centers, representing 11 tons of rubber that could apparently be used only for scrap. But simultaneously use of cork to manufacture cores of baseballs was also banned. A manufacturer experimented by using a golf-ball "pill" overlaid with scrap rubber to build it up to regulation size for a baseball core, and, with authorization from the War Production Board, the pills that were originally intended to go into golf balls can now be used to make the centers for 720,000 baseballs, requiring only nine tons of scrap rubber in addition to the 11 tons of pills.

St. Louis Post-Dispatch
St. Louis Mo.
7-10-5

Cutter Rips River Ice With a Detachable Plow

Patterned after ice breakers used in Holland, the Coast Guard's new cutter, the Fern, has a detachable 85-ton plow that is fastened snugly to the bow with heavy chains. The cutter was put into service to keep open the channel of the Illinois River, normally locked by ice from about Jan. 1 to early March, and insure the movement of naval craft built on inland ways and war commerce to the Mississippi River. Equipped with 350-horsepower Diesel engines, the Fern plows through 12 inches of river ice at six miles an hour. The engines are operated by remote control from the retractable-type pilot house. The Fern, designed by Naval Architect A. M. Deering, is 114 feet by 30 feet and has a draft of five feet six inches.

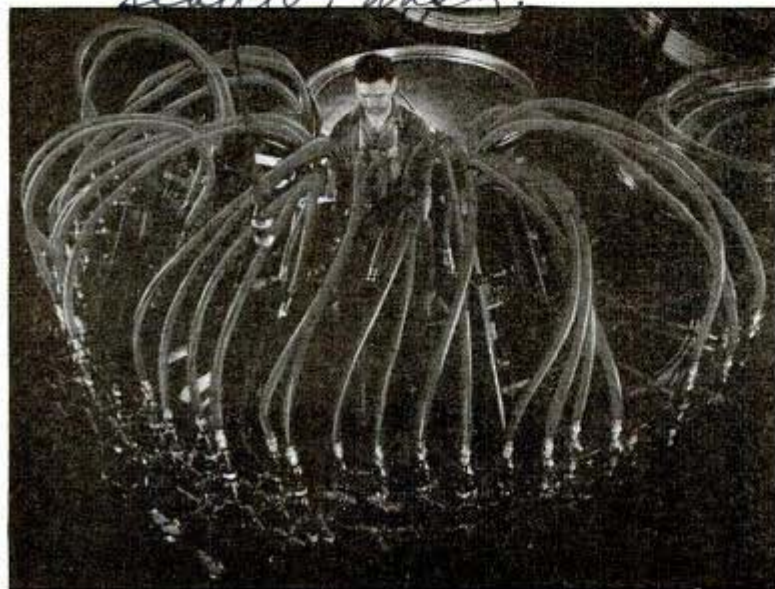


New Coast Guard ice breaker cuts channel in frozen Illinois river

'Octopus' Cuts 'V' in Fortress With Hydraulic Tentacles

Its real name is "circumferential hydro-punch," but Boeing Aircraft workers have given the nickname of "octopus" to a ma-

chine used to notch V-shaped holes in the ribs of Flying Fortresses, because its tubular arms rear up like the tentacles of a marine monster. The punch handles 19 dies on a 190-degree radius, mounted to adjust to the diminishing radii of the circumferential ribs in the after portion of the bomber's fuselage. Its cutoff die cuts with both an upward and downward stroke, while the hydraulic pressure exerts only a downward stroke. It does its work 45 times as fast as the machine it replaced.



Workman at left appears to be enmeshed in arms of the giant punch nicknamed the "octopus"

**BLASTING
IS THEIR
BUSINESS**



A chunk of Virginia earth leaps toward the sky as a member of demolition squad (left) throws the switch of an electric exploder in field at Fort Belvoir

Below, working in water nearly up to his hips, a trooper of airborne command in North Carolina is placing a dynamite charge to blow up old bridge

By Wayne Whittaker

OFFICERS at Fort Belvoir, Va., where thousands of husky Army engineers are trained for demolition work, like to tell their men the story of "The Young Engineer Who Was Decorated for Bravery."

His job was to blow up a bridge at the last minute in the face of advancing enemy tanks. When he pulled the switch of the electric exploder nothing happened. He rushed to the bridge under a rain of fire, corrected a faulty adjustment he had made to a charge of TNT, returned to his position and blew up the bridge. The young engineer won a citation for bravery and became a hero.



Cpl. Schuler POPULAR MECHANICS
Eugene Harmon

*Lt Geo. W
Preenell*

*Lt Mike
Chester*

Demolition instructors at Belvoir tell their men that the brave engineer also should have received a good bawling out from his commanding officer. They explain that if the charge had been properly placed, the engineer would never have had to risk his life going back to the bridge.

The rule at the Engineer Replacement Training Center is that engineers can't make mistakes—at least not more than one. Painstaking care and efficiency are the watchwords from the first minute of the first lesson. Any demolition man will tell you that handling TNT and dynamite is perfectly safe. All you need to know is how.

The familiarity with which the engineers handle blocks of nitro starch, dynamite, big bangalore torpedoes, grenades, mines and assorted "booby traps" is not born of bravado or lack of respect for these deadly tools. Their sure touch comes from expert training and "good listening."

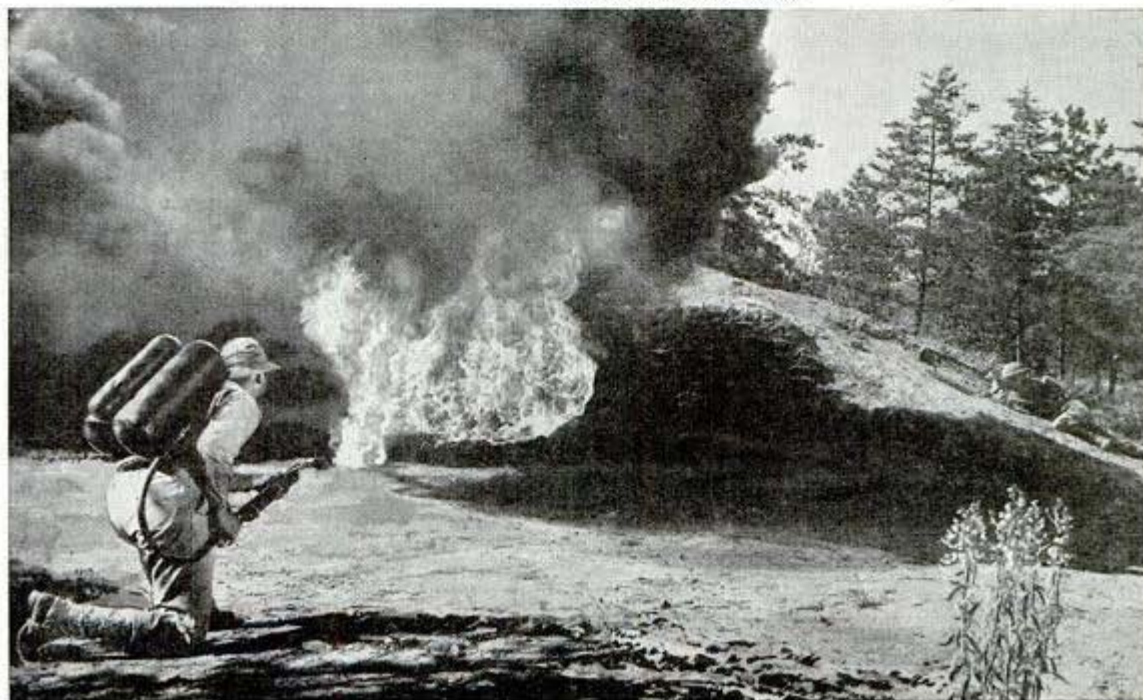
"Our boys are good listeners," says a training supervisor as he fingers a stick of nitro starch that packs the wallop of a young earthquake. "When you're handling this stuff you want to hear right the first time."

The record testifies that most of them do "hear right" the first time,



While engineer (above) waits chance to use dynamite he is holding, rifleman covers him from any sniper attack. Below, a flame thrower in action

U. S. Signal Corps photos





Engineer with flame thrower used to roast the enemy out of a pillbox

one moving 70 miles an hour," said an officer.

The time fuse and prima-cord look much alike to the uninitiated except that the former contains dark powder and the latter white. The time fuse, however, burns at the rate of about a half foot a minute, while the prima-cord "explodes" at 20,000 feet or nearly four miles a second.

The newly recruited Pioneer—so-called because he breaks trail for the infantry—has a classroom that consists of mile after mile of pine woods and hills and valleys, of creeks with red clay banks, of cleared fields that were once parts of farms in Fairfax county.

for of the thousands of men who have been given training in demolitions at the fort since Pearl Harbor there have been no injuries more serious than a slight burn or scratch. The engineers consider their daily chores no more dangerous than crossing a busy street or highway.

"They had to enlarge the fort and put us off by ourselves because we were gradually blowing the place apart," said a sergeant. "We had to give up blasting trees because at the rate we're training men there wouldn't be any left before long."

"A demolition man wouldn't mistake a time fuse for a prima-cord any more than a civilian would mistake a parked car for

Despite the vast tract over which the demolition crews rove, repair squads are kept on the jump filling in ditches, shallow holes and deep antitank craters.

This is how road checkerboarded with deadly land mines would look if they were exposed to view of foe



If one could view the demolition grounds from a low-flying plane, the region probably would come closer to resembling a battlefield during combat than any place in the Western Hemisphere. Here thousands of men, working in platoons under close supervision, are blasting away at "enemy" positions. Clouds of red dust leap skyward. For the first time, the men get the feel of battle while echoes of the fray resound in the halls of Mount Vernon a few miles away.

The demolition course is divided into seven lessons. The first introduces the men to the various types of explosives, fuses, caps and prima-cord. The platoon commander outlines the general demolition methods—fire, water, mechanical means, artillery fire, bombing and explosives. He demonstrates the firing of a cap with time fuse and the detonation of prima-cord with cap and fuse. The men are shown how to fire an electric primer. They learn how to fasten, or "crimp," a cap to a time fuse in rain or shine. They are taught how to make connections with

Sapper (right) pushes magnetic detector over mine field. Below, placing a charge of TNT under bridge at Fort Benning



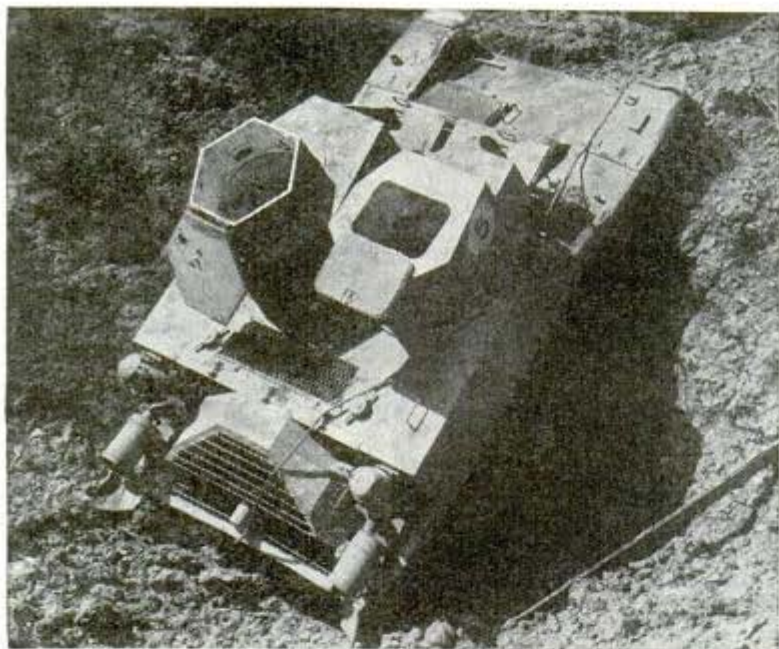
↑ Engineer creeps forward to hurl an explosive-filled bottle



prima-cord that won't fail them in combat. They get acquainted with every tool in the demolition chest from the handy crimper to the electric exploder.

In the second lesson the men get their first taste of firing. In the third they work at "cutting" reinforced concrete beams and also practice earth (buried charges) and underwater shots. The fourth lesson is centered about two bridges over Accountink Creek, one concrete and the other steel. These bridges have been "blown up" thousands of times. Dummy blocks of TNT are placed in carefully calculated positions and in exact amounts. Lesson No. 4 also covers the demoli-





Testing antitank crater—steep vertical face holds the tank in trap

tion of railroad rails, frogs and switches.

In the fifth lesson the engineers are assigned the job of routing the "enemy" from a heavily wooded section protected with mine fields and barbed wire obstacles. The men charge down a hill under the imaginary protection of their field artillery and facing the "machine gun fire" of the foe.

Under the direction of the company commander, who shouts orders through a loud speaker, the engineers rush forward carrying bangalore torpedoes and smoke bottles to clear a path for and to hide the infantry at their heels. Anyone who thought the demolition crew worked only with the rear guard in defensive action is due for a surprise. The bangalore torpedoes, resembling five-foot sections of steel pipe and loaded with high explosive, are pushed into the treacherous barbed wire barrier. The torpedoes, which may be connected to any required length, are fired after the men take cover. When the bangalores explode the nearby mines and booby traps—those unpredictable devices that catch the unwary soldier in a thousand different ways—are detonated. The infantry plunges through the gap and the "enemy" is quickly routed from its woodland position.

A second part of the lesson is devoted to blowing antitank craters.

"You can't stop 'em for good with craters," the officer tells his men, "but you

Closeup of antitank mine which is loaded with TNT and buried near surface. It explodes on pressure

can sure slow them up at a time when a few minutes may mean saving thousands of men and valuable supplies."

A successful antitank crater is a triangular pit with a steep forward face. The nearer this face is perpendicular the better the crater, for then a tank attempting to crawl out cannot get a "bite" on that forward rim to eat its way out.

In Lesson No. 6 the men study the fine points of demolishing wood and steel. Cutting steel with explosive requires extreme caution, for bits of the metal scatter for half

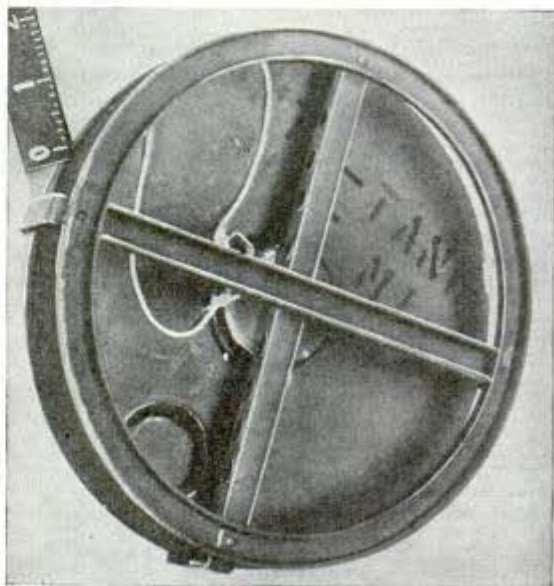
a mile. Elaborate pits of reinforced concrete and heavy wood beams are used for the steel charges. Fiber mats that weigh 1,500 pounds are an added protection over some of the pits.

The officers also learn how to use a flame thrower in assaulting a pill box.

The final lesson is devoted to booby traps and here the stress is on ingenuity. The deadly effectiveness of boobies is laid to the fact that there is no formula with which to combat them and no two need be exactly alike.

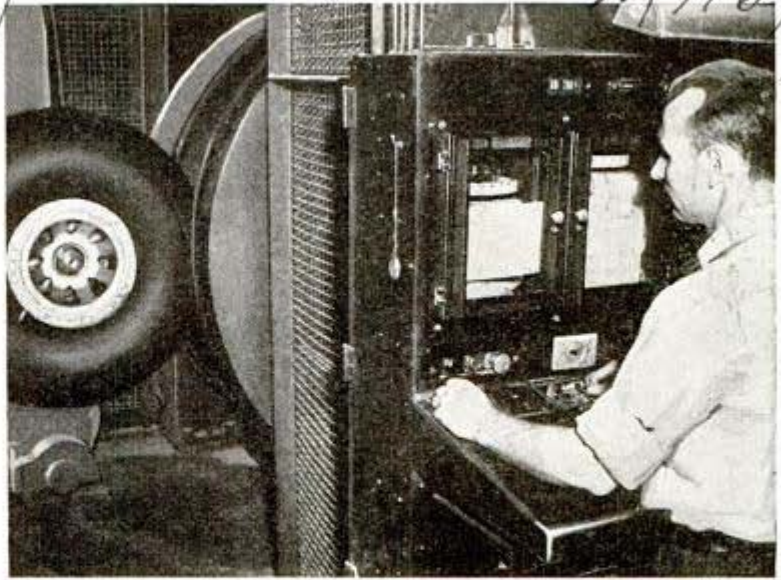
There are three general types of booby traps, which all have mechanical releases,

(Continued to page 167)



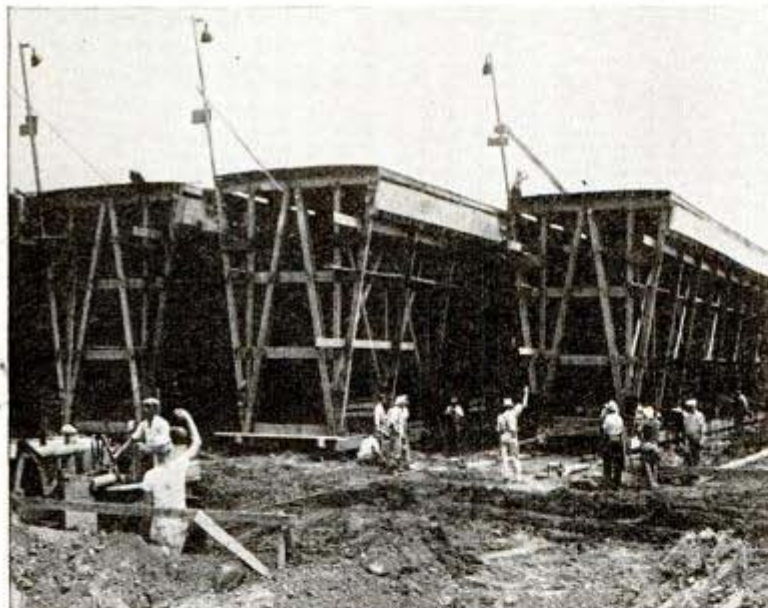
akron ohio *ca Byers* *Cuyahoga Falls*
Plane Tire Stops 15-Ton Wheel in Landing Test

It's pretty much like landing half an airplane when Goodyear Tire and Rubber Company tests a tire for a 30,000-pound bomber. Anyway the effect on the tire is the same as it lunges against a spinning 15-ton flywheel, under 15,000 pounds pressure, and a brake is applied from the control panel until it stops the huge wheel. The tests determine the time required to slow up the flywheel after applying the brake, the tire's potential tread wear, resistance to continued flexing, heat developed and other factors.



Applying brake from control panel to stop spinning flywheel which reveals whether tire is sturdy enough to support big 30,000-pound bomber

Factory Built From Roof Down With Mobile Wood Forms



Forms permit pouring concrete for roof and columns at the same time

m 1078
 Building concrete war plants is speeded with traveling wooden forms into which both roof and supporting columns are poured at the same time. The Wright Aeronautical Corporation recently completed a vast aircraft engine plant in a few months by using these mobile platforms supported by wooden trestles on rollers. Concrete is poured on top of the platform to form a section of the roof and flows over into forms which shape the columns. After a few days of drying the platform is rolled forward.

Black-Lint Cotton Grown in Russia Eliminates the Need for Dyeing

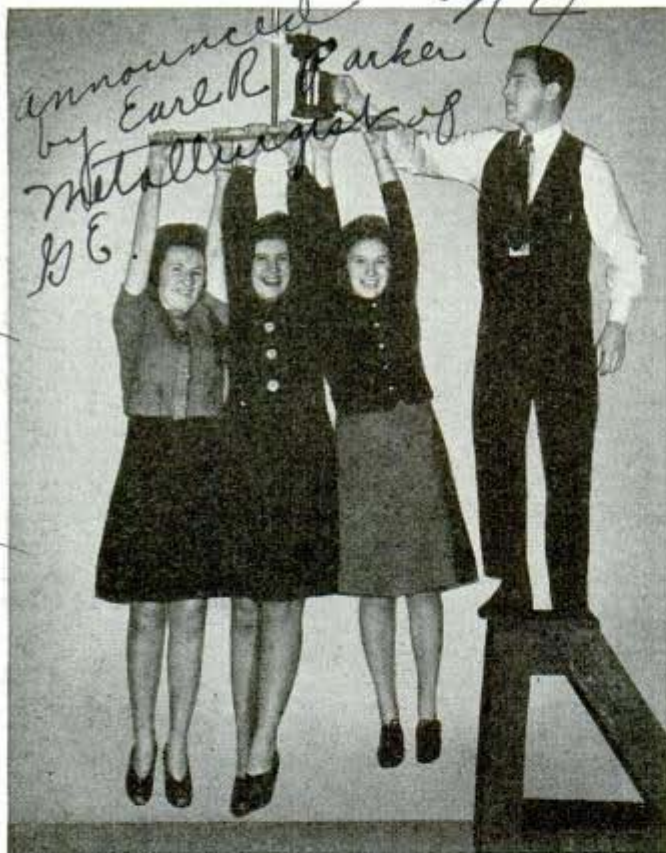
Black cotton has been grown in Russia, a new color variation, although cotton with other colored lints ranging from reddish to green have been known for some time. An advantage of the naturally colored lint is that it eliminates the dyeing process. The natural black is expected to be a faster color than the black of dyed cottons.

m 46
 American colored cottons, chiefly with green and brown tints, are not grown on a large scale. They are used chiefly in regional handicraft industries.

☐ Frogs move their lower eyelids upward to blink, while human beings wink with the upper eyelid.

30 Rockwell the Plaza

Rare Metal Alloyed With Iron Proves Tougher Than Steel



Supporting the weight of three girls though under flame of torch, rod of iron-columbium alloy proves strength at high temperatures

By adding three parts of the little-used element, columbium, to 97 parts of iron, General Electric metallurgists have developed an alloy tougher than steel. It has withstood tests at 1,100 degrees Fahrenheit, a temperature at which ordinary steel would break. Used in place of expensive special steels, the new alloy may make possible higher operating temperatures for steam turbines. It is not a steel because it contains no carbon. Though known for 142 years, columbium occurs only in relatively rare minerals, and has been used in jewelry and formerly in lamp filaments.

Eye Has Three "Detector Tubes" To Distinguish Colors

Much as a radio receiver picks up waves within the range to which the set is tuned, the human eye distinguishes colors through three sets of "color detector tubes," or groups of cells in the retina. Each set reacts to light rays of certain wavelengths, though the eye perceives only three basic colors, according to the Better Vision In-

stitute. One set responds to green, another to red, a third to violet. White light, a mixture of rays wherein the colors balance each other, stimulates the three kinds of color cells nearly equally. The concept of yellow results from a mixed stimulation of the green and red "tubes." The hundreds of other color tones that are conceived result from harmonizing and blending of the stimulations the three sets of cells receive. Color blindness might be likened to defective "tubes" in a radio: the color receptor cells do not react properly to the light stimuli. More men are color blind than are women.

"Talking" Light for Guard Protects War Plant

Any prowler caught in the beam of a searchlight developed expressly for protecting war industry from subversive activity may be simultaneously addressed through a loud speaker installed above the light. Both speaker and light turn together, and the whole unit has an extension control by which it may be operated from a point below the elevated spot where it is installed.



Mounted above the searchlight is the speaker through which guard can challenge anyone caught in the beam

Allen Warren Elliott 7 Park Ave
NYC



High on the rails and also high in the respect of railroad men is this detector car, one of a fleet guarding lives of passengers by finding tiny rail defects invisible to the human eye

WORKING as smoothly as a squad of Uncle Sam's G-men on the trail of a Nazi spy, a group of less than 100 railroad specialists are criss-crossing the nation's steel highways from dawn to dark. They are hunting down mysterious saboteurs of transportation—hidden rail defects.

On these men rests a large part of the burden of seeing that passengers, mail, express and freight get through to their destination safely. This entails preventing rail failure from paper-thin interior fissures no human eye can detect.

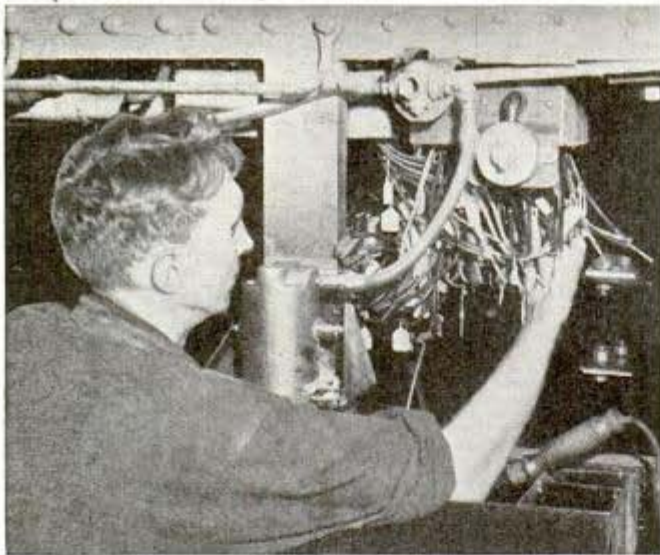
Never before have these vigilant experts been so welcome to seasoned railroad maintenance executives as they roll into sight in their bright yellow detector cars. They're only the size of ordinary coaches, but are packed like sub-

Marking the spot where automatic pen made jog caused by break in current passed through rail

marines with scientific gauges and gadgets, motors and mechanisms.

The nation's overloaded rails are taking an unprecedented pounding as the railroads struggle with the task of moving men and materials for war. The freight load jumped 33 percent last year and it has jumped again this year. The passenger load figures leaped 80 percent last year and





This is part of detector car's intricate electric wiring that leads from the searching unit above the rails to the recording units

this year's totals will be much higher, though they have already exceeded the peak of the last war by 24 percent.

The rails hum ceaselessly 24 hours a day under million-pound locomotives, tanks, guns, gigantic castings, machinery and the thousands of other things necessary to the war effort with 7,000 fewer freight locomotives and 500,000 fewer freight cars than they used at the 1929 peak. They carry the load only because cars are packed to the safety limit and speeded to their destinations. Weight and speed are two things which punish rails.

Railroad men have increased their vigilance to cope with the situation, but there is one hazard they cannot foresee without the help of the G-men of the rails and their novel detector cars. This is the internal transverse fissure which grows into the

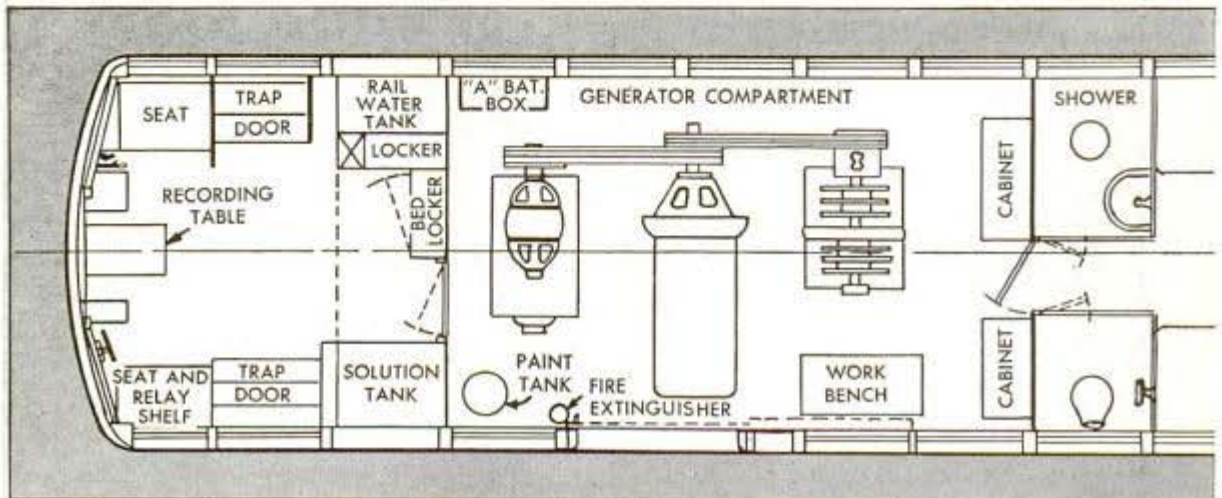
rail head, or top section, like a hidden cancer and if not discovered is capable of causing rails to rupture.

Scientifically called "sub-molecular disintegration within the steel," the transverse fissure is attributed to fatigue failure in the railhead. It appears to grow gradually, spreading outward from its center across the rail head like an invisible crack, its faces usually acquiring a high polish due to the hammering of the wheel load above. Occasionally, however, the fissure grows rapidly. At any stage in its growth, the internal transverse fissure is dangerous, able to cause a rail to rupture suddenly and break like a brittle iron casting. In nearly every case there is

nothing which visual inspection can detect until it is too late.

The late Dr. Elmer A. Sperry, who is famous as the inventor of the gyro-compass and the ship gyro-stabilizer, tackled the problem of internal rail defects and invented the detector car. A generator aboard the car introduced current into the rails by means of sets of copper brushes. Each of these brush clusters carried a searching unit consisting of a pair of electrically opposed coils mounted midway between the current brushes and directly above the railhead.

In a sound rail, current flow remained unimpeded and the flux above the rail head uniform. When a fissure was encountered, current was forced to pass around the internal break and a change in the density of the flux occurred. This variation in flux



1505 willow Ave

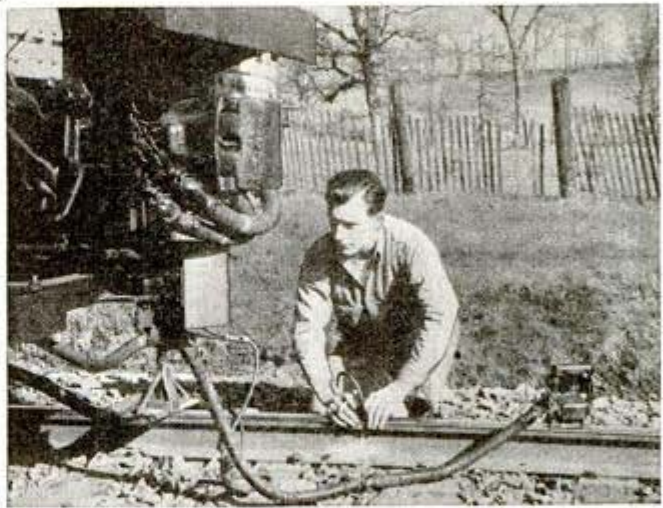
produced an electromotive force at the terminals of a sensitive "searching unit," and this force was passed into amplifiers. The output of the amplifiers was used to operate automatic pens and a paint gun beneath the car as soon as a variation occurred. A bullet of white paint was shot onto the rail at the suspected point and the pens, recording on slowly winding tape, made jogs in otherwise straight lines.

From these clues, the first G-men of the rails did a good job, but many fissures were missed because the passage of wheels over rails serves to magnetize them and the record did not always tell the truth.

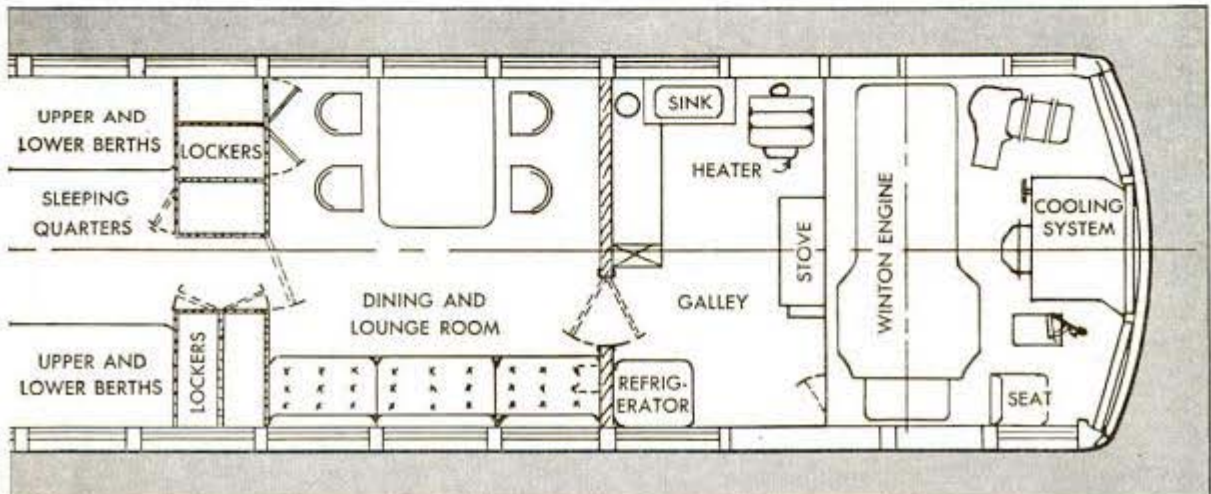
Scientists of the Sperry Rail Service in Hoboken, N. J., kept at the problem until they found that by pre-energizing the rail in advance of the brushes with current that could be controlled, the detecting equipment was more accurate. Another improvement, made by staggering the coils, caught lopsided fissures which were not growing from the center of the rail head. Another device discriminated between a rail burn—caused by setting the brakes too quickly and scuffing off the top of the rail head—and a hidden fissure. Horizontal fissures were revealed and the disclosure of vertical split heads was added to the accomplishment of the yellow detector cars and their crews.



Rail G-man points to unit under car which automatically sets off paint gun to mark defective point revealed by "searcher"



Using hand unit (above) to recheck findings registered by the recorder. Below, floor plan of the Sperry detector car where crew of four or five can work and live in comfort. It boasts stationary berths, lounge and dining room—the chef included





Building up worn rails by oxy-acetylene welding helps carry increased war load with safety and speed. Some defects are caused by continued pounding at joints where roadbeds are weak

The result is that though less than a score of these yellow cars have crept slowly over the rails of nearly 100 railroads recently, they have prevented a large number of wrecks. In 1942 alone, railways removed from their tracks nearly 90,000 defective rails located by Sperry's fleet. American railroads can boast they carry passengers about 2,000,000,000 miles safely for each one killed.

In fact, Sperry detector cars find an average of one hidden fissure in approximately every three miles of track and the railroads yank out the weakened rails. Maintenance men can heave a sigh of relief when the detector has scrutinized the tracks of their railroad.

Creeping along at a steady six miles an hour, the detector car is routed along a railroad just like a special train. It has a regular train crew supplied by the railroad. This crew includes a brakeman with his flag and torpedoes. When a stop of any consequence is made for examination of

Here are examples of internal rail defects invisible to the eye but found by the rail G-men

a suspected section of rail, the brakeman hurries back to halt any approaching train just as if he were brakeman on a string of passenger or freight cars.

The G-men of the Sperry Rail Service—there are customarily four or five to a car—are usually at their three posts doing the bulk of the operating work. One, in a tiny cabin in front, operates the electric drive which propels the car from power originating in a gasoline marine engine. Another sits at a desk watching the tape which crawls slowly downward as the car moves. A third may be stationed in the recording compartment also watching the tape and ready to leap from the back of the car to examine a spot in the rail when a jog occurs in a line made by an automatic pen on the record tape.

It is start and stop, start and stop, continuously throughout the day. Seldom a mile is traversed that a stop is not made and one or two Sperry men leap from the rear of the car to bend over a rail where the paint gun has marked it.



The brakeman hustles down the track, flag in hand ready to stop any oncoming train.

Most of the stops are for a mere minute or two, but when a dangerous section of rail is found a splotch of red paint is slapped on the spot. Later in the day, or the next day at very latest, a track maintenance crew will follow along and the red splotch spells its message of danger.

Utmost care is taken by the Sperry men not to put a danger mark on a section of good track. When doubt arises, an ingenious hand "searching unit" is used to recheck the findings registered on the tape.

In making a "hand test," a delicate meter wired in circuit with the hand searching unit reveals the exact extent of the hidden defect. Defects which cover up to 20 percent of the rail head area are classified as "small," 21 to 40 percent as "medium," 41 to 100 percent as "large."

The detector cars waste little time between dawn and dark and for that reason the cars are overstaffed so the men can take rest periods. Breakfast, lunch and supper are eaten on the compact car which has a tiny kitchen very much like that on a dining car.

They have a small library, a radio, and some have even rigged up tiny darkrooms where they experiment with photography, the constant traveling giving them opportunities for good pictures. They play cards and games and often take advantage of the nightly stops to go to a small town movie. Such diversions are helpful for detector car crews work long hours.

Aside from the nightly layovers and the halts for rail examination, cars are constantly on the move except when it is necessary to shop for food or gasoline.

Gasoline is the lifeblood of the detector car, for its motive power, as well as electricity to make the tests and to light and heat the vehicle, are provided by the gasoline engine.

A gasoline engine drives a main generator which delivers a current up to 4,500 amperes at 2 to 3 volts to the main brush carriages and an extra generator which supplies current for supplementary "pre-energizing" brush carriages.

These unsung G-men of the rails lead an unusual life, but they like it and the company had a long waiting list of applicants until the draft cut the number. They get an extra dividend in knowing they are saving lives and materials for Uncle Sam.

B.I. du Pont de Nemours & Co.
Wilmington Del
Bricks of Dehydrated Food
Save Waste Cargo Space



Comparing potato brick with dried spuds in package

By compressing dehydrated foods into bricks, the saving in cargo space ranges from 30 to 80 percent. A shoe box can hold enough potatoes for 100 men. The dehydrated material is compressed under sub-freezing temperatures which keep the fat globules of the food from breaking down under pressures from 250 to 2,500 pounds per square inch. The process was developed for possible lend-lease and army shipments. Aside from saving valuable shipping space, the compressed foods are said to keep longer because there is less opportunity for oxidation. The bricks are heat-sealed in moistureproof cellophane.

Adapter for Submachine Gun
Uses .22 Ammunition

Ammunition of only .22 caliber may be substituted for the more expensive .45 bullets for live practice with the Thompson submachine gun ("tommy gun") by use of an adapter invented by C. William Robbins of Cincinnati. It consists chiefly of a .22-caliber barrel, inserted down the larger bore of the submachine gun, and a magazine to carry the smaller caliber, long-rifle cartridges. The gun is operated the same as with its normal ammunition.

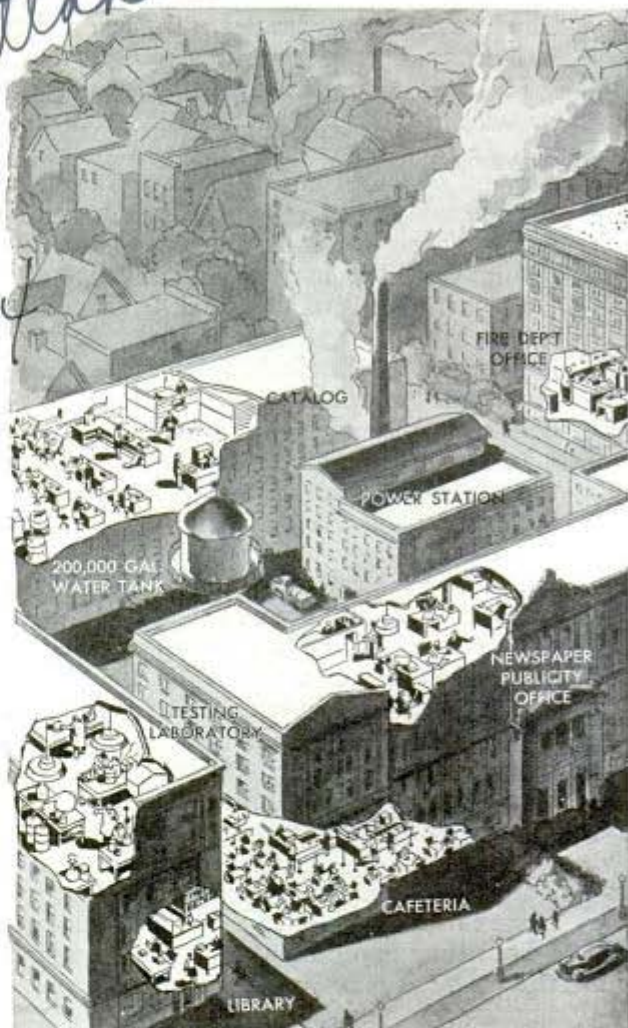
A CITY *in a* STORE

MOST hidden cities have been dead for hundreds of years. You know the kind in explorers' yarns that begin: "I stumbled over a stone, pulled back the lush growth of jungle vines and there before us just as the Aztecs left it was the hidden city."

Four miles west of Chicago's Loop is a different type of hidden city. It's a bustling place confined within four blocks. Brick walls instead of jungle vines hide it from the "explorers'" eyes. Life within this city reaches into every county in every state in the nation. It is the home office and Chicago mail order division of Sears, Roebuck & Co.

Many stories have been written about this gargantuan mail order house, its catalogue, its testing laboratories and the farflung operations of the company's branches. But the story of the self-sustaining "city" within the home plant has never been told.

This city makes its own electricity and pumps water from its private well. (The



"population" of 9,500 requires 300 gallons of water every minute.) It has its own fire department, watchmen and traffic cops, post office and telephone system. It boasts a hospital, bank, newspaper, service station, park, subway, private bus, retail store and restaurants.

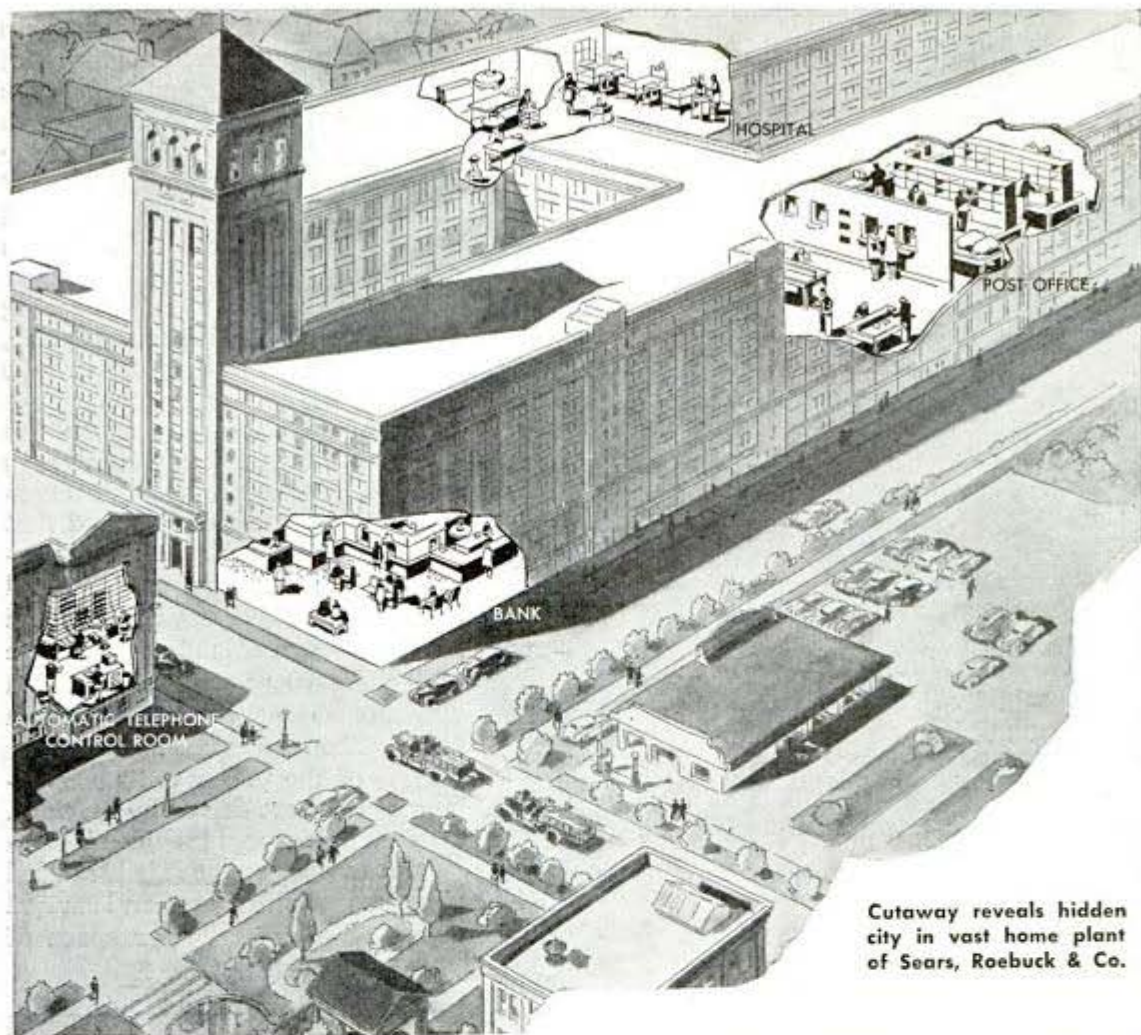
If a rubberneck sight-seeing tour were conducted through the city, the first stop might be at the fire department on the second floor of the big merchandising building.

"We've got everything here but the fire engine," explains Fire Marshal E. J. Kamin, "and that's in a little house by itself just around the corner."

The fire department not only guards "Searsville" day and night, but its "suburbs," the retail stores

Life within "city" hums—here billers handle an avalanche of 40,000 parcels daily



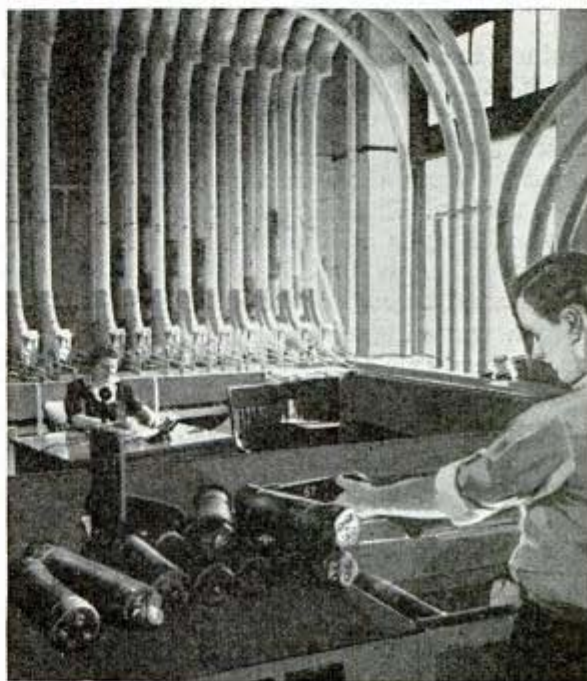


Cutaway reveals hidden city in vast home plant of Sears, Roebuck & Co.

and warehouses scattered over the city of Chicago. Once Marshal Kamin called the manager of a warehouse and asked about a fire in his basement before the manager knew of the fire. This was possible because all Chicago fire alarms are received in the marshal's office and are traced quickly with a card index system.

The office has an elaborate automatic signal system that records any disturbance in the plant's sprinkler system. If the sprinkler heads in this system were placed half a mile apart they would go around the world at the equator with 10,000 to spare. In the plant they are placed eight feet apart. Several hundred alarm boxes are located in the buildings and 10 men are constantly on patrol. There are 21 volunteer employee fire companies. The members are trained with great care and each is instructed to perform a specific duty at the sound of an alarm.

Nerve center of "city"—central station of pneumatic tube system speeds carriers through miles of tubes





Testing hot water heater (in background) in Sears laboratory

Aside from the fire engine and hundreds of feet of hose, the protective equipment includes more than a thousand extinguishers and pumps.

"We're prepared for everything including failure of two sources of water supply," says Mr. Kamin. "If our own supply and the city supply fail us, we have three reserve tanks that hold 190,000 gallons and a secondary surge tank of 250,000 gallons.

In case of an air raid, men are trained to man 13 special watch posts, including roof stations. Each post is connected with the marshal's office by "blackout" telephones separate from the company's private system. The blackout phones have red bulbs on the base which light up when the bell rings. Alarms are located throughout the plant to give a wavering note for warning and a steady ring for "all clear."

The marshal, who recently celebrated his 37th anniversary with the company, modestly points out that the largest fire loss has been less than \$2,000.

Near the fire marshal's office is the "police station" located con-

Wrapper pulls a cord to release packages sorted in "crow's nest" above the chute

veniently near the thriving Sears Community State Bank. Uniformed policemen, who serve primarily as traffic cops, keep such a wary eye on the bank that no bandit has ever been tempted to "do business" there. Incidentally, the bank is used by nearby residents as well as Sears employees.

The next stop in the sight-seeing tour is the powerhouse. Its size, nearly half a block long, never fails to amaze visiting engineers.

"Here's where we produce the heat, light, power and water," says Edward Buhrmester, chief engineer, with a wave of his hand that takes in six whirring power generating units, air compressors and pumps. "Until 1938 we generated all of our own electric power. We still make 60 percent of it which amounts to more than a million kilowatt hours a month."

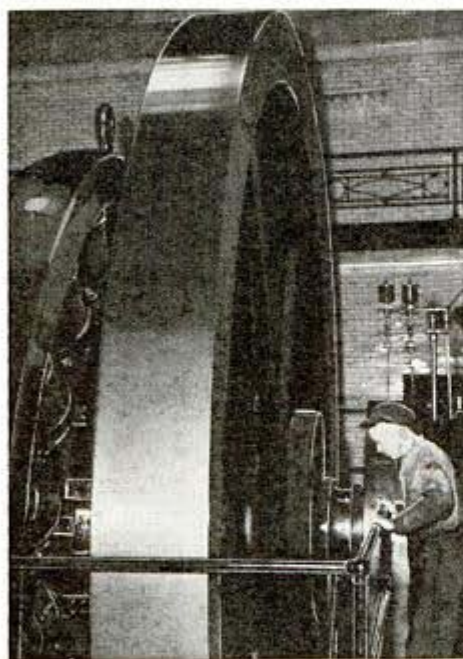
Four of the power units are engine driven and two are driven by turbines. Steam for the engines and turbines is considered "free" in winter, for it is also used to heat the two main buildings and several smaller ones with a total floor space of about 4,000,000 square feet.



Water is pumped by air pressure from a well 1,870 feet below. The well was drilled in 1905 when the company, then 19 years old, moved to its present site.

"In those days there was just prairie and marsh land around here and no utilities to speak of," says Edward J. Lempera, plant engineer. "They had quite a time drilling the well. In one place they hit a crevice 100 feet deep, probably an underground river. The water is fine for drinking. Its mineral content, however, is too high for our boilers. We use city water in them."

The air compressors also supply the power for some five miles of



↑ These "blackout" phones with red bulbs on base are used by fire department to contact 13 air raid watch stations

Giant wheel of power generating unit (left) has been in use for 40 years helping supply "homemade" electricity. Six units generate enough power to serve a city of 60,000

Below, packages pour down post office chute in never ending stream—40,000 in normal day, 100,000 at peak season

pneumatic tubes in the plant. Through these tubes 3,500 carriers make 96,000 trips a day.

Three huge pumping units operate accumulators weighing 50 tons each to supply pressure for the institution's hydraulic elevators. They maintain a static pressure of 800 pounds. Everything in the power house operates with precision, from the big turbines to the electric eye in the chimney that warns of smoke density.

The hidden city tour winds

(Continued to page 154)



*Intl News Photos, 32c
W. Modison, Chicago
War Writer Wears Lamp
With Mosquito Net*
M 1172

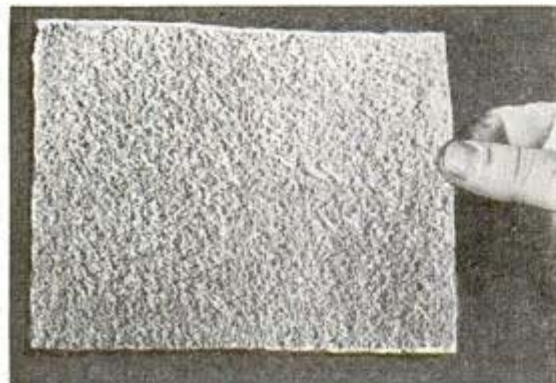


Correspondent protected from insects taps out story

War correspondents at the front face plenty of annoyances as well as dangers. One writer in Liberia fought off voracious insects by wearing a miner's lamp to illuminate his typewriter while protecting his face with netting. The lamp kept his hands hidden in the dark as he turned out his story of the landing operations of an American army engineer task force.

Scouring Pad of Plastic and Cloth Cleans Pots and Pans

To take the place of metal scouring pads, such as steel wool, which are made scarce by the war, an effective substitute in the

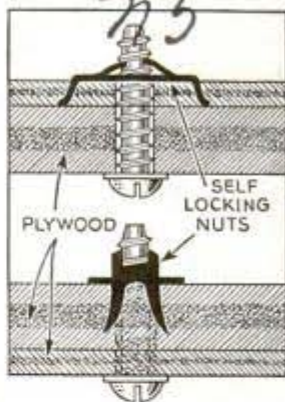


This pinch hitter for steel wool is easy on hands

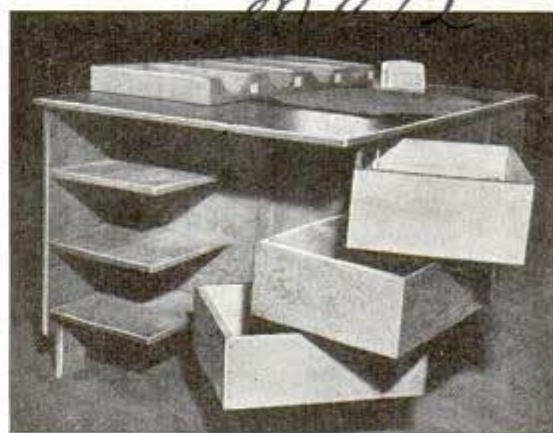
*Timmerman Budshue
20387 Utton Rd
form of cloth impregnated with plastic particles is offered housewives for keeping pots and pans clean. Easy on the hands, the plasticized cloth is said to remove dirt and grease without excessive rubbing.*
Cleveland O

Self-Locking Nut for Plywood Anchors Screw by Tension

Two pairs of attaching legs that spread when driven into plywood hold a new self-locking nut permanently over the end of a screw. When driven into thin plywood, the Speed Nut flattens against a backing plate, and when driven into thick plywood the legs spread, holding the nut with a spring-tension grip.



Wooden Desk Stripped of Steel Used by Army Air Corps



Army's all-wood desk features swivel-type drawers

Many tons of steel and other vital war materials are saved for military purposes by the army's judicious use of substitutes. An ultra-plain desk made entirely of wood, in use at a new combat crew school in Texas, affords a striking example. There are no steel locks, hinges or drawer pulls. Its swivel-type drawers save even wood which would be needed to box in the ordinary sliding style.

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

44 *Dawny Products Co
Central Ave, Orange, N.C.*

Acme POPULAR MECHANICS

4661-8 av, NYC

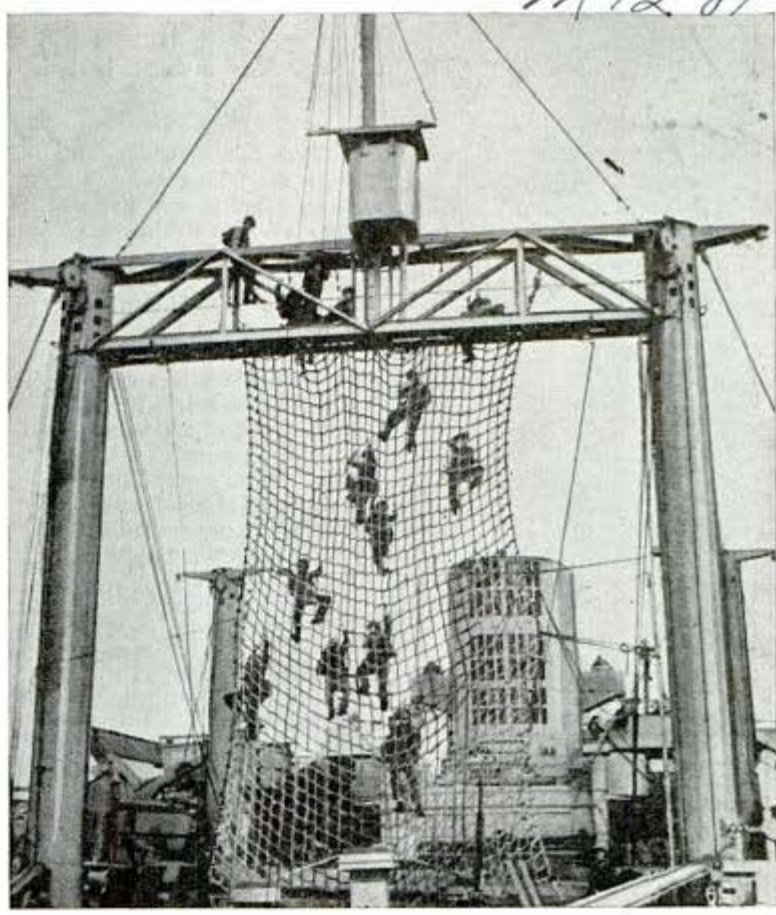
*Tanned & dried
at 100° F*

*Acme new pictures, 461 - 8 av
nyc*

Commandos Practice on Net for Barge Landing

M 12 01

There is no rest for U. S. fighting men training for Commando tactics, even when they are at sea. They find the ship an ideal locale to practice some of the maneuvers embraced in making landings on enemy-held beaches. Using a net suspended from a boom, the men develop skill and agility in transferring from a ship into barges. In these exercises they carry all the equipment they would normally require in an actual landing.

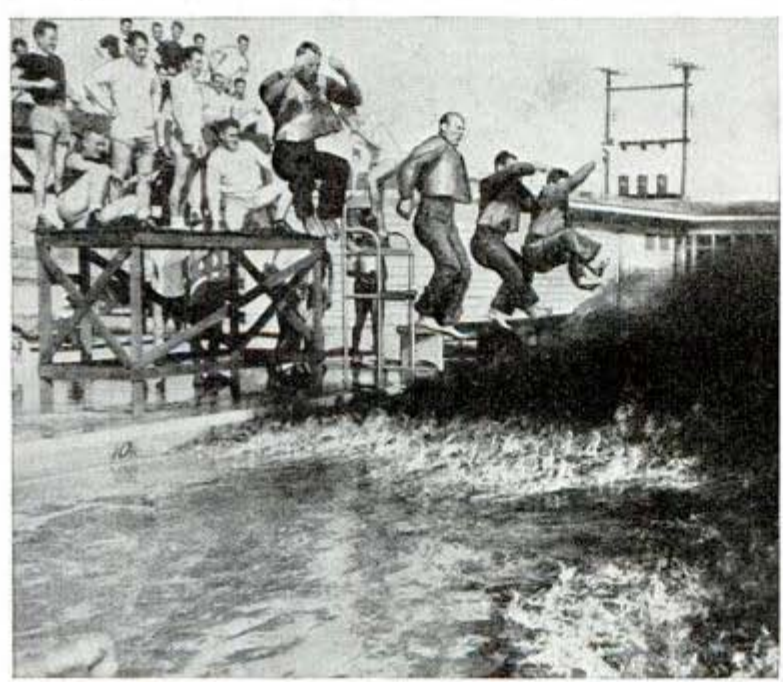


While at sea, U. S. Commandos keep in trim for difficult barge landings by working out on huge net fastened to a boom. Similar nets are used for transfer to barges

Leap Into Blazing Swimming Pool Trains Men to Quit Ship

*M 1175
Acme*

Jumping into a swimming pool covered with flaming oil, navy officers teach cadets the art of "hitting the sea" when the surface is similarly ablaze with fuel oil. The idea is to get under quickly when the order is given to abandon ship and stay there until you can swim beyond the danger area. One vital rule is to keep the lifebelt deflated so the swimmer will not bob up too soon.



Cadets learn how to jump into sea when it is covered with burning oil

☐ America's record snow mantle, over 73 feet deep, was measured in 1906 at Tamarack, Calif., and 60 inches fell in one day at Giant Forest, Calif.

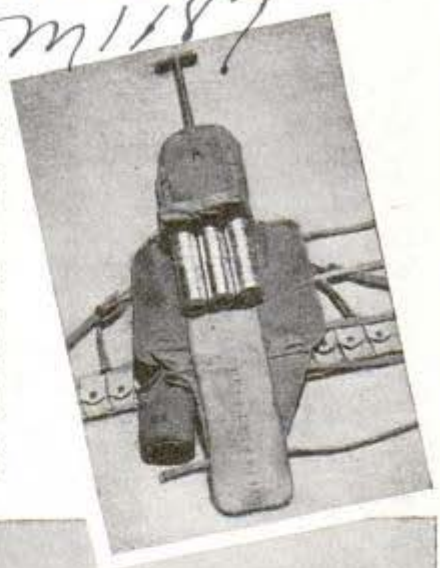
MAY, 1943 *staged at US Naval Air Training Center, Corpus Christi, Tex* 45

*A. D. Pitney
7651 N
Chicago*

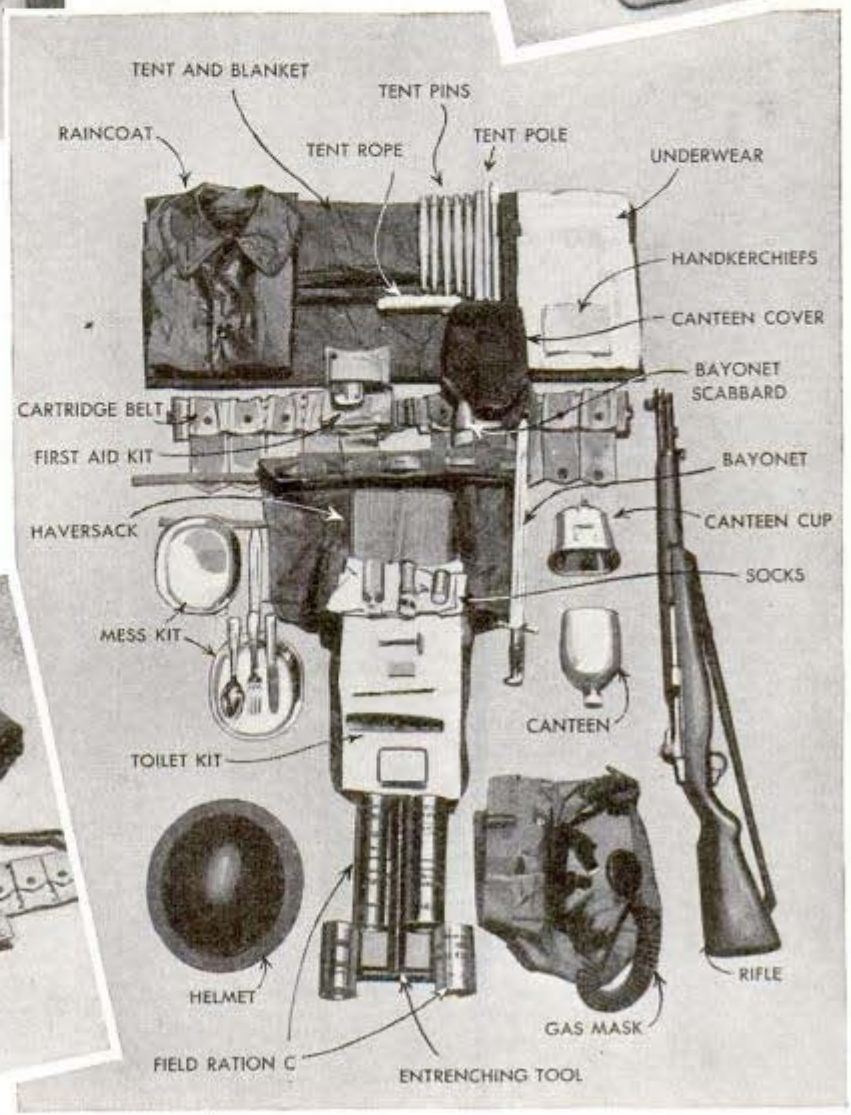
PACK UP YOUR TROUBLES—



Soldiers in the field must carry everything needed to fight and to live. Packs are models of compact efficiency, and include clothing, food, toilet articles, mess and first aid kits, entrenching tool and ammunition, all stowed so as to be available in the order they'll most likely be needed. Right, first step in assembling a pack for soldier. Officer's pack (left) lacks blanket and overcoat, which are carried for him by truck when possible



Infantry packs in winter, including arms and equipment, may weigh 75 pounds and layout at right shows why. Fully assembled, as below, canteen hangs beside gas mask on left hip, first aid packet on right hip. Entrenching tool is slung outside where twist of strap will free it in emergencies. Mess kit is in separate pouch, and the overcoat, top, is secured by tent rope. Summer pack weighs roughly 50 pounds



Capt. A. S. K. Bourne, Insp. H. G. Palmer, 1st Lt. M. J. E. Chick

Sgt. C. L. Hamm

805th
A.S.
Bn.



Regular inspection of packs, as shown above, is usually held on Saturday morning, but may be at any time, consequently all equipment must be kept constantly in order. Each man's pack contains half a shelter tent; the erected tent is shown here. Compressed rations in cans, carried when on duty in the field, will sustain a soldier for several days. Gas mask, canteen and first aid kit are carried by all officers and men. Special packs in addition are also used for special tasks. U. S. Army Signal Corps photos

Privates with full packs in picture above are shown in simulated action against an enemy. Note that though packs are bulky, they are slung to allow the men freedom to bring rifles to bear on the target

Stripped down for action and carrying new type of combat packs (right) soldiers are not burdened with tent and bedding rolls nor overcoats. Above blade of the entrenching tool is the mess kit



New "Mustangs" Roll on Wood To Save Tires Until Flight



Fighter plane's wooden wheel saves rubber during ground tests

When new P-51 "Mustang" fighter planes come off the production lines of North American Aviation Corp., they are equipped with wooden wheels to conserve precious rubber until actual flight tests, when the conventional rubber-tired wheel is installed. With the "peg-leg" installation, the craft can be wheeled about and adjusted during ground tests without waste of rubber. Factory humorists label the wooden wheels with an ironic, "Do not inflate."

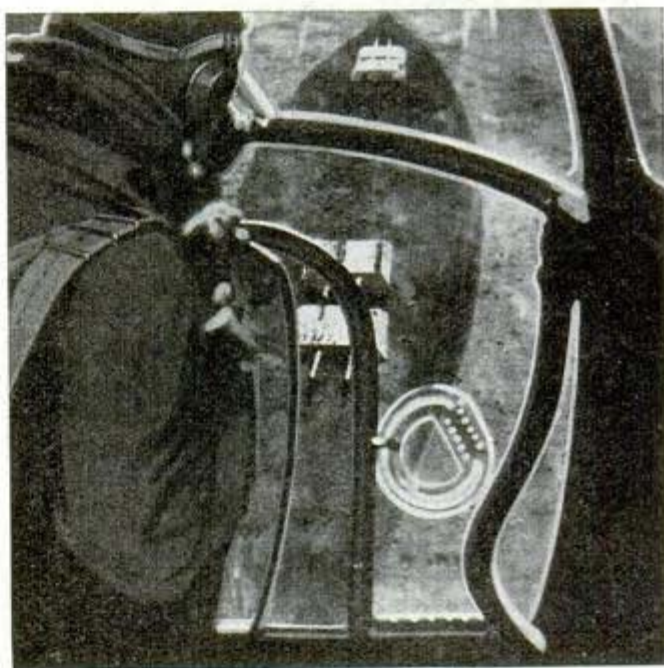
Tenth of Oil Saved at Night By Lowering Thermostat

Setting back the thermostat 6 to 10 degrees at night may save home owners about a tenth of their fuel oil, tests showed at the University of Illinois Research Home. A setback of 6 to 10 degrees was con-

sidered the practical limit, except in most severe climates. Normal temperature reading in the research home daytimes was 72 degrees. From 10 p.m. to 5:30 a.m. the thermostat was set back to 66 degrees. Except for the morning warming-up period, reduced night temperature had no effect on the household temperature during the day. The heating system tested operated with flow control valve and low-limit aquastat, maintaining a minimum boiler water temperature of 165 degrees Fahrenheit. Operated without the flow control valve and aquastat, only a slight saving of fuel was effected.

Nazi Battleship on Plains Is Target for Bombers

"Afloat" near a Texas army air field is a replica of the powerful Nazi battleship Von Tirpitz, tantalizing target for student bombardiers. Sight of the deck outlined on the ground and the fake gun turrets gives incentive to training flights, and when a student lands one "on the button" he gets a preview of the thrill of pounding a real enemy target.



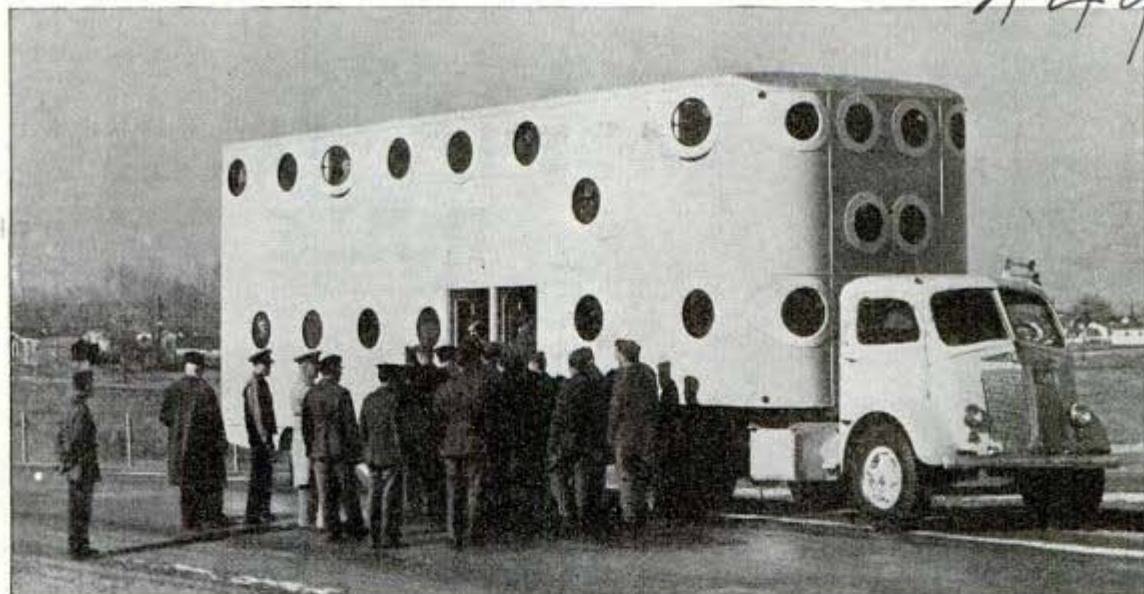
Bombs away! Bombardier student gets a thrill when he lands one on this Texas model of the Nazi battleship Von Tirpitz

I'll new photos 3264 machine
Chicago
eye work on

midland

Built by Simpette Bros, E 40th Av. & York Denver, Colo.
Bus Packs in 260 Soldiers 'for World's Record

749



Porthole windows give nautical air to this bus which hauls soldiers from gate to barracks at Camp Carson

An ingenious arrangement of seats and aisles on different levels in a two-decker army bus provides a record capacity of 260 persons. The bus of trailer-tractor design can carry a load equivalent to that of 52 five-passenger automobiles. It was designed by Dean Gillespie, Denver engineer, to transport soldiers through sprawling Camp Carson, near Colorado Springs. The lower deck has a wide aisle down the center with seats at the side, and the second

deck has seats on a raised center "island." The aisle on the second deck circles the seating platform and is 14 inches lower, providing headroom of about six feet eight inches for standees. There are seats for 100 persons. The bus, which is built mostly of non-strategic materials, is 10 feet wide, 15 feet high and 45 feet long. Its "cruising speed" is about 40 miles an hour but it can go much faster and is said to be stable at any speed.

Torpedo Warbird Folds Wings to Fit Berth on Carrier

Among the deadliest of aerial enemies faced by surface vessels, the Grumman

TBF Avenger—torpedo bomber—can be stored quickly upon return to the carrier

741174

since it takes only a few seconds for the plane to fold its wings by hydraulic power. To prepare for a bombing mission the bay at the bottom of the warbird's fuselage opens to receive a 1,950-pound torpedo, which it drops at low altitude. In an attack, the planes "box" their target so the ship will be hit no matter which way she may turn.

*acme
461
800
2742*



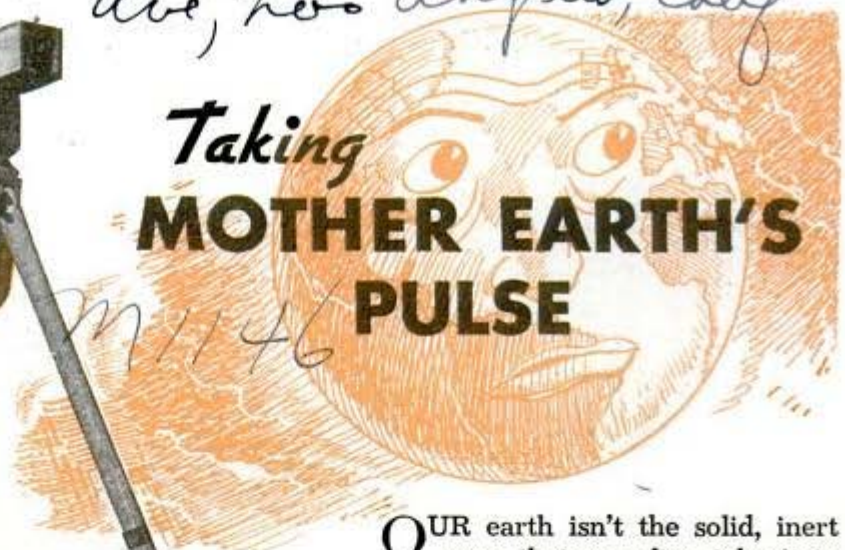
This carrier-based torpedo bomber can fold its wings to fit tight quarters. The "egg" in its bomb bay weighs a ton

Thos. E. Stinson, 38727 ranklin Ave, Los Angeles, Calif

Ref: Dr Bus Gutenberg, Calif Inst of Technology, Pasadena Cal



Taking MOTHER EARTH'S PULSE



OUR earth isn't the solid, inert mass that we often take it to be. A model of our planet would need to be made of some jellylike substance that would respond to the slightest vibration, for earthquake recording instruments show that the earth's surface is never at rest. A constant trembling runs through it. It is so jellylike, in fact, that the vibrations caused by heavy surf pounding on the shores of the Alaskan peninsula are recorded as far away as southern California by delicate seismographs.

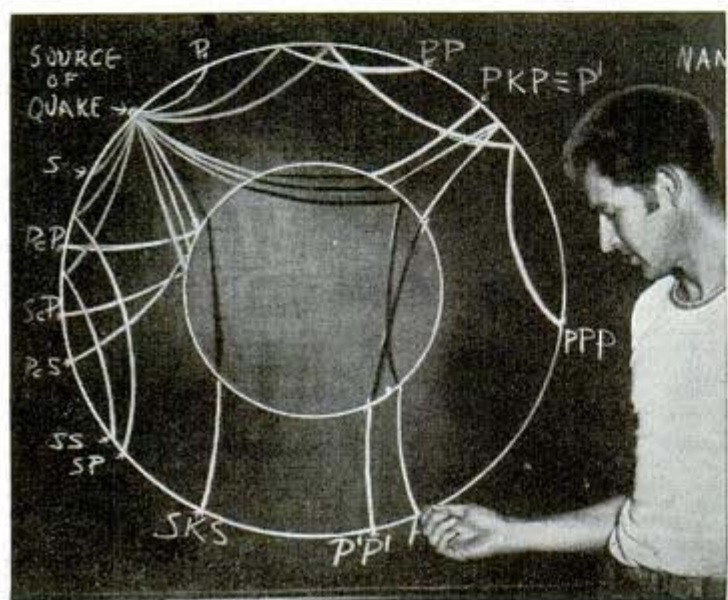
Tides run through the crust twice a day and the ground bends and shakes under the impact of windstorms. The ground is slowly rising in some places and is sinking in others. Not even the mountains are securely anchored. Mountain ranges are now recognized as great masses of rock that float like icebergs.

Geologists know that the northern coasts of our continent are rising at a very slow rate. They also have measured the rate, up to three feet per century, at which the region north of the Great Lakes is rising due to the retreat of the polar ice cap.

Not so well known is that many local areas are also in motion. Some time ago a surveying party in Los Angeles was perplexed to find that its elevations didn't agree with the heights on existing monu-

Not a doctor and stethoscope, but a surveyor operating a light beam over "target" to aid a distant surveying party

Diagram shows tremors recorded by seismograph after quake



ments. When Dr. U. S. Grant of the University of California at Los Angeles co-related these latest measurements with the older records he found that one populated neighborhood is sinking at the rate of half an inch per year. A few miles away are other areas that are also sinking, and in other spots the land is rising. Over long periods of time these changes add up, differences as great as five feet having been measured in the Santa Clara Valley south of San Francisco.

If the ground itself is shifting under our feet, what can the engineers use as a permanent base from which to measure these changes? The most stable mark they have is an imaginary surface that can be ascertained only by mathematics.

Mean sea level is the most permanent datum line that can be found. This is the theoretical level that would be assumed by the oceans if there were no tides, no other influences of astronomical

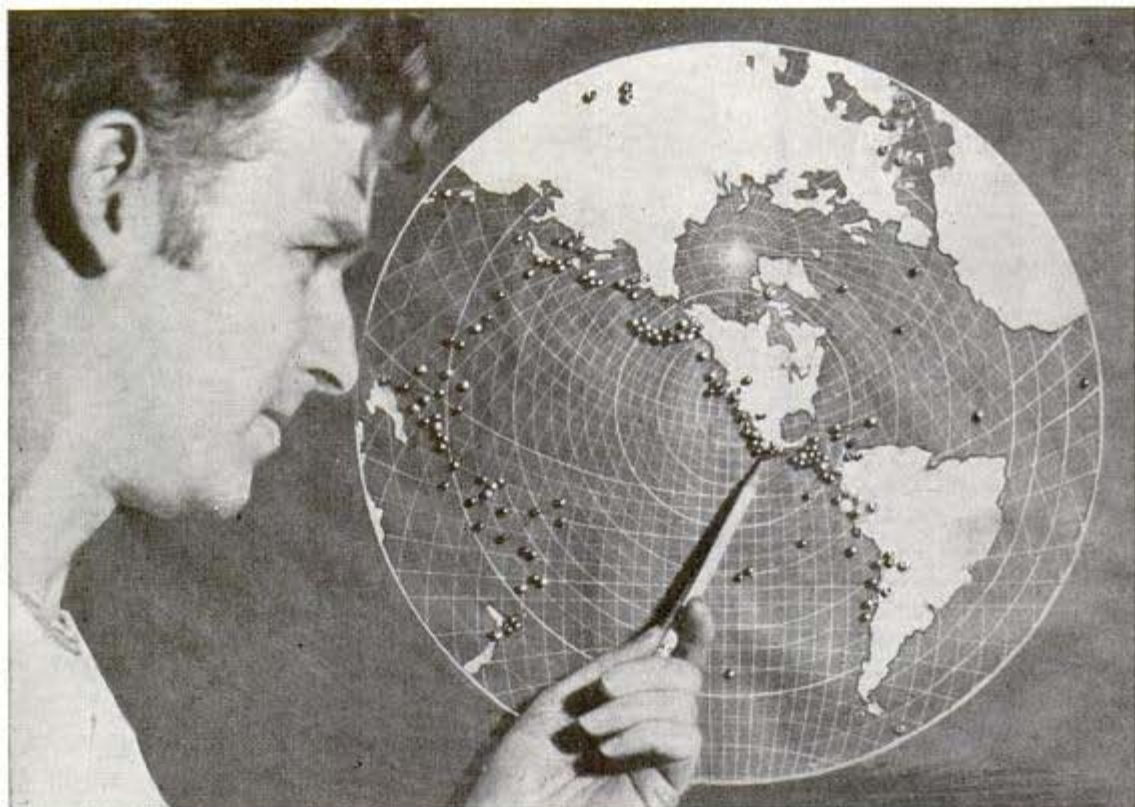


↑ Surveyors making readings simultaneously on theodolite to reduce errors

Right, delicate instrument set under shelter to protect it from heat of sun

Unwinding metal measuring tape (below) which has a scale for gauging tension





bodies, and no winds or currents. Even this reference point is rising about four inches per century. All measurements of elevation on earth are tied to it.

Most populated parts of the United States are surveyed with extreme care and when a re-survey is made, shiftings of the ground are often encountered. In setting up a network of survey marks the engineers like to measure their angles at night when the temperature and atmosphere are most stable. In the daytime they set up their instruments in hooded shelters that give protection from the sun's heat.

Distances are measured with steel and nickel alloy tapes that are less affected by temperature changes than are most other metals. Even so, a thermometer is tied to the tape so that exact heat expansion corrections may be made. The tape is always stretched to the same measured tension. These precautions result in errors of less than one millimeter in a mile and a half.

Some of the earth movements seem to be caused by man, while others are due to natural causes. When man builds a town he often unavoidably dries out the ground below it causing a local subsidence. He pumps water from the underground gravels and at the same time prevents the streams from replenishing the gravels by

Pins on map show the location of recent major earthquakes. Note how they follow rim of Pacific basin

Inspecting vacuum chamber that looks like a periscope on a sub, but houses a large accurate clock



Cutaway model of earth showing interior zones—liquid core is 1,800 miles down

installing storm drains. The underground hydrostatic pressure is reduced and the earth consolidates itself.

Similar reductions in hydrostatic pressure also account for subsidences at many oil fields. Removing petroleum and gas from the seep sands allows the ground to sink. Signal Hill oil field in California subsided half a foot in five years. The Goose Creek oil field in Texas sank 3¼ feet in a somewhat longer time. Eventually, such areas may rise again, halfway back to their original elevations, after ground waters seep into the depleted sands.

But most earth movements are natural. Geologists believe that the earth was a liquid mass when it was first formed and that it acquired a crust upon cooling. This crust probably was broken up time after time before it became stable. The earth's core, which begins at a depth of 1,800 miles, is



Radio speaker diaphragm in plywood box serves as a unique barometer which revealed storms shake earth



still at a temperature above 2,000 degrees Centigrade, and is liquid. The earth is still cooling off slowly, most geologists believe, although not all parts of the sphere are radiating heat at the same rate. These conditions lead to the thought that there are slow movements in the form of convection currents in the plastic interior. These currents, plus old inequalities in the crust itself, cause slight movements in the surface layers. When one of these adjustments occurs suddenly, we experience an earthquake. Other adjustments known as plastic flow occur slowly, but in the long run may change surface contours more than an earthquake.

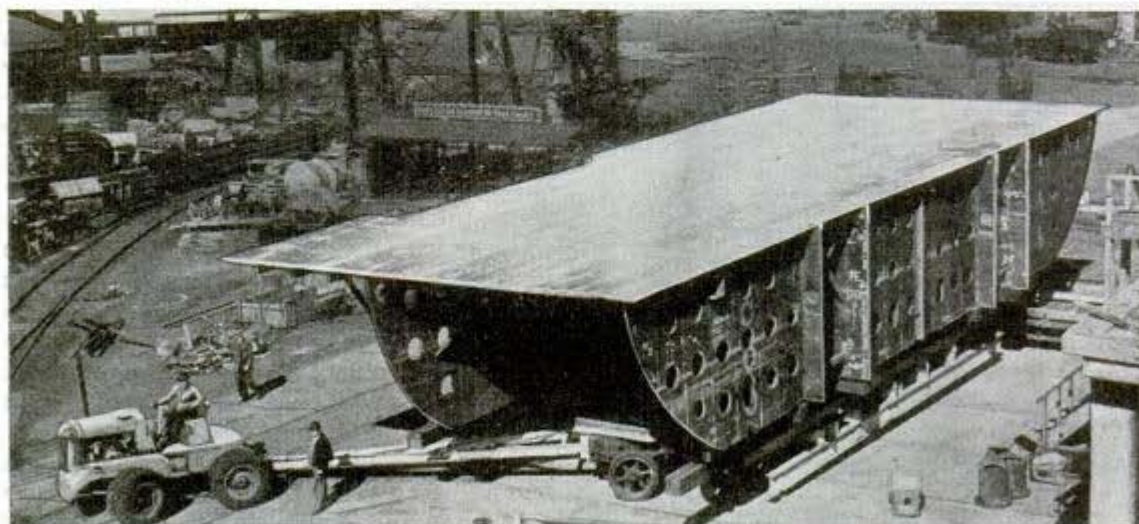
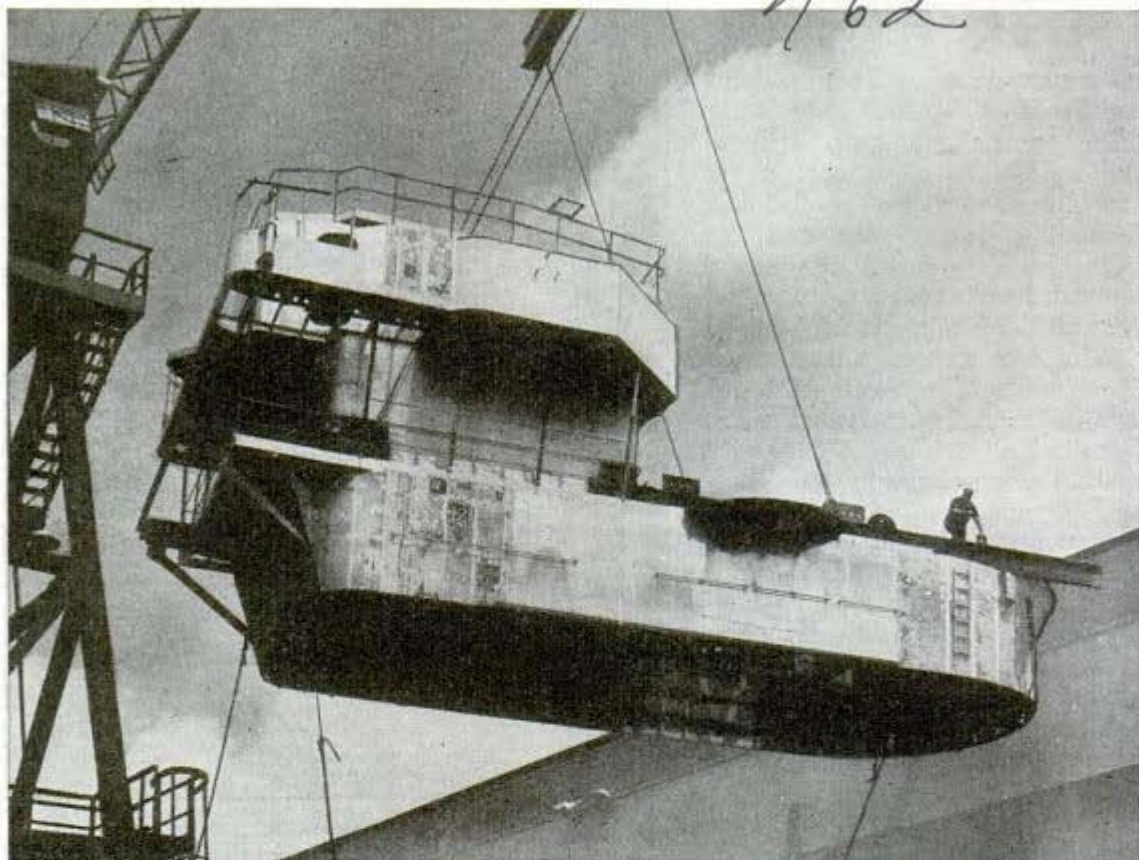
Seismological laboratories such as the one maintained by the California Institute of Technology are not devoted to a study of earthquakes alone. Scientists use the earthquakes to tell them more about the earth itself. Some 20,000 earthquakes potentially strong enough to be felt occur every week somewhere on earth, with two of destructive intensity.

Dr. Beno Gutenberg of Caltech's seismic staff used a group of convenient earthquakes recently to confirm the theory that

(Continued to page 160)

Destroyers Welded of 42-Ton Building Blocks

762



Cranes and tractors handle prefabricated sections of escort vessels as a child would assemble a mechanical toy

When a tenth of an acre of steel, weighing as much as five four-room bungalows, is trundled across the grounds of the Federal Shipbuilding and Dry Dock Company at Kearny, N. J., it gets the right-of-way it deserves, because it's part of one of the speedy escort vessels that Uncle Sam has given top priority rating in the battle of

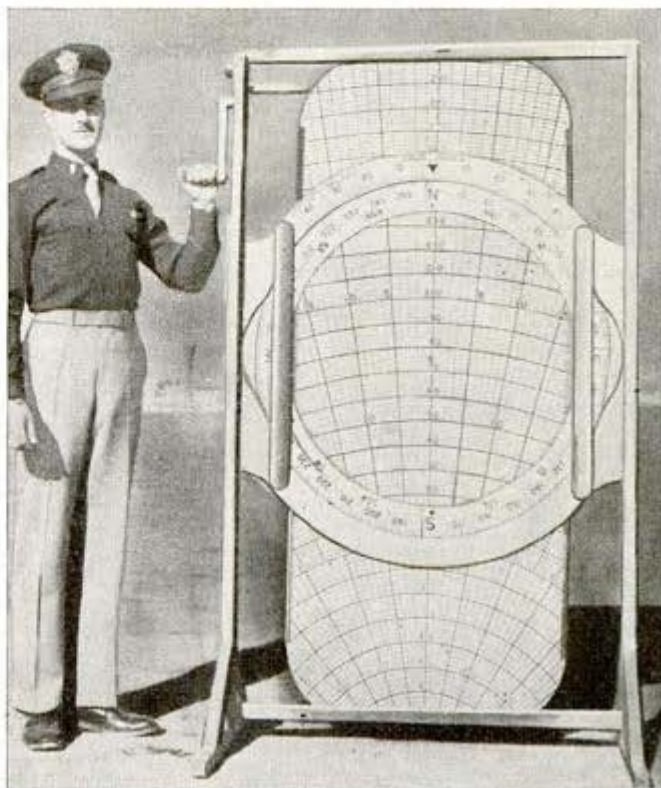
the convoy lines. Hulking sections of destroyers, prefabricated and "sewn" together by welders, are cradled on a 16-wheel trailer and hauled by tractor to the shipway for final assembly. The technique of prefabrication is expected to enable American shipyard workers to meet the goal of 50 percent more ship production

in 1943—a year that began with the yards turning out ships at the rate of four a day. “Building blocks” of steel, weighing together up to half-a-million pounds, are swung into place on the shipways by mammoth cranes in this dry-land race against the U-boat packs. A chunk of metal as big as a tennis court, swinging overhead, may be part of the hull; another the size and shape of a tug-boat is the deckhouse, from which one day a Yankee officer may direct a convoy to Yokohama. Ton for ton, eight times as many man-hours of direct labor go into a destroyer as are required to turn out a cargo ship.

Model Subchaser Deck Trains Sailors Ashore

Sailing, sailing, with never the feel of salt spray in their faces, students at a Navy submarine chaser school train on the dry deck of a “ship ashore,” a model laid out in precise detail on the floor of one of their buildings. The student sailors may not need sou’westers, but they do learn the location of the subchaser’s gear, so that they are on familiar footing when they finally sail against the submarine wolf-packs.

Giant Dead-Reckoning Computer “Blown Up” for Flier School

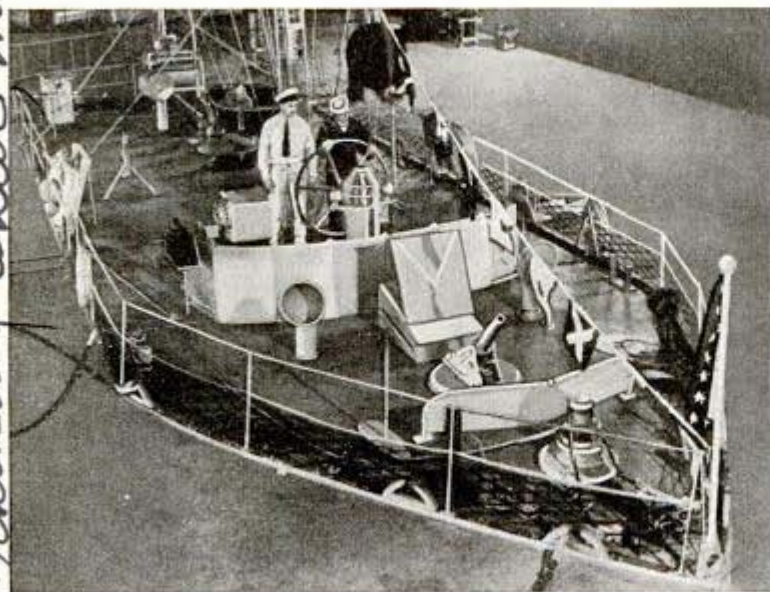


Original of this giant computer would fit in designer's hand

Almost matching his six-foot height is a giant enlargement of an aerial dead-reckoning computer designed by Lt. Norman N. Taylor, bombardier instructor at an Arizona air field, by which he teaches cadets its use in one-quarter the former instruction time. The normal computer fits comfortably in a man's palm. Lt. Taylor had photographs of the original computer enlarged, then further enlarged the “blown-up” picture, section by section, using his knowledge of cartography to fit the sections together with precision. The computer is used mainly to tabulate a plane's true course against wind drift or velocity or other weather factors, though it may also serve as an “adding machine” or compass calculator. Complete mastery of the use of the computer is invaluable for bombardiers.

at U.S. Navy's submarine chaser training center in Miami, Fla.

Williams Field



Sailors to man subchaser learn deck routine on model laid out on floor

Allen Warren Elliott, 7 Park St
nyc

"CAT CRACKERS" --

M 1190

MOST military experts, who think largely of weapons, manpower, tactics and logistics, are beginning to realize that since the road to victory is likely to be largely through the air, their plans for success depend on such a commonplace article as gasoline.

They are thanking their stars for the foresight and research of the oil companies that gave our airplanes 100 octane gasoline in quantity production in the nick of time. They are pulling for these oil companies to increase the output of this miracle gasoline fast enough to keep pace with the building of planes which will smother the axis with air-borne bombs, troops, supplies and equipment.

Right now the oil companies are racing against the clock, 24 hours a day, setting up new type fluid catalytic cracking plants to turn out huge quantities of 100-octane gas.

The enemy might be able to build as good planes, but probably not as many; if they did, it is unlikely they could match American production of 100-octane gas to keep a comparable air fleet in action. Our growing superiority in the air, therefore, is likely to be cinched forever by these gasoline cracking plants sprouting up over the United States.

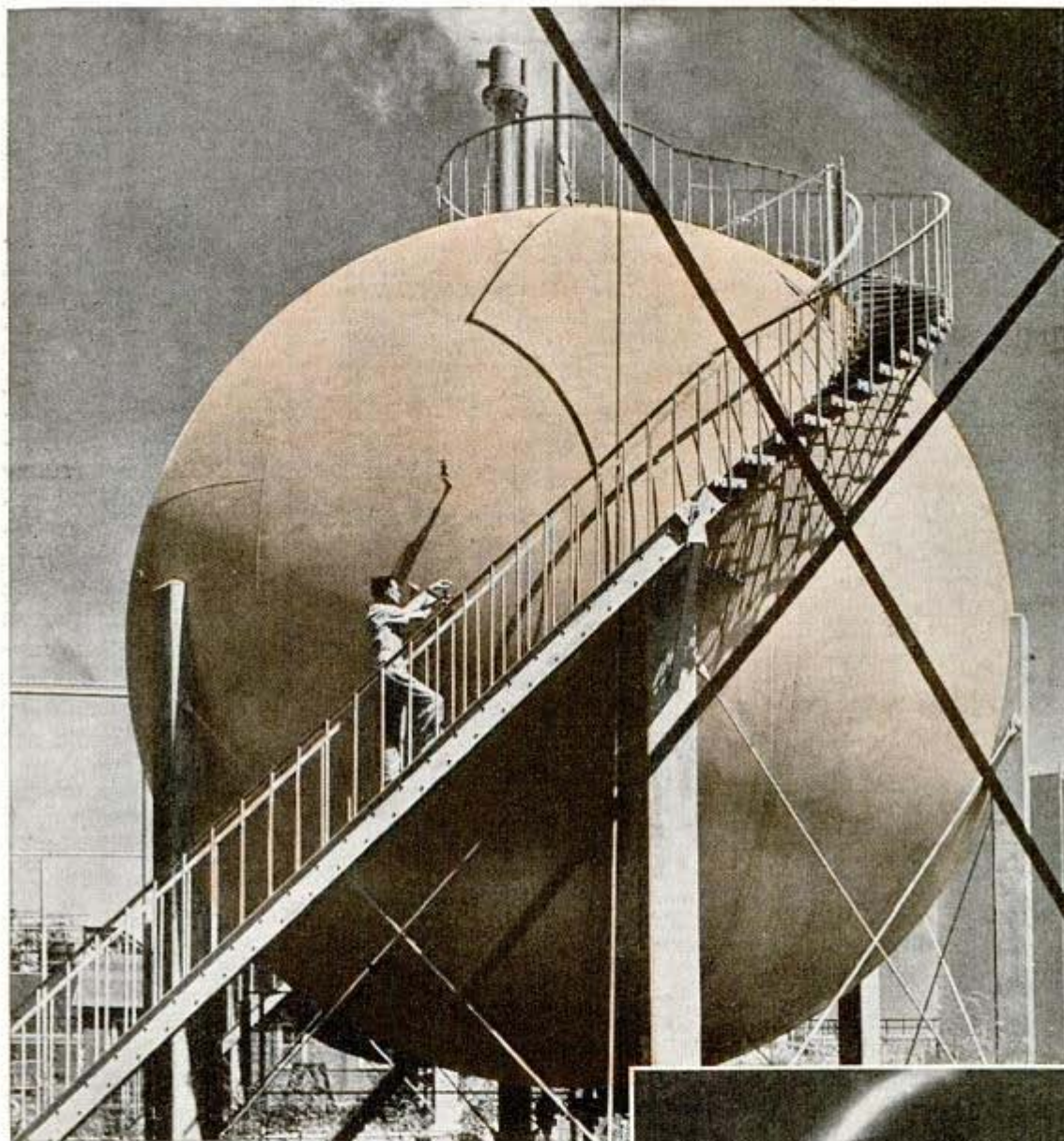
The difference between 87-octane gasoline, until recently the best available, and 100-octane in aerial warfare may be the difference between life and death. With 100-octane gasoline instead of 87, an engine will use 20 percent less gasoline. Apply this to a modern bomber with four engines each developing 1,500 horsepower. Bombing a target 1,000 miles away, this plane can carry five additional 1,000-pound bombs; 5,000 additional pounds



Top, a worker turns valve controlling flow of crude oil at new catalytic cracking plant which has few moving parts, machines or wheels in motion. Below, pipe lines leading to "cat cracker" Standard Oil of New Jersey photos



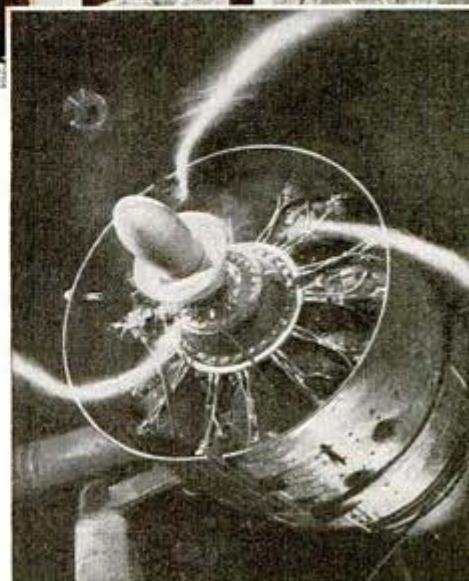
NEMESIS *of the* AXIS



Highly volatile products to be mixed in final steps of 100-octane gasoline manufacture are stored in huge spheres (above). Right, a new engine gets first taste of aviation gas on test block

of bombs per plane in a 1,000-bomber raid means 5,000,000 additional pounds of devastation dumped on the foe.

A plane using 100-octane gasoline instead of 87 gets a 25 percent bonus in power, which gives a pilot a chance to pick his place and time of battle, or to get away if the going gets tough. This 100-octane-powered plane can fly 300 miles farther than if it used 87 octane gasoline. It can have additional gun power or heavier armor or bulletproof gas tanks. Ferry pilots flying bombers to the four corners of the earth get there because 100-octane gives them extra miles for long





Various forms of crude oil flow through these pipe-line manifolds to refinery for cracking

to vibrate or knock. But the higher compression ratio of an internal combustion engine increases its efficiency, so the problem was to get efficiency without detonation.

General Motors scientists first found engine knock was primarily a fuel rather than a mechanical problem. They discovered tetraethyl lead, an anti-knock solution. Standard Oil Com-

pany of New Jersey scientists learned how to make this anti-knock agent in commercial quantities, and a new era in fuels arrived. But tetraethyl lead is peculiar in that its effectiveness decreases as the amount added to gasoline increases. Therefore, its use did not raise the practical octane number beyond 87, the highest octane gasoline used in American military airplane engines for years. It would not

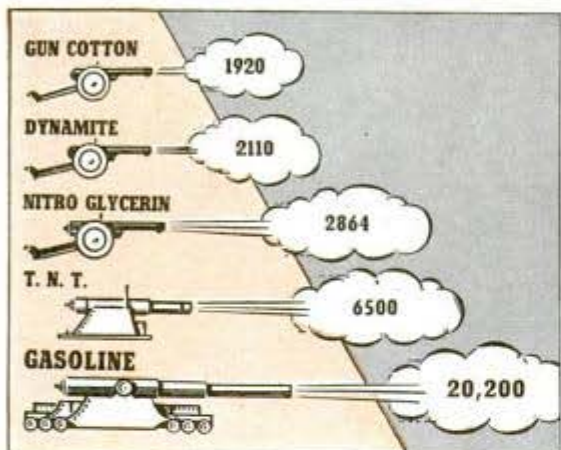
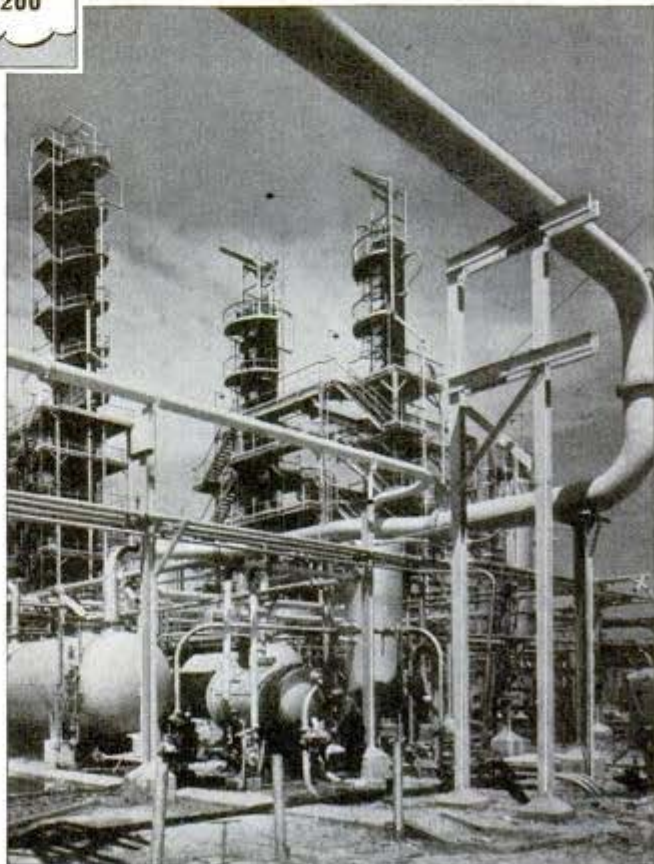


Chart shows relative energy of various explosives compared with that in a gallon of 100-octane gas. Right, plant without walls where alkylates for aviation fuel are made

over-water jumps. Cargo planes take heavy loads aloft because this super-gas permits their engines to develop the power required.

The reason for its superiority is that this fuel does much to lick detonation, the knock in an internal combustion engine. Detonation is increased by an increase of engine compression. Knocking in an automobile engine is annoying. It can destroy an airplane engine in a few seconds.

The latest explanation of detonation is that there are two explosions within 100th of a second in a cylinder, one set off by the spark plug, the other a flash back when the unburned gasoline is compressed to igniting point by expansion of gas in the first explosion. This causes the cylinder





Eight of the nine men needed to run a huge "cat" cracking plant are shown in control room above. Right, cost of a gallon of high-octane gasoline has dropped from \$20 to 15c

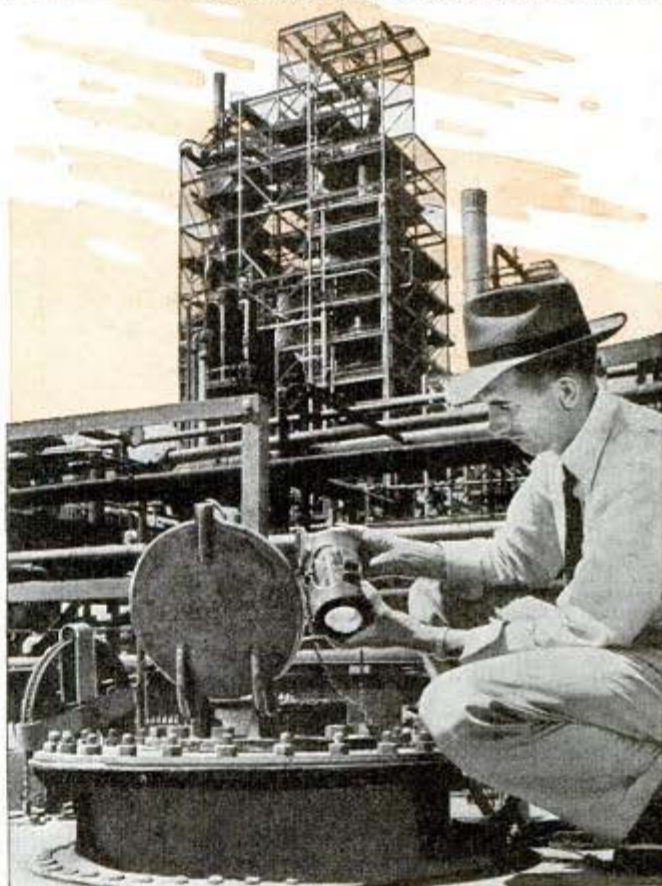
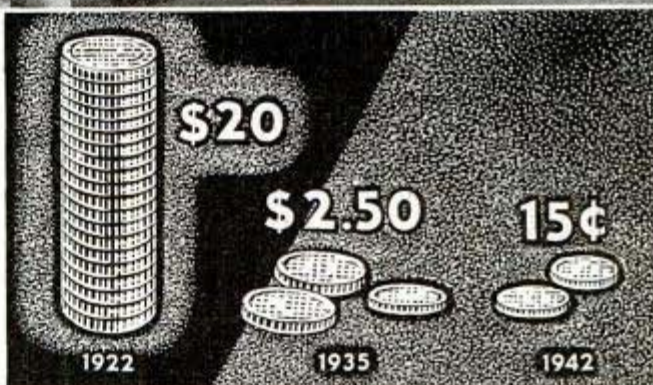
lift many of our planes off the ground, loaded as they are today.

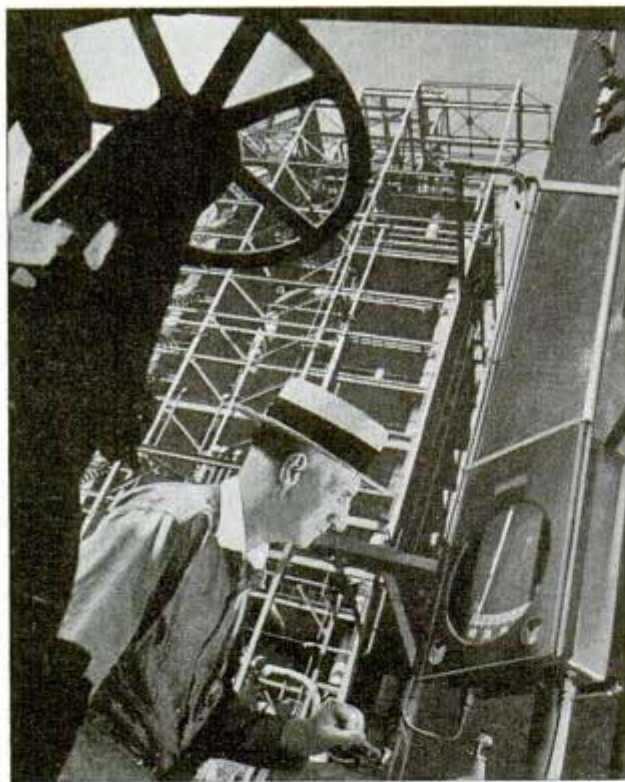
Standard Oil Company finally found the key was a chemical known as iso-octane, which knocks less than any known fuel. Iso-octane is a hydrocarbon, a bunching together of atoms of hydrogen and carbon, found in such small quantities in crude oil that its recovery usually is not justified. It was so good that the measuring scale was based on it and it set the figure 100 octane which has now been exceeded.

The oil industry couldn't extract it directly from crude. It then looked to waste refinery gases resulting from distillation of crude. It developed a way to collect from these gases a product known as isobutylene. It next rearranged the molecules of isobutylene to secure di-isobutylene. This still wasn't iso-octane; but Standard Oil in 1929 had secured from the Germans a process known as hydrogenation, by means of which hydrogen molecules are added to other molecules. So the scientists took di-isobutylene, hydrogenated it, converted di-isobutylene into iso-octane.

But the refiners found the

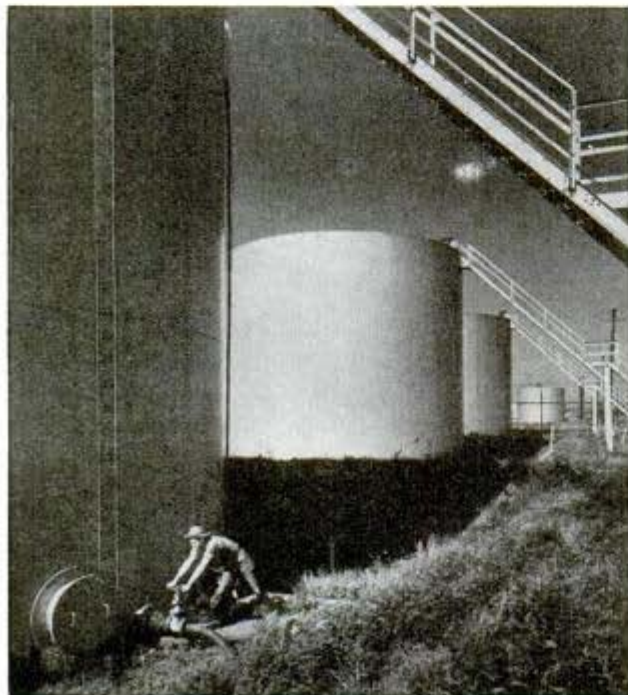
Taking a sample of the secret blending agent used in raising octane rating of stock fuel





amount of iso-octane they could produce was limited by the amount of available refinery gas. So they developed the alkylation process by means of which blending agents known as alkylates, having an octane number almost as good as iso-octane, could be manufactured without

Blending of 100-octane gasoline is often carried on in big tanks like these, at one of the new catalytic cracking plants



Hundreds of automatic controls, gauges and meters enable nine men to process millions of pounds of petroleum daily in this one plant

going through the hydrogenation process.

Actually an alkylate is a mixture of iso-octanes, some better than the anti-knock iso-octane, some worse. But again, the amount contained in refinery gases was not sufficient. It became necessary to make directly the gases from which they are produced. The art of doing this has advanced miraculously and it is really through the development of this science that we are today producing high octane aviation gasolines in vast quantities.

One process is known as fluid catalytic cracking, the very ultimate in petroleum refining. Basically, it is a method by which oil is cracked into molecules which are rearranged into many products. The catalyst hastens, controls or brings about chemical reactions.

Into these refining units thousands of barrels of oil are fed daily. This oil is broken down chemically into many products, through cracking controlled by that chemical phenomenon known as catalysis. Not only are the raw materials for alkylates made in these units but, at the same time, they produce aviation gasoline base stocks. Despite the huge scale on which these operations are carried on, a fluid catalytic cracker is operated by only nine men—and they are present rather to be available in emergency than for practical operating necessity. Millions of pounds of petroleum are processed daily in one of these plants.

These units are masses of steel pipes, reactor chambers, valves, gauges, meters and coils. Their operation is unspectacular. Oil goes in through pipes, the catalyst is fed into hoppers in carload lots, and the almost miraculous chemical changes which convert this oil into many different products takes place invisibly.

Standard Oil of New Jersey has two plants in operation, five more are under construction by this one company and, under rights granted by this company or technical information supplied by it, the industry has

Simply Demonstrator
 Box 87, Glenview Ill
Mock 'Stick' and Rudder Bar
Demonstrate Plane Control

many other catalytic cracking plants under way. Each will cost six million dollars. When all are in operation they will have a total daily capacity of many hundreds of thousands of barrels of crude oil.

These "cat crackers" also produce large quantities of the butylenes which are subsequently converted into butadiene, basic material in the manufacture of the Buna synthetic rubbers.

If it had not been for the highly competitive initiative of this American industry we wouldn't have enough high-octane gasoline today to carry on the war aloft on one front, let alone on many fronts. Thus, the peacetime research, ingenuity and vision of the petroleum industry is making it possible for us to increase our marked superiority in the air day by day.

After the war this fuel will be available for automobiles. For the first time since the industry has grown up, engineers will be able to start from scratch in designing automobiles and engines. They will be able to design engines for high octane gasoline, with greater horsepower per pound and greater operating economy. Radical body design changes will be possible. Four-wheel drives may be commonplace and the smaller, lighter automobile engine may be moved to the rear of the car.

These new and greatly improved gasolines will permit drivers to get 25 or 35 miles on a gallon of gasoline, which, in turn, will promote an even more widespread use of the motor car.



Stick set in rubber, bar on spring, give flight practice

Though the ceiling and visibility at a training field may be zero, instructors may still put fledgling fliers through their paces with a device that duplicates the hand and foot movements that control an airplane in flight. The demonstrator includes an imitation joystick, set in a rubber socket, and a rudder bar bolted to the baseboard and moved against the tension of a coil spring. The instructor may demonstrate, before the student takes off, the control movements for the maneuver to be practiced.

Air-Cooling Fins on Pipe Bowl
Make It Easier to Handle



7-53
 (Lighter weight and a cooler bowl are said to be advantages of a pipe with fins that are designed to dissipate the heat of the burning tobacco. In appearance it resembles the cylinder of an air-cooled motor, such as are used in modern planes. Besides being cooler to the

touch, the makers of the pipe claim that it gives a cooler smoke.

Blind Man's Scale Tells Weight
By Sound Instead of Sight

Mr. 159
 Indicating the correct weight by a buzzing sound instead of visible numerals, an "audio" scale can be operated in total darkness as in film rooms, or by a blind person. It is useful also where the operator must focus his attention on filling the container. The scale uses the airplane radio beam principle, sounding the audible signal "A" as long as the weight is under that for which the scale is set, and the signal "N" if overweight is registered. Correct weight is signaled by an unbroken buzz. In war plants, the scale weighs out powder for fuses, mica for radio mechanisms, and buttons for uniforms.

MAY, 1943
C.B. Weber, Inc.
 139 Cator Ave.
 Jersey City, N.J.

Toledo Scale Co.
 Toledo, O. 61

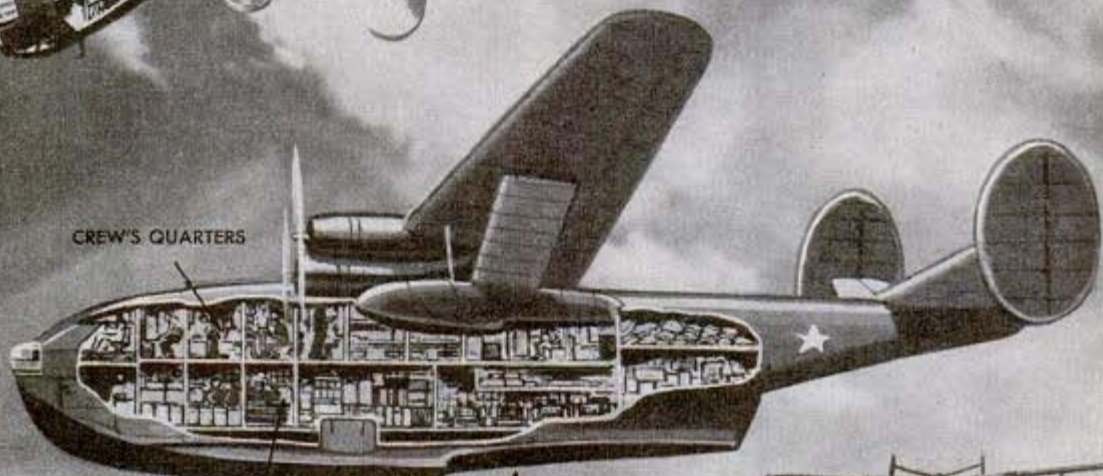
*London Electrotape Agency
134 Fleet St, London, England
M 1186*

FLYING TRANSPORTS

BRITISH "STIRLING" BOMBERS
CARRY 8 TONS IN ADDITION
TO GUNS, AMMUNITION,
CREW AND FUEL



THE CURTISS "COMMANDO,"
MASS-PRODUCED U. S. ARMY
AIR CORPS TRANSPORT, HAS A
LOADED WEIGHT OF 25 TONS



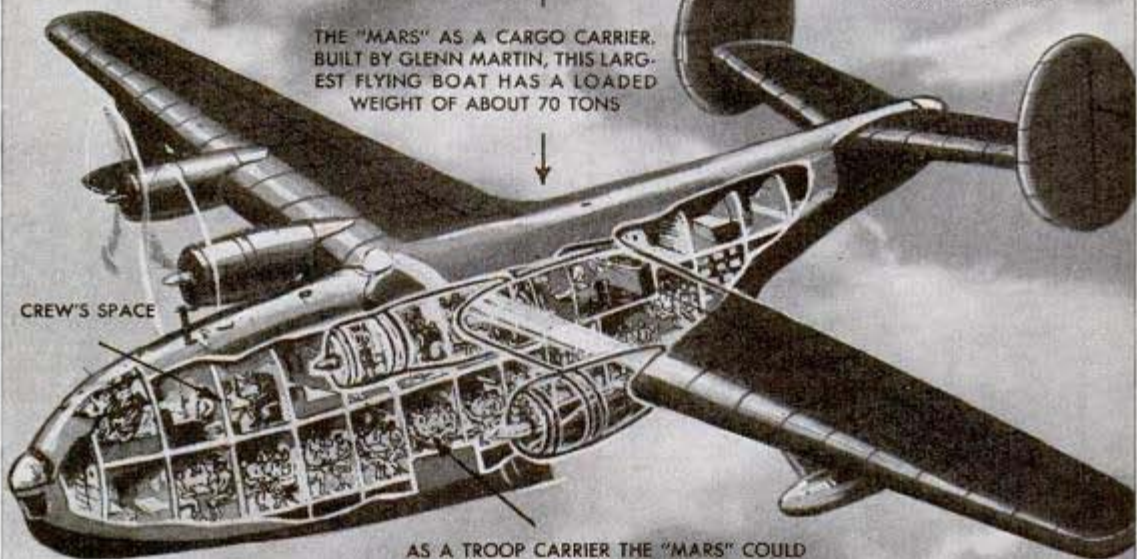
CREW'S QUARTERS

APPROXIMATELY 15 TONS OF CARGO



THE "MARS" HAS A 200-
FOOT WING SPAN

THE "MARS" AS A CARGO CARRIER,
BUILT BY GLENN MARTIN, THIS LARG-
EST FLYING BOAT HAS A LOADED
WEIGHT OF ABOUT 70 TONS

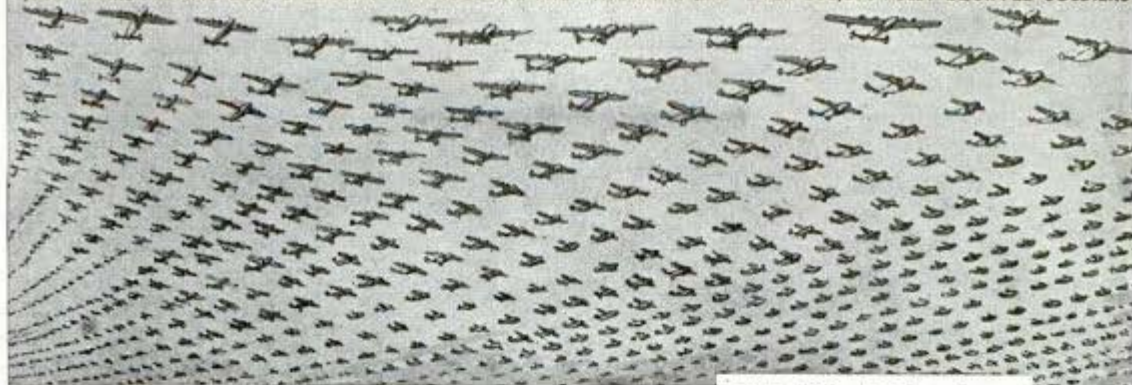


CREW'S SPACE

AS A TROOP CARRIER THE "MARS" COULD
CARRY 150 FULLY EQUIPPED MEN

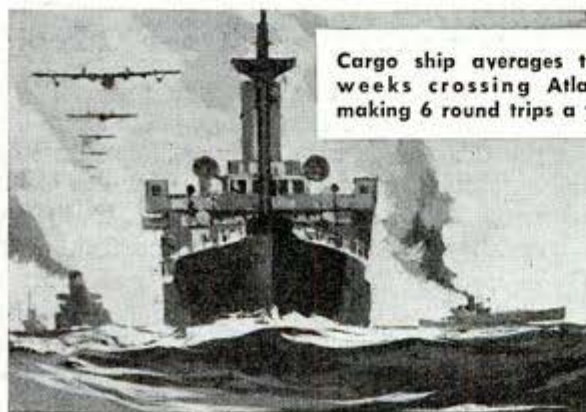
G. HAVIS
1942

5,000 "MARS" FLYING BOATS COULD FLY ACROSS THE ATLANTIC IN A DAY OVER 500,000 FULLY EQUIPPED SOLDIERS

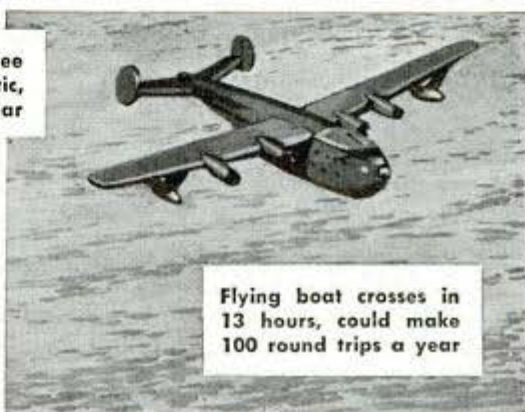


IN COMBATTING submarine wolf packs at sea and the blitz tactics of the enemy on land, Allied military leaders are aware of the potentialities of air transport. Fifteen cargo planes with a freight capacity of 20 tons each could transport as much military equipment across the Atlantic in a year as the average merchantman. Sky freighters, such as the Glenn Martin Mars flying boat, could make 50 round trips annually—against the merchantman's six—on a 12,000-mile route. This substratosphere route would be free of torpedoes, dive bombers and surface raiders. Giant cargo planes like the new Lockheed Constellation would be able to outrun any four-motored bombers and most fighter craft they might encounter. Experts estimate that 5,000 planes with the capacity of the Mars could carry half a million troops from the United States to England in a day. They could land 75,000 tons of food, equipment and munitions in another day's flying. The U. S. leads the world in the design of huge cargo planes and they are regarded by experts as far superior to the cargo and troop carriers of the Luftwaffe. While the Mars and Douglas B-19 are considered experimental types, the Constellation, Curtiss Commando and others are in mass production.

5,000 "Mars" flying boats could cross the Atlantic in a day with 75,000 tons of vital cargo, the capacity of fifteen 7,000-ton ships



Cargo ship averages three weeks crossing Atlantic, making 6 round trips a year



Flying boat crosses in 13 hours, could make 100 round trips a year

Ni, Way Service Corp, 3841 N
Wisconsin Av, Milwaukee Wis
Shovel Packs Snow Into Quarter Its Volume

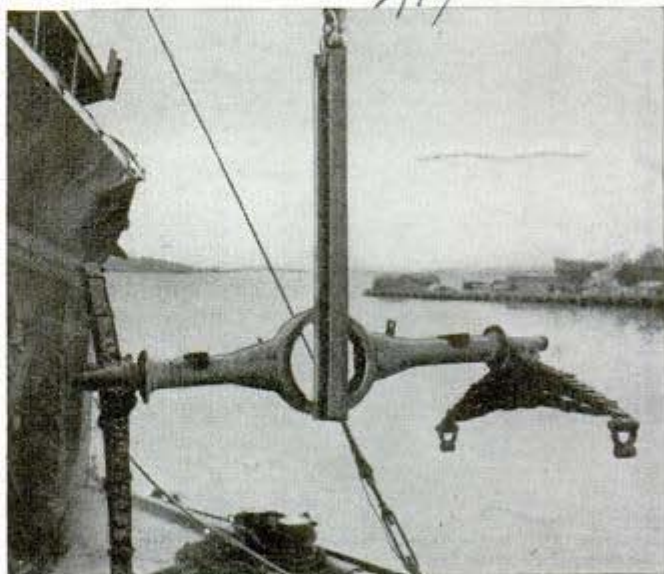


By packing it as it lifts, tractor-propelled clam shovel removes more snow

n28
 In snow removal, bulk is more of a problem than weight. Accordingly a clam shovel has been devised that will pack into its jaws up to four times as much snow as the shovel's rated capacity. If the snow is loose enough, 12 yards can be compressed into a three-yard bucket. The snow buckets come in three, five, seven and 10-yard sizes, and dirt buckets may also be fitted to the unit, which is made in three sizes to fit current models of tractors.

Free as bird, 50
Rockefeller Plaza, NYC
Axle and Springs Form Anchor for Torpedoed Ship

When an Allied ship lost part of her bow and her anchors in a submarine attack in the Caribbean, she put into a United States repair station in the West Indies, where Yankee ingenuity fashioned a new anchor from materials at hand. A length of railroad track formed the shank, and for arms a truck axle and differential housing was welded at right angles. For flukes, the truck's springs were suspended at the ends of the axle.



Though the ship escaped destruction it lost part of its bow and its anchors in a submarine attack, but old truck parts were used to make a serviceable anchor

Pick-a-Back Glider on Top of Bomber Gives Added Lift for Takeoffs

For takeoffs, a heavily loaded bomber or transport plane could use the extra lifting power represented by another wing; once air-borne, the second wing would cause drag that would reduce the plane's speed. Vadim S. Makaroff of New York has patented a method of attaching a "hitch-hike glider" to the big plane which, in effect, transforms its "host" into a temporary bi-plane. Normally a bomber or transport has enough engine power for takeoff to

n65
 make efficient use of much more lifting surface than its own wings provide, so the glider's wings, with their additional lifting surface, more than make up for the extra weight of the glider and its pilot. The glider would ride pick-a-back aboard the host plane until the latter was safely air-borne. At the proper time, the glider could be readily cast off, to be steered back to the airport where it would be ready to give another big fellow a lift.

64 Pat # 2,308,764

Vulter Field, Calif

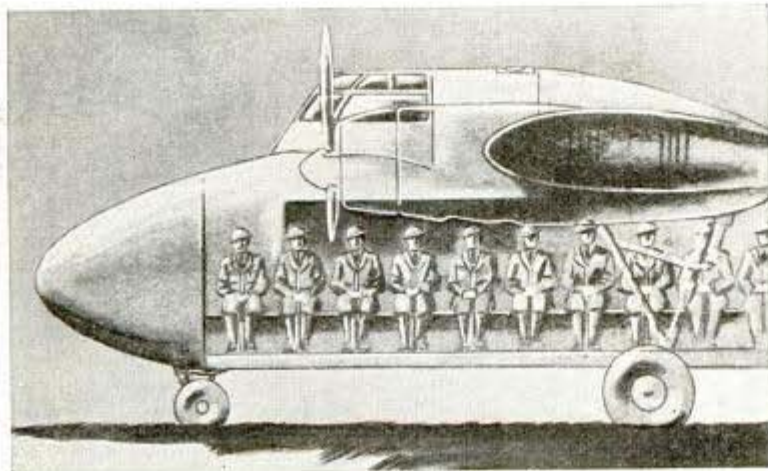
Radio Robot Records Operation in Test Flight

More complete and efficient check on the performance and reactions of a new-design airplane under test flight is possible with a radio-operated recorder on the ground that receives continuous reports sent automatically from the air. This instrument makes it possible for the ground technicians in many cases to know more than the pilot himself about actual flight conditions; so they may warn him in the event of impending danger. It makes a permanent record of conditions at 70 different points throughout the plane's structure which is not lost even if the plane should crash, thus saving months in developing experimental models. Invented by H. D. Giffen, an engineer for Vulter Aircraft, Inc., the radio robot records each of the 70 indications once each three-quarters second, or it can obtain a continuous, unbroken recording of any one instrument for special study. A switching arrangement permits this continuous recording of 15 different instruments, one at a time, during a single flight. Recording is accomplished by a standard 16 mm. sound recorder or, in the case of continuous broadcast, by a standard high-fidelity disk recorder. Should the coded signals be received by enemy agents, they would be meaningless.



Recorder on ground (top) receives report of performance at 70 points on plane during test flight. Lower photo shows engineers installing transmitter in new plane

All-Wood Plane for Army to Haul Paratroops and Cargo



Cutaway shows how air-borne troops will ride on powerful sky freighter

Said to be the first modern plane built entirely of wood for the U. S. Army, the new Curtiss C-76, called the Caravan, will carry paratroops, air-borne task forces or equipment to our distant battle fronts. The giant air freighter has a wing-spread of 108 feet.

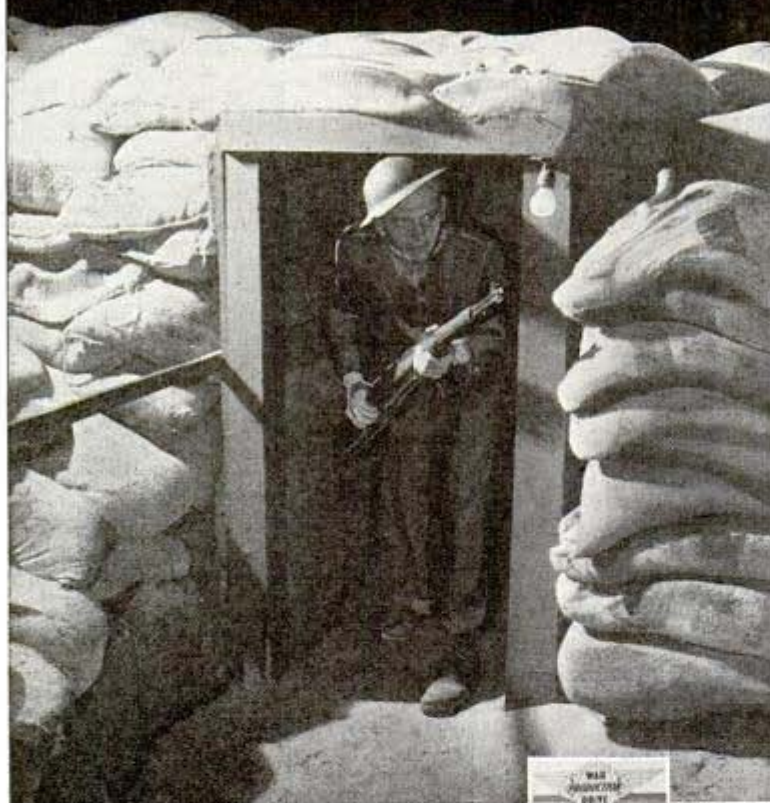
Ⓞ Paper fleece impregnated with synthetic resins is replacing leather in Germany.

MAY, 1943

built by airplane Div. of Curtiss Wright; somewhere in Missouri

Thos. E. Steinson, Jr.; 3872 Franklin Ave., Los Angeles Calif.

The JOB that COULDN'T BE DONE



tastic dream—though it's a realistic nightmare to Germany and Japan.

In its six plants, three in California and three elsewhere, Douglas is building 10 different kinds of war-planes and testing other types not yet in production. Those being built include the DB-7, the attack bomber used by the British; the A-20, American counterpart of the DB-7; the A-24 Army dive bomber that has sunk many Jap vessels; the SBD Navy dive bomber used at Midway and the Coral Sea; and the TBD Navy torpedo plane that saw service in the same

An army sentry emerges from a sandbagged shelter at an aircraft factory (left). Below, a Douglas worker tosses a scrap rubber tire to the "Tokio Kid"

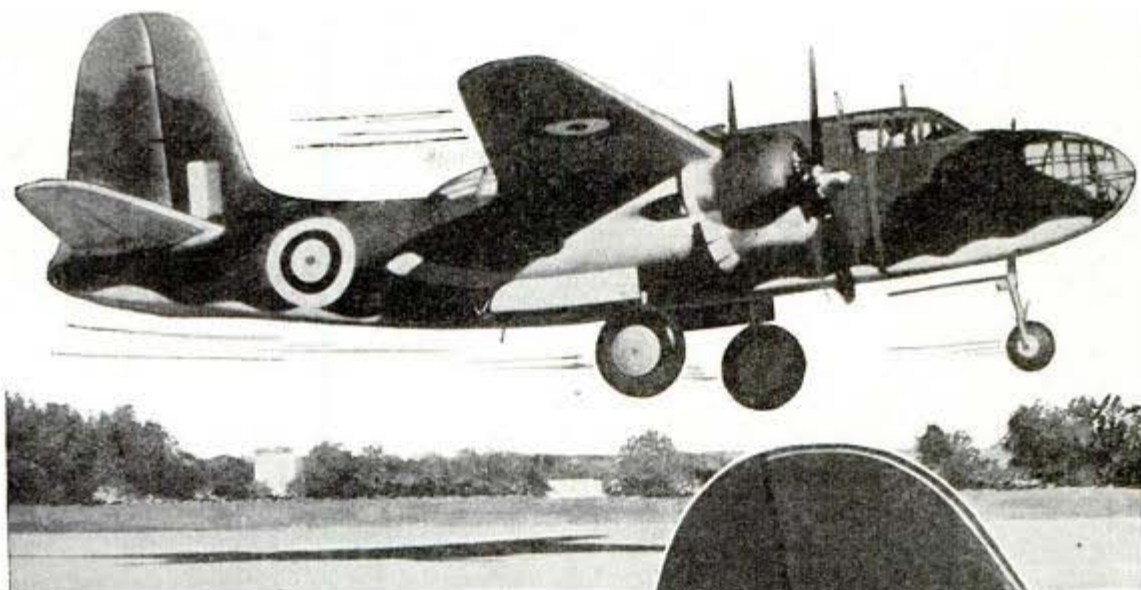
IN THE last year America's aircraft factories have built a vast cloud of fighters and bombers that is casting a deadly shadow across enemy territory.

A year ago it was a job that "couldn't be done." Today, the world is amazed at the numbers of American aircraft that are going into battle. So rapidly are new planes taking shape that the training of flight and ground crews to man them, and the production of high-octane gasoline to fly them, have had to be speeded up tremendously.

Production figures are military secrets, but you begin to grasp the size and power of our aerial striking force by reviewing the work being done by one plant alone. Douglas Aircraft Company is one manufacturer among many, yet Douglas alone is building enough planes every year to fight a vast campaign. The story of its growth since war began seems almost a fan-

WAR
PRODUCTION
DATE
TOKIO KID
SAY—
RUBBER
SCRAP
NOT GOOD
FOR JAP



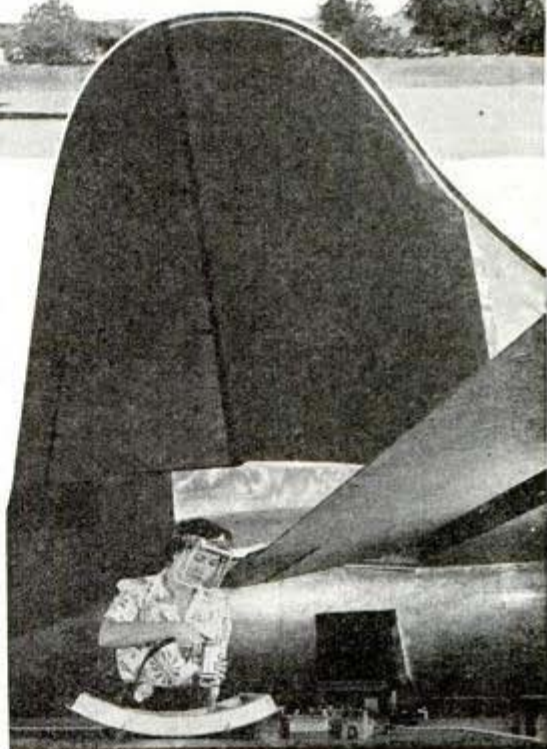


Dressed in mottled camouflage, an attack bomber built in America for the British takes off for war

areas. Through pooling arrangements with other factories the company is manufacturing huge B-17 and B-24 bombers. In addition to these it is building C-47 cargo carriers, C-53 troop transports, and the new C-54 four-motored cargo carriers that have the same capacity as standard railway boxcars.

In one Douglas plant alone the uniformed police force and fire department number more men than the police and fire staffs of any west coast city except Los Angeles or

Right, a "woman at work" in Vega plant finishes the hatch cover for B-17 in background. Below, uniformed Douglas painter, fireman, "cold room" researcher, sand blaster, welder, and assemblyman in crash hat





Blueprints are shot to various departments at Douglas by these tubes

San Francisco. To train new employees and school enlisted army mechanics the company employs a teaching faculty larger than that of most universities. Circus tents and loudspeaker systems are educational aids in this mass instruction.

Although the Douglas payroll already has increased by nine times in two years, the company is spending \$15,000 per month in the help wanted columns, in addition to billboard and radio advertising for new employees. Company representatives are constantly touring the technical schools hunting for engineering talent. If you apply for work, it will take about 12 hours to go through the routine of establishing

your citizenship, passing the physical examination, and complying with other regulations. Twenty-eight doctors are required for examining applicants.

A year ago, one woman was employed for every two men hired; now three women are employed for each new male employee. Women from 18 to 70 are working in 60 percent of the plant departments. A big percentage of them are riveters. Twenty thousand women are employed in one of the California plants alone. Without experience, they start at 60 cents per hour,

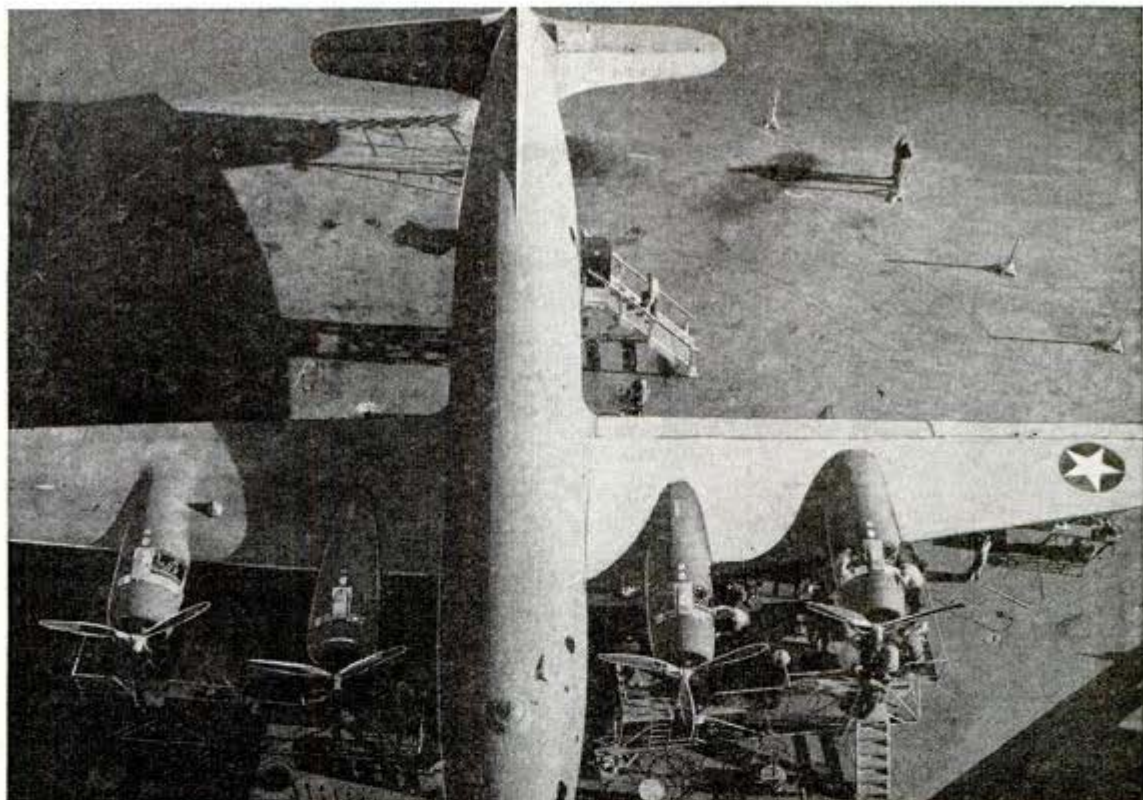
which is increased shortly to 75 cents.

In such tremendous armies of employees, absences due to sickness and other causes are bound to mount up. It would take seven men working 45 years each to duplicate, at six days per week, the time lost in the three California Douglas plants in one month alone. Reduction of lost time is one of the goals being sought.

Every employee is urged to use his brains to find short cuts and better methods that will speed production. Out of 500 ideas submitted in one plant in a month, enough valuable suggestions were found to save 2,000 man-hours of work daily, or 730,000 man-hours per year. One suggestion alone

Engines of a "Flying Fortress" are given their final test. By now this battlewagon is flying over Europe or Africa





doubled the speed at which certain electrical sub-assemblies are turned out. Cash awards go to those who make useful suggestions. Such ideas, in a year, provide enough savings to manufacture a fleet of 154 extra attack bombers.

The employee welfare department operates eight cafeterias, a general store, gasoline station, post office, candy stores, loan service, legal service, and 100 acres of parking lot. Fourteen thousand meals a day are served at the Santa Monica plant, 17,000 at the Long Beach plant. At Santa Monica, employees buy 6,700 cups of coffee per day, 18,000 soft drinks, 5,000 hamburgers, and spend 24,000 nickels for gum and candy bars. The welfare department's loan service charges no interest and usually has about \$15,000 outstanding in sums ranging from emergency carfare to \$500 loans, mostly for hospital expenses.

Employees have the use of an aeronautical library and also have their own monthly magazine, with a greater circulation than many metropolitan dailies. Each issue re-

This C-54 cargo plane, being completed outdoors, has the capacity of a standard railway boxcar

Assembled ready for installation on planes, these motor cowlings will house over 50,000 horsepower





Attack bombers for Britain line up for final ground inspection

quires 15 tons of paper. Jobs inside the plants include practically every sort of occupation, from operating huge hydro presses that shake the ground with their impacts to the delicate work of building and calibrating precision instruments. Photography might not seem necessary in building planes, yet the photo department in one plant alone exposes more than 11,000 negatives per year and turns out more than 126,000 prints. The work includes microphotography, copying, halftone negatives, automatic photos of recording instruments, pictures of mock-ups and parts, and employee identification pictures. Thousands of feet of motion pictures are also made of technical subjects.

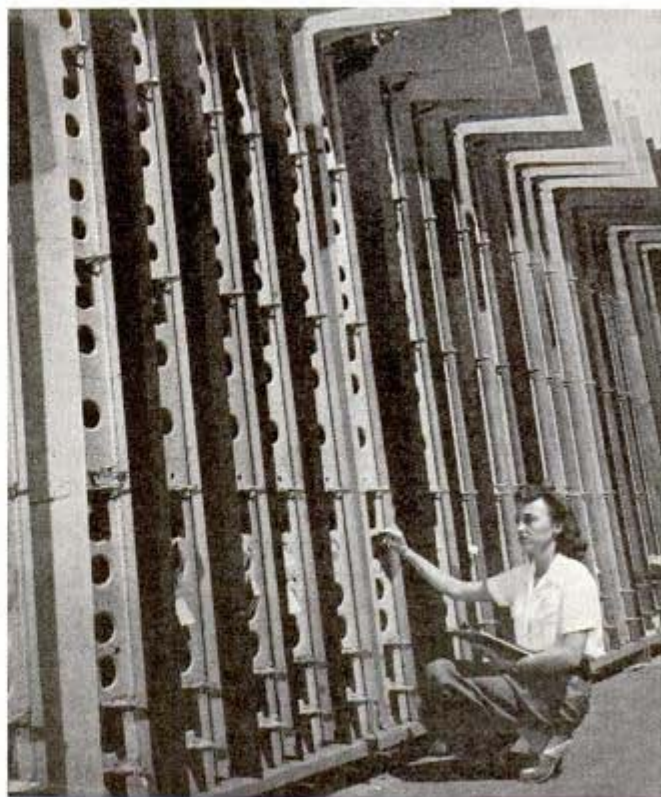
From conception to test flight, production of a new design is carried on with meticulous care. So many drawings are needed in laying out a new design that the C-54 transport, for instance, couldn't lift off the ground the paper work required in its construction.

Draftsmen of the engineering

division begin by making outline drawings that establish the shapes and sizes of such parts as the fuselage, tail group, and wing. Other engineers are deciding on the type of airfoil, working out power plants, and establishing the center of gravity, and are locating fuel tanks and electrical and hydraulic systems.

Now the plane is broken down into pieces. Three hundred draftsmen go to work on detailed design. Even a fairly small plane will require as many as 1,500 preliminary drawings. Each part must be correlated with the rest. The man designing a bulkhead, for instance, will have electrical, surface controls, hydraulics, and heat and vent experts looking over his shoulder, each hunting for the best place in the bulkhead for passage room. Meanwhile, the purchasing department begins preliminary ordering. There will be some 18,000

component parts in the new plane. Some will come from the 1,800 subcontractors in southern California who work for Douglas, others from manufacturers in all parts of the United States.



Elevators are stacked up at the Vega Aircraft plant ready for assembly on planes

Truckloads of paper have already been used up and the design work is still far from finished. You begin to understand why the engineering department runs 1,000 miles of yard-wide paper through its blue print machines every year, and why 450,000 pounds of shop bulletins and forms are lithographed.

Next, some 6,000 drawings to pattern the brackets, fittings, junction boxes, fuel and oil system, assemblies, and installation fittings are made. Each such drawing then goes through different departments for checking. A pulley bracket, for instance, may be shown as an aluminum alloy casting. The drawing of the bracket first is checked in the engineering department to make certain that it conforms to good design practice, then it goes to the strength-check group that analyzes the stresses it will receive, then to the weight-control group where its weight is entered on the plane's gross weight card. By now the drawing of the bracket has been approved, the necessary patterns and dies are ordered and the blueprints for various departments are made.

Tooling up for production is another big job. The tool planning division is a factory in itself. Some 20,000 "tools," including molds, jigs and frames, had to be designed and built for production of the A-20 attack bomber alone. Even now, production can't begin until the scheduling department has worked out orderly schedules by which the parts will flow from parts of the factory or from subcontractors to their places in the production lines. By now the 700 inspectors inside the plant are busy, as well as 150 other inspectors who supervise the work of subcontractors. There are 12,000 separate inspections in the making of a bomber, before it leaves the ground. The first plane of a new design, before production really begins, may be flight tested 60 or 70 times, spending upwards of 150 hours in the air, carrying five tons of special testing equipment. One big plane may be photographed in flight by 400,000 frames of motion picture film, and the technical aspects of its test flights may make a record that consists of 17 books containing 300 pages each.

Too complicated? American manufacturing genius hasn't found it so. Neither have the American pilots who fly the planes. Their record in the air speaks for America.

MAY, 1943

Exerciser for Weak Eyes Gives "Movie" Show



Double-tube optical instrument trains crossed eyes

Cross-eyed children are trained to use both eyes in seeing with the aid of an eye-muscle exerciser having special lenses and using object cards that provide a fascinating movie show. Changing the angle of the two tubes and inserting different cards cause two halves of a picture to merge into one, so birds jumping in and out of cages can be seen in three dimensions. The instrument, demonstrated by American Optical Company, is said to train the non-seeing squinting eye to take its share.

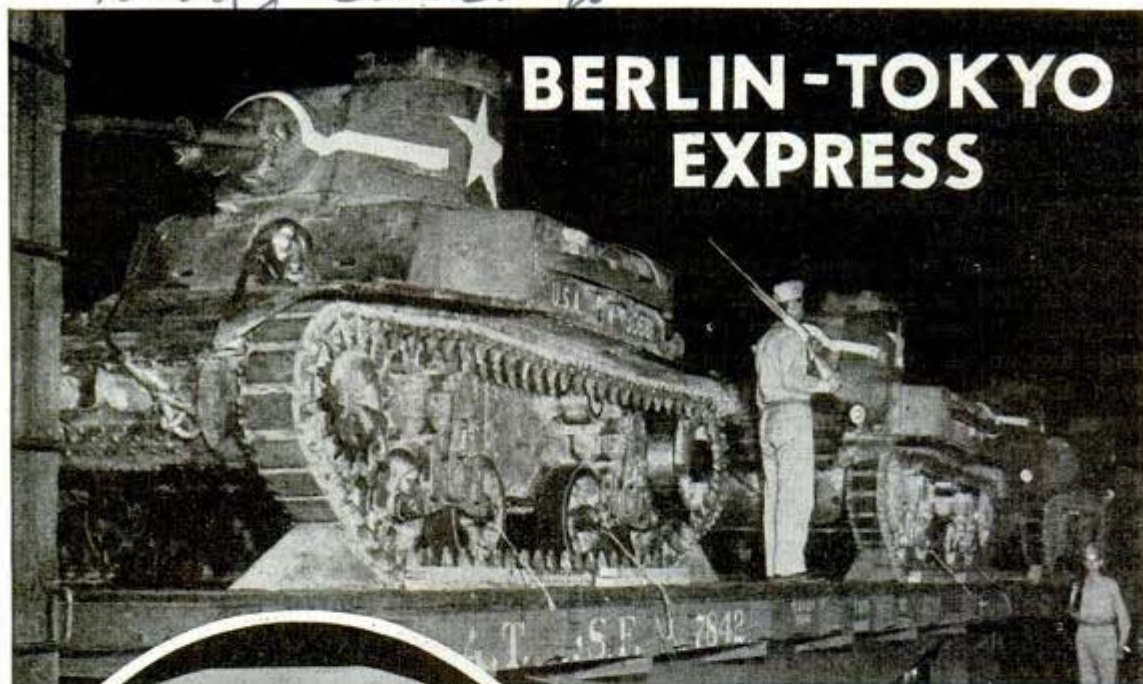
Oil Pads Shield Battery Cables From Deposit of Corrosion

Formation of corrosion on battery cables and terminals can be prevented, according to a manufacturer, by placing a special metal reservoir over the battery terminal and setting a felt pad in the reservoir. Saturating the felt pad with light oil each time the battery is checked, it is said, will put an end to the corrosive deposits.



Southbridge, Mass
1188
 Sterling Lock Co 71
 35 Holden St., Dept. 3, Merrimack

The A.T. & P. Ry System, 80 E. Jackson
Bldg, Chicago



BERLIN-TOKYO EXPRESS



Last year some 11,000,000 soldiers, sailors and marines traveled on the American railroads, their destinations Berlin and Tokyo. Men and armament crowded the rails with the greatest cargo in history. The total freight tonnage of 1942 would have loaded a train 440,940 miles long; in all, there were 42,818,739 carloads moved. Above, a military train on the Santa Fe railway stops briefly on its way to a point of embarkation and its armed sentries change guard. At no time from starting point to destination does the army relax its vigilance



† From the platform of rear passenger car of army train a sergeant watches the guard in a baby tank, alert with a machine gun

Santa Fe Railway photos



† An army field piece is coaxed up the loading ramp by a tractor, to be put aboard a flatcar. A working crew member stands at the side to guide tractor driver

While the loading crew blocks a tank on a flatcar, a helmeted soldier opens the turret top and prepares to take his post inside as guard en route



One of the army's "half-tracks" crosses the spanner from ramp to flatcar of the "Berlin-Tokyo Express"

Motor trailers are carefully stacked in pyramids aboard Santa Fe train as inspector checks fastenings



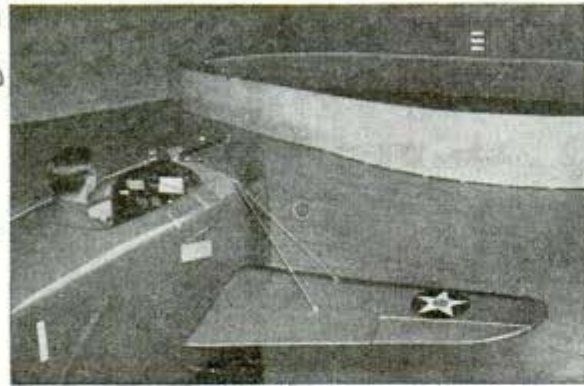
"First call for mess" brings a trail of troopers into the kitchen car of a military train

A trainload of tanks backs up to a ramp and non-commissioned officer signals to unload



1. Lt John W. Jensen, Essex, Ill
 2. Maj John A. Dunning, San Antonio Tex
 3. Richard W. Jones, Bridgetowne Del.
- Moving Targets Train Fighter Pilot Cadets
M1212

4. Leslie F. Garrison
Phonolite, Tex.

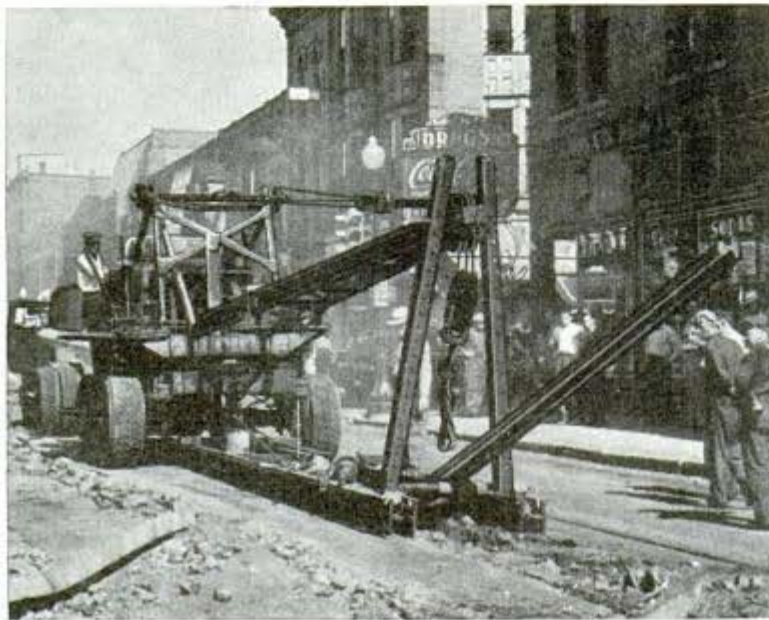


Cadet in Link trainer (left) keeps eye on paper target on circular track; right, studying BB machine gun. Army Air Force Advanced Flying School, Victoria Tex

Pieces of paper flying from steel staffs that ride about a circular track represent enemy planes in an indoor Link trainer target at Foster Field, Tex. They combine the effects of maneuverable flight in a plane with those of a moving target, giving lessons that are valuable to the pilot cadets later when they fly advanced trainer planes and shoot live ammunition at tow and

ground targets. The shooting range uses BB machine guns operated by 60-pound air pressure, and three cadets can fire simultaneously at separate targets, their scores being tallied by the number of hits. Of special value to the cadets is the experience they gain in "leading" the moving targets, the speed of which can be regulated by manipulating a switch.

Rail-Puller Salvages the Steel From Unused Streetcar Lines



1611 se
It's like pulling teeth to rip out steel tracks from city streets, but a huge rail-puller pries them up with little damage to the surrounding pavement. Mounted on a truck is a boom with its far end attached by a steel bar near the top of an A-shaped frame that straddles the rail and stands on two beams which serve as runners paralleling the track. The manual operation consists mainly in removing part of the pavement at the rail joint. Then pulley-operated tongs grip the end of the rail and lift it high enough

Heavy steel roller inserted under rail being lifted protects pavement

Материал защищенный авторским правом

so a nickel-steel roller, across the bottom of the A-frame, may be inserted under it. Pulling the truck forward causes the roller to pry the rail upward, while the runners hold the pavement in place with downward pressure. A second truck hitched at the front provides additional power. The machine, patented by R. L. Shambaugh of Lafayette, Ind., can pull up tracks at the rate of 10 blocks an hour from asphalt. Spikes come out with the rails.

Lining for Old Tire Made of Cotton Prolongs Life

Old automobile tires with cracked sidewalls, worn thin, or rough on the inside, will give a little longer service if a cotton liner is inserted to protect the inner tube from damage. Made of 100 percent cotton, the liner is shaped to fit any tire and forms a wall between the tube and casing so inside cuts will not chew holes in the inner tubes.

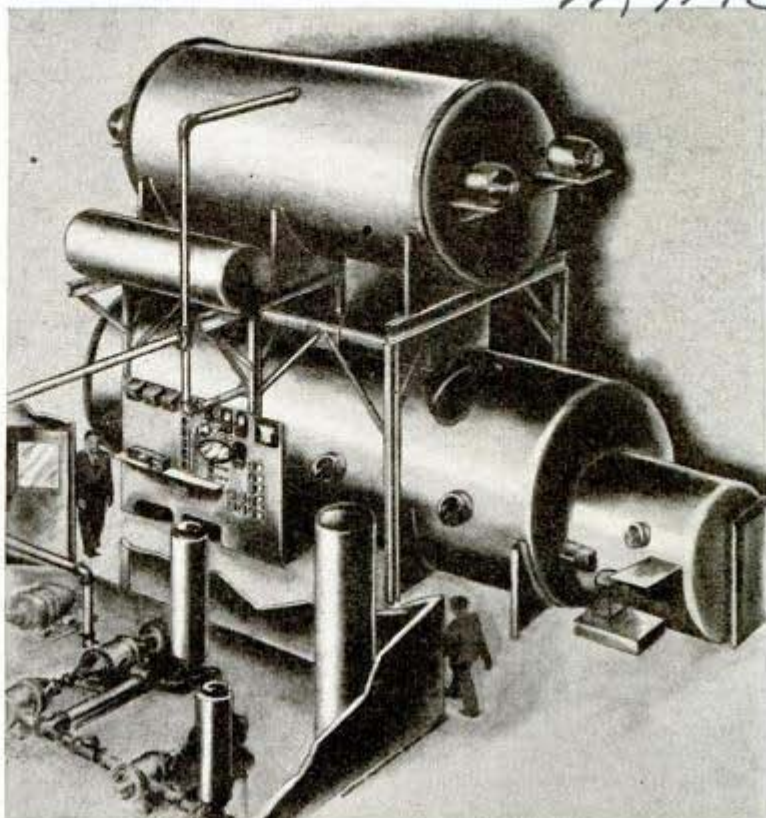


Liner goes between tube and casing, fits any size

MAY, 1943
Southern Specialty Co
 116 Mitchell St., S.W.
 Atlanta, Ga.

Flight Tests for Model Airplane Simulate 700 Miles an Hour

m 1195-



Giant new \$2,100,000 wind tunnel dwarfs workmen. Note the control panel

Atmospheric conditions met by high-flying planes will be duplicated in an altitude chamber to be installed as part of the research laboratories being constructed at Buffalo, N. Y., by the airplane division of the Curtiss-Wright Corporation. Used in conjunction with a new \$2,100,000 wind tunnel designed to operate at simulated speeds exceeding 700 miles an hour for testing scale model airplanes, this chamber will make exhaustive altitude tests on single-place fuselages, reproducing actual dive and climb conditions. Coils and fans are housed in the upper section of the chamber, while the working chamber and control panel are below. In helping to speed the development of special equipment and structures suited to low temperatures and rarefied atmosphere at extremely high levels, the chamber will be of great value in evolving the world's best warplanes.

ⓘ You can obtain additional information about products described in this magazine by writing to the firms listed in the Where-to-Buy-It index. Say You Saw It in Popular Mechanics.

So Research fellow Olaya iys.

Thos E Stimson Jr, 3872 Franklin Av
Los Angeles Calif

YOUR HOBBY CAN HELP WIN the WAR

M1094

Taylor



Home crafts may lead to war jobs, such as welder (below) is doing, or hobbyists may themselves become subcontractors like the banker above, whose home workshop now turns out parts for war machinery



DO YOU know that you can turn your workshop into a wartime factory?

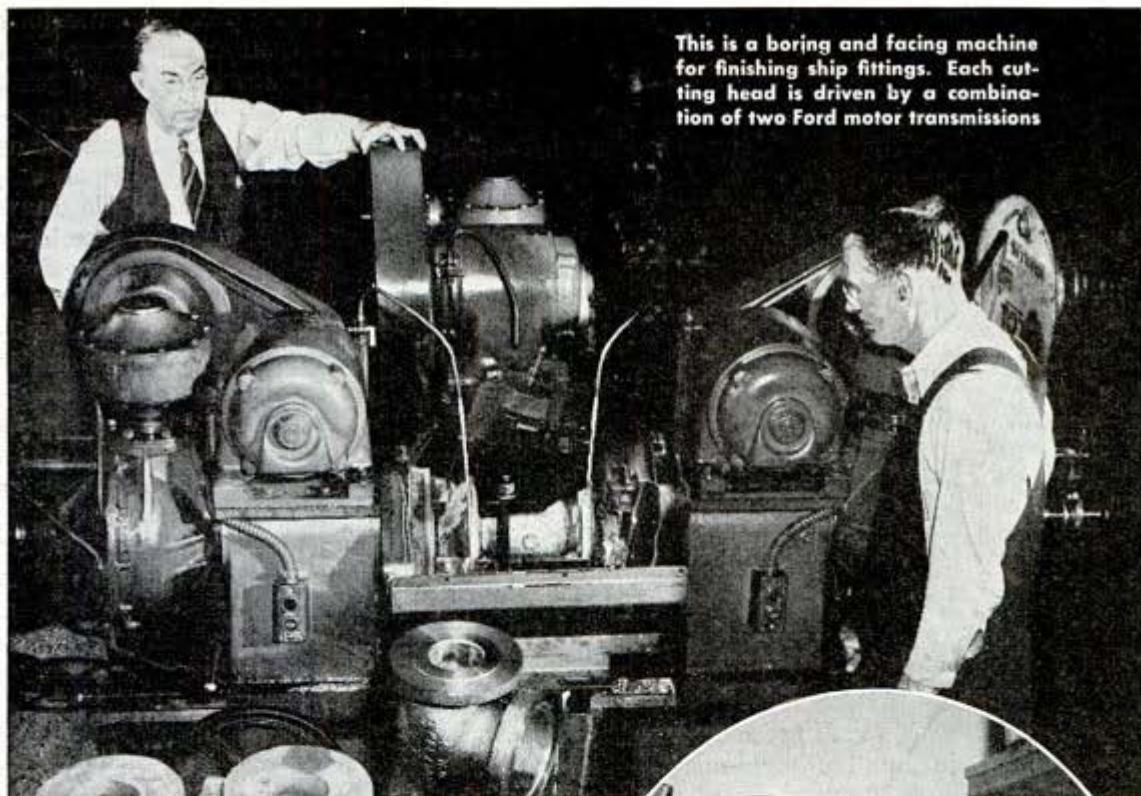
Thousands are doing it. Men whose hobby is model railroading, or who used their workbenches and tools simply for building garden furniture and knickknacks, are now a vital part of the arsenal of democracy, producing at home small parts for guns, tanks and airplanes. Even the small amount of work you could do at home is needed. This is a war of "tremendous trifles."

Two men who have put their hobbies to work are Los Angeles bankers. One, W. C. Taylor, is a model railroad fan. He has 1,200 feet of "0" gauge system, with 10 engines, 30 passenger and 70 freight cars, all built in his own small workshop.

But now his backyard shop is busy on war orders. He and two neighbors put in as many as 30 hours a week each after business hours. Two wives run drill presses in the daytime. Together, they deliver 150 man-hours of production per week—more than the equal of three men working full time.

It all started when a busy subcontractor for a large aircraft plant, recalling Taylor's skill in making models, asked him to turn out a few

4419 Maricota St.



This is a boring and facing machine for finishing ship fittings. Each cutting head is driven by a combination of two Ford motor transmissions

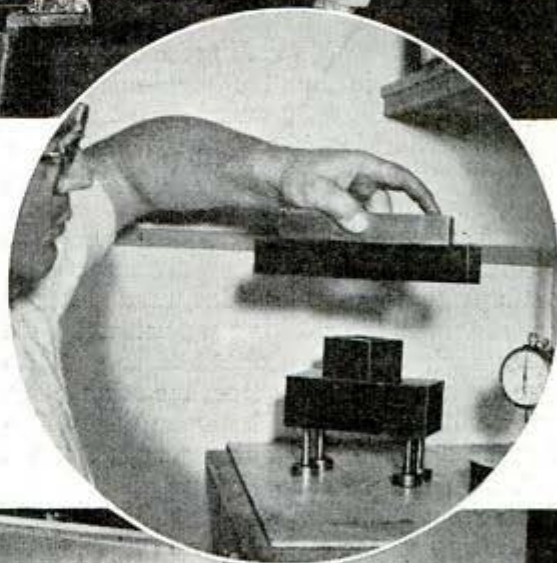
Skilled amateur designer (right) lifts heavy parallel with another. A thin film of oil acts as an adhesive

dozen small fixtures. There was no rush, but the work had to be accurate to 1/10,000 inch. That was easy for anyone who had built model railroad engines. Tayloe turned out the work and asked for more. His shop has been busy ever since. One order may be for a few thousand special nuts, another for only a dozen steel straps that must be drilled and tapped to specifications—all to go into some sub-assembly, possibly for a dive bomber, possibly for hospital equipment.

Materials are provided by the contractor. Sometimes Tayloe does a job on a straight subcontract basis, sometimes at a unit price. Most of the work consists of small items for which the contractor hasn't room in his own shop, or doesn't want to take time to produce.

With the profits, Tayloe

His chief hobby once was making tiny locomotives. Now, he makes precision fixtures for war



Tayloe



Air raid wardens, working in backyard workshops, constructed this portable pressure system for fighting fires as a safeguard against bombing

has been able to add drill presses, an arbor press, a grinder, and other tools to his equipment. The home workshop has a respectable backlog of orders.

The other banker, Ivan C. Wallace, makes machine tools as a hobby. When he wants a set of parallels, for instance, he grinds them himself. These are metal bars with perfectly parallel sides, used as bases in some metal-working operations. He does such exact work that if one of the parallels is held flat against the other, with only a thin film of oil between them, lifting the one on top will also raise the other.

Wallace now builds special tools for small machine shops working on war orders. One night he may complete a wooden foundry pattern for a set of pulleys on his wood lathe; the next he builds steel jigs with which a machine shop will turn out small parts. One "customer" needs special precision chucks for a high speed automatic lathe, another an automatic depth attachment for a countersinking drill. Much of the several thousand dollars worth of equipment in his backyard workshop was paid for out

Making machine tools, hobby of this banker, taught him the skills he uses in designing parts for war machines

of the profits of such jobs.

Still another example of how hobbies are going to war is a college professor who is producing small fittings for an airplane factory. He casts small parts in aluminum or brass and turns them down to size on his lathe at home. He uses illuminating gas to heat his small furnace, with an attachment from a vacuum cleaner to supply the air.

Some sort of war work is being done in nearly every town in the United States. If you want to help, make a list of your skills and tools and ask some local manufacturer what you can do. Samples

of work you have done will help prove your ability. Don't bother with large factories turning out finished products. The people who need your help are the subcontractors. Ask your chamber of commerce for advice. The Los Angeles chamber of commerce, for instance, has a special department to put subcontractors in touch with small shops, and tell small shops where such work may be had.

If an order is too big to handle alone, organize a group who have home equipment. Such a club, or company, can do much work nights and week ends. Sometimes it



is best to pool the equipment and install it in a central shop. Two things to remember are that if you promise or subcontract to turn out a job at a certain time, you must meet that delivery date; and although a small amount of spoilage may be tolerated, sloppy workmanship will bring a cancellation of the order. You will find plenty to do even if your equipment is confined to wood-working machines. One big recent contract called for hundreds of huge wood and plywood troop-carrying airplanes. Much of the work of building these will be "farmed out."

Numbers of small backyard shops have grown into big businesses. One radio amateur who began to cut and grind frequency control crystals for his own use was asked by his friends for similar crystals. Work piled up until he had little time for his regular occupation; now he employs 300 people and turns out control crystals for military uses.

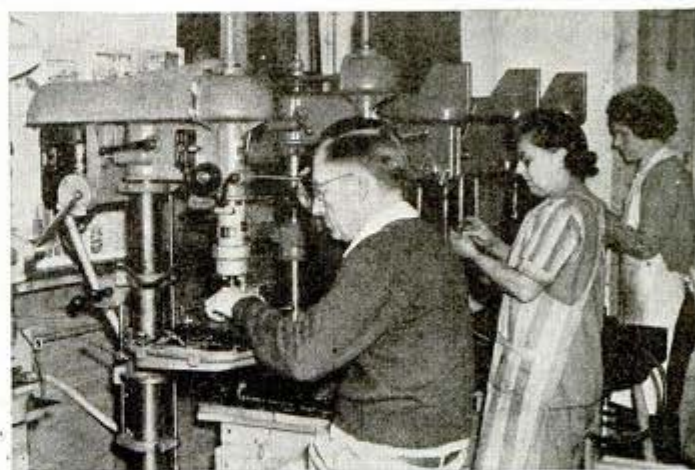
You will be doing your part, too, if you develop methods to save material, or step up production. The Army ordnance department figures that eight tons of steel and 8,000 hours of machine tool use were saved in one contract for bombs when carrier lugs were redesigned in pressed steel instead of as forgings. Almost nine carloads of steel were saved on another contract when someone found a way to stamp out steel clips that would do the job of a more complicated locknut assembly.

Don't give up without a try if you need a special tool and can't buy it. Maybe you can build it yourself — out of old automobile parts, for instance. Sam Carter of Los Angeles devised a multiple drill press that uses a truck transmission to drive the drilling heads, together with some automotive universal joints.

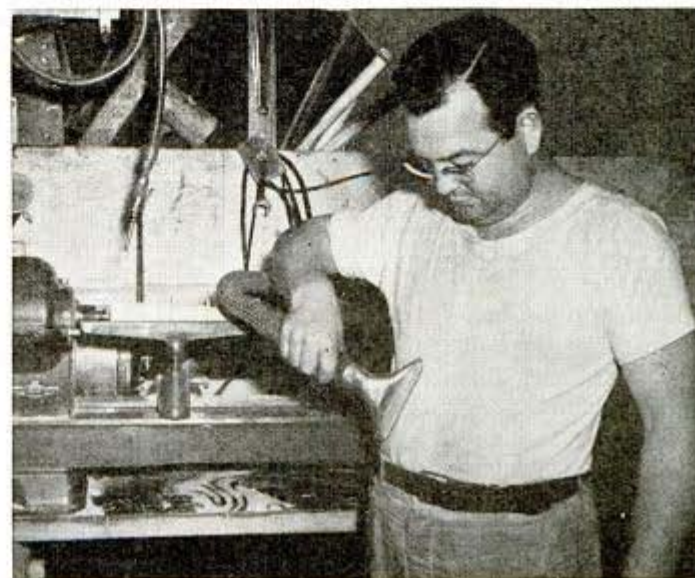
MAY, 1943



Hobbyist shaped and ground the woodworking tools he inspects here

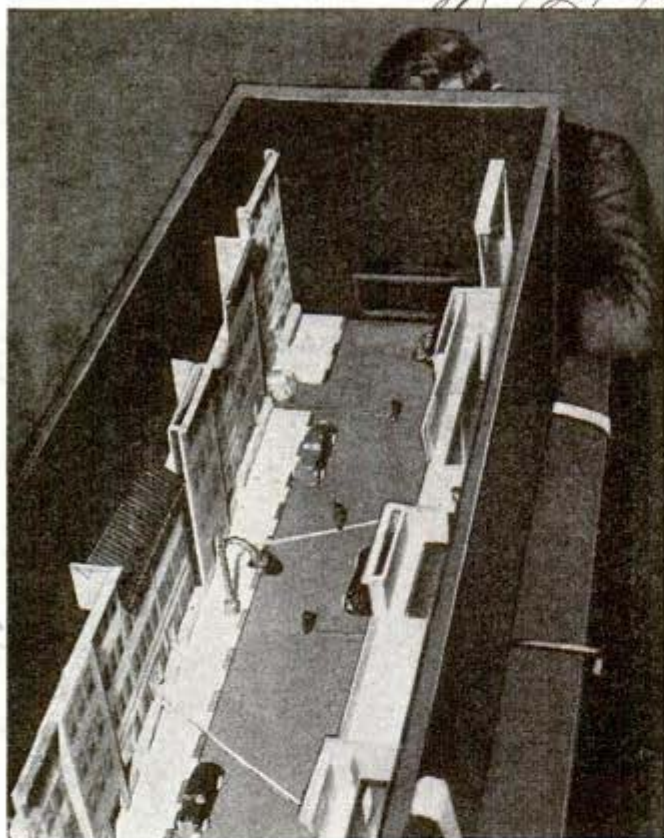


In this home workshop, owner and neighbors devote 150 man-hours weekly to war work (above). Hobbyist below demonstrates vacuum attachment with which he whisks away dust from lathe operations



*Int'l News Photos
326 N. Madison
Chicago*

Model of Street Under Dimout Tests Visibility for Safety



Model is used with "dimometer" for testing vision on streets in an effort to reduce pedestrian accidents in wartime dimout

In the hope of reducing pedestrian accidents, which took a 20 percent jump when dimout regulations went into effect in New York, a "dimometer" for testing vision has been developed by New York University Center for Safety Education. It includes a model of a city street on which various lighting and traffic conditions can be duplicated for study.

Robot Aims, Fires Ack-Ack Within Five Seconds

Performing computations that would require hours of work from a score of mathematicians, the Army's anti-aircraft director figures the horizontal and vertical distances and the speed of approaching planes, then dictates the moment that the guns must be fired so that shells will converge

*80 NY Times
Jan 1 - 43*

on a target perhaps five miles overhead. Foreign matter in its delicate machinery would throw off its calculations so it is assembled in air-conditioned rooms, and women working on it must forego nail polish or long fingernails and must keep their hair covered. Even a particle of nail polish in the delicate gears might spoil the aim of an anti-aircraft battery.

Platform to Service Plane Mounted on "Stairway"

All the outer parts of an airplane can be reached by servicemen who use an elevating platform that is moved around as easily as a dolly and is climbed by stairs. Adjusted for height by a hydraulic strut, the lift provides a three to 10-foot "stretch." Thus the stand, capable of holding 1,500 pounds and enclosed for protection of the workers, can be placed within easy range of wings, fuselage, engine or tail, permitting access to the hard-to-get-at places. For long hauls, the stand can be towed by automobile like a trailer on its 16-inch air wheels.

*Pacific Eng. Corp.
3123 S. 7th
Lodi, Calif.*



Mobile service platform, from which mechanics can reach all parts of an airplane, folds for towing behind an automobile

Rip-Resisting 'Chute Opens at Only 100 Feet



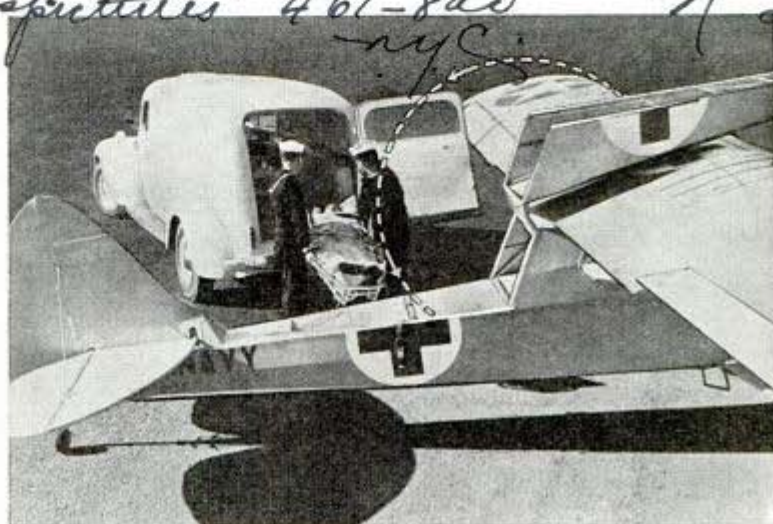
Inverted cone directs air into slits in parasol, relieving the shock when new parachute opens, even at low altitudes, (above). At right, it drops motorcycle in its own trailer

Successful landings from only 100-foot altitudes have been made with a parachute designed by Dr. Christian A. Volf to eliminate the jar on the fabric caused by too-rapid opening at the high speeds of modern planes. Inside the parasol is an inverted cone of silk, and around the parasol proper a series of slits, in addition to the standard opening in the top. Tests showed that air rushes through these slits as the canopy first opens, easing the strain so much that heavy loads dropped at high speeds won't

rip the fabric. It can be used at low altitudes because its "shock load" is only one-fifth that of the older types, the inventor says. With the parachute Dr. Volf invented is a boatlike trailer that contains a motorcycle. When the unit lands, a paratrooper removes two bolts, folds down the trailer's wheels, and attaches it to the motorcycle. The trailer could carry men, supplies or, if used by a Red Cross unit, wounded paratroopers. Army tests of the new parachute have been scheduled.

Hospital Plane Has Hinged Top to Admit 'Stretcher Cases'

Injured fliers are sped from the scene of a crash back to the base hospital at a Gulf Coast naval air station in a flying ambulance with a folding roof, capable of taking off and landing in limited space. The casualty is cradled in a sturdy, basketlike stretcher, which fits snugly within the hinged portion of the fuselage. When this is folded back, the injured man, stretcher and all, can be removed from the plane with a maximum of comfort.

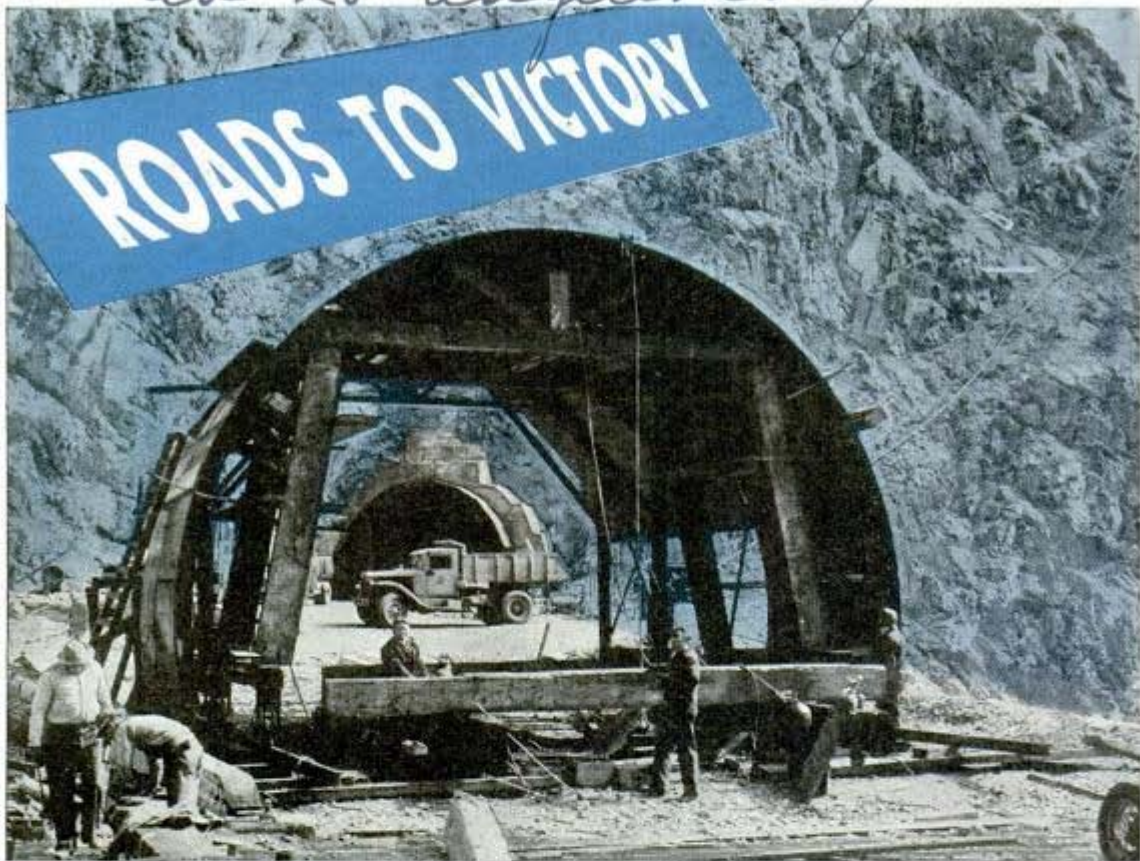


Fuselage section the length of a stretcher folds back in flying ambulance

MAY, 1943

*Copus Christi Naval Air Station, 81
Copus Christi, Tex.*

Thos E Stinson jr 3872 Franklin Ave Los Angeles Calif



War "orphans" some highways, requires building of others. Workers at tunnel portal, above, are guarded from falling debris by steel shield



IF AN engineer should level and partly pave the entire states of New Hampshire, Rhode Island and Connecticut he could represent roughly the proportion of the country's area used as roads and highways.

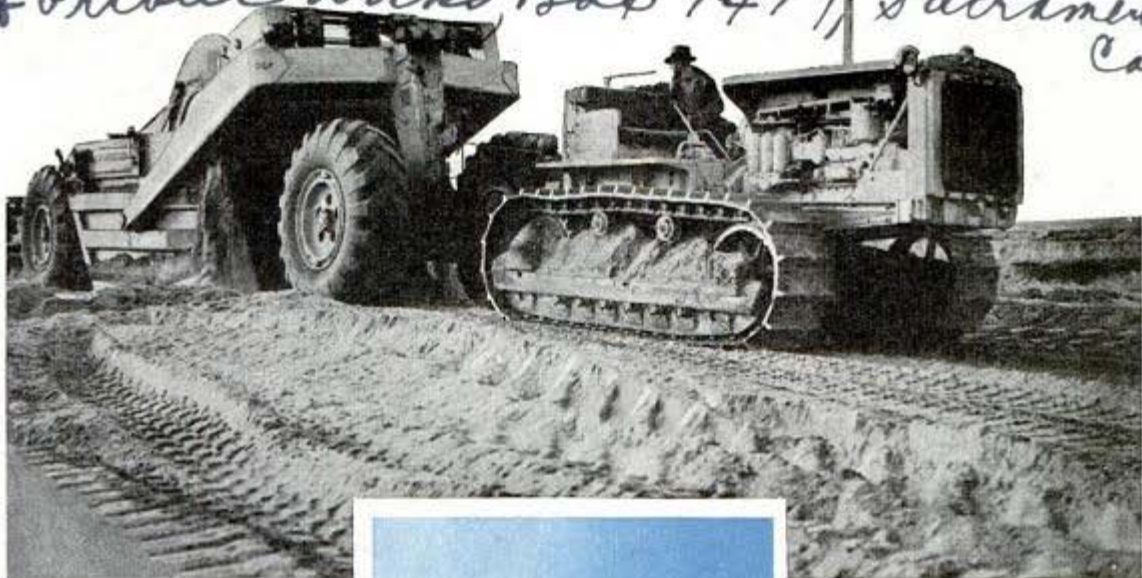
Not even counting city streets, about one acre in every 200 in the United States is devoted to public travel.

Wheels on these highways are beating out the rhythms of war. Munitions and war workers speed over hard surfaced travel arteries. Construction of airplanes and even of ships is stepped up by building subsections at scattered points, then trucking these parts to assembly plants. Army convoys move on the strategic military highways.

So complete is our highway system that except for a few connecting links, no new construction is required. One might think the

True machine of war is this huge truck-loading scoop, lifting roadbed rocks and dirt

Ref: John Howe, California Highway
& Public Works, Box 1499, Sacramento,
Calif



highway engineers could rest from their duties.

But, suddenly, a great air base must be built almost overnight at a remote location. Contractors are asked to overload their trucks and operate them 24 hours a day. In a week the secondary roads that lead to the airport receive a greater pounding than during a year of ordinary use. The pavements crumble.

Unexpectedly, heavy truck travel develops on roads that were built only to carry light vacation



Scale models of new bridges, such as one shown above, are not possible on hurry-up job like the Alaska Highway, where pontoon span (below) was built

Distances are shortened by highway realignment, as in job above

traffic into the mountains. Ore from great mineral deposits or logs from the forests must flow in steady streams down to the mills. Bridges shake under the impact of the loads. The asphalt is churned to mush.

Traffic dwindles over many urban routes but multiplies on others that lead to great war plants. Unusual maintenance problems begin to plague the highway engineers. With fewer men, only a





Bomber wings made at distant factory are trucked to main fabrication plant for final assembly of plane

fraction of the equipment they used to have, and with most customary materials unavailable, they still have a job to do.

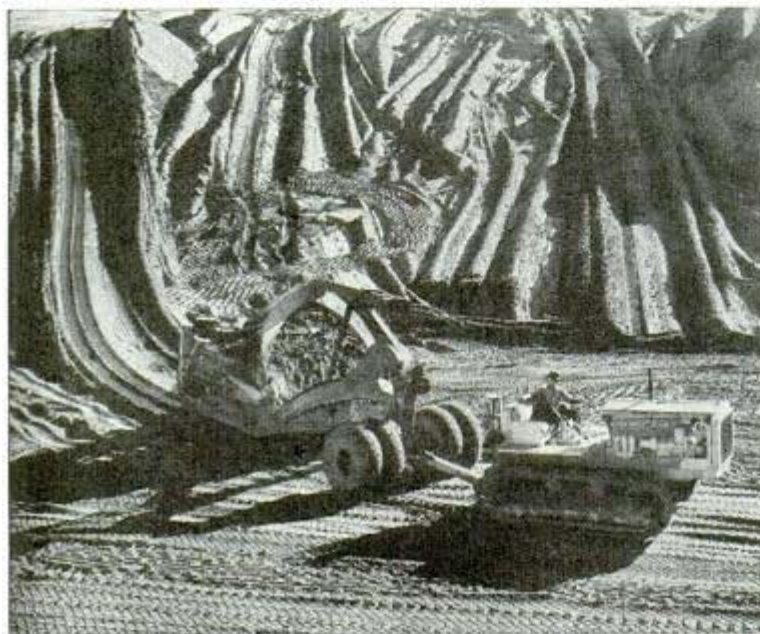
Bridges are a special problem. California highways, for instance, include 1,400 bridges, totaling about 100 miles of roadway. They are of all sizes and designs, from a cable suspension bridge, built in 1856 with materials shipped around the Horn, to the great new steel and concrete structures that span San Francisco Bay. Usually, bridges never get a chance to wear out. They become obsolete instead and are replaced by wider, sturdier structures designed for modern loads, or they are torn down when an improved highway is built over a better route. In the past the highway engineers followed an orderly

schedule of replacing old bridges according to the growing needs of traffic. With war, this schedule had to be dropped, and now engineers are scheming up all sorts of ways to strengthen some bridges, repair others, and replace them when necessary. Every old bridge is a different problem because no two are alike.

Now and then engineers are able to reshape an old steel railway span into a highway bridge. Often they must rob existing bridges of steel to create a new one. For instance, one old steel bridge may be repaired by shortening it—building out the abutments from each end, shortening the span. A few girders and trusses are left over. Another obsolete steel bridge can be replaced entirely with a timber structure

laid on top of concrete arches. Now they have one old bridge and part of another, enough metal for a modern welded structure that is badly needed a few hundred miles away.

But the engineers aren't always that lucky in finding materials. When steel first became scarce, they prepared to pour concrete bridges. But not even steel for concrete reinforcing could be obtained. In California the state highway department bought up all the old lightweight rail-

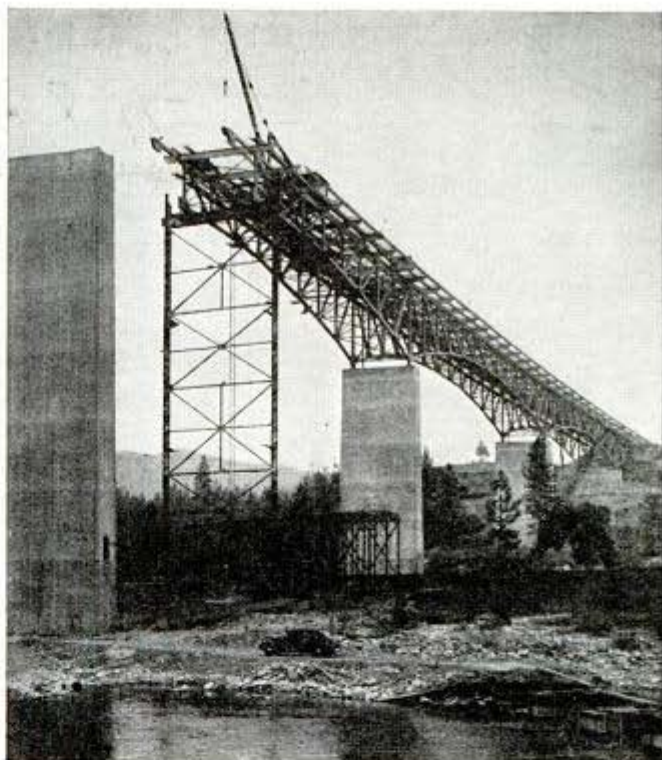


Earth is scored as by marks of giant claws when scrapers (left) level a hill for a new highway

way trackage it could find. When the rails were split lengthwise with a cutting torch and then annealed, the metal made good reinforcing material for concrete structures. When the last of the rails was used, the engineers went over to massive concrete bridge designs that required no reinforcing. Then cement became scarce, so timber structures were built. Now timber itself is on the priority list and the engineers are scratching their heads again.

In one western canyon the engineers had trouble with "sea-going" bridges. The small wooden structures they built across the stream were frequently washed out by winter floods. Traffic didn't warrant larger spans, so they anchored each bridge deck with heavy cables to adjacent trees. Now when one of the bridges is washed away it floats only to the length of its cables, and can be hauled back in place.

Inspection crews are constantly testing the strength of highway bridges. Main members of timber bridges are bored with an electric drill to check against core rot or termites. The inspection holes are then plugged with wood and sealed against the weather. Steel bridges near the seacoasts rust rapidly if they are not kept painted. Concrete structures require little maintenance but regular inspections are made for cracking, settlement and chemical action.



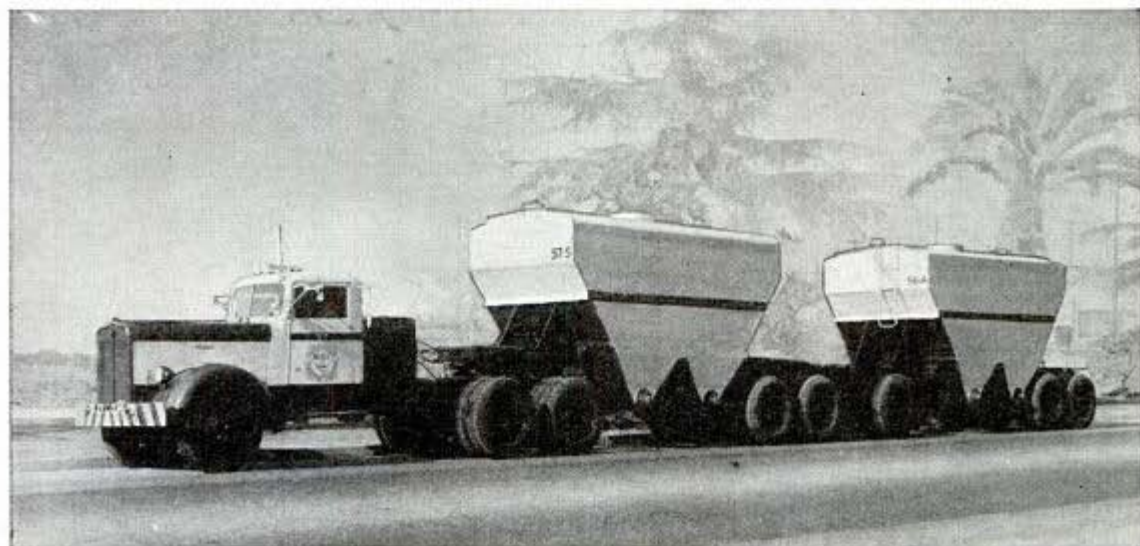
Steel bridge frame stretches out toward its next support in construction of new highway made necessary by pressure of war

Engineering records of each bridge note its present condition and safe load limit. Weak bridges are posted with warnings of the safe allowable load and speed.

More than \$50,000,000 has been spent in California alone in the last two years on improving highways. The program includes realignments of strategic roads, building access roads to new military bases, and completing emergency flight strips ad-

(Continued to page 162)

Thirty-wheeled truck train hauls 30-ton loads of magnesium ore concentrates to railhead in Southwest



Lamp Bases on "Jitters Table" Flip Endwise for Inspectors



Inspectors' sloping table vibrates to keep lamp bases moving

Heart of the "jitters table" used by Westinghouse inspectors to spot defective light-bulb bases is a series of "turnover tubes," spiral channels across the center of the table which turn the bases end over end, eliminating the tedious job of picking up each base to examine both sides for flaws. The automatic turn makes inspection 400 percent faster. A motor underneath the sloping table keeps it vibrating, to jog the accepted bases on down the production line.

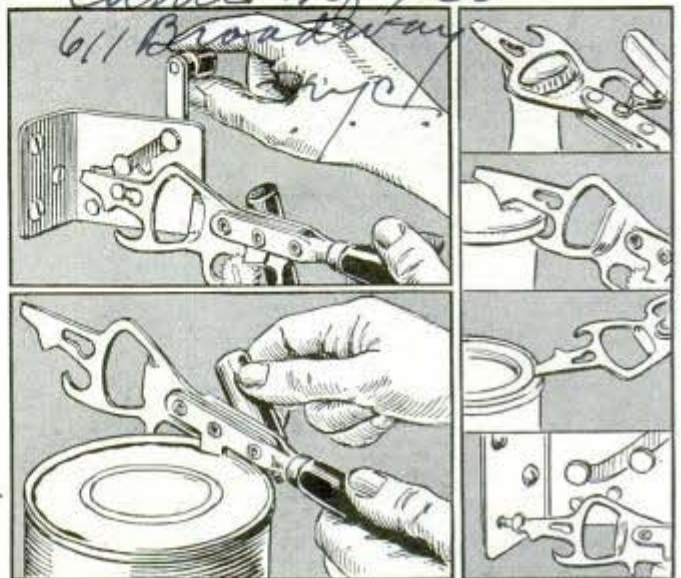
"Upside Down" Eyesight Rights Itself in Weeks

How the human eye, fitted with an instrument that turned everything the subject saw upside down, "righted" its visible world within a week is reported by the Better Vision Institute. The inverting instrument, fitted on one eye, reversed the visual images on the retina of that eye. The other eye

was blindfolded. For a week the subject wore the instrument each day; both his eyes were blindfolded at night. At first, the wanderer in this scientifically topsy-turvy world had difficulty in walking, or in judging the movements of his hands. After a few days he learned to gauge distances fairly well, and before the end of the week everything looked rightside-up again. His eye had adjusted itself to the new condition. After the week, the instrument was removed, and the subject again experienced difficulty in standing or walking straight, until, after another period of confusion, his eyes again adjusted themselves to normalcy.

Five-in-One Can Opener Serves as Screw Driver

Five kitchen tools are combined in one in a can opener that operates with equal ease on round, square or oval cans. For opening cans, the blade is placed over the rim and a side "wing" is turned to pull it forward while the handle is held firm. The opener is also used as a screw driver, bottle cap remover, fruit jar cover lifter or pry. A bracket is supplied with the opener, by means of which it can be mounted on a wall.



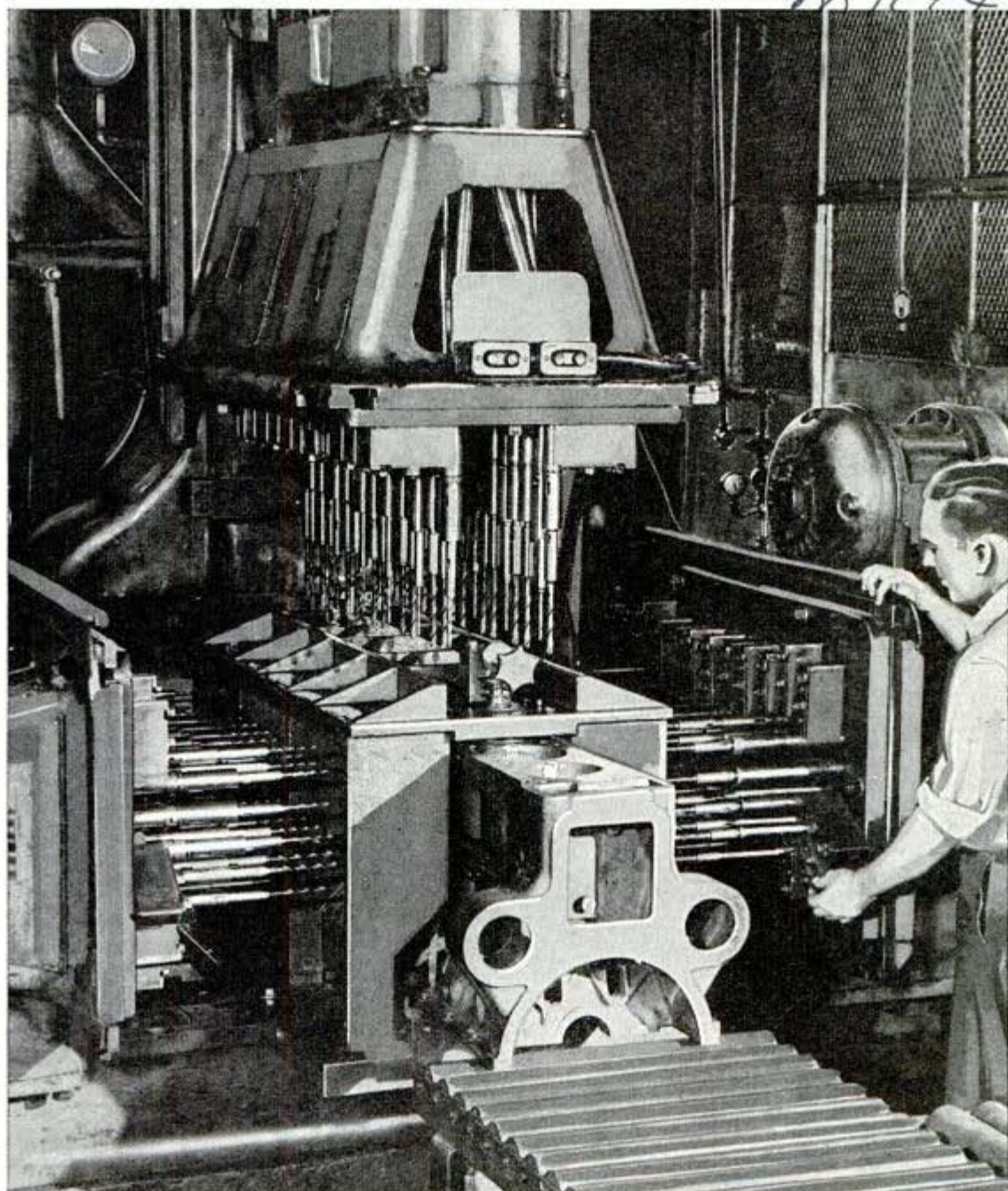
Attaching opener to wall bracket, upper left; five uses shown

630-56
n.p.c.

All. & mfg. co. Inc. East Pittsburgh Pa

Cahil mfg co
611 Broadway

*Hudson Motor Cars
Detroit, Mich.*
Drill Bores 100 Holes at Once in Engine Block



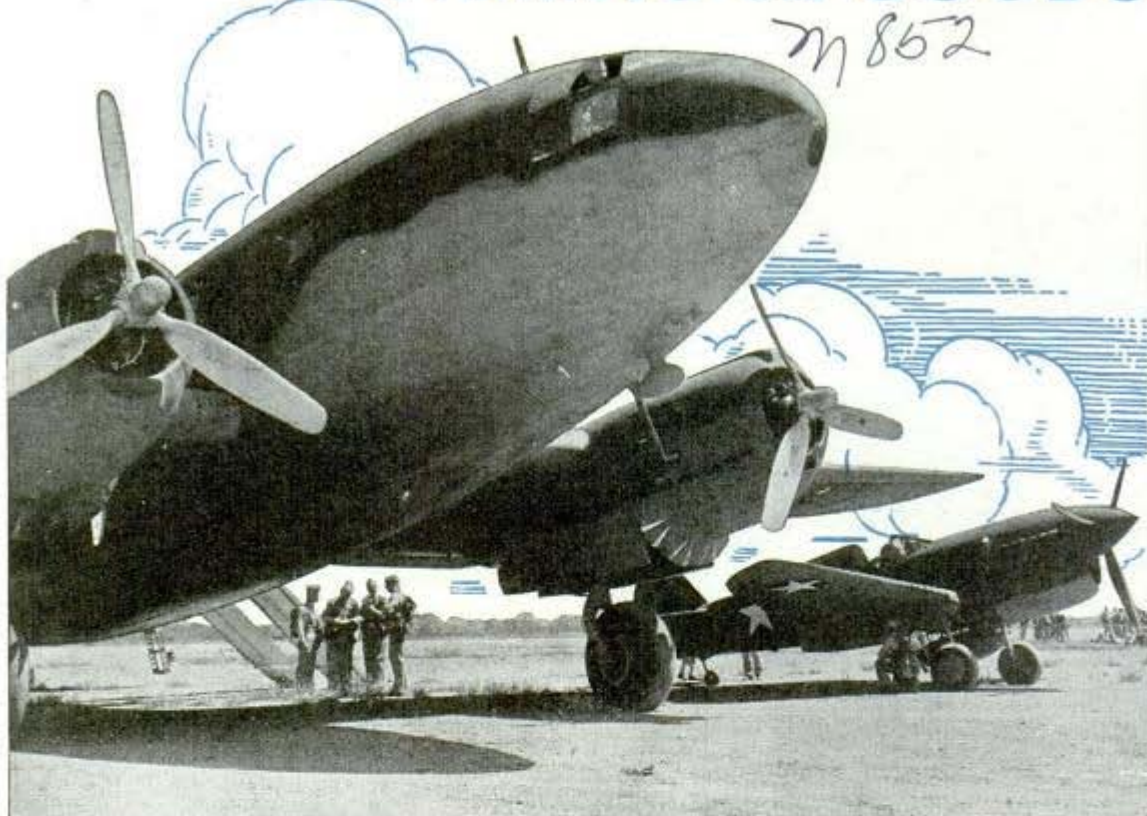
Boring from three sides at once, this multiple drill speeds delivery of engines on a contract for the Navy

At the touch of a button, more than 100 drills from three sides bore holes into a big Hudson Invader engine cylinder block. This big three-way multiple drill saves both time and manpower in accelerating the output of these airplane engines. This machine, with its companion which follows it by tapping the holes, handles more cylinder blocks in one hour than were produced in an entire day under former meth-

ods, when holes were drilled one at a time and then tapped singly. The multiple drill was set to work on an important war contract for the Navy, after a pilot job was successfully tested.

☐ In a single year, one female moth and her descendants, if permitted to develop unmolested, could destroy as much wool as 13 sheep can produce in a similar period.

DELIVERING *the* GOODS



This giant "sky troopship"—the Curtiss Commando C-46—is the world's largest twin-engine military transport. It carries soldiers, jeeps, guns. The "dwarf" beside it is a P-40 fighter

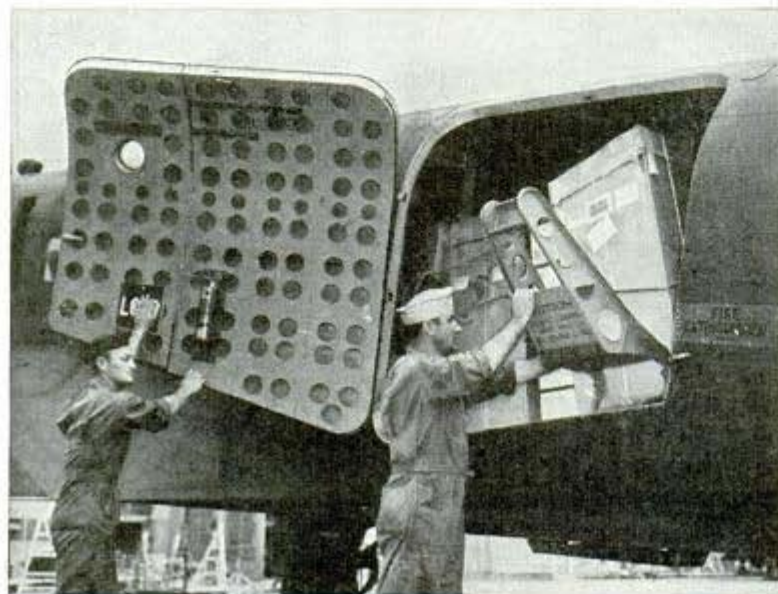
ROARING over strange lands and strange seas by day and by night, an unheralded group of flying heroes is taking the fight to America's enemies all over the globe.

They drop no bombs and they fire no guns; their job is to deliver the goods—

airplanes and equipment and supplies—to the combat teams doing the actual fighting, often thousands of miles from home shores. They are the pilots and the members of crews of the Air Transport Command.

If a big, four-engine bomber is to be delivered to a base halfway around the world,

these modern pioneers climb into the huge airplane and take off with little more concern than if they were going for a joy ride. Then, hour after hour, they drive steadily for their destination, flying mostly at night and landing only for fuel and a catnap. Dawn usually finds them gliding down, so that maintenance men may have daylight for accomplishing whatever repairs may be necessary, then on at dusk, until they



Loading a big Douglas transport with airplane parts that will be rushed to U. S. base overseas

Capt. J. P. Leggett, 2500 Far Hills av
Oakwood, Dayton, Ohio

AROUND the WORLD



Troops march into a Commando—number it carries is kept secret to disturb the rest of Hitler and Hirohito

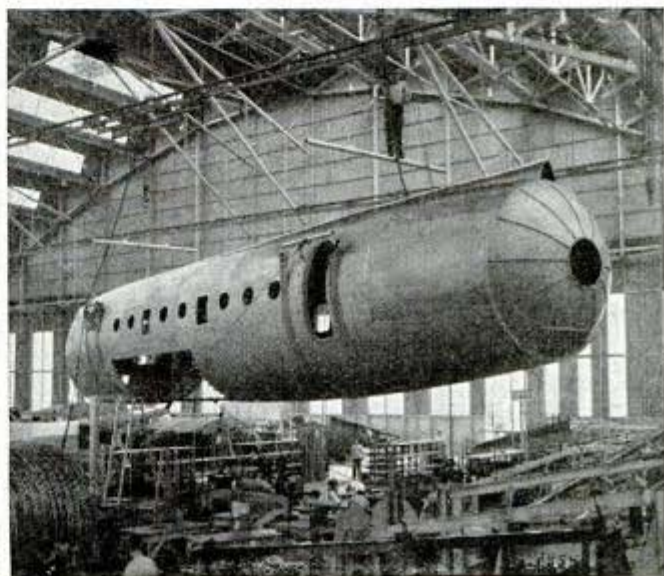
set the bomber down where it is needed to help conquer the enemy.

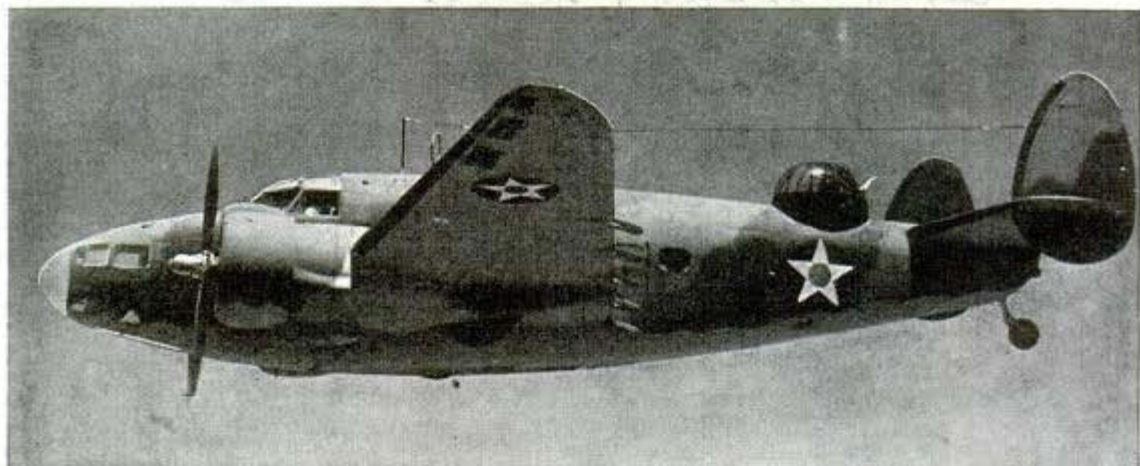
That is the ferrying job of the Air Transport Command's pilots and crews. Then there is the gigantic task of transporting millions of pounds of weapons, ammunition, spare parts and supplies to Uncle Sam's far-flung string of air bases, as well

as to the flying stations of the nations allied with this country. This too the Air Transport Command is doing, and doing well, by operating a transport system so vast that it eclipses even the dreams of America's aviation visionaries.

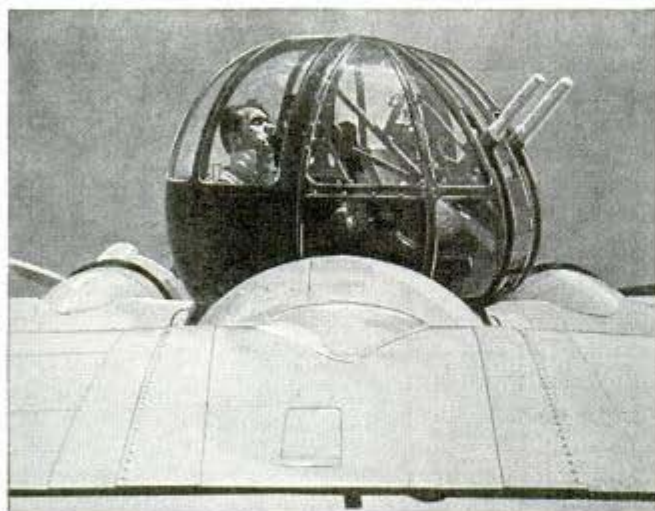
Of an entirely different nature is another phase of the Air Transport Com-

Man in mask (left) insulating plane with kapok. Right, fuselage of Douglas flying boxcar being lifted from jig





A familiar sight on the Atlantic ferry route is this Lockheed, called Hudson bomber by the RAF. Scores of them have been flown across the ocean by Air Transport Command pilots



Closeup of turret on the Hudson bomber with gunner on alert for enemy fighter planes. Gunner can train guns in wide arc

This view of the inside of cargo plane under construction gives some idea of its size; the workmen are installing folding seats



mand's breath-taking task. A unit, known as the Air Evacuation Group, has been organized for the purpose of transporting from theaters of war the sick and wounded military personnel. Among other things, facilities for treatment in transit are provided.

The unit uses transport planes, which serve the double purpose of bringing in supplies and carrying out the wounded. For the latter purpose, the planes are equipped with fittings for racks and supports to accommodate standard army litters. As many as 40 patients may be transported in a single plane at a time, and in comfort. Each evacuation is under the direction of a flight surgeon, who is in charge of one nurse and one trained Medical Corps enlisted man. Some idea of the value of this service may be gained through a simple comparison; over difficult terrain, a trip by ground means may take as many as 18 hours, whereas, the "flying hospital" makes it in one hour. In addition, the patient is spared the strain of jolting over rough roads.

Planes used for this purpose have facilities for surgical teams and for blood transfusions and the use of plasma, as well as medicines, stimulants and sedatives, thermos jugs for liquids and chemical heating pads. When necessary, the standard oxygen mask can be employed to advantage.

Equipment of practically every description is included in the cargoes of the ocean-jumping aircraft

Asme newspapers
461-8 ad ny
Amphibious "Barrel" Tank
Built With Less Steel

of the Transport Command. A typical cargo may contain airplane engines, medical supplies, food concentrates, radios, flashlights and cigarettes. In the first 11 months of operations, about 125,000 pounds of letters were carried by the command's planes. Since installation of V-mail, about three times as many letters may be carried.

A few months ago an average of 1,000,000 pounds of essential priority air cargoes were being handled by the domestic service of the Transport Command. This service formerly was known as the Contract Air Cargo Division, which utilized the facilities of 15 commercial airlines to deliver airplane parts, equipment and replacements throughout the Western Hemisphere. At that time, the schedule called for each contract airplane to fly an average of 10 hours, or 1,500 miles per day, carrying about 3,500 pounds of cargo, as well as transporting military personnel.

Among the commercial transport aircraft in this service are converted Douglas DC 3s, Lockheed Lodestars and Boeing 247s, and the new Douglas C-47s and four-engine C-54s and the Curtiss C-46s—the huge two-engine planes. Generally, these aircraft are fitted with a large loading door in the side and reinforced floors.

At one of the command's bases on the Atlantic coast, there is encouragement aplenty for every American. Formations of fast, new aircraft—big bombers and other types—not long off the production lines, swoop down onto the landing field at frequent intervals, then, in a few hours, are roaring across the ocean. At the controls of these airplanes are the unheralded heroes, young pilots and members of crews, who take the ocean crossing as routine.

They talk casually of their trips, journeys which may have taken them 30,000 to 40,000 miles and during which they may have landed in a dozen countries and have passed over many more. Automatic pilots give the crew periods of rest as they swing more than halfway around the globe; out of tin cans come their food, the preparation of which falls to the best cook on board. The navigators carry a complete set of world maps as standard equipment.

And with all this flying, often to points never considered by commercial airlines in their plans for transoceanic service, the safety record is almost unbelievably excellent due to the system of weather re-

(Continued to page 158)

MAY, 1943



Cecil H. Starbuck
Washington D.C.

Model of roller tank shows end mounting of wheels

Among many devices inventors have brought to Washington as offerings toward winning the war is an amphibious armored tank model having a unique two-wheel arrangement. The two wheels, hemispherical in shape, are placed at the ends of the roly-poly vehicle, moving it along in barrel fashion. A trailer wheel at the rear prevents revolving of the entire body, where the crew and engines are housed. The driving wheels can be moved independently to steer the tank. Less steel would be consumed in its manufacture. Turret guns are unnecessary since the tank itself can spin around.

One Pound of Man's Finest Silk
Would Span 20,000 Miles

Rivaled in fineness only by the strand of a spider's web, a new synthetic textile filament weighing one-eighth as much as the finest natural silk filament has been developed by the Celanese Corporation of America. It takes 20,000 miles of the thread, described as the finest produced by man or nature, to weigh a pound.

180 madison av
ny
91

akron Q

Steam Helps to Free Wires In Old Electric Conduits

M 1180



Hot steam melts covering on old wire stuck to tube

"Frozen" electric wires that cling tenaciously within conduits can be removed by forcing live steam into the ducts. A portable steam generator, developed by Utilities Research Commission of Chicago, has extricated wires that resisted all other removal efforts where the old, undersize circuits were to be replaced with adequate wiring. The combined effect of the steam and heat emulsifies the hardened wax and asphaltum covering the wires, tending to loosen the wires and providing a lubrication for easier passage through the pipe when they are pulled. In place of the old wires, new ones with the thin-wall insulation can be installed, obviating the use of unsightly exposed conduits on ceiling and wall surfaces.

2,000 Plants Tested for Rubber; Russian Dandelion Found Best

M 1114

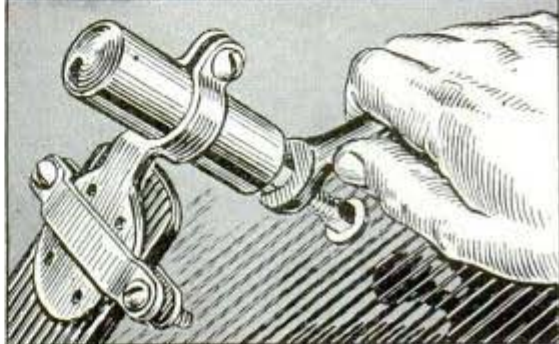
In the ceaseless search to replace the supplies cut off by the Jap conquests of Greater East Asia, investigators of the Department of Agriculture at Cornell University, with financial aid from the

B. F. Goodrich Company, have tested nearly 2,000 varieties of plants found in this hemisphere. A five-minute test has been developed which gives an approximate estimate of the natural rubber in plant tissues. Most of the plants examined show rubber content too low for commercial use, though some contain sufficient quantities of resin to justify further study as possible sources of materials for synthetic rubber. The Russian dandelion appears to be the most promising emergency rubber-bearing plant for growth in northern climes, for its root's rubber content is readily obtained by mechanical means, and after rubber is extracted roots can also be used for alcohol production.

"Speed Warden" Warns Driver At 34 Miles an Hour

M 1181

It's so easy to let your car skip along faster than the national speed limit of 35 miles an hour, that a warning device will help drivers keep within the legal bounds. It is called the Speed Warden and gives the foot a nudge by resisting pressure of the accelerator beyond the 30- or 35-mile point. Attached to the foot pedal, the device has a plunger that strikes the floor at a predetermined position, yet it does not create a positive stop at that point. If the driver wants more power for passing, he can get it by exerting a little extra pressure on the pedal.



"Foot nudger" in place, top; below, adjusting plunger

*72 N. Adams St
Rpt*

92 Ithaca NY

*B.F. Goodrich Co
Akron Ohio*

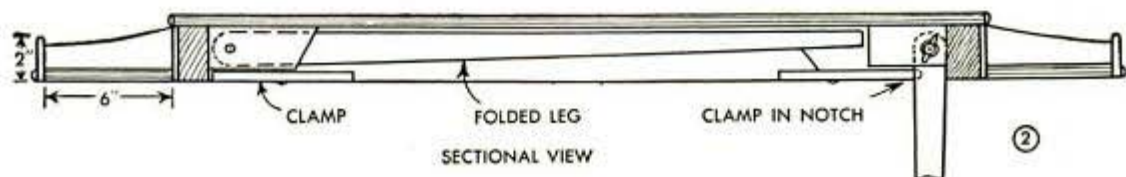


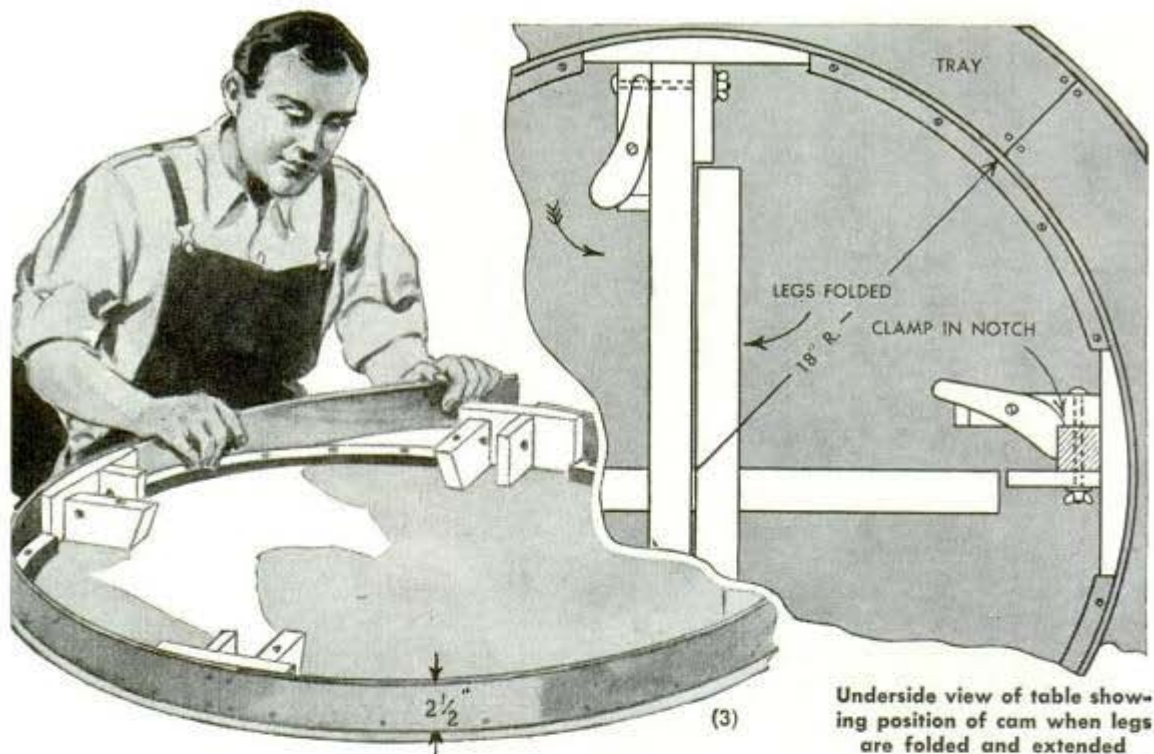
The CRAFTSMAN

Steady legs on this GAME TABLE

By Robert L. Smith

ON HOMEMADE circular card tables that have folding legs, the use of leg braces of the usual kind that are found on square card tables, is not always practical. In such cases, rigidity of the legs when they are extended can be obtained by using clamps of the kind shown in Fig. 1. Each clamp consists of a camlike piece pivoted on one of the two blocks between which the leg swings, so that the large rounded end of the cam wedges tightly against the leg to "freeze" it in position against piece A, Fig. 1. With this arrangement, considerable wear must take place before the locking action becomes ineffective, if the legs and cams are hardwood. Piece A is cut from 2 by 4-in. stock and one side is rounded to fit the curvature of the apron. The block on which the cam is pivoted should be $1\frac{1}{8}$ in. thick but $\frac{3}{4}$ -in. stock is suitable for the other block. Although a dowel might be used as a substitute for the bolt, maximum rigidity results by tightening the wingnut as this eliminates side wobble, while the cam prevents any tendency of the leg to move





inward. Note how each leg is rounded at the upper end, which prevents it from binding against piece A when swinging in or out. When extended, the leg must fit snugly against piece A. Also note that the notch in the leg to receive the cam is cut at an angle to assure getting full benefit from the wedging action of the cam. A sectional view of the table, with one leg folded and the other extended, is shown in Fig. 2. The apron of thin plywood serves to hide the blocks on which the legs and cams are pivoted, and also stiffens the table top. The diameter of the top of the original model was 36 in., and its height above the floor

30 in. The width of the tray was 6 in. and it was attached to the apron by means of eight bracing partitions, each one being set at an angle of 45 degrees to adjacent ones. The legs are planed down on one side only to a thickness of about 1 in. at the bottom. This tapering will permit the legs to fold more compactly than if left square, although two of the legs will still project a little beyond the apron. If you prefer to have the legs nest flush within the top, the apron width will have to be increased to about 4 in. When the legs are folded, the cams are swung to the position indicated in Fig. 3, and the wing nuts tightened.

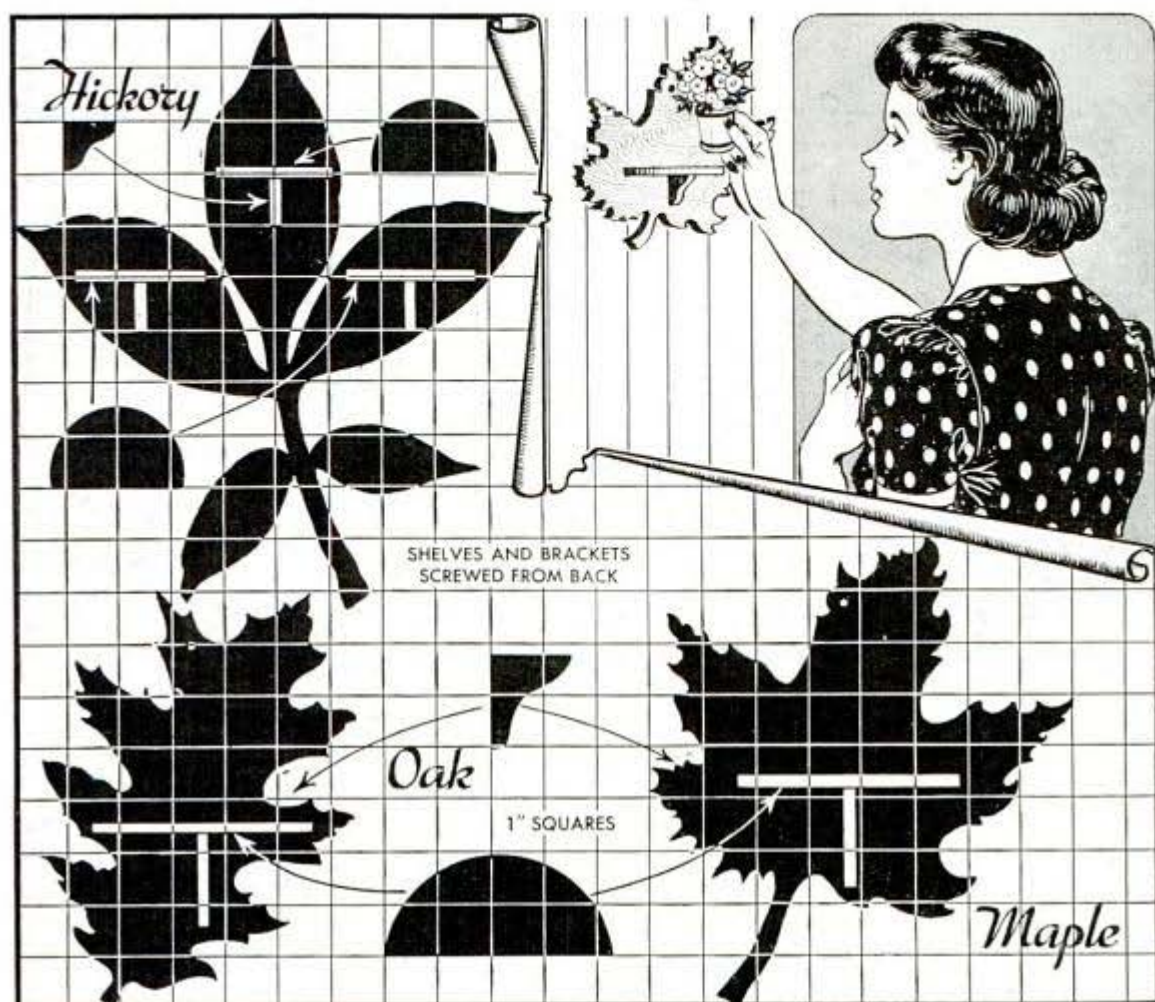
Wild Berries Planted for Birds Protect Cultivated Crops

Fruit and berry raisers often can protect their crops against loss by birds if they plant wild trees and shrubs that mature their fruits about the same time that the cultivated crops ripen. In most cases, you will find that birds prefer the wild fruit to the cultivated kind. The following list of fruit-bearing trees and shrubs and the months in which they ripen will enable anyone to work out a schedule suitable to the fruits cultivated in any given locality. Of course, there may be a slight variation in the ripening time in different parts of the country. Wild mulberry and Juneberry, or shad-bush, will ripen in late June

and early July about the same time as cherries and strawberries, while English, or golden currant, and blueberries will mature in July along with raspberries and currants. In August, elderberries, chokecherries, buckthorn and huckleberries will attract birds away from ripening blackberries, dewberries, youngberries and boysenberries. September, of course, is grape time, which is also the same time that wild pokeberries and wild grapes ripen.

☛ If the grass in your lawn is sparse, you will usually find that fertilizer is needed much more than reseeding.

Leaf Shelves Make Novelty Wall Decorations



Holding small knickknacks, these novelty leaf shelves are highly decorative on walls, especially when placed at the sides of large pictures or mirrors. Besides the three designs shown, various other combinations can be worked out, patterning them after the leaves of your favorite trees or those that are peculiar to your locality. The leaves are scroll-sawed from $\frac{1}{4}$ -in.

stock and are fitted with one or more shelves, depending on the leaf combinations. As shown, the hickory leaf lends itself to the use of three shelves, while the oak or maple are suitable for only one. The shelves and brackets are attached to the leaves with small wood screws, which are driven from the back of the leaves.

—Warren R. Stevenson, Chester, Ill.

Crabgrass Seedlings Killed by Thick Tall Lawn Grasses

One of the best ways of keeping crabgrass out of a lawn is to provide a heavy turf. Seedlings of crabgrass are extremely sensitive to shade, and if the turf is thick and allowed to remain at a height of 3 or 4 in. to provide dense shade during the germination period of crabgrass, which is early May in the northern states, the seedlings are likely to be killed. As lawns produce most growth during spring and fall months, condition them early in the spring.

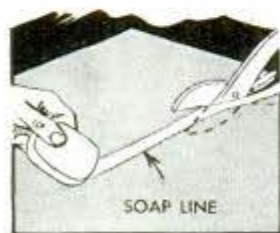
Lime applied at the rate of 50 lbs. per 1,000 sq. ft. in January will be beneficial. Fertilizer should not be applied later than early in March as later applications are beneficial to crabgrass. If there are spots that need reseeding, do it early so there will be a thick turf before the crabgrass germinates. Avoid watering during the summer months until the lawn starts to wilt; then water until the soil is soaked to a depth of 4 inches.

Scraper Iron on Side of Truck Cleans Form Boards



To simplify the cleaning of cement from concrete form boards while loading them, one contractor used a piece of flat iron bent at right angles and screwed to the side of the truck body as indicated. The workmen inspect the boards when loading them and those that have dried cement on the edges are passed over the scraper to clean them.

Soap Mark Lubricates Sheet Metal To Cut It With Shears



If you have some heavy sheet metal to cut with shears, the job can be made easier by marking the line of the cut on the metal with a bar of soap. This will serve as a lubricant so that the shears will cut the metal with less effort.

Keeping Circular Saw in Balance

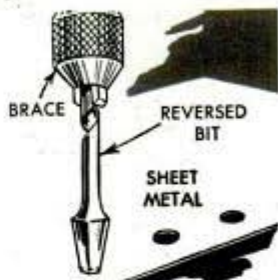
When a circular saw runs untrue and out of balance often the trouble is due to play between the mandrel and the hole in the saw blade. Jointing seldom improves the condition unless care is taken to place the saw on the mandrel in the same position each time it is removed. However, by putting an identifying mark on the blade

and keeping it uppermost when placing the saw on the mandrel, the relation between the mandrel and saw is always the same and, after jointing a few times, the saw will run true and in balance. The same thing applies to dado heads, cutoff wheels and other attachments used on a saw.

—L. A. B. Hutton, Ottawa, Can.

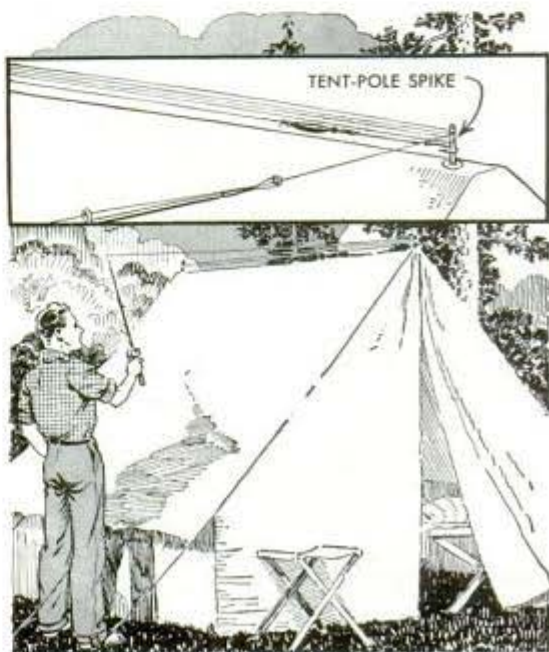
Twist Drill Used as a Reamer

Having a number of holes in sheet metal that were too small, and having no reamer at hand to enlarge them, one tinsmith did the job with a twist drill. This was reversed end for end in the chuck of a brace so that the shouldered end of the drill could be used as a reamer.

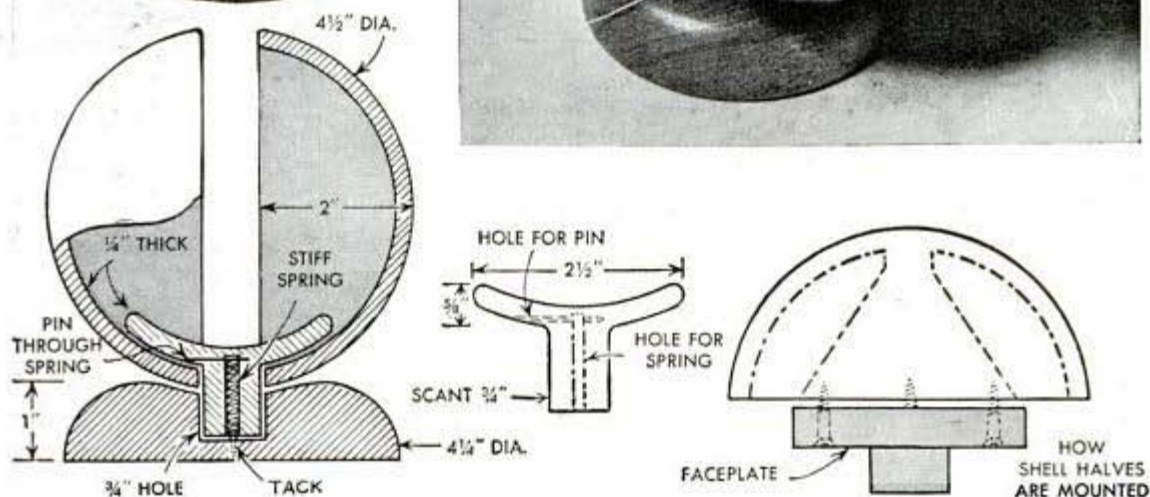
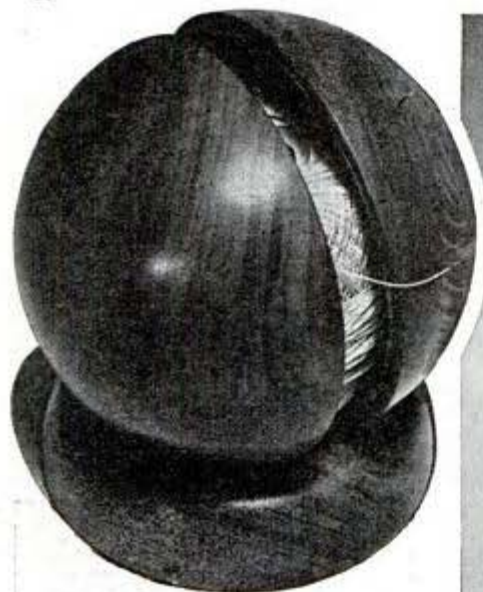


Projecting Spikes on Tent Poles Serve as Fishline Drying Reel

One sportsman who always dries his fishlines each time that he has fished with them, uses the spike ends of his tent poles as a reel for this purpose. It is a simple matter to wind the line around the ends of the spikes projecting above the ridge pole, using the casting rod to weave the line back and forth.



Spherical Thread Holder Opens Like Clam Shell



You won't have to hunt through a drawer or dig around in a bag for your crocheting thread if it is kept in a holder like this one, which is ornamental enough to be left right on a table or dresser where it is always at hand. Turned from walnut or maple, the holder consists of a base supporting two half-round shells, which enclose the thread. An unusual method of attaching the shells to the base makes it easy to spread them apart for removing or inserting the ball of thread. A flanged piece turned as shown in the lower center detail, is drilled to take a small but strong coil spring, which is pinned at the upper end of the piece and tacked to the base as indicated in the lower left-hand detail. The shells are slipped under the flanged edge of the piece, which holds them tightly against the base in a vertical position. The detail at the lower

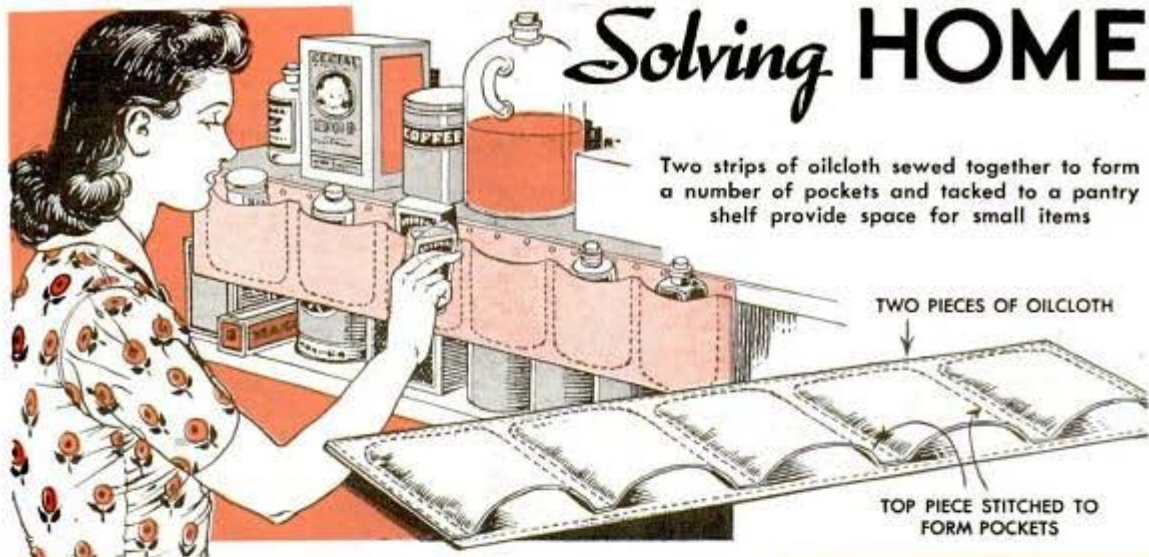
right shows the method by which each half of the shell is mounted on the lathe faceplate for turning the inner concave surface.

Identifying Microscope Slides

Notching the edges of microscope slides provides an easy method of numbering them for identification. The notches cannot be washed off or erased, and provide a means of identifying the slides even under poor lighting. You can make the notches with a fine file, one notch for number one slide, two for number two, etc.



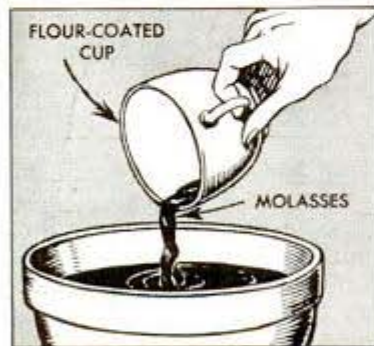
Solving HOME



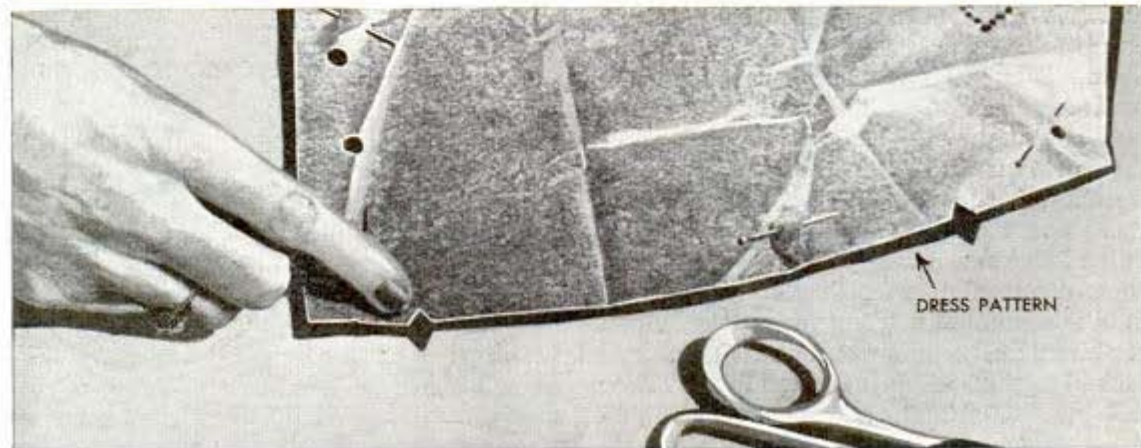
Two strips of oilcloth sewed together to form a number of pockets and tacked to a pantry shelf provide space for small items



To utilize pieces of scrap soap, put them in a cloth-covered funnel and invert it on the bottom of a wash boiler as at the left. Boiling water will percolate through the funnel and dissolve the chips. Spring wire stapled to the jaws of a spring-type clothespin makes a handy clamp for holding a cloth strainer on container as shown at the right



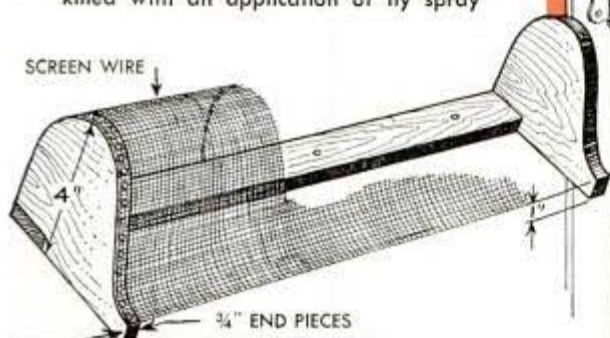
Left, before using a cup to measure molasses for cooking, coat the inside surface with flour and the molasses will pour easily from the cup, leaving it almost clean. Right, alphabet macaroni is ideal for labeling jelly glasses. Just drop a macaroni letter on top of the paraffin cover before it hardens and the letter will stick in place



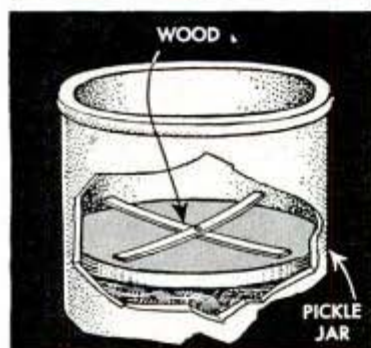
Instead of notching cloth to correspond with notches in a pattern, which may result in tiny holes showing in a narrow seam, cut small projecting tabs in the cloth where the notches appear in the pattern

PROBLEMS

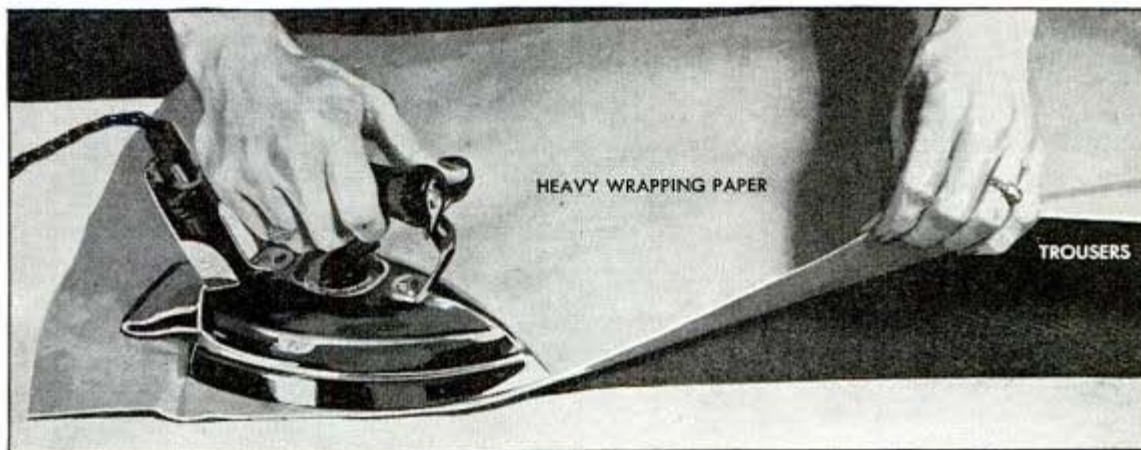
If flies gather near the top of your screen door and enter when it is opened, use this trap, which is placed on the outside. Flies in the trap can be killed with an application of fly spray



Left, an inexpensive tobacco humidifier consists of a rolled blotter placed in a salt shaker and wetted thoroughly, after which the shaker is wiped dry and inserted into the can of tobacco. Right, if the threaded wooden handle of a push broom has a tendency to loosen, remove the handle, insert a cork disk in the hole and reassemble the parts



Strips of hardwood nailed across the cover of a pickling jar to project slightly beyond the edge as at the left, will wedge the cover at any desired height inside the jar. When using a small piece of steel wool, roll it and grip it with a spring-type clothespin, which then serves as a holder as shown at the right



To assure "knifelike" creases when pressing trousers, first use a damp cloth in the usual way, but before the cloth dries replace it with a sheet of heavy wrapping paper and again press over the creases

Sawbuck Faced With Metal Lath To Keep Work From Turning



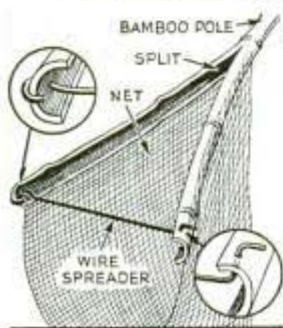
Tacked to a sawbuck as indicated, strips of metal lath provide rough surfaces that will help keep sticks and small logs from twisting and turning while sawing them. The lath is bent over the edges of the sawbuck and nailed to the sides.

Refinishing Golf Balls

To remove old paint from golf balls, dip them into a warm solution of ten-percent sodium hydroxide for a few minutes. This should be followed immediately by a good scrubbing. Two or three thin coats of enamel will give a good finish.

—H. J. Kerber, Chicago.

Split Bamboo Provides Handle For Folding Minnow Net



You can make a minnow net that can be folded by splitting a length of bamboo pole and attaching a wire to one section to be used as a spreader. The wire is looped at one

end to engage a hole in one leg of the pole, and given a double, right-angle bend at the other to permit insertion into a hole in the opposite leg. The net is attached by sewing or by use of waterproof glue. When not in use, the pole is folded and the net wrapped around it.

Handy Dispensing Wire Reel Made From Shoe-Polish Can

The difficulty of removing a length of piano wire from its coil, without having the coil loosen and become entangled, can be avoided by using an empty shoe-polish can as a reel. A small hole is punched in one side of the can, after which the wire is placed in the can with the free end extending through the hole. When needed, the wire is pulled out through the hole.



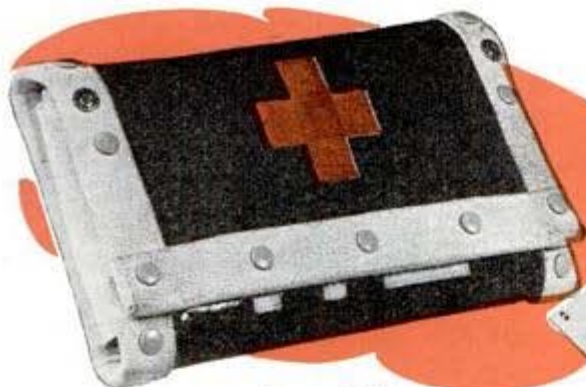
Felt Oilers on Lawnmower Roller Increase Life of Bearings



Bearings of a lawnmower roller, both new and older types, are difficult to keep lubricated adequately once they become worn. You can slow down this rate of wear in the older type bearing and provide ample lubrication and grit protection for the newer types simply by cutting disks from $\frac{1}{4}$ -in. felt and fitting these on the roller spindles. Put a few drops of medium oil on the disks occasionally.

Substitute for Rubber Eraser

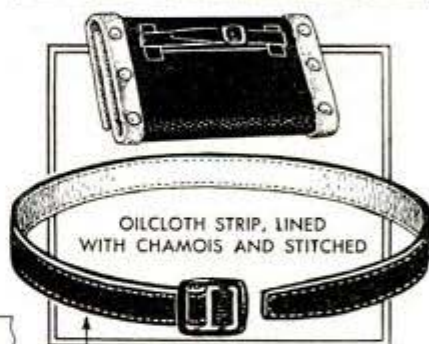
When no longer useful for their original purpose, mimeograph impression rollers and some printing-press ink rollers of the glue-and-glycerine composition type can be used for erasers if cut into suitable shapes. This material resembles ordinary gum eraser in its erasing action.



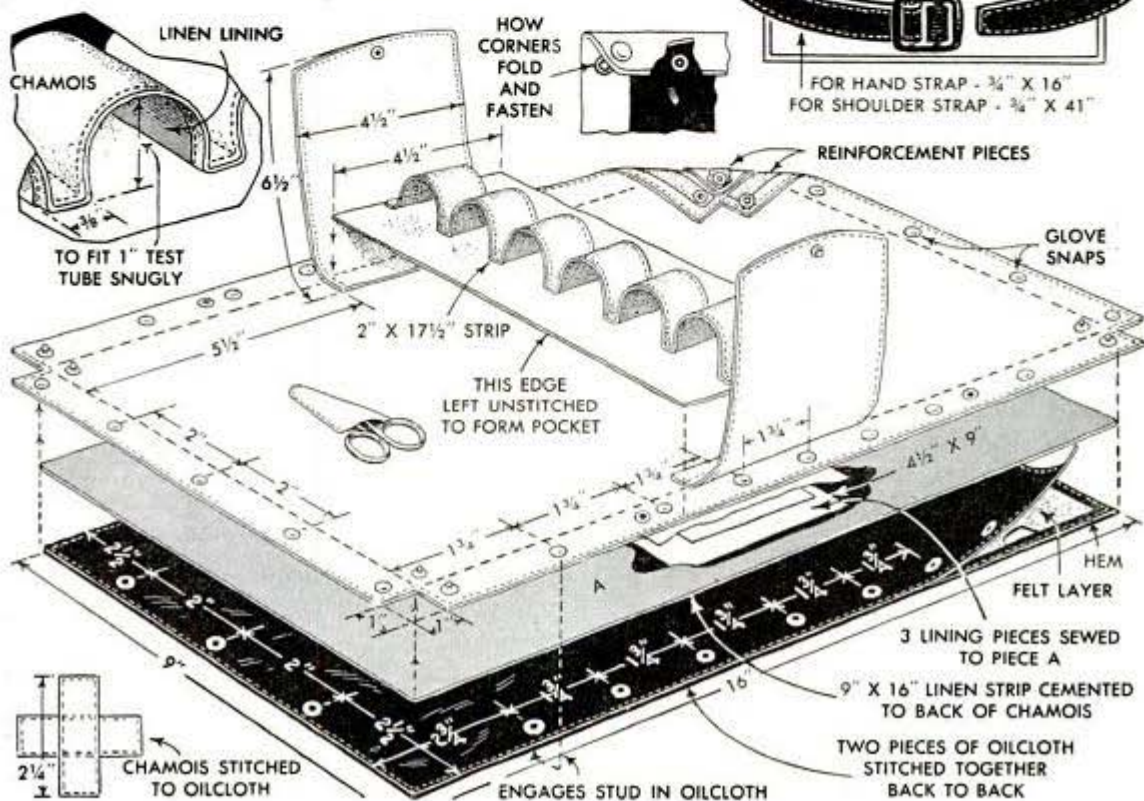
Washable FIRST-AID KIT

WORN about the waist or carried like a purse from the shoulder, this novel first-aid kit has a chamois lining that can be unstrapped from an oilcloth back and washed when soiled. Six glass tubes fitted with corks hold a supply of sterilized cotton, gauze pads, bandage compresses, inhalants, iodine swabs, compress adhesives and small tubes of ointment. The chamois as well as the linen pieces should be preshrunk by washing in lukewarm water and soap before cutting them to size. Instead of the glove snaps, buttonholes can be cut in the chamois to engage buttons sewed to the oilcloth.

—Helen Lemberger, Chicago.



FOR HAND STRAP - $\frac{3}{4}$ " X 16"
FOR SHOULDER STRAP - $\frac{3}{4}$ " X 41"



Tools Are Kept Handy on the Job In This Canvas Carrier



This multi-pocket tool carrier will be found handy about the shop or house as the tools are easily accessible, and the carrier can be hung where they are within convenient reach, such as on the rung of a ladder, on top of a stepladder, or over a fence, sawhorse or the back of a chair. Made of canvas, the carrier can be any size desired with as many pockets as needed. A piece of flat iron sewed in the center prevents sagging and provides a rigid place for riveting a leather handle.

—H. R. Wallin, Washington, D. C.

Putty From Paint and Whiting Prevents Stain Discoloration

If you have used putty to fill nail holes and small cracks before painting over them and found later that the putty caused



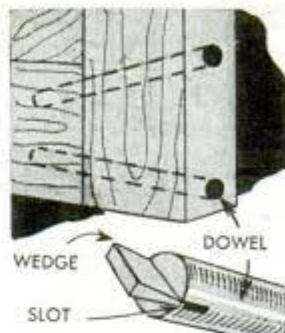
stains, this can be avoided in most cases by mixing your own putty. To do this, use whiting and the same kind of paint that is to be applied to the walls and mix it to the desired consistency.

—Benj. Nielsen, Aurora, Nebr.

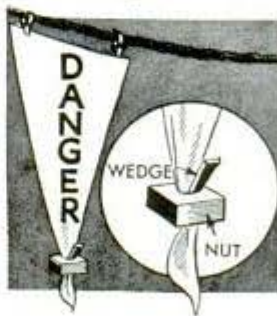
Easy Method of Repairing Door Having Loose or Broken Tenon

When a tenon breaks or loosens on a door that is otherwise in good condition, you can repair it with a couple of dowels.

First pull up the door parts tightly with a bar clamp, and then drill two holes for the dowels as indicated, making the lower one straight and the upper one at an angle. Before inserting the dowels slot the ends to take small wedges. Then coat them with glue and drive them into place. When the wedges strike the bottoms of the holes they will spread the dowel ends and anchor them tightly in place.



Nut Wedged on Tip of Small Flag Keeps It Unfurled in Wind



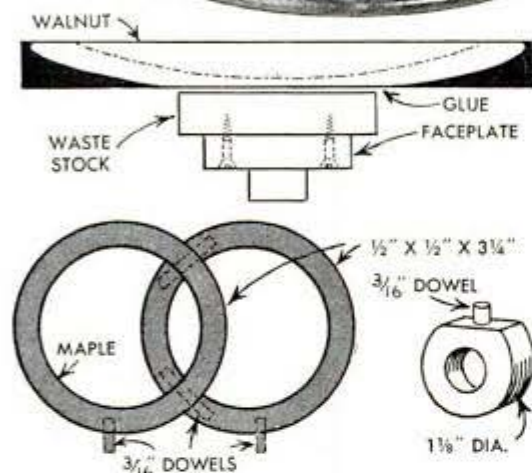
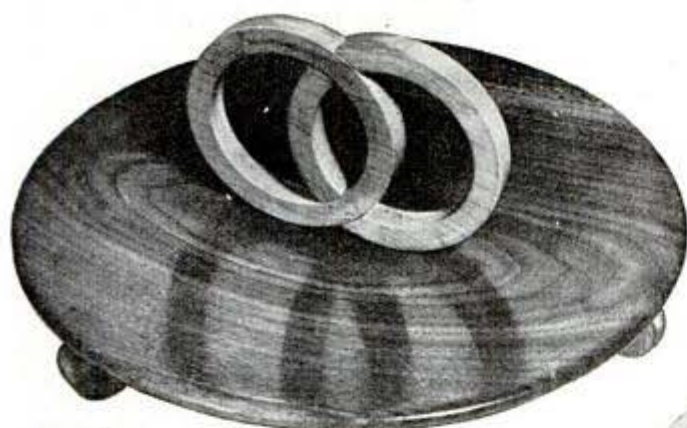
Next time you hang a warning flag vertically where the wind might wrap it around the cord or wire from which it is suspended slip a nut over the lower end of the flag to provide additional

weight. Driving a soft-pine wedge between the flag and nut holds the latter in place.

Simple Limed-Oak Effect

A simple formula for securing a limed-oak effect on wood can be had by stirring unslaked lime, 1 lb., into water, 2 qts. This solution should be rubbed on across the grain and wiped when partly dried. This prevents the accumulation of excess lime. Two coats of thin white shellac will seal it and a thin coat of paraffin wax will finish it.

Interlocking Rings Form Handle on Cake Tray



Maple handles and feet contrasting with a walnut plate make this a beautiful tray. To mount a walnut disk for turning on a lathe, glue it to a soft pine block of waste stock, using a sheet of paper between the two to permit easy separation. Then attach the pine block to the faceplate. Turn the walnut to shape, sand and shellac it while it is still in the lathe, and then remove it from the block. Two rings that serve as a handle are turned from maple. One is cut to interlock with the other, small dowels being used to hold the pieces together as shown. The feet are maple rings flattened at the top and drilled for short dowels with

which they are attached to the underside of the plate. In drilling the holes for the dowels, be careful that the point of the bit does not pierce the top surface of the tray.

How to Give Printed Pictures Cloth Texture to Simulate Oil Paintings

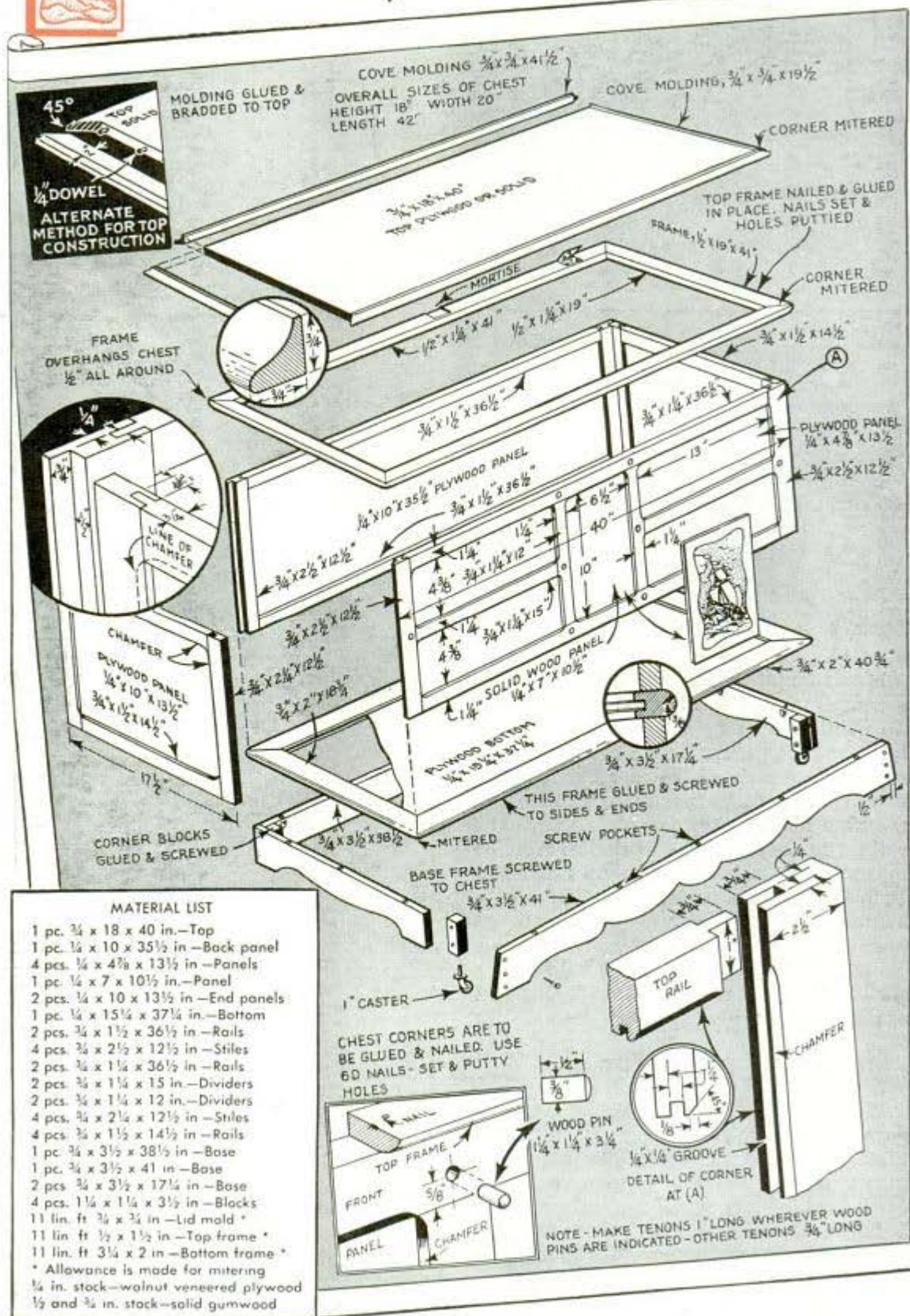
Pictures taken from magazines, calendars, etc., can be given the canvaslike texture of oil paintings by the following treatment: First, glue the picture to heavy cardboard, being careful to remove all air bubbles. Then lay cheesecloth on the picture and fold the edges over the back, pulling the cloth taut by connecting the folded edges with large stitches across the back

of the picture. In doing this, take care to keep the cloth meshes parallel with the edges of the picture. Now, apply white shellac, not too thick, directly to the cloth-covered picture, using a soft brush. Best results are obtained by using a picture having large areas of color rather than one having very much small detail.

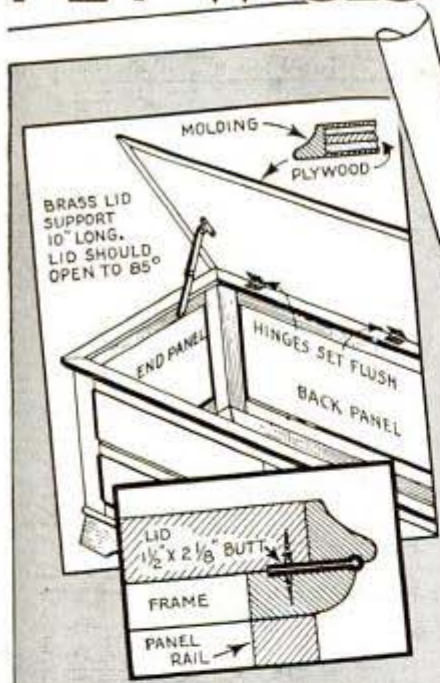
—H. V. Prenzel, Brooklyn, N. Y.



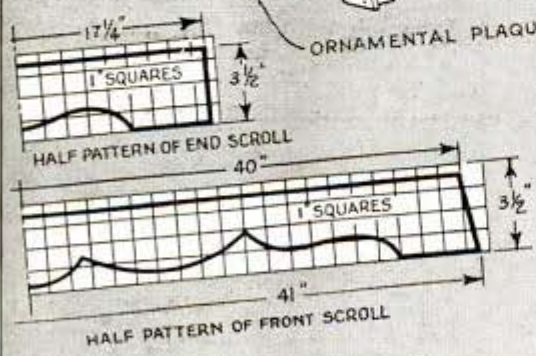
Picture panel decorates



PLYWOOD HOPE CHEST



ORNAMENTAL PLAQUE



Use of plywood panels set in hardwood frames not only simplifies construction of this chest, but also keeps the material cost at a minimum and produces a strong, neat chest that is light in weight. Wood pins are used at the frame joints in the front, both for rigidity and decorative effect, and the center panel is covered with a suitable picture. If available, this can be a hammered brass or copper plaque, or you can use a painted or printed picture. When the latter is used, it should be coated with clear shellac or lacquer to protect its surface



PLAQUE MAY BE A MAGAZINE PICTURE GLUED TO CENTER PANEL AND VARNISHED OR A TOOLED WOOD PANEL



CHAMFERS ARE CUT AFTER PANEL HAS BEEN GLUED

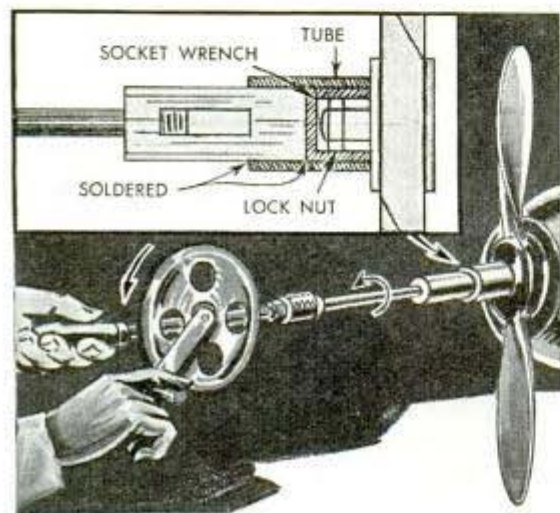
Bench Vise Used as Gluing Clamp On Heavy Work



To handle many of his gluing jobs, especially the heavy ones, without the use of special clamps, one woodworker used a bench vise. To do this, he cut a number of holes in the bench top in line with the end of the vise to make a series of strong stops. In use, the work is placed between a stop and the vise.

Model-Airplane Motor Cranked With Mechanical Starter

A model-airplane motor can be started more easily with this starter, which rotates the motor with a quick snap, than by



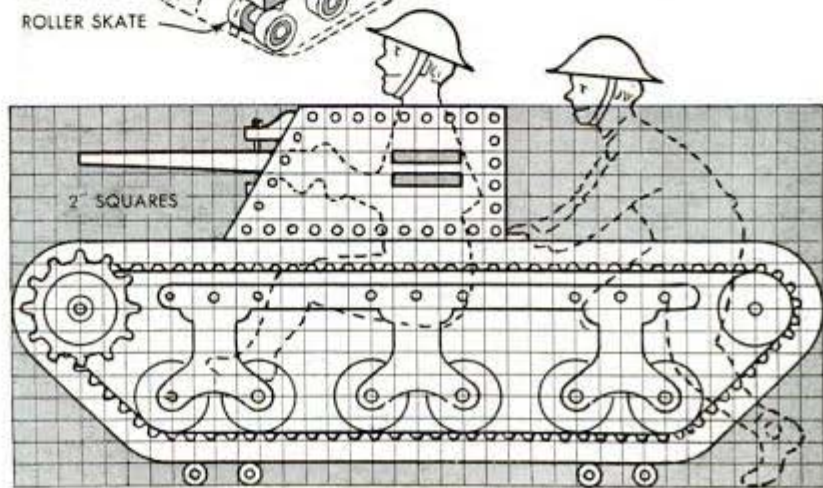
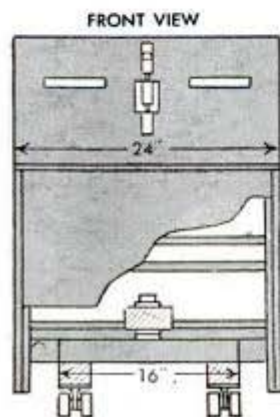
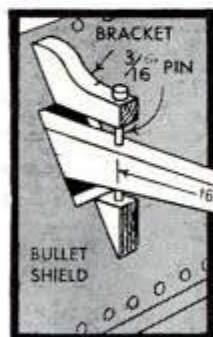
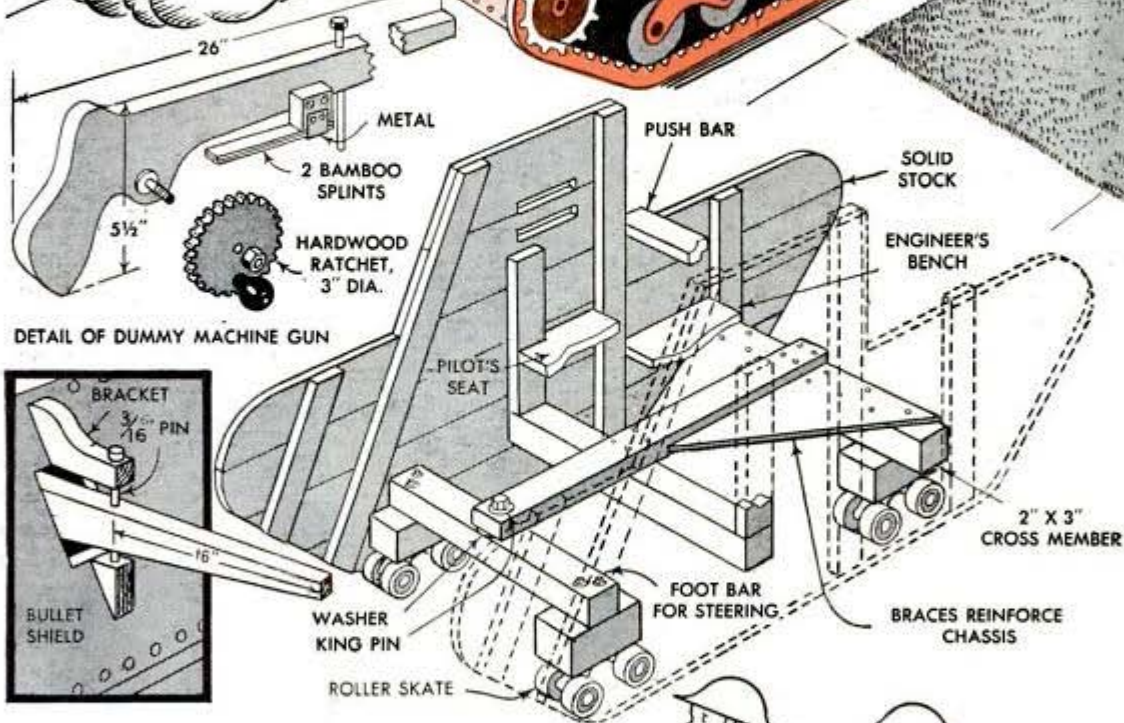
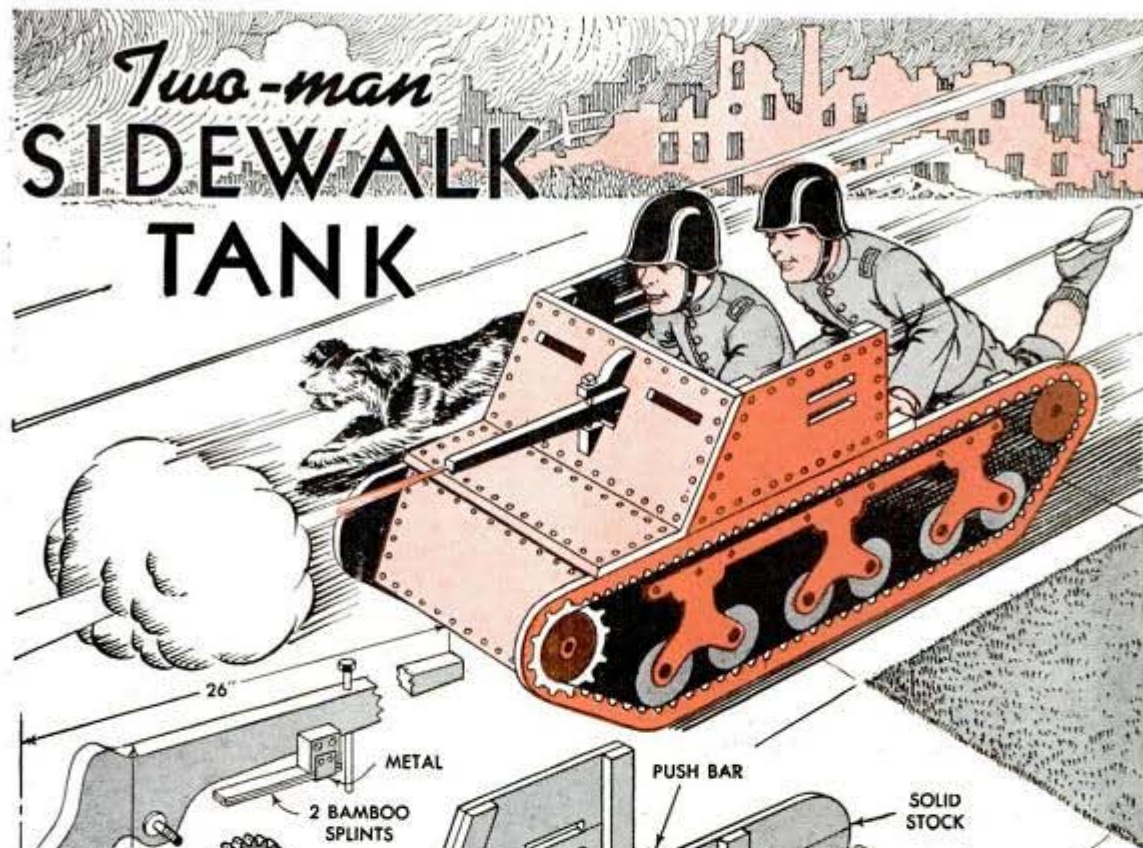
turning the propeller by hand. As shown, an ordinary hand drill is used, and a ratchet screwdriver with the handle removed is chucked in it. A socket wrench to fit the nut on the end of the propeller shaft is attached to the screwdriver by means of a sleeve soldered to both the socket and screwdriver. The motor is cranked by a quick jerk on the drill handle rather than a complete rotary motion. When the motor starts, the ratchet of the screwdriver acts in a manner similar to an over-running clutch until the socket can be removed from the end of the propeller shaft.

—R. I. Salzer, Baldwin, L. I., N. Y.

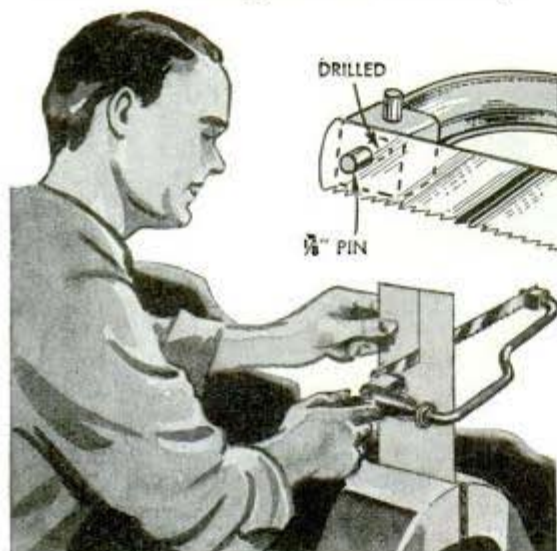
Wooden Tank Has Skate Wheels And Painted Treads

Built of packing-box lumber, crates and short pieces of boards usually found around any home, this junior battle tank will make a big hit as an outstanding sidewalk vehicle in any neighborhood. Two pairs of old roller skates may be used for the wheels or old cart wheels will serve the purpose. The framework should be of sturdy stock and the sides of the tank may be plywood or hard-pressed board if this is available. Sides should be far enough above the lower edge of the wheels to make allowance for irregularities in the surface of sidewalks. Note that the front axle is pivoted, which enables the pilot to steer with his feet, leaving his hands free to man the machine gun. The engineer at the rear furnishes the motive power on level ground although he too can get a ride when going downhill. When pushing, he can rest one knee on the support provided. The pilot sits higher up, with his head above the turret to have full vision all around. A dummy machine gun with appropriate sound effect is simply made as illustrated. It consists of a one-piece barrel and stock fitted with a hardwood ratchet wheel that engages two bamboo splints fastened to a block on the right side of the gun. A mounting pin fastened on the front or bullet shield permits the gun to be swung from side to side. The rough and crude appearance of the scrap lumber can be covered to a great extent with a good paint job in which the drive sprocket, track, rollers and other details are made to contrast with the background. Imitation rivet heads also are painted in black along seams and edges as shown to add a further touch of realism.

Two-man SIDEWALK TANK



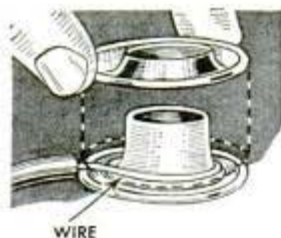
Extra Pins in Frame of Hacksaw Permit Using Blade Sideways



When the frame of a hacksaw prevented cutting a lengthwise slot in a strip of metal, I adapted it to take the blade sideways so that the work could be done. Small holes were drilled in the bottom ends of the frame, as indicated, after which pins made by cutting off small nails, were forced into the holes. This permitted the blade to be used at right angles to the frame.

—Louis Hochman, Brooklyn, N. Y.

Wire Terminals From Grommets



Grommets can be used instead of small lugs on the bared ends of insulated wires used in experimental laboratories where they must be connected and

disconnected frequently. The end of the wire is formed into an eye to fit over the grommet, which is then set down tightly on it. Grommets are inexpensive and can be attached without soldering, which is necessary when lugs are used as terminals.

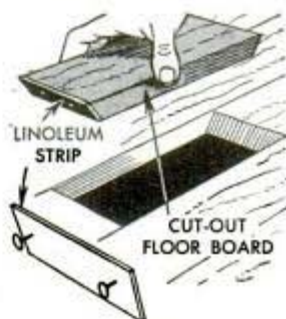
Cleaning Unglazed Tile

Unglazed tile is porous and therefore very difficult to clean, especially after exposure to grease or oil. Washing with ammonia and water sometimes gives good results, but applications of kettle-boiled linseed oil are more helpful. The oil protects

the tile, acting as a repellent to prospective grease and oil spots as well as reducing old spots. Several applications may, over a period of time, make old spots disappear. Kettle-boiled linseed oil may be purchased from local dealers.

Linoleum Strips Aid in Replacing Cut-Out Floor Boards

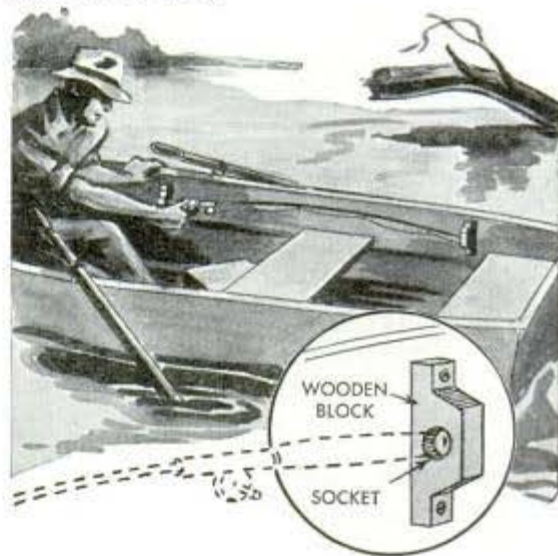
Electricians and plumbers who often are required to saw out pieces of flooring will find that these can be replaced snugly if strips of thin linoleum are tacked onto the ends of the pieces as



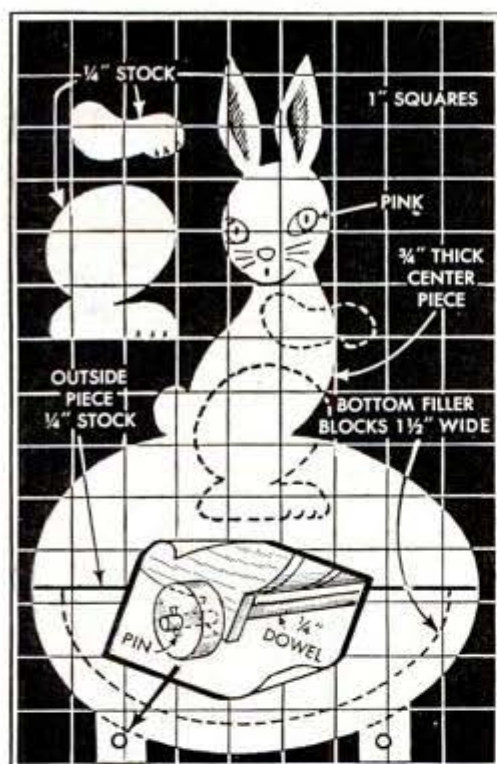
shown. One thickness of the linoleum at each end is usually sufficient to compensate for the stock that has been removed by the saw cuts.

Handy Rack to Hold Casting Rod In Small Rowboat

Carrying his casting rod safely in a rowboat where it would be out of the way and yet handy for instant use was accomplished by one fisherman who mounted a couple of wooden blocks inside the boat just below the gunwale. Shallow holes or sockets were bored in the blocks after which they were spaced and attached securely so that the handle and tip of the rod would slip into them when slightly bowed against the side of the boat.



Easter-Bunny Pull Toy of Wood Easy to Make



A gaily colored bunny atop a large egg makes this wheeled toy attractive to the children. The egg and bunny are jigsawed in one piece from $\frac{3}{4}$ -in stock, after which the legs are glued and bradded in place as overlays. Filler blocks $1\frac{1}{2}$ in. wide are sawed to the same curvature as that of the lower part of the egg and are nailed and glued to it. Side pieces of $\frac{1}{4}$ -in. stock are

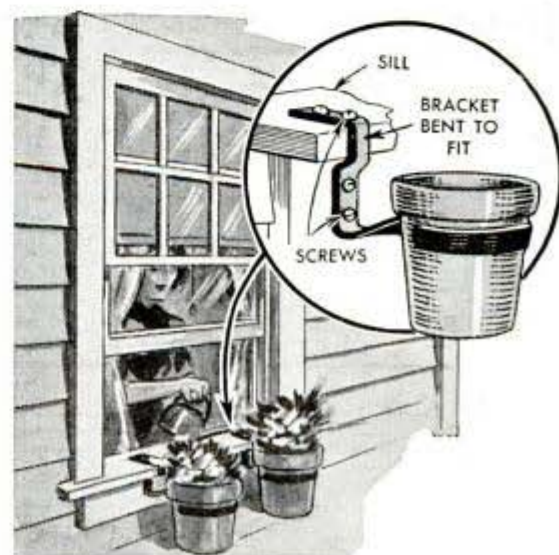
bradded to the blocks, and have tabs projecting from the lower edges through which $\frac{1}{4}$ -in. dowel axles are inserted. The wheels are wood disks cut from $\frac{1}{2}$ -in stock and drilled to slip over the axle ends. Coloring consists of a brightly painted egg with contrasting wheels to set off a snow white bunny having pink eyes and nose-and-ear shadings outlined in black.

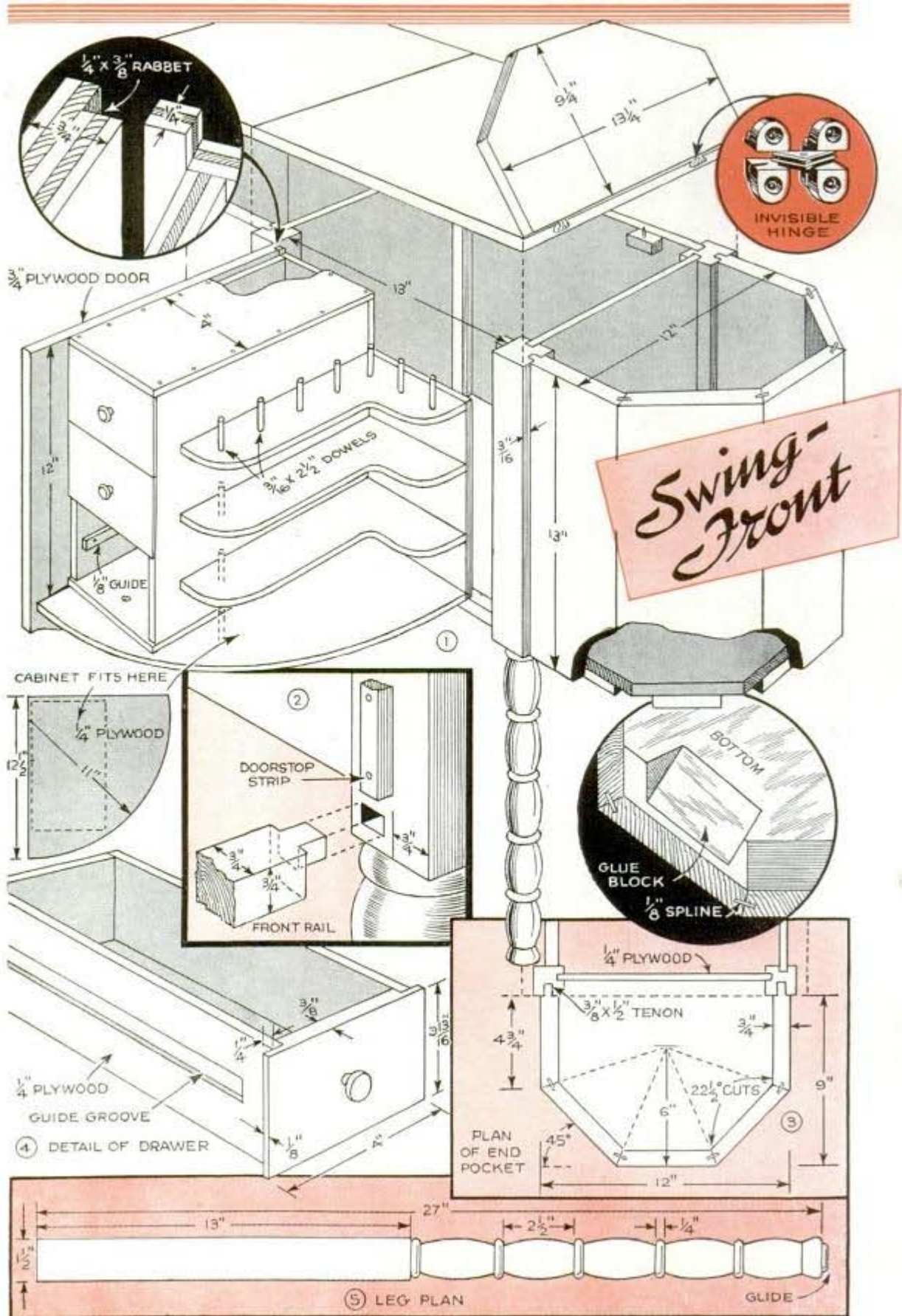
Flowerpots Hung From Sill Used Instead of Window Box

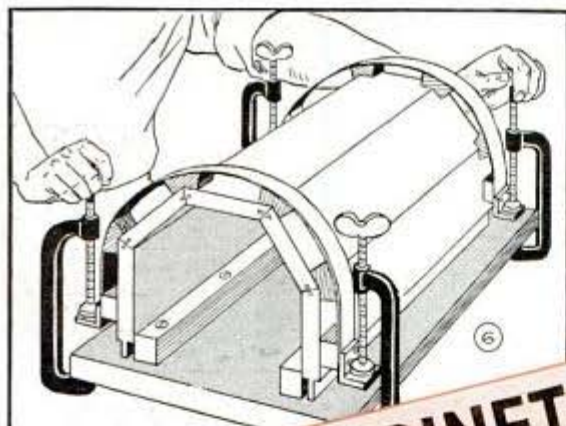
If you like flowers outside your window, but dislike a window box because of its appearance or the possibility of it staining the side of the house, flowerpots supported by brackets screwed to the window sill will solve the problem. The pots are neat and, as they do not come in contact with the side of the house, cannot cause stains. Besides this, the pots can be removed during winter months, leaving only the brackets, which do not mar the appearance of the house as do empty window boxes.

Frederic Tellander, Chicago.

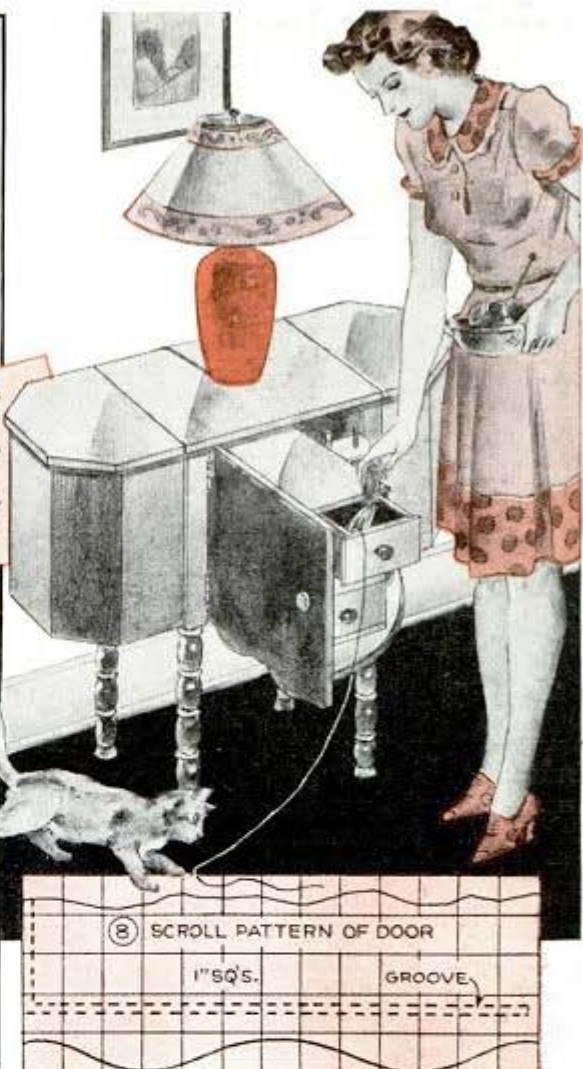
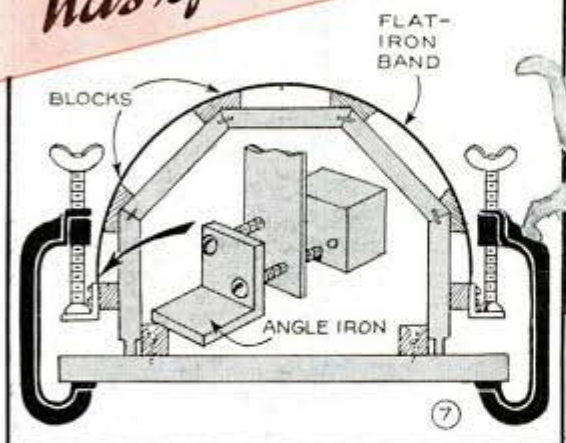
■ A sponge-rubber mat on which to stand while ironing will greatly lessen fatigue, as the soft surface of the mat keeps the feet from becoming tired.







SEWING CABINET has spool-type legs



THERE'S a place in this cabinet for all your sewing equipment from needles to unfinished work. The octagon-shaped ends of the cabinet are closed to form pockets for unfinished sewing, cloth remnants, etc. The front swings outward as shown in Fig. 1, bringing into easy reach three small drawers and three shelves containing thread-spool spindles as well as space for other accessories. To reduce cost, the original cabinet was made mostly of plywood and painted, but if plywood cannot be obtained, solid stock can be used.

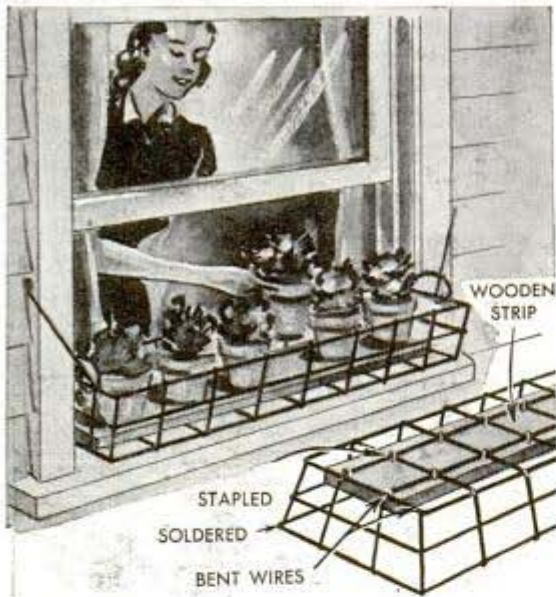
Construction begins with the legs, which are simple turnings as shown in Fig. 5. After completing them, the octagon ends are built up, each one consisting of five pieces splined and glued together as in Figs. 6 and 7. The angles at which the edges of the pieces are beveled to produce the desired shape are shown in Fig. 3. Notice in the circular detail above Fig. 3 how glue blocks are put on the inner surfaces of

each piece to support a bottom for the pocket. After assembling both pockets to the legs, the back of the cabinet is put in place and the front rail is glued into mortises in the front legs as in Fig. 2. The top comes next and is in three pieces, the ends being hinged and cut to blend with the shape of the pockets.

Now for the front, which is a piece of $\frac{3}{4}$ -in. stock scrolled at the bottom as indicated in Fig. 8 and strongly hinged to the left front leg. The drawer cabinet and shelves are built up in a separate unit, and are attached to the inside surface of the front. Fig. 4 shows the construction of a drawer, and the upper left detail of Fig. 1 shows how the rear of the unit fits in a rabbet cut in the rear edge of the door.

☞ Irises do not like an acid soil, and therefore, since manure creates an acid condition, only bone meal and potash fertilizers should be used.

Flowerpot Window Box of Wire Removed Easily for Storage



If you like window boxes but have refrained from using them because they marred the appearance of your windows during the winter months, this wire one will solve the problem. It holds potted flowers and is made of wire as indicated, a wooden strip being stapled to the bottom of the box on which to set the pots. The box rests on the window sill and is kept in place by two wire brackets screwed to the side of the house. To remove the box, just take out the pots and unscrew the two brackets, after which the light box can be stored until spring.

Fahrenheit Thermometer Scale Translated to Centigrade



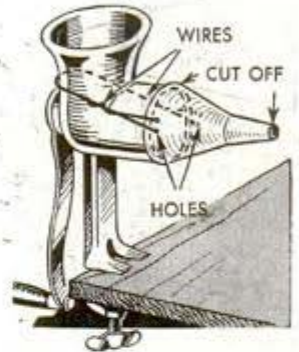
Anyone who occasionally has to translate Fahrenheit thermometer readings to centigrade will find this celluloid shield handy and accurate enough where the translations are not too critical. Make the opening in the shield an accurate

fit over the thermometer tube. To calibrate the shield, fit it in place over the thermometer and mark zero on the shield at

32 degrees above zero on the thermometer. At the reading of 95 degrees above zero on the thermometer mark 35 degrees above zero on the shield. Then divide the space on the shield between zero and 35 into thirty-five equal divisions. If it is necessary to take centigrade readings higher or lower continue the divisions accordingly.

Sausage Stuffing Attachment Made From Tin Funnel

A stuffing attachment for your sausage grinder or food chopper can be made for 15 or 20 cents by using a tin funnel. After cutting off the tapered funnel spout to get the desired diameter, the funnel is slipped over



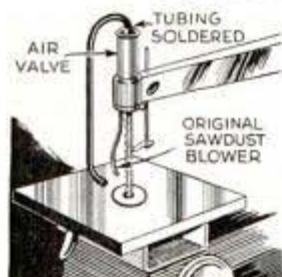
the end of the grinder where it is held tightly in place with wire, as indicated. If necessary, the upper end of the funnel can be cut off, as the end of the grinder must fit tightly against the funnel to prevent the sausage from squeezing past it.

Hints on Sowing Annual Flowers

There are two methods of sowing annual flower seeds—directly into the ground, where the plants are to remain, or in frames, flats and boxes for later transplanting. Many species of flowers will not grow properly if their roots are disturbed by transplanting, while other varieties grow better when transplanted as this practice encourages a strong root system. The more well-known varieties that can be transplanted are ageratum, alyssum, aster, balsam, black-eyed Susan, calliopsis, carnation and campanula, as well as cockscomb, chrysanthemum, cosmos, cup flower, calendula, dusty miller, evening primrose. Also flax, forget-me-not, four-o'clock, flowering tobacco, gaillardia, godetia, kochia and lupine. The same is true of lobelia, marigold, nigella, pinks, pentstemon, portulaca, petunia, periwinkle, pansy, snapdragon, straw flower and verbena. Those that cannot be transplanted are anagallis, bachelor's button, candytuft, ice plant, larkspur, mignonette, morning glory, moonflower, phlox, nasturtium, poppy, etc.

Flowers of the latter variety can be started in the early season, however, by putting a few seeds in containers such as ice-cream cartons, berry boxes, etc. When putting the seedlings in the ground outside, the entire contents of the container are removed and set in the ground without disturbing the roots of the plants.

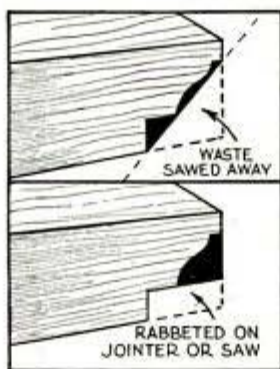
Fitting an Extra Sawdust Blower To Your Jigsaw



If the sawdust blower on your jigsaw is ineffective or if you desire more air than your present blower produces, the spring container on the upper arm of some jigsaws can be utilized as a blower. To do this, just solder a length of tubing over the upper end of the container and bend the tube to direct the air at the desired point.

Waste Stock Removed With Saw To Save Shaper Cutters

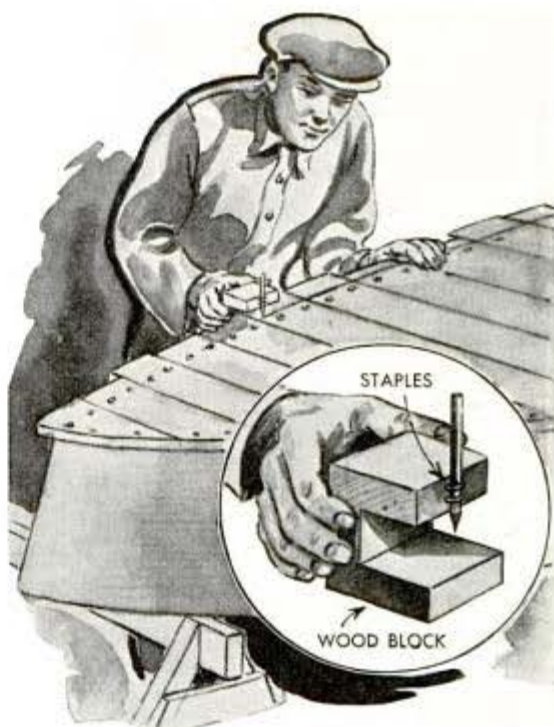
When running a molded edge on end grain of hardwood with a small shaper, the cutters are likely to be burned if a full cut is made at one pass over the machine. Instead of taking several shallow cuts to avoid this, which takes time in re-setting the fence, remove the waste with a circular saw or jointer as indicated in the drawing. In most cases, the waste stock can be removed at one pass over the saw or jointer.



Making Wall Paper Washable

In keeping with the present trend of conservation, you can treat any wall paper to make it washable. Use a large, clean brush and apply a thin coat of pure, clear gelatin and apply a thin coat of pure, clear shellac. Then, as a final finish, apply a thin, even coat of pure, white shellac that has been reduced to about one-pound cut.

Gauge Marks Planking Accurately On Flat-Bottom Boat



Assembled from scrap pieces of hardwood, this simple marking gauge is especially handy in boat building where the ends of bottom planks are cut after they have been screwed in place. The gauge is made by screwing three blocks of wood together, after which a pencil holder is provided by driving two staples into the edge of the upper block. Note that the bottom of the gauge is a little wider than the top to allow for the thickness of the pencil. In use, it is held against the side of the boat and advanced along the bottom planks, being careful to hold it vertically.

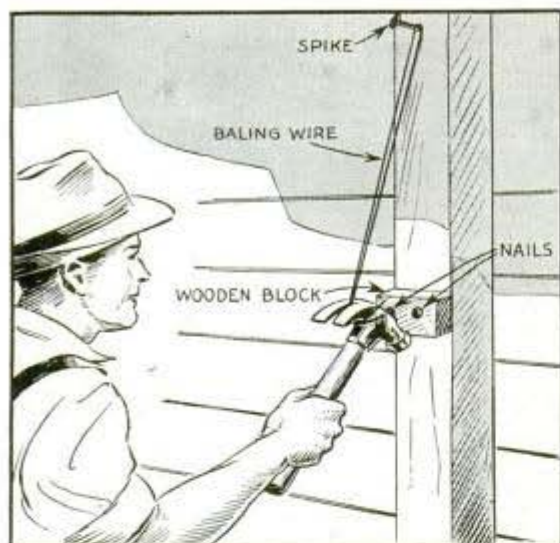
Floating Tag for Your Boat Key

Instead of throwing away an old fishing plug of the floating type, remove the hooks and use it as a tag for your boat key. Besides keeping the key afloat if accidentally



dropped into the water, the bright colors on the plug will be helpful in locating the key if it should be dropped in tall grass or weeds.

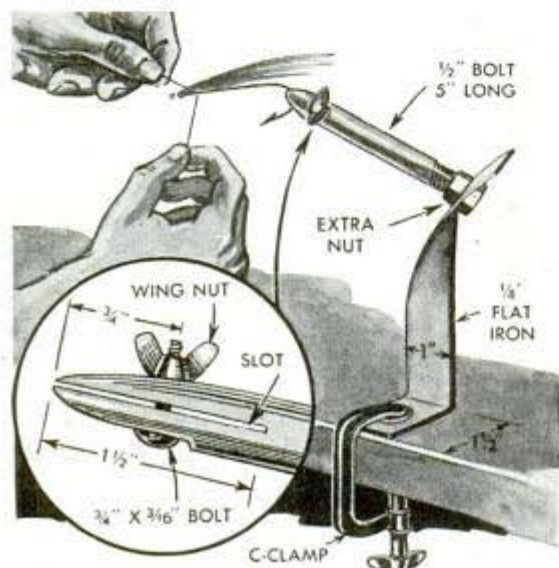
Nail and Wooden Block on Stud To Straighten Baling Wire



To salvage wires removed from bales of hay, one farmer drove a spike into the barn studding and nailed a wood block below it. Then by looping the kinked wire over the spike and pulling on the ends with a claw hammer held against the block, as shown, the wire can be straightened easily.

Fly-Tying Vise From Bolt

An inexpensive fly-tying vise can be made from a $\frac{1}{2}$ -in. machine bolt 5 in. long. The bolt head is cut off and the end is slotted lengthwise for a distance of $1\frac{1}{2}$ in., to form the vise jaws, which are operated by a small bolt and wing nut as shown in the circular detail. The slotted end is rounded and tapered, after which the



threaded end of the bolt is locked to a length of flat iron by means of two nuts, using a nut on each side of the iron, which is then bent to hold the vise jaws at a convenient working angle when the vise is fastened to the edge of a bench or table with a small C-clamp.

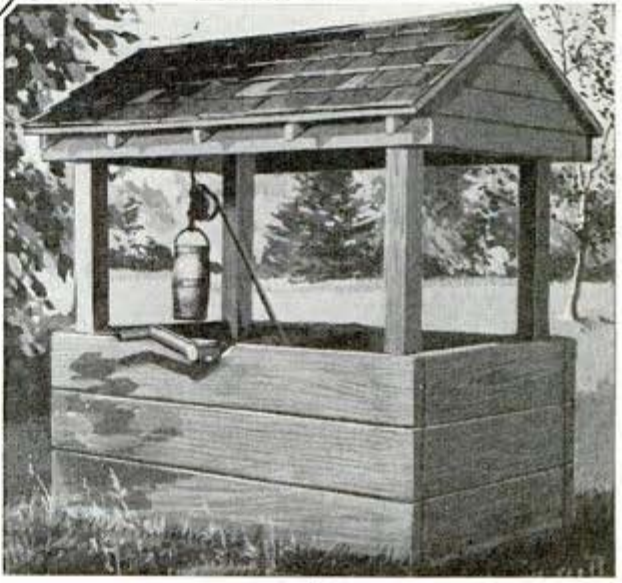
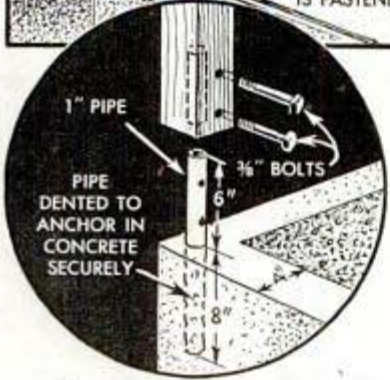
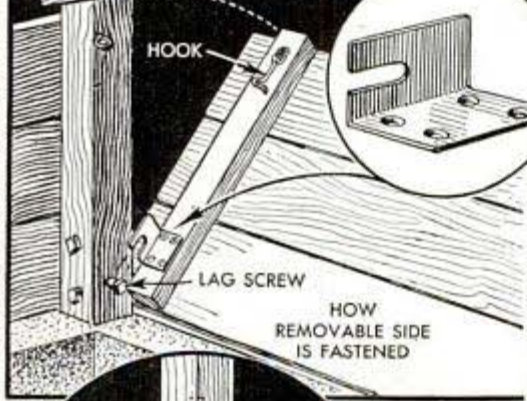
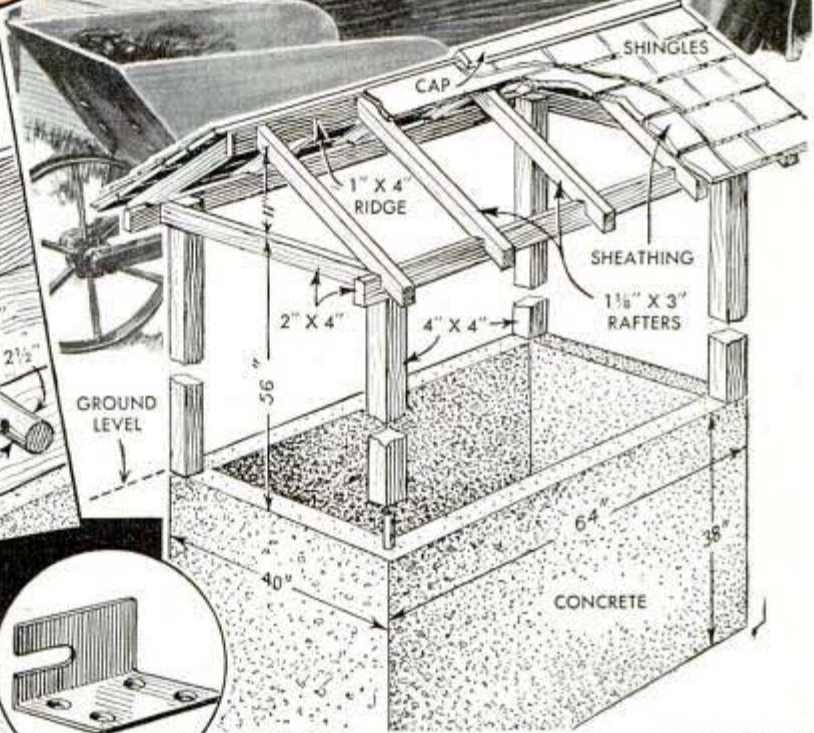
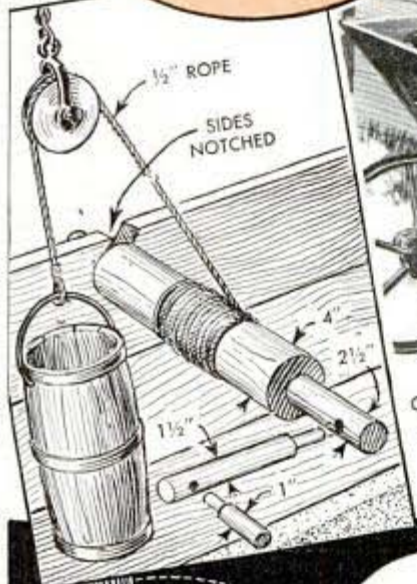
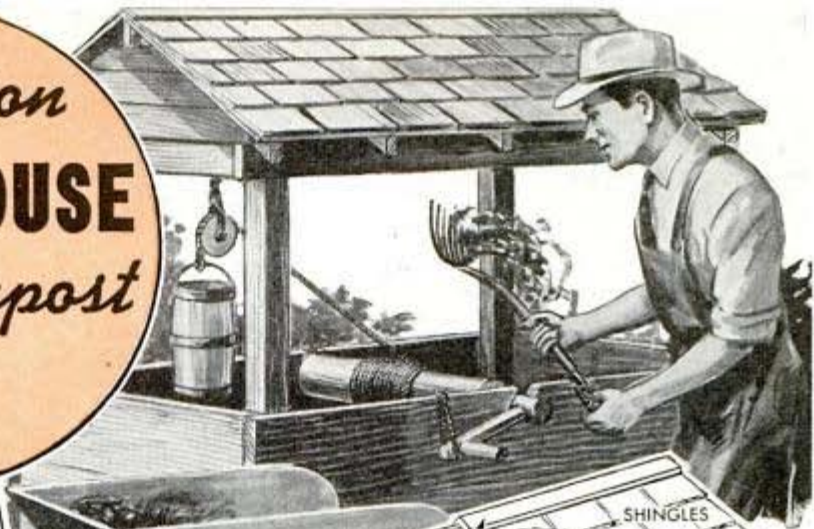
—Maurice H. Kirby, Jr., Atlanta, Ga.

Compost Pile in Well House Hidden From View

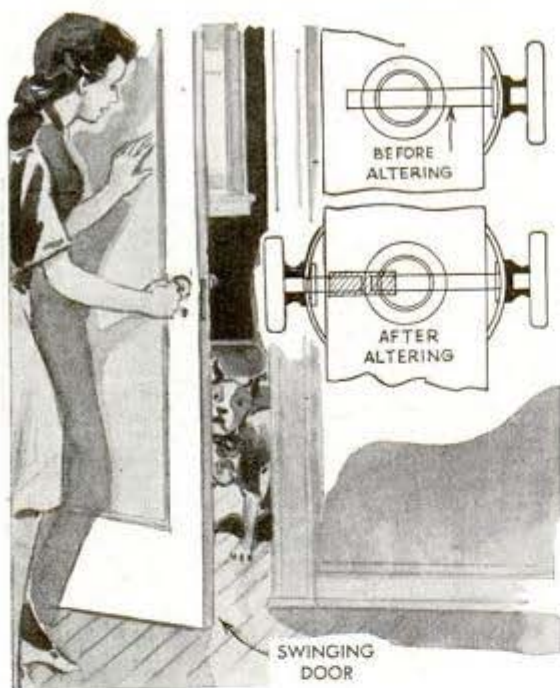
If your home grounds lack a shrub or evergreen screen behind which a compost pile can be hidden, this well house will serve the purpose, and also add a decorative touch. Built as shown, with a concrete pit 38 to 40 in. below the ground, and boarded up to a height of 28 to 30 in. above ground, the house has a capacity of approximately 75 cubic feet. Besides being used for composting garden waste, the well also is handy for composting and storing manure over the fall and winter months, or for housing a bale of peat moss which, after a thorough soaking, will loosen and crumble within the pit. The roof prevents loss by leaching, and the sides deflect drying winds so that after the compost is wetted thoroughly, little moisture need be added. Compost in the well is kept at a higher temperature during winter than if piled on the open ground, thus hastening decomposition. Having one side removable as shown, permits you to work in the pit, and provides a convenient means of removing the compost. If desired, you can make one pile in half of the pit, then start another pile in the other half, separating the two with old boards. Lumber for the sides and posts should be cypress or other rot-resistant wood. All wooden parts should be given several coats of wood preservative, using one that has a brown color if possible to carry out the desired weathered appearance. It is a good idea to line the sides above the ground line with old boards as you build up the compost pile. The bucket, windlass, rope and pulley serve no purpose except to carry out the effect of a well house. Slanting notches prevent the weight of the bucket from lifting the windlass out of place yet make it easy to remove.

Keep extra shear pins in the handle of your outboard motor and they will always be at hand if one is sheared in the propeller.

Imitation
WELL HOUSE
hides compost pile



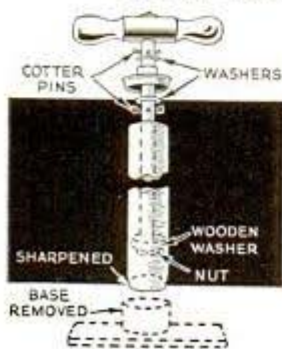
Mortise Bolt on Swinging Door Operated From Either Side



If you have a swinging door that is fitted with a mortise bolt, and you would like to operate the bolt from either side, alter it as shown in the drawing. Use the arbor and knob from another bolt and shorten the arbor to a length of about $\frac{5}{16}$ in. Then cut off the arbor of the bolt on the door to a length of $1\frac{3}{8}$ in. Now flatten a piece of tubing to connect the two arbors, drill through the side of the door opposite the bolt and assemble the two arbors as shown in the lower detail.

—James Edward Mouch, Delphi, Ind.

Tool to Cut and Transplant Creeping-Bent Grass



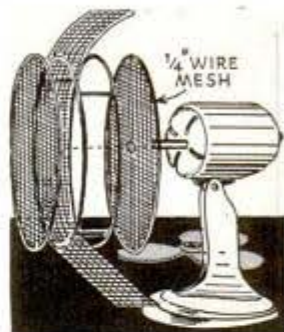
A handy tool that will save time and labor when cutting plugs of creeping bent grass from a lawn to transplant elsewhere can be made from an old tire pump. First remove the base from the pump

and sharpen the lower end of the barrel. Then replace the leather on the plunger with a wooden washer or disk, and drill

the plunger rod near the handle end for a couple of cotter keys, one to serve as a depth gauge when pushing the tool into the ground and the other to keep the plunger from coming out the lower end of the barrel. To use the tool, merely push it into the grass and then push on the plunger to force out the plug. Also, the tool is ideal for making holes in which to transplant the grass plugs.

Wire-Mesh Guard on Electric Fan Keeps Out Children's Fingers

When an electric fan is used in a home and there are small children around, it is a good idea to provide a guard of $\frac{1}{2}$ -in. wire mesh for the fan. Even though the fan is set up out of reach there is always a possibility that a little tot will climb up on a chair and reach it. The mesh can be fitted over the regular fan guard by using two disks and a spacer strip as shown, which are attached with thread or fine wire.



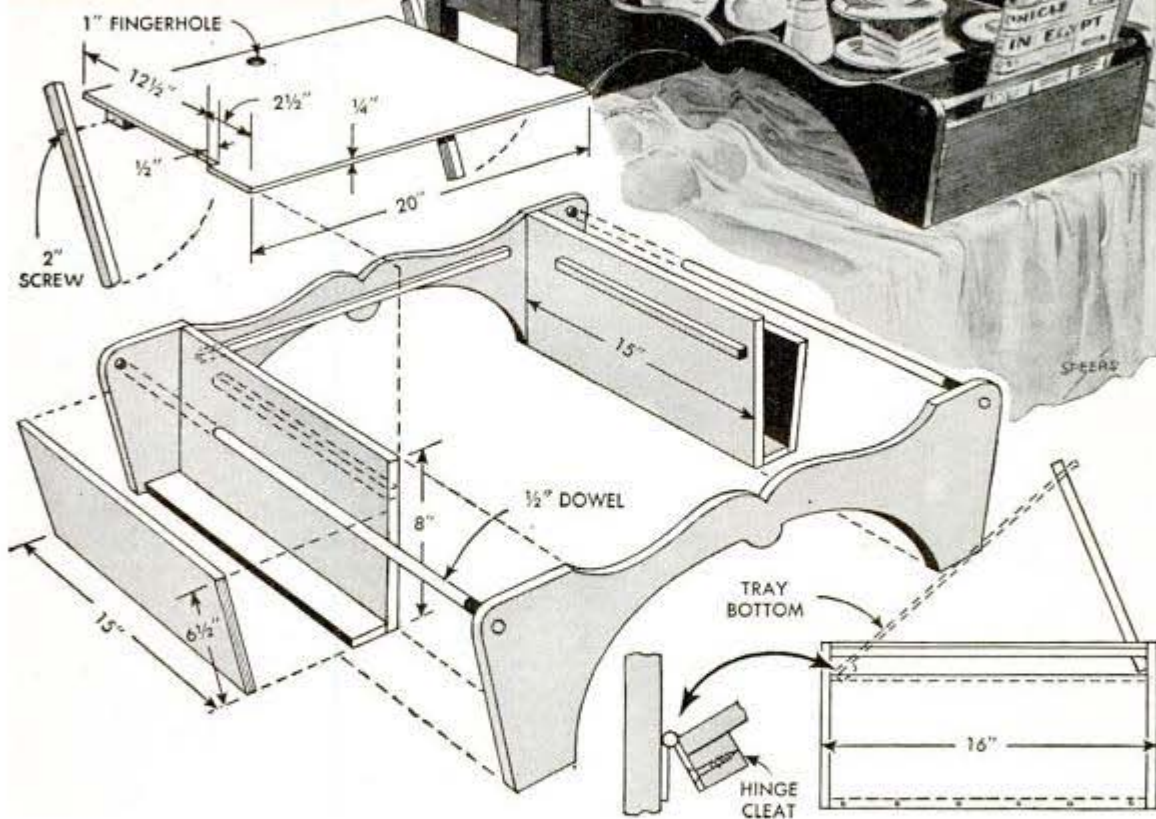
Simple Dye for Leather Goods

To darken light tan leather articles such as belts, shoes, etc., rub them with a cloth dipped in ammonia. This will give the leather a deep brown finish. Take care to apply the ammonia uniformly so that the finish will not be spotty.



BED TRAY

tilts for reading



A serving top that tilts to support reading material, plus pockets for magazines and newspapers at the ends, make this tray highly appealing. It can be made of plywood, solid stock or wood veneered to match your bedroom furnishings. After sawing the front and back according to the half pattern shown in the squared detail, cut the six pieces that form the magazine pockets, which also are the ends of the tray. To assure uniformity, clamp the front and back pieces together when drilling the holes for the dowel handles. When these parts have been assembled, nail small cleats to the inner surfaces of the front and ends about $1\frac{1}{2}$ in. below the upper edges

to support the tray top. This is cut from $\frac{1}{4}$ -in. plywood and is hinged to the back of the tray. Cleats may be needed at the rear and front of the top for attaching the hinges and the $\frac{1}{2}$ -in. pivoted strips that support the top in the tilted position. Notice that the ends of the top are cut in $\frac{1}{2}$ in. for a distance of $12\frac{1}{2}$ in. from the front to allow the pivoted strips to fold flush.

☐ If correctly finished and cared for, a mahogany surface will not show finger marks unless the fingers are dirty. When this happens, wipe off the marks with a soft cloth dampened with mild soapsuds and dry by wiping in the direction of the grain.

GROWING



they will be considered first. The chart in Fig. 2 gives a partial list of good perennials and their requirements. You will notice that blooming periods of different kinds vary. Delphinium, for example, blooms only for a few weeks, gaillardia for many months, while others are in bloom from six to ten weeks. Therefore, it is possible to have a border that blooms only in the spring, or a mixed border of many different plants that will keep in bloom for several months. However, the more plants of different kinds there are, the more will be the rather spotty effect at any one

THERE is nothing that beautifies the home grounds so much with so little cost as flowers. Anyone can grow them successfully if a little spare time can be spent on their care. Flowers are divided into two types, perennials that renew their growth each year from their own roots, and annuals that must be started from seed each year. First, decide how you want your grounds to appear, and then plan the flower borders or beds accordingly. In planning the borders, remember that when once established, perennials must remain in the same place year after year. Arrangement of annuals, of course, can be changed each year if desired.

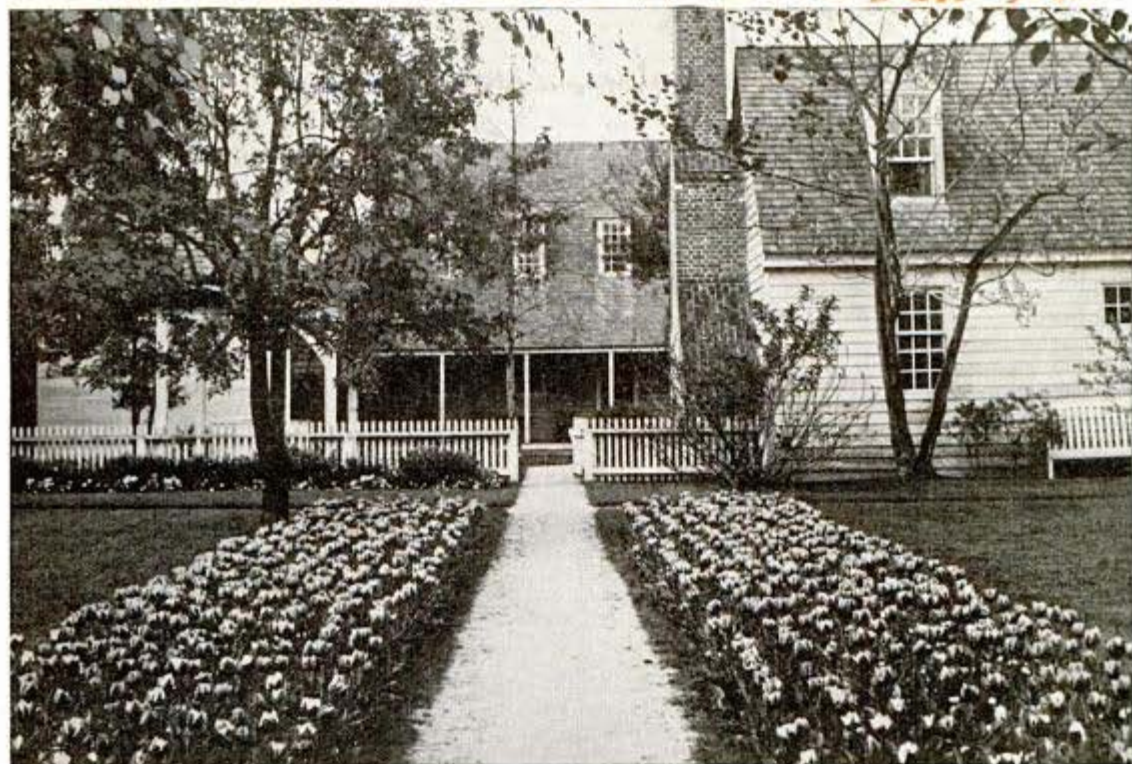
As perennials take longer to bloom than annuals, usually not until the second year,

time. It is possible to avoid this spottiness and still have a variety of color by using a few kinds of perennials each having two or more varieties different in color and in shape. Gaillardia comes in several named types of different color. Achillea gives you ptarmica (Perry's white), ptarmica (snow ball), and millefolium rubrum (bright red). These and a few others that have long blooming periods may well form the foundation of your border, supplementing and dividing them with other varieties that bloom for at least two or three months. Then there is the late border that blooms only in the fall and must be confined to chrysanthemums and late asters.

After deciding what flowers you want, order the plants or seed from a reliable



BETTER FLOWERS



nursery, as much of your success will depend on getting the best possible stock. It is best to start a perennial border from plants, preferably field-grown plants. These are rather expensive but they have been transplanted several times to induce root strength, and may be two or three years old when shipped. Such plants provide immediate results in blooming. If, however, you cannot obtain plants, you can grow your own from seed, but it takes longer to get a perennial border from seed as most perennials do not bloom until they are at least one year old.

When starting from seed, sow it early in a cold frame and give it plenty of time to germinate. Seed of many perennials germinates in temperatures of 45 to 50 degrees, so the sowing should be done before light frosts have ceased. Slow-germinating seed such as aquilegia and viola can be started indoors in cans several weeks in advance of frame sowing. When germination starts, set the cans in the frame, sinking them into the soil. As a large number of plants of each variety are unnecessary, sow only half of the seed in each packet. Then, if results are not entirely satisfac-



ADD BONEMEAL, 10 LBS., AND A 2-IN. LAYER OF MANURE PER 100 SQ. FT.

SOIL CAN BE PACKED DOWN FIRMLY BY WALKING ON IT

THEN LEVEL UP THE BED BY A LIGHT RAKING PRIOR TO PLANTING

2

Partial list of good perennials and their requirements

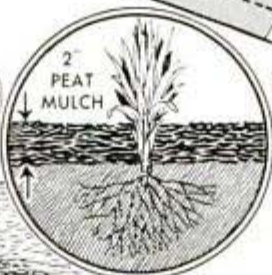
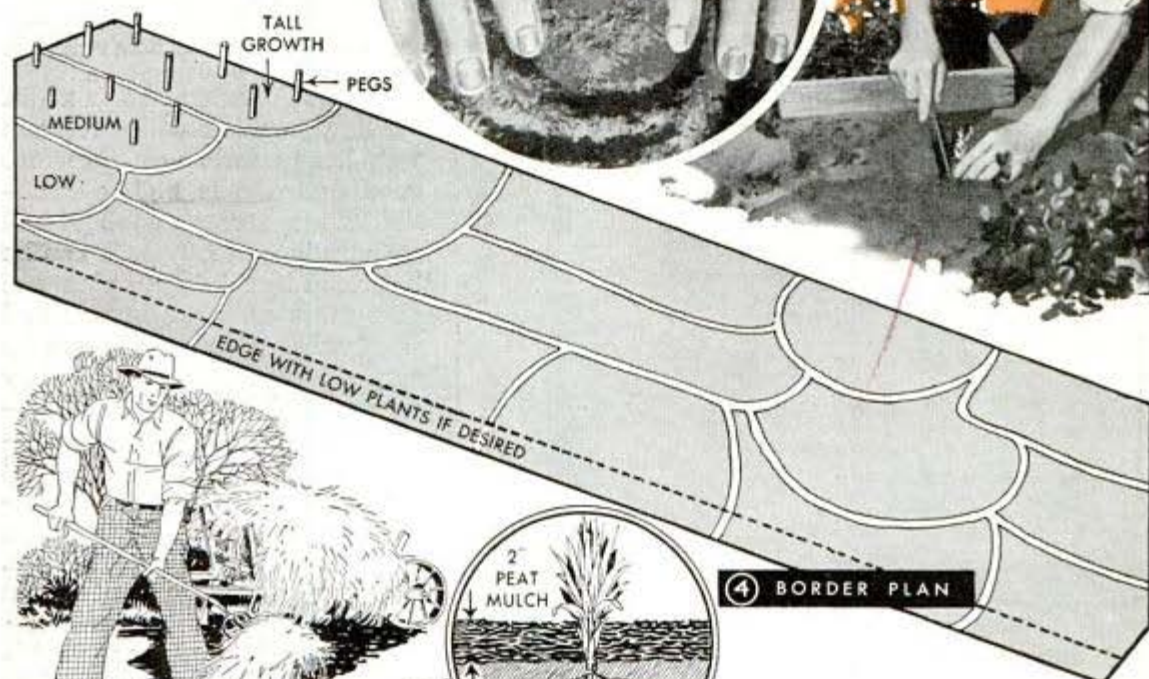
Genus	Common Name	Soil			Likes		Set in		Space apart	Height	Used for				Color	Seeds germinate (days)	Blooms (months)	One of several good varieties
		Rich, humic	Good garden	Ordinary	Light sandy	Sun	Part shade	Spring			Fall	Border	Rock work	Edging				
Achillea 1 and 2	Yarrow—d	X	X		X		X	X	10	24	X				white 4	10	6-11	Parmica
Alyssum	Madwort—d, c	X	X		X		X	X	8	12		X		X	yel. 4	7	4-5	Saxatile Comp.
Anchusa	Bugloss—d	X			X	X	X	X	18	48	X				blue	12	7-8	Dropmore
Aquilegia	Columbine—d	X	X		X	X	X	X	12	36	X	X			various	30	5-7	Dreer's L. S.
Armeria	Thrift—d			X	X		X	X	8	18	X	X	X		various	10	6-8	Formosa G. F.
Centaurea 1	Cornflower—d, c	X	X		X		X	X	10	24	X				blue 4	5	7-8	Montana
Chrysanthemum maximum 3	Shasta Daisy—d, c	X	X		X		X	X	12	36	X				white	7	6-8	Alaska
Coreopsis	Tickseed—d	X	X		X		X	X	12	30	X				yel.	5	6-8	Dbl. Sunburst
Delphinium 5	H. Larkspur—d, c	X			X	X	X	X	24	60	X				lilac 4	21	6	Lancelot
Dianthus 5	H. Pinks—d, c	X	X		X		X	X	8	18	X	X	X		mixed 4	8	6-8	Plumarius Semp.
Erigeron 1	Fleabane—d		X		X		X	X	12	30	X	X			blue	15	6-8	Speciosus
Gaillardia 6	Blanket Flower—d, c	X	X		X		X		12	30	X				various	21	6-11	All are fine
Gypsophila 5	Baby's Breath—d, c	X	X	X	X		X	X	24	36	X	X			white 4	10	8-9	Paniculata
Geum 6	Avens	X			X		X		8	18	X				red 4	10	6-9	Mrs. Bradshaw
Helianthus 3	Hardy Sunflower—d, c	X	X	X	X		X	X	12	48	X				yel.	5	9-10	Cucumerifolius
Heliopsis 1	Hardy Zinnia	X	X		X		X	X	12	40	X				yel.	10	7-9	Pitcheriana
Heuchera 1	Coralbells—d, c	X			X		X	X	8	24	X	X			red 4	21	6-9	Sanguinea
Lavandula	Lavender—d	X	X		X		X		10	18	X	X			blue	10	7-8	Vera
Liatris	Gay-feather—d	X	X		X	X	X	X	12	48	X				purp 4	21	7-8	Pycnostachya
Linum	Flax—d		X	X	X		X	X	8	24	X	X			blue 4	10	6-7	Perenne
Lychnis 1	Compion—d, c	X	X		X		X	X	18	30	X	X	X		red 4	10	7-9	Chalcedonica
Matricaria	Feverfew—d	X	X		X		X	X	12	18	X	X	X		white 4	10	6-9	Dbl. White Imp.
Nepeta	Catmint—d	X	X		X		X	X	8	12	X	X	X		lav.	10	5-8	Mussini
Pentstemon—d	Beard Tongue	X	X		X		X	X	10	30	X				blue	10	6-10	Grandiflora
Physostegia 3	False Dragonhead—d, c	X	X		X		X	X	12	36	X				pink 4	15	7-8	Virginica
Platycodon 7	Bellflower—d	X	X	X	X		X	X	8	18	X	X			blue 4	21	7-9	Mariesii
Pyrethrum 1-8	Painted Daisy—d	X			X		X		15	24	X	X			red 4	21	5-6	Roseum J. K.
Rudbeckia 1	Coneflower—d	X	X		X	X	X	X	15	36	X				purp. 4	21	6-8	Purpurea
Salvia 1	Blue Sage—d, c	X	X		X		X	X	10	40	X				blue 4	15	8-9	Azurea
Scabiosa	Pincushion Flower—d	X	X	X	X		X	X	8	24	X				lav. 4	10	6-8	Caucosica I. H.
Sedum	Stonecrop—d, c	X	X	X	X		X	X				X	X					
Sidalcea	Greek-mallow	X	X		X		X	X	8	36	X				mixed	15	7-8	Stark's Hyb'ds
Stokesia	Stokes' Aster—d	X	X	X	X		X	X	8	24	X				blue 4	21	8-10	Cyanea
Tunica	Coat Flower—d	X	X		X		X	X	6	6	X	X	X		pink	5	6-9	Saxifraga
Verbena 6	Verbena	X	X	X	X		X	X	6	12	X	X			blue 4	10	6-10	Venosa
Veronica	Speedwell—d	X	X	X	X		X	X	8	24	X	X	X		blue 4	15	7-8	Longifolia
Valeriana—d	G. Heliotrope	X	X		X		X	X	12	24	X				red 4	15	6-9	Coccinea
Viola—d	Tufted Pansy	X	X		X		X	X	8	10	X	X	X		blue 4	48	5-9	Jersey Gem.
Perennials to be had by division																		
Aconitum 7-8	Monkshood	X	X			X	X	X	8	30	X				blue		9-10	Fischeri
Anemone 6-8	Windflower	X	X		X	X	X		10	30	X				white 4		9-11	Japanica
Aster *	Starwort 3	X	X	X	X		X	X	24	40	X				white 4		fall	Mt. Everest
Aster Hybrids 3		X	X	X	X		X	X	12	15	X	X	X		blue 4		6-10	Frikarti
Campanula *	Bellflower	X	X		X	X	X	X	10	30	X	X			blue 4		6-7	Persicifolia Telham Beauty
Chrysanthemum	Garden var. ** 3	X			X		X		18		X				various		fall	All are excellent
Chrysanthemum	Korean 3	X			X		X		18		X				various		fall	All are excellent
Geranium	Crane's-bill 7	X	X		X		X	X	12	18	X	X	X		red 4		7-8	Sanguineum
Phlox Decussata	Hardy Phlox 1	X	X		X		X	X	12	24	X	X			pink 4		long	Columbia
Potentilla	Cinquefoil 1		X	X	X		X	X	12	18	X	X			or'ng. 4		6-9	Lady Rolleston

Symbols and abbreviations:

1. Dig, divide and replant every third year
2. Cut back shoots after flowering
3. Dig, divide and replant every second year
4. Indicates that varieties may be had in other colors
5. Likes lime in soil
6. Protect in winter with dry straw

7. After planting, do not disturb
8. Needs plenty of moisture
- (d) Propagate by division
- (c) Propagate by cutting
- * Indicates plants will come from seed
- ** Range in height from dwarf to 4 ft.

If a border is to be entirely of perennials, it should be at least 5 ft. wide. The most attractive showing is had when they are planted in masses or clumps instead of a hit-or-miss manner, especially if consideration is given to color harmony with white flowers predominating



5 WINTER-MULCH WITH PEAT MOSS AND STRAW

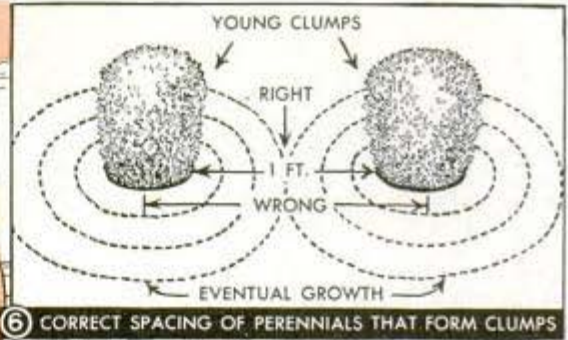
4 BORDER PLAN

tory, you can sow again in late summer. Although spring is the ideal time to start perennials, some gardeners wait until mid-August to sow them. In either case, you should provide more plants than are actually needed, keeping those not needed in the cold frame until the plants in the border have become well established. Transplant the seedlings from the cans into the cold frame as soon as they can be handled and have grown their second set of leaves. As few perennials bloom the first year, little if any advantage is gained by using fertilizers or heat in the cold frame to force their growth in the early stages.

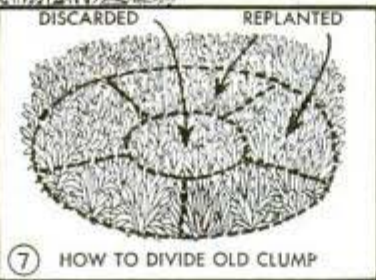
While your seedlings are growing to a suitable size for transplanting to their permanent positions, prepare your borders. Fig. 4 shows a plan that can be used as a guide. Borders can have straight or irregular lines, and their length is optional, but the width should not be less than 5 ft. If

the border is to have an irregular outline, a garden hose is ideal to use as a guide in getting the desired shape. Preparation of the soil is very important. For average garden soil, follow the steps shown in Fig. 1. Avoid slipshod methods of spading. Drive the spade straight down into the ground to the top of the blade, then pull the handle back toward you until the soil gives slightly. Raise the spade and turn the soil under with the top soil to the bottom. If the spading is to be done in the fall, turn all grass and other vegetation under deeply. If it is done in the spring, use a sharp hoe and cut it off just above the roots and rake it off. When spading is done in the spring take small bites, break up each one with the spade as you go. After turning over a small area, work it up at once. Don't let it lie for the sun and wind to dry into tough clods.

After the soil has been spaded and worked to fine particles, sift a heavy application of peat moss over it and work into the soil. Any fertilizer needed can now be



6 CORRECT SPACING OF PERENNIALS THAT FORM CLUMPS



7 HOW TO DIVIDE OLD CLUMP

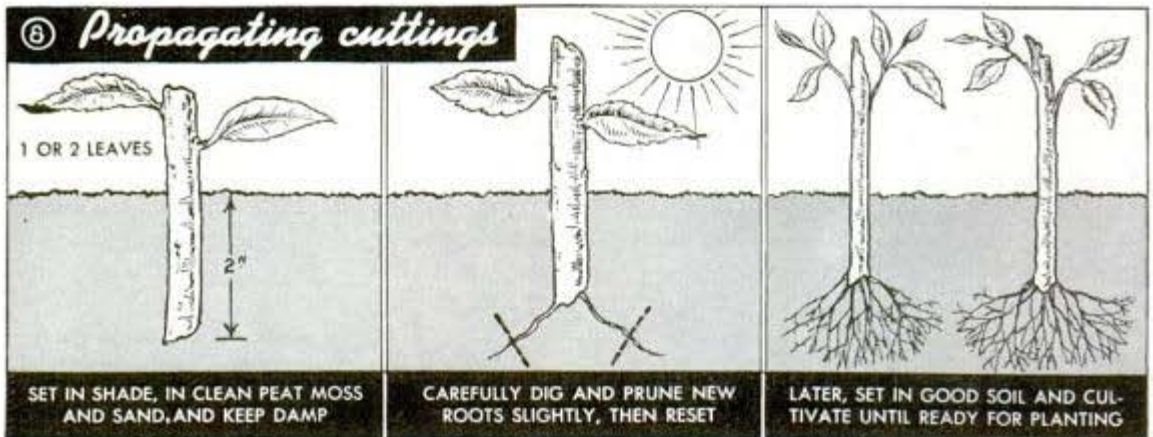
worked into the soil with the peat. When this has been done, firm the soil by walking on it. Start with the feet close together and shift your weight from one foot to the other, keeping them close together as you move forward. Continue this action until the bed has been completely firmed. Then level the ground by raking it lightly, using the rake to break up any remaining clods. Your bed should now be in good condition. Under the surface there are no open spaces to interfere with movement of soil water. In the fine, compacted soil, seeds will germinate readily and transplanted seedlings

will quickly extend their roots.

Few perennials will survive in wet, heavy soils and therefore good drainage is highly essential. Do a thorough job of soil preparation. Heavy soils can be lightened by mixing in plenty of peat moss or other humus and sand, while light soils can be converted to good garden soil by adding plenty of decayed manure, peat and compost, supplementing this with potash and phosphorus fertilizers. For perennials, nitrogen fertilizers should be the progressive types. Bone meal is an excellent source

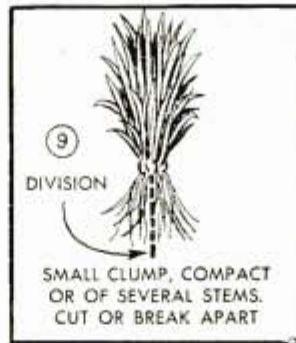
of phosphorus.

If the soil is of exceptionally poor quality, as for instance soil that has stood in thin sod without attention for some years, it may be necessary to spend a year in building it up before using it for flowers. There are two ways of doing this: First, as soon as the ground can be worked in spring, prepare it as shown in Fig. 1. Then set annuals of the erect-growing types, spacing them apart about the recommended distance. This will permit frequent deep cultivation. In the fall, pull out the annuals and spade the soil, turning the

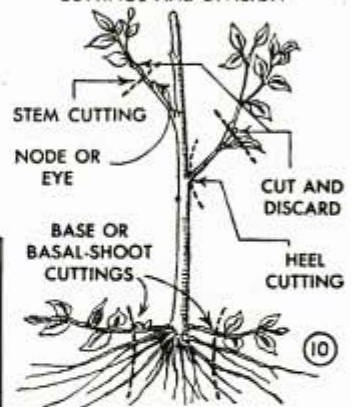


cultivated portion to the bottom. Apply more peat or compost and fertilizer as needed, mixing it thoroughly. Then transplant to this soil perennial seedlings that were sown in mid-August. The second way of building up a poor soil is to work the ground as before, but in the fall. Let the worked soil lie until just before winter, then spade it again, taking large bites with the spade and leaving the surface rough. The following spring, when the soil can be worked, apply more peat and other needed materials, mixing them thoroughly into the soil, which is then ready for plants.

When the seedlings are large enough for transplanting from the cold frame, they should be "hardened off" for a week or two by exposing them to air and full sunlight before they are taken from the cold frame. Then, two or three days before setting the plants in their permanent locations, water them thoroughly so they can take up plenty of moisture and have plenty of damp but not wet earth clinging to their roots. Never transplant seedlings when they and the soil around their roots are dry. If possible, transplant them



CUTTINGS AND DIVISION



Partial list of annuals and their requirements		Soil		Likes		Sow		Space apart		Blossoms (months)	Used for			Germination days	Hardy
Catalog name	Common name	Rich, humic	Good garden	Ordinary	Full sun	Part shade	Transplant	In situ	Height		Border	Rockery	Edging		
Acroclium	Everlasting	x	x		x		x		10 15	7-9	x			10	
Ageratum	Floss Flower		x		x		x		6-10 6-20	6-11	x	x	x	5	
Alyssum 1	Sweet Alyssum		x	x	x		x		8 8	5-9	x	x	x	5	x
Anagallis	Pimpernel		x	x	x		x		8 10	6-9	x	x	x	10	
Arctotis	African Daisy		x		x		x		6-18 6-36	6-10	x	x	x	8	x
Aster	China Aster	x		x	x		x		12-18 12-36		x			10	
Browallia	Amethyst		x	x	x		x		6-10 12-18	5-10	x	x		10	
Calendula 2	Pot Marigold		x		x		x		12 12	6-10	x	x	x	10	x
Calliopsis	Calliopsis		x	x	x		x		8-12 9-36	6-10	x	x	x	8	x
Chrysanthemum 2	Annual 'Mums		x		x		x		12-18 24-36	6-10	x			8	
Cosmos	Cosmos		x	x	x		x		24-30 48-72	7-10	x			8	
Dianthus	Pinks	x	x	x	x		x		12 12-18	7-10	x	x	x	8	x
Delphinium	Larkspur		x	x	x		x		12 24-30	7-8	x			15	x
Euphorbia 3	Snow-on-mountain		x	x	x		x		12-24 30-48	*	x			15	x
Gaillardia	Blanket Flower		x	x	x		x		12 12-18	6-11	x			20	x
Helichrysum	Strawflower		x		x		x		15-18 24-36	8-9	x			5	
Marvel-of-Peru	Four o'Clock		x	x	x		x		24 24	7-10	x			5	
Marigold	Marigold		x	x	x		x		12-24 8-36	7-10	x	x	x	5	x
Nasturtium 1	Nasturtium 3			x	x		x		10 8-12	6-10	x	x		10	
Pansy 2	Pansy	x			x	x	x		8 8	**	x	x	x	10	x
Petunia	Petunia		x	x	x		x		12 12	6-10	x	x	x	10	x
Phlox 1	P. Drummondii	x	x	x	x		x		10 15	6-9	x	x		10	x
Portulaca 3	Rose Moss		x	x	x		x		8 6	6-10	x	x	x	10	x
Rudbeckia	Black-eyed Susan		x	x	x	x	x		15 24	8-10	x			20	
Salvia	Sage	x	x		x	x	x		12-18 24-36	8-10	x			15	
Salpiglossis	Painted Tongue		x	x	x	x	x		12 30	7-9	x			15	
Scobiosa	Pincushion Flower		x	x	x		x		12 24-36	7-10	x			10	x
Snapdragon	Snap		x		x	x	x		10-18 10-36	7-10	x	x	x	10	x
Venidium	Manarch of the Veldt		x		x		x		15 30	8-10	x			10	
Verbena 3	Verbena			x	x		x		8-12 12-15	6-10	x	x	x	8	x
Xeranthemum	Immortelle		x	x	x		x		10 24	7-10	x			10	
Zinnia	Zinnia	x			x		x		10-24 12-24	6-10	x	x	x	5	x

1 Likes lime added to soil 2. At their best in cool climates where summers are not long and hot 3. Use no manure; avoid rich soil Annual Asters have three blooming seasons: some varieties flower in late spring; others in mid-season, and still others mid-season until frost * Flowers are of no value, and is usually grown for its rich foliage. ** Blooms to perfection in cool spring or fall, but is fickle in hot weather For spring flowers, sow in mid-August and winter over Sow in June for fall flowers.

toward evening on a cloudy day. Set the plants firmly in the soil as in Fig. 3, and in groups of three or more of each variety. The plants will be small but don't be tempted to set them too close together. They will spread in a year or two and fill up the open spaces, Fig. 6. Spacing indicated in the chart can be used for those having a single stem, but when planting clumps, space them several inches farther apart than the distances specified.

Some perennials are likely to winter-kill unless they are mulched. Peat serves well between the plants, but clean straw, hay, excelsior or



One is sufficient where only one plant stood before. Habit of growth will serve as a guide in dividing them.

With few exceptions, perennials can be propagated by cuttings and divisions, Figs. 8, 9 and 10. Stem and heel cuttings can be taken any time after the wood has hardened, but usually are cut immediately after blooming has ceased. Cuttings from plants that yield base shoots, such as chrysanthemums, can be taken in early spring.

Annuals are the busiest of all plants. Starting from seed in spring, they soon mature, bloom, produce seed, and die, all in a few months. A few varieties are tender perennials in the south, but because they bloom soon after their seedling stage, are treated as annuals in the north. In the chart, Fig. 11, many varieties have been omitted for various reasons; some have short blooming seasons, others thrive only where summers are cool, and some are weedy and their flowers of little interest.

Like perennials, annuals have a preference for certain soils and locations. The seed of zinnias, for instance, is often sown for transplanting and the seedlings then set in any kind of soil. But if you want the best possible flowers, sow zinnias in rich soil as these plants are gross feeders. Also, provide plenty of water. With some exceptions, spring-sown seeds of annuals are treated in much the same manner as those of perennials. Those that are not hardy are sown in cold frames later than perennials, unless you provide gentle heat. Such seed germinates in a temperature range of from 60 to 80 degrees, but will not be harmed by temperatures in the fifties. In early spring there are plenty of warm days that will germinate such seed without additional heat. However, you will have to use the cover of the cold frame more often than is necessary for hardy annual and perennial seed.

other coarse material should be used over the plants, particularly those having a crown of foliage close to the ground that stays green throughout the winter. A 2-in. depth of peat as in Fig. 5 is sufficient. Don't mulch until a freeze hardens the soil. Its purpose is to keep the plants cold and frozen as much as possible to prevent heaving by alternate freezing and thawing. In the spring, don't let shoots come up under the mulch. Remove it as soon as possible, gradually if the sun is hot or all at once if the weather is cool and cloudy. Feeding and cultivation should now begin. Continue to give light cultivations until the summer mulch of peat or grass clippings is applied.

After the border has become well established, some of the plants must be dug and divided as in Fig. 7. Those that are finished blooming by late summer can be dug and divided in the fall. Fall bloomers and the summer bloomers that continue into the fall months are divided in the spring. When you dig the plants the roots should be protected with wet newspapers. Likely, humus must be added to the dug soil. In any event, prepare it well and add any necessary plant food before resetting the plants. Don't try to put back all of the divisions.

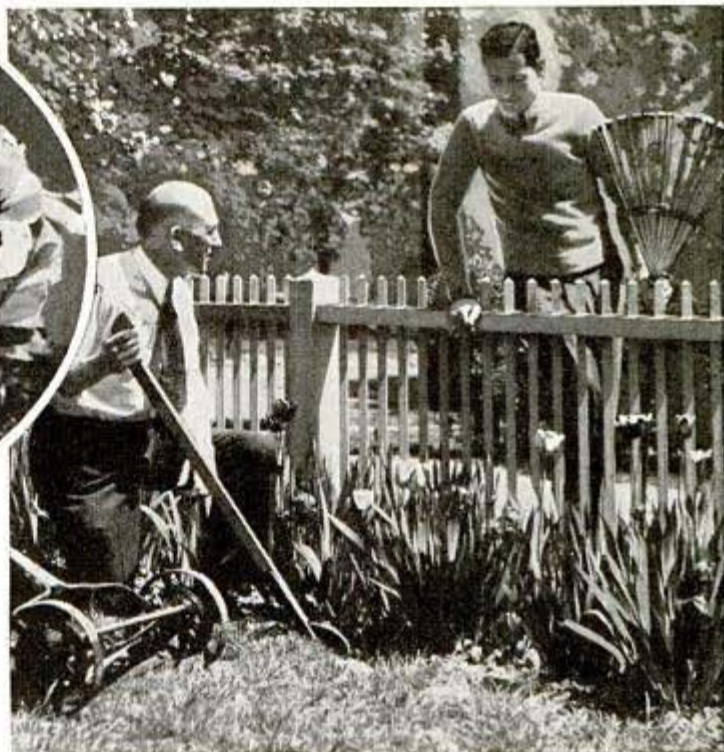
So-called hardy annuals are resistant to light frost. Therefore, their seed germinates in temperatures lower than seed of the tender annuals, and it can be sown either in the open ground or in a frame after heavy frosts have ceased. In the chart, Fig. 11, germination periods are only approximate, and are more or less accurate only when ideal conditions for germination exist. In growing annuals, it is important to know which seeds to sow for transplanting and which to sow in the open ground. Many annuals put forth only a few long



straggly roots if sown in the open ground, but if transplanted, the roots are broken and lateral growth is induced. The result is a dense, compact root system that increases its capacity to take up food and moisture.

Soil preparation for annuals is similar to that for perennials. Annuals are very effective when a single genus is bedded, usually in mixed colors. A large bed of asters alone is a glorious sight. So is one of snapdragons. A variety of zinnias can be used to advantage. Marigold in numerous heights and varieties will give you a golden garden in ordinary soil. Keep annuals growing, but don't fertilize beyond the needs of the plants. Cultivate frequently as annuals quickly respond to it. Seedlings from the seed that was sown in open ground should be thinned at once. Don't let a crust form on the soil around the selected ones. After they have become established, hoe deeply to within a few inches of the plants. Repeat a week later, but keep a bit farther away from the plants. Thereafter, give frequent but shallow cultivations; a depth of an inch or two is sufficient. Loosen the soil after rain or watering. When you "lay the plants by" (cease cultivation), warm weather will be well under way, at which time a 1-in. layer of peat or lawn clippings should be applied.

From the time seedlings are well established in the garden, and perennials are in good growth, adopt a spraying routine at not less than ten-day intervals, Fig. 12. These sprays should be a combination of materials which control both leaf eaters and sucking aphids. Between the ten-day



periods load a dust gun with dusting sulphur (not flowers of sulphur) and use it to ward off attacks by red mites and to control mildew on the foliage.

It is advisable to remove blossoms as soon as they wilt, Fig. 13. This prevents seed from forming, which takes strength from the plants. Many annuals drop seed which remains in the ground and produces seedlings the following year. It is best to ignore these, just as it is good judgment not to save seed from your own plantings as the flowers produced usually will be inferior to those from specially selected seed.

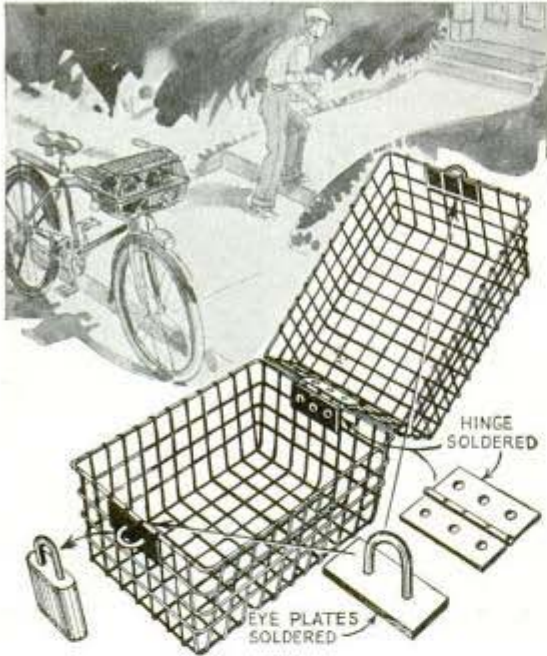
Garden Hose Protected From Air By Submerging It in Water

To protect my garden hose against exposure to hot summer air, which oxidizes the rubber, I keep it submerged in water when not in use. The hose is coiled in a tub, which is kept in the shade so that

the hose will not be exposed to the direct sunlight.—A. H. Waychoff, Phoenix, Ariz.



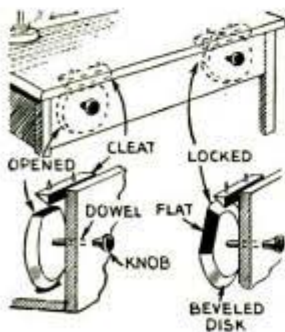
Hinged Cover on Bicycle Basket Prevents Theft of Contents



One boy who made store deliveries with his bike often had packages stolen from the basket while he was inside a home delivering part of his load. To prevent this trouble, he hinged another basket to the top of the one on his bike to serve as a cover, and fitted it with a padlock. When he had to leave the bike outside with some packages in the basket he locked the cover.

Easy Method of Locking Drawers

Having a drawer that I wished to lock so that my small daughter could not open it, and not wishing to use a lock that required a key, I made a lock by altering the drawer knobs as shown. The knobs were removed and drilled to slip over short dowels, which were run through the front of the drawer and fitted with small wooden disks. These



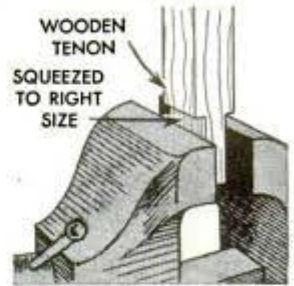
were beveled around the edges and flattened on one side. The disks engaged small triangular blocks screwed to the underside of the desk top so that the drawer could not be opened, but when the flat sides were

turned upward, they would clear the blocks. Arrows were painted on the knobs to indicate when the flattened portions of the disks were turned upward.

—John J. O'Shea, Philadelphia, Pa.

Wood Tenons Squeezed in Vise To Make Tight Mortise Joint

Sometimes exceptionally tight mortise-and-tenon joints can be made by cutting the mortise a little undersize and then squeezing the tenon in a bench vise to reduce its size to fit the mortise. Later, the tenon will expand to its original size, thus making the joint very tight. This should not be done when the joint is close to the end of the work as the expansion of the tenon may cause the wood to split.



Bell Controlled by Electric Clock Awakens Sound Sleeper

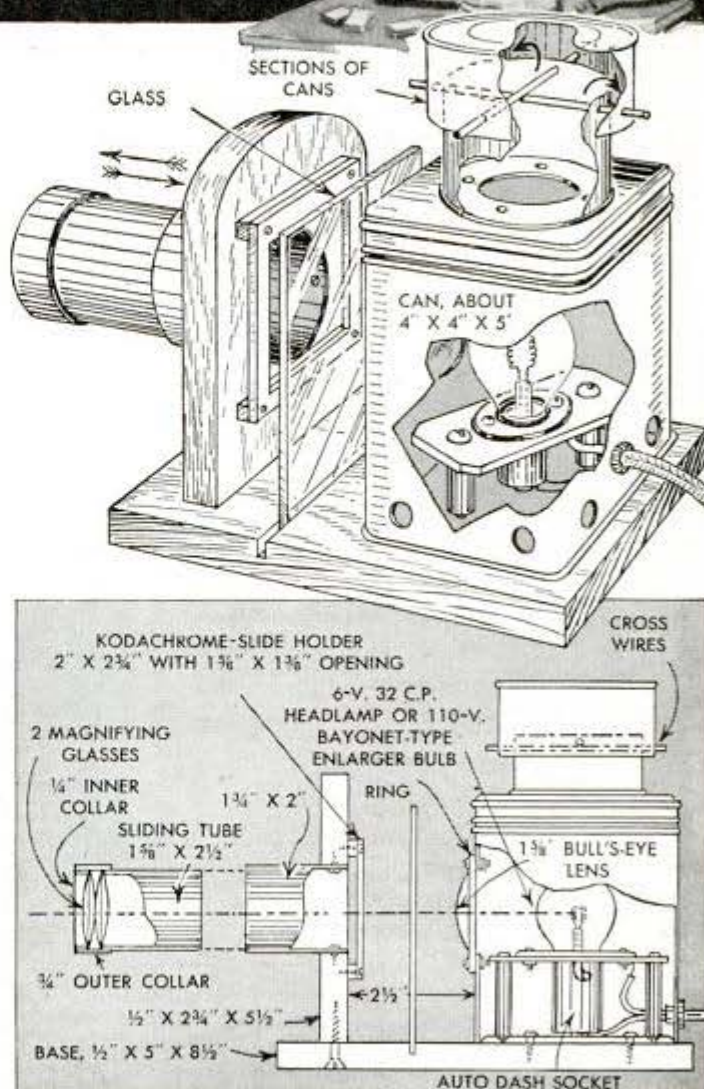
If you are hard of hearing or sleep so soundly that the regular alarm clock does not awaken you, this bell-and-clock hook-up will solve your problem. It consists of a clock of the type used to turn on or off electrical appliances in the home, and a bell or buzzer, the latter being placed under the pillow of the sleeper. Four dry cells or a bell-ringing transformer are plugged into the receptacle of the clock and the bell connected to the appliance outlet. A switch is put in the bell line to shut it off.—Bernard Stein, New York City.



Miniature Slide Projector Costs Two Dollars

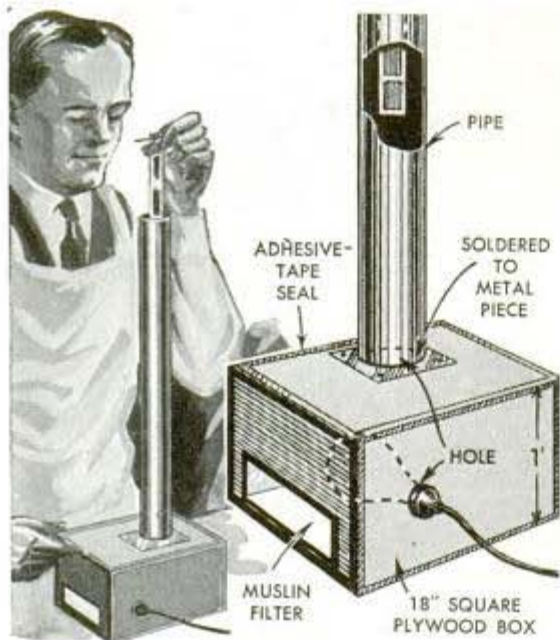


This tiny projector for miniature Kodachrome slides was made from old tin cans, scrap pieces of wood, some tubing, two dime-store magnifying glasses, a bull's-eye flashlight lens, a single-contact auto-dash lamp socket and a 110-volt miniature enlarger bulb to fit, besides a length of lampcord and a plug. A 6-volt auto headlight bulb can be used if a storage battery or a suitable transformer is available to supply current, although a 6-volt lamp connected in series with a 400-watt heating unit was used successfully instead of a battery or transformer. Ventilation is provided by holes in the sides near the bottom and a "cupola" at the top, which does not allow much light to escape. The socket is mounted on a piece of fiber or hard-pressed board and two fiber bushings or drilled dowels space it from the base to which the assembly is fastened with slender wood screws. The bull's-eye lens is mounted over a hole cut in the lamp housing, the center of the lens being in exact line with the filament of the bulb. A ring of fiber or hard-pressed board holds the lens, the ring being attached with small machine screws. The lampcord should be protected with a small bushing where it passes through the can. To shield the slides from intense heat, a piece of glass the edges of which are filed dull, is set in a slot cut



in the base. Cardboard or other tubing can be used for the telescoping lens mount, which must be adjustable for focusing. By using two magnifying glasses as shown, a life-size image is produced on a screen about 8 ft. from the projector.

Warm-Air Drier for Rolls of Film Minimizes Dust on Negatives



Warm air from a 40-watt light bulb, drawn through a cloth filter and passed over a film dries it quickly in this easily made drier. The filter minimizes dust collection on the negative. A piece of drain pipe, slightly longer than the longest film to be accommodated, is mounted over a hole in the top of the plywood base. The light socket is mounted in a hole on one side of the base and the opening for the muslin filter is near the bottom at one end.

—Opie Read, Jr., Chicago.

Exposure Table for Indoor Photos Uses Home-Lighting Lamps

Amateur photographers, who may be unable to secure flash or flood bulbs, can take indoor pictures with ordinary home lighting bulbs if the table shown here is followed carefully. The exposures shown

Lamp-to-Subject Distance	Lens Opening	EXPOSURE IN SECONDS			
		1 60-watt & 1 100-watt	1 100-watt & 1 200-watt	1 150-watt & 1 300-watt	
3½ ft.	f/4.5	1/10	1/25	1/50	
	f/6.3	1/5	—	1/25	
	f/8	—	1/10	—	
	f/11	1/2	1/5	1/10	
5 ft.	f/16	1	1/2	1/5	
	f/4.5	1/5	1/10	1/25	
	f/6.3	—	—	1/10	
	f/8	1/2	1/5	—	
8 ft.	f/11	1	1/2	1/5	
	f/16	2	1	1/2	
	f/4.5	1/2	1/5	1/10	
	f/6.3	1	—	1/5	
	f/8	—	1/2	—	
	f/11	2	1	1/2	
	f/16	4	2	1	

in the table, released by Eastman Kodak Co., are for two bulbs in standard cardboard reflectors and extra-fast panchromatic film. With chrome-type roll film or medium speed panchromatic film the next larger stop opening must be used, and with slow, very fine-grain panchromatic film, two stop openings larger or four times the exposure will be necessary. One stop opening larger must also be used for dark-colored interiors. The lower-wattage lamp is used at the camera, while the stronger one is placed at a 45° angle to the line from the camera to the subject, about 2 ft. higher than the camera and the same distance from the subject. The light from both lamps must be superimposed on the subject. Owners of box cameras or other simple cameras without lens-aperture adjustments should calculate the exposure on the basis of a lens aperture of f/16, which is roughly equivalent to the largest lens opening on most box cameras.

Masking Film Window With Tape Lessens Chance of Light Fog

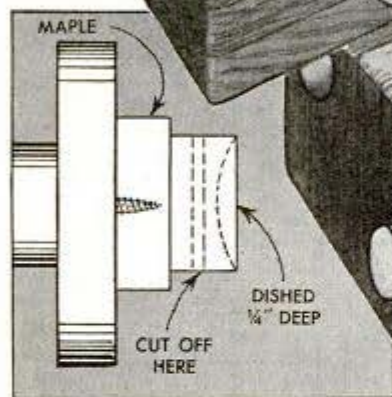
Film windows of older cameras sometimes admit sufficient light to fog some of the ultra-fast films now in use. This can



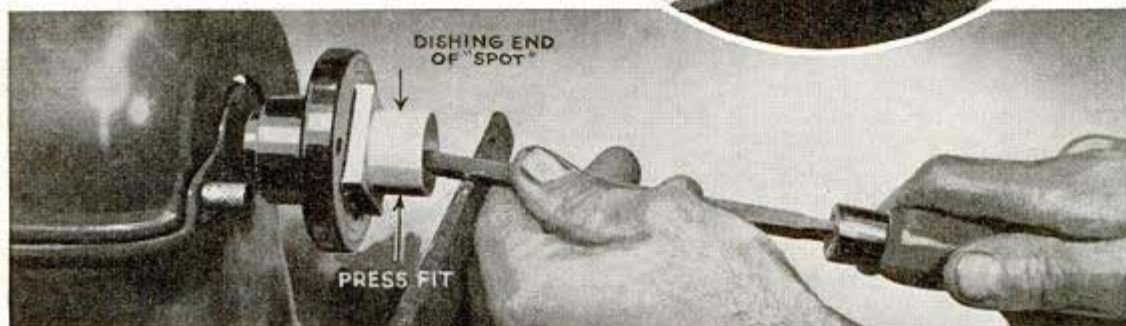
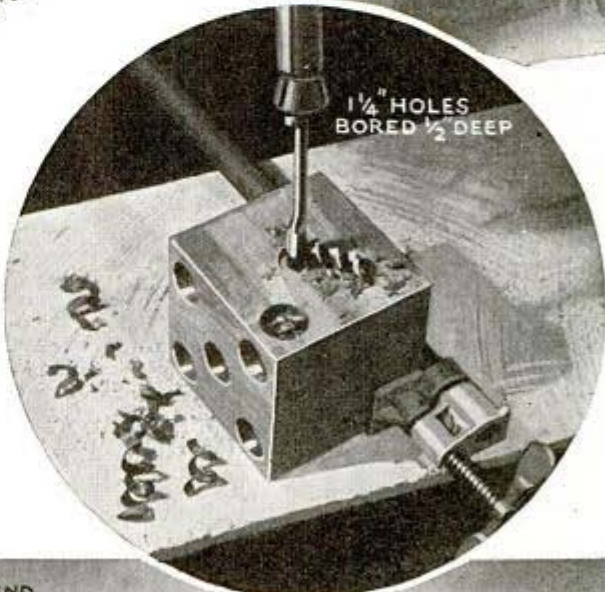
be guarded against by covering two sides of the window with strips of dark gummed paper or masking tape, leaving only a narrow opening in the center. The small opening allows the numbers on the film to be seen, but admits only about one-third as much light as the entire window.

—Kenneth Murray, Colon, Mich.

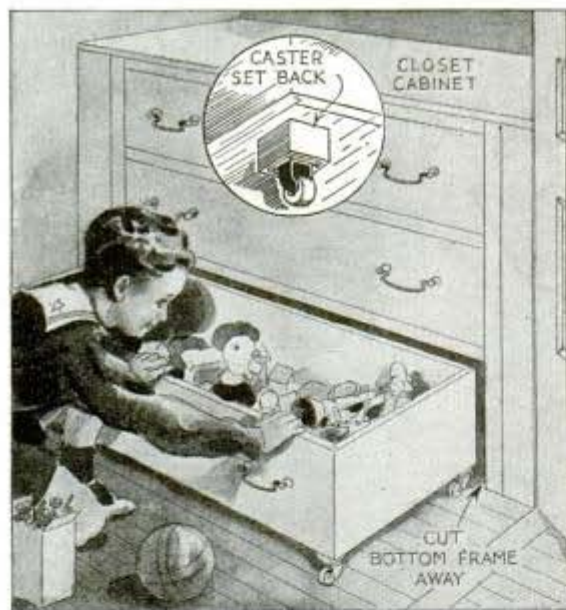
Lucky-dice BOOK ENDS



These giant dice book ends will not fail to receive attention from your guests. To make them, use any available stock, preferably hardwood. Cut it in 5½-in. squares and glue up to obtain blocks of 5 in. in thickness, which are trimmed and sanded to size. Bore the holes with an expansive bit and glue in the spots, which are turned on a lathe and have the exposed ends slightly dished. The dice shown were made of walnut and maple for contrast. Other wood should be stained for contrast. Corners and edges are rounded slightly and the flat surfaces are well sanded before shellacking and waxing. If desired, the spots could be a nonshrinking crack filler mixed with a pigment to get color effects

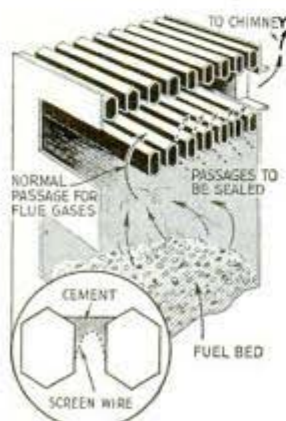


Mobile Drawer Provides Storage For Child's Toys



If you have no place for the children to keep their toys, this mobile drawer will solve the problem. It can be moved about as desired and, when not in use, slides into the lower part of a drawer tier in a closet. If you already have drawers built in the closet, the lower one can be converted easily. Just remove the slides, guides and lower apron and attach a caster to each corner of the drawer. It may be necessary either to reinforce the drawer bottom or replace it with a heavier one.

Recementing Sections of Boiler

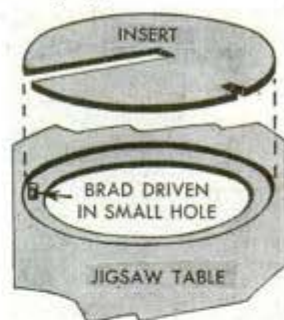


Some domestic heating boilers are designed to have certain spaces between the sections sealed to force the hot gases to wipe most of the heating surfaces on their way to the flue. Often, however, these seals become loose and drop out, creating a shortcut to the flue. If you have tried to reseal these passages only to have the seals drop out try the following method: First clean the iron parts to which the sealing cement is to adhere. Then place pieces of screen wire between the parts, wedging

the wire in place as shown in the circular detail. Now wet both the screen wire and iron surfaces and apply the cement. The wire will hold the cement in place until it dries and need not be removed as it will soon burn away and not interfere with the absorption of heat by the iron sections of the boiler.—Herbert Ellison, Chicago.

Stop Prevents Insert Turning In Table of Jigsaw

A good way to prevent a table insert in a jigsaw from turning and striking the blade is to use a stop pin as shown. The pin fits in the slot of the insert, and is held in place by driving it tightly



into a small hole drilled in the table. Be sure that the pin does not project above the insert to catch the work.

—Robert Clark, Chicago.

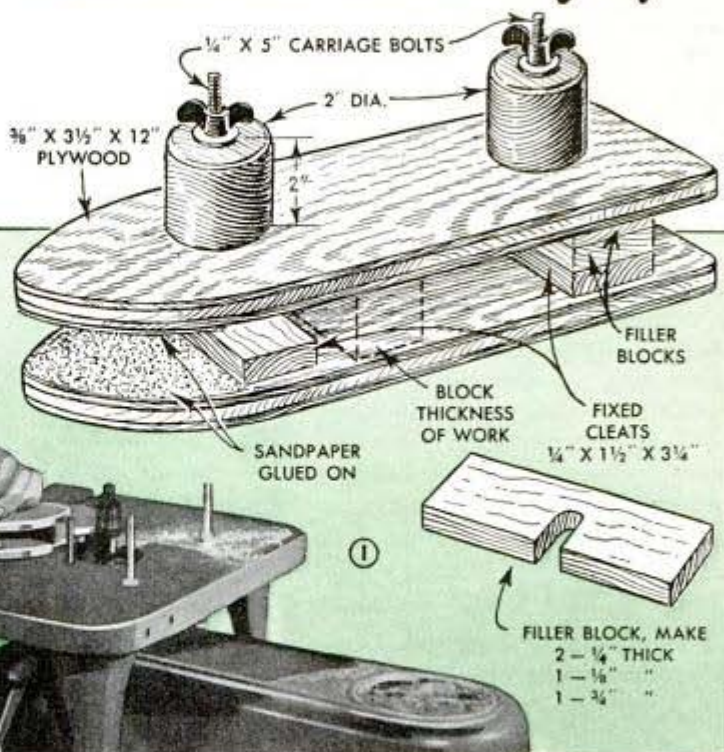
How to Spade Your Garden

Spading up a garden in the spring isn't just a matter of loosening the soil. The basic trick is to turn each forkful of soil completely over so that what was the top is at the bottom. This is essential to get the nutrients already in the soil properly distributed. Also, to get the manure or compost, previously spread in an even layer on top, down where the roots will reach it. Spade your garden only when the soil is in the proper physical condition, neither too wet and gummy, nor too dry and cloddy. You can tell by taking a lump of soil and squeezing it between thumb and fingers. If it neither wads into mud nor crumbles into dust, but gently breaks like rich pie crust, then it is ready for spading. Do not take too large bites with your fork. This makes the work hard to do and you may bend or break a fork tine. Give each forkful a whack with the back of the fork to break up the larger pieces. Go over the spaded soil with the back of a hoe to do a little more breaking up if necessary. Finally work the smaller clods down to a proper granulation with the rake, at the same time you are smoothing and leveling the surface.



SHOP NOTES

SHAPER TONGS *hold small work safely*



TRYING to hold small work by hand, especially when shaping it freehand, is a hazardous practice which sooner or later will result in painful injury or possibly the loss of a finger. If your shaper accessories do not include fixtures for holding such work, you should take the time to make these two safety jigs. The one detailed in Fig. 1 is designed especially for freehand work, that is, shaping without a fence. The jig consists of two pieces of plywood, bluntly pointed at one end, and fitted with

Two types—one grips irregular work tightly for feeding freehand, other holds straight stock when shaping with fence. Both are adjustable for width and thickness

By Edwin M. Love

the work rigidly to withstand the usual kickback when starting the cut. As maximum clamping pressure is had when the jaws are nearly parallel, a block of the same thickness as the work is placed back of the front bolt and filler blocks of various thicknesses are selected to fill the space at

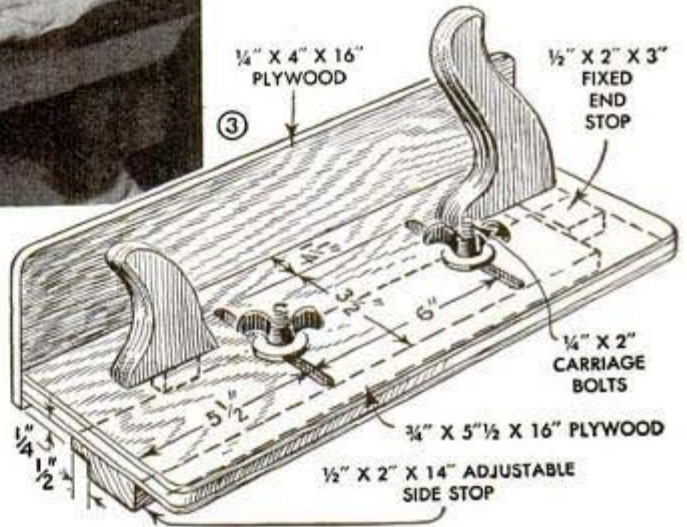
two handholds through which pass $\frac{1}{4}$ -in. carriage or flat-head bolts. Fixed cleats across the lower piece are provided to give extra thickness for the bolt heads. Sandpaper on the jaws helps greatly in holding



the rear. In use, the jig is held like a plane, shaping as much of the exposed edge of the work as is possible before turning the latter around in the jaws. The handholds afford complete control so that there is little chance of spoiling the work. If the overhanging portion of the work needs supporting, a $\frac{3}{8}$ -in. plywood strip can be clamped to the shaper table on which the work can rest while shaping it.

The jig detailed in Figs. 2 and 3 keeps

your hands fully shielded from the cutter when running short and narrow straight pieces along the shaper fence in the usual way. It consists of a baseboard having an adjustable side stop and a fixed end or heel cleat. In use, the side stop is set so that the work, which is placed in the rabbet, projects the amount to be shaped. The end cleat bears against the work in advancing it to the cutter. Notice that the lower edge of the guard

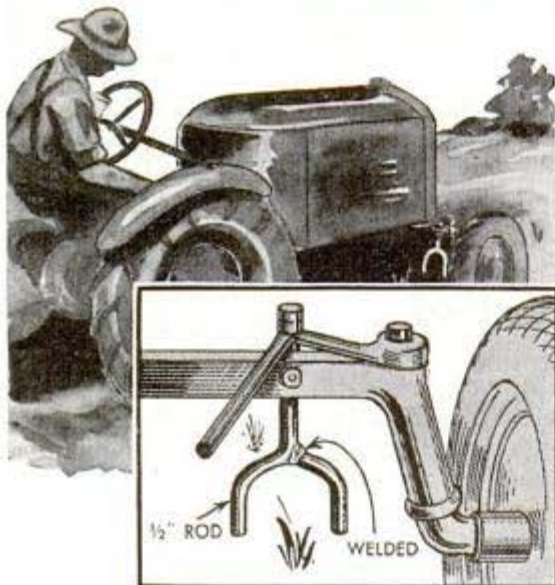


board projects below the baseboard to bear against the work and keep it firmly in contact with the table.

Y-Shaped Row Guide on Tractor Helps When Cultivating

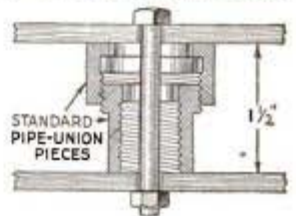
One farmer, whose tractor was fitted with a straight-rod type of row guide that was

difficult to see under certain conditions, improved the guide by bending the lower end as shown and welding on a short piece to form a Y-shape. Painted yellow, this guide is easy to see under all conditions.



Old Pipe Unions Used as Spacers

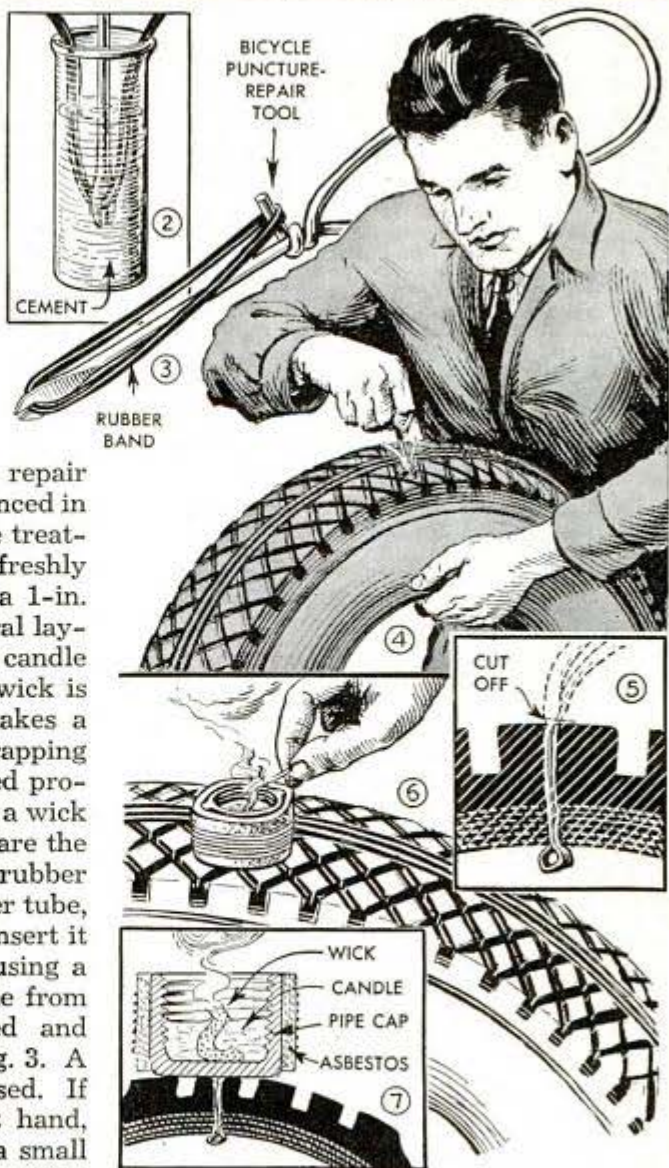
While bolting some steel shelving to a wall where a spacing of $1\frac{1}{2}$ in. had to be maintained correctly, I found that old pipe unions were ideal for the purpose. Being hollow, they allowed bolts to pass through them, and being adjustable, spacing between the shelves could be set accurately. The cap and threaded end of each union were used.—W. F. Schaphorst, Newark, N.



Vulcanize Small Punctures to Make Tires Last



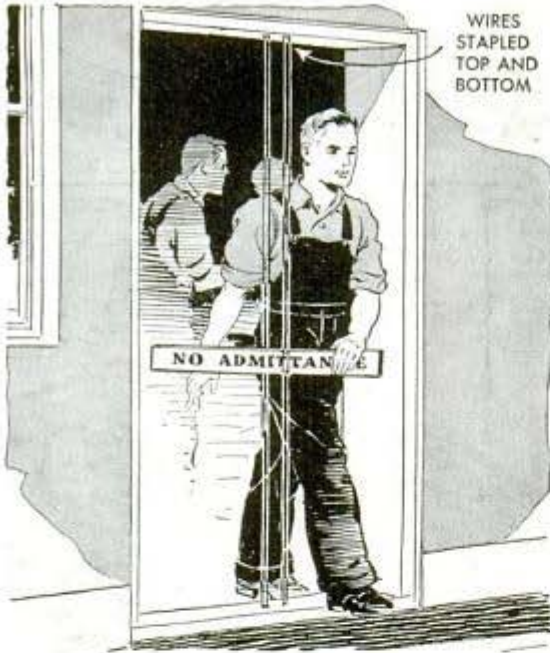
Don't just patch the inner tube when you puncture a tire, but also seal the hole in the casing immediately. If this is not done, water coming in through the hole gradually rots the fabric and causes a weak spot. As the weakened area increases, a blowout results sooner or later as illustrated in Fig. 1. The best way to seal the puncture is to vulcanize it. Anyone can do this with a simple spot vulcanizer such as shown in Fig. 7. However, if the puncture is an old one and the fabric has started to rot, the repair should be left to a mechanic experienced in vulcanizing, as the hole will require treatment different from that of one freshly made. The vulcanizer consists of a 1-in. pipe cap that is wrapped with several layers of asbestos and half filled with candle wax or light motor oil in which a wick is inserted. A piece of sash cord makes a good wick. If this is unavailable, wrapping cord or similar material can be used provided it is bundled and tied to form a wick at least $\frac{3}{16}$ in. in diameter. To prepare the hole, first clean it thoroughly, dip a rubber band, or a strip cut from an old inner tube, in vulcanizing cement, Fig. 2, and insert it into the hole as in Figs. 4 and 5, using a bicycle tire-repair tool or one made from a length of heavy wire flattened and notched at the end as shown in Fig. 3. A long slender nail may even be used. If there is no vulcanizing cement at hand, you can make some by shredding a small piece of tube-patching rubber and soaking it in gasoline until it swells and softens. After inserting the rubber band in the hole, cut off the projecting ends inside and outside the casing. Now, with the casing supported in a vertical position, center the vulcanizer over the hole, using a screen-door spring to hold it tightly against the tire. Fasten one end of the spring to a harness ring that is slightly smaller than the diameter of the vulcanizer. Place the ring



on top of it, bring the spring around the casing and then fasten the other end to the ring, thus causing the spring to pull down on the vulcanizer. Put three or four drops of rubber cement on the end of the wick to make it burn rapidly and ignite it as shown in Fig. 6. Wait about 10 to 15 min. after the wax or oil has been burned before removing the vulcanizer.

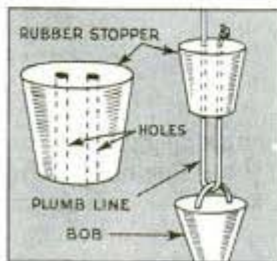
—A. L. Murray, Auburn, Ind.

'No Admittance' Bar Across Door Swings to Pass Employees



In a building where it was desired to have the door open and yet prevent anyone other than employees from entering, a "No Admittance" sign was lettered on a wood bar, which was then suspended on two wires in the doorway as shown. The wires were stretched taut and stapled to the top and bottom of the doorway. Then the sign was inserted between the wires, which were spaced several inches and tacked to each side of the sign. In this way, the sign was held horizontally across the doorway, yet could be turned to one side to allow a person to pass, after which it would swing back across the doorway.

Adjustment of Plumb-Bob Line Made With Bottle Stopper



Here is an easy way to provide an adjustment for a plumb-bob line so that it can be raised or lowered without tying knots in the line.

Just punch a couple of small holes through a rubber stopper as shown, making the line a tight fit in the holes. Push the line through one hole, then through the plumb bob and back up through the other hole in the stopper, tying

a knot in the end of the line to keep it from coming out of the hole. With this arrangement, the bob is adjusted by sliding the stopper up or down the line.

—A. H. Waychoff, Phoenix, Ariz.

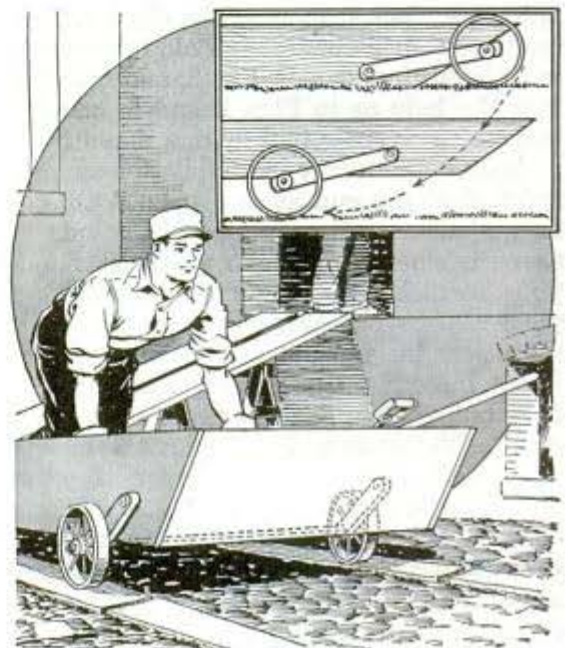
Holes in Handle of a Tin Cup Hold Marking Brush

To keep a marking brush handy with the lettering fluid, one shipping clerk carries both the fluid and brush in a tin cup. The handle of the cup is punched, as shown, to take the brush handle. In this way the brush is always ready for instant use, and is not likely to be mislaid.

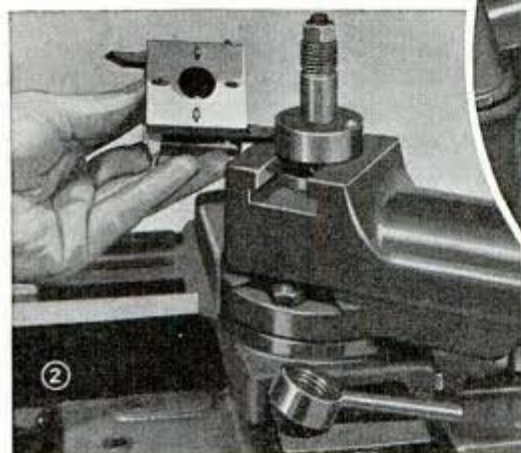


Wheels on Heavy Mortar Box Make It Easy to Move

Finding it necessary to move a heavy mortar box from place to place on a large job, one contractor fitted it with wheels, as shown. The axle on which the wheels rotate is pivoted to the box near one end by lengths of 2 by 4-in. stock, which permit the wheel-and-axle assembly to swing under the box for moving it, or to swing over the end out of the way when not needed.



Four-Position, TOOL-POST TURRET

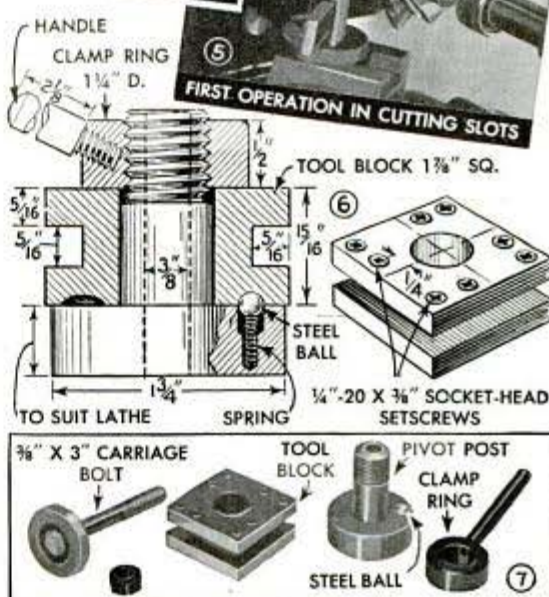


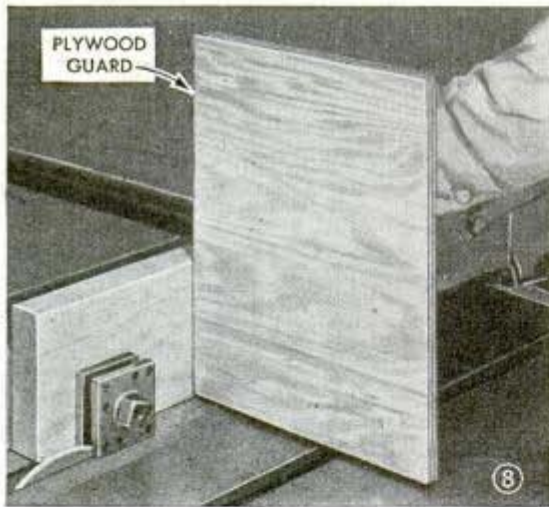
Use any of four bits by simply rotating tool block

ON ANY lathe job, a good part of the time is spent setting up various tool bits. Many of these changes can be eliminated by using a four-position tool-post turret, such as the one shown in Fig. 1 and described below. The main part of the turret is a slotted tool block, which holds four standard $\frac{1}{4}$ -in.-square bits. The tool block rotates on a pivot post, and is automatically indexed by means of a steel ball engaging slots ground on the underside of the tool block, as can be seen in Fig. 2. The pivot post itself is clamped solidly to the compound by means of a carriage bolt driven through a turned washer, the edges of which are ground flat to fit the T-slot in the compound.

Lacking a milling machine, the hardest part of the job is cutting the slots in the tool block. The method used in making the original called for making the pivot post first, Fig. 3, followed by the clamp ring, Fig. 4. These two parts provide an arbor on which the tool block can be mounted, in which position the slots are cut by turning to a depth of about $\frac{1}{8}$ in. below the edge of the square section. See Fig. 5. This leaves but a small amount of metal in the slots, which can be removed by grinding as shown in Fig. 8.

The dimensions given in Fig. 6 can be

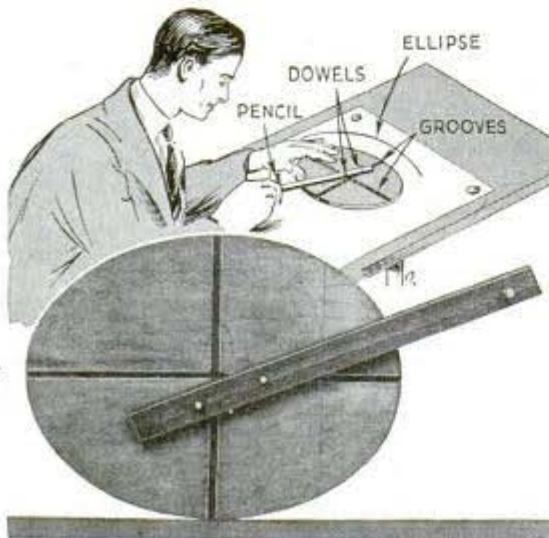




altered slightly if desired. The thickness of the pivot post base will depend on your particular lathe, and should be such that with the turret assembled, the top edge of the tool bit will come to the lathe centerline. The thread on the upper end of the pivot post should be fairly coarse—10 or 12-pitch—so that a quarter-turn of the clamp ring will release the tool block sufficiently to permit its rotation.

Accurate Ellipses Drawn Quickly With This Simple Tool

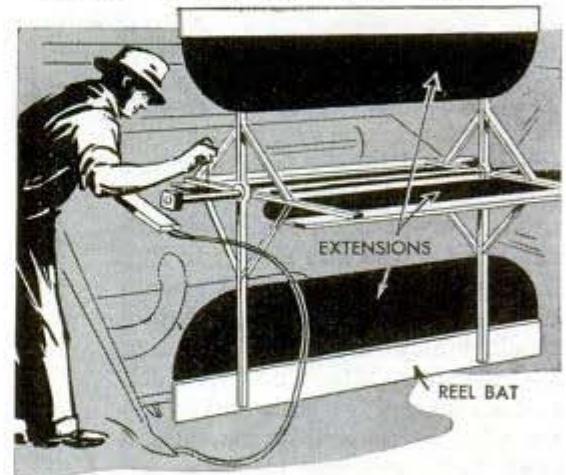
Anyone who frequently has to draw an ellipse will find this device a timesaver over the usual method of doing this work. It consists of a wood strip and an oval-shaped block, the latter being grooved at right angles as shown in the photo. The strip is drilled near one end to receive a pencil, and two holes are drilled near the



other end for short dowels. One of these holes is located at a distance from the pencil equal to one half of the width of the desired ellipse, and the other is located at a distance from the pencil point equal to one half of the length of the ellipse. The dowels should fit snugly in the holes, and should move freely in the grooves without allowing any side play. In use, the dowel nearest the pencil is inserted into the longest groove and the other dowel is put in the shortest one. Then, the block is placed on top of the work and the pencil is swung around, keeping the dowels in their respective grooves as they move. Ellipses of various sizes can be drawn by varying the distances of the dowels from the pencil.

—James O. Cavanaugh, Portland, Ore.

Reel Extensions on Grain Binder Prevent Wrapping of Weeds



On grain binders, combine harvesters and windrowers that are used in standing grain, trouble often is experienced in weedy fields by having both grain and weeds wrap around the reel blades or bats. To avoid this trouble, one operator fitted extensions on the blades as shown. These were cut from 1/8-in. wood and screwed to the reel arms in the positions indicated.

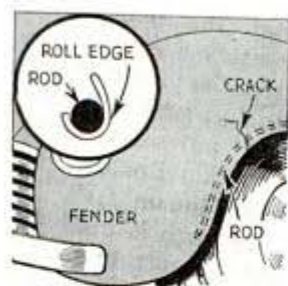
Keeping Insects Off Fresh Paint

The unsightly appearance of a freshly painted surface covered with insects can be avoided by adding pine oil, cedar oil or citronella to the paint before applying the final coat. A spoonful to a pail of paint should be sufficient. Most insects dislike the odor of these oils and will not come close to the paint.—H. J. Kerber, Chicago.

Stopping Squeak in Fan Belt

If there is an annoying squeak that seems to come from the fan belt of your car, it is likely to be caused by the groove on the crankshaft pulley, or perhaps the water-pump pulley, being worn smooth by the belt. An application of paraffin wax to the belt every 1,000 or 1,500 miles will stop the trouble.

Repairing Broken Fender of Car



When a fender is damaged and the rolled edge is broken, a good way to make it strong and rigid, is to weld a $\frac{1}{2}$ -in. rod across the cracked portion as shown.

First the rod is bent to the shape of the fender, then the rolled edge is opened and the rod placed into it. After welding the rod in position, the cracked portion that extends back into the fender is also closed by welding.

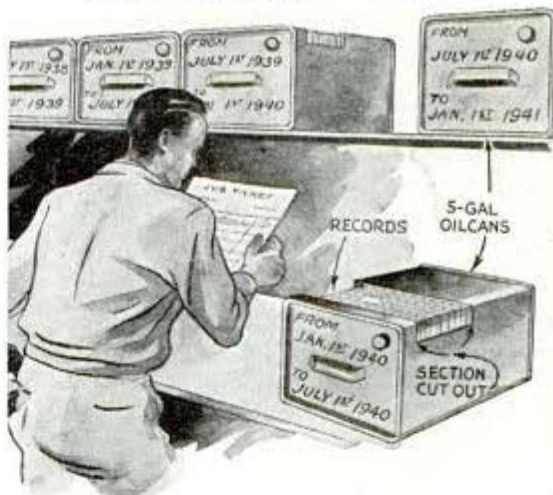
Height of Underpasses Checked With Fishing Rod on Truck

After causing considerable damage to his truck by driving through a doorway that did not provide enough clearance for his load, one driver attached a telescoping fishing rod to the front bumper to prevent similar accidents. The rod is adjusted to the exact height of each load before starting out so that it can always be used to check the clearance of doorways, underpasses, etc., without getting out of the cab.



MAY, 1943

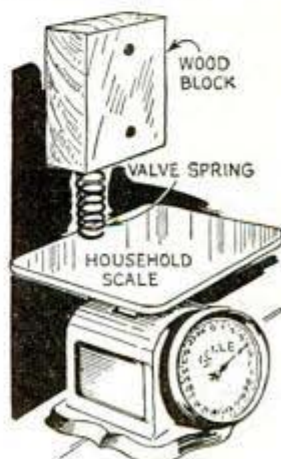
Oilcans Converted to File Cases For Storing Job Tickets



If you own a garage and have a number of empty five-gallon oilcans on hand, they can be put to good use by converting them into storage cases for job tickets and other records. All you need to do is cut out a portion of one side of the cans and bend the sharp edges down to provide suitable openings. The files are labeled permanently on the front with a paint brush and in case it is necessary to move them, they can be carried easily by the handles. Where additional drawers are needed, such containers can also be used for this purpose, if suitable slides are installed.

Strength of Valve Springs Tested With Household Scale

An ordinary household scale can be used to test valve springs accurately in the garage. Place the scale on a workbench near the wall and nail a wooden block directly above it, spacing the block a little closer to the scale than the length of a valve spring. By wedging the springs between the block and scale table, one at a time, the corresponding spring strength will be registered for easy comparison.



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JIGS *made at low*



Photos courtesy Linde Air Products Co.

Scrap pile goes to work

Machine-shop jigs and fixtures used in production lines can be made quickly by welding together pieces of scrap steel. This method not only conserves metal, but also saves the time and labor in making such units by the usual pattern-and-casting method. Besides serving to weld the units, an oxyacetylene torch is used to flame-harden parts to be subjected to severe wear

By H. J. Chamberland

IN MODERN machine shops, the amazing speed of production depends to a great extent on the use of jigs and fixtures. Their purpose is to hold identical pieces in certain positions either for machining operations or for welding to other units in process of construction. By using jigs and fixtures, it is possible to eliminate the work of measuring, laying out, etc., on each separate piece, and also the work of clamping each piece separately to the machine tables and making the machine adjustments. Once a jig or fixture has been properly made and adjusted to hold work in the desired relation to the tool, it is only a matter of removing one piece of work and substituting another. Quick-acting clamps reduce the time required to put the work into and remove it from a jig or fixture.

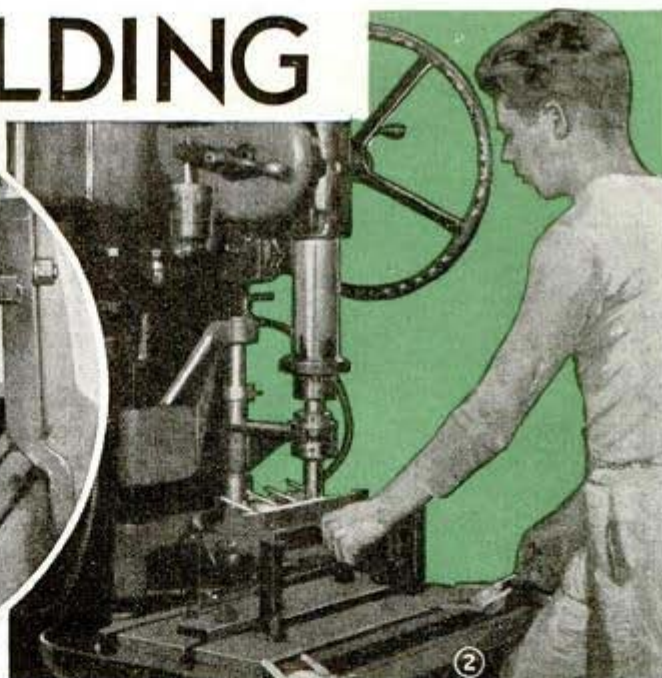
In making the numerous jigs and fixtures needed in industrial plants, welding provides a means of making the units at a great saving in time, labor and material. Savings in material result from the extensive use of scrap stock, thus conserving metal which can be used to greater advantage for other purposes. Fusing a number of scrap pieces together into a single unit assures strength and rigidity. Considerable

savings in time and labor are possible over the usual method of casting and machining the units because welded units built to specifications require only some machining to finish them or no machining at all, and the work of making patterns and castings is eliminated. In many cases the welding method results in reduction of from 50 to 60 percent in cost.

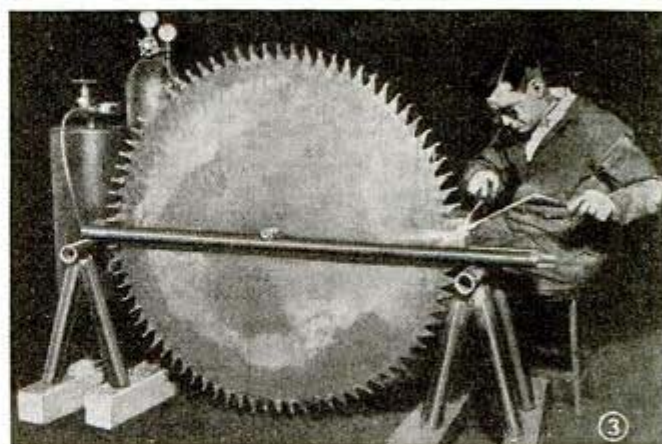
A jig is not necessarily clamped or bolted to a machine table, bed or base but a fixture, which serves an identical purpose, usually is bolted to some machine part. A jig is self-guided but a fixture depends on something else for guidance. For example, Fig. 2 shows a jig on a drill press, the jig being free to move because there are usually several holes that must be drilled, reamed, counterbored and threaded. The jig could be bolted to the table if only a single hole were to be drilled. The tool shown in Fig. 1 is a fixture which is guided by the table of a milling machine. On either a jig or a fixture, the parts that are to be exposed to severe wear can be hardened for greater durability by means of the flame of an oxyacetylene welding torch followed by a quenching stream.

Figs. 3 and 4 illustrate how scrap parts

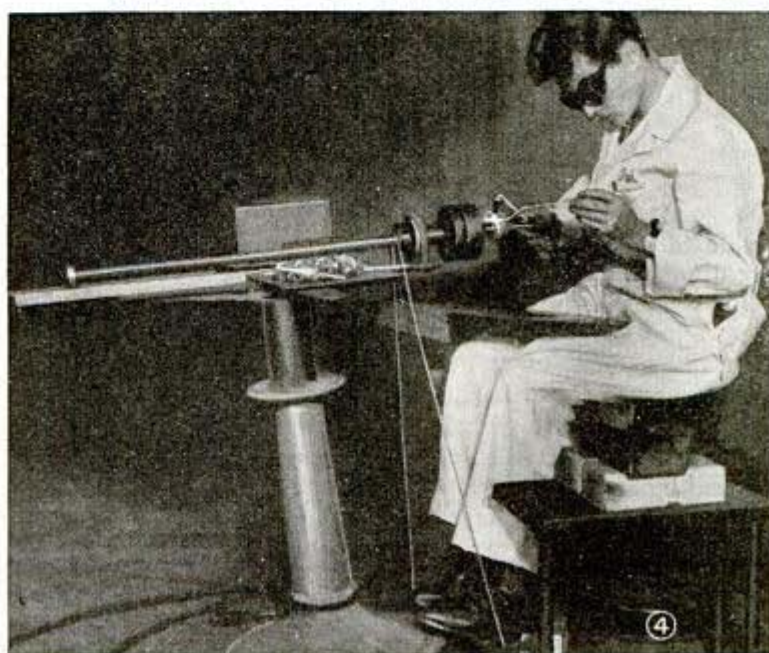
cost by WELDING

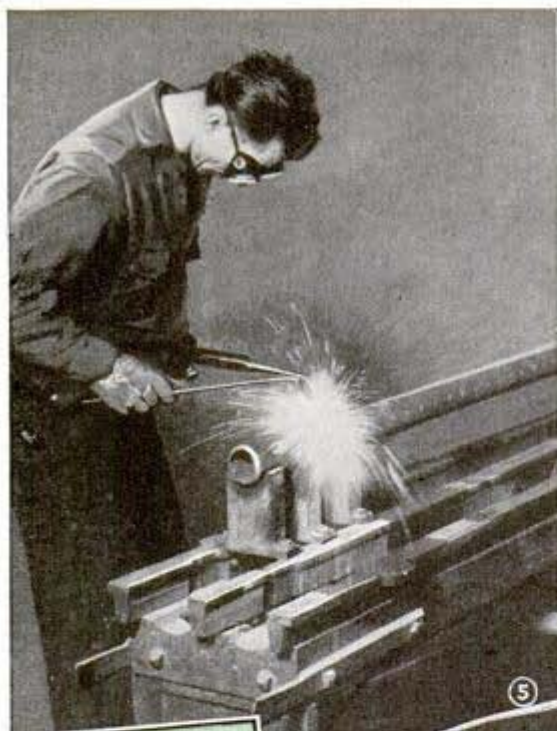


can be used for building jigs and fixtures. Fig. 3 shows a holder made of pipe, its purpose being to support large circular saws when resurfacing their teeth, while Fig. 4 shows how use was made of a discarded grinder pedestal on which a shaft was mounted and a foot treadle arranged to rotate circular pieces, the purpose being to control uniformity of the weld deposit on the work. The fixture shown in Figs. 7 and 8 was used to hold cylindrical parts such as barrels, drums, water heaters and similar containers when welding longitudinal seams. A horizontal arm is supported by a post and two quick-acting counter-balanced clamps are pivoted at the rear.

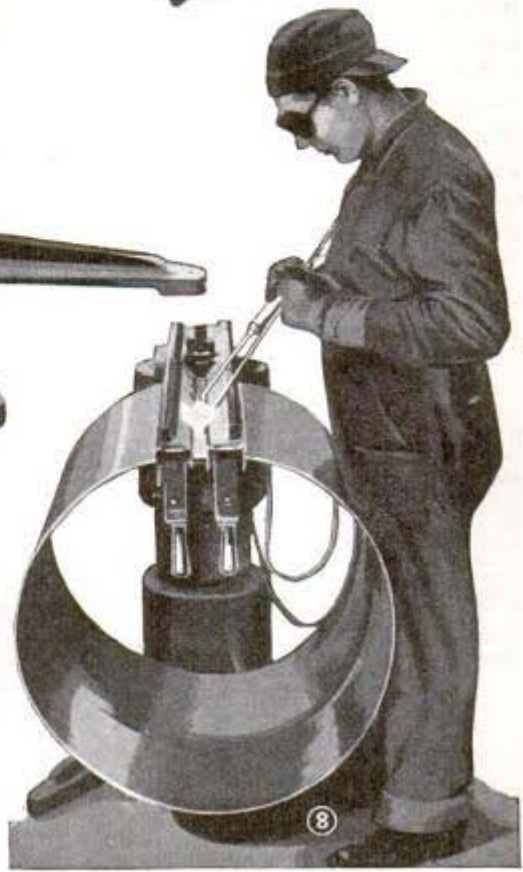
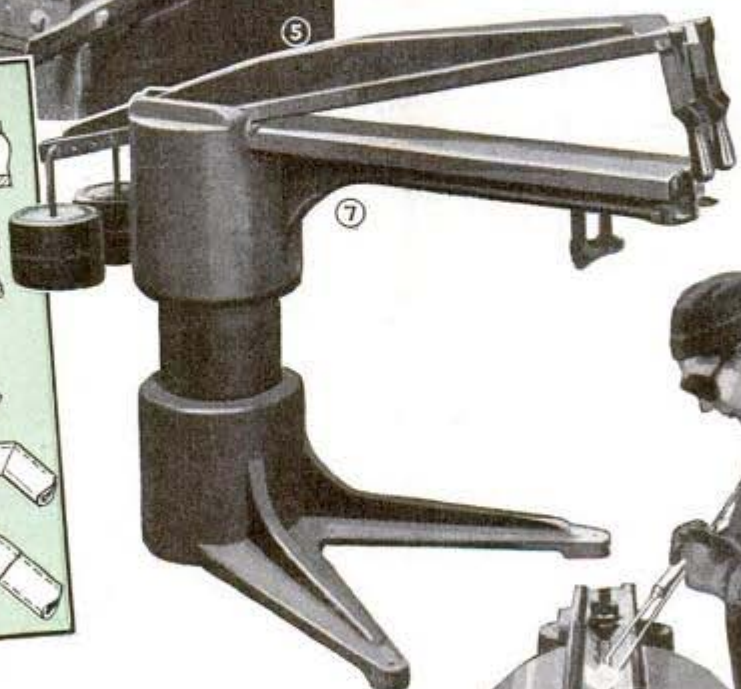
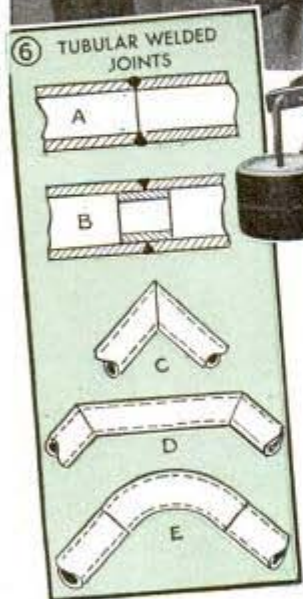


When welding thin sheet metal with an oxy-acetylene torch, particularly stock $\frac{1}{32}$ in. and less in thickness, it is highly advisable to use holders to keep the work in position, as the tendency of thin stock to distort under the influence of heat becomes greater as the thickness of the stock is





Welded connections between tubular shapes can be made by a plain butt joint as shown in Fig. 6A or by means of a back-up-ring joint as shown in detail B. When butt-welding heavy tubing, the adjoining ends should be beveled. To weld one tube to another at an angle, it may be cut to fit on the curved surface of the other, or else a hole may be cut in one to permit insertion of the other. In the latter case, the hole must be so shaped as to permit a close fit of the entering member at the desired angle. Detail C of Fig. 6 shows how mitered ends of two tubes or pipes are welded at an angle. By adding an extra piece as shown in detail D, the sharp corner shown in detail C is eliminated. Sometimes the appearance of a corner can be improved by using an evenly curved piece for the intermediate fitting as shown in detail E. Fig. 5 shows two pieces of tubing being welded



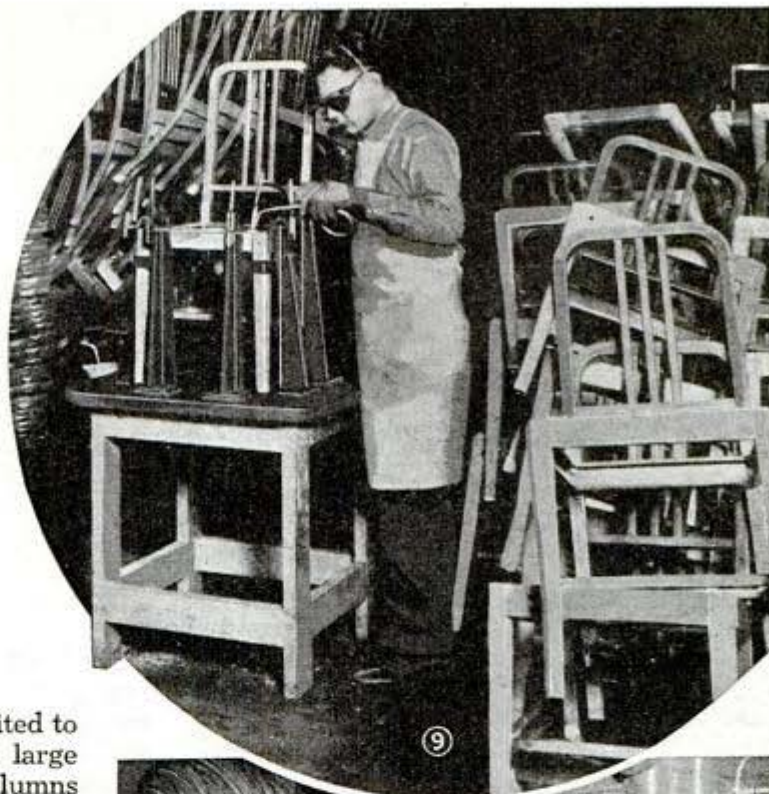
reduced. When the flame is applied to comparatively heavy sheets, expansion takes place along three dimensions so that there is little apparent distortion in any one direction. A heat differential of 500 degrees F. between the upper and lower surfaces of a $\frac{1}{16}$ -in. sheet has about twice the warping effect as a $\frac{1}{8}$ -in. sheet under the same heat differential. The latter has about four times as much resistance to bending and warping as the former. A $\frac{1}{2}$ -in. plate tends to warp only one-eighth as much as a $\frac{1}{16}$ -in. sheet of the same material, and its resistance to bending is about 64 times greater.

together, for which purpose identical V-shaped supports are used.

In the modern machine shop, the metal-cutting band saw provides a means of cutting sheet stock quickly when making jigs and fixtures. Fig. 10 shows channel-shaped parts being band-sawed to shape before bending them at right angles and welding. Some of the resulting work is stacked on the band-saw table. Cutting of parts for all-steel units, such as the chairs shown in Fig. 9, is an important step, and the welding results depend a great deal on the accuracy of the cut. Welded

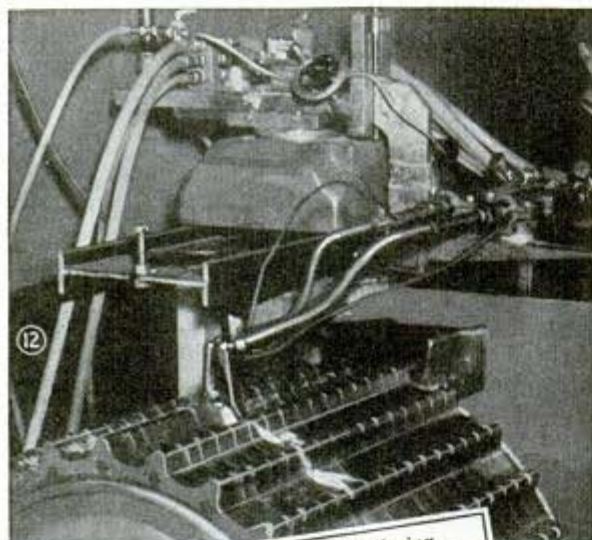
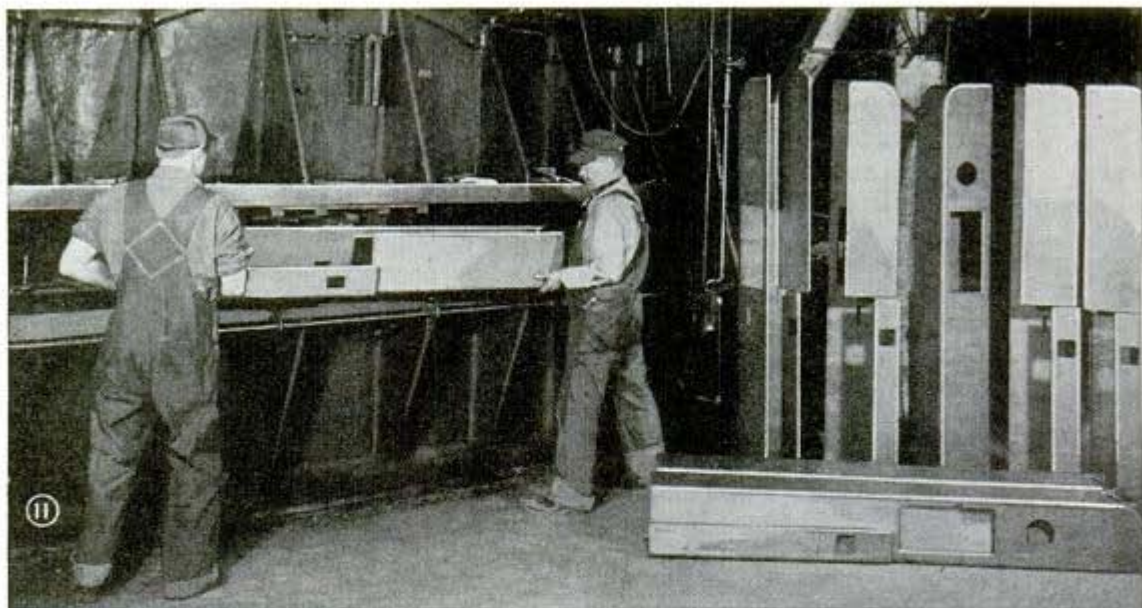
steel construction is not limited to small jigs and fixtures, but large machine-tool bases and columns also are made by welding. Many machine tools formerly made in the form of unnecessarily heavy castings are now being pressed out of heavy-gauge sheet steel as shown in Fig. 11, the parts being welded together.

Flame-hardening as practiced today is a development whereby certain kinds of iron and steel can be made far more resistant to surface wear than the base metal. This procedure has been known as the heat-and-quench method of hardening, but the oxyacetylene flame is responsible for its present application. Intense localized heat is applied to a desired surface and at such a rapid rate that the hardness depth can be controlled. The surface metal is heated to the critical temperature and quenched so that it is hardened to a predetermined depth, while the rest of the part retains its original degree of hardness. There is no definite line of demarcation that separates both zones because the maximum degree of hardness gradually diminishes and blends with the unaffected metal. The term "critical temperature" means the degree of heat just below the overheating stage. With flame-hardening on steel, this occurs between 1,400 and 1,600



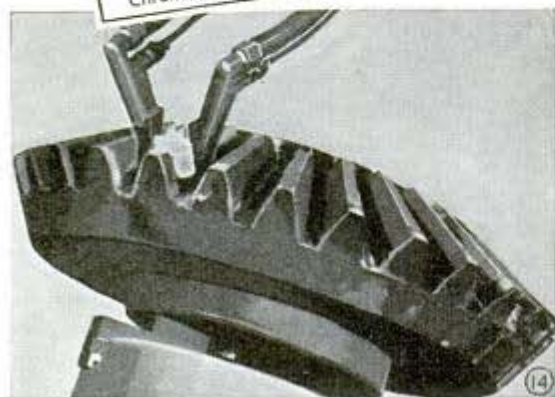
degrees F., or approximately 1,000 degrees below the melting point.

A flame-hardening operation is shown in Fig. 12, where sixteen large sprockets are ganged together and only the teeth are hardened. Formerly, large sprockets, gears and worms were made of expensive material for wear resistance but now it is possible to bring the flame-hardening unit to the job and harden the teeth without affecting the remaining inner structure. Fig. 14 shows how the teeth of gears are heated on both sides to a bright red, after which the gases are shut off and an ample flow of water is directed over the heated area.



13 Steels suitable for flame-hardening

Steel	Carbon content
Plain carbon	0.30 to 0.55
Medium manganese	0.25 to 0.45
Nickel steel	0.30 to 0.55
Nickel chromium	0.25 to 0.45
Chromium molybdenum	0.30 to 0.55
Chromium steel	0.35 to 0.50
Chromium vanadium	0.30 to 0.55



After heating small parts, they are immersed in water. Flame-hardening is expedited by various mechanical means, such as automatic indexing, built-in quenching devices, etc. Fig. 13 gives a list of steels most suitable for flame-hardening, while Fig. 16 lists a number of tools and machine parts considered excellent applications for the process.

The simplest method of flame-hardening is known as "spot-hardening," with which anyone can experiment. Take a piece of steel, about $\frac{1}{2}$ by 1 by 4 in. in size, containing .05 percent of carbon, this analysis being termed S.A.E. 1040 steel. You can obtain an idea of the approximate hardness of the steel by using a file and referring to Fig. 17. With the torch flame adjusted to normal, heat one end of the piece until it is bright red and then let it cool slowly. When cool, test the heated section with a file and note that no change in hardness has occurred as indicated in the left detail of Fig. 18. By repeating the same heating operation and quenching quickly in water, another filing test will show that the heated and quenched portion is approximately twice as hard as the opposite end as indicated in the center detail. In this case the metal is hardened throughout the entire thickness of the heated portion. If the flame is moved over the surface and a stream or spray of water is applied to the metal directly behind the flame as shown in the right detail, the hardening will occur only at the surface. The distance between the flame and



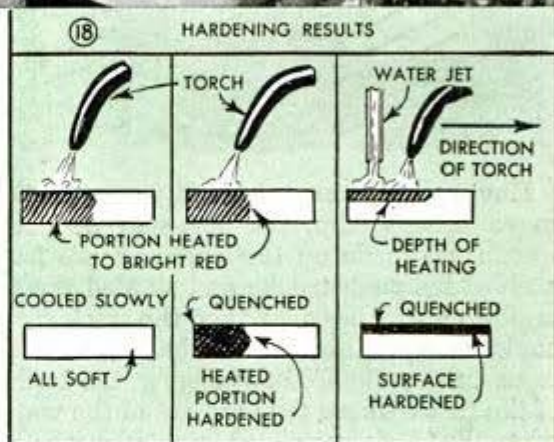
16 Flame-hardening applications

Dogs	Valve seats
Dies	Piston rods
Gears	Wrench jaws
Rollers	Crane wheels
Sheaves	Machine ways
Ratchets	Pump plungers
Sprockets	Bearings on shafts
Valve stems	Cams and cam surfaces

17 Effect of hardness on filing

Brinell hardness	Reaction to filing
100	File bites easily, metal is soft
200	Slightly more pressure to file
300	File encounters first resistance
400	More resistance, metal quite hard
500	File barely cuts, metal slightly softer than file
600	File slides over metal and teeth dull rapidly

the water spray should be regulated in order to provide proper quenching effects without interfering with the flame. Speed of movement of the flame and the quench governs the depth of hardening.



The flame-hardening process has revolutionized the manufacture of metal-cutting band saws to a point where the depth of tooth hardness is controlled so uniformly that it is possible to maintain a soft back throughout the band and impart tensile strength. Fig. 15 shows flame-hardening applied in modern band-saw processing.

Vibrating Machine Causes Breakage of Pipe Connections

When pipe and similar materials must be connected rigidly to a machine that vibrates in operation, breakage often results at the points of connection because the constant motion causes the metal to crystallize. In most cases of such trouble, it has been found that breakages of this type occurred in connections that were made to the machine at points farthest from the base. The solution in avoiding this trouble is to lower the pipe or part to a position near the foundation or base of the machine

and make the connection there. The explanation is that the motion of vibration is always the least at the foundation and the greatest in the parts of the machine that are more remote from the foundation, precisely as in a tuning fork. Therefore, the logical place for connecting pipes, cables, ducts, etc., is as near the point of least vibration as possible. This applies also to flexible types of connectors made especially to resist vibration because even they have their bending limitations.

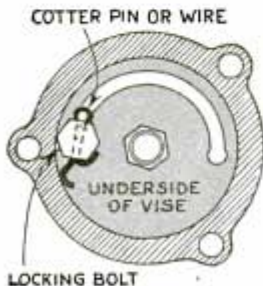
Two Canvas Sacks on Push Truck Carry Small Packages



Having a number of small packages to move occasionally, the foreman of one warehouse made up two canvas sacks for each of his push trucks and stapled them to the cross braces so that the packages could be carried on the trucks. When not in use, the sacks fold flat against the back of the truck where they are out of the way when the truck is used for its regular work.

Repair for Worn Locking Bolt In Base of Swivel Vise

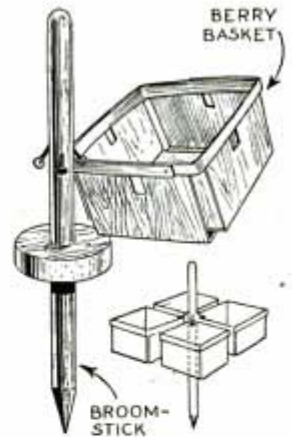
If the hexagon head of the locking bolt on a swivel vise has worn at the corners because of too severe tightening and allows the bolt to turn, here is a simple way to repair it. Remove the vise from the bench and take out the bolt. Drill a hole through it to take a heavy cotter key or piece of wire. If a key is used, bend one leg around the head to hold the key in place, and bend the other leg to bear against the side of the base and keep the bolt from turning. Be sure to bend the latter leg so that it will slide freely against the recessed edge of the base. If a wire is



used, bend one end around the bolt head and shape the other end to rest against the base.—C. Greydanus, Paterson, N. J.

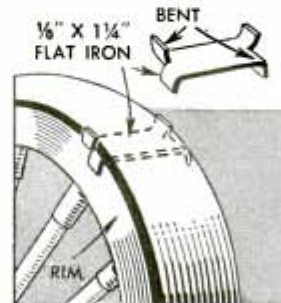
Berry-Box Holder and Carrier

To assemble small berry boxes for easy carrying and at the same time to elevate them above the vines in the field, one grower made holders of the type shown. These consist of 2-ft. lengths of broomstick pointed at one end and inserted through wooden disks. Nails driven into the sticks at an angle slip over the corners of the boxes to hold them in place.



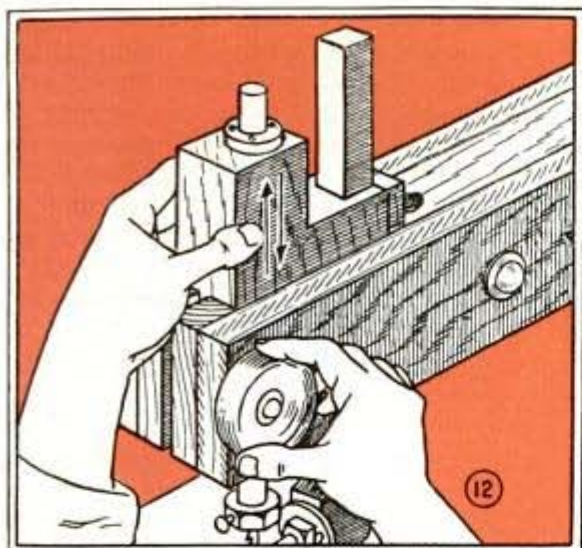
Tires Kept on Wagon Wheels By Simple Two-Way Clips

When the wooden felly of a wagon wheel dries and shrinks so that the tire will not stay in place, use clips bent from flat iron as shown. First the metal is cut to size and then slit back from the ends in the center with a hacksaw to form tabs. Then the metal is driven between the felly and tire, after which the two tabs at each end are bent in opposite directions, one over the tire and the other down over the felly. Three clips evenly spaced around each wheel usually are sufficient.



Applying Enamel to Brass

Enamel will not adhere to brass unless the surface has been prepared correctly. A thorough washing with any household cleaner that does not contain soap followed by a wiping with denatured alcohol is all that is needed. Enamels designed for metal surfaces may be applied directly to the cleaned brass.

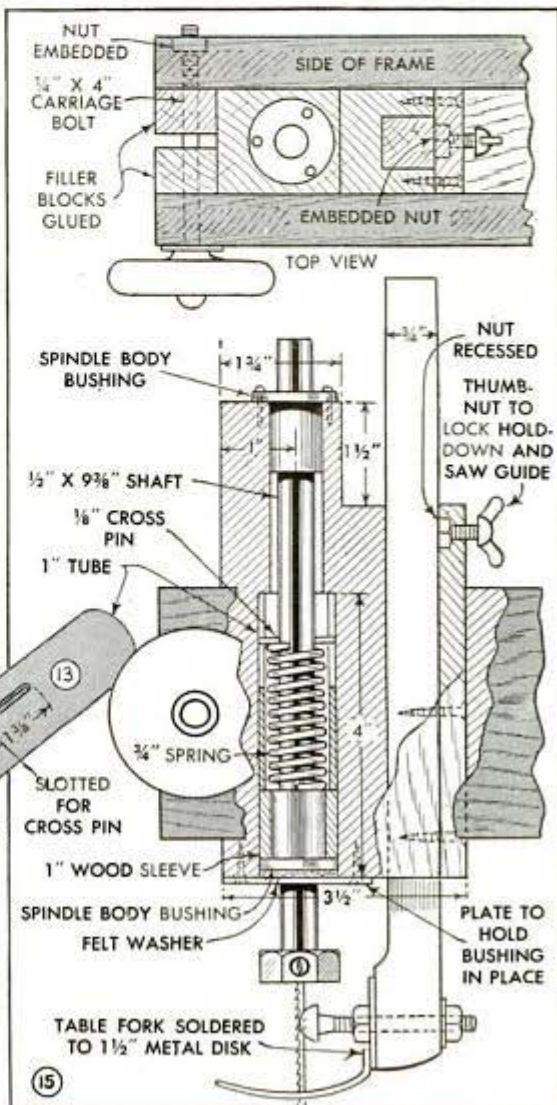
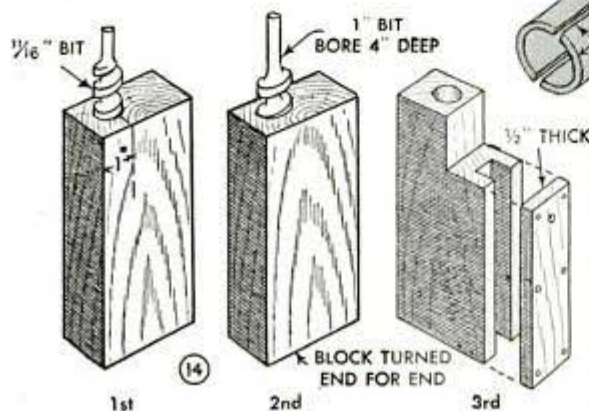


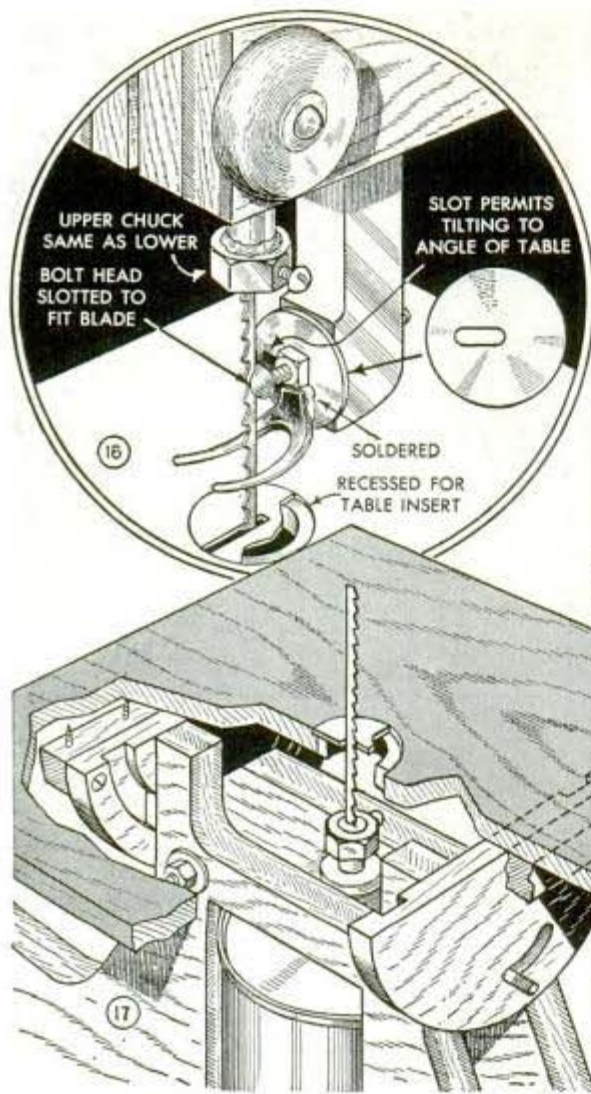
Foot-powered SCROLL SAW

By Wayne C. Leckey

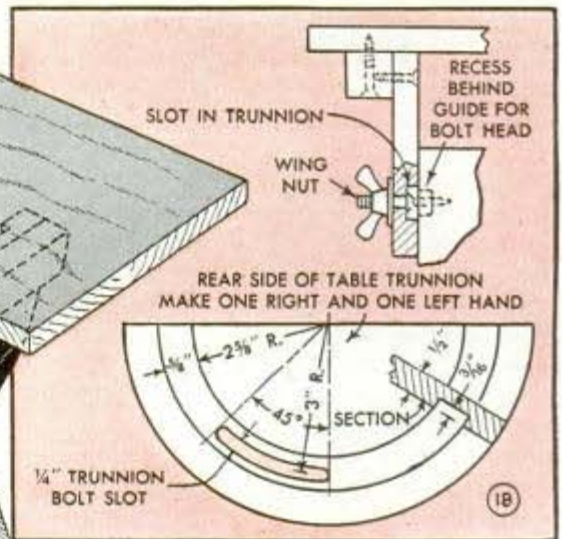
PART II

CONTINUING construction of your foot-powered scroll saw, you make the blade-tension unit, Fig. 12, next. This is adjustable up and down in the arm so that the tension on the blade can be varied to suit the size being used and thereby reduce breakage. A record of the tension found best for each blade can be indicated on the side of the unit by marking on it across the top of the frame. These calibrations will tell you how much to raise or lower the unit when changing to a finer or coarser blade. Fig. 14 gives the steps in making the wooden housing of the unit. You begin with a hardwood block $1\frac{1}{2}$ by 3 by 7 in. A line is drawn down one side and across both ends to mark the points for boring.





lower bushing is done after the large hole is lined with a 1 by 2 $\frac{3}{4}$ -in. metal or Bakelite tube, slotted like the one shown in Fig. 13. This tube, besides forming a well for grease to lubricate the spring and lower bushing, keeps the shaft tracking without twist by engaging a cross pin in the shaft in slots in the tube. Needless to say, the slots in the tube must be cut down each side exactly in the center, otherwise the pin is apt to bind or prevent assembly. The shaft, with the cross pin either threaded or pressed into it, must be slipped inside the tube and both inserted in the hole at the same time, after which the spring is added and the lower bushing and its



As it is important that the holes be in line centrally through the block, a drill press is preferred to boring them by hand, although the latter can be done fairly accurately if you are careful to keep the bit running as straight as possible. Bore the top hole 3 in. deep, then turn the block end for end, and with a 1-in. bit, bore through to meet the first hole. Next, groove the rear edge of the block to take the hold-down, after which the upper corner is notched according to the dimensions given in Fig. 15.

The cutaway sectional view in Fig. 15 shows what the tension mechanism looks like when installed in the counterbored housing. Bronze bushings of the type that were used in the drive head are used here to carry the shaft; the upper bushing being pinned to the block through the flange and the lower one bushed centrally in the hole with a turned wooden sleeve. Fitting the

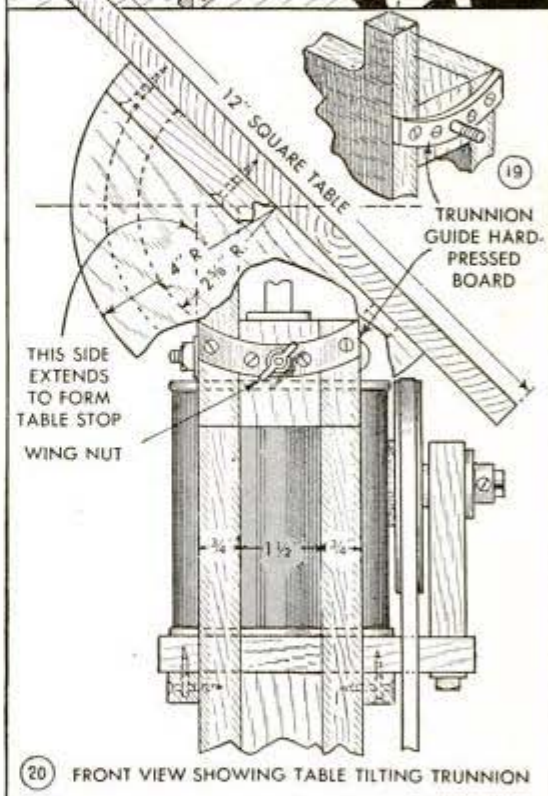
sleeve are pressed in the end to hold the tube in place. The width of the slots in the tube should equal the diameter of the cross pin. Note that a thick felt washer is provided between the bushing and the metal plate which holds the former in place, to prevent oil from being thrown out through the shaft clearance in the plate. The upper blade chuck is made the same way as the lower one, which was described previously, the end of the shaft being threaded for the nut before the shaft is installed in the housing.

A turn of a handwheel clamps the unit securely in the arm. This can be made of wood and fitted with a carriage bolt to engage an embedded nut in the opposite side as shown in the top view of Fig. 15. The completed unit must be mounted in the arm so that the upper chuck will be directly in line with the lower one. You can do this best by clamping the unit tem-

porarily in place with a C-clamp or a handscrew and checking it for alignment with a square held along the underside of the arm. When centered, the frame core piece along the top of the arm is fitted and bolted in place behind the unit and filler blocks or stops are glued between the sides at the front. See top view, Fig. 15.

The work hold-down, Figs. 15 and 16, is improvised from an old table fork having the two center tines removed. It is soldered to a 1½-in. disk slotted crosswise, to permit the hold-down to be adjusted to whatever slant the table may be tilted. The fork and disk are held to a wood shaft by a bolt blade guide. Several of these guides will be needed to accommodate blades of various thicknesses. You can make them easily from ¼-in. carriage bolts by slotting the heads the required depth with a hacksaw and then closing the slot slightly by peening it to suit the blade thickness. A thumbnut fitted as shown in Fig. 15 serves to lock the hold-down at the desired height, and wax applied to both the shaft and the channel in which it moves will make it slide easily.

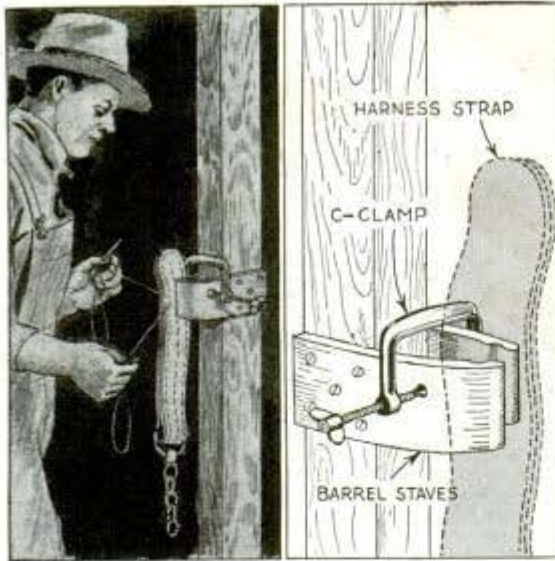
Making the trunnions for the tilting table will require the use of a lathe, as a groove must be turned in them to take guides on which they move. Both trunnions can be had from one plywood disk by sawing it carefully in half after turning to size. Note in Fig. 18 that the bolt slots through the trunnions must be cut on opposite sides of the centerline to obtain right and left-hand units. Use hard-pressed board from which to turn a ring to fit the trunnion grooves nicely and then screw 3-in. segments of the ring flush with the top of the frame at the front and back as shown in Figs. 19 and 20. Notice that the square heads of the trunnion bolts are embedded under the guides before screwing the latter in place. A wing nut and washer are provided on each bolt to lock the trunnions in position. Wax applied to the trunnion grooves and the guides will make the table tilt smoothly. Plywood is preferred to solid stock for the table, as it will stay flat. It is attached to the trunnions with cleats as shown in the upper detail in Fig. 18. You will have to do this, of course, while the trunnions are in place on the guides. The recess for the metal table insert is formed easily by pressing a turned ring in the hole as shown in Fig. 17. Here you also can see how the frame extensions



provide stops to permit returning the table quickly to a horizontal position. Where it is desired to have the table so it can be tilted 45 degrees to the left also, the stops can be cut off. With this arrangement, the clamping-bolt slots are extended and the trunnion indexed 90 degrees for rapid setting.

If you are unable to buy an endless V-belt long enough to reach the drive pulley, you can resort to round leather belting or even sash cord, applying belt dressing if slippage develops.

Simple Vise Holds Harness Straps While Repairing Them



When sewing and repairing harness, one farmer uses a vise made from two short pieces of barrel stave. These are screwed to a timber in the barn with the curved ends facing each other to provide jaws. A C-clamp pulls the jaws together.

Easy Way to Finish Antiques

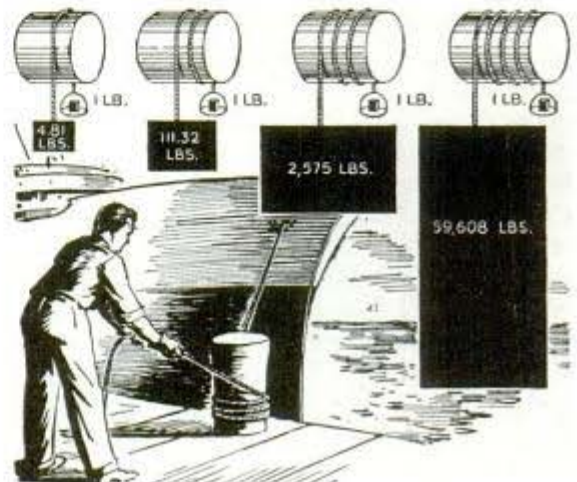
For refinishing old pieces of early American pine or maple furniture or for finishing reproductions of the same, I have found that the following method produces an authentic color. The finish will withstand alcohol, and hot dishes, and gives the piece a worn appearance. First, wet the wood to raise the fibers and then smooth it with fine sandpaper. Apply a coat of boiled linseed oil mixed with turpentine. This gives the wood a filler so that the sapwood and the end grain around the knots will not take the stain too fast. After completing this operation, you are ready for the stain, which consists of burnt umber, 1 tablespoonful, sienna, 1 teaspoonful and a mixture of boiled linseed oil and turpentine, 1 pt. The stain should have a consistency of very thin paint, which can be obtained by adding more oil if necessary. Try the stain on a piece of scrap pine or maple. Adding umber will increase the brown color and adding sienna makes the color more red. After applying the stain, set the piece in the sun until almost dry and then wipe it off with a cloth. When doing this, wipe more stain from the spots that would nat-

urally get the most wear. This produces the well worn finish that is desired on this type of furniture. After the stain has dried thoroughly, polish with a solution of boiled linseed oil, 3 parts and turpentine, 1 part, using a cloth. Let the work dry in the sun again and then repeat the oil polishing. About three polishings will be sufficient, letting the work dry in the sun each time.

—Carroll M. Elder, Bozman, Md.

Wrap Is Very Important When Creating Frictional Forces

The sketches below illustrate the importance of wrap when it is desired to create frictional forces as on drums, sheaves, pulleys and the like. The left-hand detail shows a rope given a half turn around a drum, thus embracing 90 degrees of arc of contact between the drum and the rope. The coefficient of friction of the rope is assumed to be .5 in the computations. Under such conditions a 1-lb. weight on one end of the rope will support 4.81 lbs. suspended from the other end of the same rope, due to friction and to the arc of contact between the rope and drum. In the second detail the rope is wrapped around the drum 1.5 times. The same 1 lb. will now support 111.32 lbs. suspended from the other end. The last two drawings further illustrate the rapid rise in weight that can be supported as the number of wrappings around the drum are increased. The foregoing figures show why a wrapper pulley often is so important on a belt drive. The pulley causes the belt to have more than 180 degrees of contact. At 180 degrees of contact with a belt that has a coefficient of friction of .5, a pull of 100 lbs. on the slack side will create a pull of 481 lbs. on the tight side.



RADIO



Extension Speaker Installations

AUXILIARY speakers conserve tubes, as a single broadcast receiver may be used to serve additional rooms, thus permitting extra sets to be held in reserve. Photo A shows an old console receiver chassis installed as a central receiving station operating several loudspeakers located at remote points. One of the extension speakers mounted in a bookcase is illustrated in photo B. Extra speakers may be salvaged from discarded sets, and should be of the "self-powered" permanent-magnet dynamic type if possible.

Connections to receivers having either single or push-pull output tubes are shown in Fig. 1; ordinary bell wire can be used. A s.p.s.t. switch may be used to cut one voice coil lead at the remote speaker when it is not required.

A 10-ohm rheostat connected directly across the voice coil leads of the set loudspeaker may be employed to adjust the volume of that speaker without interfering with others at remote points.

Although some hum can be expected in any receiver operating on an a.c. line, some of the older types employing ordinary dynamic speakers were excessive "hummers." When such hum originates in the set speaker itself, there are a few first aid ideas that advanced radio experimenters often try with good results. Fig. 2 shows several turns of wire wound around the field coil and connected in series with the voice coil to provide an effective hum-bucking arrangement. If the old set has a 2½-volt transformer winding, a 20 or 30-ohm potentiometer connected as in Fig. 3 provides an excellent hum bucker.

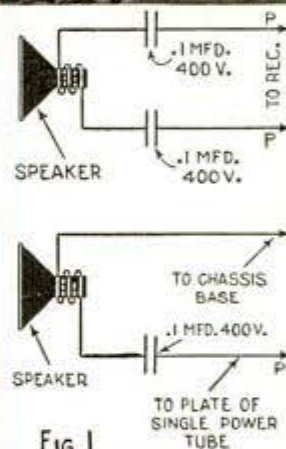
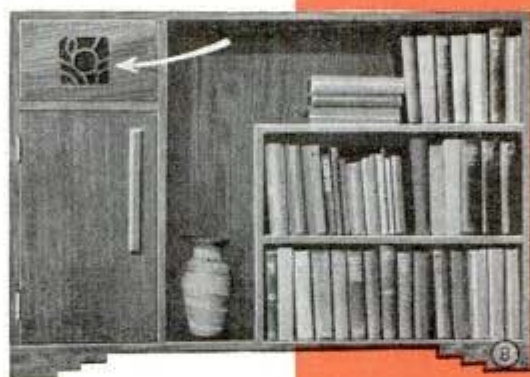


FIG. 1

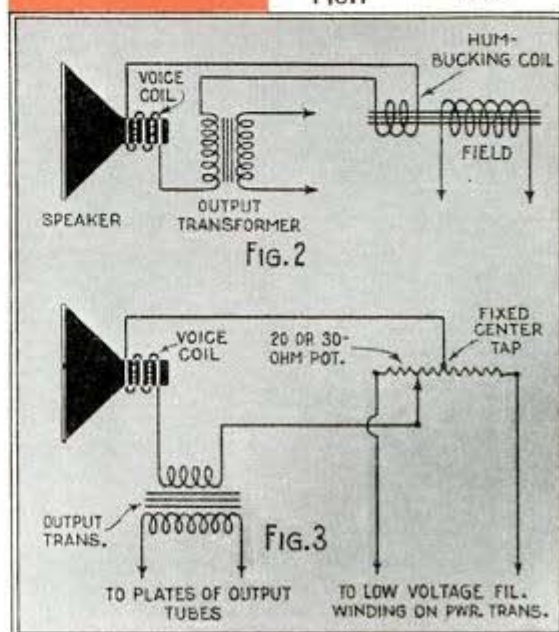


FIG. 2

FIG. 3

EASY-TO-BUILD "BREADBOARD"



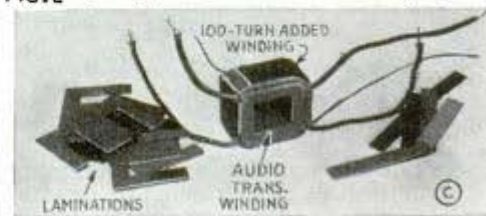
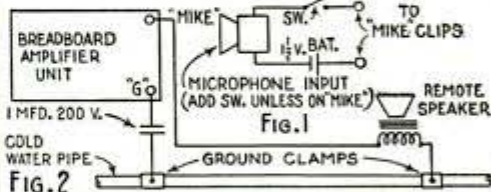
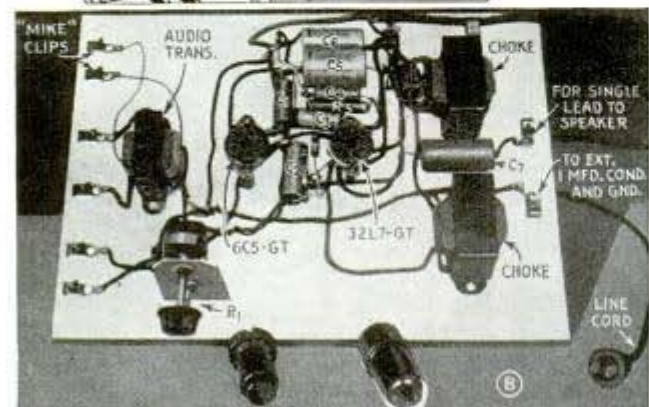
ALTHOUGH designed primarily as a classroom project and assembled from odds and ends for a demonstration model, this simple amplifier unit serves several other useful purposes in schools, homes and workshops. It not only makes a first rate unit to use as a call system but it is also an excellent 1½-watt utility amplifier for playing phonograph records or for stepping up the output of one- and two-tube sets.

The output circuit of the amplifier is specially arranged for the call system hookup so that it is possible to use a single wire between it and any small magnetic speaker at a distant point in the home, shop or garage. This wire-saving method employs a ground return through a 1 mfd. 200-volt paper-type condenser. Ground connections at both the unit and remote speaker must be good; in most cases a cold water pipe may be used as shown in diagram Fig. 2. If you have ordinary electric light cord, a 2-wire line between the amplifier and speaker will, of course, give better results.

A single-button carbon microphone that may be of the "dollar" store variety, is connected in series with a 1½-volt dry cell and a switch across the "mike" clips on the baseboard, as detailed in Fig. 1.

When a record player is the signal source it is connected to the phono pickup terminal clips. Photos A, B and D, show various views

Photos A, B and D, show various views

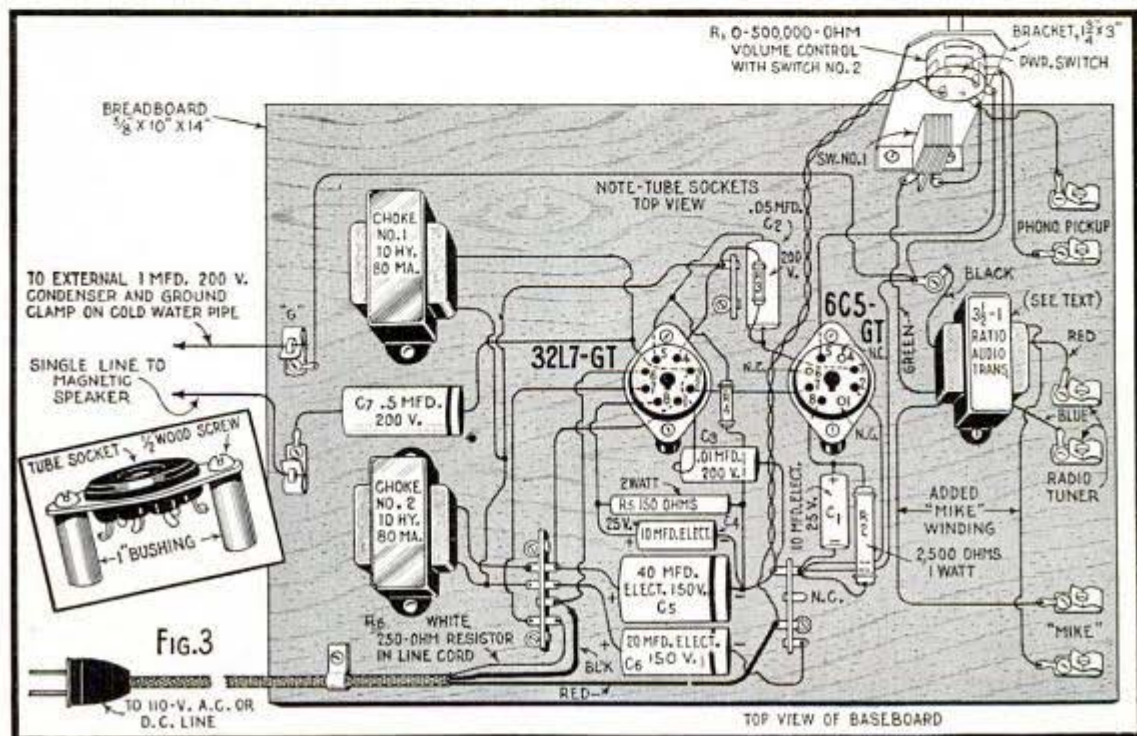
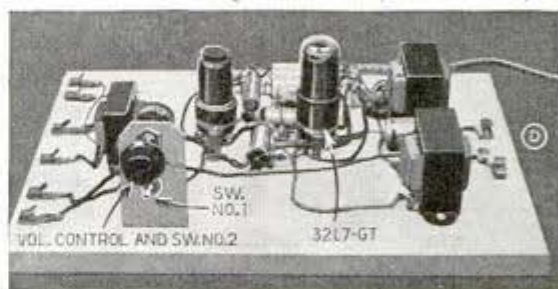


A.C.-D.C. CALL SYSTEM

of the completed "breadboard" unit; the simplified wiring diagram and specifications appear in Fig. 3. The tubes are types commonly found in the average radio experimenter's junk box; the 32L7-GT is a half-wave rectifier and power amplifier, and the 6C5-GT is an ordinary triode tube. A 6C5 or 6C5-G may be substituted for the 6C5-GT if you have them on hand.

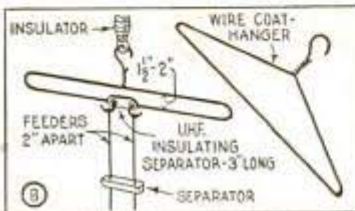
The 3-way input circuit of the amplifier is made possible by a simple alteration of an ordinary 3½ to 1 ratio audio transformer, preferably a large one as it will be easier to take apart and put together again. This usually involves taking off the frame and pulling out the core pieces one at a time. Observe carefully how the core parts are stacked so that you can reassemble them without difficulty. When the laminations have been removed as shown in photo C, wind 100 turns of No. 30 enameled wire or wire of about this size that may be obtained from a similar old transformer, over the regular transformer wiring. If your trans-

(Continued to page 170)

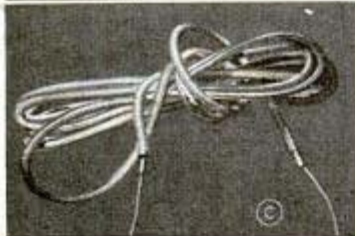


Practical RADIO SUGGESTIONS

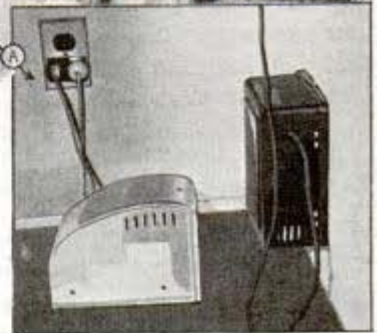
(A) Air raid wardens expect emergency calls at any time. This west coast warden uses an "electric sentry" to relay phone bell signals to his attention when other members of the family are not in the home and he is working in his backyard workshop, or visiting in the home of the next door neighbor. The "transmitter" unit is placed near the phone bell and plugged into the lighting line; the portable receiver end may then be plugged into the line at either remote point. No wiring other than the power line is required



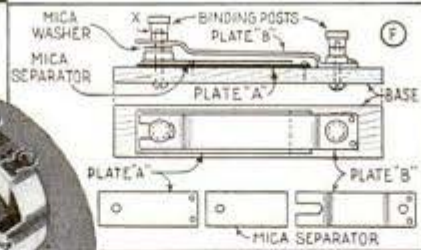
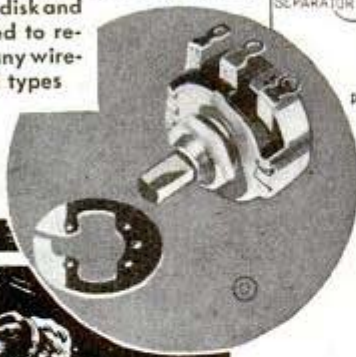
(B) "Hair-pin" type ultra-high-frequency antenna made from a coat hanger



(C) Glass-insulated flexible heating element supplied in any length by the inch, foot or yard, can be bent and fitted into tight spots for use in soldering irons, temperature control ovens for oscillating radio crystals and other low-power applications

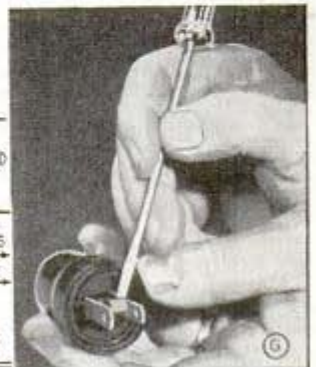
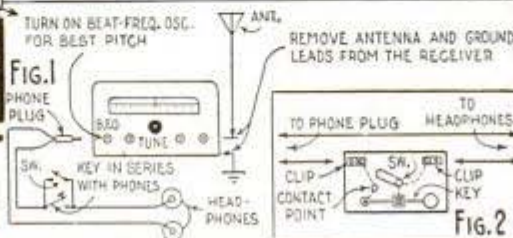


(D) Potentiometer employs a stabilized resistive coating on a Bakelite disk and is claimed to replace many wire-wound types



(F) Homemade variable condenser made from scrap materials. If plates A and B are 2 in. long and 1 in. wide, the maximum capacity will be about 75 mmfd. Mount on thin wood or Bakelite base; plate B should be spring brass or similar material. Adjustment is made with post X. (G) Attachment plug has built-in automatic circuit breaker

(E) If your short-wave receiver includes a beat-frequency oscillator you can practice sending code signals by inserting a key and switch in series with one side of the headphone cord as illustrated in Figs. 1 and 2



MILITARY AIRCRAFT
SPARK PLUG



AUTOMOTIVE SPARK
PLUG

 Awarded to AC
on September 2,
1942, for out-
standing achievement in
producing for Victory.



"MISSION ACCOMPLISHED"—and safe return! Both depend heavily on aircraft spark plugs. So, those which AC produces for the Army Air Forces must be painstakingly built to the exactness and reliability of the finest watch.

AC has been building quality and performance into automotive spark plugs for more than 34 years. It was only logical, therefore, that AC should make aircraft plugs for Army planes.

But, a pilot's success requires still more. Those plugs must be kept in peak condition. So, ground crews clean and adjust plugs after a specified number of operating hours.

Expert Care for YOUR Spark Plugs

These days, your spark plugs should be given similar care. And this is easy—through the Conservation Service which America's mechanics are rendering. This is now being augmented by contacts from AC, carrying to all service organizations the latest and most practical methods of diagnosis and repair of AC products.

The service which spark plugs, and the eight other AC automotive products, should receive is briefly described in the panel below. Help to conserve vital materials—and gasoline, oil, and rubber—by regularly following the suggestions given.

When replacement is needed, select AC—and be sure of complete satisfaction.

AC SPARK PLUG DIVISION—GENERAL MOTORS CORPORATION



OIL FILTERS—Slow driving accelerates the formation of soot and carbon in engine oil. If not constantly filtered from the oil, this dirt will clog piston rings, which causes increased consumption of oil and gas. So, replace your oil filter element whenever your dealer's AC Oil Test Pad shows that your oil is dirty.



SPARK PLUGS—Dirty or worn plugs waste as much gas as one coupon in ten. They also cause hard starting which weakens your battery. Under present slow driving conditions, have your plugs cleaned and adjusted every few months.



AIR CLEANERS—A dirty air cleaner increases gasoline consumption because it chokes down the flow of air into the carburetor. Your air cleaner should be rinsed whenever your car is lubricated.



FUEL PUMPS—Practically trouble free. But, if yours has been in use thirty or forty thousand

miles, it may be worn to the point where a check-up is due.



DRIVING INSTRUMENTS—Speedometer, gasoline gauge, oil pressure gauge, ammeter, and temperature gauge seldom need service. But, if they give trouble, have them cared for at once.



Food FROM PISTON RINGS

● Down on the farm they must keep their production going—so the nation can eat. The failure of a tractor, truck or car may mean the loss of a crop, a cow or a load of hogs.

And farmers have learned that Hastings Steel-Vent piston rings never let them down—they save oil and gas, check cylinder wear, make engines last longer.

Your car is vital to the war effort, too. Its life must be stretched to the limit, its performance protected. So watch your piston rings—and at the first symptom of ring failure, go to your motor service man for a Steel-Vent installation.

HASTINGS MANUFACTURING COMPANY, HASTINGS, MICH.

Hastings Mfg. of Canada, Ltd., Toronto

HASTINGS

STEEL-VENT PISTON RINGS

TOUGH ON OIL-PUMPING GENTLE ON CYLINDER WALLS

A City in a Store

(Continued from page 43)

through block-long corridors, past shelves loaded with the 100,000 items of merchandise, past miles of conveyors piled with thousands of packages, and into the shipping room. Here orders are assembled, wrapped and started to the weighing room. Life within the city moves on a 15-minute schedule. Some 1,900 orders (6,000 individual packages) bearing the same "time mark" must move forward at each 15-minute interval to the next operation. The schedule system is part of the reason the company can handle 100,000 orders received daily (in the Chicago house only at the Christmas peak) and speed the merchandise on its way. The Sears' employees, themselves, order 3,000 items daily that are delivered to their desks.

Four times daily, in the busy shipping and weighing rooms music is heard through a loud speaker system.

"They don't have to wait for the Saturday night band concert in our 'town'," says Paul W. Briggs, manager of the shipping department. "Music relieves fatigue and the workers love it. We use both radio and records. The music is on for half hour periods the first thing in the morning, before lunch, early in the afternoon and just before they go home."

Mr. Briggs says the packages really sail along to the tune of "Praise the Lord and Pass the Ammunition," but he had to abandon "Deep in the Heart of Texas."

"They all stopped to clap their hands," he explains.

The Sears post office is one of the world's busiest. Pouches loaded with packages move in an endless stream to the loading platform where they are then carried to the mail trains. Canceled stamps are provided to save time. They are applied in the weighing room and one day's supply costs \$15,000 in a busy season.

Sears' catalogue advertising department is a veritable publishing house that turns out 15,000,000 catalogues annually, including summer and winter editions, also produces 117 other sales publications. These include a semi-annual midseason salesbook (17,000,000 copies); the "bargain bulletins" (26,000,000) and a special Christmas supplement (6,000,000). Thousands of

(Continued to page 157)



Taking the Jeeps over the Jumps!

PRODIGIOUS jumpers that they are, our fighting Jeeps still can't jump broad rivers. So the Army's resourceful Engineers find still another job for their Evinrudes! Huge rubber rafts are bridged in tandem . . . Jeeps and troops are loaded aboard . . . husky Evinrudes sing their deep-throated song of power . . . and quickly the Jeeps are over another jump!

Giving a lift to the leaping Jeeps is but one of many wartime jobs which Evinrudes are performing today. For Evinrudes are *enlisted for the duration* . . . in the Army, the Navy, the Marine Corps. Great Evinrude "Fours" power swift assault craft and landing boats.

Evinrudes help build bridges, ferry supplies, troops, equipment. Mountbatten's famed Commandos know their power, rugged reliability and trigger-quick starting ease.

All the experience gained in 33 years of building fine outboards is centered on our assignments to build Evinrudes for the armed services. Knowledge of some of the tasks these motors must perform is an ever-pressing incentive to build them finer . . . and still finer! *After Victory*, there will again be Evinrudes for all who love the water . . . sparkling new Evinrudes whose performance will ably reflect many advancements achieved in their fighting forebears!

EVINRUDE MOTORS, Milwaukee, Wisconsin

Evinrude Motors of Canada, Peterboro, Canada

EVINRUDE
OUTBOARD MOTORS



★ Invest in America! Every War Bond you buy helps speed the day of Victory. Then, good fishing to you.



My Argus C-3 gives me professional results, says Miss Ruth Underhill of New York City.

Tsing-Ying Tsang is designing clothes to raise money for Chinese Relief.

Professional results are important. It must be right the first time. Miss Underhill chose her Argus C-3 because of the features that make good pictures... the coupled Range Finder, critically sharp Cintar Lens and Built in Photo Flash Synchronizer. If you have an Argus C-3 you're lucky. New ones are scarce, your dealer may have one and some used ones are available.

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workers are employed in this publishing enterprise, millions of dollars are spent and the product created is given away. In return, some 11,000,000 customers order millions of dollars in merchandise in a single year.


Another publishing activity is the city's newspaper, a tabloid called the Sears News Graphic. It has its "local" staff, "foreign" correspondents (located in nine mail order branches) and is circulated "nationally." It carries the news about employee activities, special features, several columns and has an inquiring reporter department and "letters from the people." Recently it has featured news about the more than 6,000 former Sears employees now working for Uncle Sam in the armed forces.

The two main buildings of the plant are connected by a subway for pedestrians. A second subway, that few employees have ever seen, leads from the powerhouse and extends under the merchandising building. This subway facilitates the servicing of equipment and carries steam pipes, electric cables and pneumatic tubes.

On every executive's desk are two telephones, one for outside calls and the other connected with the Sears system. The system has dial phones and an automatic control room which handles 7,500,000 calls a year.

Scattered through the plant are various recreation rooms and across the street from the administration building is the "city park." It has fountains, pools, benches and is landscaped with beds of flowers.

This is about where the rubber-neck tour of the hidden city would end. Everyone would rush to a bench and somebody would have out his pencil figuring how 9,500 persons could use up 300 gallons of water every minute.



Model Builders Attention!

	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

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Delivering the Goods Around the World

(Continued from page 91)

ports and recognition signals worked out for the ferry operations. It appears that during the early stages of the operations one of the principal dangers was the gunfire at the Allies' bases; cautious guardians of the landing fields were apt to fire first and identify the airplane afterward.

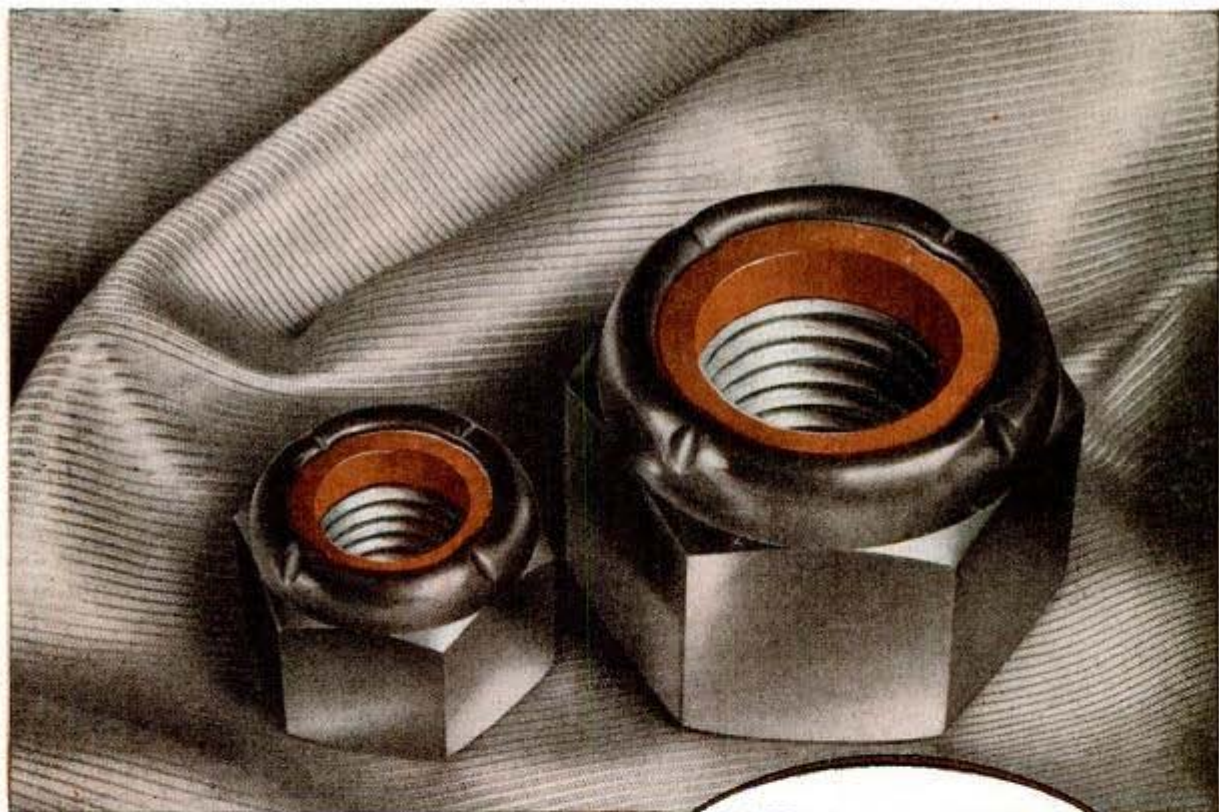
Greenland and Brazil, Africa and the distant Middle East, Alaska and Australia are but a few of the points to which the ferry, as well as the cargo-carrying aircraft wing their way. The same pilot may be in Darwin one day, then in the Arctic a few weeks later, and finally glide onto a field in India or Africa 30 days after. These pilots are the first real globe-trotters.

At home, the pilots are doing a grand job, too, flying their cargo-and-passenger planes. Here are some of the hardest-working planes in the world. Keeping them flying are the facilities of the commercial airlines. Only by taking advantage of existing airline maintenance and pilot facilities was it possible to solve the problem of transporting the essential supplies.

Miraculous—to the layman—are some of the feats of Transport Command crews. For instance, a single airplane shuttled between Brazil and Africa 10 times in six days, running up a total mileage of 18,500, in carrying officers and enlisted men, also oil and aircraft fuel and medical supplies, to African bases. A big bombing plane took off from the airport at Washington, D. C., with a load of military personnel and extra-priority supplies, made a 21,000-mile round trip across the Pacific and was back in Washington before the end of the week.

There is service across the oceans today that is more frequent than that offered not long ago between the two biggest cities in the United States—New York and Chicago. There are many trips each week to India and Australia, and the Central and South American service is so frequent that it would astound many who once considered themselves as air-minded.

The commanding general of the Air Transport Command predicts that its operations will expand into a gigantic organization at least 10 times greater than all of the world's peacetime airlines; and it's not far from that point now.



WHAT IS A NUT?

A nut is a fastening.

Its purpose is to hold things together.

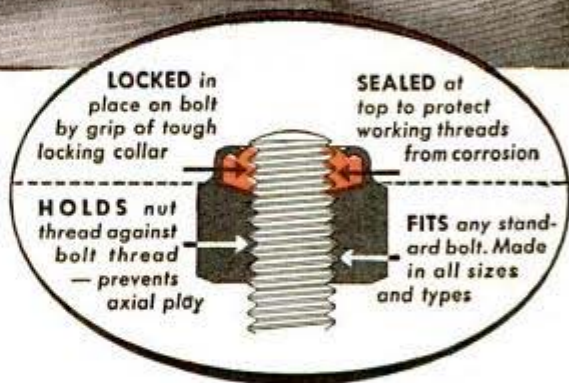
If it loosens, breaks or slips under strain, stress or vibration, it fails in its purpose.

But here is a nut which has never failed in service.

It holds tight, even when removed and put back many times.

We have made billions of these Elastic Stop Nuts. We do not know of one that has fallen down in its job.

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Lock fast to make things last



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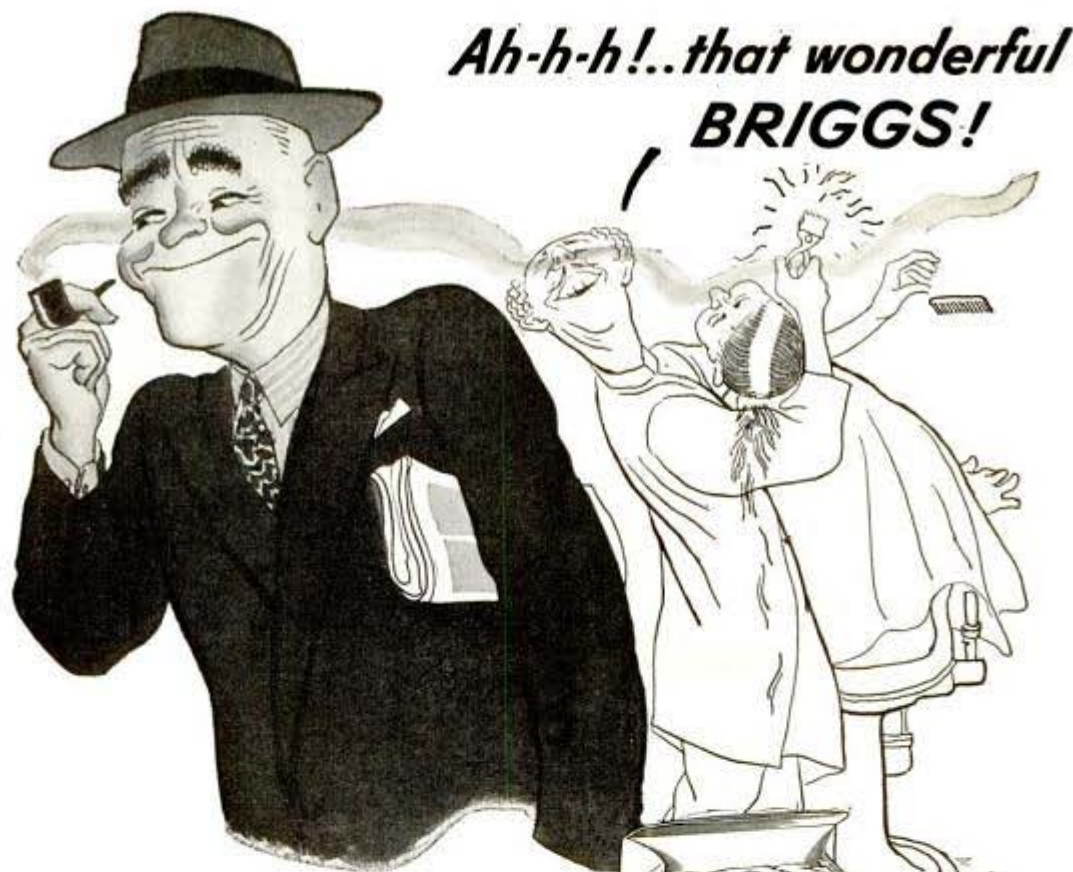
(Continued from page 53)

mountain ranges have roots. The material in mountains has a specific weight of 2.8 as compared to an average specific weight of more than 3 for the earth's crust. This suggested the idea that mountains are actually supported in the slightly heavier material of the crust, with most of their bulk below the surface just as icebergs are supported by sea water.

A network of earthquake recording stations with automatic instruments has been established in California, and the proof that mountains have roots was obtained from the records. Earthquakes that originated on one side of the mountains traveled at their regular speed of about three miles per second to recording stations on the same side of the mountains. The waves that traveled directly through the mountain material to recording stations on the other side of the Sierra Nevada traveled half a mile per second faster, due to the lighter material through which they moved. But the records also showed a second set of seismic waves that arrived after some delay, just long enough for them to have traveled a deeply curved path under the mountains and back up to the surface again. Additional research revealed that a range such as the Sierra Nevada extends downward from the surface as deep as 40 or 50 miles.

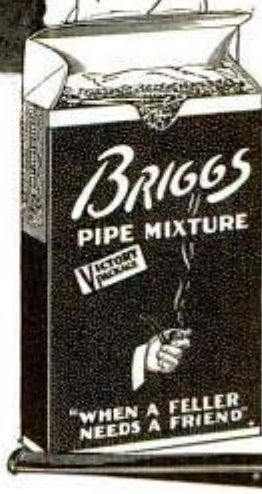
Earthquake instruments also were used to show the buffeting the earth receives from a storm. A supersensitive barograph and a special seismograph were put into continuous operation. After a heavy storm the records of the two instruments were compared. The barograph indicated when the storm started and the time at which it stopped. The record of tremors from the seismograph was practically a duplicate.

Few of the thousands of earthquakes that occur every week are strong enough to be detected except by delicate instruments. Some seismographs are capable of magnifying a slight motion as much as a million times. Traffic vibrations, industrial tremors, and even the vibrations from a not-too-distant naval battle are registered on the instruments. One of the unique problems of the scientists is to detect and discount the earth waves that are caused by man.



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A REVOLUTIONARY development in power hack saws, Blu-Mol "Double-Life" is a high-speed molybdenum power blade with teeth on both edges. Priced only 50% higher, it delivers twice the service of the finest single-edge blades. Used primarily by plants doing large volume of cutting. Typical Millers Falls quality. For hand sawing, use Blu-Mol singles.



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MILLERS FALLS TOOLS

SINCE 1868

MILLERS FALLS COMPANY

GREENFIELD MASSACHUSETTS

Roads to Victory

(Continued from page 85)

acent to highways. Twenty-five separate sharp turns were eliminated in one short stretch of representative secondary road, and the maximum grade was reduced from 9.5 degrees to 2.5 degrees. Traffic noise and even the roar of airplanes is so loud on some of the realignment projects that levelmen and recorders of the survey parties use a portable telephone system, dragging the wires along with them as they move.

Maintenance is being curtailed or abandoned on many roads that are not required in the war effort. Other roads, now paved, will go back to graveled surfaces when their present surfaces are worn through. Road asphalts and oils are becoming scarce, and the maintenance crews are trying all sorts of experiments, such as mixing heavy grades of asphalt with kerosene, to obtain a workable road mixture.

Engineers' experience with roadbeds has been a valuable help in building the hundreds of miles of landing strips required for the expanded Air Force. Earth-moving equipment that can carry huge loads at upwards of 30 miles an hour instead of the five mile per hour top speed of the past have been diverted from highway construction to air fields.

Technical developments in handling traffic flow that are now being worked out will be put to use after the war. One new device is an automatic traffic signal dispatcher with a built-in memory. This intersection signal, operated by vacuum tubes and connected to vehicle indicators buried in the approaches to the intersection, automatically times its lights to accommodate traffic demands. Cross traffic that has tripped the approach indicator but hasn't had time to cross the intersection before being stopped by the red light is automatically accounted for, and the signals change back to let this cross traffic proceed, as soon as convenient, before the green light is again flashed for traffic on the other street.

In ordinary times the nation's automobiles travel nearly 500 billion miles a year. Today this traffic has been reduced by at least half. Remaining traffic is the kind that must carry on, in war or peace, and it is the job of the highway engineers to see that it can.

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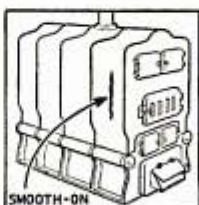
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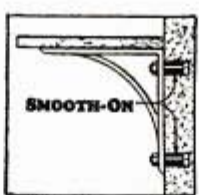
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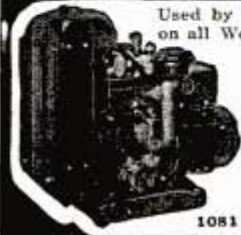
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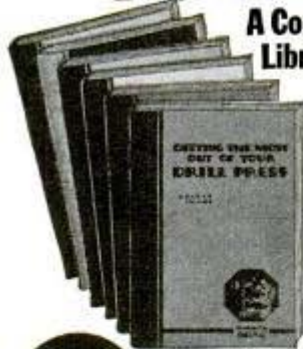


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IF YOU OWN A CUSHMAN, remember it must serve you for the duration. Lubricate it regularly. Give it utmost care. Your instruction book contains complete directions. For a new copy, see your Cushman dealer or write us for a free copy.

CUSHMAN MOTOR WORKS, Dept. P-5, Lincoln, Nebr.

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Broken Furniture can often be repaired quickly with P. W. Handles like putty, hardens like wood. At Paint, Hdwe., 10¢ Stores

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With **WORK UNIFORMS**

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GRAY HAIR VITAMIN NOW \$1.95

No dyes—No drugs—Hair grew out in Natural Color in almost nine out of ten test cases just taking one tablet Calcium Pantothenate Vitamin each day.

Why pay \$3.50 to \$5.00 for the famous "Gray Hair Vitamin"? SEND NO MONEY. Just send name and address. We will ship 100 10-mg. tablets (100 days' supply) genuine standard quality Calcium Pantothenate Vitamin C.O.D. for \$1.95 plus few cents postage. Guaranteed same quality as used in National Tests or money back. LILEE PROD. CO., 2017 S. Michigan Ave., Dept. 95, Chicago, Ill.

POPULAR MECHANICS

Paper Runs the World

(Continued from page 25)

on felt through suction and compression rolls and steam-heated cylinders where it dries out rapidly. At the end of the line it winds up on a reel, where it is cut to spool widths and trundled into boxcar or cargo ship en route to become your favorite magazine, tarpaper for your home, a soda straw or cable insulator or mail order catalogue. Last year's issue of Sears Roebuck catalogues alone represented a sizable tract of woodland; they weighed 70,000,000 pounds, sufficient to fill 1,720 freight cars in a train over 16 miles long. That's something; but Uncle Sam can go Sears one better. The government printing office ordered nearly 100,000,000 pounds of paper for a mere six months' supply. And that didn't include the 20,000,000 paper bags in which the doughboys packed their lunches in the Louisiana war games last summer, or the cartons for the "iron rations" the boys in New Guinea carry, or the cardboard tanks the army used for practice on the New Mexican desert.

Yes, sir, paper has acquired a lot of talent since the first Chinese concocted it out of a batch of mulberry bark, bamboo and second hand fish nets back around 105 A.D. It is more useful today than ever, in this era of unaccustomed scarcities. Paperboard forms are used in place of wood to shape round concrete piers. The Brown Company offers "Aqualized" paper for pup tents, waterproof clothing, sand bags and potato sacks. The McDonnell Aircraft Corporation of St. Louis molds laminated paper into airplane wings, rudders, elevators and ailerons; formed with cheaper dies than necessary for shaping aluminum, the plastic paper wing is 40 percent stronger yet lighter than aluminum, with a smooth surface that needs no finishing and has high resistance to abrasion. Westinghouse puts the pressure on resin-impregnated paper and molds it into such unexpected forms as helmets for soldiers and miners, bearings for propeller-shafts of ships, gears for electric motors and linings for refrigerators. Paper lithographic plates save zinc. Treated paper covers oil pipe lines. Flares dropped from American warplanes to illuminate a battlefield or bomb target are hung from paper parachutes

(Continued to page 167)

THE "Pals" THEY LEFT BEHIND



are Harley-Davidsons

Letters continue to pour in from men in the armed services telling how they miss the Harley-Davidson Motorcycles they left behind. One outstanding feature of ALL these letters is the way every man speaks of the stamina, power, and rugged dependability of his Harley-Davidson "sweetheart." And they look forward to the day when they can again thrill to the ownership of new Harley-Davidsons — motorcycles with greater performance than ever, made possible by the severe tests of wartime action.

HARLEY-DAVIDSON
MOTOR COMPANY

Department P
Milwaukee, Wis.



Write today for your FREE copy of "Enthusiast" magazine, filled with motorcycle action pictures and stories.

HARLEY- DAVIDSON MOTORCYCLES

Keep YOUR IDEAL Sharpener

... SHIPSHAPE FOR SERVICE!

Spring and Summer are the big seasons for sharpening lawnmowers ... when you can make plenty of extra money if your Ideal Lawnmower Sharpener is in shape to give satisfactory service.

Today all types of shop equipment have an added measure of value, because of the difficulty in getting replacements. It is important, therefore, that you keep your Ideal rust-free and well-lubricated. Check all moving parts, and replace those that are worn. Parts are available. Keep in mind that the War Program has placed restrictions on all manufacturing facilities, and make your Ideal last ... for the duration. Sharpening and servicing lawnmowers is highly profitable ... full or spare time work. Put your Ideal in shape ... start now when the demand is the greatest in years.



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1543 BELL STREET • PLYMOUTH, OHIO

PAINT STRIPING TOOL

ONLY \$1.00 POST PAID

Try it! See the Added Beauty

With this NEW TOOL (not a brush) everyone can now draw lines with paint. Used on autos, models, toys, tiled walls, cabinets, furniture, linoleum floors and all home workshop projects.

As easy to use as a pencil



Send only \$1.00 for complete tool for painting a 1/16" wide stripe, including adjustable guide, operating instructions, etc. C. O. D. price \$1.25. Tool uses paint, enamel, lacquer, etc. Patented interchangeable tips are available for wider or narrower stripes.

Every Painter and Craftsman Should Own One. Send for your tool today. Use it. If you are not satisfied that you have added character as well as beauty to your work, return the tool and we'll refund your money promptly.

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WENDELL MFG. CO.

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TO MAKE THIS UNIQUE GAS SAVING TEST



Will you permit us to send you at our risk the Vacu-matic, a device which auto owners everywhere are praising? Install it on your car. Test it at our risk. Unless it trims dollars off your gas bills by saving up to 30% on gasoline consumption, gives more power, quicker pickup and faster acceleration, the test will cost you nothing.

Automatic Supercharge Principle
Vacu-matic is entirely different! It operates on the supercharge principle by automatically adding a charge of extra oxygen, drawn free from the outer air into the heart of the gas mixture. It is entirely automatic and allows the motor to "breathe" at the correct time, opening and closing as required. Saves up to 30% on gas costs, with better motor performance.

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FOR INTRODUCING. Here's a splendid opportunity for unusual sales and profits. Every car, truck, tractor owner a prospect. Send name and address now for big money making offer and how you can get yours Free. The Vacu-matic Co., 7617-797 W. State Street, Wauwatosa, Wis.

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BUILD YOUR OWN GARDEN OR FARM TRACTOR—\$1.00 brings either set of plans, postpaid, telling how to build tractor chiefly from old auto parts. Will plow, cultivate, haul, etc., Handy man can also ...

BUILD RIDING TRACTOR IN ONE DAY by using old auto parts, powered by 3 H. P. Briggs and Stratton or other engines, larger or smaller.

SEND \$1.00 for Garden or Farm Tractor Plans (State which wanted) and to introduce them we will include, free on request, plan to **BUILD RIDING TRACTOR IN ONE DAY.** Money Back Guarantee !!!

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Foto Stamps are clever, new, personal photo reproductions on postage size stamps, and they are literally taking the country by storm. On letters Foto Stamps help cheer and bring far-away loved ones closer. Dozens of uses. Any photo reproduced. Just show sample. Take quick orders—plenty of re-orders. Splendid profits. Excellent sideline with personal or Service Men's stationery lines, or home, office, camp products. Write immediately for samples and our profitable offer.

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PROTECT valuable tools from thieves and tool borrowers! Electro Etcher BURN'S your name, any design, permanently on tools, instruments, dog collars, any metal. Easy! Simple as writing with pen or pencil. Rush order today—supply limited—no more when these are gone! SEND NO MONEY! Pay postman \$1.00 plus few cents postage on delivery. Use 5 days—money back if not delighted. Electro Etcher, Dept. M-600, Strader Ave., Cincinnati, O.



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The paper mill is also a contributor to the making of synthetic rubber, for alcohol for Buna-S rubber is produced from the waste sulphite liquor that has hitherto done little more than pollute the streams below the paper factory.

Back in 1776, fifty-six men signed their names to the sheet of paper we call our Declaration of Independence. The Constitution by which we set up the rules of American liberty was written on a precious bit of paper. In a train bound for Gettysburg, Lincoln wrote his immortal address on a scrap of paper. The Bill of Rights, the Atlantic Charter—these scraps of paper represent what we are fighting for.

The nation bids the shipyards build ten million tons of ships. In the same twelve months the mills roll out 18 million tons of paper. A third of it, and more, will go toward winning the war. The future is planned, the present is directed, history is written on paper. From confetti to battle-ships, paper runs the world.

Blasting Is Their Business

(Continued from page 32)

and they can be attached to any explosive from small hand grenades to huge bangalores and mines. They can also be attached to firecrackers which are used in the various trap arrangements during training.

The three types are pressure, pull, and pressure release. The two latter types are often used together in anti-personnel mines, tank mines and the traps attached to barbed wire barriers.

When an engineer has inched his way through the woods and chances to see a fine wire stretched across his path he knows he has found a booby trap, but the kind is a mystery. He knows that if he cuts the wire the trap may be the pressure release type that will explode a mine under him. He also knows that it might just as well be the pull type that if pressed against would detonate a charge. Or it might be both in the same hookup. The

(Continued to page 168)

Save Manpower—

**TAKE NO
CHANCES**



The prevention of injury becomes a national obligation—an obligation to use the best tools; Plumb tools! The scientifically tempered face of the Plumb Machinist Hammer is crowned and chamfered to overcome dangerous chipping. Perfect striking control is provided by perfected balance. The Plumb take-up wedge keeps head tight! You use the *safest* tools when you use Plumb.

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KEEP 'EM
FLYING



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WAR BONDS

Atlas
DRILL
PRESS
in
**"FIGHTING
FORM"**



No. 73 with production attachments* for war work.



How are Atlas Drill Presses used in war plants? Many ask that question. This picture is one answer. It shows your usual work shop model with Tapping Attachment, Production Oil Table, and Foot Lever Control—the speed demon of production lines from coast to coast! When you need a drill press—and they are available for non-war use—be sure to see an Atlas in action. Atlas Press Co., 543 North Pitcher Street, Kalamazoo, Michigan.



**VICTORY
FIRST!**

*-THEN Atlas
TOOLS FOR YOU*

wise engineer will either blast the booby from a safe distance or stake out a danger area around it.

Sometimes the enemy will place an obvious booby trap. He knows the approximate position from where an alert commander will spot it and where he will halt his men. At least he hopes he knows. The enemy assumes that a couple of men will be sent forward to explode the booby. If they do, a mine will explode where the platoon halted and the only survivors will be the men who were sent ahead.

That's just one example of the battle of ingenuity on the field. The engineer is trained to be suspicious of everything—discarded helmets, bits of equipment, every object in an abandoned house. The most innocent object, such as a faucet, doorknob or picture frame, may be an instrument of surprisingly sudden death.

Once the mine has been found, it must be exploded or deactivated. Bangalore torpedoes are invaluable for exploding them, but when the bangalores are not available it is up to the engineers to use all their skill in finding the mines and rendering them harmless. The engineer, who must work with the care of a surgeon performing a brain operation, is never sure his job of deactivation is complete.

Perhaps the enemy has placed two mines together, one above the other. After the top one is deactivated an unwary engineer might lift it, thus setting off a pull type trap attached to the lower mine.

The young American engineer takes a grim pleasure in outwitting his foe. He's proud of his knowledge and thankful that his Uncle Sam has given him the training to do the job in what once were the quiet hills of old Virginia.


Scout Plane Launches Pigeons In Self-Opening Cages

Carrier pigeons are increasingly used to carry messages from reconnaissance planes that are forced to observe radio silence. Above 10,000 feet, however, the birds cannot fly because the air is too thin. The Army Signal Corps has devised a canvas-covered wire cage in which the pigeon is placed before it is dropped overboard from a scouting plane at high altitude. The cage falls any desired distance, then opens automatically.

ny. times

POPULAR MECHANICS

1-24-45



The Bearing
THAT WAS
Ready for War



★ Long before Pearl Harbor, Tyson was producing large quantities of "All-Rolls" Bearings for vital Army and Navy uses. Because of the extra load-carrying rollers, Tyson Bearings have more capacity . . . longer life . . . greater rigidity.

These advantages, demanded on fighting fronts, are important on production fronts, too. Vital transportation and industry have long used Tyson Heavy-Duty Bearings . . . and are depending on Tyson more than ever today.

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HEAVY-DUTY BEARINGS

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★ Tyson Products Also Include Precision Parts for America's Airplane Engines ★



Help conserve CASCO GLUE for War use!



Prefabricated, demountable Army hutment for 16 men. Made by Pacific Huts, Inc., Seattle, Wash. Curved ribs laminated with CASCO-RESIN (liquid) Resin Glue.

• Hutments, wood aircraft, life rafts, boats and truck bodies call for the strongest, most durable industrial glues. That's why almost all supplies of CASCO and CASCAMITE go into wood war equipment.

You can help conserve these glues and do your part on the home front, too — by using CASCO or CASCAMITE only for essential repairs that make your home equipment last until the war is over.

There will be plenty of time and plenty of CASCO for hobbies — tomorrow.



CASCAMITE Resin Glue for waterproof gluing. CASCO Casein Glue for water-resistant gluing. 10¢ and larger sizes at hardware stores.



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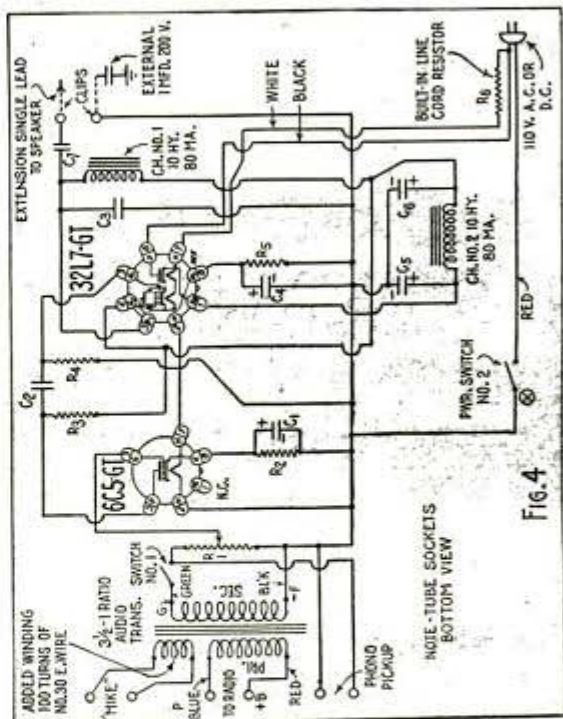
ADDRESS

----- Save 2¢ — Stick coupon on penny postcard -----

A.C.-D.C. "Breadboard" Call System

(Continued from page 151)

former is fairly good size you will be able to wind it on in one close-wound layer, a small transformer will require two layers. Pull the wire tight so that it will take up a minimum of space. When the winding is completed, cover it with a layer of very thin paper, preferably "onion skin" type-writer paper, which should be glued on with china cement. This provides the mi-

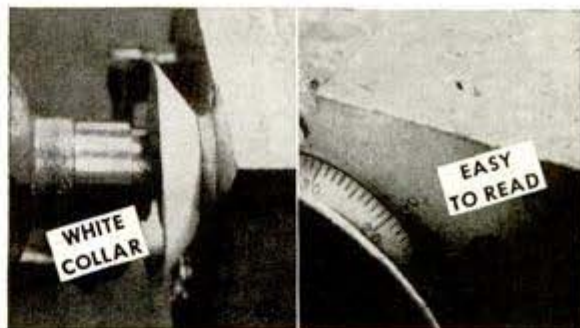


crophone winding shown in the schematic circuit diagram Fig. 4. Now reassemble the transformer; the extra winding usually will make the core parts fit very snugly, therefore the job must be done carefully. The specifications for the other parts are noncritical; the output and filter chokes Nos. 1 and 2, may be larger than specified, and the line cord resistor can vary about 10 percent in resistance value. Material list R-315 is available if desired. To amplify a small receiver, connect the speaker directly to the output clips, and the receiver phone posts to the "radio tuner" clips. When a record player is connected to the phono pickup terminals switch No. 1 should be turned to the "open" position; this takes the transformer out of the circuit and insures maximum output from the pickup.

HOW Light Helps Speed WAR PRODUCTION!



Spots snags. Smooth, silhouetting light from recessed G-E MAZDA Fluorescent lamps covered with sanded glass makes it easy to locate weak spots in parachute material . . . and do it fast.



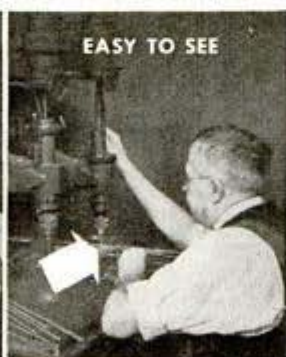
Saves time. Shadows on the dial made it hard to read. But a white collar placed around the dial shaft at a 45° angle reflects light on the scale to speed seeing, increase accuracy, reduce fatigue.



Makes "mikes" talk . . . and talk plainly. In many a war plant confusing reflections on the barrel of a micrometer make it hard to read. But under a large area source, of low brightness, the figures stand out clearly.



Tattle-tale. Inspecting a polished bearing surface is tough under ordinary light. But place it on a smoothly lighted diffusing glass with lines on it; clean-cut reflections say "OK", distortion says "roughness".



Gloom chaser. When you have to work in your own shadow, you strain to see, make more mistakes. But move the lighting fixture slightly, to put the light where it helps and you can see the difference!

Write for a copy of the new booklet "How Light Can Speed Victory". Gives many practical suggestions on lighting for production. Write Dept. 166 PM, General Electric, Nela Park, Cleveland, Ohio.

Made to stay brighter longer



G-E MAZDA LAMPS
GENERAL ELECTRIC

When worming for
Tape, Round (ascaris)
and Hook Worms

You Can't Worm Your Dog WRONG



—you're sure to worm right if you follow the easy picturized directions with Pulvex (the combination treatment) Worm Capsules. Here's why—

Your dog can have Tape, Round (ascaris) and Hook Worms, any or all, at the same time! To worm for all three AS YOU ALWAYS SHOULD, especially tapeworms, YOU MUST USE 2 TYPES OF CAPSULES. No single-type capsule can expel those three worms. You definitely expel them (including tapeworms) when you use the 2 types of capsules, to be given a few days apart, in the Pulvex Combination Treatment Worm Capsule package.

Worm right; avoid worming wrong for those worms; use Pulvex Capsules. Packaged two ways: for puppies, for dogs. Either 50c. Double size package, 75c. At pet, drug, department stores. Quantity discounts to kennels; write direct to—

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PULVEX



Combination Treatment
WORM CAPSULES

New Designs in FRANZITE GRIPS



Modernize Your Gun! Improve Your Score!

Most durable grips made. Positively unbreakable! For Colt, Smith & Wesson, Hi-Standard, Ortgies, Luger & Mausers in a wide choice of beautiful designs in ivory, pearl, walnut, onyx, etc. Low prices. FREE CATALOG. Dealers Wanted.

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See you saw it in Popular Mechanics!

BUILD THE BIGGEST \$1.00 PLANE IN U.S.

New, Redesigned 7-Ft. Super CONDOR Soaring Glider

Stronger, longer flights, more graceful lines, construction simplified. **\$1.00**
Easier than ever to build. Soars for hours. Kit VE-5019.....



Send 5c for new No. 40 Catalog (none free)

4-Ft. Cleveland Eaglet

Unusually good model of a secondary type glider. Patterned after "Baby Bowlius". Easily built. Kit VE-5018, only..... **50c**



If your dealer can't supply you, order direct. Enclose 15c extra on orders for less than \$1.00.

Be Sure to Build These Six New Big 3-Foot Famous War Models

- Kit T74—Messerschmitt ME-109; Kit T76—Bell Airacobra P-39; Kit T77—Curtiss P-40 "Warhawk"; Kit T85—P-38 "Lightning"; Kit T78—Hawker "Hurricane"; Kit T91—P-51 "Mustang".....Each only **\$1.50**



CLEVELAND MODEL & SUPPLY CO., INC., 4508C45 Lorain Ave., Cleveland, Ohio

Digging for War Treasure

(Continued from page 15)

the ore worked with mechanical shovels.

Giant operations using Goliath-sized equipment, and on down the line to the midget mines in which one man or a family does all the work, are turning out unprecedented amounts of metal from the nation's vast mineral deposits. Some of the mines have never been worked before, some haven't been worked since the last war.

The old war mines that are opening up again in a sense have been hoarded until this time of need when foreign sources of the metals aren't available. Tungsten and quicksilver, especially, can be purchased abroad more cheaply than mined here during peacetime.

In some cases our high grade deposits have been worked out, but there are usually thousands of tons of low grade material for every ton of richest ore, and with modern machinery the poor ore can be made to supply our needs. The New Almaden quicksilver mine in California, for instance, 80 years old, produced more than a million 76-pound flasks of mercury in the days when the high grade ore could be mined sack by sack. Now steam shovels are taking out the low-grade, tons every hour, to be run through huge furnaces.

Gold mining and silver mining have lost their romance, now that the demand is for industrial metals. Gold mining is practically at a standstill, though in some areas gold is being extracted as a byproduct from ores that also contain metals needed for war—a reversal of the usual practice. At some other gold mines the huge dumps are now being reworked for minerals that weren't wanted at the time that the ore was worked for its gold content alone.

Part of the nation's vast silver hoard is being resurrected from the storage vaults as a substitute for vital copper in manufacturing massive electrical conductors. Loaned to war plants for the duration, the silver will be returned to the government after the war. Some of this silver will make it possible to extract far more aluminum from the earth than we ever dreamed we would need, a year ago. Fourteen thousand tons of silver are being loaned to the Aluminum Corporation of America to be made into electrical bus bars. Based on

(Continued to page 174)



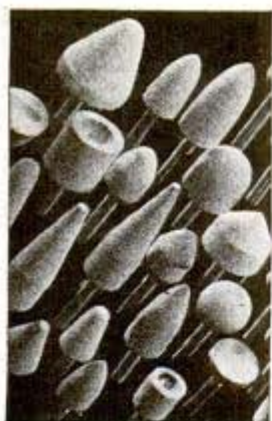
INDIAN MOTORCYCLES are in warpaint today. We've ripped off the streamlined fenders and hung on a rifle holster; we've discarded for the time being that flashy chrome trim; we've souped up the motor; and hidden those snappy two-toned colors under Army drab.

The vital point is—they're *Indian Motorcycles*... favorites for fighting as for sport. Indian's world-famous power, safety and dependability have already been proved in action on a dozen fighting fronts. *Ask the Ranger who rides one!*

When motorcycles go back to mufti after the war, there'll be new and greater Indians for you to ride. In the meantime, your Indian dealer is the man to help you keep your present machine in good shape... and he *may* have a dandy re-conditioned "buy" for you. See him today.

INDIAN MOTORCYCLE COMPANY, SPRINGFIELD, MASS.

**BUY WAR BONDS NOW
★ ★ TO BUY AN INDIAN LATER ★ ★**



FINISH THE JOB RIGHT

Like setting the last rivet as the plane comes off the production line—burring, finishing and polishing to minute specifications mean the job is right.

CHICAGO MOUNTED WHEELS

Famous since their introduction 45 years ago for quality and long life. There is a "just right" Chicago Mounted Wheel for every operation.

PROMPT DELIVERIES—We are working 24 hours a day and due to our central location, can make prompt shipment on all Mounted Points and Grinding Wheels 3" in diam. and under. With the approval and endorsement of W P B, all our facilities are concentrated on these smaller sizes, enabling us to give the most potent service to the war program.

HANDEE TOOL OF 1001 USES and HI-POWER GRINDERS have gone to war—available to all who have priorities

FREE Catalog, shows actual sizes and colors of largest line of Mounted Wheels made.

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America's Headquarters for Mounted Wheels
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YOUR reputation as a sportsman will be safe when you get this 100 page book, ram-jam full of hitherto unpublished secret methods for cramming your creel and garnishing your game bag. No time worn tripe, but swell new success secrets.



Written by Mark W. Burlingame, famous sportsman, author, editor—specially for Hodgman Rubber Co., whose fine waterproof sporting specialties are known to thousands of American Sportsmen. No, we can't sell you any merchandise because it all goes to Uncle Sam, but we can send you this "reputation protector" if you will mail the coupon and only one thin dime.



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Dept. P, Framingham, Massachusetts

Here's my dime. Send me "Secrets".

Name.....

Address.....

MAIL IT TODAY!

present silver prices, the electrical conductors are valued higher than is the great corporation that is using them.

Gold did its part to help win the war before the war started. Gold is so valuable that it pays miners to work great deposits of low grade material just to recover small amounts of the metal, and the wholesale methods that they devised are now making it possible to extract other kinds of metal economically. In the Rand mining district in California, which was the source of 60 percent of the tungsten that America used in the last war, miners have turned to gold-mining methods in their search for more tungsten.

One large operator is stripping 40 feet of overburden from a whole area with tremendous draglines so that a 10-foot deposit that carries both tungsten and gold in its gravels can be reached. Nearby, individual miners are using small gold recovery machines for sifting tungsten nuggets from the dry stream deposits. Chunks and nuggets of high grade tungsten ore are worth up to a dollar a pound and they are being sought with the same techniques the miners once used in seeking gold.

Nearly every metal and mineral that can be mined can be put to work these days. Platinum, iridium, osmium, and rhodium, ranging up to \$125 per ounce, are needed for electrical instruments and for thermocouples. The use of strontium has boomed because it is important to pyrotechnics.

Some rare metals have magical effects when they are alloyed with common metals, or when used to assist in refining operations. A small amount of beryllium makes copper as hard as steel, and beryl ores are now being sought. Indium, found with zinc ores in Arizona, keeps searchlight reflectors bright for long periods, makes strong, noncorrosive bearings when alloyed with copper-lead or cadmium, and makes brazing materials that have wide ranges of melting points. Only two tons of indium are being mined a year, and it is all needed.

Metallic zirconium, used in radio tubes; metallic cerium that adds fluidity and strength to cast iron; vanadium and titanium that make steels harder, are only a few of the rarer metals being put to work today.

(Continued to page 176)

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Most ores are complex mixtures of a number of minerals, and in the old days the mills usually extracted only the most valuable kind of metal from an ore. The other valuable constituents were thrown away in the waste, often because it wasn't economical at going prices to reclaim them.

Today many mining operations are conducted on a by-product basis and several minerals that occur in paying quantities may all be extracted from the ore. In fact, a gold mine may have ore that is so poor that it just pays for the cost of operations, and the profits are derived from the silver or copper that are associated with it. Improvements are still being made in milling methods and the time will come when all the valuable materials in an ore will be extracted from it before the waste is thrown away.

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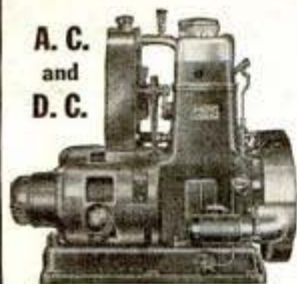
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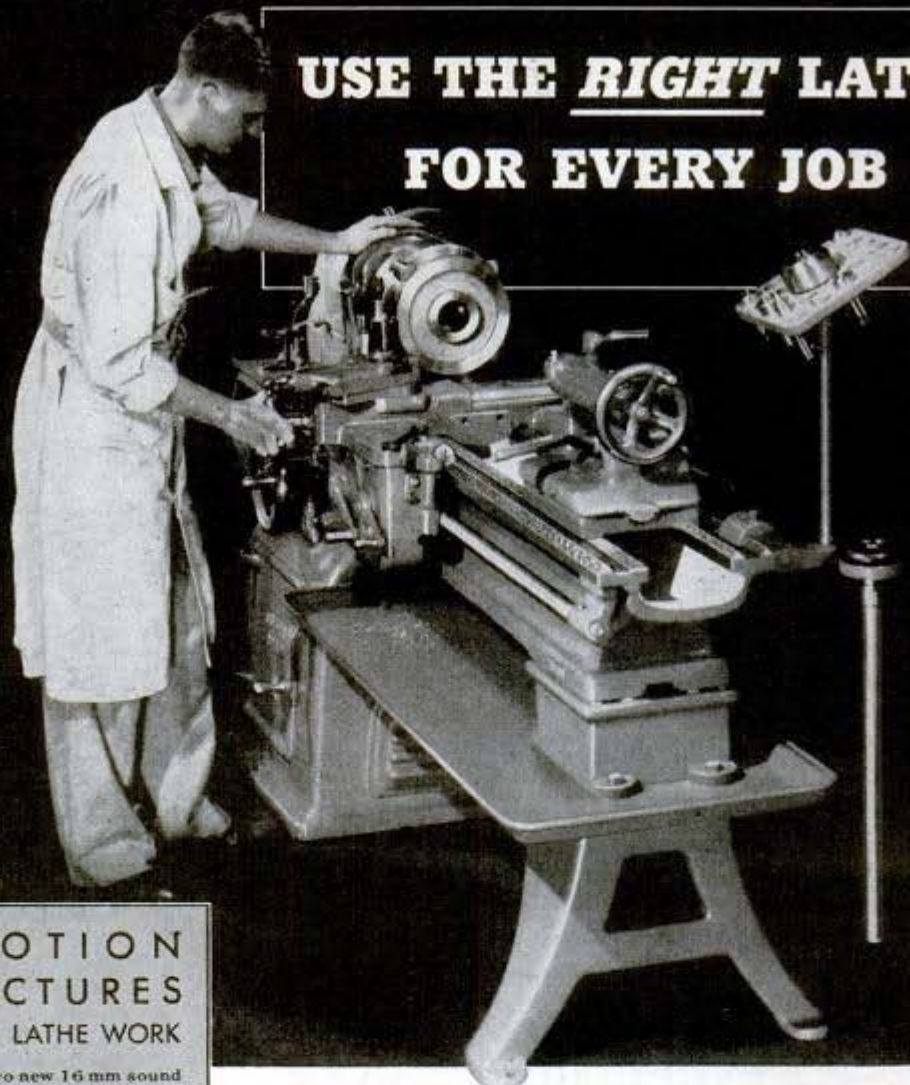
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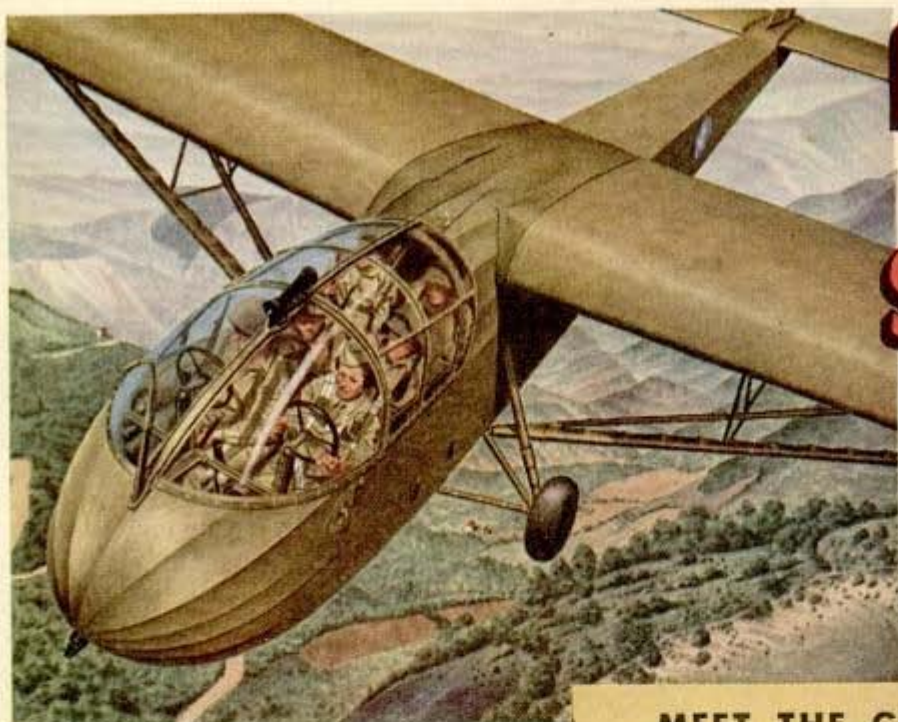
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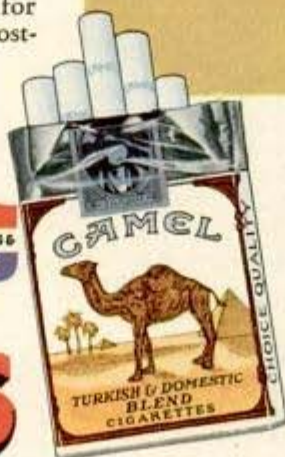
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